APPENDIX A

Land Condition Assessment (AECOM, 2024a)

Prepared for
Tamboran B2 Pty Ltd
ABN: 42 105 431 525

Land Condition Assessment

Shenandoah South Program

24-Jul-2024
Beetaloo Joint Venture Exploration Project

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Land Condition Assessment

Shenandoah South Program

Client: Tamboran B2 Pty Ltd

ABN: 42 105 431 525

Prepared by

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0	11-Jul-2024	Submission to client	William Riddell	
1	24-July-2024	Final report addressing comments from client	William Riddell	

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Table of Acronyms

Acronym	Meaning
°C	Degrees Celsius
%	Percentage
AEP	Annual Exceedance Probability
BOM	Bureau of Meteorology
CLA	Cambrian Limestone Aquifer
cm	Centimetre
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEPWS	Department of Environment, Parks and Water Security (NT)
E&A	Exploration and Appraisal
EP##	Exploration Permit (e.g., EP76, EP98 and EP117)
EMP	Environmental Management Plan
EPBC Act	Environmental Protection and Biodiversity Conservation Act
GDE	Groundwater dependent ecosystem
GPS	Global Positioning Device
ha	hectare
IBA	Important Bird Area
IBRA	The Interim Biogeographic Regionalisation of Australia
IECA	International Erosion Control Association
km	Kilometre
km^2	Square kilometres
LCA	Land Condition Assessment
L/s	Litres per second
m	metre
m AHD	Metres above Australian Height Datum
Ma	Million years ago
ML/year	Megaliter per year
MNES	Matters of National Environmental Significance
mm	millimetre
NAFI	North Australian Fire Information
Nov	November
NR Maps	Natural Resource Maps
NT	Northern Territory
PMST	Protected matters search tool
PPL	Perpetual Pastoral Lease
SREBA	Strategic Regional Environmental and Baseline Assessment
sp.	unspecified species (e.g *Corymbia* sp. = unspecified species of the Corymbia genus)

Acronym	Meaning
spp.	Several species (unspecified species of genus)
TPWC Act	Territory Parks and Wildlife Conservation Act
WoNS	Weed of National Significance

1.0 Introduction

1.1 Purpose of this Report

AECOM Australia Pty Ltd (AECOM) completed a Land Condition Assessment (LCA) for Tamboran B2 Pty Ltd (Tamboran) associated with the proposed exploration areas located within Exploration Permit 98 (EP98) and EP117 in the Beetaloo Sub-basin, Northern Territory (NT). Tamboran are proposing to undertake 3D seismic exploration and the appraisal of multiple onshore shale petroleum wells over the next 5 years for the Shenandoah South Exploration and Approval (E&A) program (Shenandoah South E&A Program).

The primary aim of this LCA is to identify and document site condition of the proposed Shenandoah South E&A program area to inform the environmental risk assessment. This LCA report summarises the result of the survey and documents baseline conditions of the areas assessed for the Shenandoah South E&A program.

The baseline field survey was completed during 27 May to 1 June 2024. Previous field surveys have been undertaken in the Shenandoah South E&A program area in December 2022 and March 2023 (AECOM, 2023). Data from these surveys have supplemented this report.

1.2 Project Boundary

The areas assessed under this LCA occur on Hayfield Perpetual Pastoral Lease (PPL) and Shenandoah PPL and are within Tamboran permits EP98 and EP117 (Figure 1). The Shenandoah South E&A program area is accessed via the existing Kyalla Turn-in located off the Stuart Highway and along the existing access track prepared as part of the Kyalla 117 N2 exploration program.

The location of the Shenandoah South E&A program area is presented in Figure 2.

1.3 Tamboran's Proposed Activities

Tamboran is proposing to undertake a series of activities to expand their gas exploration and appraisal program in the Beetaloo Sub-basin. The Shenandoah South exploration and appraisal (E&A) program may include any regulated activities as defined under Regulation 5 of the Petroleum (Environment) Regulations 2016. The activities are planned for the study area located across Shenandoah and Hayfield Stations on EP 98 and EP 117.

The primary activity covered by the Land Condition Assessment is the execution of a low impact three dimensional (3D) seismic acquisition survey. The 3D seismic survey will consist of low impact vegetation disturbance of 70 seismic lines, spaced 300 m apart (length 1,041.2 km x 5 m wide) across an area of 31,418 ha, with less than ~80 to 132 ha of vegetation clearing of the tree and shrub layers across the survey area. The total vegetation clearing extent will be refined further in the Environment Management Plan (EMP).

3D seismic specific activities include:

- Construction of low impact receiver lines, with minimal line preparation due to use of rubber tracked carriers which removes tyre puncture risk and create low ground pressure when travelling, such as tractors, skid steers, or 4WD vehicles, that are narrower and lighter than the traditional vibroseis trucks.
- Installation of nodes within the receiver lines.
- Data collection.
- Rehabilitation.

The 3D seismic program avoids land clearing through use of low impact energy sources such as weight drop and dynamite, which can be deployed by a range of light vehicle/machinery or by foot.

Minimal vegetation clearing and driving over the proposed source lines during execution will be prioritised through activity planning. Clearing avoidance will be underpinned by use of Lidar to avoid

dense vegetation and weaving around mature trees and shrubs, and other identified areas such as thicker vegetation communities (i.e. Lancewood/Bullwaddy community), drainage depressions and identified heritage sites. The source and receiver lines follow the easiest path to navigate without disturbance where possible, with substantial flexibility on the placement of the source lines.

1.4 Scope of Works

This report describes the assessment methodology, physical environment and outcomes of field surveys for future onshore gas exploration sites. The scope of work for the LCA involved:

- A review of historical data and reports prepared during the previous Beetaloo onshore oil and gas exploration programs, particularly from recent LCA surveys undertaken in the Shenandoah South E&A program area in December 2022 and March 2023.
- Database searches of the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters database at 10 km and 50 km buffer (March 2024).
- NT Department of Environment, Parks and Water Security (DEPWS) Natural Resource Maps Database (flora and fauna Atlas database) (14/03/2024) and the more recently published Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin (SREBA) data set.
- Completion of a LCA field survey of the proposed Shenandoah South E&A program area (27 May to 1 June 2024).
- Preparation of this LCA report.

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GEOCENTRIC DATUM OF AUSTRALIA 94

0 12.5 25 50

Kilometers

- Project Boundary
- Highway
- Permit Areas

LOCATION

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro 2019

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Project Location

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Figure 1

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GEOCENTRIC DATUM OF AUSTRALIA 94

0 1.25 2.5 5

Kilometers

- Project Boundary
- Populated Place
- Tracks
- Highway
- Water Bodies
- Pastoral Lease Boundary

LOCATION

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro 2019

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Figure 2

2.0 Assessment Method

2.1 Desktop Review

Field data collected between 2004 and 2023 within the permit areas was mapped based on image interpretation, with ground-truthing of the proposed survey areas being completed during field assessments (Section 2.3). This information was reviewed prior to the field work to identify the following:

- Vegetation types and flora and fauna species within the region that potentially occur within the Shenandoah South E&A program area, using previous reports and aerial / satellite imagery.
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act) listed threatened species or communities that potentially occur within the Shenandoah South E&A program area.
- Matters of National Environmental Significance (MNES) or other matters protected by the EPBC Act that potentially occur within the Shenandoah South E&A program area.
- Weeds or feral animals listed under the EPBC Act or *Weeds Management Act 2001* that potentially occur within the Shenandoah South E&A program area.

Table 1 provides a chronological list of reports (2004 - 2023), previously compiled in relation to environmental approvals and management support for petroleum exploration activities in the Beetaloo Sub-basin, NT.

The extent of work undertaken since 2004 has enabled a good understanding of the natural environment, which has been used in assessing the land condition of the Shenandoah South E&A program area.

Table 1 Summary of Existing Environmental Assessment and Reports for the Beetaloo Basin (2004-2023)

Date	Report
Company: Sweetpea Petroleum	
Jul- Aug 2004	Baseline land condition assessment (LCA)
	Site database established
Jul 2005	Exploration EMP finalised and approved
November 2019 to February 2020	LCA for EP136 (Seismic and Drilling Exploration Program)
Petrohunter Australia (Partner to Sweetpea)	
Dec 2006	Baseline vegetation assessment
Apr 2007	Drill site assessments
Apr 2007	Annual report
Jun 2007	Update of the existing EMP to include the new Exploration Permit areas
Jul 2007	Drill Site maps
Jul 2007	Supplemental Environmental Management Plan, Drilling Program 2007, Beetaloo Basin, NT
Jul 2007	Soil erosion assessment
Jul 2007	Groundwater quality
July 2007	Emergency Maps
Jul 2007	Environment & Heritage Induction Materials

Date	Report
Falcon Oil and Gas	
Dec 2010	Drill site condition assessments
Jan 2011	Archaeological survey
March 2011	Site-specific drilling EMP
2011	Falcon Shenandoah 1 Stimulation and Testing Groundwater Monitoring
2011/2012	Shenandoah 1 Re-Entry Environment Plan (EP)
July 2012	EP99 Archaeological Survey, Beetaloo Basin
2013	EP99 Seismic Exploration Environmental Management Plan
Tamboran B2 Pty Ltd	
2015 and 2016	Beetaloo Basin Environmental and Heritage Assessment and preparation of Approval documentation
October 2018	LCA and Heritage Assessment of proposed lease area (Velkerri 76 S1-1, Velkerri 76 S2-1, Velkerri 117 E1-1, Velkerri 98 N1-2, Kyalla 117 N2-1 and Kyalla 117 W1-2, Kyalla 98 W1-1)
July 2019	Weed Survey of Kyalla 117 N2-1 and access tracks, including Kalala S1 and Amungee NW-1H
December 2019	LCA and Heritage Assessment of EP76, EP117 and EP98
June 2020	Beetaloo Exploration Program Annual Weed Survey Report 2020
September 2021	Land Condition Assessment and weed surveys for Velkerri 76 N1, Amungee NW and Beetaloo W
May 2022	Additional Land Condition Assessment field survey of this specific proposed exploration program
December 2022	Land Condition Assessment field survey in Tamboran B2 Pty Ltd permit area
March - April 2023	Land Condition Assessment specific to the revised Amungee NW-3, Amungee NW-4, Shenandoah South and Shenandoah North lease pad and seismic areas.

2.2 SREBA Data Set

AECOM have undertaken a review of the recently published SREBA data and reports which were prepared by the Northern Territory Government specifically for the Beetaloo Sub-basin. The aim of the SREBA is to provide the information necessary for decisions to be made about the development of any onshore shale gas industry in the region.

To prepare this LCA report, AECOM have utilised the outputs to supplement the data obtained in the field during the survey. The terrestrial ecosystem baseline data reviewed include:

- regional vegetation mapping
- description of regional biogeographic patterns for terrestrial biodiversity
- spatial distribution models for significant species and communities
- identification and mapping of areas of high conservation value
- evaluation of the sensitivity of significant species to development.

2.3 Field Assessment and Reporting

The aim of this LCA is to document the proposed Shenandoah South E&A program area condition prior to on ground activities and inform Tamboran on potential constraints that will require specific environmental mitigations.

The LCA field surveys completed for the Shenandoah South E&A program used an aerial rapid condition assessment method like previous assessments carried out by AECOM for past exploration activities. The method allows for large areas to be surveyed over a relatively short period of time using a helicopter platform to assess proposed exploration area, as well access remote locations for on-ground-truthing.

A total of 97 sites were assessed across the Shenandoah South E&A program area during the May 2024 surveys. The level of assessment undertaken at each site varied as follows:

- 7 full assessment sites
  - Assessment of soil profile up to 1 m depth using an auger to excavate.
  - Soil samples collected to be sent to a laboratory to test chemistry and nutrients, and a geotechnical consultant to test for soil erodibility and suitability for wastewater disposal.
  - 10–15-minute bird survey, including call-playback for threatened Northern Shrike-tit (*Falcunculus whitei*).
  - Fauna habitat features, such as hollows, logs, and burrows (the fauna habitat quality for each mapped vegetation community type would be assessed).
  - The presence of weeds and/or feral animals (*i.e.* indication of scats, tracks, wallows etc.).
  - Description of vegetation communities (based on dominant species within each canopy strata).
  - Vegetation transects recording canopy cover along 4 x 50 m transects from centre point in northerly, easterly, southerly and westerly directions.
- 31 rapid assessment sites:
  - Assessment of surface soil (top 10cm).
  - 10–15-minute bird survey, including call-playback for the threatened Northern Shrike-tit.
  - Fauna habitat features, such as hollows, logs, and burrows (the fauna habitat quality for each mapped vegetation community type would be assessed).
  - The presence of weeds and/or feral animals (*i.e.* indication of scats, tracks, wallows etc.).
  - Description of vegetation communities (based on dominant species within each canopy strata).
- 59 aerial assessment sites
  - Photos site taken aerially from a helicopter.
  - Description of vegetation community based on photos.

The field locations assessed for the Shenandoah South E&A program are presented in Table 2 and Figure 3. The full suite of assessments, including soil profile assessment to 1 m depth and vegetation transect surveys, was undertaken at a total of seven sites, while rapid assessments were undertaken at 31 sites.

Table 2 2024 Field survey assessment site names and corresponding proposed exploration area

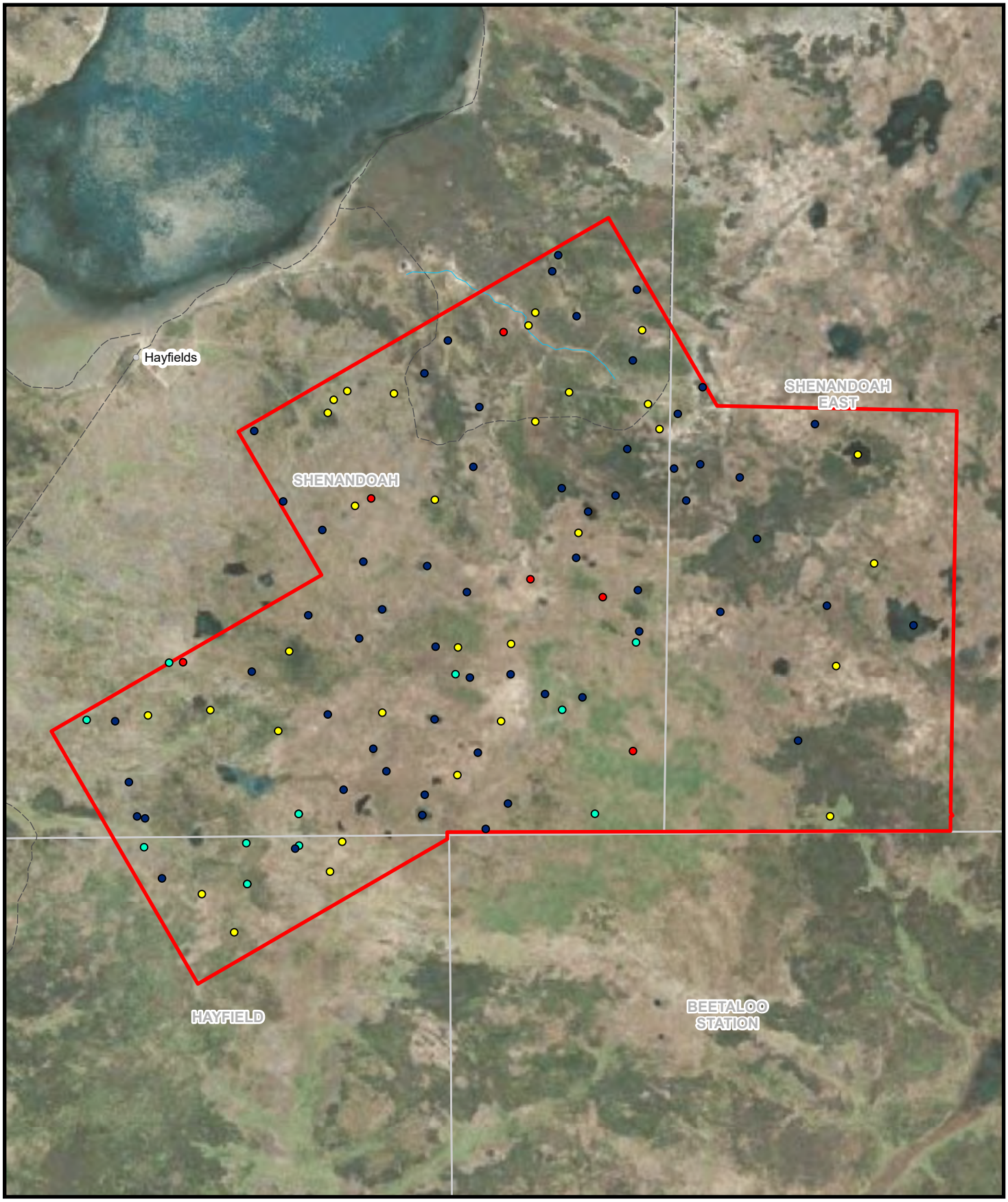
Exploration Area	GDA94, zone 53	
	Easting	Northing
Full assessment sites		
Site 14	341519	8140072

Exploration Area	GDA94, zone 53	
	Easting	Northing
Site 40	347238	8145051
Site 48	355198	8137372
Site 53	352080	8142596
Site 54	349174	8145011
Site 59	351262	8150108
Site 65	354280	8142052
Rapid assessment sites		
Site 6	342090	8133025
Site 7	343075	8131863
Site 8	345988	8133708
Site 9	346358	8134616
Site 11	344413	8137983
Site 12	342348	8138618
Site 13	340453	8138457
Site 16	344747	8140404
Site 23	347578	8138540
Site 27	349860	8136643
Site 31	347573	8141680
Site 36	345920	8147653
Site 37	346099	8148050
Site 38	346512	8148317
Site 39	347931	8148240
Site 41	346748	8144826
Site 45	349878	8140523
Site 47	351188	8138281
Site 52	351491	8140629
Site 54	349174	8145011
Site 60	352229	8147387
Site 63	353541	8144005
Site 67	361192	8135391
Site 69	361375	8139958
Site 74	353256	8148279
Site 75	352021	8150310
Site 76	352229	8150701
Site 80	355656	8147921
Site 81	356005	8147161
Site 88	362034	8146383
Site 95	355477	8150167

Several sites within the Shenandoah South E&A program area were also assessed in December 2022 and April 2023. These sites are presented in Table 3 and Figure 3.

Table 3 2022 & 2023 assessment sites

Exploration Area	Easting	Northing
Shenandoah S A	340335	8134450
Shenandoah S B	345035	8135464
Shenandoah S C	343471	8133330
Shenandoah S2	355291	8140676
Shenandoah S3	354041	8135466
Shenandoah S4	349802	8139709
Shenandoah S5	353046	8138627
Start – Shenandoah S B well site	345035	8135461
Intersection to existing track	345046	8134499
Intersection to Shenandoah S C	343442	8134573
End – Shenandoah S C well site	343471	8133331
Shenandoah South Line A – Start	337173	8137667
Shenandoah South Line A – End	346090	8128616
Shenandoah South Line B – Start	338589	8138319
Shenandoah South Line B – End	347421	8129410
Shenandoah South Line C – Start	341095	8140059
Shenandoah South Line C – End	349562	8131482



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0 1.25 2.5 5

Kilometers

- Project Boundary
- Populated Place
- Tracks
- Pastoral Lease Boundary

Survey Site

- Air (assessed from the air)
- Full (full assessment completed)
- Ground (rapid assessment on ground)
- 2022/2023 Survey Sites

LOCATION

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro 2019

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Survey Sites

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Figure 3

3.0 Physical Environment

3.1 Climate

The climate of the Shenandoah South E&A program area can be described as arid to semi-arid, with rainfall decreasing in frequency and quantity from north to south. The climate is monsoon influenced and has a distinctive wet and dry season. The wet season occurs in summer, between October and March and is characterised by hot and wet conditions. The dry season occurs during the winter months between May and August and is characterised by mild days and cool nights. September and April are transitional months, with occasional rainfall. Approximately 90% of the rainfall occurs during the Wet Season, and annual totals show moderate variability from year to year.

There is a pronounced north-south rainfall gradient through the region, with mean annual rainfall of ~1200 mm in the north and ~500 mm in the south (DEPWS 2022b). The maximum rainfall for the permit areas occurs in January and February, coinciding with the northern Australian annual monsoon event and average monthly rainfall is very low in the dry season (between May and October) (BOM 2024; DEPWS 2022b). Daly Waters airstrip is on a similar latitude with the northern end of the permit areas and recorded the highest average rainfall in the region at this time, with 167 mm falling in January and 188 mm in February. The May to September period is generally very dry, with average monthly rainfall ranging from 0.3 – 6.2 mm (BOM, 2024). The annual rainfall pattern within the area is highly variable. Drought conditions are known to occur in the region once every 10 years (Holt & Bertram, 1981).

Average maximum and minimum temperatures are also high in the wet season and lower in the dry season, with slightly greater extremes of temperature in the southern part of the region. At Daly Waters, annual monthly maximum temperatures range between 29.0 °C (June) and 38.2 °C (Nov), and minimums between 11.9 °C (Jul) and 24.2 °C (Dec) (DEPWS 2022b).

The LCA for Shenandoah South E&A program was completed in May 2024 at the start of the dry season, not long after a larger than average wet season (November to April) rainfall of 1320 mm. A significant amount of surface water remained on the landscape during the May 2024 survey.

The average annual rainfall experienced in the region (which includes the BOM data from Daly Waters Airstrip) is shown in Table 4.

Table 4 Annual rainfall 2016 – 2024

Year	Annual rainfall (mm)	Months during which rain was recorded
2016	608	12
2017	866	7
2018	752	7
2019	277	8
2020	951	9
2021	679	7
2022	561	10
2023	762	8
2024*	1141	4

*Rainfall statistics as of July 2024

3.2 Topography, Surface Water and Drainage

The Shenandoah South E&A program occurs within a topographic zone classified as laterite plains that predominantly slope in a south and south westerly direction (Tickell, 2003).

The SREBA Beetaloo Wiso Basin Water Management Area mapping reveal that The Shenandoah South E&A program is situated in the Wiso River Basin (Figure 4). The Wiso River Basin covers the southern half of EP98 (south of the Carpentaria Highway) and a large proportion of EP117. The Wiso Basin is internally drained by Newcastle Creek and several small ephemeral creeks. Newcastle Creek flows into Lake Woods, which is located south of Newcastle Waters Station, around 87 to 110 km south of the Shenandoah South E&A program.

The location of Lake woods and Newcastle Creek within the wider landscape is displayed in Figure 5.

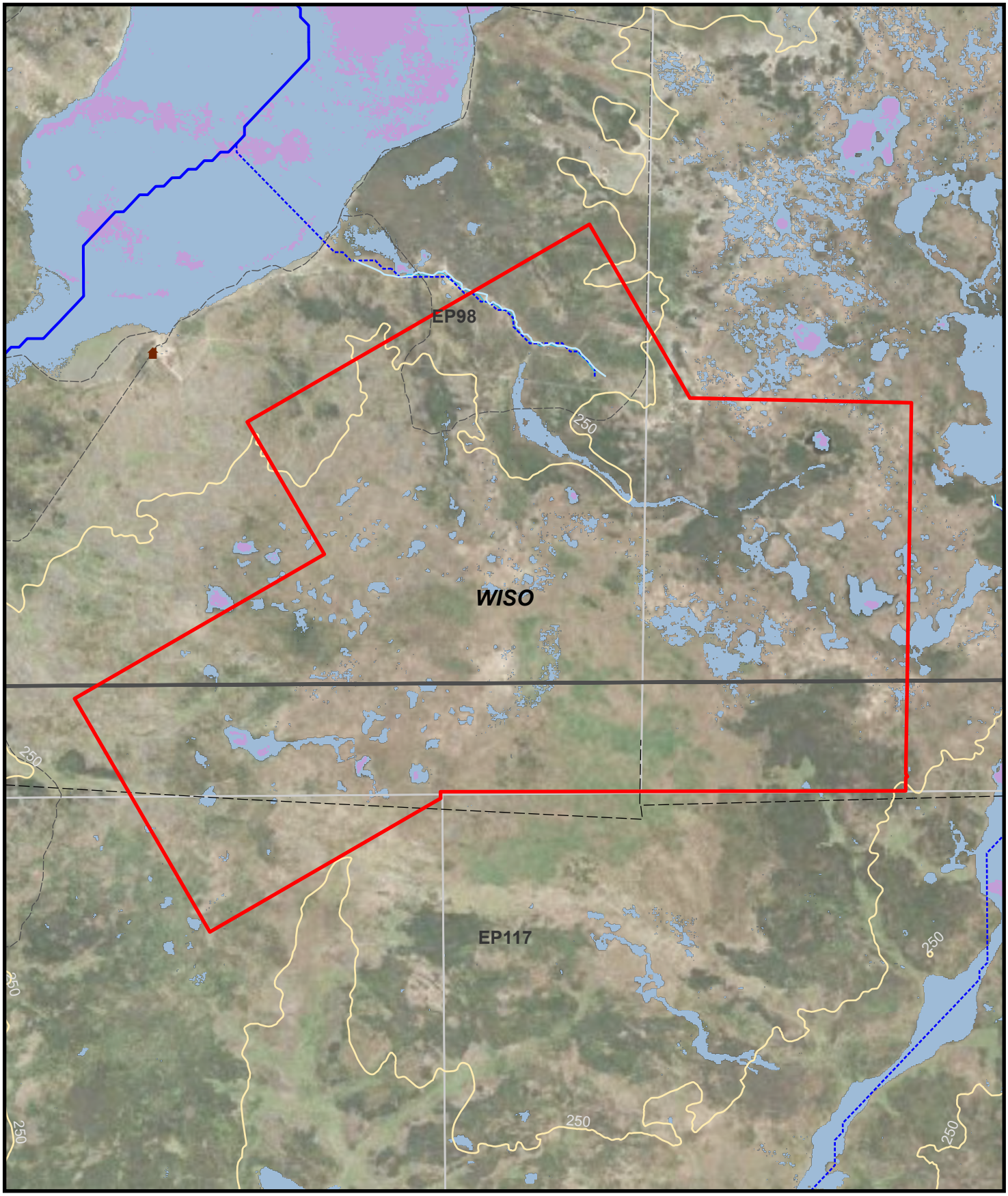
Lake Woods covers an area of inundation of approximately 50,000 ha in normal rainfall years, extending to 80,000 ha in exceptionally wet years, after which it can retain water for several years (AECOM, 2015). Lake Woods is described as a major quasi-permanent surface water body in the region, although some semi-permanent and many ephemeral waterholes are located across the permit area (HLA, 2006). Lake Woods fills during major flood events of Newcastle Creek and is listed as a wetland of national significance in the Directory of Important Wetlands in Australia (DIWA: NT013 Lake Woods) (DEPWS, 2022a).

Although Lake Woods is located approximately 86 to 109 km south, outside of the exploration permit area, it is fed principally by surface inflow of Newcastle Creek, originating more than 160 km north-east on Amungee Mungee Station (DEPWS, 2022a). During the period of inundation, Lake Woods supports over 100,000 waterbirds including internationally significant numbers of Plumed Whistling-Duck (*Dendrocygna eytoni*). Numerous bird species nest and feed in the diverse wetland habitat, and the conservation group ‘Birdlife International’ nominated Lake Woods as an ‘Important Bird Area’ (IBA). The lake also includes the largest area of lignum swamp in the Northern Territory and in tropical Australia (NRETAS, 2009).

DEPWS studies (2022a) have identified over 7,000 records of 81 waterbird species and all large-scale waterbird breeding events and the largest congregation of waterbirds, were from Lake Woods and nearby waterholes on Newcastle Creek.

Across the Shenandoah South E&A program area there are no creeks that will be intersected during the program and one intermittent stream (stream order 1) located to the north. In addition, there are some occurrences of palustrine (non-riverine or non-channel systems) and floodplain systems, with shallow depressions and gullies. These surface water systems will require management actions that aim to avoid activity in a waterway as to not materially change the shape of the water way, the volume, speed or direction divert local water or a cause change to the bed or bank stability. Where avoidance is not achievable Tamboran will seek a permit to Interfere with a Waterway under the NT *Water Act 1992* (refer Section 3.3).

Based on SREBA Environmental Health Baseline Report on water, surface water quality across the Beetaloo study area varied widely due to climate conditions, associated with signification rainfall during the wetter months of the year and lower rainfall during drier periods which has the potential to influence surface water quality across the study area. The historical water summary data on Newcastle Creek and Daly Waters from show neutral surface water pH, while spring water shows higher alkaline pH. Salinity varies from fresh to brackish conditions, however, it is greatly reduced during the wet season due to rainfall.



LOCATION

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GEOCENTRIC DATUM OF AUSTRALIA 94

0 1 2 4

Kilometers

- Project Boundary
- **River Basins**
- Wiso
- Contours
- **Stream Order**
- **Intermittant Streams**
- 1
- 2
- Populated Place
- Tracks
- Permit Areas
- Pastoral Lease Boundary
- AHGHF Mapped Stream - SREBA
- **Aquatic ecosystem**
- Palustrine System
- Floodplain System

Data sources: Permit Area, Cadastre - NT Gov 2019. Places, Vegetation - Aust Gov 2019 Highways, Roads, Drainage - StreetPro 2019

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Shenandoah South Program
Surface Water and Drainage

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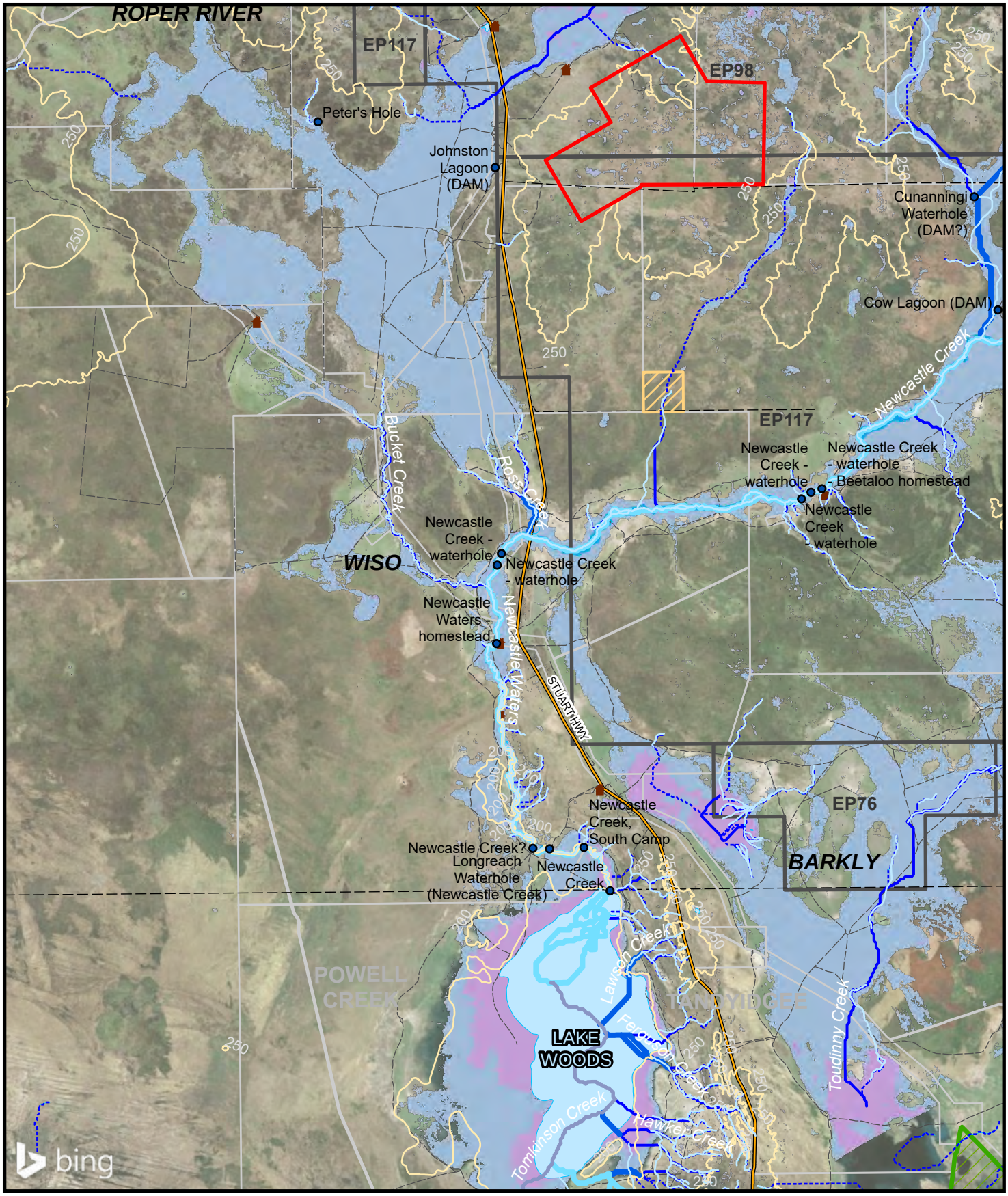
Figure 4



LOCATION

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0 1 2 4

Kilometers

River Basins
- Barkly
- Roper River
- Wiso
- Contours

Stream Order

Intermittant Streams
- 1
- 2

Creeks
- 3
- 4

Rivers
- 5
- Project Boundary
- Populated Place
- Tracks
- Highway
- Permit Areas
- Aboriginal Land
- Pastoral Lease Boundary
- Water Bodies
- Bullwaddy Conservation Reserve
- SREBA Beetaloo Aquatic Ecosystems - Refugia points
- AHGHF Mapped Stream - SREBA

Aquatic ecosystem
- Riverine System
- Lacustrine System
- Palustrine System
- Floodplain System

Data sources: Permit Area, Cadastre - NT Gov 2019. Places, Vegetation - Aust Gov 2019 Highways, Roads, Drainage - StreetPro 2019

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New Castle Waters and Lake Woods Surface Water and Drainage

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Figure 5

3.2.1 Flood risk

The extent of inundation within the permit area depends on the severity of the wet season and can range from completely dry to widespread flooding. One non-perennial stream (Stream Order 1) passes through the northern section of the Shenandoah South E&A program area. The stream would flow for only a short period of the wet season, with waterholes potentially forming at the beginning of the dry season.

To understand the flood risk within the permit area, AECOM undertook hydraulic modelling to determine the 1% Annual Exceedance Probability (AEP) flood extent. A two-dimensional (2D) TUFLOW hydraulic model was used for the assessment. **Figure 6** shows a 1% AEP flooding which includes both local catchment and regional catchment flood mechanisms.

The potential inundation depth ranges from around 1.7 metres in the gullies within the permit area to very shallow (<100 mm) depths closer to the top of the catchment. The average 1% AEP velocity within the gullies is low ranging from 0.1 to 0.6 m/s. From a flood risk perspective, works within the permit area should avoid the deeper flows in the gullies.

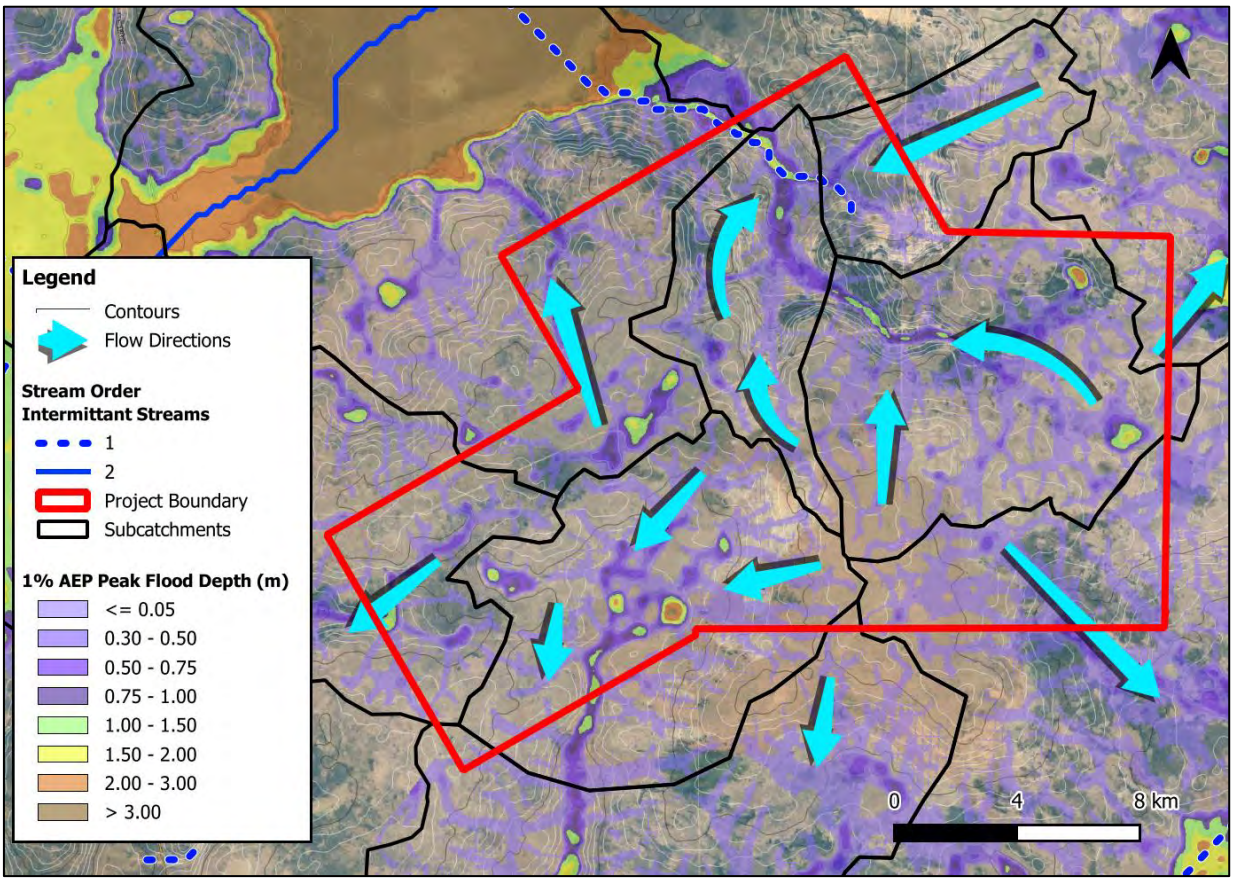


Figure 6 1% AEP flood depth with sub-catchment boundary

3.3 Hydrogeology

The Beetaloo Basin consists of a series of stacked sedimentary basins ranging in age from Mesoproterozoic to Cretaceous with a thin Cenozoic cover (DEPWS 2022c). Beetaloo Basin is characterised by lateritic plains and rises, clay plains, alluvial flood plains, sandstone plains and rises, lateritic plateau and basalt plains and rises. Shenandoah South E&A program area consists of a thick sequence of sandstone formations and rises that were deposited between 1,500 and 1,430 million years ago (Ma) (Table 5). The sandstone formation is estimated to reach 5,000 m in thickness in the centre of the basin, while the northern and eastern margins have an average depth of approximately 500 m (CloudGMS, 2015).

The sandstone formations are overlain by the Georgina Basin (630 – 497 Ma), which includes widespread basalts and a thick limestone sequence that forms the Cambrian Limestone Aquifer (CLA), which is a significant water supply aquifer in the region. The Georgina Basin is capped by Cretaceous mudstone and sandstone (145 – 66 Ma) and recent alluvial and laterite deposits.

The generalised Hydrostratigraphy of the Beetaloo Basin is presented in Table 5.

Table 5 Summary of Beetaloo Basin Hydrostratigraphy (DEPWS 2022b; CloudGMS 2015)

Province	Period/Age	Formation		Aquifer Status	Thickness (m)	Yield (L/s)	Ave EC (µs/cm)
CARPENTARIA BASIN	CRETACEOUS 145 – 66 Ma	Undifferentiated		*Local Aquifer*	0 - 130	0.3 - 4	1,800
GEORGINA BASIN	CAMBRIAN 497-630 Ma	Cambrian Limestone Aquifer (CLA)	Anthony Lagoon Beds	REGIONAL AQUIFER	0 – 200	1 - 10	1,600
			Gum Ridge Formation	REGIONAL AQUIFER	0 – 300	0.3 - >20	1,400
		Antrim Plateau Volcanics		REGIONAL AQUITARD	0 – 440	0.3 - 5	900
		Bukalara Sandstone		*Local Aquifer (not regionally connected)*	0 – 75	0.3 - 5	1,000
BEETALOO BASIN (ROPER GROUP)	NOT KNOWN	Hayfield Mudstone		REGIONAL AQUITARD	0 – 450	-	32,000
		Jamison Sandstone		*Local Aquifer (not regionally connected)*	0 – 150	-	138,000
	MESO-PROTEROZOIC 1,430-1,500 Ma	Kyalla Formation		REGIONAL AQUITARD	0 – 800	-	-
		Moroak Sandstone		*Local Aquifer (not regionally connected)*	0 – 500	0.5 - 5	131,000
		Velkerri Formation		REGIONAL AQUITARD	700 – 900	-	-
		Bessie Ck Sandstone		*Local Aquifer (not regionally connected)*	450	0.5 - 5	-

Across parts of the Beetaloo Basin, undifferentiated Cretaceous deposits form the uppermost aquifer which is utilised for stock use. Notably, a basal sandstone unit immediately overlying the CLA produces yields of up to 5 L/s. Shallow groundwaters have also been recorded within the permit area between 1 and 2 metres below ground level.

The CLA, comprising the Gum Ridge Formation and the Anthony Lagoon Beds, is an extensive regional aquifer system that forms the principal water resource in the Beetaloo Basin. Limestone in the CLA is commonly fractured and cavernous; regionally bore yields of up to 100 L/s have been recorded from

this aquifer. Approximately 80% of groundwater bores drilled in the basin screen the CLA and the aquifer supplies water for the pastoral industry and local communities including Elliot, Daly Waters, Larrimah and Newcastle Waters.

The CLA contains a significant but largely undeveloped groundwater resource with the sustainable yield from the Georgina Basin estimated to be in the order of 100,000 ML/year. Existing groundwater use in the Beetaloo Basin is estimated at 6,000 ML/year.

The regional groundwater flow direction in the CLA is north-west toward Mataranka, where the aquifer discharges into the Roper River and supports significant groundwater dependent ecosystems including the Roper River at Elsey National Park and Red Lily/57 Mile Waterhole. These discharge features occur around 100 km north-west of the Beetaloo Basin. Dry season flow in the Roper River has been gauged at 95,000 – 126,000 ML/year and provides an estimate of the magnitude groundwater discharge from the CLA. Large decadal changes in the discharge to the Roper River suggest that most recharge input occurs close to the discharge zone (i.e. beyond the Beetaloo Basin region). Groundwater recharge mechanisms to the CLA are poorly characterised but are likely to be dominated by infiltration through sinkholes and preferential recharge through soil cavities.

Limited information exists on the hydrogeological characteristics of the Roper Group sequence as it occurs at depth within the Beetaloo Basin. Sandstone dominated formations may behave as aquifers, however, drilling results suggest these formations have limited permeability and will only form marginal, very local scale aquifers. Groundwater in the Roper Group is highly saline and contrasts with the shallower, utilised aquifers in which groundwater is generally of drinking water quality.

The Velkerri Formation represents the primary unconventional gas target in the Beetaloo Basin, although small hydrocarbons intersections have been encountered in other formations within the Roper Group. Vertical pressure gradients between the Roper Group and the CLA are not well characterised, however, previous exploration well formation tests indicate there is an upward pressure gradient from the Roper Group to the CLA. Over much of the basin the CLA is separated from these formations by multiple aquitards including the Antrim Plateau Volcanics and Hayfield Mudstone.

The Tamboran permit area currently falls within the Daly Roper Beetaloo Water Control District, that encompasses 175,580 km^2 and includes the Roper River and its tributaries as well as the Beetaloo Sub-basin (DENR, 2018). Legislation in Water Control Districts covers all aspects of sustainable water management, including the investigation, use, control, protection and allocation of water resources. Through the NT *Water Act 1992*, water control districts and water allocation plans, allocation of water to various declared beneficial uses, including agriculture, aquaculture, public water supply, riparian and industry while ensuring that adequate provisions are made to maintain cultural and environmental requirements. Water control districts are geographical areas declared under the *Water Act* by the minister to allow for intensive management of water resources. Tamboran have an existing water extraction licence from DEPWS Water Resource Division in accordance with the *Water Act* (Cloud GMS, 2015).

There are 12 groundwater bores located within 12 km of the Shenandoah South E&A program. Six of the bores are associated with Tamboran activities at Kyalla 117 NE and the remaining are Stuart Highway Roadside bores or pastoral bores.

3.4 Aquatic systems

There were no surface aquatic ecosystems recorded within the Shenandoah South E&A program area. The nearest aquatic ecosystem is Johnston Lagoon, located approximately 7.5 km west to the Shenandoah South E&A program area (SREBA Beetaloo Aquatic Ecosystems – Refugia points meta data set).

3.5 Land systems and units

The Shenandoah South E&A program area occurs within the Beetaloo Land System, which is classified as lateritic plains and rises. This land system is characterised by plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products, sandy and earth soils (DLRM, 2013).

Land units are defined based on a combination of geology, topography, soils and vegetation. Land unit mapping has been undertaken for a large portion of the Shenandoah South E&A program area in the south-west, at a scale of 1:50,000, and is derived from *Soil and Land Suitability Assessment for Irrigated Agriculture in the Dunmarra Area* (Burley *et al*., 2019).

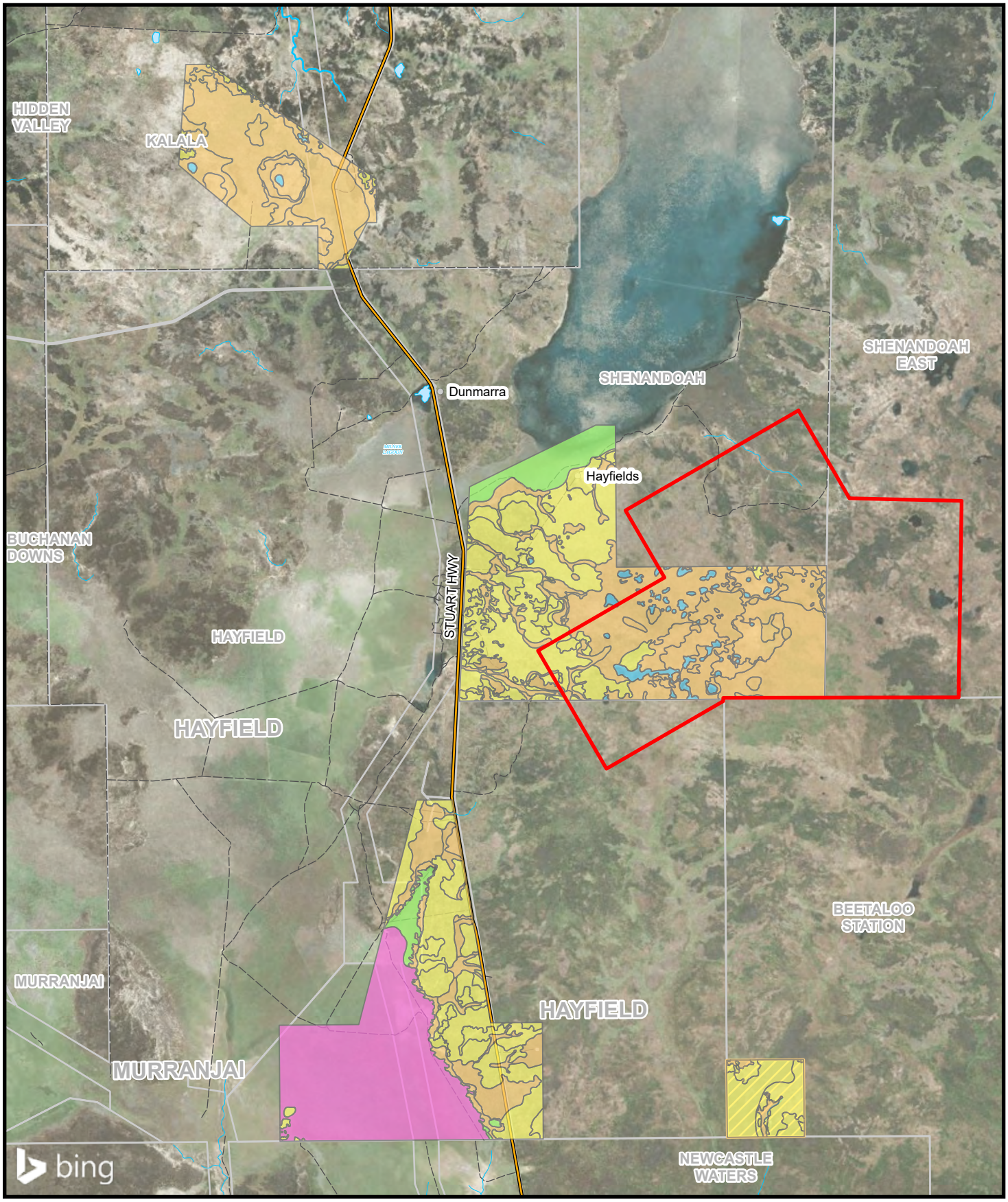
The Shenandoah South E&A program area comprises three different landform classes (low rises, plains and swamps), which have been further subdivided into 12 land units. Most of the mapped Shenandoah South E&A program area comprises the plains landform class.

Landform classes within the Shenandoah South E&A program area are displayed in Figure 7, and land units are summarised below in Table 6.

Table 6 Land Unit details (Burley et al., 2019)

Land Unit	Landform Class	Landform Description	Soil Decsription	Vegetation Description
7a	Low Rises	Gently undulating dissected gravelly low rises and pediment slopes	Shallow to moderately deep (0.25-1 m), brown or red massive earths over ferricrete (sandy topsoil) (Brown or Red Kandosols).	*Corymbia dichromophloia* low open woodland
7b	Low Rises	Scoured gravelly level to gently undulating low rises and pediment slopes	Shallow to moderately deep (0.25-1 m), brown or red massive earths over ferricrete (clay loamy topsoil) (Brown or Red Kandosols).	*Acacia shirleyi* low woodland
7c	Low Rises	Gently undulating weathered sandstone low rises	Shallow (0.25-0.5 m), moderately gravelly, undeveloped sandy soil over ferruginised sandstone (Clastic Rudosols)	*Eucalyptus leucophloia* subsp. *euroa* low open woodland
8a1	Plains	Level plains of residual plateau surface	Very deep (>1.5 m), red massive earths (Red Kandosols)	*Corymbia dichromophloia, Erythrophleum chlorostachys, Corymbia ferruginea* mid open woodland
8a2	Plains	Level plains on margins of residual plateau surface	Moderately deep to very deep (>0.5 m) earthy sands over ferricrete (Leptic Tenosols)	*Corymbia dichromophloia, Corymbia ferruginea* mid woodland
8a3	Plains	Level wash-slope plains and pediments	Shallow (0.25-0.5 m), earthy sands (Leptic Tenosols) or moderately deep (0.5-1 m), brown massive earths (Brown Kandosols) over ferricrete	*Corymbia dichromophloia* low open woodland
8a4	Plains	Broad, imperfectly drained lower-lying areas on level plains	Deep to very deep (>1.0 m), grey or yellow massive earths over ferricrete (Grey or Yellow Kandosols)	*Melaleuca nervosa* low open woodland
8b1	Plains	Level colluvial plains and valley flats within narrow relict drainage features	Very deep (>1.5 m), red massive earths (Red Kandosols)	*Erythrophleum chlorostachys, Corymbia dichromophloia, Corymbia terminalis* mid woodland
8b2	Plains	Level colluvial plain margins and	Moderately deep to deep (0.5-1.5 m), red massive	*Erythrophleum chlorostachys, Corymbia*

Land Unit	Landform Class	Landform Description	Soil Decsription	Vegetation Description
		valley flats within narrow relict drainage features	earths over ferricrete (Red Kandosols)	*dichromophloia, Corymbia terminalis* low woodland
8b3	Plains	Level, imperfectly drained, colluvial valley flats and margins within relict drainage features	Deep (1-1.5 m), brown massive earths over ferricrete (clayey subsoil) (Brown Kandosols)	*Erythrophleum chlorostachys, Corymbia dichromophloia, Bauhinia cunninghamii* low open woodland
8c2	Plains	Level clay plains within steep-sided open depressions	Moderately deep (0.5-1.0 m), massive brown clays over ferricrete (Brown Kandosols)	*Macropteranthes kekwickii, Terminalia volucris* tall shrubland
11a	Swamps	Localised shallow, level closed depressions and seasonal swamps	Very deep (>1.5 m), seasonally wet, mottled soils (Redoxic Hydrosols)	*Eucalyptus microtheca* low open woodland



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GEOCENTRIC DATUM OF AUSTRALIA 94

0 2.5 5 10

Kilometers

- Project Boundary
- Populated Place
- Tracks
- Highway
- Water Bodies
- Aboriginal Land
- Pastoral Lease Boundary

Landform Class

- Downs Plains
- Inland Wetlands
- Low Rises
- Plains
- Swamps

LOCATION

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro 2019

tamboran RESOURCES

Shenandoah Project Area Land Units

PROJECT ID	60623736
CREATED BY	CummingsL
LAST MODIFIED	08-Jul-2024
VERSION	1

Figure 7

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3.6 Soils

Soils within the Sturt Plateau have been derived from ancient rock formations and ancestral soils that were formed during earlier weathering cycles. The soils have been deeply weathered, leached and are relatively infertile because they have not been enriched by any recent geological events (Orr & Holmes, 1984). The soil types located within the plateau range from the very strongly leached lateritic soils of the Tertiary land surface to the calcareous desert soils and desert loams in the southern drier areas.

The lateritic plains and rises, which encompass the Shenandoah South E&A program, are classed as very strongly leached soils of the Tertiary land surface (Richards *et al* 2023).

Land Unit mapping within the Shenandoah South E&A program area indicates that the Corymbia/Eucalypt plains mostly comprise Kandoslol soils, with a mixture of red, brown and yellow earths, while swamp landforms contain seasonally waterlogged Hydrosols (Burley *et al*., 2019).

3.6.1 Field Assessment

A soil assessment was completed at the Shenandoah South E&A program. The result of the assessment is presented in Table 7, and includes soils assessed within the Shenandoah South E&A program area in 2022 and 2023. Soils assessed in the top 10 cm during a rapid assessment are detailed in Appendix A. The soils within the Shenandoah South E&A program were predominantly loamy sands in the A horizon, grading to sandy loams or sandy clay loams in the B horizon. Grey and brown coloured soils, such as those encountered at Site 40 and Site 54, are indicative of poorly drained soils, which the rich reddish soils encountered at Site 48 and Site 65 are well-drained.

Soil material structure samples were collected during the field work. Soil lab results are provided in Appendix B.

Table 7 Soil summary – Full assessment sites

Horizon	Depth (m)	Texture	Colour	Coarse fragments	pH	EC (µS/cm)	Moisture	Mottles	Emerson class no.	Photo
Site 14										
A1	0-0.2	Loamy sand	7.5YR 3/2 Dark brown	-	6.8	6.0	Dry	-	3	
A3	0.2-0.45	Loamy sand (heavy)	7.5YR 3/3 Dark brown	-			Moist	Grey and reddish brown		
B1	0.45-0.7	Sandy loam	7.5YR 4/4 Dark brown	-	6.9	7.0	Moist	Grey and reddish brown	-	
B2	0.7-1.0	Sandy loam (heavy)	2.5YR 3/3 Dark reddish brown	40% subangular ironstone, 0.2-3 mm 10% subangular ironstone, 3-6mm			Moist	Grey and reddish brown		
Site 40										
A1	0-0.2	Loam sand (light)	7.5YR 4/1 Dark grey	-	6.7	7.0	Dry	-	3	
A3	0.2-0.55	Sandy loam (light)	7.5YR 6/1 Grey	-			Dry	-		
B1	0.55-0.70	Sandy clay loam	7.5YR 4/1 Dark grey	15% subangular ironstone, 0.2-2mm 15% subangular ironstone, 2-6mm	6.6	8.0	Moist	Grey and brown	4	
B2	0.7-0.9	Sandy clay loam (heavy)	7.5YR 3/2 Dark brown	25% subangular ironstone, 0.2-2mm 25% subangular ironstone, 2-6mm			Moist	Grey and brown		

Horizon	Depth (m)	Texture	Colour	Coarse fragments	pH	EC (µS/cm)	Moisture	Mottles	Emerson class no.	Photo
Site 48										
A1	0-0.08	Loam sand	5YR 4/3 Reddish brown	-	6.3	5.0	Dry	-	4	
A3	0.08-0.3	Sandy loam (light)	2.5YR 4/6 Red	-			Dry	-		
B1	0.3-0.7	Sandy loam	2.5YR 4/6 Red	-	6.8	8.0	Dry	-	5	
B2	0.7-1.0	Sandy loam (heavy)	10YR 4/6 Red	-			Slightly moist	-		
Site 53										
A1	0-0.1	Loamy sand (light)	7.5 YR 2.5/1 Black	-			Dry	-	-	
B1	0.1-0.25	Sandy loam	10YR 4/1 Dark grey	-	5.7	8.0	Dry	-	4	
B2	0.25-0.35	Sandy loam (heavy)	5YR 4/2 Dark reddish grey	5% 0.2-2mm subangular ironstone 5% 2-5mm subangular ironstone			Moist	Reddish-brown and grey		
Hard rock substrate (laterite) at 0.35m										

Horizon	Depth (m)	Texture	Colour	Coarse fragments	pH	EC (µS/cm)	Moisture	Mottles	Emerson class no.	Photo
Site 54										
A1	0 – 0.2	Loamy sand (light)	7.5YR 3/2 Dark brown	-	5.8	5.0	Dry	-	-	
A3	0.2– 0.4	Loamy sand	10YR 4/1 Dark grey	15% 0.2-2mm subangular ironstone 15% 2-6mm subangular ironstone			Dry	-		
B1	0.4-1.0	Sandy loam	7.5YR 5/2 Brown	20% 0.2-2mm subangular ironstone 30% 2-5mm subangular ironstone	6.3	8.0	Dry	-	-	
Site 59										
A1	0 – 0.1	Loamy sand	5YR 4/2 Dark reddish grey	20% 0.2-2mm subangular ironstone 20% 2-5mm subangular ironstone 10% 5-10mm subangular ironstone	6.0	8.0	Dry	-	-	
A3	0.1–0.2	Loamy sand	5YR 3/2 Dark reddish brown	25% 0.2-2mm subangular ironstone 35% 2-10mm subangular ironstone			Dry	-		
B1	0.2-0.4	Sandy loam	2.5YR 4/6 Red	15% 0.2-2mm subangular ironstone 5% 2-5mm subangular ironstone	6.1	5.0	Slightly moist	-	4	
B2	0.4-0.75	Sandy clay loam	2.5YR 4/6 Red	15% 0.2-2mm subangular ironstone 5% 2-5mm subangular ironstone			Moist	Yellow and reddish-brown		

Horizon	Depth (m)	Texture	Colour	Coarse fragments	pH	EC (µS/cm)	Moisture	Mottles	Emerson class no.	Photo
Site 65										
A3	0 – 0.3	Loamy sand	5YR 3/3 Dark reddish brown	5% 0-5mm subangular ironstone	6.0	6.0	Dry	-	3	
B1	0.3–0.6	Loamy sand (heavy)	2.5YR 4/6 Red	-	6.4	8.0	Dry	-	6	
B2	0.6-1.0	Sandy clay loam	2.5YR 4/6 Red	-			Slightly moist	-		
Shenandoah South A										
A1	0-0.2	Sandy Loam with Gravel	7.5YR 4/3 Brown	10% coarse, 3 mm	-	-	Dry	-	-	
B1	0.2-0.5	Sandy Loam with Gravel	7.5YR 3/4 Dark brown	30% coarse, 3-5 mm	7.3	6	Dry	-	2	
B2	0.5-0.75	Sandy Loam with Gravel	5YR 3/3 Dark reddish brown	40% coarse, 3-10 mm	7.1	7	Dry	-	2	

Horizon	Depth (m)	Texture	Colour	Coarse fragments	pH	EC (µS/cm)	Moisture	Mottles	Emerson class no.	Photo
Shenandoah South B										
A1	0-0.3	Clay Loam Sandy	10YR 4/1 Dark grey	40% fines, no coarse	7.0	17	Moist	-	2	
B1	0.2-0.5	Light Medium Clay	10YR 6/1 Grey	40% fines, no coarse	-	-	Moist	-	2	
B2	0.5-0.75	Medium Clay	10YR 6/1 Grey	40% fines, no coarse	7.4	13	Moist	-	2	
Shenandoah South C										
A1	0-0.3	Silty Clay Loam	10YR 4/1 Dark grey	<5% coarse, 2mm	6.7	8	Dry	-	2	
B1	0.2-0.5	Clay Loam Sandy	10YR 5/3 Brown	20% coarse, 3-7mm	7.0	10	Dry	-	2	
B2	0.5-0.75	Clay Loam Sandy	10YR 5/2 Greyish brown	20% coarse, 3-7mm	6.8	12	Moist	-	2	

Horizon	Depth (m)	Texture	Colour	Coarse fragments	pH	EC (µS/cm)	Moisture	Mottles	Emerson class no.	Photo
Shenandoah South 2										
A1	0-0.2	Loamy Sand	5YR – 3/4 Pale brown	No Coarse Fragments	5.8	24	Dry	-	3	
B1	0.2-0.7	Sandy Loam	5YR 3/3 Dark reddish brown	65% fines, 20% 1-2 mm subangular ironstone, 15% 2-5 mm subangular ironstone	6.3	13	Dry	-	6	
Shenandoah South 3										
A	0 – 0.25	Loamy Sand	5YR – 3/4 Dark reddish brown	-	6.4	9	Dry	-	3	
B	0.25 – 0.60	Sandy Loam	5YR – 4/4 Reddish brown	-	6.3	9	Dry	-	6	

Horizon	Depth (m)	Texture	Colour	Coarse fragments	pH	EC (µS/cm)	Moisture	Mottles	Emerson class no.	Photo
Shenandoah South 4										
A1	0 – 0.15	Sandy Clay Loam	10YR – 4/1 Dark grey	-	5.3	15	Dry	-	3	
B1	0.15– 0.75+	Clay Loam Sandy	10YR 7/1 Light grey	-	5.4	8	Slightly Moist	-	6	
Shenandoah South 5										
A1	0 – 0.15	Sandy Clay Loam	10YR – 3/4 Dark yellowish brown	-	7.1	16	Dry	-	3	
B1	0.15–0.60+	Clay Loam Sandy	10YR – 6/3 Pale brown	-	7.6	13	Dry	-	6	

3.6.2 Erosion Susceptibility

Soil erosion susceptibility varies throughout the permit area, dependent upon soil types, slope and extent of ground disturbance. Apart from the erosive impact of climatic conditions, soil erosion is influenced mainly by the inherent properties of the soils and the processes which occurred during the formation of the landscapes (Aldrick & Wilson, 1990).

Erosion will occur in the Shenandoah South E&A program area if the land is used beyond its capacity, as is seen if land is overstocked or vehicle movements not controlled. Factors considered to determine the risk of erosion occurring include the following:

- Soil type – soils with higher clay content are prone to generation of bulldust and are easily eroded by wind and water. The surface soils at sites where a full soil assessment was undertaken had low clay content in the upper 0.2m, usually comprising loamy sands (5-10% clay). Gravelly soils tend to be more robust to disturbance on the scale expected during construction within the Shenandoah South E&A program area. The sites assessed mostly lacked surface gravels and were generally non-dispersive soils as shown below:
    - Site 14 – no surface gravel, Emerson class number 3 (A horizon)
    - Site 40 – no surface gravels, Emerson class number 3 (A horizon), 4 (B horizon)
    - Site 48 – no surface gravels, Emerson class number 4 (A horizon), 5 (B horizon)
    - Site 53 – no surface gravels, Emerson class number 4 (B horizon)
    - Site 54 – no surface gravels
    - Site 59 – Surface gravel 30%, Emerson class number 4 (B horizon)
    - Site 65 – Surface gravel 5%, Emerson class number 3 (A horizon), 6 (B horizon)
    - Shenandoah South A – Surface gravel 10-30%, Emerson class number 2
    - Shenandoah South B – no surface gravels, Emerson class number 2
    - Shenandoah South C – 5-10% surface gravels, Emerson class number 2
    - Shenandoah South 2 – no surface gravels, Emerson class number 3
    - Shenandoah South 3 – no surface gravels, Emerson class number 3
    - Shenandoah South 4 – no surface gravels, Emerson class number 3
    - Shenandoah South 5 – no surface gravels, Emerson class number 3
- Slope – the slope of the site will determine the risk of erosion during rainfall events, with steeply inclined areas a higher risk than small undulations in the landform. Sites assessed within Shenandoah South E&A program were generally flat with slopes of ≤1%. As such the project area has a low erosion risk regarding slope. Some isolated areas with slopes of greater than 2% occur where additional measures to mitigate erosion impacts may be required.
- Aspect - the position of the access tracks, well pads, gravel pits and seismic lines in relation to the direction of the contour should be considered and creation of tracks across (as opposed to parallel with) the contour should be avoided.
- Rainfall – Table 8 and Table 9 presents the erosion risk rating based on average monthly rainfall using the rating system provided in the IECA (2008) for Daly Waters Airstrip (located north of the Shenandoah South E&A program). Construction activities are planned for completion prior to the wet season, November – March for Daly Waters and December – March for Newcastle Waters , to minimise the risk of erosion resulting from rainfall impacts.

Table 8 Erosion Risk Rating based on average monthly rainfall at Daly Waters Airstrip

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	167.3	188.1	105.5	20.8	6.2	2.9	2.6	0.3	1.8	21.3	52.9	116.8
Erosion Risk	H	H	H	VL	VL	VL	VL	VL	VL	VL	M	H

H = High (100+ to 225 mm); M = Moderate (45+ to 100 mm); L = Low (30+ to 45 mm); VL = Very Low (0 to 30 mm) Data sourced from Bureau of Meteorology, Climate Averages for Station 014626 Daly Waters Aerodrome recorded from 1939-2023.

Table 9 Erosion Risk Rating based on average monthly rainfall at Newcastle Waters

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	125.0	130.4	82.3	19.0	7.3	4.8	2.7	1.2	4.8	18.2	39.1	75.0
Erosion Risk	H	H	M	VL	VL	VL	VL	VL	VL	VL	L	M

H = High (100+ to 225 mm); M = Moderate (45+ to 100 mm); L = Low (30+ to 45 mm); VL = Very Low (0 to 30 mm) Data sourced from Bureau of Meteorology, Climate Averages for Station 015086 Newcastle Waters recorded from 1889-2023.

3.7 Bushfire

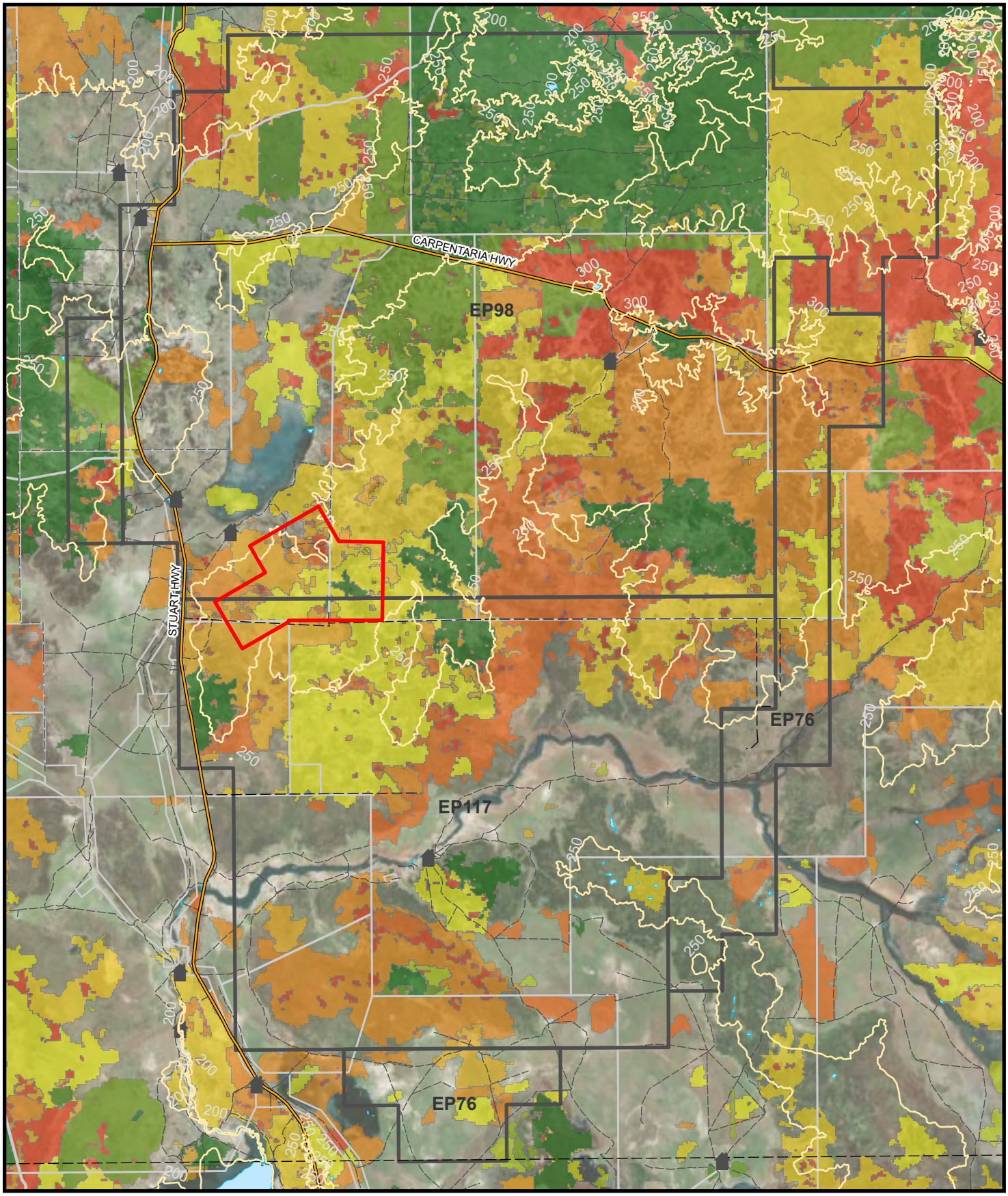
Fire is a natural occurrence in most Australian ecosystems and plays an important ecological role. Fire is generally excluded from Mitchell grasslands by pastoral management to maintain forage throughout the dry season (HLA, 2005). Fire is more frequent in the Eucalypt and Acacia woodlands situated within the Sturt Plateau bioregion.

Historically most high intensity fires within EP98 and EP117 occur during the dry season fires (June to September) (HLA, 2005). Wet season fires (October to May) have occurred within the permit area. These fires are likely to be patchy and of lower intensity, depending on the state of curing of the fuel load.

Fire sensitive Bullwaddy and Lancewood vegetation associations are located throughout the permit area. The impacts of hot fires can impact flora and fauna species and reduce habitat quality. Research suggests that hot fires may impact fauna diversity and in particular diurnal reptiles (e.g., Legge *et al*., 2008).

Land condition assessments undertaken for the Shenandoah South E&A program indicated low intensity fire events greater than 2 years at most assessed sites.

Fire data was acquired from the North Australian Fire Information (NAFI) site and queried for the Shenandoah South Area. Ten-year fire data (2014 to 2023) shows that most of the Shenandoah South E&A program area has been burnt between one and four times in the past 10 years, with sections of the north remaining unburnt, and parts in the south-east burnt five times. Figure 8 shows the fire frequency within the exploration areas over the past 10 years (2014 to 2023).



LOCATION

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GEOCENTRIC DATUM OF AUSTRALIA 94

0 7.5 15 30

Kilometres

- Project Boundary
- Contours
- Populated Place
- Tracks
- Highway
- Permit Areas
- Pastoral Lease Boundary
- Water Bodies

Years Burnt 2014 - 2023

1 2 3 4 5 6 7 8 9 10 11

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro 2019

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Permit Area Annual Fire Frequency 10 year, 2014 - 2023

PROJECT ID	60623736
CREATED BY	CummingsL
LAST MODIFIED	08-Jul-2024
VERSION	1

Figure 8

3.8 Air quality

SREBA Beetaloo environmental health interim baseline report on air quality reveals that, dust rate at nearby monitoring stations of the Shenandoah South E& A Program area such as Bullawaddy, Daly Waters and Elliott is within the adopted objective level (4 g/me/month). Concentrations of nitrous oxide (NO_2), sulphur dioxide (SO_2) and hydrogen sulphide (H_2S) were also well below the annual criterion at three monitoring stations as in Table 10.

Table 10 Summary of air quality datafrom the SREBA environmental health interim baseline report

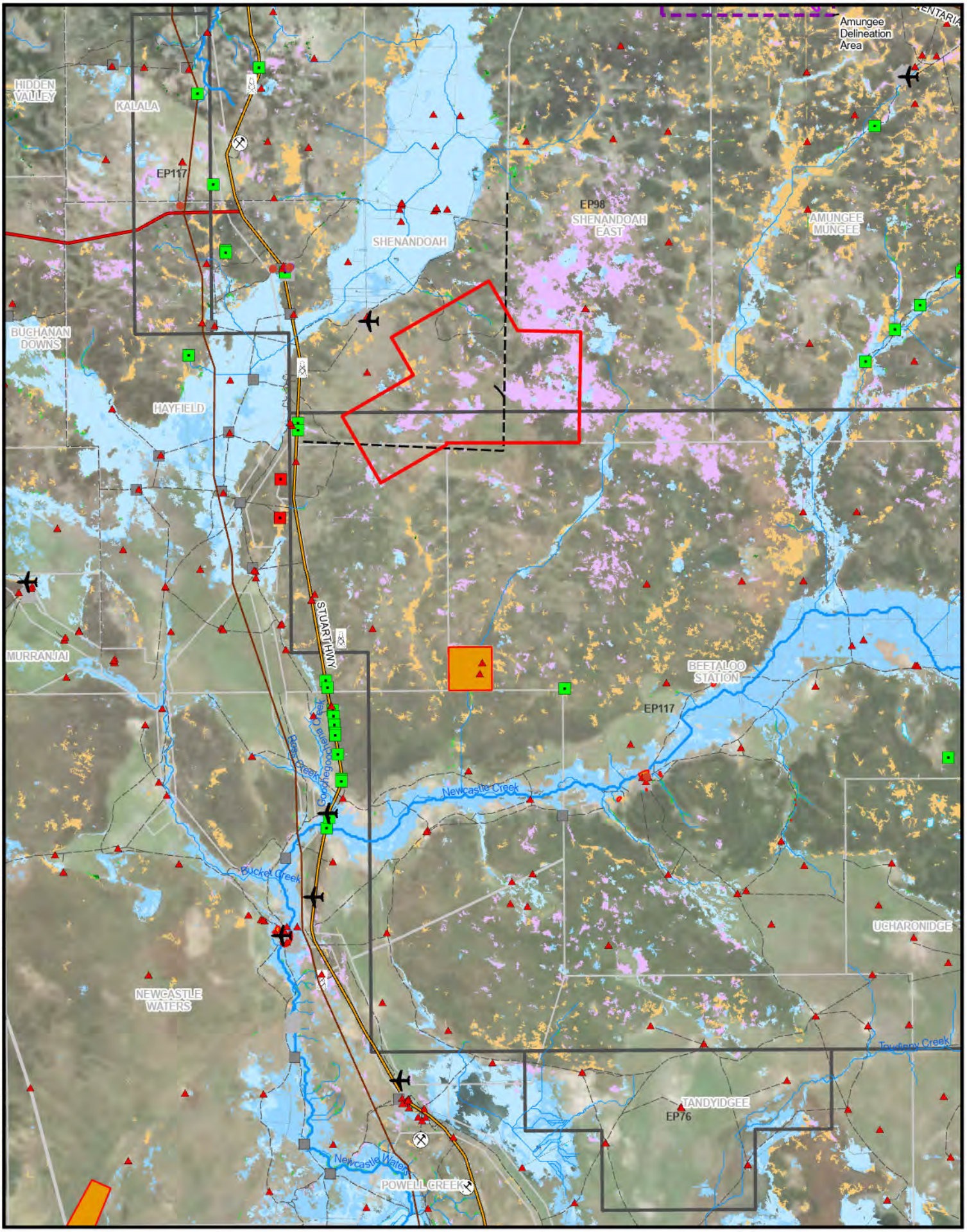
Gas type	Annual criterion	Bullwaddy	Daly Waters	Elliott
NO_2(October to November 2022)	31 (µg/m3)	2	2	3.4
SO_2 (October to November 2022)	57(µg/m3)	0.6-1	0.3-2	1
H_2S (October to November 2022)	0.5 µg/sample	Below the detectable limit		
Volatile Organic Compounds (VOC) (October to November 2022)	Below the detectable limit for various organic compounds			
Dust (October 2022)	4 g/m^2/month	1.0 0	0.40	0.70

3.9 Land use and sensitive receptors

Approximate separation distances from the Shenandoah South E&A program area to the nearest environmental and community receptors is summarised in Table 11. Sensitive receptors for the Shenandoah South E&A program area are illustrated in Figure 9.

Table 11 Shenandoah South E&A program area environmental and community receptors

Receptor	Distance from Shenandoah South E&A Program area
Closest pastoralist bore - Hayfield	4 to 28 km west
Nearest homestead - Hayfield	4 to 28 km west
Nearest community - Daly Waters	56 to 77 km north-west
Nearest Indigenous community - Jingaloo	25 to 45 km south
Stuart Highway	5 to 32 km west
Carpentaria Highway	45 to 66 km north
Bullwaddy Conservation Reserve	69 to 93 km north-east
Frew Ponds Reserve	16 to 38 km south-west
Lake Woods	86 to 109 km south
Nearest mapped major watercourse	4 km
Aquatic ecosystem (SREBA 2023) P = Palustrine system F = Floodplain system	Seismic lines intersect with floodplains (low sensitivity) throughout the Shenandoah South E&A program area.



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GEOCENTRIC DATUM OF AUSTRALIA 94

1:560,078 (when printed at A3)

0 5 10 20

Kilometres

- Project Boundary
- Amungee Delineation Area
- Access Tracks
- Populated Place
- Aircraft Facility
- Tower
- Mine
- Yard
- Tracks
- Highway
- Gas Pipeline
- Permit Areas
- Aboriginal Land
- Aboriginal Communities
- Pastoral Lease Boundary
- Pastoralist Bores
- Creek
- River
- Water Bodies

Threatened Flora and Fauna
- CR - Critically Endangered
- VU - Vulnerable

Heritage
- Historic Heritage Sites
- Archaeological Sites

Significant vegetation
- Riparian
- Riparian/wetland
- Wetland
- Wetland/floodplain
- Floodplain
- Floodplain/drainage
- Run-on

LOCATION

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro

Permit Area – sensitive receptors and features of interest

PROJECT ID	60623736
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VERSION	1

Figure 9

A3 size

4.0 Natural Environment

4.1 Bioregions

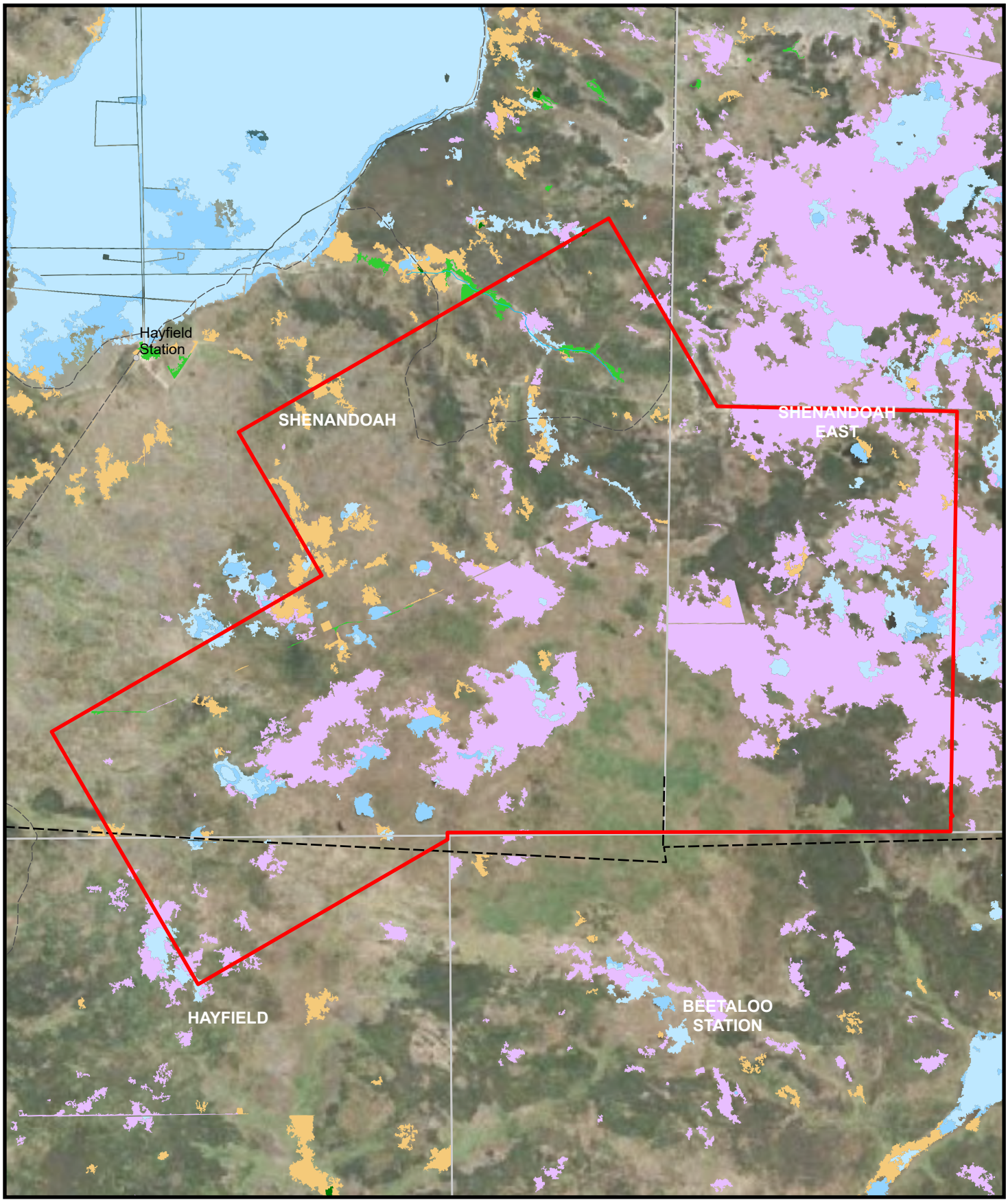
The Interim Biogeographic Regionalisation of Australia (IBRA) classifies the Shenandoah South E&A program area as occurring within the Sturt Plateau Bioregion. The Sturt Plateau Bioregion comprises undulating plains on sandstone, with predominantly neutral sandy red and yellow earth soils. Dominant vegetation is eucalypt woodland (dominated by variable-barked bloodwood *Eucalyptus dichromophloia*) with spinifex understorey, as well as extensive areas of Lancewood (*Acacia shirleyi*) - Bullwaddy (*Macropteranthes kekwickii*) vegetation association and associated fauna, including the Spectacled Hare-Wallaby (*Lagorchestes conspicillatus*). Land condition in the bioregion is moderate to good but threatened by impacts from weeds, feral animals, pastoralism and changed fire regimes (Baker *et al*, 2005).

4.2 Vegetation Communities

4.2.1 SREBA assessment

The SREBA Terrestrial Ecosystems Baseline Report identified 51 vegetation communities and 21 broad vegetation groups (BVG) comprising the final vegetation classification for the study area (Young et al, 2022).

Significant vegetation communities identified by the SREBA Baseline Report were also identified in the Shenandoah South E&A area. These include wetland, floodplains/drainage depressions and run-on areas. Significant vegetation communities within the Shenandoah South E&A program area are displayed in Figure 10.



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LOCATION

N

GEOCENTRIC DATUM OF AUSTRALIA 94

0 1 2

Kilometers

- Project Boundary
- Populated Place
- Tracks
- Pastoral Lease Boundary

SREBA Significant vegetation

- Riparian
- Riparian/wetland
- Wetland/floodplain
- Floodplain
- Floodplain/drainage depression
- Run-on

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro 2019

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Significant Vegetation

PROJECT ID	60623736
CREATED BY	CummingsL
LAST MODIFIED	16-Jul-2024
VERSION	1

Figure 10

4.2.2 Field surveys

Eleven vegetation communities were identified within the Shenandoah South E&A program area from 50 vegetation sites. Of these, 37 sites were recorded during the survey and further 13 sites were incorporated from land condition surveys undertaken within the Shenandoah South E&A program area in 2022 and 2023 (AECOM, 2023). Vegetation communities were further confirmed via aerial helicopter survey and an additional 59 air survey sites were recorded. Geolocated digital photos were also taken from the air and refenced to confirm the location of vegetation communities within the Shenandoah South E&A program area.

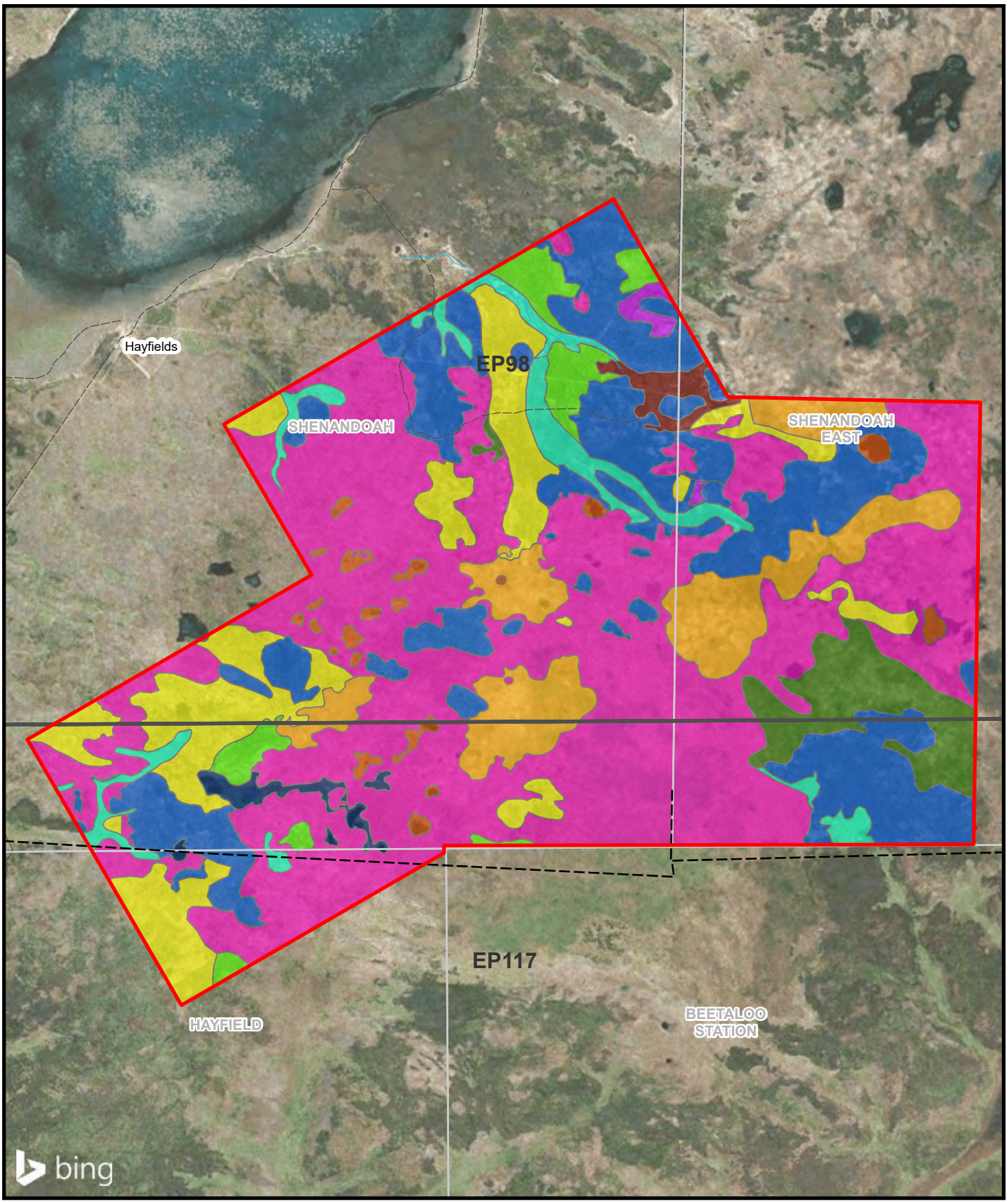
Vegetation communities are shown below in Table 12 and a map of vegetation community boundaries within the Shenandoah South E&A program area is shown in Figure 11. The area of each vegetation community and corresponding land types within the Shenandoah South E&A program area are provided in Table 28 in Section 5.0. Detailed vegetation community descriptions are provided in (Appendix C).

Table 12 Vegetation community descriptions

Vegetation Community	Description	Survey Sites	Photo
Comm 1a	*Acacia shirleyi* mid high woodland over, *Macropteranthes kekwickii, Terminalia volucris* mid high open shrubland, over *Eragrostis fallax, Sorghum intrans, Waltheria indica* mid high open tussock grassland	**No of sites:** (18) 16 Ground, 36 Ground, 45 Ground, Ex 9 Ground, Ex 170 Ground, Ex Shen S C Well, 15 Air, 57 Air,61 Air, 68 Air, 72 Air, 73 Air, 78 Air, 84 Air, 91 Air, 92 Air, 93 Air, 94 Air	
Comm 2a	*Corymbia dichromophloia* ± *Erythrophleum chlorostachys* mid high open woodland, over *Acacia difficilis, Terminalia canescens, Dodonaea hispidula* mid high open shrubland, over *Triodia bitextura* ± *Chrysopogon fallax, Schizachyrium fragile* mid high hummock grassland	**No of sites:** (37) 8 Ground, 9 Ground, 13 Ground, 14 Full, 23 Ground, 27 Ground, 38 Ground, 39 Ground, 40 Full, 48 Full, 52 Ground, 63 Ground, 65 full, 87 Ground, Ex 8 Ground, Ex 60 Ground, Ex 61 Ground, Ex Shen S A Well, 2 Air, 4 Air, 18 Air, 22 Air, 33 Air, 34 Air, 43 Air, 44 Air, 46 Air, 51 Air, 55 Air, 56 Air, 64 Air, 66 Air, 71 Air, 77 Air, 79 Air, 82 Air, 90 Air	
Comm 2b	*Acacia shirleyi, Corymbia dichromophloia* ± *Corymbia polycarpa* mid high open woodland, over *Terminalia canescens, Macropteranthes kekwickii* ± *Petalostigma pubescens* mid high open shrubland, over	**No of sites:** (11) 6 Ground, 12 Ground, 54 Full, 59 Full, Ex 24 Ground, 1 Air, 3 Air, 5 Air, 29 Air, 35 Air, 85 Air	

Vegetation Community	Description	Survey Sites	Photo
	Triodia bitextura, Schizachyrium fragile, Chrysopogon fallax mid high hummock grassland		
Comm 2c	*Eucalyptus leucophloia* low open woodland, over *Acacia gonoclada, Melaleuca viridiflora, Terminalia canescens* mid high open shrubland, over *Eriachne armittii, Eulalia aurea* mid high open tussock grassland	**No of sites:** (2) 95 Ground, 83 Air	
Comm 3a	*Corymbia polycarpa,* ± *Erythrophleum chlorostachys* mid high open woodland, over *Acacia difficilis* ± *Atalaya hemiglauca* mid high open shrubland, over *Chrysopogon fallax, Sehima nervosum* mid high tussock grassland	**No of sites:** (7) 37 Ground, 60 Ground, 67 Ground, 75 Ground, Ex 27 Ground, 10 Air, 58 Air	
Comm 3b	*Eucalyptus chlorophylla, Acacia shirleyi* mid high open woodland, over *Acacia difficilis, Macropteranthes kekwickii, Bauhinia cunninghamii* mid high open shrubland, over *Chrysopogon fallax, Schizachyrium fragile, Eragrostis tenellula* mid high tussock grassland	**No of sites:** (7) 7 Ground, 11 Ground, 74 Ground, 76 Ground, Ex Shen S B Well, 28 Air, 96 Air	
Comm 4a	*Eucalyptus pruinosa* ± *Eucalyptus chlorophylla, Atalaya hemiglauca* low open woodland, over *Carissa lanceolata, Terminalia canescens* mid high open shrubland, over *Eulalia aurea, Chrysopogon fallax* mid high tussock grassland	**No of sites:** (2) 80 Ground, 81 Ground	

Vegetation Community	Description	Survey Sites	Photo
Comm 4b	*Corymbia polycarpa, Eucalyptus microtheca* mid high open woodland, over *Hakea arborescens, Melaleuca nervosa* mid high open shrubland, over *Aristida contorta, Waltheria indica* mid high open tussock grassland	**No of sites:** (4) Ex 29 Ground, Ex 54 Ground, Ex 59 Ground, 20 Air	
Comm 4c1	*Acacia ancistrocarpa* ± *Melaleuca viridiflora* tall shrubland, over *Triodia bitextura, Schizachyrium fragile* mid high hummock grassland	**No of sites:** (8) 47 Ground, 53 Full, 17 Air, 30 Air, 49 Air, 50 Air, 70 Air, 89 Air	
Comm 4c2	*Melaleuca viridiflora, Terminalia canescens* low sparse shrubland, over *Eulalia aurea*, *Eriachne obtusa* open tussock grassland	**No of sites:** (1) 69 Ground	
Comm 5	*Lophostemon grandiflorus, Eucalyptus microtheca* ± *Eucalyptus camaldulensis* low open woodland, over *Lophostemon grandiflorus, Acacia difficilis* mid high open shrubland, over Eragrostis speciosa, *Eragrostis fallax* mid high sparse tussock grassland	**No of sites:** (12) 31 Ground, 88 Ground, 19 Air, 21 Air, 24 Air, 25 Air, 26 Air, 32 Air, 41 Air, 42 Air, 62 Air, 86 Air	



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DATUM OF AUSTRALIA 94

0 1.25 2.5

Kilometres

- Project Boundary
- Populated Place
- Tracks
- Permit Areas
- Pastoral Lease Boundary

Vegetation Community

- Comm 1a- A. shirleyi mid high woodland
- Comm 2a - C. dichromophloia ± Erythrophleum chlorostachys mid high open woodland
- Comm 2b - A. shirleyi, C. dichromophloia ± C. polycarpa mid high open woodland
- Comm 2c - E. leucophloia low open woodland
- Comm 3a - C. polycarpa, ± Erythrophleum chlorostachys mid high open woodland
- Comm 3b - E. chlorophylla, A. shirleyi mid high open woodland
- Comm 4a - E. pruinosa ± E. chlorophylla, Atalaya hemiglauca low open woodland
- Comm 4b - C. polycarpa, E. microtheca mid high open woodland
- Comm 4c1 - Acacia ancistocarpa ± M. viridiflora tall shrubland
- Comm 4c2 - M. viridiflora, Terminalia canescens low sparse shrubland
- Comm 5 - Lophostemon grandiflorus, E. microtheca ± E. camaldulensis low open woodland

Data sources:
SREBA 2023, Permit Area, Cadastre - NT Gov 2019. Places, Highways, Roads, Drainage - StreetPro 2019.

tamboran RESOURCES

Shenandoah South Project Area Vegetation Communities

PROJECT ID	60623736
CREATED BY	CummingsL
LAST MODIFIED	09-Jul-2024
VERSION	1

Figure 11

4.3 Flora

The SREBA Terrestrial Ecosystem Report (Young *et al*, 2022) indicated that the flora surveys completed over 2021-2022 contributed 15,419 new plant records within the Beetaloo sub-basin.

A search of the NT Government flora atlas database was undertaken for the exploration area, with a 10 km buffer applied. This search generated records for 328 species, none of which are listed as threatened species. These species are listed in Appendix D.

4.3.1 Threatened Flora

Desktop analysis of flora in the region indicates that one threatened species may occur in the Shenandoah South E&A program area. In 2022 *Carex fascicularis* (Tassel Sedge) was recorded in a *Fimbristylis* herbland within an *Astrebla* spp. mixed tussock grassland on cracking clay soils, near a flowing creek, approximately 20 km south of the Shenandoah South E&A program area (Young *et al*., 2022). This species listed as Vulnerable under the TPWC Act but is not listed under the EPBC Act.

Carex fascicularis is an erect densely tufted perennial sedge to 1 m with trigonous culms and short rhizome. The species is common in south-eastern Australia and was previously known from a single population in the West MacDonnell Ranges. The scarcity of *Carex fascicularis* in the NT is likely due to the absence of suitable habitat, which comprises swampy areas in mesic and sub-coastal regions throughout its range (DEPWS, 2021a). The species may occur within swamps and springs in the Shenandoah South E&A program area. Minimising ground disturbance within these habitat areas during the Shenandoah South E&A program will reduce potential impact on these species.

4.3.2 Field survey

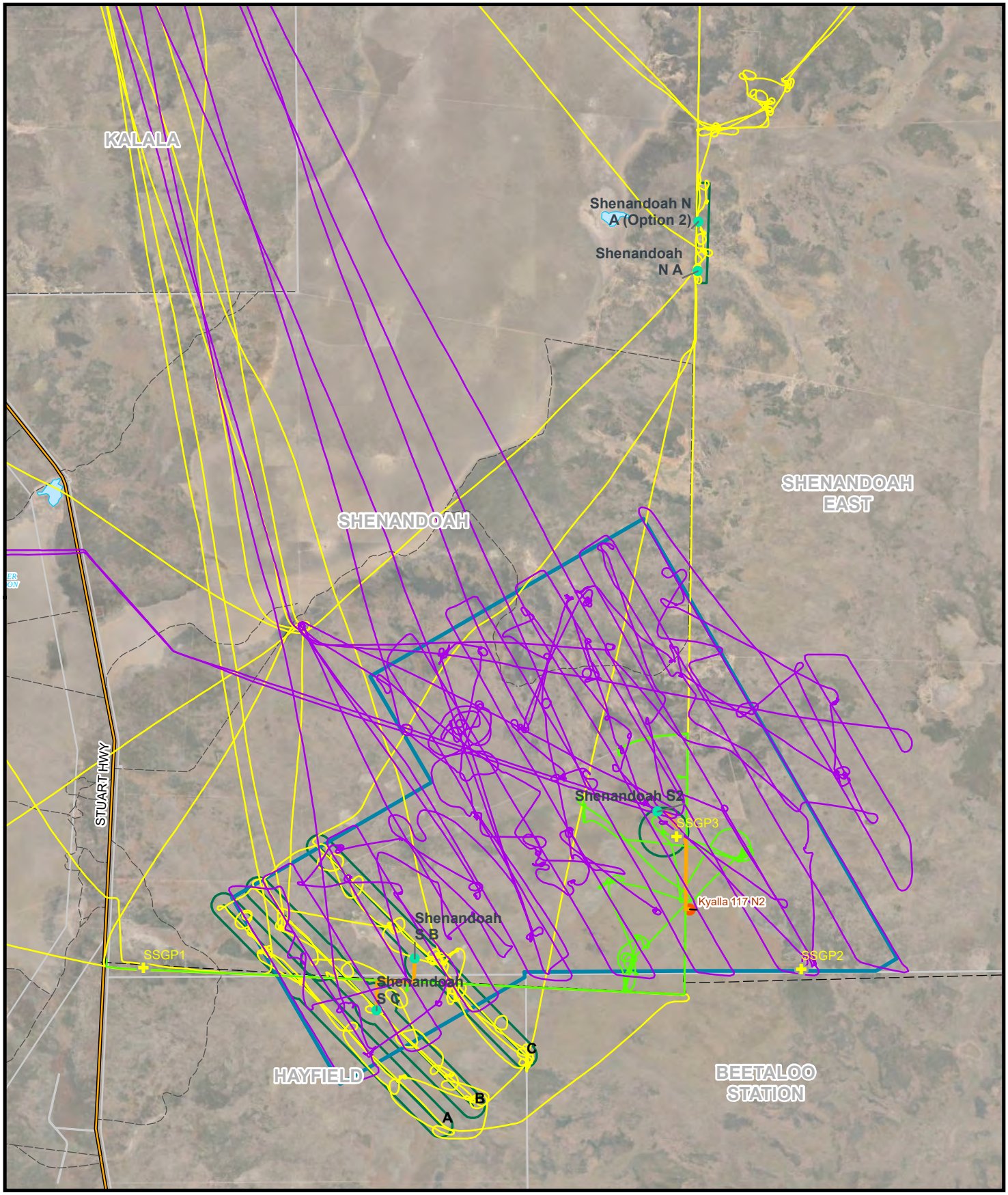
The field survey undertaken during May 2024 recorded 79 individual flora species. The survey focused on recording dominant species to describe vegetation communities rather than a comprehensive floristic assessment, based on *Northern Territory guidelines and field methodology for vegetation survey and mapping* (Brocklehurst *et al*., 2007). A full list flora species recorded in the desktop review and field survey is provided in Appendix D.

No threatened flora or threatened vegetation communities were recorded during the field survey within the Shenandoah South E&A program area.

4.4 Weeds

Previous surveys within the Tamboran Permit Areas have recorded a low number and density of weed species, indicating that land condition is generally good. Three declared weed species, *Calotropis procera* (Rubber bush), *Parkinsonia aculeata* (Parkinsonia) and *Mesosphaerum suaveolens* (Hyptis), have been recorded during previous surveys.

No weeds were detected within the Shenandoah South E&A program area during surveys undertaken from 2022 to 2024. Figure 12 displays areas surveyed for weeds in 2022, 2023 and 2024.



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GEOCENTRIC DATUM OF AUSTRALIA 94

0 1 2 4

Kilometres

- Study Area
- May 2024 weed survey track
- March 2023 weed survey track
- December 2022 weed survey track
- Gravel Pits
- Proposed Exploration Well Pads
- Proposed Seismic Lines
- Tracks
- Highway
- Water Bodies
- Pastoral Lease Boundary
- Gathering Line

LOCATION

Data sources:
Permit Area, Cadastre - NT Gov 2019.
Places, Vegetation - Aust Gov 2019
Highways, Roads, Drainage - StreetPro 2019

tamboran RESOURCES

Weed Survey 2022-2024

PROJECT ID	60623736
CREATED BY	sam.schroder
LAST MODIFIED	09-Aug-2024
VERSION	1

Figure 12

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Table 13 provides a list of weed species that are known to occur or likely to occur Shenandoah South E&A program area based on a desktop review of the following sources:

- Tennant Creek Regional Weeds Strategy (DEPWS, 2021b),
- Katherine Regional Weeds Strategy (DEPWS, 2021c).
- Mapping data provided by the Weed Management Branch, DEPWS.
- Guidelines for the Management of the Weeds of Beetaloo 2018 (DLRM & CDU, 2018).
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) EPBC Act Protected Matters Report database.
- Previous data collected by AECOM in the permit area.

There are four classes of weeds under the NT *Weed Management Act*, which was amended in May 2022. The classes are described as:

A - it is necessary to eradicate the plant.

B - it is necessary to prevent the growing and spreading of the plant.

C - it is necessary to prevent the introduction of the plant into the Territory or a part of the Territory.

D - it is necessary to prevent the plant being spread by the actions of persons.

Based on the available data none of the weeds in Table 19 have Class D status.

Table 13 NT Listed Weeds known or likely to occur within Shenandoah South E&A program

Scientific Name	Common Name	Status
Alternanthera pungens	Khaki Weed	Class B and C
Andropogon gayanus	Gamba Grass	Class A and C, WoNS
Azadirachta indica	Neem	Class B and C
Calotropis procera	Rubber Bush	Class B and C (south of 16°30' S latitude)
Cenchrus ciliaris	Buffel Grass	Class B and C
Cenchrus echinatus	Mossman River Grass	Class B and C
Datura ferox	Fierce Thornapple	Class A and C
Mesosphaerum suaveolens	Hyptis	Class B and C
Jatropha gossypiifolia	Bellyache Bush	Class B and C, WoNS
Parkinsonia aculeata	Parkinsonia	Class B and C, WoNS
Sida acuta	Spinyhead Sida	Class B and C
Sida cordifolia	Flannel Weed	Class B and C
Sida rhombifolia	Paddy's Lucerne	Class B and C
Tamarix aphylla	Athel Pine	Class B and C, WoNS
Themeda quadrivalvis	Grader Grass	Class B and C, WoNS
Tribulus terrestris	Caltrop	Class B and C
Vachellia nilotica	Prickly Acacia	Class A and C, WoNS

In addition to the species listed in Table 13, a range of grassy weeds are known to occur along road corridors throughout the region. This includes Buffel Grass which was originally introduced for livestock feed and soil stabilisation but has subsequently shown to alter fire regimes and impact biodiversity.

The *Katherine Regional Weeds Strategy 2021-2026* (DEPWS, 2021c) provides strategic approach to reduce the adverse impact of weeds in the Katherine Region. The plan includes a list of weed species that require priority management attention. The nine priority weed species are listed in Table 14. If located, the program EMP requires the Weed Management Branch to be contacted for identification and disposal.

Table 14 Priority weed species identified for the Katherine Region (DEPWS, 2021c)

Scientific Name	Common Name	Declaration
Vachellia nilotica	Prickly Acacia	Class A
Prosopis spp.	Mesquite	Class A
Parthenium hysterophorus	Parthenium	Class A, WoNS
Mimosa pigra	Mimosa	Class A
Cryptostegia grandiflora	Rubber vine	Class A, WoNS
Salvinia molesta	Salvinia	Class B
Cylindropuntia spp.	Rope cactus	Class A
Hyparrhenia rufa	Thatch grass	Class A
Sporobolus spp.	Giant rats tail grass	Not Declared

The *Tennant Creek Regional Weeds Strategy* and *Katherine Regional Weeds Strategy* also identifies three alert weed species that potentially occur within the Tamboran permit areas (Table 15). Alert weeds have been identified as the principal threatening weeds to specific regions of the NT.

Table 15 Alert weed species in the Katherine and Tennant Creek regions (DEPWS, 2021b; DEPWS, 2021c).

Scientific name	Common name	Declaration
Themeda quadrivalvis	Grader Grass Class B	Class B and C
Parthenium hysterophorus	Parthenium	Class A and C, WoNS
Chromolaena odorata	Siam weed	Class C

In the last 24 months Kapok bush (*Aerva javanica*) (Plate 1) has been observed along the Stuart Highway between Katherine and Mataranka. Kapok bush is an erect woody shrub that is not declared in the NT but has potential to become a weed and should be treated as such by Tamboran to avoid spreading within the Permit area.

Plate 1 Kapok bush (*Aerva javanica*) near Katherine, NT

4.5 Fauna and Habitat

A search of the Department of Environment, Parks and Water Security (DEPWS) Natural Resource Maps database reveals that a total of 166 fauna species have been recorded within 5 km of the Shenandoah South E&A program comprising 103 species of bird, 48 reptiles ten mammals and five amphibians.

The recent SREBA surveys identified 354 vertebrate species have been recorded within the region consisting of 202 bird species, 99 reptile species and 39 mammal species and 14 amphibians (Young, 2022). A full list of recorded fauna species is provided in Appendix E.

The Shenandoah South E&A program primarily comprises open woodland consisting of mixed Eucalyptus/Corymbia species with a mixed tussock grass understorey. Often, scattered stands of Lancewood/ Bullwaddy communities occur across the proposed sites and individuals of both species are dispersed throughout. In the wider landscape, including proposed access tracks, additional vegetation types include those associated with drainage lines, grasslands/floodplains and *Acacia sp.* shrublands.

*Eucalypt*us/*Corymbia* sp. Woodland provides habitat for a range of species. The proposed sites had high native grass cover and included numerous species suitable for granivorous birds (seed eaters). Dense leaf litter and numerous logs provide suitable refuge and foraging sites for fauna such as reptiles. Although most of the species found in this vegetation type are widespread in the tropical savannas of the Northern Territory, some such as the threatened Northern Shrike-tit (*Falcunculus whitei*) are rare and known to utilise this habitat (Ward, 2008). Many of the sites have a high density of hollow-bearing trees that provide important habitat for many fauna species. Avoiding clearing large hollow-bearing trees will reduce the impact to native wildlife within the permit area.

The Lancewood/Bullwaddy vegetation community provides shady habitat for fauna within a hot arid landscape, including species such as the Spectacled Hare-Wallaby (*Lagorchestes conspicillatus leichardtii*) and the Northern Nailtail Wallaby (*Onychogalea unguifera*) (PWCNT, 2005).

4.5.1 Bird surveys

Bird surveys were undertaken for 10-15 minutes at each site. Surveys were undertaken by two AECOM staff, each with a pair of binoculars. Birds were identified by sight and calls. Birds recorded during surveys are listed below in Table 16. A total of 42 species were identified during the surveys.

Table 16 Birds recorded during May 2024 surveys

Scientific Name	Common name	Number of sites recorded
Brown Goshawk	*Accipiter fasciatus*	1
Pacific Black Duck	*Anas superciliosa*	1
Australasian Darter	*Anhinga novaehollandiae*	1
Red-winged Parrot	*Aprosmictus erythropterus*	1
Great Egret	*Ardea alba*	1
White-necked Heron	*Ardea pacifica*	1
Black-faced Woodswallow	*Artamus cinereus*	4
Little Woodswallow	*Artamus minor*	1
Wedge-tailed Eagle	*Aquila audax*	1
Grey Shrike-thrush	*Colluricincla harmonica*	1
Rufous-throated Honeyeater	*Conopophila rufogularis*	3
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	1
White-bellied Cuckoo-shrike	*Coracina papuensis*	2
Torresian Crow	*Corvus orru*	1
Pied Butcherbird	*Cracticus nigrogularis*	5
Blue-winged Kookaburra	*Dacelo leachii*	1
Varied Sitella	*Daphoenositta chrysoptera*	3
Mistletoebird	*Dicaeum hirundinaceum*	8
Galah	*Eolophus roseicapilla*	6
Spotted Nightjar	*Eurostopodus argus*	1
Brown Falcon	*Falco berigora*	1
Nankeen Kestrel	*Falco cenchroides*	1
Grey Falcon	*Falco hypoleucos*	1
Peaceful Dove	*Geopelia placida*	13
White-throated Gerygone	*Gerygone olivacea*	2
Whistling Kite	*Haliastur sphenurus*	2
White-winged Triller	*Lalage tricolor*	1
Singing Honeyeater	*Lichenostomus virescens*	10
Brown Honeyeater	*Lichmera indistincta*	19
Hooded Robin	*Melanodryas cucullata*	2
Rainbow Bee-eater	*Merops ornatus*	6
White-throated Honeyeater	*Melithreptus albogularis*	1
Cockatiel	*Nymphicus hollandicus*	2

Scientific Name	Common name	Number of sites recorded
Crested Bellbird	*Oreoica gutturalis*	10
Rufous Whistler	*Pachycephala rufiventris*	28
Striated Pardalote	*Pardalotus striatus*	8
Royal Spoonbill	*Platalea regia*	1
Grey-crowned Babbler	*Pomatostomus temporalis*	3
Varied Lorikeet	*Psitteuteles versicolor*	1
Willie Wagtail	*Rhipidura leucophrys*	4
Apostlebird	*Struthidea cinerea*	2
Double-barred Finch	*Taeniopygia bichenovii*	3

Plate 2 Crested Bellbird *Oreoica gutturalis*

Plate 3 Rufous-throated Honeyeater *Conopophila rufogularis*

4.5.2 Threatened Fauna

A search of the DCCEEW Protected Matters database of nationally significant fauna (PMST) and records from the NT Government Fauna Atlas database (NR Maps) was undertaken at 10 km and 50 km of the proposed Shenandoah South E&A program. The search results indicate the potential presence of 22 fauna species listed as threatened under the EPBC Act and/or the TPWC Act at the 50 km. These included 11 birds, six mammals, six reptiles and one shark. Of these species, one is confirmed to occur, 13 possibly occur and 10 are unlikely to occur within the Shenandoah South E&A program.

One threatened fauna, specifically the Grey Falcon (*Falco hypoleucos*), was recorded during the field survey within the Shenandoah South E&A program.

The likelihood of occurrence assessment (Table 17) is based on the availability of suitable habitat within the permit area, records in the vicinity and distributional data. Therefore, many of the threatened and migratory fauna species indicated in databases as ‘occurring’ or ‘likely to occur’ have been assessed as unlikely to occur within the Shenandoah South E&A program area. As some areas in the Shenandoah South E&A program area have not been subject to intensive survey and some species are very cryptic, a conservative approach has been taken to assess species presence. A full description of each species, their distribution and habitat associations are outlined in Table 17 below.

Table 17 EPBC and TPWC Listed Threatened Species and Likelihood of Occurrence within the Tamboran Shenandoah South E&A program area

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Birds					
Sharp-tailed Sandpiper *Calidris acuminata*	VU	-	Most of the Sharp-tailed Sandpiper population migrates to Australia in the non-breeding season, with widespread records occurring both inland and in coastal locations. In the NT the species mostly occurs in the north coastal regions. Widely scattered inland records occur south to northern Tanami Desert, and in southern NT (Higgins & Davies 1996).	In Australia the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation (Higgins & Davies 1996).	Possible Suitable habitat occurs within the Shenandoah South E&A program area and recent (2021) records occur 45 km south of the Shenandoah South E&A program area.
Curlew Sandpiper *Calidris ferruginea*	CE	VU	In the NT this species occurs around Darwin, north to Melville Island and Cobourg Peninsula, and east and south-east to Gove. It has been recorded inland from Victoria River Downs and around Alice Springs (Higgins & Davies, 1996).	Coastal habitats, inland it has been found around lakes, dams and ephemeral/permanent waterholes.	Unlikely No suitable habitat within Shenandoah South E&A program area
Red Goshawk *Erythrotriorchis radiatus*	EN	VU	Found across most of Northern Australia, in the NT most records are from the Top End but there are records from central Australia (Pizzey & Knight, 2012).	Red Goshawks occupy a range of habitats, often at ecotones, including coastal and sub-coastal tall open forest, tropical savannahs crossed by wooded or forested watercourses. In the NT, it inhabits tall open forest/woodland as well as tall riparian woodland (Aumann & Baker-Gabb, 1991).	Possible No records and no suitable breeding habitat within the Shenandoah South E&A program area
Gouldian Finch *Chloebia gouldiae*	EN	VU	Formerly widespread across northern Australia. In the NT they are found in the Top End south past Daly Waters (Palmer *et al*., 2012).	Gouldian Finches occupy different habitat types in the breeding and non-breeding season. Breeding habitat consists of hillsides with suitable nesting trees. Outside of the breeding season	Possible The closest record occurs 75 km east of the Shenandoah

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
				they are found in lowland drainages to feed on suitable perennial grasses (Dostine & Franklin, 2002).	South E&A program area. Suitable foraging habitat is present
Grey Falcon *Falco hypoleucos*	VU	VU	This species has a widespread distribution, and records occur throughout the NT. However, most records are from arid and semi-arid regions (Pizzey & Knight, 2012).	Grey Falcon is typically found on inland drainage systems in lightly treed lowland plains, pastoral lands, timbered watercourses and, occasionally, the driest deserts (DEPWS, 2021d).	Confirmed Two Grey Falcon were observed over treeless plains during the May 2024 survey.
Northern Shrike-tit *Falcunculus whitei*	VU	NT	This species has been recorded from widely scattered localities from near Timber Creek to the east Gulf Country, north to Kakadu National Park and in north-eastern Arnhem Land (DEPWS, 2021e).	Occupies wet and semi-arid melaleuca and eucalypt open woodlands. May be associated with bloodwoods with flaky bark and ironwood (Ward, 2008).	Possible No recent records occur in the vicinity of the Shenandoah South E&A program area. Sub-optimal habitat is present.
Painted Honeyeater *Grantiella picta*	VU	VU	This species is migratory based on seasonal variation in occurrence. They breed on the inland slopes of the Great Dividing Range. After the breeding season they sometimes occur in the north-eastern NT, south of the Roper River (Garnett & Baker, 2021).	Painted Honeyeater inhabits woodlands dominated by Acacia and/or Eucalyptus species and open forests but prefers habitats with abundant mature trees that host mistletoes. The species specialises on the fruit of mistletoes and also forages on nectar and insects (Garnett *et al.*, 2011).	Possible No recent records occur close to the Shenandoah South E&A program area; however suitable habitat is present
Night Parrot *Pezoporus occidentalis*	EN	EN	Night Parrot was once widespread across arid and semi-arid regions. Recent confirmed records of the species come from widely separated locations in	This species occupies spinifex grasslands in stony or sandy areas, in ephemeral herblands, samphire and chenopod shrublands on floodplains (DEPWS, 2021f).	Unlikely No recent records occur within the area Suitable habitat does not occur

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
			western Queensland and Western Australia (DEPWS, 2021f).		within the Shenandoah South E&A program area.
Princess Parrot, Alexandra's Parrot *Polytelis alexandrae*	VU	VU	This species irregularly occurs across the arid zone from near Oodnadatta in South Australia, west to near Coolgardie and the east Murchison River in Western Australia, and north to near the Fitzroy River in Western Australia and to Howell Ponds in the Northern Territory (Higgins 1999; Baxter & Henderson 2000)	Princess Parrot is usually recorded from shrubland in swales between sand dunes, with occupied sites typically having a variety of shrubs (including Grevillea, Hakea, Cassia and Eremophila species) among scattered emergent trees, with a ground-cover of spinifex Triodia species. The species occurs less often in woodland. The princess parrot forages on the ground and in flowering shrubs and trees (Higgins 1999; Pavey *et al*. 2014)	Unlikely No recent records occur close to the Shenandoah South E&A program area.
Australian Painted Snipe *Rostratula australis*	EN	VU	Records of the species occur across the NT. More recent records come from McMinns Lagoon near Darwin, Yellow Waters in Kakadu, the Sturt Plateau, the Barkly and the Tanami (DEPWS, 2021g).	Australian Painted Snipe prefers a habitat of recently flooded temporary vegetated wetlands during the non-breeding period and brackish temporary freshwater wetlands with minimum vegetation during breeding periods. Birds usually forage in thick, low vegetated areas during the day (Curtis *et al*, 2012).	Possible Heavy wet season rainfall has improved the habitat suitability for this species in the Shenandoah South E&A program area. A tracked individual has been detected in wetlands near Daly Waters.
Masked Owl (northern)	VU	VU	The subspecies occurs in northern Australia, although its distribution is not well known. In the NT, occurs from	This species inhabits tall open eucalypt forest in the NT, especially those associated with *Eucalyptus miniata* and	Unlikely No recent records occur close to the

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Tyto novaehollandiae kimberli			Cobourg south to Katherine and the VRD and east to the McArthur River (DoE, 2014).	*E. tetrodonta (*Woinarski, 2007*)*. Also found in riparian and monsoonal forest and rainforest (DoE, 2014).	Shenandoah South E&A program area and suitable habitat is not present
Mammals					
Northern Quoll *Dasyurus hallucatus*	CE	EN	The species once occurred throughout most of Northern Australia although it is has declined across much of its range (Woinarski & Hill, 2012). In the NT it is found in the Top End as far southeast as Borroloola.	Northern Quolls do not have highly specific habitat requirements although the most suitable appear to be rocky habitats. They occur in a variety of habitats across their range, including open forest and woodland. Daytime den sites provide important shelter. Shelter sites include rocky outcrops, tree hollows, hollow logs, termite mounds, goanna burrows and human dwellings (Woinarski & Hill, 2012).	Unlikely No recent records, occur in the vicinity of the Shenandoah South E&A program area and habitat is sub-optimal
Ghost Bat *Macroderma gigas*	VU	NT	The species' range in northern Australia is from relatively arid conditions in the Pilbara region of Western Australia to humid rainforests of northern Queensland. A large colony occurs in a series of gold mine workings at Pine Creek, NT. This species has also been recorded throughout the mainland Top End north of approximately 17° latitude (DEPWS, 2021h).	The distribution of Ghost Bats is influenced by the availability of suitable caves and mines for roost sites. The species often roosts in a deep crack or cave during the day (DEPWS, 2021h).	Unlikely No recent records occur close to the Shenandoah South E&A program area. Suitable habitat does not occur within the Shenandoah South E&A program area
Greater Bilby *Macrotis lagotis*	VU	VU	This species occurs in south-western Queensland and in arid north-western Australia (Western Australia and Northern Territory). This species was previously	In the NT, this species is found on sandy soils dominated by spinifex. It also occurs in hummock grassland associated with low lying drainage	Unlikely No recent records, occur in the vicinity of the Shenandoah

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
			widespread in arid and semi-arid Australia (Pavey, 2006). The most northern records are from Newcastle Waters and Wave Hill (Southgate & Paltridge, 1998).	systems and alluvial areas (Pavey, 2006). Recent surveys in the Beetaloo region have recorded Greater Bilby in Eucalyptus and Corymbia woodlands mixed tussock and hummock grasses in sandy/loam soils (Davis *et al*., 2021).	South E&A program area and suitable habitat is not present
Bare-rumped Sheath-tailed Bat *Saccolaimus saccolaimus nudicluniatus*	VU	DD	Wide distribution from India through south-eastern Asia to the Solomon Islands, including north-eastern Queensland and the NT. Records of the species in the NT are sparsely scattered across the Top End (DEPWS, 2021i).	Previous specimens have been collected from Open *Pandanus* woodland fringing the sedgelands of the South Alligator River in Kakadu National Park, and from eucalypt woodlands and forests from coastal and adjacent inland areas (DEPWS, 2021i).	Unlikely No recent records, occur in the vicinity of the Shenandoah South E&A program area and habitat is not suitable
Common Brushtail Possum *Trichosurus vulpecula arnhemensis*	VU	NT	The Common Brushtail Possum (northern subspecies) occurs discontinuously from the Gulf of Carpentaria hinterland near Borroloola, NT westward to the Kimberley, WA (TSSC, 2020b).	The species occurs mainly in tall eucalypt open forests with large hollow-bearing trees, particularly where the understorey includes some shrubs that bear fleshy fruits (TSSC, 2020b).	Possible Recent records of the species occur at nearby Kalala Station and suitable habitat occurs within the Shenandoah South E&A program area.
Pale Field-rat *Rattus tunneyi*	-	VU	Pale Field-rat inhabits higher rainfall areas of northern and eastern Australia, including the Top End of the NT (Menkhorst & Knight, 2011).	This species favours dense vegetation found along rivers where it occupies burrows in loose colonies (Cole & Woinarski, 2002). Pale Field-rat occurs within a variety of habitats including woodlands if a dense understorey of grasses is present (Menkhorst & Knight, 2011)	Possible One record from 1999 occurs approximately 55 km from the Shenandoah South E&A program area. Suitable habitat occurs within the

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
					Shenandoah South E&A program area.
Reptiles					
Plains Death Adder *Acanthophis hawkei*	VU	VU	Fragmented populations of the Plains Death Adder are known to occur in the Mitchell Grass Downs of western Queensland, the Barkly Tableland on the Northern Territory / Queensland border and east of Darwin in the Northern Territory.	Suitable habitat for the Plains Death Adder consists of flat, treeless, cracking-soil riverine floodplains (Cogger, 2000).	Possible No recent record within the vicinity of the Shenandoah South E&A program area. Suitable habitat occurs within the Shenandoah South E&A program area
Gulf Snapping Turtle *Elseya lavarackorum*	-	EN	Gulf Snapping Turtle is restricted to rivers draining into the Gulf of Carpentaria, including the Calvert and Nicholson River systems (DEPWS, 2021j)	The species occurs in deep pools in the upper catchments of permanently flowing spring-fed river systems, particularly in areas with intact riparian vegetation (DEPWS, 2021j).	Unlikely No recent record within the vicinity of the Shenandoah South E&A program area. No rivers or large permanent water bodies occur within the Shenandoah South E&A program area
Northern Blue-tongue Skink	CE	-	The Northern Blue-tongue Skink occurs across northern Australia from Eighty Mile Beach in Western Australia (WA), across the southern Kimberley and Top End of	The Northern Blue-tongue Skink occurs in a wide variety of ecosystems, including riparian forest, vine scrub, monsoon rainforest, pandanus-lined	Possible Recent records occur nearby, and

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Tiliqua scincoides intermedia			the Northern Territory (NT), to approximately the Gregory Downs / Cloncurry area in western Queensland (DCCEEW, 2023).	gorges, melaleuca forest, eucalypt woodland and savanna, sparse and dense shrubland, and spinifex and tussock grassland. GPS tracking has shown that northern blue-tongue skinks move widely across savanna landscapes in the wet-season, but they spend most (~ 95 %) of their time in small, fragmented patches of relatively dense vegetation that provide cool, shaded, and damp conditions (DCCEEW, 2023a).	suitable habitat occurs within the Shenandoah South E&A program area.
Mertens' Water Monitor *Varanus mertensi*	EN	VU	Mertens' Water Monitor has a broad distribution that encompasses coastal and inland waters across the far north of Australia. In the NT, the species has been recorded across most of the Top End and the Gulf region (DEPWS, 2021k).	Mertens' Water Monitor is highly aquatic and rarely ventures more than 5-10 m from the edge of water. The species has been recorded in the following habitat: • Perennial and semi-permanent pools, including springs, seeps, swamps, creeks and gorges, • The margins of permanent streams, rivers and lakes, • Floodplain billabongs, lagoons, swamps and soaks, • Perennial waterholes in woodlands, Man-made irrigation channels and the margins of dams (DCCEEW, 2023b).	Possible Sparse records at similar latitudes occur across the NT, and suitable habitat is sparsely distributed across the Shenandoah South E&A program area.

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Mitchell's Water Monitor *Varanus mitchelli*	CE	VU	Mitchell's water monitor occurs across the wet-dry tropics of northern Australia from the far west Kimberley of WA across the Top End of the NT to far northwest Queensland (DCCEEW, 2023).	Mitchell's water monitor inhabits freshwater and saline wetlands that range from seasonal gorges in upper catchments to large rivers and coastal floodplains. It is recorded from rivers, creeks, gorges, springs, lagoons, swamps, mangroves, and foreshores (DCCEEW, 2023c).	Unlikely No recent records occur at similar latitudes and the Shenandoah South E&A program area appears to be south of the species current distribution.
Yellow-spotted Monitor *Varanus panoptes*	-	VU	Occurs across a broad geographic range across northern Australia. In the NT most records are from the Top End but occurs as far south as Renner Springs (Ward *et al.*, 2012).	Occupies a variety of habitats including coastal beaches, floodplains, grasslands and woodlands (Ward *et al*., 2012).	Possible 2017 records occur approximately 20 km from the Shenandoah South E&A program area and suitable habitat is present.
Shark					
Largetooth Sawfish *Pristis pristis*	VU	VU	Largetooth Sawfish have been recorded in numerous drainage systems in northern Australia in fresh and saline water including the Fitzroy, Durack, Robinson and Ord rivers (Western Australia), the Adelaide, Victoria, Daly, East and South Alligator, Roper, McArthur, Wearyan and Robinson rivers (Northern Territory), and the Gilbert, Mitchell, Normanby, Wenlock, Mission, Embley and Leichhardt rivers (Queensland) (DoE, 2015).	This species in northern Australia appears to be confined to freshwater drainages and the upper reaches of estuaries, occasionally being found as far as 400 km from the sea (Thorburn *et al.* 2007; Whitty *et al*. 2008).	Unlikely No rivers or large permanent water bodies occur within the Shenandoah South E&A program area.

VU = Vulnerable, EN = Endangered, CE = Critically Endangered, NT = Near Threatened, DD = Data Deficient

No habitat that can be classified as critical to the survival of threatened fauna was identified within the Shenandoah South E&A program area. However, some species may occur and are known to occur in the wider landscape. Threatened species that potentially occur include:

- Gouldian Finch *Chloebia gouldiae* (Endangered EPBC Act, Vulnerable TPWC Act)
- Red Goshawk *Erythrotriorchis radiatus* (Endangered EPBC Act, Vulnerable TPWC Act)
- Grey Falcon *Falco hypoleucos* (Vulnerable EPBC Act and TPWC Act)
- Northern Shrike-tit *Falcunculus whitei* (Vulnerable EPBC Act)
- Painted Honeyeater *Grantiella picta* (Vulnerable EPBC Act and TPWC Act)
- Australian Painted Snipe *Rostratula australis* (Endangered EPBC Act and TPWC Act)
- Greater Bilby *Macrotis lagotis* (Vulnerable EPBC Act and TPWC Act)
- Pale Field-rat *Rattus tunneyi* (Vulnerable TPWC Act)
- Common Brushtail Possum (northern) *Trichosurus vulpecula arnhemensis* (Vulnerable EPBC Act)
- Plains Death Adder *Acanthopsis hawkei* (Vulnerable EPBC ACT and TPWC Act)
- Northern Blue-tongue Skink *Tiliqua scincoides* intermedia (Critically Endangered EPBC Act)
- Yellow-spotted Monitor *Varanus panoptes* (Vulnerable TPWC Act).

As records of species may be limited in remote areas the precautionary principle has been applied. There are some species that have been assessed as possibly occurring even though their primary habitat is not found within the proposed sites or access tracks. These include species that are associated with ephemeral wetlands, low lying areas that may be seasonally inundated and creeks. During the wet and early dry season these areas may sustain threated species such as wetland birds (including migratory species).

The SREBA study for significant terrestrial fauna (Young *et al*, 2022) included the development of species distribution models using covariates for climate, topography, fire soil, vegetation and hydrology. These models have been used to aide assessment of the likelihood of some threatened species (Northern Shrike-tit, Greater Bilby, Gouldian finch and Yellow-spotted monitor) occurring within the Shenandoah South E&A program area.

The following provides summary of each threatened species that potentially occurs within the Shenandoah South E&A program area.

Gouldian Finch

Research has shown that critical components of suitable habitat for the Gouldian Finch include suitable nesting trees during the breeding season (particularly *Eucalyptus tintinnans*, *E. brevifolia* or *E. leucophloia*), a water source and a diverse range of favoured annual and perennial grasses (Dostine & Franklin, 2002).

During the wet season, Gouldian Finches move from breeding habitat on hillsides with suitable trees down to lower lying areas where they forage on perennial grasses such as *Triodia sp.*, *Alloteropsis semialata*, and *Chrysopogon fallax* (Palmer *et al*. 2012). Some of the perennial grasses were recorded during recent surveys so potential foraging habitat is present; however, there are limited records in the vicinity.

Corymbia and Eucalyptus trees that are potentially suitable for nesting and perennial grasses suitable for feeding have been observed within the Shenandoah South E&A program area. Potential nest trees observed during surveys include *Corymbia dichromophloia* and *Eucalyptus leucophloia*. Habitat in the Shenandoah South E&A program was moderately suitable for Gouldian Finch. No Gouldian Finch were observed during the bird surveys.

The SREBA species distribution model for Gouldian Finch indicates a low probability of the species occurring throughout most of the Shenandoah South E&A program area, as displayed in Figure 13.

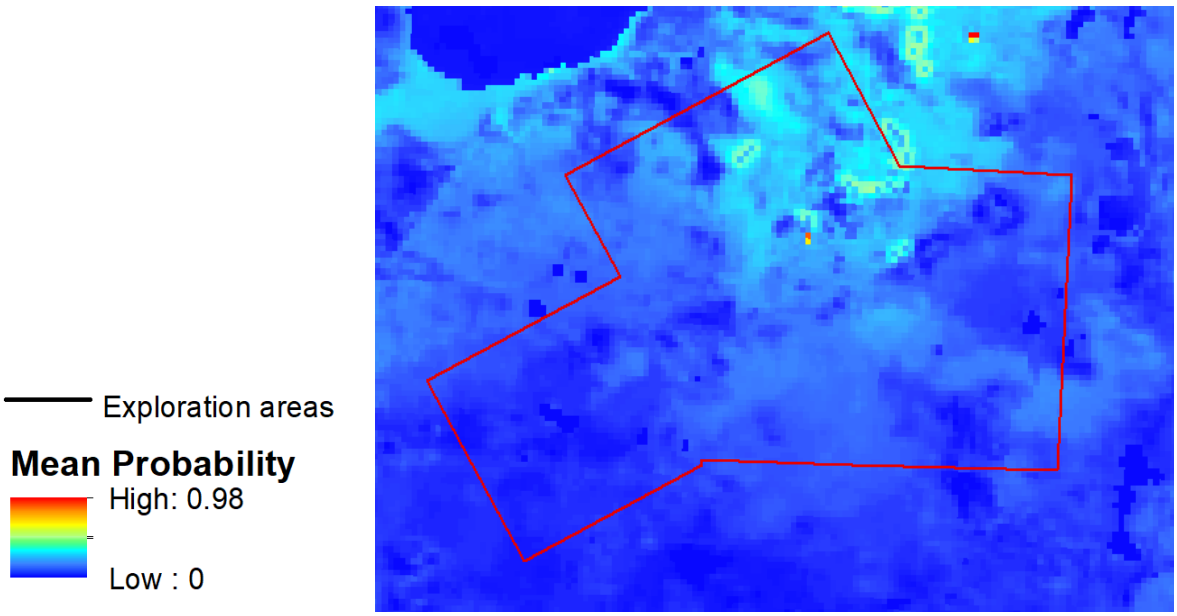


Figure 13 Mean probability of presence of Gouldian Finch within the exploration areas (Young *et al.*, 2022)

Red Goshawk

The Red Goshawk has a large home range of up to 200 km^2 (Aumann & Baker-Gabb 1991), and recent satellite tracking of individuals has shown them to travel distances of over 1500 km outside of the breeding season (MacColl *et al*. 2021).

The closest known breeding records of the species occur close to Mataranka and along the Roper River, more than 200 km north of the Shenandoah South E&A program area. The species is unlikely to breed more than 50 km south of Mataranka due to a lack of suitable habitat, including a lack of suitably sized trees and insufficient abundance of medium sized avian prey.

According to the recent conservation advice for the species (DAWE, 2023), foraging habitat critical to the survival of the species includes:

- coastal and subcoastal tall open forests and woodlands;
- tropical savannas traversed by wooded or forested creeks and rivers;
- freshwater wetlands and their margins; and
- edges of rainforest.

Habitat within the Shenandoah South E&A program area does not fall within these classifications. The woodlands cannot be classified as tall, while the creeks within the region are mostly ephemeral and are lightly wooded at best. The habitat can be described as marginally suitable for a Red Goshawk dispersing from its home breeding territory, or a dispersing juvenile.

Greater Bilby

In the NT, this species is found on sandy soils dominated by spinifex. It also occurs in hummock grassland associated with low lying drainage systems and alluvial areas (Pavey, 2006). Recent surveys in the Beetaloo region have recorded Greater Bilby in Eucalyptus and Corymbia woodlands mixed tussock and hummock grasses in sandy/loam soils (Davis *et al*., 2021).

The SREBA species distribution model for Greater Bilby (Figure 14) indicates that most of the Shenandoah South E&A program area has a low likelihood of containing suitable habitat for Greater Bilby. Some parts of the project have a moderate likelihood of containing suitable habitat, partly due to the presence of broad vegetation communities assessed to be high quality for the species including *Corymbia/Eucalyptus* open woodland on sandy loam, Bullwaddy shrubland and woodland, *Acacia* shrubland and hummock grassland on sandplains and *Bauhinia* and *Corymbia* open woodland on sandy clay (Young *et al*, 2022).

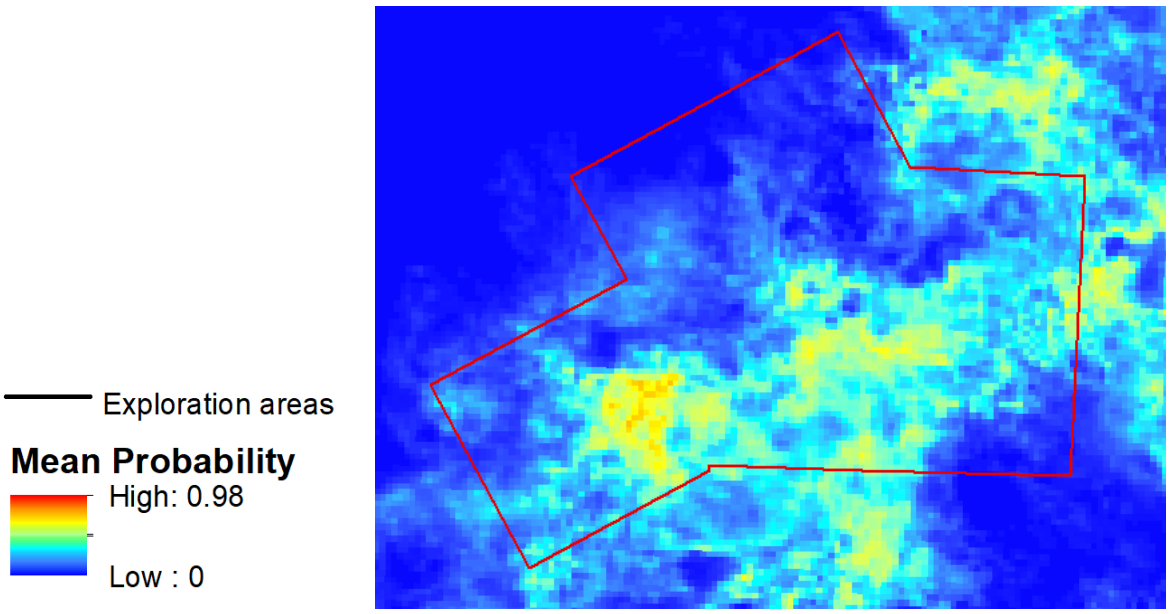


Figure 14 Mean probability of presence of Greater Bilby within the exploration areas (Young *et al.*, 2022)

Grey Falcon

The Grey Falcon (*Falco hypoleucos*) is a widespread species listed as Vulnerable in the NT and possibly occurs in the Shenandoah South E&A program area. The species occurs in low densities throughout arid and semi-arid areas of Australia (DEPWS, 2021d).

Two Grey Falcons were observed during the May 2024 survey. The birds were easily identified by the grey plumage and yellow cere and legs and were sighted flying overhead within treeless plain habitat at Site 69. The species is known to nest on repeater towers in the region, including one site located approximately 100 km south-west of Shenandoah South E&A program area where the species bred in 2014 (Jonny Schoenjahn, personal communication, 2022). The species also nests in the tallest trees along watercourses, such as Red River Gums (*Eucalyptus camaldulensis*) (TSSC, 2020). Grey Falcon may forage within the Shenandoah South E&A program but is unlikely to be impacted by project activities because suitable nesting trees won't be cleared.

Northern Shrike-tit

The Northern Shrike-tit lives in dry Eucalypt forests and woodlands where it feeds on insects from the canopy and under bark. It has been recorded in wet Melaleuca open woodlands and woodlands dominated by Nutwood (*Terminalia arostrata*) and Bloodwoods with flaky bark and ironwood (Ward, 2008). In the NT, nesting has been recorded from September through to January and nests are built in terminal branches at the top of trees (Ward *et al.*, 2009). The stronghold of this species is north of the Shenandoah South E&A program area, with NR Maps showing only four records south of -16.25° latitude. Targeted surveys by the NT Government in the Beetaloo Basin failed to detect the species south of -16.0° latitude despite significant survey effort (>30 call playback surveys). Additionally, the SREBA distribution model suggests that the entire project has a low likelihood of the species occurring (Young *et al.*, 2022).

Although it is possible the Northern Shrike-tit may be present in the area, it is unlikely to represent an important area for this species.

During the May 2024 field survey call-playback was undertaken for Northern Shrike-tit. Call-playback was undertaken for approximately 5 minutes at each site assessed. Following 5 minutes of call playback the area was surveyed for approximately 10 minutes with binoculars. The search area was within 50 m of where call playback was undertaken, covering an approximate 0.8 ha search area. No Northern Shrike-tits have been observed during these surveys.

The targeted call-playback surveys failed to detect Northern Shrike-tit across the 38 surveyed sites.

Painted Honeyeater

The Painted Honeyeater has been known to occur in the region, however, given it does not breed in the NT it would only be present intermittently for foraging. Suitable habitat for the species potentially occurs within the Shenandoah South E&A program are. Areas proposed for disturbance are relatively small compared to available suitable habitat within the region.

Australian Painted Snipe

The Australian Painted Snipe breeds in shallow, temporary or infrequently filled freshwater wetlands following flooding (Garnett and Baker, 2020). Most records for the species occur on the east coast of Australia, though this likely reflects where the density of birdwatchers is higher. An individual fitted with a satellite tracker in southern New South Wales has been detected at a large wetland near Daly waters in June (Tracking Australian Painted Snipe, 2024), indicating that the species visits the region.

Tamboran's proposed activities do not occur in wetland areas, therefore the species is unlikely to be impacted.

Pale Field-rat

The Pale Field-rat occurs in a wide range of habitats, including tall grasslands and woodlands (Cole & Woinarski, 2002). There are no recent records of the species within the region; however, this may reflect a lack of survey effort. Suitable habitat for the species occurs within the Shenandoah South E&A program area. The proposed area of disturbance is relatively small compared to available suitable habitat within the region.

Common Brushtail Possum

Recent surveys have detected Common Brushtail Possum (*Trichosurus vulpecula arnhemensis*) on Kalala Station (Young, *et al*, 2022). Suitable woodland habitat is contiguous through the landscape; therefore, the species potentially occurs within the Shenandoah South E&A program area. Given the large amount of suitable habitat within the region comparative to the project footprint the risk to regional populations of the species is small.

Plains Death Adder

Suitable habitat for the Plains Death Adder consists of flat, treeless, cracking-soil riverine floodplains (Cogger, 2000). A population of the species occur in the Barkly Tableland from the Northern Territory to central-western Queensland. In the Beetaloo Basin records of the species occur close to Lake Woods, Lake Sylvester and Lake Tarrabool. The species may occur within the Shenandoah South E&A program area, particularly following heavy wet season rainfall.

Northern Blue-tongue Skink

The Northern Blue-tongue Skink occurs in a wide variety of vegetation communities, eucalypt woodland and savanna, sparse and dense shrubland, and spinifex and tussock grassland. Areas of dense vegetation that provide cool and moist conditions within hot, dry, and flammable landscapes are critical habitat for the survival of the species, as such habitat provides the Northern Blue-tongue Skink with food, water and protection from environmental exposure and predation. Examples of such habitat includes rainforest and vine thicket, riparian forests, well-vegetated creeks and drainage lines, well-vegetated swamps and springs, and dense thickets within floodplains, grasslands, shrublands, savannas and woodlands (DCCEEW, 2023).

Several recent (2020-2022) records of the species occur within 100 km, and suitable habitat occurs within the Shenandoah South E&A program area. The species was recently listed as Critically Endangered under the EPBC Act in December 2023.

Yellow-spotted Monitor

The Yellow-spotted Monitor (*Varanus panoptes*) occurs across northern Australia where it occupies a variety of habitats, including grasslands and woodlands (Ward *et al*., 2012). Most records of this species are from the Top End, though it has been recorded in the Barkly Tablelands. The species likely occurs close to wetlands and riparian habitats within the permit areas; however, such habitat won't be impacted by proposed activities.

The SREBA species distribution for Yellow-spotted Monitor (Figure 15) indicates a high probability for the species in the north of the Shenandoah South E&A program area, north of -16.794° latitude, with probability decreasing in the south (Young, *et al*, 2022).

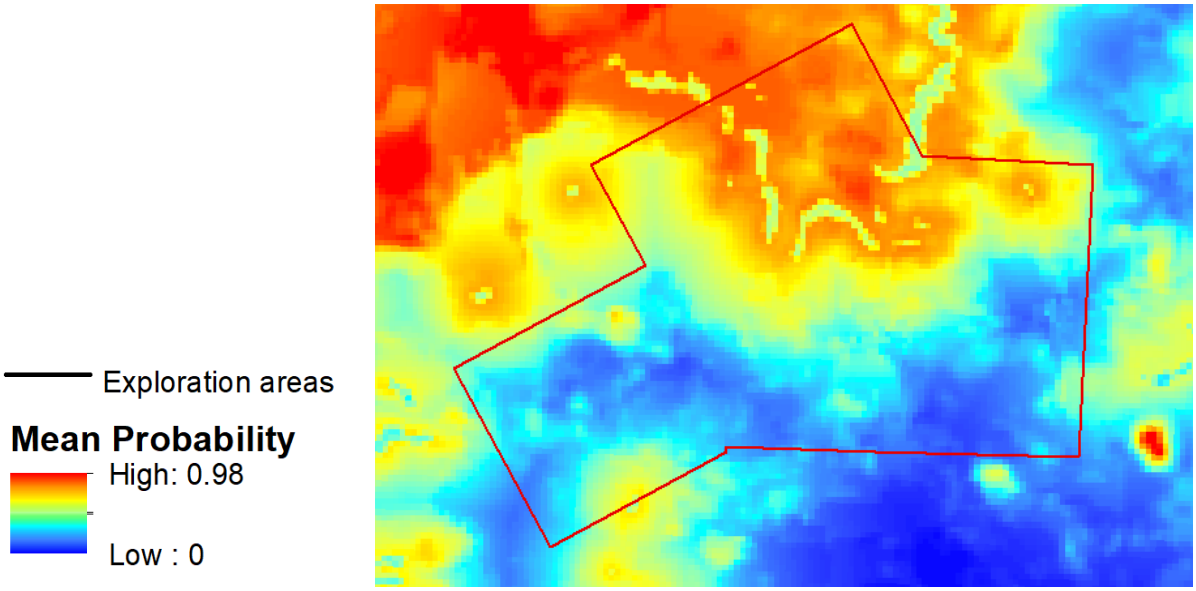


Figure 15 Mean probability of presence of Yellow-spotted Monitor within the exploration areas (Young *et al.*, 2022)

4.5.3 Migratory and Marine Species

The EPBC Protected Matters database (Appendix F) indicated the potential presence of 13 Migratory and 18 Marine listed species within the Shenandoah South E&A program area (Table 18). Of these species, three are considered likely to occur, nine possibly occur and eight are unlikely to occur within the Shenandoah South E&A program. Several migratory wetland bird would possibly occur within the area in ephemeral wetlands that would fill up following wet season rainfall. The Shenandoah South E&A program area does not contain critical habitat for any Migratory or Marine listed species.

Table 18 Migratory listed species potentially occurring within the Shenandoah South E&A program area

Scientific Name	Common Name	EPBC Act	Likelihood of Occurrence
Actitis hypoleucos	Common Sandpiper	Migratory, Marine	Possible
Anseranas semipalmata	Magpie Goose	Marine	Possible
Apus pacificus	Fork-tailed Swift	Migratory, Marine	Likely
Bubulcus ibis (Ardea ibis)	Cattle Egret	Marine	Likely
Calidris acuminata	Sharp-tailed Sandpiper	Migratory, Marine	Possible
Calidris ferruginea	Curlew Sandpiper	Migratory, Marine	Possible
Calidris melanotos	Pectoral Sandpiper	Migratory, Marine	Possible
Cecropis daurica	Red-rumped Swallow	Migratory, Marine	Unlikely
Charadrius veredus	Oriental Plover	Migratory, Marine	Possible

Scientific Name	Common Name	EPBC Act	Likelihood of Occurrence
Chalcites osculans (Chrysococcyx osculans)	Black-eared Cuckoo	Marine	Possible
Cuculus optatus	Oriental Cuckoo	Migratory	Possible
Glareola maldivarum	Oriental Pratincole	Migratory, Marine	Possible
Haliaeetus leucogaster	White-bellied Sea-eagle	Marine	Unlikely
Hirundo rustica	Barn Swallow	Migratory, Marine	Unlikely
Merops ornatus	Rainbow Bee-eater	Marine	Likely
Motacilla cinerea	Grey Wagtail	Migratory, Marine	Unlikely
Motacilla flava	Yellow Wagtail	Migratory, Marine	Unlikely
Pristis pristis	Freshwater Sawfish	Migratory	Unlikely
Rostratula australis (*Rostratula benghalensis*)	Australian Painted Snipe	Migratory, Marine	Possible

4.5.4 Feral Animals

Feral animals known to occur within the region include:

- Pig (*Sus scrofa*)
- Wild dog (*Canis lupus familiaris*)
- Feral cat (*Felis catus*)
- Cane toad (*Rhinella marina*)
- Horse (*Equus caballus*)
- Donkey (*Equus asinus*)
- Water buffalo (*Bubalus bubalis*)
- Camel (*Camelus dromedarius*)
- Black rat (*Rattus rattus*)
- Domestic cattle (*Bos Taurus*)

During the May 2024 field survey evidence of current cattle grazing or grazing within the last 1 to 2 years was recorded at the majority of assessed sites.

The cane toad is known to be present in the Shenandoah South E&A program area and the Commonwealth DCCEEW recognises this species as a ‘key threatening process’ related to their impacts on biodiversity through predation, competition, land degradation and poisoning. In the NT, the cane toad has been implicated in the decline of several reptile species such as the Plains Death Adder (*Acanthophis hawkei*), King Brown Snake (*Pseudechis australis*) and Varanus monitors (Smith & Phillips, 2006).

Pest predators such as cats likely occur within the Shenandoah South E&A program area, though their abundance is difficult to assess due to their cryptic nature. Introduced predators such as cats can impact many vertebrates (Dickman, 1996 & 2009). One of the primary concerns of introduced predators are the impacts on reptiles and ground-dwelling birds. Feral cats are also believed to be one of the factors that have led to the decline of the threatened ground-dwelling Partridge Pigeon (Woinarski *et al*. 2007).

There is potential for pest species to be attracted to the Shenandoah South E&A program area due to increased site activities. Inappropriate dumping of rubbish on site can attract feral animals for food.

Care should be taken during project activities to ensure that rubbish is securely contained (i.e. with suitable lids) and removed from the site as soon as possible to discourage attracting feral animals.

4.6 Ground Condition

An interactive supervised classification method was used to assess the proposed 3D seismic line disturbance area. This assigned the ground type (i.e. Bare Earth, Dry Grass, Grass, Shrubs and Trees) that would be encountered along the seismic line alignment from freely available Sentinel 10 m resolution satellite imagery with infrared band, captured on 24 December 2023.

The Satellite imagery was analysed using a supervised classification and training samples to determine the proportion of bare earth, dry grass, grass, shrubs and trees within 1 ha grid squares across the 31,418 ha study area. Table 19 shows that the majority of the 3D seismic survey disturbance area primarily consists of bare earth, dry grass and grass equating to 75% of the survey area. The remaining 25% of the survey area is the tree and shrub layers.

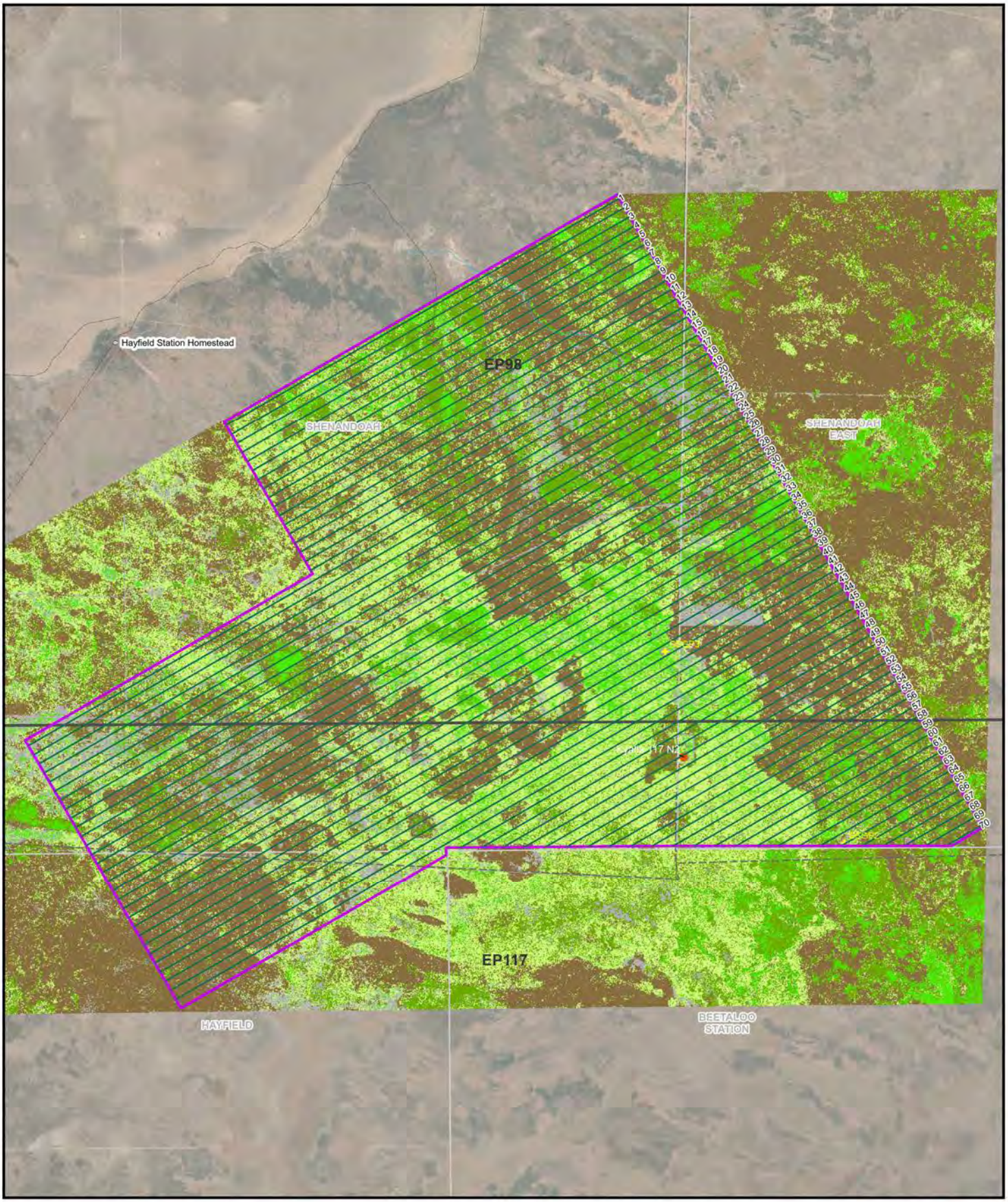
Classified sentinel imagery of the Shenandoah South E&A program area is displayed in Figure 16.

Table 19 Ground Cover Description of Seismic Lines

Line	Ground Condition Disturbance (ha)					
	Bare Earth	Dry Grass	Grass	Shrub	Tree*	Total
Line 1	0.12	2.12	1.51	1.86	0.86	6.47
Line 2	0.15	1.66	1.39	2.26	1.01	6.48
Line 3	0.19	1.87	1.57	1.94	0.90	6.48
Line 4	0.25	1.88	1.54	2.06	0.75	6.48
Line 5	0.25	1.93	1.83	1.66	0.80	6.48
Line 6	0.23	2.25	2.10	1.24	0.66	6.48
Line 7	0.14	2.25	2.16	1.47	0.46	6.48
Line 8	0.16	2.65	2.04	1.25	0.38	6.48
Line 9	0.10	2.50	2.18	1.50	0.20	6.48
Line 10	0.28	3.43	1.28	1.16	0.32	6.48
Line 11	0.38	3.02	1.41	1.31	0.35	6.48
Line 12	0.41	2.92	1.84	1.14	0.17	6.48
Line 13	0.58	2.85	1.66	1.22	0.17	6.47
Line 14	0.67	2.52	1.82	1.20	0.27	6.48
Line 15	0.65	2.73	1.71	1.22	0.17	6.47
Line 16	0.81	2.47	1.74	1.23	0.23	6.47
Line 17	0.59	2.36	1.84	1.49	0.20	6.48
Line 18	1.81	3.40	3.67	1.77	0.56	11.21
Line 19	1.75	3.68	3.54	1.72	0.52	11.21
Line 20	1.72	3.72	3.41	1.77	0.58	11.21
Line 21	1.82	3.65	2.92	2.27	0.56	11.21
Line 22	1.91	3.51	2.57	2.43	0.79	11.21
Line 23	1.58	3.53	2.91	2.02	1.16	11.21
Line 24	0.70	4.86	2.97	1.75	0.94	11.21

Line	Ground Condition Disturbance (ha)					
	Bare Earth	Dry Grass	Grass	Shrub	Tree*	Total
Line 25	1.35	4.04	3.22	1.62	0.98	11.21
Line 26	0.67	4.70	3.44	1.76	0.65	11.21
Line 27	0.63	4.58	3.27	1.60	1.14	11.21
Line 28	1.01	4.32	2.76	1.80	1.33	11.21
Line 29	1.22	5.32	2.18	1.38	1.12	11.21
Line 30	1.01	5.27	2.67	1.41	0.85	11.21
Line 31	1.12	4.94	2.78	1.18	1.19	11.21
Line 32	0.80	4.24	2.99	1.63	1.56	11.21
Line 33	0.93	3.63	3.09	1.37	2.20	11.21
Line 34	0.80	3.18	3.68	1.20	2.36	11.21
Line 35	0.87	3.41	3.50	1.49	1.95	11.21
Line 36	0.72	3.17	3.52	1.58	2.22	11.21
Line 37	1.20	3.57	3.58	1.35	1.51	11.21
Line 38	1.35	4.66	3.02	0.99	1.20	11.21
Line 39	1.29	4.87	3.17	0.96	0.93	11.21
Line 40	1.15	5.24	2.88	0.98	0.96	11.21
Line 41	1.03	5.45	2.90	1.14	0.68	11.21
Line 42	1.08	5.57	3.03	0.67	0.86	11.21
Line 43	0.73	5.07	3.71	0.89	0.81	11.21
Line 44	0.84	4.42	3.96	0.76	1.23	11.21
Line 45	0.86	3.50	4.63	1.04	1.19	11.21
Line 46	1.08	3.33	4.27	1.28	1.24	11.20
Line 47	0.23	1.80	2.94	0.61	1.00	6.59
Line 48	0.16	1.75	2.83	0.97	0.61	6.33
Line 49	0.21	1.90	2.46	0.94	0.55	6.06
Line 50	0.30	1.95	2.27	0.82	0.42	5.76
Line 51	0.32	1.60	2.67	0.57	0.38	5.54
Line 52	0.10	1.37	3.09	0.36	0.36	5.27
Line 53	0.20	1.61	2.36	0.50	0.35	5.01
Line 54	0.16	2.00	1.79	0.63	0.17	4.75
Line 55	0.13	1.92	1.63	0.66	0.14	4.48
Line 56	0.12	1.41	1.71	0.75	0.21	4.21
Line 57	0.05	0.95	1.52	1.01	0.41	3.95
Line 58	0.00	0.96	1.43	0.98	0.32	3.69
Line 59	0.02	0.81	1.26	0.85	0.48	3.43
Line 60	0.06	0.63	1.31	0.87	0.29	3.16

Line	Ground Condition Disturbance (ha)					
	Bare Earth	Dry Grass	Grass	Shrub	Tree*	Total
Line 61	0.07	0.50	1.18	0.99	0.15	2.90
Line 62	0.03	0.83	0.79	0.85	0.14	2.64
Line 63	0.07	0.63	0.61	0.80	0.27	2.38
Line 64	0.08	0.68	0.47	0.72	0.17	2.11
Line 65	0.07	0.63	0.42	0.62	0.11	1.85
Line 66	0.01	0.61	0.27	0.64	0.07	1.59
Line 67	0.03	0.50	0.22	0.51	0.05	1.31
Line 68	0.05	0.56	0.11	0.34	0.00	1.05
Line 69	0.00	0.37	0.10	0.16	0.14	0.77
Line 70	0.00	0.37	0.03	0.10	0.02	0.51
Total disturbance (ha)	**41.43**	**190.55**	**157.31**	**83.27**	**47.98**	**520.56**
% of 3D seismic survey area	**8**	**37**	**30**	**16**	**9**	**100**
% of Shenandoah South E&A program area (total study area of 31,418 ha)	**0.13**	**0.61**	**0.50**	**0.27**	**0.15**	**1.66**



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GDA 1994 MGA Zone 53

0 0.5 1 2

Kilometres

Seismic Lines
Study Area
Class type
Bare Earth
Dry Grass
Grass
Shrub
Tree
Water
Existing Exploration Well Pads
Gravel Pits
Tracks
Pastoral Lease Boundary

Data sources:
SREBA 2023, Permit Area, Cadastre - NT Gov 2019, Placed_Highways_Roads_Drainage - StreetPro 2019

tamboran RESOURCES

Shenandoah South Classified Sentinel Imagery Overview

PROJECT ID	60623736
CREATED BY	sam.schroder
LAST MODIFIED	19-Jul-2024
VERSION	1

Figure 16

4.7 Conservation Areas

There are no national or world heritage places, Commonwealth land or heritage places or reserves or critical habitat areas listed under the EPBC Act are located within or adjacent to the exploration area.

The Bullwaddy Conservation Reserve occurs approximately 70-93 km north-east of the Shenandoah South E&A program. The Reserve was declared in 2000 and is approximately 11,500 ha in area. It represents the only declared conservation area within the Sturt Plateau region to protect the Lancewood/Bullwaddy vegetation community. Less than 3% of this vegetation community is reserved nationally (PWCNT, 2005). The most significant values of the reserve are the flora and the associated fauna for which it provides habitat. This includes the Spectacled Hare-Wallaby, the Northern Nailtail Wallaby and the Giant Frog (*Cyclorana australis*). It is also a valuable area for research on the ecology of Bullwaddy, particularly the effects of fire (PWCNT, 2005).

Lake Woods is located approximately 86-110 km south-west of the Shenandoah South E&A program area on Newcastle Waters Station. This wetland is listed as a Site of Conservation Significance by the Department of Land Resource Management and is listed in the Directory of Important Wetlands in Australia. Although Lake Woods is located outside of the Shenandoah South E&A program area, it is fed principally by surface inflow of Newcastle Creek, itself originating more than 160 km north-east on Amungee Mungee Station. During the period of inundation, Lake Woods supports over 100,000 waterbirds including internationally significant numbers of Plumed Whistling-Duck (*Dendrocygna eytoni*). Numerous bird species nest and feed in the diverse wetland habitat, and the conservation group ‘Birdlife International’ nominated Lake Woods as an ‘Important Bird Area’ (IBA). The lake also includes the largest area of lignum swamp in the Northern Territory and in tropical Australia (NRETAS, 2009).

4.8 Aquatic Ecosystems

Mapping of aquatic ecosystems undertaken by the NT Government indicates that while most of the Shenandoah South E&A program area can be classified as terrestrial aquatic ecosystems they are sparsely scattered throughout. Most of these are classified as floodplain systems, which are seasonally or intermittently flooded areas that have hydric soils and contain vegetation that has adapted to the intermittent presence of water. A smaller portion of the area is classified as a lacustrine system, which are characterised by deep standing or slow-moving water, and have less than 30% of their extent covered by vegetation such as trees, shrubs or persistent emergent vegetation (DEPWS, 2022d).

4.9 Groundwater Dependent Ecosystems

A search of the National Groundwater Dependent Ecosystems (GDE) Atlas was undertaken in September 2023. The dataset expresses the potential for groundwater interaction/use for river/spring/wetland ecosystems across Australia. It shows the ecosystems that rely on groundwater that has been discharged to the surface, such as baseflow or spring flow.

The Atlas identifies two aquatic GDEs within the exploration area, consisting of Newcastle Creek and Yaroo Creek. The Shenandoah South E&A program is not anticipated to impacts these GDEs.

Based on the SREBA Beetaloo vegetation map (Young *et al*., 2022), three broad vegetation groups within the Shenandoah South E&A program area have been classified as groundwater-dependent ecosystems:

- *Corymbia bella* woodland on alluvial plains
- *Melaleuca* forests (springs, river channels)
- Riparian woodland (ephemeral streams).

Corymbia bella woodland on alluvial plains and Riparian woodland GDE vegetation communities have been mapped approximately 14 km and 20km west of the Shenandoah South E&A program area respectively.

4.10 Stygofauna

Stygofauna comprise aquatic taxa occurring in groundwater aquifers and subterranean water bodies. Stygofauna inhabit and form a component of groundwater dependent ecosystems. Stygofauna are likely to be present in the karstic systems such as the Gum Ridge Formation aquifer, located within the Georgina Basin that underlies the Shenandoah South E&A program area, where water levels are less than 100 m below ground level (GISERA, 2020). Stygofauna inhabit the interstitial spaces of the cavities of alluvial, sedimentary and karstic aquifers. Recent studies by the Gas Industry Social and Environmental Research Alliance (GISERA) program have identified and characterised stygofauna assemblages in the cambrian limestone aquifer units of the Beetaloo Sub-basin. Data is available that can provide an indication of the likelihood of stygofauna presence, with the following factors determining the distribution of stygofauna:

- Formation type: Stygofauna are predominantly found in aquifers with large (mm or greater) pore spaces, which are more common for alluvial, karstic and some fractured rock aquifers.
- Depth below ground level: The abundance and diversity of stygofauna typically decreases with depth below ground, with fauna being rarely found more than 100 m below ground level.
- Proximity of exchange and recharge: Stygofauna are more abundant in areas of surface water-groundwater exchange, compared to deeper areas or those further along the groundwater flow path remote from areas of exchange or recharge (Hose *et al*., 2015).

4.10.1 Stygofauna surveys

Stygofauna surveys through the use of eDNA have been undertaken in the Beetaloo Basin in August and October of 2019 (Rees *et al*, 2020), and during May 2021 and October 2022 (Humphreys *et al*., 2022). These surveys involved sampling across several bores in the region, including four bores within 50 km of the Shenandoah South E&A program. The results of stygofauna surveys at these bores are summarised in Table 26. A full list of Stygofauna identified at the bores is provided in Appendix G.

Table 20 Stygofauna survey results (Rees *et al*, 2020; Humphreys *et al*., 2022)

Bore	Distance from Shenandoah South E&A program area	Summary of results
RN041444	24 km north-west	No stygofauna detected
Hayfield Shenandoah Homestead Bore	3 km north-west	25 stygofauna identified by DNA: • 6 to family level • 7 to order level • 8 to class level • 4 to phylum level
Sturt Plains Homestead Bore	21 km south-west	11 stygofauna identified by DNA: • 1 to family level • 4 to order level • 5 to class level • 1 to phylum level
RN038816	16 km south-west	18 *Enchytraeidae* sp. (pot worms) detected

Stygofauna baseline sampling results recorded no Stygofauna taxa recorded within the Shenandoah South E&A program area. The nearest records are from the Hayfield Shenandoah Homestead bore, located approximately 3 km north-west to the Shenandoah South E&A program area.

Stygofauna surveys found that diversity was greater within the Tindall aquifer of the Daly Basin, located north of the Shenandoah South E&A program area. Stygofauna diversity is lower in the Georgina Basin despite the presence of limestone strata. This is possibly due to the prevalence of mudstone and siltstone, which are less suitable habitat for stygofauna due to the lack of cavities and pore space (Humphreys *et al*., 2022).

4.11 Matters of National Environmental Significance

4.11.1 Potential EPBC Act Controlling Provisions

Actions such as the proposed 2024 Tamboran exploration program may require approval by the Commonwealth Minister for the Environment, under the *EPBC Act*. Approval is only required if the action is likely to result in significant impacts on Matters of National Environmental Significance (MNES) or if the action will have or is likely to have a significant impact on the environment.

Potential triggers under the EPBC Act include a significant impact on:

- The world heritage values of a declared World Heritage Property
- The national heritage values of a listed National Heritage Place
- The ecological character of a declared Ramsar wetland
- A listed Threatened Ecological Community, or its habitat
- The members of a listed threatened species
- The members of a listed migratory species or their habitat
- A water resource, in relation to coal seam gas development and large coal mining development.

4.11.2 Matters of National Environmental Significance

An EPBC Protected Matters Search was generated on the 8 March 2024 (refer Appendix F) to identify whether MNES or other matters protected by the EPBC Act are likely to occur on or in the near vicinity of the Shenandoah South E&A program area. Results of the search are provided below in Table 21.

Table 21 Summary of EPBC Aspects for Shenandoah South E&A program

Aspect	Located within the Shenandoah South E&A program area
Matters of National Environmental Significance	
World Heritage Properties	None
National Heritage Places	None
Wetlands of International Significance	None
Great Barrier Marine Park	None
Commonwealth Marine Area	None
Listed Threatened Ecological communities	None
Listed Threatened Species	17
Listed Migratory Species	13
Other Matters Protected by the EPBC Act	
Commonwealth Land	None
Commonwealth Heritage Places	None
Listed Marine Species	17
Whales and other Cetaceans	None
Critical Habitat	None
Commonwealth Reserves Terrestrial	None
Australian Marine Parks	None
Habitat Critical to the Survival of Marine Turtles	None

Aspect	Located within the Shenandoah South E&A program area
Extra Information (Information that may also be relevant to the Exploration sites)	
State and Territory Reserves	None
Regional Forest Agreement	None
Nationally Important Wetlands	None
EPBC Act Referrals	1 - Improving rabbit biocontrol: releasing another strain of RHDV, southern two thirds of Australia, Not Controlled Action - Completed
Key Ecological Features (Marine)	None
Biologically Important Areas	None
Bioregional Assessments	None
Geological and Bioregional Assessments	None

Section 4.5 provides details on threatened, migratory and marine fauna species that potentially occur within the Shenandoah South E&A program area. The threatened and migratory species that potentially occur within the Shenandoah South E&A program area are unlikely to be significantly impacted by the exploration activities.

5.0 Land Condition Assessment

AECOM undertook a land condition assessment of the proposed Shenandoah South E&A program area. The aim of the assessment was to provide a baseline assessment of ecological conditions to support Tamboran's application to the NTG DEPWS to continue exploration activities. Information obtained during the LCA will assist in determining the effectiveness of site rehabilitation once exploration activities have ceased.

Vegetation communities within the Shenandoah South E&A program area are summarised in Table 22.

Table 22 Vegetation communities and associated landforms within Shenandoah South E&A program area

Vegetation Community		Area and % of Exploration Area
Scoured gravelly level to gently undulating low rises and pediment slopes		
1	*Acacia shirleyi* mid high woodland	7,121.47 ha (19.84%)
Level plains of residual plateau surface		
2a	*Corymbia dichromophloia* ± *Erythrophleum chlorostachys* mid high open woodland	16,578.52 ha (46.18%)
2b	*Acacia shirleyi, Corymbia dichromophloia* ± *Corymbia polycarpa* mid high open woodland	3,953.55 ha (11.01%)
2c	*Eucalyptus leucophloia* low open woodland	146.47 ha (0.41%)
Level, imperfectly drained, colluvial valley flats and margins within relict drainage features		
3a	*Corymbia polycarpa,* ± *Erythrophleum chlorostachys* mid high open woodland	1,341.03 ha (3.47%)
3b	*Eucalyptus chlorophylla, Acacia shirleyi* mid high open woodland	1,019.41 ha (2.84%)
3c	*Eucalyptus pruinosa* ± *Eucalyptus chlorophylla, Atalaya hemiglauca* low open woodland	309.72 ha (0.86%)
4a	*47g-1 Acacia sp. 2* ± *Melaleuca viridiflora* tall shrubland	3,136.72 ha (8.74%)
4b	*Melaleuca viridiflora, Terminalia canescens* low sparse shrubland	1,507.11 ha (4.2%)
5	*Corymbia polycarpa, Eucalyptus microtheca* mid high open woodland	322.47 ha (0.9%)
Localised shallow, level closed depressions and seasonal swamps		
6	*Lophostemon grandiflorus, Eucalyptus microtheca* ± *Eucalyptus camaldulensis* low open woodland	461.56 ha (1.29%)
	Total	**35,898.03 ha**

During the survey the Shenandoah South E&A program area was assessed to be in generally moderate to good condition with no current evidence of weeds, minor erosion, and some disturbance from cattle.

EPBC and TPWC Act Listed threatened species that have a potential to be encountered within the Shenandoah South E&A program include:

- Gouldian Finch *Chloebia gouldiae* (Endangered EPBC Act, Vulnerable TPWC Act)
- Red Goshawk *Erythrotriorchis radiatus* (Endangered EPBC Act, Vulnerable TPWC Act)
- Grey Falcon *Falco hypoleucos* (Vulnerable EPBC Act and TPWC Act)
- Northern Shrike-tit *Falcunculus whitei* (Vulnerable EPBC Act)
- Painted Honeyeater *Grantiella picta* (Vulnerable EPBC Act and TPWC Act)
- Australian Painted Snipe *Rostratula australis* (Endangered EPBC Act and TPWC Act)

- Greater Bilby *Macrotis lagotis* (Vulnerable EPBC Act and TPWC Act)
- Pale Field-rat *Rattus tunneyi* (Vulnerable TPWC Act)
- Common Brushtail Possum (northern) *Trichosurus vulpecula arnhemensis* (Vulnerable EPBC Act)
- Plains Death Adder *Acanthopsis hawkei* (Vulnerable EPBC ACT and TPWC Act)
- Northern Blue-tongue Skink *Tiliqua scincoides* intermedia (Critically Endangered EPBC Act)
- Yellow-spotted Monitor *Varanus panoptes* (Vulnerable TPWC Act).

Mitigation measures are presented in Tamboran's exploration program EMPs and will assist in minimising the impacts from Tamboran's activities on the natural environment and threatened species that may occur within the Shenandoah South E&A program area.

Detailed land condition description and photographs of the Shenandoah South E&A program has been provided in Table 23 to Table 32.

Table 23 Site 14 land condition description

Site 14					
Location	GDA94, Zone 53, 341953E, 8140027N	**Vegetation community**	Comm 2a: *Corymbia dichromophloia ± Erythrophleum chlorostachys* mid high open woodland		
Vegetation description	*Corymbia dichromophloia* mid high open woodland, over *Acacia difficilis, Petalostigma pubescens* mid high open shrubland, over *Triodia bitextura, Chrysopogon fallax* mid high open tussock grassland				
Vegetation transect	*Corymbia dichromophloia (52.5%), Acacia difficilis (46.5%), Petalostigma pubescens (0.6%), Hakea arborescens (0.6%)*				
Basal area (5 sweeps)	*Corymbia dichromophloia (17), Gardenia sp. (1), Petalostigma pubescens (0.5), Dead tree (1.5)*			**Stand basal area (average)**	3.7 m²/ha
Landform	Level plains of residual plateau surface	**Habitat**	Scattered tree hollows and fallen logs. Flowering plants common. Mistletoe absent. Moderate leaf litter		
Disturbance Fire damage low > 2 years ago. No erosion. Minor cattle impacts.					
Termite mounds Sparse					
Slope < 1%					
Ground cover 30% Vegetation, 15% Litter, 55% Bare Soil					
Vegetation Structure	**Upper storey (7 - 12 m)**	*Corymbia dichromophloia (24%)*			
	Mid-storey (0.5 - 7 m)	*Acacia difficilis (16%), Petalostigma pubescens (8%), 11g-1 Brachychiton sp. 1 (2%)*			
	Understorey (0 - 0 5 m)	*Triodia bitextura (15%), Chrysopogon fallax (15%)*			
Soil texture	Loamy sand grading to heavy sandy loam. Gravels at 0.7m.				
Drainage	Well drained				
Soil colour	7.5YR 3/2. Dark brown grading to 2.5YR 3/3 Dark reddish brown				
Soil pH	A horizon – 6.8 B horizon – 6.9				

Table 24 Site 40 land condition description

Site 40					
Location	GDA94, Zone 53, 347565E, 8141255N	**Vegetation community**	Comm 2a: *Corymbia dichromophloia* ± *Erythrophleum chlorostachys* mid high open woodland		
Vegetation description	*Corymbia dichromophloia, Corymbia polycarpa* mid high open woodland, over *Acacia difficilis, Hakea arborescens, Alphitonia excelsa* mid high open shrubland, over *Triodia bitextura, Chrysopogon fallax, Schizachyrium fragile* mid high hummock grassland				
Vegetation transect	*Acacia difficilis (67.4%), Corymbia dichromophloia (27.2%), Hakea arborescens (4.3%), Corymbia ferruginea (1.1%)*				
Basal area (5 sweeps)	*Corymbia dichromophloia (7), Acacia difficilis (2), Dead tree (3.5)*			**Stand basal area (average)**	1.8 m²/ha
Landform	Level plains of residual plateau surface	**Habitat**	Scattered tree hollows and flowering plants. Fallen logs common. Mistletoe absent. Shallow leaf litter.		
Disturbance Fire damage low > 2 years ago. No erosion. Minor cattle impacts. **Termite mounds** Sparse					
Slope < 1% **Ground cover** 50% Vegetation, 20% Litter, 30% Bare Soil					
Vegetation Structure	**Upper storey (8 - 12 m)**	*Corymbia dichromophloia (10%), Corymbia polycarpa (2%)*			
	Mid-storey (0.5 - 6 m)	*Acacia difficilis (15%), Hakea arborescens (5%), Alphitonia excelsa (5%)*			
	Understorey (0 - 0 5 m)	*Triodia bitextura (20%), Chrysopogon fallax (15%), Schizachyrium fragile (15%)*			
Soil texture Loamy sand grading to heavy sandy clay loam. Gravels starting at 0.55m. **Soil colour** 10YR 4/1. Dark Gray grading to 7.5YR 3/2 Dark brown. **Soil pH** A horizon – 6.7 B horizon – 6.6					

Table 25 Site 48 land condition description

Site 48				
Location	GDA94, Zone 53, 354952E, 8137475N	**Vegetation community**	Comm 2a: *Corymbia dichromophloia* ± *Erythrophleum chlorostachys* mid high open woodland	
Vegetation description	*Corymbia dichromophloia* mid high open woodland, over *Alphitonia excelsa, Erythrophleum chlorostachys, Corymbia ferruginea* mid high open shrubland, over *Triodia bitextura* mid high hummock grassland			
Vegetation transect	*Corymbia dichromophloia (58.8%), Erythrophleum chlorostachys (20%), Corymbia ferruginea (11.3%) Acacia difficilis (10%)*			
Basal area (5 sweeps)	*Corymbia dichromophloia (11), Erythrophleum chlorostachys (2), Corymbia ferruginea (1), Dead tree (3)*	**Stand basal area (average)**	2.8 m²/ha	
Landform	Level plains of residual plateau surface	**Habitat**	Tree hollows common, fallen logs and flowering plants scattered. Mistletoe absent and shallow leaf litter.	
Disturbance Fire damage moderate > 2 years ago. No erosion. Minor cattle impacts.				
Termite mounds Sparse				
Slope < 1%				
Ground cover 60% Vegetation, 10% Litter, 30% Bare Soil				
Vegetation Structure	**Upper storey:8- 12 m**	*Corymbia dichromophloia (16%)*		
	Mid-storey: 0.5- 8 m	*Alphitonia excelsa (6%), Erythrophleum chlorostachys (4%), Corymbia ferruginea (2%)*		
	Understorey: 0 – 0.5 m	*Triodia bitextura (60%)*		
Soil texture	Loam sand grading to heavy sandy loam.			
Soil drainage	Well drained			
Soil colour	5YR 3/3 Dark reddish-brown grading to 10YR 4/6 Red			
Soil pH	A horizon – 6.3 B horizon – 6.8			

Table 26 Site 53 land condition description

Site 53					
Location	GDA94, Zone 53, 351166E, 8142872N	**Vegetation community**	Comm 4a: *Acacia ancistrocarpa* ± *Melaleuca viridiflora* tall shrubland		
Vegetation description	*Acacia ancistrocarpa*, *Melaleuca viridiflora* tall shrubland, over				
Vegetation transect	*Acacia ancistrocarpa (53.9%), Melaleuca viridiflora (44.7%), Terminalia canescens (1.5%)*				
Basal area (5 sweeps)	-			**Stand basal area (average)**	0 m²/ha
Landform	Broad, imperfectly drained lower-lying areas on level plains.	**Habitat**	Tree hollows, fallen logs, and mistletoe absent, flowering plants abundant. Shallow leaf litter.		
Disturbance Fire damage moderate >2years ago. No erosion. Mod. cattle impacts **Termite mounds** Absent					
Slope < 1% **Ground cover** 60% Vegetation, 10% Litter, 30% Bare Soil					
Vegetation Structure	**Upper storey (2 - 4 m)**	*Acacia ancistrocarpa (30%)*			
	Mid-storey (1 - 2 m)	*Melaleuca viridiflora (15%)*			
	Understorey (0 - 1 m)	*Triodia bitextura (50%), Schizachyrium fragile (5%)*			
Soil texture	Loamy sand grading to heavy sandy loam. Gravels at 0.35m.				
Soil drainage	Poorly drained, seasonally waterlogged				
Soil colour	7.5YR 2.5/1 Black grading to 5YR 4/2 Dark reddish grey				
Soil pH	B horizon – 5.7				

Table 27 Site 54 land condition description

Site 54				
Location	GDA94, Zone 53, 349522E, 8144946	**Vegetation community**	Comm: 2b *Acacia shirleyi*, *Corymbia dichromophloia* ± *Corymbia polycarpa* mid high open woodland	
Vegetation description	*Corymbia dichromophloia, Acacia shirleyi* mid high open woodland, over *Petalostigma pubescens, Terminalia canescens, Terminalia volucris* mid high open shrubland, over *Triodia bitextura, Chrysopogon fallax, Schizachyrium fragile* mid high hummock grassland			
Vegetation transect	*Corymbia dichromophloia (30.9%), Acacia shirleyi (29.1%), Petalostigma pubescens (20%), Calytrix exstipulata (7.3%), Terminalia canescens (6.4%), Terminalia volucris (4.5%), Denhamia cunninghamii (0.9%), Corymbia ferruginea (0.9%)*			
Basal area (5 sweeps)	*Acacia shirleyi (14.5), Corymbia dichromophloia (4), Terminalia volucris (2), Denhamia cunninghamii (0.5), Petalostigma pubescens (0.5), Corymbia ferruginea (0.5), Dead tree (6)*	**Stand basal area (average)**	4.4 m²/ha	
Landform	Level plains of residual plateau surface	**Habitat**	Scattered tree hollows, fallen logs and mistletoe. Flowering plants common. Shallow leaf litter.	
Disturbance Fire damage Mod. > 2 years ago. No erosion. Mod cattle impacts.				
Termite mounds Sparse				
Slope < 1%				
Ground cover 70% Vegetation, 20% Litter, 10% Bare Soil				
Vegetation Structure	**Upper storey: 7 - 12 m**	*Corymbia dichromophloia (10%), Acacia shirleyi (8%)*		
	Mid-storey: 0.5 - 7 m	*Petalostigma pubescens (10%), Terminalia canescens (5%), Terminalia volucris (3%)*		
	Understorey: 0 – 0.5 m	*Triodia bitextura (35%), Chrysopogon fallax (20%), Schizachyrium fragile (15%)*		
Soil texture	Ligh loamy sand grading to sandy loam. Gravels start at 0.35m.			
Soil colour	7.5YR 3/2 Dark brown grading to 7.5YR 5/2 Brown			
Soil pH	A horizon – 5.8 B horizon – 6.3			

Table 28 Site 59 land condition description

<table>
<tr><th colspan="6">Site 59</th></tr>
<tr><td>Location</td><td>GDA94, Zone 53, 351289E, 8150383N</td><td>Vegetation community</td><td colspan="3">Comm: 2b
Acacia shirleyi, Corymbia dichromophloia ± Corymbia polycarpa mid high open woodland</td></tr>
<tr><td>Vegetation description</td><td colspan="5">Acacia shirleyi, Corymbia dichromophloia, Corymbia polycarpa mid high open woodland over, Acacia shirleyi, Macropteranthes kekwickii, Terminalia canescens mid high open shrubland, over Schizachyrium fragile, Eriachne triseta and Eragrostis fallax mid high tussock grassland</td></tr>
<tr><td>Vegetation transect</td><td colspan="5">Acacia shirleyi (80.9%), Macropteranthes kekwickii (14.6%), Corymbia dichromophloia (2.5%), Terminalia canescens (1.9%)</td></tr>
<tr><td>Basal area (5 sweeps)</td><td colspan="3">Acacia shirleyi (14), Macropteranthes kekwickii (2), Corymbia polycarpa (1), Corymbia confertiflora (1)</td><td>Stand basal area (average)</td><td>3.6 m²/ha</td></tr>
<tr><td>Landform</td><td>Level plains of residual plateau surface</td><td>Habitat</td><td colspan="3">Scattered tree hollows, fallen logs and flowering plants common. Mistletoe absent and shallow leaf litter.</td></tr>
<tr><td>Disturbance
Fire damage moderate > 2 years ago. No erosion. Minor cattle impacts.
Termite mounds
Common</td><td colspan="5">   </td></tr>
<tr><td>Slope
< 1%
Ground cover
50% Vegetation, 5% Litter, 25% Bare Soil</td><td colspan="5">   </td></tr>
<tr><td rowspan="3">Vegetation Structure</td><td colspan="2">Upper storey (6 - 12 m)</td><td colspan="3">Acacia shirleyi (8%), Corymbia dichromophloia (2%), Corymbia polycarpa (2%)</td></tr>
<tr><td colspan="2">Mid-storey (0.5 - 6 m)</td><td colspan="3">Acacia shirleyi (10%), Macropteranthes kekwickii (6%), Terminalia canescens (4%)</td></tr>
<tr><td colspan="2">Understorey (0 - 0 5 m)</td><td colspan="3">Schizachyrium fragile (30%), Eriachne triseta (15%), Eragrostis fallax (5%)</td></tr>
<tr><td>Soil texture</td><td>Loamy sand grading to sandy clay loam. Gravels at surface and through the profile.</td><td colspan="3" rowspan="3">   </td></tr>
<tr><td>Soil colour</td><td>5YR 4/2 Dark reddish grey grading to 2.5YR 4/6 Red</td></tr>
<tr><td>Soil pH</td><td>A horizon – 6.0
B horizon – 6.1</td></tr>
</table>

Table 29 Site 65 land condition description

<table>
<tr><th colspan="6">Site 65</th></tr>
<tr><td>Location</td><td>GDA94, Zone 53, 354464E, 8141858N</td><td>Vegetation community</td><td colspan="3">Comm 2a:
Corymbia dichromophloia ± Erythrophleum chlorostachys mid high open woodland</td></tr>
<tr><td>Vegetation description</td><td colspan="5">Corymbia dichromophloia, Corymbia ferruginea, Erythrophleum chlorostachys mid high open woodland, over Acacia hammondii, Alphitonia excelsa, Dodonaea hispidula, mid high open shrubland, over Triodia bitextura, Aristida contorta, Schizachyrium fragile mid high hummock grassland</td></tr>
<tr><td>Vegetation transect</td><td colspan="5">Corymbia dichromophloia (79.5%), Corymbia ferruginea (10.3%), Erythrophleum chlorostachys (8.5%), Alphitonia excelsa (1.7%)</td></tr>
<tr><td>Basal area (5 sweeps)</td><td colspan="3">Corymbia dichromophloia (21), Corymbia ferruginea (4), Erythrophleum chlorostachys (2), Dead tree (2.5)</td><td>Stand basal area (average)</td><td>5.4 m²/ha</td></tr>
<tr><td>Landform</td><td>Level plains of residual plateau surface</td><td>Habitat</td><td colspan="3">Moderate - Common tree hollows and falling logs. Mistletoe and flowering plants absent. Shallow leaf litter.</td></tr>
<tr><td>Disturbance
Fire damage > 2 years ago. No erosion. Minor cattle impacts.
Termite mounds
Sparse</td><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td>Slope
< 1%
Ground cover
40% Vegetation, 5% Litter, 55% Bare Soil</td><td colspan="2">  </td><td colspan="3">  </td></tr>
<tr><td rowspan="3">Vegetation Structure</td><td colspan="2">Upper storey (7 - 12 m)</td><td colspan="3">Corymbia dichromophloia (10%), Corymbia ferruginea (5%), Erythrophleum chlorostachys (3)</td></tr>
<tr><td colspan="2">Mid-storey (0.5 - 7 m)</td><td colspan="3">Acacia hammondii (8%), Alphitonia excelsa (3%), Dodonaea hispidula (1%)</td></tr>
<tr><td colspan="2">Understorey (0 - 0 5 m)</td><td colspan="3">Triodia bitextura (30%), Aristida contorta (8%), Schizachyrium fragile (2%)</td></tr>
<tr><td>Soil texture</td><td colspan="3">Loamy sand grading to sandy clay loam</td><td colspan="2" rowspan="4">  </td></tr>
<tr><td>Soil drainage</td><td colspan="3">Well drained.</td></tr>
<tr><td>Soil colour</td><td colspan="3">5YR 3/3 Dark reddish-brown grading to 2.5YR 4/6 Red</td></tr>
<tr><td>Soil pH</td><td colspan="3">A horizon – 6.0
B horizon – 6.4</td></tr>
</table>

Table 30 Shenandoah South A land condition description (2023)

Shenandoah South A					
Location	GDA94, Zone 53, 340335E, 8134450N	**Vegetation community**	**Comm 2a:** *Corymbia dichromophloia* ± *Erythrophleum chlorostachys* mid high open woodland		
Vegetation description	*Corymbia dichromophloia* mid high open woodland over *Acacia difficilis, Terminalia canescens, Grevillea parallela* mid high shrubland over *Triodia bitextura, Chrysopogon fallax, Mnesithea formosa.*				
Vegetation transect	*A. difficilis (62%), C. dichromophloia (18.8%), Terminalia canescens (15.4%), Brachychiton diversifolius (2.9%), Erythrophleum chlorostachys (1%)*				
Basal area (5 sweeps)	*C. dichromophloia 14.5, Terminalia canescens 1, Dead 1*			**Stand basal area (average)**	3.1 m²/ha
Landform	Simple slope	**Habitat**	Moderate -scattered tree hollows, fallen logs and flowering plants. Mistletoe and leaf litter absent.		
Slope	< 1%				
Disturbance					
Fire damage low > 2 years ago. No erosion. Minor cattle impacts.					
Termite mounds					
Sparse					
Ground cover					
35% Vegetation, 10% Litter, 45% Bare Soil, 10% Gravel					
Vegetation Structure	**Upper storey (6 - 12 m)**	*Corymbia dichromophloia (12%)*			
	Mid-storey (0.5 - 6 m)	*Acacia difficilis (20%), Terminalia canescens (6%), Grevillea parallela (2%)*			
	Understorey (0 - 0 5 m)	*Triodia bitextura (15%), Chrysopogon fallax (10%), Mnesithea formosa (5%)*			
Soil texture	Sandy loam in upper 0.75 m. Surface gravels present.				
Soil drainage	Well drained				
Soil colour	7.5YR 3/4. Dark brown				
Soil pH	7.3				

Table 31 Shenandoah South B land condition description (2023)

Shenandoah South B					
Location	GDA94, Zone 53, 345579E, 8135469N	**Vegetation community**	**Comm 3a:** *Corymbia polycarpa, Eucalyptus chlorophylla, Acacia shirleyi* mid high open woodland		
Vegetation description	*Corymbia polycarpa, Eucalyptus chlorophylla, Acacia shirleyi* mid high open woodland over *Acacia difficilis, Acacia gonoclada, Macropteranthes kekwickii* mid high open shrubland over *Aristida contorta, Aristida hygrometrica* mid high open tussock grassland.				
Vegetation transect	*A. shirleyi (28.4%), E. chlorophylla (23.4%), A. gonoclada (19.9%), A. difficilis (11.3%), C. polycarpa (7.8%), Terminalia canescens (3.5%), Bauhinia cunninghamii (2.1%), Macropteranthes kekwickii (2.1%), Dolichandrone heterophylla (1.4%).*				
Basal area (5 sweeps)	*A. shirleyi 8, E. chlorophylla 4.5, C. polycarpa 4.5, Bauhinia cunninghamii 2, Dead 1.5*			**Stand basal area (average)**	4.1 m²/ha
Landform	Simple slope	**Habitat**	Moderate -Scattered tree hollows, fallen logs and flowering plants common. Mistletoe and leaf litter absent.		
Slope	< 1%				
Disturbance					
Fire damage low > 2 years ago. No erosion. Minor cattle impacts.					
Termite mounds					
Sparse					
Ground cover					
15% Vegetation, 10% Litter, 25% Bare Soil, 50% Gravel					
Vegetation Structure	**Upper storey (7 - 12 m)**	*Corymbia polycarpa (6%), Eucalyptus chlorophylla (5%), Acacia shirleyi (5%)*			
	Mid-storey (0.5 - 7 m)	*Acacia difficilis (12%), Acacia gonoclada (8%), Macropteranthes kekwickii (5%)*			
	Understorey (0 - 0 5 m)	*Aristida contorta (8%), Aristida hygrometrica (7%)*			
Soil texture	Clay Loam Sandy in upper 0.5 m. Light Medium Clay to 0.7 m. No surface gravels.				
Soil drainage	Well drained, potential for standing water following rainfall.				
Soil colour	10YR 4/1. Dark Gray.				
Soil pH	7.0				

Table 32 Shenandoah South C land condition description (2023)

<table>
<tr><th colspan="6">Shenandoah South C</th></tr>
<tr><td>Location</td><td>GDA94, Zone 53, 343472E, 8133331N</td><td>Vegetation community</td><td colspan="3">Comm 2b: Acacia shirleyi, Corymbia dichromophloia ± Eucalyptus leucophloia, C. polycarpa mid high open woodland</td></tr>
<tr><td>Vegetation description</td><td colspan="5">Acacia shirleyi, Ventilago viminalis mid high open woodland over Macropteranthes kekwickii, Terminalia volucris, Eucalyptus chlorophylla mid high open shrubland over Sorghum intrans, Eulalia aurea, Chrysopogon fallax mid high tussock grassland</td></tr>
<tr><td>Vegetation transect</td><td colspan="5">A. shirleyi (24.5%), Macropteranthes kekwickii (41.2%), C. grandifolia (13.7%), Ventilago viminalis (6.9%), Calytrix exstipulata (6.9%), Terminalia volucris (5.9%), Gyrocarpus americanus (1%)</td></tr>
<tr><td>Basal area (5 sweeps)</td><td colspan="3">Macropteranthes kekwickii 6.5, A. shirleyi 3, Gyrocarpus americanus 2</td><td>Stand basal area (average)</td><td>1 m²/ha</td></tr>
<tr><td>Landform</td><td>Simple slope</td><td rowspan="2">Habitat</td><td colspan="3" rowspan="2">Moderate - Tree hollows, Mistletoe and leaf litter absent. Fallen logs and flowering plants common.</td></tr>
<tr><td>Slope</td><td>< 1%</td></tr>
<tr><td>Disturbance
Fire damage low > 2 years ago. No erosion. Minor cattle impacts.
Termite mounds
Sparse</td><td colspan="5">   </td></tr>
<tr><td>Ground cover
15% Vegetation, 10% Litter, 25% Bare Soil, 50% Gravel</td><td colspan="5">   </td></tr>
<tr><td rowspan="3">Vegetation Structure</td><td>Upper storey (7 - 12 m)</td><td colspan="4">Acacia shirleyi (8%), Ventilago viminalis (2%)</td></tr>
<tr><td>Mid-storey (0.5 - 7 m)</td><td colspan="4">Macropteranthes kekwickii (12%), Terminalia volucris (6%), Eucalyptus chlorophylla (2%)</td></tr>
<tr><td>Understorey (0 - 0 5 m)</td><td colspan="4">Sorghum intrans (20%), Eulalia aurea (10%), Chrysopogon fallax (10%)</td></tr>
<tr><td>Soil texture</td><td>Silty Clay Loam in upper 0.3 m. Progressing to Clay. No surface gravels.</td><td colspan="4" rowspan="4">  </td></tr>
<tr><td>Soil drainage</td><td>Well drained</td></tr>
<tr><td>Soil colour</td><td>5YR 3/3. Dark reddish brown</td></tr>
<tr><td>Soil pH</td><td>6.7</td></tr>
</table>

6.0 References

AECOM Australia Pty Ltd. 2023. *Land Condition Assessment – Shenandoah South E&A Program*. Report prepared for Tamboran B2 Pty Ltd, Darwin, NT.

AECOM Australia Pty Ltd. 2015. *Exploration Environmental Plan, Beetaloo Basin, NT*. Unpublished report for Origin Energy Resources Limited, Darwin, NT.

Aldrick JM and Wilson PL. 1990. Land systems of the Southern Gulf Region, Northern Territory, Technical Report No. 42, Conservation Commission of the Northern Territory, Palmerston, NT.

Aumann, T. and Baker-Gabb D. 1991. RAOU Report 75. *A Management Plan for the Red Goshawk*. RAOU. Royal Australasian Ornithologists Union, Melbourne.

Baker, B., Price, O., Woinarski, J, Gold, S., Connors., G, Fisher, A. and Hempel, C. 2005. *Northern Territory Bioregions: assessment of key biodiversity values and threats*. Department of Natural Resources, Environment and the Arts, Northern Territory Government.

Brocklehurst, P.S., Lewis, D., Lynch, D. and Napier, D. 2007. *Northern Territory guidelines and field methodology for vegetation survey and mapping*. Department of Natural Resources, Environment and the Arts. Northern Territory Government. Palmerston, NT.

Burley, P., Carnavas, M. and Hem. pel, J. 2019. *Soils and Land Suitability Assessment for Irrigated Agriculture in the Dunmarra Area*. Department of Environment and Natural Resources. Northern Territory Government, Palmerston.

Bureau of Meteorology, 2022. Northern Territory Weather Observations. Available from http://www.bom.gov.au/nt/observations/index.shtml. Site accessed 29 May 2022.

CloudGMS, 2015. *Beetaloo Basin Hydrogeological Assessment.* Prepared by S. Fulton and A. Knapton, February 2015.

Cogger, H. 2000. Reptiles and Amphibians of Australia (6th edition). Ralph Curtis Publishing.

Cole, J. and Woinarski, J. 2002. *Field Guide to the Rodents and Dasyurids of the Northern Territory*. Surrey Beatty and Sons, Chipping Norton, NSW.

Curtis, Lee K., A. J. Dennis, K. R. McDonald, P. M. Kyne, and Debus S.J.S., Eds. (2012). *Queensland's Threatened Animals*. CSIRO Publishing, Collingswood.

Davis, J, Gillespie, G, Cuff, N, Garcia, E, Andersen, A, Young, L, Leiper, I, Ribot, R, Kennard, M, Pintor, A, Bonney, S, and Wedd, D. 2021. *Beetaloo GBA Region Baseline Survey Program*. Research Institute for Environment & Livelihoods, Charles Darwin University, Darwin, Australia.

Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2023a. *Conservation Advice for Tiliqua scincoides intermedia (northern blue-tongue skink)*. Australian Government, Canberra.

Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2023b. *Conservation Advice for Varanus mertensi (Mertens' Water Monitor)*. Australian Government, Canberra.

Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2023c. *Conservation Advice for Varanus mitchelli (Mitchell's Water Monitor)*. Australian Government, Canberra.

Department of Environment (DoE). 2015. *Sawfish and River Sharks – Multispecies Recovery plan*. Commonwealth of Australia, Canberra. https://www.dcceew.gov.au/sites/default/files/documents/sawfish-river-sharks-multispecies-recovery-plan.pdf. [Accessed 19 March 2024].

Department of Environment and Natural Resource (DENR). 2018. *Northern Territory Stream Order, Strahler stream orders over the Northern Territory, topographic scale data 250k*, Spatial Data and Mapping Branch, Water Resources Division, Northern Territory Government, Darwin, NT.

Department of Environment Parks and Water Security (DEPWS) 2022a, SREBA Data Catalogue, https://srebadata.nt.gov.au/ [accessed 6 July 2023].

Department of Environment Parks and Water Security (DEPWS) 2022b, Regional Report, Strategic Regional Environmental and Baseline Assessment (SREBA) for the Beetaloo Sub-basin, Northern https://depws.nt.gov.au/__data/assets/pdf_file/0005/1247018/sreba-beetaloo-regional-report.pdf. [accessed 7 July 2023]

Department of Environment Parks and Water Security (DEPWS) 2022c, Meta data: SREBA Beetaloo Geology. https://srebadata.nt.gov.au/view/ntg-spa-000000076 [accessed 7 July 2023]

Department of Environment Parks and Water Security (DEPWS) 2022d, Aquatic Ecosystems Baseline Report, Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin. https://territorystories.nt.gov.au/10070/903891 [accessed 7 July 2023].

Department of Environment Park and Water Security (DEPWS). 2021a. *Threatened species of the Northern Territory – Tassel sedge Carex fascicularis*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0020/208424/carex-fascicularis.pdf.

Department of Environment Park and Water Security (DEPWS). 2021b. Tennant Creek Regional Weeds Strategy. depws.nt.gov.au/__data/assets/pdf_file/0006/258099/tennant-creek-regional-weeds-strategy.pdf. Site accessed 6th July 2023.

Department of Environment Park and Water Security (DEPWS). 2021c. Katherine Regional Weeds Strategy. Katherine Regional Weeds Strategy 2021-2026 (nt.gov.au). Site accessed 6th July 2023

Department of Environment, Parks and Water Security (DEPWS). 2021d. *Threatened species of the Northern Territory – Grey Falcon Falco hypoleucos*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0020/206354/grey-falcon.pdf.

Department of Environment, Parks and Water Security (DEPWS). 2021e. *Threatened species of the Northern Territory – Crested Shrike-tit (northern) Falcunculus frontatus whitei*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0004/376168/crested-shrike-tit.pdf.

Department of Environment, Parks and Water Security (DEPWS). 2021f. *Threatened species of the Northern Territory – Princess Parrot Polytelis alexandrae*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0017/206360/princess-parrot.pdf

Department of Environment, Parks and Water Security (DEPWS). 2021g. *Threatened species of the Northern Territory – Australian Painted Snipe Rostratula australis*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0018/206361/australian-painted-snipe.pdf.

Department of Environment, Parks and Water Security (DEPWS). 2021h. *Threatened species of the Northern Territory – Ghost Bat Macroderma gigas*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0010/376138/ghost-bat.pdf

Department of Environment, Parks and Water Security (DEPWS). 2021i. *Threatened species of the Northern Territory - Bare-rumped sheath-tailed bat Saccolaimus saccolaimus nudicluniatus*. Northern Territory Government. Available from: https://nt.gov.au/__data/assets/pdf_file/0007/376117/bare-rumped-sheath-tailed-bat.pdf

Department of Environment, Parks and Water Security (DEPWS). 2021j. *Threatened species of the Northern Territory - Gulf snapping turtle Elseya lavarackorum*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0008/376181/gulf-snapping-turtle.pdf

Department of Environment, Parks and Water Security (DEPWS). 2021k. *Threatened species of the Northern Territory – Mertens' Water Monitor Varanus mertensi*. Northern Territory Government. https://nt.gov.au/__data/assets/pdf_file/0018/206460/mertens-water-monitor.pdf

Department of the Environment (2014). *Tyto novaehollandiae kimberli in Species Profile and Threats Database*, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed Wed, 10 Sep 2019.

Department of Land Resource Management (DLRM). 2013. *Land Systems of the Southern part of the Northern Territory*. Northern Territory Government.

Directory of Important Wetlands in Australia (DIWA), Department of Climate Change, Energy, the Environment and Water (DCCEEW). https://www.environment.gov.au/cgi-bin/wetlands/report.pl [accessed 7 July 2023].

Dickman, C. R. 1996. *Impact of exotic generalist predators on the native fauna of Australia*. Wildlife Biology 2(3):185-195.

Dickman C.R. 2009. *House cats as predators in the Australian environment: impacts and management*. Human-Wildlife Conflicts 3:41-48.

Dostine, P.L., and Franklin, D.C. 2002. *A comparison of the diet of three finch species in the Yinberrie Hills area, Northern Territory*. *Emu* 102:159-164.

Garnett, S and Baker, G.B. 2021. *The Action Plan for Australian Birds 2020*. CSIRO Publishing.

Garnett, S., J. Szabo & G. Dutson. 2011. *The Action Plan for Australian Birds 2010*. CSIRO Publishing. Collingwood, Victoria.

GISERA. 2020. *Characterising stygofauna and microbial assemblages in the Beetaloo Sub-basin*. Retrieved from Gas Industry Social and Environmental Research Alliance:

Higgins, P.J. and Davies, S.J.J.F. 1996. *Handbook of Australian. New Zealand and Antarctic Birds, Volume 3, Snipe to Pigeons*. Oxford University Press, Melbourne.

Hose, G.C., Sreekanth, J., Barron, O. and Pollino, C. 2015. *Stygofauna in Australian Groundwater Systems: Extent of Knowledge*. CSIRO, Australia.

HLA-Envirosciences, 2005, *Environmental Management Plan, Onshore Petroleum Exploration, Beetaloo Basin, NT*, Prepared for Sweetpea Corporation, NT.

Humphreys G, Hamilton Z, Finston T, Hitchen Y. 2022. *Aquatic Ecosystems Baseline Report: Stygofauna. Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-Basin*. DEPWS Technical Report 29/2022. Report to Northern Territory Department of Environment, Parks and Water Security. Biota Environmental Sciences and Helix Molecular Solutions.

Legge, S., Murphy, S. and Heathcote, J. 2008. The Short-term Effects of an Extensive and High-intensity Fire on Vertebrates in the Tropical Savannas of the Central Kimberley, Northern Australia. *Wildlife Research*, Volume. 35, pp. 33-43.

MacColl C, Ryan S, Murphy S, Tiwi Land Council Rangers, Aumann T, Debus S, Seaton R, Hobson R, Stewart D, Riddell W, Garnett ST. 2021. *Red Goshawk Erythrotriorchis radiatus*. In The Action Plan for Australian Birds 2020. (Eds ST Garnett and GB Baker). CSIRO Publishing, Melbourne.

Menkhorst, P. and Knight F. 2011. *A Field Guide to the Mammals of Australia*. Oxford University Press, Sydney.

Northern Territory Government (NTG 2021a), A-Z list of weeds in the NT, List of declared weeds in the NT. https://nt.gov.au/__data/assets/pdf_file/0016/252133/declared-weeds-in-the-nt.pdf. Accessed on July 2023.

Northern Territory Government (NTG 2021 b), Important biodiversity conservation sites, Sites of conservation significance list, https://nt.gov.au/environment/environment-data-maps/important-biodiversity-conservation-sites/conservation-significance-list. [accessed 7 July 2023].

Palmer, C., Woinarski J., and Ward S. 2012. *Threatened Species of the Northern Territory: Gouldian Finch Erythrura gouldiae*. Department of Land Resource Management, Northern Territory Government.

Parks and Wildlife Commission of the NT (PWCNT). 2005. *Bullwaddy Conservation Reserve Plan of Management*, Parks and Wildlife Commission of the NT, Darwin.

Pavey, C. 2006. *National Recovery Plan for the Greater Bilby Macrotis lagotis*. Northern Territory Department of Natural Resources, Environment and the Arts.

Pizzey, G., and Knight, F. 2012. *The Field Guide to Australian Birds*. HarperCollins Publishers, Sydney.

Rees G.N, Oberprieler, S., Nielsen, D., Watson, G., Shackleton, M. and Davis, J.A. 2020. *Characterisation of the stygofauna and microbial assemblages of the Beetaloo Sub-basin, Northern Territory*. CSIRO, Australia.

Richards, C. Bond, M. (2023) *Environmental Health Baseline Report: Soils. Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin*. Report prepared for the Northern Territory Department of Environment, Parks and Water Security by Tetra Tech Coffey

Southgate, R. I. & Paltridge, R. 1998. *Recovery of the Greater Bilby Macrotis lagotis*. Final Report for Project Number 185, Nature Australia, Biodiversity Group, Endangered Species Program and Feral Pests Program.

Smith, J.G., and Phillips, B.L. 2006.*Toxic tucker: the potential impact of cane toads on Australian reptiles*. Pacific Conservation Biology 12:40-49.

Threatened Species Scientific Committee (TSSC). 2020b. *Conservation Advice Trichosurus vulpecula arnhemensis Northern Brushtail Possum*. Commonwealth Government.: http://www.environment.gov.au/biodiversity/threatened/species/pubs/83091-conservation-advice-11052021.pdf .

Threatened Species Scientific Committee (TSSC). 2020a. *Falco hypoleucos Grey Falcon Conservation Advice.* Commonwealth Government: https://www.environment.gov.au/biodiversity/threatened/species/pubs/929-conservation-advice-09072020.pdf

Tickell, S, J, 2003. Water Resource Mapping of the Barkly Tablelands. Department of Infrastructure, Planning and Environment, Northern Territory Government.

Tracking Australian Painted Snipe. 2024. X. *Tracking Australian Painted Snipe*. https://x.com/trackingapsnipe

Ward, S.J. 2008. Habitat-use, foraging and breeding ecology of the northern shrike-tit *Falcunculus frontatus whitei*. Report to NHT (Department of Natural Resources, Environment, the Arts and Sport, Darwin).

Ward, S.J., Berghout, M. and Baker, B. 2009. Notes on the form and habitat of nests of the northern shrike-tit. *Northern Territory Naturalist.* Volume 21, pp. 54-60.

Ward, S., Woinarski, J., Griffiths, T. and McKay, L. 2012. *Threatened Species of the Northern Territory: Yellow-spotted Monitor, Northern Sand Goanna, Floodplain Monitor Varanus panoptes*. Department of Land Resource Management, Northern Territory Government.

Ward, S., Woinarski, J., Griffiths, T. and McKay, L. 2012. *Threatened Species of the Northern Territory: Yellow-spotted Monitor, Northern Sand Goanna, Floodplain Monitor Varanus panoptes*. Department of Land Resource Management, Northern Territory Government.

Ward, S. and Phillips, B. 2012. *Threatened Species of the Northern Territory: Plains Death Adder Acanthopsis hawkei*. Northern Territory Department of Environment and Natural Resources, Darwin, NT.

Wilson, S. and Swan, G. 2010. *A Complete Guide to the Reptiles of Australia*. 2010. New Holland, Sydney.

Woinarski, J. and Hill, B. 2012. *Threatened Species of the Northern Territory: Northern Quoll Dasyurus hallucatus*. Northern Territory Department of Environment and Natural Resources, Northern Territory Government, Darwin, NT.

Woinarski, J.C.Z. and Tidemann, S.C., 1991. *The bird fauna of a deciduous woodland in the wet-dry tropics of northern Australia*. *Wildlife Research* 18: 479-500.

Woinarski, J.C.Z. 2004a. *National Multi-species Recovery Plan for the Partridge Pigeon Geophaps smithii smithii, Crested Shrike-tit, Falcunculus frontatus whitei, Masked Owl Tyto novaehollandiae kimberli and Masked Owl Tiwi Islands Tyto novaehollandiae melvillensis 2004-2009*. Northern Territory Department of Infrastructure Planning and Environment. Available http://www.environment.gov.au/biodiversity/threatened/publications/recovery/smithii-whitei-kimberli-melvillensis/index.html.

Woinarski, J.C.Z. 2004b. National Multi-species Recovery Plan for the Carpentarian Antechinus *Pseudantechinus mimulus*, Butler's Dunnart *Sminthopsis butleri* and Northern Hopping-mouse *Notomys aquilo*, 2004 - 2009. Northern Territory Department of Infrastructure Planning and Environment.

Woinarski, J.C.Z., Pavey C., Kerrigan R., Cowie I. & Ward S. 2007. *Lost from our Landscape: Threatened Species of the Northern Territory*. Palmerston: Department of Natural Resources, Environment and the Arts.

Woinarski, J.C.Z, 2006. Threatened Species of the Northern Territory: Gulf Snapping Turtle. Department of Environment and Natural Resources, Northern Territory Government.

Woinarski, J.C.Z and Ward, S. 2012. Threatened Species of the Northern Territory: Crested Shrike-tit *Falcunculus (frontatus) whitei*. Department of Land Resource Management, Northern Territory Government.

Young L, Patykowski J, Leiper I, Nano C, Fisher A, Gillespie G, Barnett G, Buckley K, Hanrahan N, McDonald P, Miller A, Ribot R, Ruykys L, Stewart A, Zimny A (2022). *Terrestrial Ecosystems Baseline Report: Strategic Regional Environmental and Baseline Assessment for the Beetaloo Sub-basin*. DEPWS Technical Report 36/2022. Flora and Fauna Division, Northern Territory Department of Environment, Parks and Water Security, Darwin.

Appendix A

Rapid Soil Assessment

Table A Soil summary – rapid assessment

Site 6		Site 7	
Details	**Photo**	**Details**	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Sandy loam (heavy) **Colour**: 2.5 YR 3/1 Very dark grey **Details**: Dry, no mottles		**A horizon** **Depth**: 0 – 10cm **Texture**: Sandy loam (heavy) **Colour**: 2.5 YR 3/1 Very dark grey **Details**: Dry, no mottles	
Site 8		**Site 9**	
Details	**Photo**	**Details**	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Loamy sand **Colour**: 5YR 3/2 Dark reddish brown **Details**: Dry, no mottles		**A horizon** **Depth**: 0 – 5cm **Texture**: Loamy sand **Colour**: 5YR 5/4 Brown **Details**: Dry, no mottles	

Site 11		Site 12	
Details	**Photo**	**Details**	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Loamy sand **Colour**: 2.5YR 3/1 Very dark grey **Details**: Dry, no mottles		**A horizon** **Depth**: 0 – 10cm **Texture**: Loamy sand (heavy) **Colour**: 7.5YR 3/1 Very dark grey **Details**: 10% subangular ironstone fragments, 2-5mm Dry, no mottles	
Site 13		**Site 16**	
Details	**Photo**	**Details**	**Photo**
A horizon **Depth**: 0 – 5cm **Texture**: Sandy loam **Colour**: 10YR 3/1 Very dark grey **Details**: Dry, no mottles		**A horizon** **Depth**: 0 – 10cm **Texture**: Loamy sand **Colour**: 7.5YR 4/2 Brown **Details**: Dry, no mottles	

Site 23	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Loamy sand **Colour**: 10YR 3/1 Very dark grey **Details**: Dry, no mottles	

Site 27	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Loamy sand **Colour**: 7.5YR 3/2 Dark brown **Details**: Slightly moist, no mottles	

Site 31	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Sandy clay loam **Colour**: 2.5YR 3/1 Very dark grey **Details**: Moist, no mottles	

Site 36	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Sandy loam (heavy) **Colour**: 10YR 4/1 Dark grey **Details**: 10% 0.2-2mm subangular ironstone, 5% 2-5mm subangular ironstone Dry, no mottles	

Site 37	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Sandy loam (heavy) **Colour**: 5YR 3/3 Dark reddish brown **Details**: Dry, no mottles	

Site 38	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Sandy loam **Colour**: 5YR 3/2 Dark reddish brown **Details**: 20% 0.2-2mm subangular ironstone, 10% 2-5mm subangular ironstone Dry, no mottles	

Site 39	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Loamy sand **Colour**: 5YR 3/2 Dark reddish brown **Details**: 20% 0.2-2mm subangular ironstone, 20% 2-5mm subangular ironstone Dry, no mottles	

Site 45	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Loamy sand **Colour**: 7.5YR 4/3 Brown **Details**: Dry, no mottles	

Site 47	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Sand **Colour**: 10YR 4/1 Dark grey **Details**: Dry, no mottles	

Site 52	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Loamy sand **Colour**: 5YR 3/3 Reddish brown **Details**: Dry, no mottles	

Site 54	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Clayey sand **Colour**: 10YR 4/1 Dark grey **Details**: 10% 0.2-3mm subangular ironstone Dry, no mottles	

Site 60	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Clay loam **Colour**: 10YR 3/2 Greyish brown **Details**: Moist, grey and yellow mottles	

Site 63		Site 67	
Details	**Photo**	**Details**	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Clayey sand **Colour**: 5YR 3/2 Dark reddish brown **Details**: Dry, no mottles		**A horizon** **Depth**: 0 – 10cm **Texture**: Sandy loam (heavy) **Colour**: 10YR 4/1 Dark grey **Details**: Dry, no mottles	
Site 69		**Site 74**	
Details	**Photo**	**Details**	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Sandy clay loam **Colour**: 7.5YR 3/1 Very dark grey **Details**: Dry, no mottles		**A horizon** **Depth**: 0 – 10cm **Texture**: Sandy clay loam **Colour**: 10YR 3/2 Very dark greyish brown **Details**: Dry, no mottles	

Site 75	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Clay loam **Colour**: 10YR 4/2 Dark greyish brown **Details**: Moist	

Site 76	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Clay loam **Colour**: 7.5YR 4/1 Dark grey **Details**: Dry, no mottles	

Site 80	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Clay loam **Colour**: 10YR 3/3 Dark brown **Details**: 10% 0.2-2mm subangular ironstone, 10% 2-6mm subangular ironstones Dry, no mottles	

Site 81	
Details	**Photo**
A horizon **Depth**: 0 – 5cm **Texture**: Loamy sand **Colour**: 10YR 4/2 Dark greyish brown **Details**: Dry, grey and brown mottles	

Site 87	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Loamy sand **Colour**: 5YR 3/1 Very dark grey **Details**: 5% 0.2-2 mm subangular ironstone, 5% 2-5 mm subangular ironstones Dry, no mottles	

Site 88	
Details	**Photo**
A horizon **Depth**: 0 – 10cm **Texture**: Sandy loam **Colour**: 7.5YR 5/1 Grey **Details**: Saturated, brown and grey mottles	

Site 95	
Details	**Details**
A horizon **Depth**: 0 – 10cm **Texture**: Sandy loam (heavy) **Colour**: 7.5YR 3/2 Dark brown **Details**: Dry, no mottles	

Appendix B

Soil Material Laboratory Results

Material Test Report

Douglas Partners
Geotechnics | Environment | Groundwater
Douglas Partners Pty Ltd
Darwin Laboratory
Unit 2/14 Caryota Circuit Coconut Grove NT 0810
Phone: (08) 8948 6800
Fax: (08) 8948 6899
Email: Sunil.Sukhdeo@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Sunil Sukhdeo
Laboratory Manager
Laboratory Accreditation Number: 828

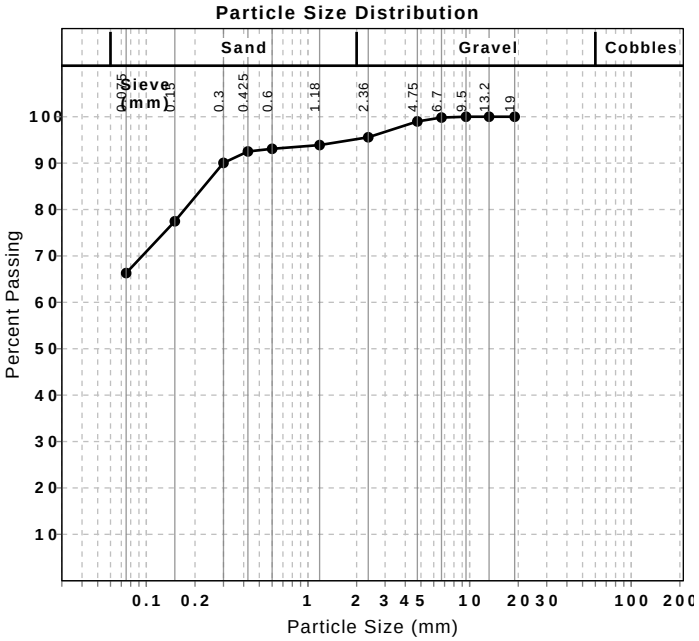
Report Number: **208810.00-1**
Issue Number: 1
Date Issued: 15/09/2021
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: Azrai Parish-Perandis
Project Number: 208810.00
Project Name: Project 60623736 Beetaloo
Project Location: ,
Work Request: 3610
Sample Number: DW-3610A
Date Sampled: 30/08/2021
Dates Tested: 06/09/2021 - 15/09/2021
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **AM1VFSM5**

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**100**		
9.5 mm	**100**		
6.7 mm	**100**		
4.75 mm	**99**		
2.36 mm	**96**		
1.18 mm	**94**		
0.6 mm	**93**		
0.425 mm	**93**		
0.3 mm	**90**		
0.15 mm	**77**		
0.075 mm	**66**		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Wet Sieve		
Liquid Limit (%)	24		
Plastic Limit (%)	12		
Plasticity Index (%)	**12**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	5.0		
Cracking Crumbling Curling	Cracking		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**5**		
Soil Description	Natural Soil		
Nature of Water	Deminerlised water		
Temperature of Water (^{o}C)	25.7		
* Mineral Present	Gypsum		



Material Test Report

Douglas Partners
Geotechnics | Environment | Groundwater
Douglas Partners Pty Ltd
Darwin Laboratory
Unit 2/14 Caryota Circuit Coconut Grove NT 0810
Phone: (08) 8948 6800
Fax: (08) 8948 6899
Email: Sunil.Sukhdeo@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Sunil Sukhdeo
Laboratory Manager
Laboratory Accreditation Number: 828

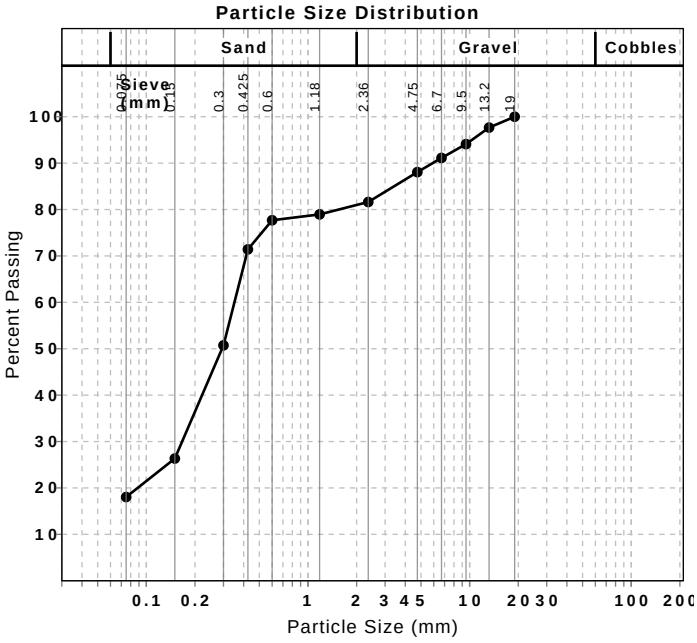
Report Number: **208810.00-1**
Issue Number: 1
Date Issued: 15/09/2021
Client: AECOM Australia Pty Ltd
PO Box 3175, Darwin NT 0801
Contact: Azrai Parish-Perandis
Project Number: 208810.00
Project Name: Project 60623736 Beetaloo
Project Location: ,
Work Request: 3610
Sample Number: DW-3610B
Date Sampled: 01/09/2021
Dates Tested: 06/09/2021 - 15/09/2021
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **BW1 AP VFSM10**

Particle Size Distribution (AS1289 3.6.1)			
Sieve	Passed %	Passing Limits	
19 mm	**100**		
13.2 mm	**98**		
9.5 mm	**94**		
6.7 mm	**91**		
4.75 mm	**88**		
2.36 mm	**82**		
1.18 mm	**79**		
0.6 mm	**78**		
0.425 mm	**71**		
0.3 mm	**51**		
0.15 mm	**26**		
0.075 mm	**18**		

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Wet Sieve		
Liquid Limit (%)	Not Obtainable		
Plastic Limit (%)	Not Obtainable		
Plasticity Index (%)	**Non Plastic**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	0.0		
Cracking Crumbling Curling	None		

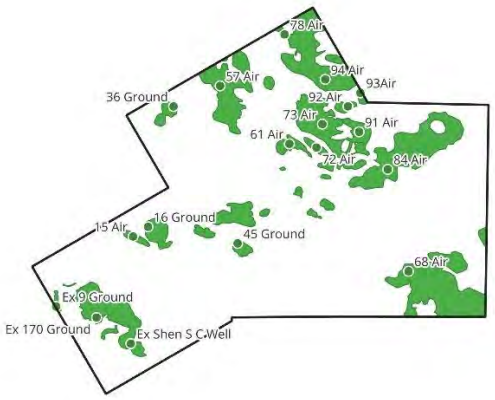
Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**		
Soil Description	Natural Soil		
Nature of Water	Demineralised Water		
Temperature of Water (^{o}C)	25.7		



Appendix C

Vegetation Community Description

Appendix C Vegetation Community Descriptions

Community 1a - *Acacia shirleyi* mid high woodland over, *Macropteranthes kekwickii, Terminalia volucris* mid high open shrubland, over *Eragrostis fallax*, *Sorghum intrans*, *Waltheria indica* mid high open tussock grassland
Upper 1: Mid high woodland dominated by *Acacia shirleyi* (fq 100%)
Mid 1: Mid high open shrubland dominated by *Macropteranthes kekwickii* (fq 66.67%), *Terminalia volucris* (fq 66.67%)
Ground 1: Mid high open tussock grassland dominated by *Eragrostis fallax* (fq 33.3%), *Sorghum intrans* (fq 16.67%), *Waltheria indica* (fq 33.3%)
 
No. of sites: (6) 16 Ground, 36 Ground, 45 Ground, Ex 9 Ground, Ex 170 Ground, Ex Shen S C Well
Other common species
Upper stratum (U1): *Macropteranthes kekwickii, Ventilago viminalis*
Mid stratum (M1): *Acacia shirleyi, Acacia ancistrocarpa, Dodonaea physocarpa, Acacia difficilis, Santalum lanceolatum, Gyrocarpus americanus, Eucalyptus chlorophylla, Carissa lanceolata*
Ground stratum (G1): *Panicum trichoides, Chrysopogon fallax, Eulalia aurea, Panicum mindanaense, Melhania oblongifolia, Bidens bipinnata, Bulbostylis barbata, Hibiscus sturtii var. campylochlamys, Setaria surgens, Sida rohlenae, Blumea saxatilis*
Landform: Scoured gravelly level to gently undulating low rises and pediment slopes
Soil: Sandy loam
Total area of the survey area: 7,121.47 ha (19.84%)
Community structural summary

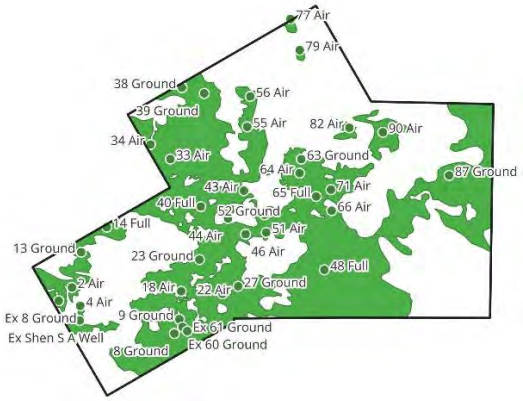
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	35.1 (10 – 55)	11.3 (10 - 12
Mid M1	Shrub	27.8 (15 – 40)	6 (5 – 7)
Ground G1	Tussock grass	24.1 (5 – 40)	0.58 (0.5 – 1)

Community 2a - *Corymbia dichromophloia* ± *Erythrophleum chlorostachys* mid high open woodland, over *Acacia difficilis*, *Terminalia canescens*, *Dodonaea hispidula* mid high open shrubland, over *Triodia bitextura* ± *Chrysopogon fallax*, *Schizachyrium fragile* mid high hummock grassland

Upper 1: Mid high open woodland dominated by Corymbia dichromophloia (fq 100%) ± *Erythrophleum chlorostachys* (fq 27.78%)

Mid 1: Mid high open shrubland dominated by *Acacia difficilis* (fq 61.11%), *Terminalia canescens* (fq 38.89%), *Dodonaea hispidula* (fq 33.33%)

Ground 1: Mid high hummock grassland dominated by *Triodia bitextura* (fq 83.33%) ± *Chrysopogon fallax* (fq 50%), *Schizachyrium fragile* (fq 44.44%)



No. of sites: (18) 8 Ground, 9 Ground, 13 Ground, 14 Full, 23 Ground, 27 Ground, 38 Ground, 39 Ground, 40 Full, 48 Full, 52 Ground, 63 Ground, 65 full, 87 Ground, Ex 8 Ground, Ex 60 Ground, Ex 61 Ground, Ex Shen S A Well

Other common species

Upper stratum (U1): *Corymbia polycarpa, Corymbia ferruginea, Eucalyptus chlorophylla, Terminalia canescens*

Mid stratum (M1): *Alphitonia excelsa, Petalostigma pubescens, Hakea arborescens, Acacia hammondii, Bauhinia cunninghamii, Corymbia ferruginea, Acacia gonoclada, Erythrophleum chlorostachys, Calytrix exstipulata, Carissa lanceolata, Grevillea parallela, Wrightia saligna, Brachychiton paradoxus, Persoonia falcata*

Ground stratum (G1): *Setaria surgens, Aristida hygrometrica, Aristida contorta, Aristida contorta, Waltheria indica, Aristida contorta, Aristida inaequiglumis, Sorghum plumosum, Corchorus sidoides, Mnesithea formosa*

Landform: Scoured gravelly level to gently undulating low rises and pediment slopes

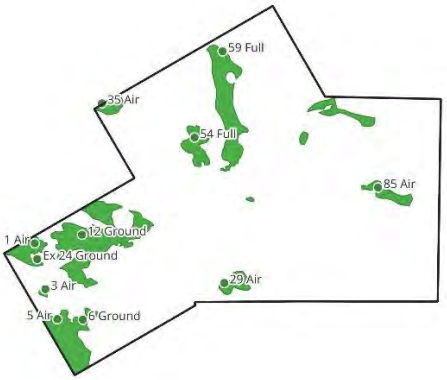
Soil: Sandy loam

Total area of the survey area: 16,578.52 ha (46.18%)

Community structural summary

Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	16 (8 – 24)	11.7 (10 – 14)
Mid M1	Shrub	19.5 (12 – 30)	6.7 (6 – 7)
Ground G1	Hummock grass	39.1 (30 – 60)	0.5

Community 2b - *Acacia shirleyi*, *Corymbia dichromophloia* ± *Corymbia polycarpa* mid high open woodland, over *Terminalia canescens*, *Macropteranthes kekwickii* ± *Petalostigma pubescens* mid high open shrubland, over *Triodia bitextura*, *Schizachyrium fragile*, *Chrysopogon fallax* mid high hummock grassland
Upper 1: Mid high open woodland dominated by *Acacia shirleyi* (fq 100%), *Corymbia dichromophloia* (fq 80%) ± *Corymbia polycarpa* (fq 60%)
Mid 1: Mid high open shrubland dominated by *Terminalia canescens* (fq 80%), *Macropteranthes kekwickii* (fq 80%) ± *Petalostigma pubescens* (fq 40%)
Ground 1: Mid high hummock grassland dominated by *Triodia bitextura* (fq 80%), *Schizachyrium fragile* (fq 80%), *Chrysopogon fallax* (fq 60%)



No. of sites: (5) 6 Ground, 12 Ground, 54 Full, 59 Full, Ex 24 Ground
Other common species
Upper stratum (U1): *Corymbia grandifolia*
Mid stratum (M1): *Acacia shirleyi, Terminalia volucris, Alphitonia excelsa, Ehretia saligna, Eucalyptus chlorophylla*
Ground stratum (G1): *Eriachne triseta, Eriachne ciliata, Eragrostis fallax, Bulbostylis barbata*
Landform: Scoured gravelly level to gently undulating low rises and pediment slopes
Soil: Sandy loam
Total area of the survey area: 3,953.55 ha (11.01%)
Community structural summary

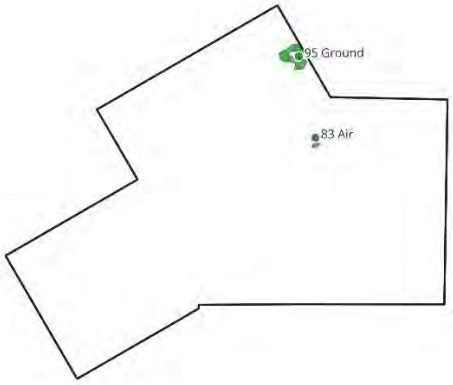
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	15.2 (8 – 22)	12
Mid M1	Shrub	17.2 (12 – 20)	6.8 (6 – 8)
Ground G1	Hummock grass	42 (15 – 70)	0.5

Community 2c - *Eucalyptus leucophloia* low open woodland, over *Acacia gonoclada*, *Melaleuca viridiflora*, *Terminalia canescens* mid high open shrubland, over *Eriachne armittii*, *Eulalia aurea* mid high open tussock grassland

Upper 1: Low open woodland dominated by *Eucalyptus leucophloia*

Mid 1: Mid high open shrubland dominated by *Acacia gonoclada*, *Melaleuca viridiflora*, *Terminalia canescens*

Ground 1: Mid high open tussock grassland dominated by *Eriachne armittii*, *Eulalia aurea*



No. of sites: (1) 95 Ground

Other common species

Upper stratum (U1): -

Mid stratum (M1): -

Ground stratum (G1): -

Landform: Scoured gravelly level to gently undulating low rises and pediment slopes

Soil: Sandy loam

Total area of the survey area: 146.47 ha (0.41%)

Community structural summary

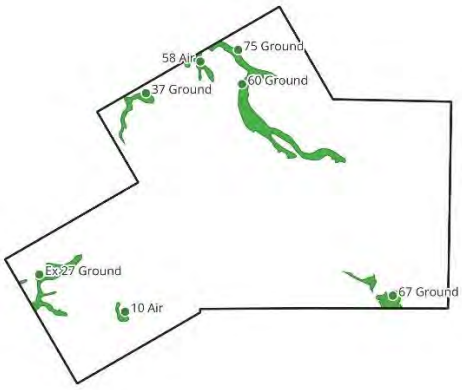
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	8	7
Mid M1	Shrub	10	5
Ground G1	Tussock grass	20	0.5

Community 3a - *Corymbia polycarpa*, ± *Erythrophleum chlorostachys* mid high open woodland, over *Acacia difficilis* ± *Atalaya hemiglauca* mid high open shrubland, over *Chrysopogon fallax*, *Sehima nervosum* mid high tussock grassland

Upper 1: Mid high open woodland dominated by *Corymbia polycarpa* (fq 100%), ± *Erythrophleum chlorostachys* (fq 40%)

Mid 1: Mid high open shrubland dominated by *Acacia difficilis* (fq 80%) ± *Atalaya hemiglauca* (fq 40%)

Ground 1: Mid high tussock grassland dominated by *Chrysopogon fallax* (fq 40%), *Sehima nervosum* (fq 40%)



No. of sites: (5) 37 Ground, 60 Ground, 67 Ground, 75 Ground, Ex 27 Ground

Other common species

Upper stratum (U1): *Bauhinia cunninghamii, Acacia shirleyi, Eucalyptus chlorophylla, Melaleuca viridiflora*

Mid stratum (M1): *Melaleuca viridiflora, Acacia lysiphloia, Acacia hammondii, Acacia thomsonii, Eucalyptus chlorophylla, Erythrophleum chlorostachys, Terminalia canescens, Melaleuca nervosa*

Ground stratum (G1): *Schizachyrium fragile, Dichanthium fecundum, Eriachne armittii, Aristida hygrometrica, Mnesithea formosa, Waltheria indica, Aristida inaequiglumis, Grewia savannicola, Pterocaulon serrulatum*

Landform: Level, imperfectly drained, colluvial valley flats and margins within relict drainage features

Soil: Sandy clay loam

Total area of the survey area: 1,341.03 ha (3.47%)

Community structural summary

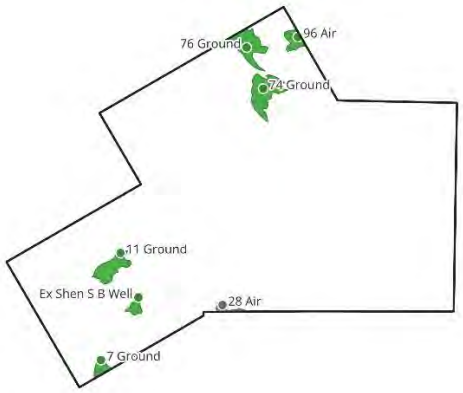
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	16.2 (7 – 22)	11.2 (10 – 12)
Mid M1	Shrub	25.4 (12 – 55)	6.4 (5 – 8)
Ground G1	Tussock grass	50 (15 – 80)	0.5

Community 3b - *Eucalyptus chlorophylla*, *Acacia shirleyi* mid high open woodland, over *Acacia difficilis*, *Macropteranthes kekwickii, Bauhinia cunninghamii* mid high open shrubland, over *Chrysopogon fallax, Schizachyrium fragile*, *Eragrostis tenellula* mid high tussock grassland

Upper 1: Mid high open woodland dominated by *Eucalyptus chlorophylla* (fq 100%), *Acacia shirleyi* (fq 80%)

Mid 1: Mid high open shrubland dominated by *Acacia difficilis* (fq 40%), *Macropteranthes kekwickii* (fq 40%), *Bauhinia cunninghamii* (fq 40%)

Ground 1: Mid high tussock grassland dominated by *Chrysopogon fallax* (fq 40%), *Schizachyrium fragile* (fq 40%), 7g-2 Eragrostis sp. 1 (fq 40%)



No. of sites: (5) 7 Ground, 11 Ground, 74 Ground, 76 Ground, Ex Shen S B Well

Other common species

Upper stratum (U1): *Macropteranthes kekwickii, Corymbia polycarpa, Erythrophleum chlorostachys*

Mid stratum (M1): *Terminalia volucris, Acacia gonoclada, Acacia holosericea, Acacia hammondii, Acacia shirleyi, Terminalia canescens, Atalaya hemiglauca, Brachychiton paradoxus*

Ground stratum (G1): *Dichanthium fecundum, Eragrostis fallax, Sorghum intrans, Aristida contorta, Aristida hygrometrica, Aristida latifolia*

Landform: Level, imperfectly drained, colluvial valley flats and margins within relict drainage features

Soil: Sandy clay loam

Total area of the survey area: 1,019.41 ha (2.84%)

Community structural summary

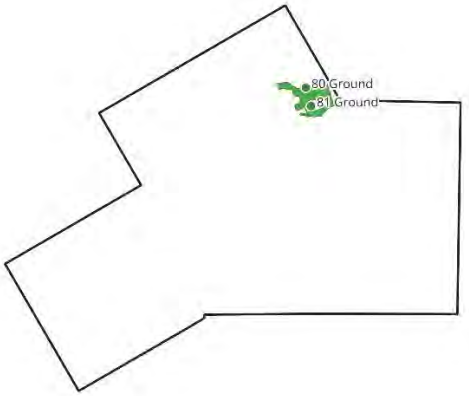
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	17.8 (12 – 35)	10.8 (8 – 12)
Mid M1	Shrub	18.8 (10 – 25)	6 (5 – 7)
Ground G1	Tussock grass	33 (15 – 55)	0.6 (0.5 – 1)

Community 4a - *Eucalyptus pruinosa* ± *Eucalyptus chlorophylla*, *Atalaya hemiglauca* low open woodland, over *Carissa lanceolata*, *Terminalia canescens* mid high open shrubland, over *Eulalia aurea, Chrysopogon fallax* mid high tussock grassland

Upper 1: Low open woodland dominated by *Eucalyptus pruinosa* (fq 100%) ± *Eucalyptus chlorophylla* (fq 50%), *Atalaya hemiglauca* (fq 50%)

Mid 1: Mid high open shrubland dominated *Carissa lanceolata* (fq 50%), *Terminalia canescens* (fq 50%)

Ground 1: Mid high tussock grassland dominated by *Eulalia aurea* (fq 100%), *Chrysopogon fallax* (fq 100%)



No. of sites: (2) 80 Ground, 81 Ground

Other common species

Upper stratum (U1): -

Mid stratum (M1): *Terminalia volucris, Hakea macrocarpa*

Ground stratum (G1): *Eriachne triseta, Aristida inaequiglumis*

Landform: Level, imperfectly drained, colluvial valley flats and margins within relict drainage features

Soil: Sandy clay loam

Total area of the survey area: 309.72 ha (0.86%)

Community structural summary

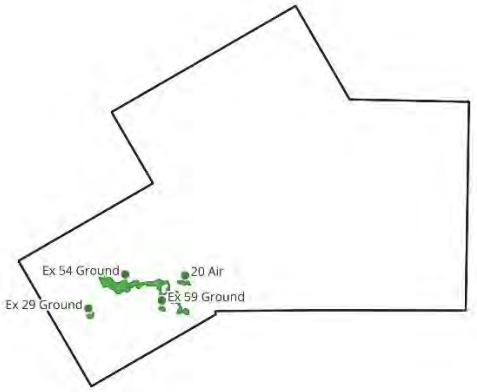
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	8	8
Mid M1	Shrub	15	5.5 (5 – 6)
Ground G1	Tussock grass	40 (30 – 50)	0.75 (0.5 – 1)

Community 4b - *Corymbia polycarpa, Eucalyptus microtheca* mid high open woodland, over *Hakea arborescens, Melaleuca nervosa* mid high open shrubland, over *Aristida contorta, Waltheria indica* mid high open tussock grassland

Upper 1: Mid high open woodland dominated by *Corymbia polycarpa* (fq 66.67%)*, Eucalyptus microtheca* (fq 66.67%)

Mid 1: Mid high open shrubland dominated by *Hakea arborescens* (fq 66.67%)*, Melaleuca nervosa* (fq 66.67%)

Ground 1: Open tussock grassland dominated by *Aristida contorta* (fq 66.67%)*, Waltheria indica* (fq 66.67%)



No. of sites: (3) Ex 29 Ground, Ex 54 Ground, Ex 59 Ground

Other common species

Upper stratum (U1): -

Mid stratum (M1): *Acacia difficilis, Acacia holosericea, Eucalyptus microtheca, Macropteranthes kekwickii, Melaleuca viridiflora*

Ground stratum (G1): *Eriachne armitii, Aristida hygrometrica, Eulalia aurea, Setaria surgens, Eragrostis cumingii*

Landform: Level, imperfectly drained, colluvial valley flats and margins within relict drainage features

Soil: Sandy clay loam

Total area of the survey area: 322.47 ha (0.9%)

Community structural summary

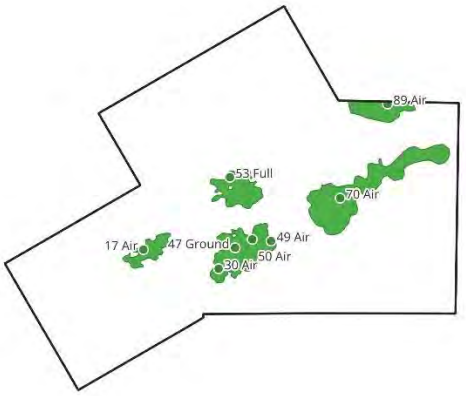
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	8	9.6 (7 – 12)
Mid M1	Shrub	26.6 (20 – 40)	5.3 (5 – 6)
Ground G1	Tussock grass	31.6 (15 – 60)	0.5

Community 4c1 - *Acacia ancistrocarpa* ± *Melaleuca viridiflora* tall shrubland, over *Triodia bitextura*, *Schizachyrium fragile* mid high hummock grassland

Upper 1: Tall shrubland dominated by *Acacia ancistrocarpa* (fq 100%)

Mid 1: Tall shrubland dominated by *Acacia ancistrocarpa* (fq 50%) ± *Melaleuca viridiflora* (fq 50%)

Ground 1: Mid high hummock grassland dominated by *Triodia bitextura* (fq 100%), *Schizachyrium fragile* (fq 50%)



No. of sites: (2) 47 Ground, 53 Full

Other common species

Upper stratum (U1): -

Mid stratum (M1): -

Ground stratum (G1): -

Landform: Level, imperfectly drained, colluvial valley flats and margins within relict drainage features

Soil: Sandy loam

Total area of the survey area: 3,136.72 ha (8.74%)

Community structural summary

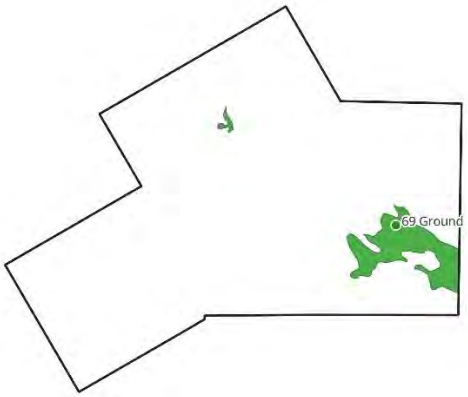
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Shrub	37.5 (30 – 45)	4.5 (4 – 5)
Mid M1	Shrub	12.5 (10 – 15)	2.5 (2 – 3)
Ground G1	Hummock grass	50 (40 – 60)	0.75 (0.5 – 1)

Community 4c2 - *Melaleuca viridiflora*, *Terminalia canescens* low sparse shrubland, over *Eulalia aurea*, *Eriachne obtusa* open tussock grassland

Upper 1: Low sparse shrubland dominated by *Melaleuca viridiflora*

Mid 1: Low sparse shrubland dominated by *Melaleuca viridiflora*, *Terminalia canescens*

Ground 1: Mid high open tussock grassland dominated by *Eulalia aurea*, *Eriachne obtusa*



No. of sites: (1) 69 Ground

Other common species

Upper stratum (U1): -

Mid stratum (M1): -

Ground stratum (G1): -

Landform: Level, imperfectly drained, colluvial valley flats and margins within relict drainage features

Soil: Sandy clay loam

Total area of the survey area: 1,507.11 ha (4.2%)

Community structural summary

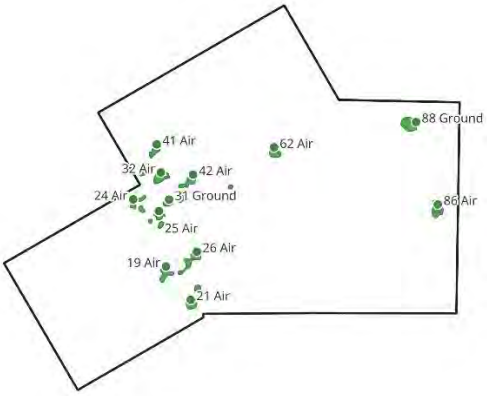
Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	6	5
Mid M1	Shrub	12	2
Ground G1	Tussock grass	30	0.5

Community 5 - *Lophostemon grandiflorus, Eucalyptus microtheca* ± *Eucalyptus camaldulensis* low open woodland, over *Lophostemon grandiflorus, Acacia difficilis* mid high open shrubland, over *Eragrostis speciosa, Eragrostis fallax* mid high sparse tussock grassland

Upper 1: Low open woodland dominated by *Lophostemon grandiflorus* (fq 100%)*, Eucalyptus microtheca* (fq 100%) ± *Eucalyptus camaldulensis* (fq 50%)

Mid 1: Mid high open shrubland dominated by *Lophostemon grandiflorus* (fq 50%)*, Acacia difficilis* (fq 50%)

Ground 1: Mid high sparse tussock grassland dominated by *Eragrostis speciosa* (fq 50%), *Eragrostis fallax* (fq 50%)



No. of sites: (2) 31 Ground, 88 Ground

Other common species

Upper stratum (U1): -

Mid stratum (M1): *Melaleuca viridiflora, Grewia savannicola*

Ground stratum (G1): -

Landform: Localised shallow, level closed depressions and seasonal swamps

Soil: Sandy clay loam

Total area of the survey area: 461.56 ha (1.29%)

Community structural summary

Strata	Modal growth form	Mean cover %	Mean height (m)
Upper U1	Tree	18 (14 – 22)	8
Mid M1	Shrub	23.5 (12 – 35)	6
Ground G1	Tussock grass	5	0.5

Appendix D

Flora Atlas and Survey Records

Appendix D Flora Atlas Species Records

Table D1 Native flora recorded within 5 km of the Shenandoah South E&A program area

Family	Genus	Species
ACANTHACEAE	*Rostellularia*	*adscendens*
	Hygrophila	*angustifolia*
AMARANTHACEAE	*Achyranthes*	*aspera*
	Alternanthera	*denticulata*
	Amaranthus	*interruptus*
	Gomphrena	*affinis*
	Gomphrena	*canescens*
	Gomphrena	*flaccida*
	Ptilotus	*fusiformis*
	Ptilotus	*polystachyus*
APOCYNACEAE	*Carissa*	*lanceolata*
	Cynanchum	*floribundum*
	Cynanchum	*viminale*
	Marsdenia	*australis*
	Marsdenia	*geminata*
	Marsdenia	*viridiflora*
	Secamone	*elliptica*
	Wrightia	*saligna*
ASTERACEAE	*Bidens*	*bipinnata*
	Bidens	*biternata*
	Blumea	*diffusa*
	Blumea	*integrifolia*
	Centipeda	*minima*
	Pterocaulon	*ciliosum*
	Pterocaulon	*serrulatum*
	Pterocaulon	*sphacelatum*
BIGNONIACEAE	*Dolichandrone*	*heterophylla*
	Ehretia	*saligna*
	Heliotropium	*plumosum*
	Heliotropium	*bracteatum*
	Heliotropium	*fasciculatum*
	Heliotropium	*glabellum*
	Heliotropium	*ramulipatens*
	Heliotropium	*tanythrix*

Family	Genus	Species
	Heliotropium	*ventricosum*
CAPPARACEAE	*Capparis*	*lasiantha*
	Capparis	*sepiaria*
	Capparis	*umbonata*
CARYOPHYLLACEAE	*Polycarpaea*	*breviflora*
	Polycarpaea	*corymbosa*
CELASTRACEAE	*Denhamia*	*cunninghamii*
	Stackhousia	*intermedia*
CLEOMACEAE	*Cleome*	*viscosa*
COMBRETACEAE	*Macropteranthes*	*kekwickii*
	Terminalia	*canescens*
	Terminalia	*volucris*
COMMELINACEAE	*Cartonema*	*parviflorum*
	Commelina	*ensifolia*
	Murdannia	*graminea*
CONVOLVULACEAE	*Bonamia*	*media*
	Bonamia	*pannosa*
	Evolvulus	*alsinoides*
	Ipomoea	*eriocarpa*
	Ipomoea	*polymorpha*
	Jacquemontia	*paniculata*
	Polymeria	*ambigua*
	Polymeria	*longifolia*
	Xenostegia	*tridentata*
CUCURBITACEAE	*Cucumis*	*argenteus*
	Cucumis	*melo*
CYPERACEAE	*Bulbostylis*	*barbata*
	Cyperus	*bifax*
	Cyperus	*nervulosus*
	Cyperus	*oxycarpus*
	Cyperus	*pygmaeus*
	Cyperus	*vaginatus*
	Eleocharis	*atropurpurea*
	Eleocharis	*nuda*
	Fimbristylis	*depauperata*
	Fimbristylis	*dichotoma*
	Fimbristylis	*laxiglumis*

Family	Genus	Species
	Fimbristylis	*neilsonii*
	Fimbristylis	*oxystachya*
	Fimbristylis	*phaeoleuca*
	Rhynchospora	*pterochaeta*
	Rhynchospora	*subtenuifolia*
	Rhynchospora	*wightiana*
	Scleria	*brownii*
DROSERACEAE	*Drosera*	*derbyensis*
ERIOCAULACEAE	*Eriocaulon*	*cinereum*
EUPHORBIACEAE	*Euphorbia*	*australis*
	Euphorbia	*biconvexa*
	Euphorbia	*coghlanii*
	Euphorbia	*mitchelliana*
	Euphorbia	*muelleri*
	Euphorbia	*schultzii*
FABACEAE	*Abrus*	*precatorius*
	Acacia	*difficilis*
	Acacia	*shirleyi*
	Acacia	*holosericea*
	Acacia	*torulosa*
	Acacia	*lysiphloia*
	Acacia	*platycarpa*
	Acacia	*colei*
	Acacia	*hammondii*
	Acacia	*wickhamii*
	Acacia	*calligera*
	Acacia	*elachantha*
	Acacia	*sp. Urandangie*
	Acacia	*gonoclada*
FABACEAE	*Acacia*	*tumida*
	Acacia	*ancistrocarpa*
	Bauhinia	*cunninghamii*
	Cajanus	*marmoratus*
	Chamaecrista	*absus*
	Chamaecrista	*symonii*
	Crotalaria	*aridicola*
	Crotalaria	*crispata*

Family	Genus	Species
FABACEAE	*Crotalaria*	*medicaginea*
	Crotalaria	*montana*
	Crotalaria	*montana*
	Crotalaria	*ramosissima*
	Cullen	*pustulatum*
	Desmodium	*brownii*
	Desmodium	*filiforme*
	Dichrostachys	*spicata*
	Erythrophleum	*chlorostachys*
	Flemingia	*pauciflora*
	Galactia	*tenuiflora*
	Indigofera	*colutea*
	Indigofera	*haplophylla*
	Indigofera	*linifolia*
	Indigofera	*linnaei*
	Indigofera	*trita*
	Jacksonia	*odontoclada*
	Neptunia	*dimorphantha*
	Neptunia	*gracilis*
	Petalostylis	*cassioides*
	Rhynchosia	*minima*
	Senna	*oligoclada*
	Sesbania	*brachycarpa*
	Sesbania	*muelleri*
	Tephrosia	*brachyodon*
	Tephrosia	*delestangii*
	Tephrosia	*leptoclada*
	Tephrosia	*simplicifolia*
	Tephrosia	*spechtii*
	Tephrosia	*stuartii*
	Tephrosia	*virens*
	Uraria	*lagopodioides*
	Zornia	*albiflora*
	Zornia	*muriculata*
	Zornia	*prostrata*
GOODENIACEAE	*Goodenia*	*lamprosperma*
	Goodenia	*odonnellii*

Family	Genus	Species
GOODENIACEAE	*Goodenia*	*strangfordii*
	Scaevola	*amblyanthera*
	Scaevola	*ovalifolia*
	Scaevola	*parvifolia*
HAEMODORACEAE	*Haemodorum*	*coccineum*
HERNANDIACEAE	*Gyrocarpus*	*americanus*
LAMIACEAE	*Premna*	*acuminata*
	Premna	*serratifolia*
LAURACEAE	*Cassytha*	*capillaris*
	Cassytha	*filiformis*
LORANTHACEAE	*Amyema*	*sanguinea*
	Amyema	*villiflora*
MALVACEAE	*Abutilon*	*fraseri*
	Abutilon	*hannii*
	Abutilon	*otocarpum*
	Brachychiton	*diversifolius*
	Brachychiton	*paradoxus*
	Corchorus	*sidoides*
	Corchorus	*pumilio*
	Gossypium	*australe*
	Grewia	*savannicola*
	Herissantia	*crispa*
	Hibiscus	*brachychlaenus*
	Hibiscus	*geranioides*
	Hibiscus	*sturtii*
	Melhania	*oblongifolia*
	Sida	*brachypoda*
	Sida	*fibulifera*
	Sida	*filiformis*
	Sida	*rohlenae*
	Sida	*sp. Musselbrook*
	Sida	*sp. Suplejack Station*
	Sida	*spinosa*
MARSILEACEAE	*Marsilea*	*angustifolia*
MENISPERMACEAE	*Tinospora*	*smilacina*
MORACEAE	*Fatoua*	*villosa*
MYRTACEAE	*Calytrix*	*exstipulata*

Family	Genus	Species
MYRTACEAE	*Corymbia*	*confertiflora*
	Corymbia	*dichromophloia*
	Corymbia	*ferruginea*
	Corymbia	*ferruginea*
	Corymbia	*flavescens*
	Corymbia	*polycarpa*
	Corymbia	*setosa*
	Corymbia	*terminalis*
	Eucalyptus	*camaldulensis*
	Eucalyptus	*chlorophylla*
	Eucalyptus	*cyanoclada*
	Eucalyptus	*leucophloia*
	Eucalyptus	*microtheca*
	Eucalyptus	*pruinosa*
	Eucalyptus	*tectifica*
	Lophostemon	*grandiflorus*
	Melaleuca	*citrolens*
	Melaleuca	*nervosa*
	Melaleuca	*viridiflora*
NYCTAGINACEAE	*Boerhavia*	*coccinea*
	Boerhavia	*dominii*
OLEACEAE	*Jasminum*	*molle*
ONAGRACEAE	*Ludwigia*	*perennis*
OROBANCHACEAE	*Buchnera*	*linearis*
PHRYMACEAE	*Peplidium*	*muelleri*
PHYLLANTHACEAE	*Flueggea*	*virosa*
	Phyllanthus	*carpentariae*
	Phyllanthus	*exilis*
	Phyllanthus	*maderaspatensis*
	Phyllanthus	*virgatus*
	Synostemon	*rhytidospermus*
PICRODENDRACEAE	*Petalostigma*	*banksii*
	Petalostigma	*pubescens*
POACEAE	*Aristida*	*calycina*
	Aristida	*contorta*
	Aristida	*holathera*
	Aristida	*holathera*

Family	Genus	Species
POACEAE	*Aristida*	*hygrometrica*
	Aristida	*inaequiglumis*
	Aristida	*latifolia*
	Aristida	*pruinosa*
	Bothriochloa	*ewartiana*
	Brachyachne	*convergens*
	Chrysopogon	*fallax*
	Chrysopogon	*pallidus*
	Cymbopogon	*bombycinus*
	Dichanthium	*fecundum*
	Dichanthium	*sericeum*
	Digitaria	*brownii*
	Digitaria	*gibbosa*
	Ectrosia	*scabrida*
	Elytrophorus	*spicatus*
	Enneapogon	*clelandii*
	Enneapogon	*lindleyanus*
	Enneapogon	*oblongus*
	Enneapogon	*pallidus*
	Enneapogon	*polyphyllus*
	Enneapogon	*purpurascens*
	Eragrostis	*cumingii*
	Eragrostis	*tenellula*
	Eriachne	*armittii*
	Eriachne	*avenacea*
	Eriachne	*ciliata*
	Eriachne	*melicacea*
	Eriachne	*obtusa*
	Eulalia	*aurea*
	Heteropogon	*contortus*
	Iseilema	*fragile*
	Iseilema	*macratherum*
	Iseilema	*vaginiflorum*
	Mnesithea	*formosa*
	Panicum	*decompositum*
	Panicum	*effusum*
	Panicum	*laevinode*

Family	Genus	Species
POACEAE	*Panicum*	*mindanaense*
	Paspalidium	*rarum*
	Perotis	*rara*
	Schizachyrium	*fragile*
	Sehima	*nervosum*
	Setaria	*apiculata*
	Setaria	*surgens*
	Sorghum	*intrans*
	Sorghum	*plumosum*
	Sorghum	*timorense*
	Sporobolus	*australasicus*
	Sporobolus	*mitchellii*
	Thaumastochloa	*major*
	Themeda	*triandra*
	Triodia	*bitextura*
	Triodia	*inutilis*
	Triodia	*pungens*
	Tripogon	*loliiformis*
	Urochloa	*holosericea*
	Urochloa	*praetervisa*
	Urochloa	*pubigera*
	Yakirra	*majuscula*
POLYGALACEAE	*Polygala*	*crassitesta*
	Polygala	*eriocephala*
	Polygala	*longifolia*
PORTULACACEAE	*Calandrinia*	*gracilis*
	Portulaca	*bicolor*
	Portulaca	*filifolia*
	Portulaca	*oleracea*
PROTEACEAE	*Grevillea*	*dryandri*
	Grevillea	*parallela*
	Grevillea	*striata*
	Hakea	*arborescens*
PTERIDACEAE	*Cheilanthes*	*brownii*
	Cheilanthes	*nudiuscula*
	Cheilanthes	*tenuifolia*
RHAMNACEAE	*Alphitonia*	*excelsa*

Family	Genus	Species
	Alphitonia	*pomaderroides*
	Ventilago	*viminalis*
RUBIACEAE	*Gardenia*	*ewartii*
	Gardenia	*pyriformis*
	Oldenlandia	*argillacea*
	Oldenlandia	*galioides*
	Oldenlandia	*mitrasacmoides*
	Spermacoce	*argillacea*
	Spermacoce	*brachystema*
	Spermacoce	*dolichosperma*
	Spermacoce	*stenophylla*
SANTALACEAE	*Santalum*	*lanceolatum*
SAPINDACEAE	*Atalaya*	*hemiglauca*
	Dodonaea	*hispidula*
	Dodonaea	*physocarpa*
	Dodonaea	*viscosa*
STYLIDIACEAE	*Stylidium*	*adenophorum*
	Stylidium	*floodii*
THYMELAEACEAE	*Pimelea*	*punicea*
VIOLACEAE	*Afrohybanthus*	*aurantiacus*
	Afrohybanthus	*enneaspermus*
VITACEAE	*Cayratia*	*trifolia*
ZYGOPHYLLACEAE	*Tribulopis*	*pentandra*

Table D2 Flora recorded during May 2024 survey

Family	Species
APOCYNACEAE	*Carissa lanceolata*
	Wrightia saligna
ASTERACEAE	*Bidens bipinnata*
	Blumea saxatilis
	Pterocaulon serrulatum
BORAGINALES	*Ehretia saligna*
CYPERACEAE	*Bulbostylis barbata*
CELASTRACEAE	*Denhamia cunninghamii*
COMBRETACEAE	*Macropteranthes kekwickii*
	Terminalia canescens
	Terminalia volucris
FABACAE	*Acacia shirleyi*
	Acacia ancistrocarpa
	Acacia difficilis
	Acacia gonoclada
	Acacia hammondii
	Acacia holosericea
	Acacia lysiphloia
	Acacia shirleyi
	Acacia simsii
	Acacia thomsonii
	Bauhinia cunninghamii
	Erythrophleum chlorostachys
HERNANDIACEAE	*Gyrocarpus americanus*
MALVACEAE	*Brachychiton paradoxus*
	Grewia savannicola
	Hibiscus sturtii var. campylochlamys
	Melhania oblongifolia
	Sida rohlenae
	Waltheria indica
MYRTACEAE	*Calytrix exstipulata*
	Corymbia dichromophloia
	Corymbia ferruginea
	Corymbia grandifolia
	Corymbia polycarpa
	Eucalyptus camaldulensis

Family	Species
MYRTACEAE	*Eucalyptus chlorophylla*
	Eucalyptus leucophloia
	Eucalyptus microtheca
	Eucalyptus pruinosa
	Lophostemon grandiflorus
	Melaleuca nervosa
	Melaleuca viridiflora
PICRODENDRACEAE	*Petalostigma pubescens*
POACEAE	*Aristida contorta*
	Aristida hygrometrica
	Aristida inaequiglumis
	Aristida latifolia
	Dichanthium fecundum
	Chrysopogon fallax
	Eragrostis cumingii
	Eragrostis fallax
	Eragrostis speciosa
	Eragrostis tenellula
	Eriachne armittii
	Eriachne ciliata
	Eriachne obtusa
	Eriachne triseta
	Eulalia aurea
	Mnesithea formosa
	Panicum mindanaense
	Panicum trichoides
	Schizachyrium fragile
	Sehima nervosum
	Setaria surgens
	Sorghum intrans
	Sorghum plumosum
	Triodia bitextura
PROTEACEAE	*Grevillea parallela*
	Hakea arborescens
	Hakea macrocarpa
	Persoonia falcata
RHAMNACEAE	*Alphitonia excelsa*

Family	Species
RHAMNACEAE	*Ventilago viminalis*
SANTALACEAE	*Santalum lanceolatum*
SAPINDACEAE	*Atalaya hemiglauca*
	Dodonaea hispidula
	Dodonaea physocarpa
SPARRMANNIACEAE	*Corchorus sidoides*

Appendix E

Fauna Atlas Species Records

Appendix E Fauna Atlas Species Records

Table 33 Native fauna recorded within 5 km of Shenandoah South E&A program area

Scientific Name	Common Name
Birds	
Acanthagenys rufogularis	Spiny-cheeked Honeyeater
Acanthiza apicalis	Inland Thornbill
Accipiter cirrocephalus	Collared Sparrowhawk
Accipiter fasciatus	Brown Goshawk
Aegotheles cristatus	Australian Owlet-nightjar
Anseranas semipalmata	Magpie Goose
Antigone rubicunda	Brolga
Aprosmictus erythropterus	Red-winged Parrot
Apus pacificus	Fork-tailed Swift
Aquila audax	Wedge-tailed Eagle
Ardeotis australis	Australian Bustard
Artamus cinereus	Black-faced Woodswallow
Artamus leucorynchus	White-breasted Woodswallow
Artamus minor	Little Woodswallow
Artamus personatus	Masked Woodswallow
Artamus superciliosus	White-browed Woodswallow
Burhinus grallarius	Bush Stone-curlew
Cacomantis pallidus	Pallid Cuckoo
Cacomantis variolosus	Brush Cuckoo
Calyptorhynchus banksii banksii	Red-tailed Black-cockatoo (north-western)
Centropus phasianinus	Pheasant Coucal
Chalcites basalis	Horsfield's Bronze-Cuckoo
Chlamydera nuchalis	Great Bowerbird
Cissomela pectoralis	Banded Honeyeater
Climacteris melanurus	Black-tailed Treecreeper
Colluricincla harmonica	Grey Shrike-thrush
Conopophila rufogularis	Rufous-throated Honeyeater
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Corvus orru	Torresian Crow
Cracticus nigrogularis	Pied Butcherbird
Dacelo leachii	Blue-winged Kookaburra
Daphoenositta chrysoptera	Varied Sittella
Dendrocygna eytoni	Plumed Whistling-Duck

Scientific Name	Common Name
Dicaeum hirundinaceum	Mistletoebird
Dromaius novaehollandiae	Emu
Eolophus roseicapilla	Galah
Eudynamys orientalis	Eastern Koel
Eurostopodus argus	Spotted Nightjar
Falco berigora	Brown Falcon
Falco cenchroides	Nankeen Kestrel
Falco hypoleucos	Grey Falcon
Falco longipennis	Australian Hobby
Fulica atra	Eurasian Coot
Gavicalis virescens	Singing Honeyeater
Geopelia cuneata	Diamond Dove
Geopelia humeralis	Bar-shouldered Dove
Geopelia placida	Peaceful Dove
Gerygone fusca	Western Gerygone
Gerygone olivacea	White-throated Gerygone
Grallina cyanoleuca	Magpie-lark
Grantiella picta	Painted Honeyeater
Gymnorhina tibicen	Australian Magpie
Haliastur sphenurus	Whistling Kite
Hamirostra melanosternon	Black-breasted Buzzard
Hieraaetus morphnoides	Little Eagle
Lalage tricolor	White-winged Triller
Lichmera indistincta	Brown Honeyeater
Malurus lamberti	Variegated Fairy-wren
Malurus melanocephalus	Red-backed Fairy-wren
Manorina flavigula	Yellow-throated Miner
Melanodryas cucullata	Hooded Robin
Melithreptus albogularis	White-throated Honeyeater
Melithreptus gularis	Black-chinned Honeyeater
Melopsittacus undulatus	Budgerigar
Merops ornatus	Rainbow Bee-eater
Microeca fascinans	Jacky Winter
Milvus migrans	Black Kite
Myiagra nana	Paperbark Flycatcher
Myiagra rubecula	Leaden Flycatcher
Ninox boobook	Australian Boobook

Scientific Name	Common Name
Nymphicus hollandicus	Cockatiel
Ocyphaps lophotes	Crested Pigeon
Oreoica gutturalis	Crested Bellbird
Pachycephala rufiventris	Rufous Whistler
Pardalotus rubricatus	Red-browed Pardalote
Pardalotus striatus	Striated Pardalote
Pelecanus conspicillatus	Australian Pelican
Petrochelidon nigricans	Tree Martin
Phaps chalcoptera	Common Bronzewing
Philemon argenticeps	Silver-crowned Friarbird
Philemon citreogularis	Little Friarbird
Platalea regia	Royal Spoonbill
Podargus strigoides	Tawny Frogmouth
Poephila acuticauda	Long-tailed Finch
Pomatostomus temporalis	Grey-crowned Babbler
Psitteuteles versicolor	Varied Lorikeet
Ptilotula flavescens	Yellow-tinted Honeyeater
Ptilotula keartlandi	Grey-headed Honeyeater
Ptilotula penicillata	White-plumed Honeyeater
Ptilotula plumula	Grey-fronted Honeyeater
Rhipidura leucophrys	Willie Wagtail
Smicrornis brevirostris	Weebill
Stiltia isabella	Australian Pratincole
Stizoptera bichenovii	Double-barred Finch
Struthidea cinerea	Apostlebird
Synoicus ypsilophorus	Brown Quail
Tachybaptus novaehollandiae	Australasian Grebe
Taeniopygia guttata	Zebra Finch
Todiramphus pyrrhopygius	Red-backed Kingfisher
Todiramphus sanctus	Sacred Kingfisher
Turnix pyrrhothorax	Red-chested Button-quail
Turnix velox	Little Button-quail
Vanellus miles	Masked Lapwing
Mammals	
Lagorchestes conspicillatus	Spectacled Hare-wallaby
Leggadina forresti	Central Short-tailed Mouse
Notamacropus agilis	Agile Wallaby

Scientific Name	Common Name
Onychogalea unguifera	Northern Nailtail Wallaby
Planigale ingrami	Long-tailed Planigale
Planigale maculata	Common Planigale
Pseudomys delicatulus	Delicate Mouse
Pseudomys nanus	Western Chestnut Mouse
Sminthopsis macroura	Stripe-faced Dunnart
Tachyglossus aculeatus	Short-beaked Echidna
Reptiles	
Amalosia rhombifer	Zig-zag Gecko
Amphibolurus centralis	Centralian Lashtail Dragon
Anilios diversus	Northern Blind Snake
Anilios ligatus	Robust Blind Snake
Antaresia childreni	Children's Python
Austroablepharus kinghorni	Kinghorn's Snake-eyed Skink
Brachyurophis roperi	Northern Shovel-nosed Snake
Brachyurophis semifasciatus	Southern Shovel-nosed Snake
Carlia amax	Two-spined Rainbow-skink
Cryptoblepharus metallicus	Metallic Snake-eyed Skink
Ctenophorus isolepis	Central Military Dragon
Ctenotus helenae	Clay-soil Ctenotus
Ctenotus inornatus	Bar-shouldered Ctenotus
Ctenotus joanae	Black-soil Ctenotus
Ctenotus leonhardii	Leonhard's Ctenotus
Ctenotus pantherinus	Leopard Ctenotus
Ctenotus pulchellus	Red-sided Ctenotus
Ctenotus spaldingi	Straight-browed Ctenotus
Delma borea	Rusty-topped Delma
Diplodactylus conspicillatus	Variable Fat-tailed Gecko
Diporiphora lalliae	Lally's Two-lined Dragon
Diporiphora magna	Yellow-sided Two-lined Dragon
Eremiascincus intermedius	Northern Narrow-banded Skink
Furina ornata	Orange-naped Snake
Gehyra australis	Northern Dtella
Gehyra purparescens	Purplish Dtella
Heteronotia binoei	Bynoe's Gecko
Lerista griffini	Stout Sandslider
Lerista orientalis	North-eastern Orange-tailed Slider

Scientific Name	Common Name
Liasis olivaceus	Olive Python
Lophognathus gilberti	Gilbert's Dragon
Lucasium stenodactylus	Sand-plain Gecko
Menetia greyii	Common Dwarf Skink
Menetia maini	Northern Dwarf Skink
Morethia storri	Northern Fire-tailed Skink
Proablepharus tenuis	Northern Soil-crevice Skink
Pseudechis australis	Mulga Snake
Pseudonaja guttata	Speckled Brown Snake
Pygopus nigriceps	Western Hooded Scaly-foot
Rhynchoedura ornata	Western Beaked Gecko
Scythrops novaehollandiae	Channel-billed Cuckoo
Strophurus ciliaris	Northern Spiny-tailed Gecko
Suta punctata	Little Spotted Snake
Varanus acanthurus	Ridge-tailed Monitor
Varanus gouldii	Sand Goanna
Varanus panoptes	Yellow-spotted Monitor
Varanus scalaris	Spotted Tree Monitor
Varanus tristis	Black-headed Monitor
Amphibians	
Cyclorana australis	Giant Frog
Cyclorana cultripes	Knife-footed Frog
Cyclorana maculosa	Daly Waters Frog
Cyclorana platycephala	Water-holding Frog
Litoria rubella	Red Tree Frog

Appendix F

Protected Matters Search Report 10 km and 50 km

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 08-Mar-2024

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	17
Listed Migratory Species:	13

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	1
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species			[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.			
Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macroderma gigas			
Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
Macrotis lagotis			
Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Saccolaimus saccolaimus nudicluniatus			
Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Trichosurus vulpecula arnhemensis			
Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			
Acanthophis hawkei			
Plains Death Adder [83821]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Tiliqua scincoides intermedia			
Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Varanus mertensi			
Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat may occur within area	In feature area
Varanus mitchelli			
Mitchell's Water Monitor [1569]	Critically Endangered	Species or species habitat may occur within area	In feature area
SHARK			
Pristis pristis			
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Pristis pristis](#) Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Terrestrial Species			
[Cecropis daurica](#) Red-rumped Swallow [80610]		Species or species habitat may occur within area	In feature area
[Cuculus optatus](#) Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
[Hirundo rustica](#) Barn Swallow [662]		Species or species habitat may occur within area	In feature area
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
[Anseranas semipalmata](#) Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
[Bubulcus ibis as Ardea ibis](#) Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
[Cecropis daurica as Hirundo daurica](#) Red-rumped Swallow [80610]		Species or species habitat may occur within area overfly marine area	In feature area
[Chalcites osculans as Chrysococcyx osculans](#) Black-eared Cuckoo [83425]		Species or species habitat may occur within area overfly marine area	In feature area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area	In feature area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat may occur within area	In feature area
[Hirundo rustica](#) Barn Swallow [662]		Species or species habitat may occur within area overfly marine area	In feature area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
Rostratula australis as Rostratula benghalensis (sensu lato)			
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area

Extra Information

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

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The following species and ecological communities have not been mapped and do not appear in this report:

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The following groups have been mapped, but may not cover the complete distribution of the species:

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Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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-Ocean Biogeographic Information System
-Australian Government, Department of Defence
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-CSIRO
-Australian Tropical Herbarium, Cairns
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-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact us page.

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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 08-Mar-2024

Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	22
Listed Migratory Species:	13

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	18
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	1
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species			[Resource Information]
Status of Conservation Dependent and Extinct are not MNES under the EPBC Act. Number is the current name ID.			
Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area	In feature area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Polytelis alexandrae](#) Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Rostratula australis](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area	In feature area
[Tyto novaehollandiae kimberli](#) Masked Owl (northern) [26048]	Vulnerable	Species or species habitat may occur within area	In feature area
MAMMAL			
[Dasyurus hallucatus](#) Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area	In buffer area only
[Macroderma gigas](#) Ghost Bat [174]	Vulnerable	Species or species habitat may occur within area	In feature area
[Macrotis lagotis](#) Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Saccolaimus saccolaimus nudicluniatus](#) Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Trichosurus vulpecula arnhemensis](#) Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat likely to occur within area	In feature area
REPTILE			
[Acanthophis hawkei](#) Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
[Elseya lavarackorum](#) Gulf Snapping Turtle [67197]	Endangered	Species or species habitat may occur within area	In buffer area only
[Tiliqua scincoides intermedia](#) Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Varanus mertensi			
Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat may occur within area	In feature area
Varanus mitchelli			
Mitchell's Water Monitor [1569]	Critically Endangered	Species or species habitat may occur within area	In feature area
SHARK			
Pristis pristis			
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species		[Resource Information]	
Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Marine Species			
Pristis pristis			
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Terrestrial Species			
Cecropis daurica			
Red-rumped Swallow [80610]		Species or species habitat may occur within area	In feature area
Cuculus optatus			
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundo rustica			
Barn Swallow [662]		Species or species habitat may occur within area	In feature area
Motacilla cinerea			
Grey Wagtail [642]		Species or species habitat may occur within area	In feature area
Motacilla flava			
Yellow Wagtail [644]		Species or species habitat may occur within area	In feature area
Migratory Wetlands Species			

Scientific Name	Threatened Category	Presence Text	Buffer Status
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area	In feature area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area	In feature area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area	In feature area

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area overfly marine area	In feature area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In feature area
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Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area overfly marine area	In feature area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine area	In feature area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area	In feature area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area	In feature area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area	In feature area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area	In feature area
[Rostratula australis as Rostratula benghalensis (sensu lato)](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area	In feature area
Reptile			
[Crocodylus johnstoni](#) Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area	In buffer area only

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
[Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia](#)	2015/7522	Not Controlled Action	Completed	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

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Appendix G

Stygofauna Recorded within 50 km of Shenandoah South E&A program area

Appendix G Stygofauna Recorded within 50 km of Shenandoah South E&A program area

Table G Stygofauna recorded within 50 km of the Shenandoah South E&A program area (Rees *et al*., 2020; Humphreys *et al*., 2022)

Stygofauna	Highest Classification	Bore		
		Hayfield Shenandoah Homestead*	Sturt Plains Homestead*	RN038816
Amoebozoa	Phyllum	✓		
Adinetida	Order	✓		
Agaricomycotina	Class	✓		
Ascomycota	Phylum	✓	✓	
Bionectriaceae	Family	✓		
Capnodiales	Order	✓	✓	
Cochliopodiidae	Family	✓		
Crustacea	Class	✓	✓	
Demospongiae	Class	✓		
Discosea	Class	✓	✓	
Dothideomycetes	Class		✓	
Enchytraeidae	Genus			✓
Exobasidiomycetes	Class	✓		
Haplotaxida	Order	✓		
Helotiales	Order	✓		
Himatismenida	Class	✓	✓	
Hypocreales	Order	✓	✓	
Leotiomycetes	Order		✓	
Macrotrichidae	Family	✓		
Malacostraca	Class	✓	✓	
Maxillopoda	Class	✓		
Nematoda	Phylum	✓		
Oomycetes	Phylum	✓	✓	
Ploima	Order	✓	✓	
Porifera	Phyllum	✓		
Saprolegniales	Order	✓		
Sordariomycetes	Family	✓	✓	
Stemonitidae	Family	✓		
Tricladida	Order	✓		
Vannellidae	Family	✓		

* Stygofauna identified by eDNA