

Beetaloo Basin Shenandoah South 3D Seismic Program Environment Management Plan (TAM3-2) EP 117 and EP 98

Prepared by Tamboran B2 Pty Ltd

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Appendices

APPENDICES A:

Appendix A Land Condition Assessment Report

APPENDICES B:

Appendix B.1 Heritage Assessment Report

Appendix B.2 Unexpected Finds Procedure

APPENDICES C – I:

Appendix C Bushfire Management Plans

Appendix D Weed Management Plan

Appendix E Erosion and Sediment Control Plan

Appendix F Environmental Commitments Register

Appendix G Rehabilitation Management Plan

APPENDIX H – K:

Appendix H Spill Management Plan

Appendix I Risk Assessment

Appendix J Stakeholder engagement:

- o Part A Stakeholder engagement log summary
- o Part B Stakeholder summary of information provided and the relevant sections of the Petroleum (Environment) Regulations 2016
- o Supporting information provided for Minister Decision (not attached to EMP)
 - o Appendix J.1.1 Pastoral stakeholder engagement
 - o Appendix J.1.2 NLC stakeholder engagement
 - o Appendix J.1.3 Historic engagement – under approved EMPs

Appendix K Emergency Response Plan

Executive Summary

Tamboran B2 Pty Ltd (Tamboran) is the registered holder and operator of exploration permits (EP) 98 and EP 117, located in the Beetaloo Sub-basin. This Environment Management Plan (EMP) represents Tamboran's application to the Northern Territory (NT) Minister for Lands, Planning and Environment for a series of exploration activities proposed for the Shenandoah South Exploration and Appraisal (SS E&A) program to be undertaken over a period of 5 years.

The Shenandoah South three dimensional (3D) seismic program (SS 3D seismic program) is designed to collect data to assist in the determination of the future technical and commercial viability of the underlying shales within EP 98 and EP 117. The SS 3D seismic EMP is specifically restricted to exploration and appraisal activities and does not cover production as defined in the NT *Petroleum Act 1984*.

The regulated activities proposed in this EMP include:

- **3D seismic acquisition** covering a total of 640 km of seismic lines in the SS E&A program area.
- **Rehabilitation of 3D seismic lines:** to meet the mandatory requirements described in CI A.3.9 of the *Code of Practice: Onshore Petroleum Activities in the Northern Territory* (the Code).

The EMP has been prepared in compliance with the NT Petroleum (Environment) Regulations 2016 (the "Regulations"), *Code of Practice: Onshore Petroleum Activities in the Northern Territory* (the "Code") and the Exploration Agreements between Tamboran, native title holders and the Northern Land Council (NLC). The EMP is designed to ensure that the proposed activities are carried out in such a manner that the environmental impacts and risks will be reduced to as low as reasonably practicable (ALARP) and acceptable.

Location of the regulated activities

The SS 3D seismic program is located on Shenandoah, Shenandoah East and Hayfield pastoral stations, within EP 98 and EP 117. The location of the proposed activities is provided in Figure 1.

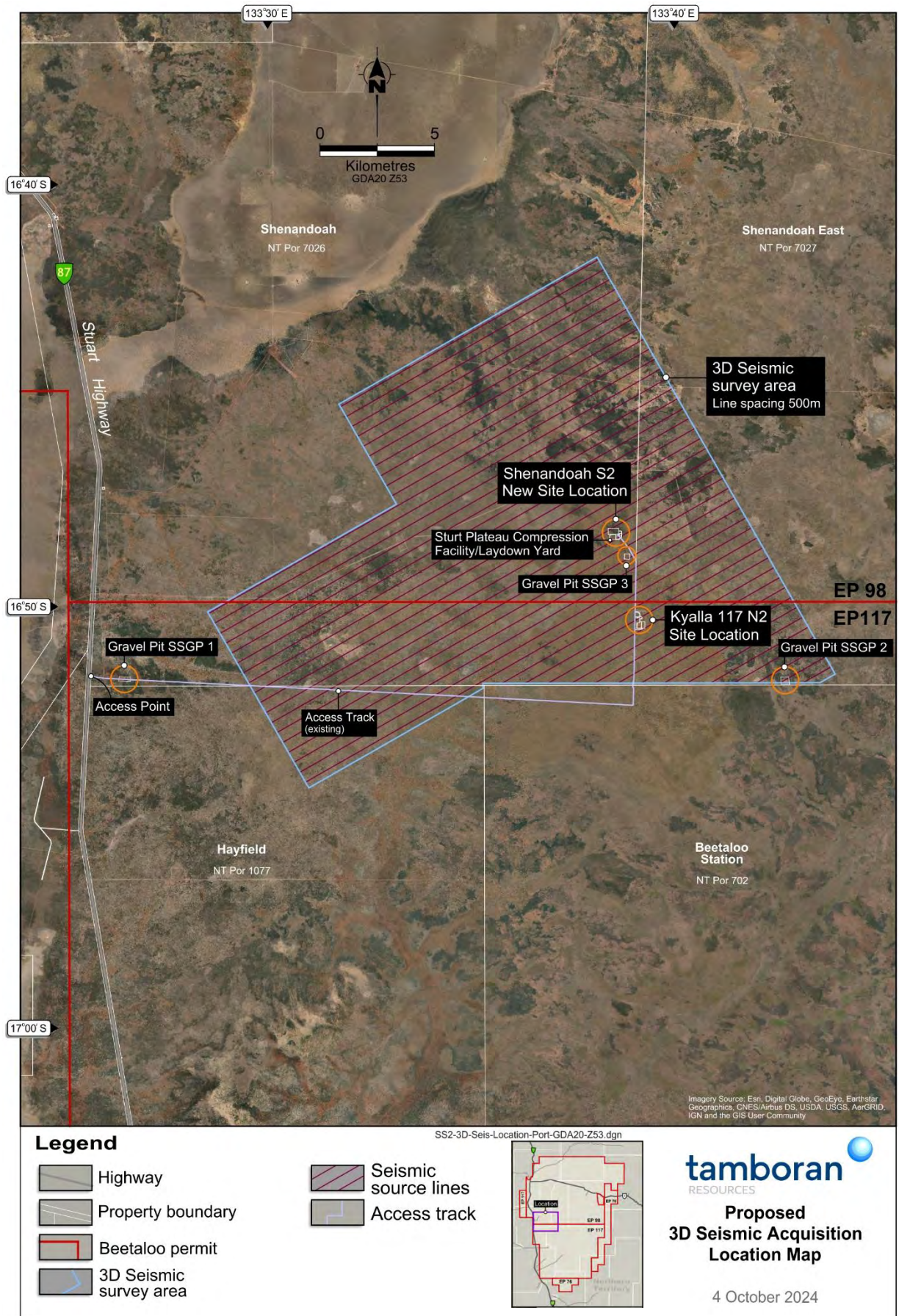


Figure 1: Location of the Shenandoah South 3D seismic program

Description of the activity

A summary of the proposed activities covered in the EMP is provided in Table 1.

Table 1: Description of the proposed activities for the Shenandoah South 3D seismic program

Activity	Parameter	Description
3D seismic line preparation	640 km (221 ha ¹) of 3D seismic lines	3D seismic program to occur within the Shenandoah South E&A area located on Shenandoah, Shenandoah East and Hayfield pastoral stations. - Line preparation that prioritises the avoidance of vegetation clearing by locating source lines that avoid large trees and dense vegetation areas. - Minimal clearing of vegetation along source lines to allow site access and data capture. - The width of 3.5 m of source lines excludes felled vegetation and soil, which will be pushed and spread into the surrounding area. - Use of existing pastoral fence lines/tracks to move between seismic lines.
Seismic acquisition	42 source lines ranging in length of 1.4 km to 22.4 km, 500 m between each line.	- The 3D seismic program will primarily use “low impact”² energy sources: accelerated weight drop (AWD) and seismic charges which use dynamite. - The use of low impact vehicles (i.e. tractor, positrak or tracked machine) to deploy the energy sources will be a priority. Vibroseis trucks may also be used as required. - Light vehicle or on foot to be used only in areas identified as sensitive such as thicker vegetation (i.e. dense Lancewood / Bullwaddy vegetation communities), heritage places / objects and drainage lines / drainage depressions / claypans / ephemeral waterholes. - Installation of seismic charges (where utilised) using a small auger, push tube or rig. - Receiver nodes deployed at regular intervals (~10-50 m) by hand and can be placed in and around riparian vegetation, thick vegetation and other sensitive areas due to the small surface impacts. - Seismic data recording following the start of line preparation.
Seismic Line Rehabilitation	Seismic survey area to be rehabilitated at completion of data acquisition.	- Progressive rehabilitation of seismic lines and shot holes to be conducted upon completion of seismic activities. - Final rehabilitation activities will aim to return all seismic lines back to a safe, stable and non-polluting form consistent with pre-disturbed condition.
Field explosive storage magazine	~0.01 ha each	Permitted explosive storage magazines (AS2187) will be placed at centralised locations along the cleared lines.

¹ 221 ha based on total length of seismic program by 3.5 m wide seismic lines. Of the 221 ha, worse-case scenario of 56.25 ha (plus 20 ha contingency) will be cleared.

² “low impact” in terms of delivering a 3D seismic program is defined as survey that minimises ground and vegetation disturbance to the greatest extent possible while still obtaining high quality seismic data to inform future technical and commercial viability of the underlying shales. Low impact seismic survey methods aim to avoid large trees, dense vegetation and sensitive flora and use machinery and equipment that have a much small footprint than traditional seismic survey method.

Activity	Parameter	Description
Seismic camp	Camp operations	Existing Shenandoah South E&A EMP (TAM1-3) approved camp to be used as a centralised camp to reduce mobilisations / new disturbance for the work program.
	Fuel and material storage areas	- A fuel, oil and lubricant and material storage area will be in designated area at camp pad to support the 3D seismic program. - Fuel, oil and lubricants storage and use will be in accordance with Australian Standards and relevant SDS.
	Traffic	- Approximately 8 traffic movements per day during site mobilisation and demobilisation (over 2 to 3 days). - Up to 4 traffic movements per day during seismic acquisition.
Groundwater extraction (average)	~1-2 ML	- Water will be required during the seismic survey for line preparation, seismic charge installation, bushfire prevention and rehabilitation activities. - Groundwater extraction will be under existing groundwater extraction licence (WEL GRF 10285).
Greenhouse gas emissions	Peak emission 4,875 tCO ₂	- All emissions in a financial year (FY) will be offset where the 100K tCO₂ safeguard trigger is exceeded. - Tamboran will offset a % of residual emissions in alignment with the NT Net Zero Policy.
Environmental monitoring	3D seismic program area	- Monitoring activities (including vegetation clearing, soils, weeds, groundwater extraction and all other low impact ancillary data collection programs). - Rehabilitation monitoring annually.

Description of the existing environment

The SS 3D seismic program is located on EP 98 and EP 117, which encompasses the Shenandoah, Shenandoah East and Hayfield pastoral stations. The seismic program falls within the area described as the Shenandoah South Exploration and Appraisal (E&A) area which is 31,418 ha in size.

Land condition and heritage assessments across the Shenandoah South E&A area have been completed over the past 20 years and supplement the more recent assessments completed specifically for the SS 3D seismic program area, the Northern Territory Government (NTG) Strategic Regional Environmental and Baseline Assessment (SREBA) studies and the CSIRO Beetaloo Geological and Bioregional Assessment Program. These assessments include a review of the physical, natural and cultural heritage environment.

The SS 3D seismic program area falls within the Sturt Plateau Bioregion. The bioregion is characterised by undulating plains on sandstone with predominantly neutral sandy red and yellow earth soils. Dominant vegetation is eucalypt woodland, which include extensive areas of Lancewood (*Acacia shirleyi*), Bullwaddy (*Macropteranthes kekwickii*) vegetation and associated fauna, including the Spectacled Hare-Wallaby (*Lagorchestes conspicillatus*). Land condition in the bioregion is moderate to good but is threatened by impacts from weeds, feral animals, pastoralism and changed fire regimes.

A description of the existing environment for the SS 3D seismic program area is provided in section 4 and in Appendix A (Land Condition Assessment) and Appendix B (Heritage Assessment). Figure 2 provides an overview of vegetation communities that occur within the SS 3D seismic program area.

A summary of the existing environment of the SS 3D seismic program area are presented in Table 2 – Table 12. The focus of the description of existing environment is based on the 11 vegetation communities described in the land condition assessment report (Appendix A) that will be intersected by the SS 3D seismic program.

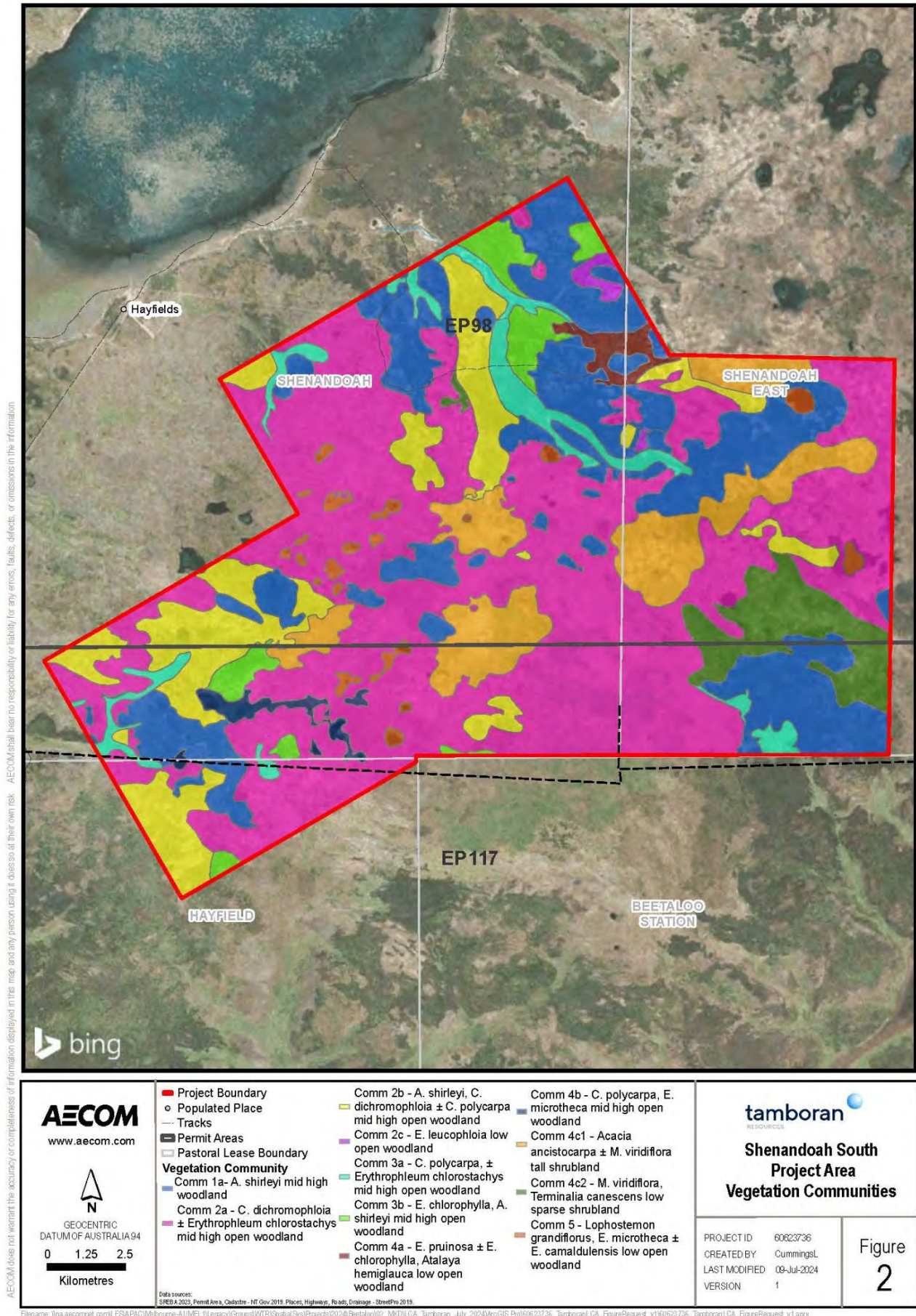


Figure 2: Vegetation communities within Shenandoah South 3D seismic program area

Table 2: Summary of existing environment and surrounds – vegetation community 1a

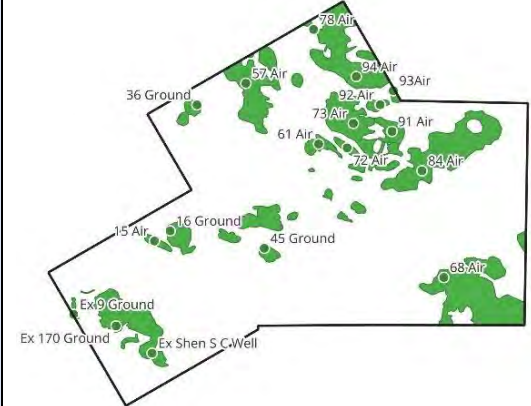
Shenandoah South 3D Seismic Area – Vegetation Community 1a		Survey photos of the vegetation/habitat	
Location			
Landform and soil	Level plains of residual plateau surface. Sandy loam.		
Vegetation community description	1a: <i>Acacia shirleyi</i> mid high woodland over, <i>Macropteranthes kekwickii</i> , <i>Terminalia volucris</i> mid high open shrubland, over <i>Eragrostis fallax</i> , <i>Sorghum intrans</i> , <i>Waltheria indica</i> mid high open tussock grassland		
Habitat condition	Good – Common tree hollows and falling logs. Flowering plants present. Shallow leaf litter. Termite mounds: Nil. Fire damage > 2 years ago. No erosion. Minor cattle impacts. Ground cover: 55% vegetation, 2% leaf litter, 43% bare.		
Dominant flora species	Upper Stratum Mid high woodland dominated by <i>Acacia shirleyi</i> (fq 100%)	Mid Stratum Mid high open shrubland dominated by <i>Macropteranthes kekwickii</i> (fq 66.67%), <i>Terminalia volucris</i> (fq 66.67%)	Ground Stratum Mid high open tussock grassland dominated by <i>Eragrostis fallax</i> (fq 33.3%), <i>Sorghum intrans</i> (fq 16.67%), <i>Waltheria indica</i> (fq 33.3%)
Weeds	No weeds of national significance or NT declared weeds present.		
Potential listed threatened species (SREBA 2023)	Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).		

Table 3: Summary of existing environment and surrounds – vegetation community 2a

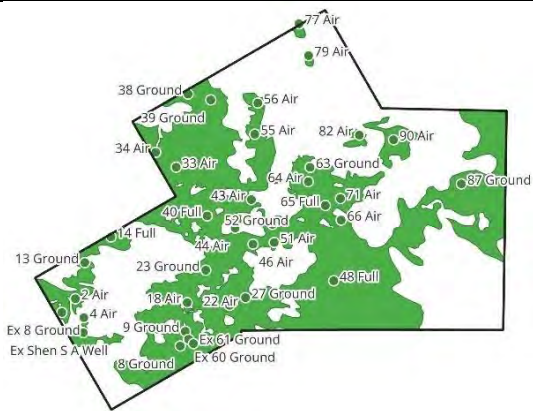
Shenandoah South 3D Seismic – Vegetation Community 2a		Survey photos of the vegetation/habitat		
Location				
Landform and soil	Level plains of residual plateau surface. Sandy loam.			
Vegetation community description	2a: <i>Corymbia dichromophloia</i> ± <i>Erythrophleum chlorostachys</i> mid high open woodland, over <i>Acacia difficilis</i> , <i>Terminalia canescens</i> , 9g-1 <i>Dodonea</i> sp. 1 mid high open shrubland, over <i>Triodia bitextura</i> ± <i>Chrysopogon fallax</i> , <i>Schizachyrium fragile</i> mid high hummock grassland			
Habitat condition	Good – Scattered tree hollows and flowering plants common. Fallen logs common. Mistletoe absent. Shallow leaf litter. Fire damage low > 2 years ago. No erosion. Minor cattle impacts. Termite mounds sparse. Ground cover: 50% vegetation, 20% litter, 30% bare soil.			
Dominant flora species	Upper Stratum Mid high open woodland dominated by <i>Corymbia dichromophloia</i> (fq 100%) ± <i>Erythrophleum chlorostachys</i> (fq 27.78%)	Mid Stratum Mid high open shrubland dominated by <i>Acacia difficilis</i> (fq 61.11%), <i>Terminalia canescens</i> (fq 38.89%), <i>Dodonea hispidula</i> (fq 33.33%)	Ground Stratum Mid high hummock grassland dominated by <i>Triodia bitextura</i> (fq 83.33%) ± <i>Chrysopogon fallax</i> (fq 50%), <i>Schizachyrium fragile</i> (fq 44.44%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebeia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 4: Summary of existing environment and surrounds – vegetation community 2b

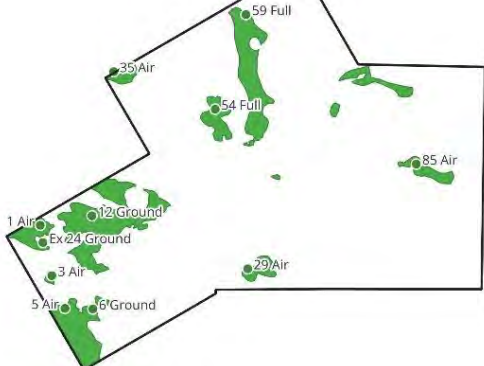
Shenandoah South 3D Seismic – Vegetation Community 2b		Survey photo of the vegetation/habitat		
Location				
Landform and soil	Level plains of residual plateau surface. Sandy loam.			
Vegetation community description	2b: <i>Acacia shirleyi</i> , <i>Corymbia dichromophloia</i> ± <i>Corymbia polycarpa</i> mid high open woodland, over <i>Terminalia canescens</i> , <i>Macropteranthes kekwickii</i> ± 12g-1 <i>Petalostigma</i> sp1 <i>pubescens</i> mid high open shrubland, over <i>Triodia bitextura</i> , <i>Schizachyrium fragile</i> , <i>Chrysopogon fallax</i> mid high hummock grassland			
Habitat condition	Moderate -Scattered tree hollows, fallen logs and flowering plants common. Mistletoe and leaf litter absent. Fire damage low > 2 years ago. No erosion or cattle impacts. Termite mounds sparse.			
Dominant flora species	Upper Stratum Mid high open woodland dominated by <i>Acacia shirleyi</i> (fq 100%), <i>Corymbia dichromophloia</i> (fq 80%) ± <i>Corymbia polycarpa</i> (fq 60%)	Mid Stratum Mid high open shrubland dominated by <i>Terminalia canescens</i> (fq 80%), <i>Macropteranthes kekwickii</i> (fq 80%) ± <i>Petalostigma pubescens</i> (fq 40%)	Ground Stratum Mid high hummock grassland dominated by <i>Triodia bitextura</i> (fq 80%), <i>Schizachyrium fragile</i> (fq 80%), <i>Chrysopogon fallax</i> (fq 60%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 5: Summary of existing environment and surrounds – vegetation community 2c

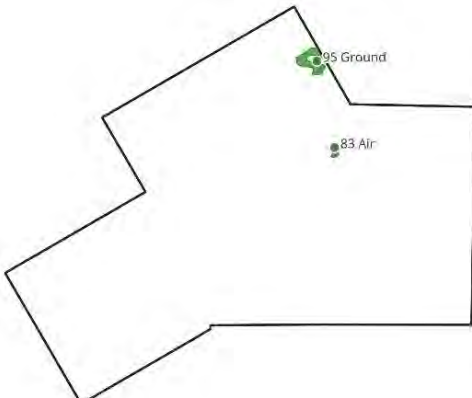
Shenandoah South 3D Seismic – Vegetation Community 2c		Survey photos of the vegetation/habitat		
Location				
Landform and soil	Level plains of residual plateau surface. Sandy Loam.			
Vegetation community description	2c: <i>Eucalyptus leucophloia</i> low open woodland, over 95g-2 <i>Acacia</i> sp. 7, <i>Melaleuca viridiflora</i> , <i>Terminalia canescens</i> mid high open shrubland, over 95g-1 <i>Eriachne</i> sp. 6., <i>Eulalia aurea</i> mid high open tussock grassland			
Habitat condition	Good - tree hollows, Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion. Minor cattle impacts. Termite mounds sparse. Ground cover: 40% vegetation, 40% litter, 20% bare soil.			
Dominant flora species	Upper Stratum Low open woodland dominated by <i>Eucalyptus leucophloia</i>	Mid Stratum Mid high open shrubland dominated by <i>Acacia gonoclada</i> , <i>Melaleuca viridiflora</i> , <i>Terminalia canescens</i>	Ground Stratum Mid high open tussock grassland dominated by <i>Eriachne armittii</i> , <i>Eulalia aurea</i>	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloeobia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 6: Summary of existing environment and surrounds – vegetation community 3a

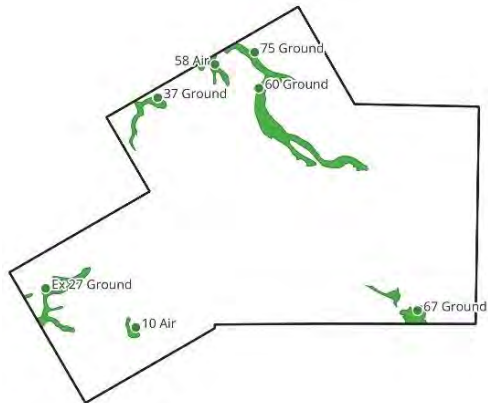
Shenandoah South 3D Seismic – Vegetation Community 3a		Survey photo of the vegetation/habitat	
Location			
Landform and soil	Level, imperfectly drained, colluvial valley flats and margins within relict drainage features. Sandy clay loam.		
Vegetation community description	3a: <i>Corymbia polycarpa</i> , ± <i>Erythrophleum chlorostachys</i> mid high open woodland, over <i>Acacia difficilis</i> ± <i>Atalaya hemiglauca</i> mid high open shrubland, over <i>Chrysopogon fallax</i> , <i>Sehima nervosum</i> mid high tussock grassland		
Habitat condition	Moderate - tree hollows, Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion. Moderate cattle impacts. Termite mounds sparse. Ground cover: 70% vegetation, 15% litter, 15% bare soil.		
Dominant flora species	Upper Stratum Mid high open woodland dominated by <i>Corymbia polycarpa</i> (fq 100%), ± <i>Erythrophleum chlorostachys</i> (fq 40%)	Mid Stratum Mid high open shrubland dominated by <i>Acacia difficilis</i> (fq 80%) ± <i>Atalaya hemiglauca</i> (fq 40%)	Ground Stratum Mid high tussock grassland dominated by <i>Chrysopogon fallax</i> (fq 40%), <i>Sehima nervosum</i> (fq 40%)
Weeds	No weeds of national significance or NT declared weeds present.		
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebeia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).		

Table 7: Summary of existing environment and surrounds – vegetation community 3b

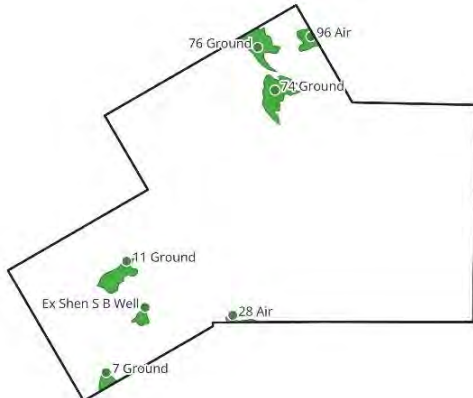
Shenandoah South 3D Seismic – Vegetation Community 3b		Survey photo of the vegetation/habitat		
Location				
Landform and soil	Broad, imperfectly drained lower-lying areas on level plains. Sandy clay loam.			
Vegetation community description	3b: <i>Eucalyptus chlorophylla</i> , <i>Acacia shirleyi</i> mid high open woodland, over <i>Acacia difficilis</i> , <i>Macropteranthes kekwickii</i> , <i>Bauhinia cunninghamii</i> mid high open shrubland, over <i>Chrysopogon fallax</i> , <i>Schizachyrium fragile</i> , 7g-2 <i>Eragrostis</i> sp. 1 mid high tussock grassland			
Habitat condition	Moderate - tree hollows, Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion. Moderate cattle impacts. Termite mounds sparse. Ground cover: 80% vegetation, 10% litter, 10% bare soil.			
Dominant flora species	Upper Stratum Mid high open woodland dominated by <i>Eucalyptus chlorophylla</i> (fq 100%), <i>Acacia shirleyi</i> (fq 80%)	Mid Stratum Mid high open shrubland dominated by <i>Acacia difficilis</i> (fq 40%), <i>Macropteranthes kekwickii</i> (fq 40%), <i>Bauhinia cunninghamii</i> (fq 40%)	Ground Stratum Mid high tussock grassland dominated by <i>Chrysopogon fallax</i> (fq 40%), <i>Schizachyrium fragile</i> (fq 40%), 7g-2 <i>Eragrostis</i> sp. 1 (fq 40%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebea gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Red Goshawk <i>Erythrotriorchis radiatus</i> (Endangered EPBC Act, Vulnerable TPWC Act), Grey Falcon <i>Falco hypoleucos</i> (Vulnerable EPBC Act and TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Greater Bilby <i>Macrotis lagotis</i> (Vulnerable EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 8: Summary of existing environment and surrounds – vegetation community 4a

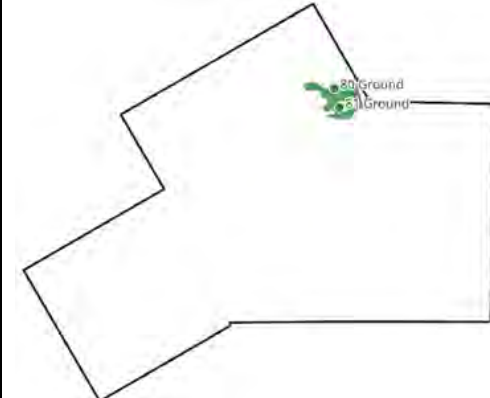
Shenandoah South 3D Seismic – Vegetation Community 4a		Survey photo of the vegetation/habitat	
Location			
Landform and soil	Broad, imperfectly drained lower-lying areas on level plains. Sandy clay loam.		
Vegetation community description	4a: <i>Eucalyptus pruinosa</i> ± <i>Eucalyptus chlorophylla</i> , <i>Atalaya hemiglauc</i> low open woodland, over <i>Carissa lanceolata</i> , <i>Terminalia canescens</i> mid high open shrubland, over <i>Eulalia aurea</i> , <i>Chrysopogon fallax</i> mid high tussock grassland		
Habitat condition	Moderate - Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion and minor cattle impacts. Termite mounds sparse. Ground cover: 75% vegetation, 10% litter, 10% bare soil.		
Dominant flora species	Upper Stratum Low open woodland dominated by <i>Eucalyptus pruinosa</i> (fq 100%) ± <i>Eucalyptus chlorophylla</i> (fq 50%), <i>Atalaya hemiglauc</i> (fq 50%)	Mid Stratum Mid high open shrubland dominated <i>Carissa lanceolata</i> (fq 50%), <i>Terminalia canescens</i> (fq 50%)	Ground Stratum Mid high tussock grassland dominated by <i>Eulalia aurea</i> (fq 100%), <i>Chrysopogon fallax</i> (fq 100%)
Weeds	No weeds of national significance or NT declared weeds present.		
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebeia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Red Goshawk <i>Erythrotriorchis radiatus</i> (Endangered EPBC Act, Vulnerable TPWC Act), Grey Falcon <i>Falco hypoleucos</i> (Vulnerable EPBC Act and TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Greater Bilby <i>Macrotis lagotis</i> (Vulnerable EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).		

Table 9: Summary of existing environment and surrounds – vegetation community 4b

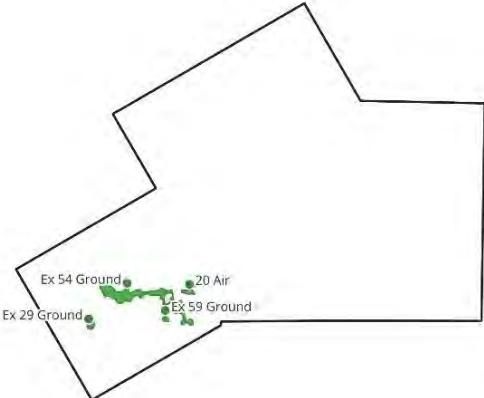
Shenandoah South 3D Seismic – Vegetation Community 4b		Survey photo of the vegetation/habitat		
Location				
Landform and soil	Broad, imperfectly drained lower-lying areas on level plains. Sandy clay loam.			
Vegetation community	4b: <i>Corymbia polycarpa</i> , <i>Eucalyptus microtheca</i> mid high open woodland, over <i>Hakea arborescens</i> , <i>Melaleuca nervosa</i> mid high open shrubland, over <i>Aristida contorta</i> , <i>Waltheria indica</i> mid high open tussock grassland			
Habitat condition	Good - tree hollows, Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion. No cattle impacts. Termite mounds sparse. Ground cover: 80% vegetation, 5% litter, 10% bare soil.			
Dominant flora species	Upper Stratum Mid high open woodland dominated by <i>Corymbia polycarpa</i> (fq 66.67%), <i>Eucalyptus microtheca</i> (fq 66.67%)	Mid Stratum Mid high open shrubland dominated by <i>Hakea arborescens</i> (fq 66.67%), <i>Melaleuca nervosa</i> (fq 66.67%)	Ground Stratum Open tussock grassland dominated by <i>Aristida contorta</i> (fq 66.67%), <i>Waltheria indica</i> (fq 66.67%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebea gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act, Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Greater Bilby <i>Macrotis lagotis</i> (Vulnerable EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 10: Summary of existing environment and surrounds – vegetation community 4c1

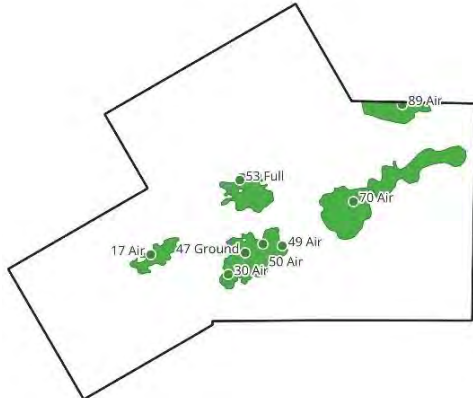
Shenandoah South 3D Seismic – Vegetation Community 4c1		Survey photo of the vegetation/habitat		
Location				
Landform and soil	Broad, imperfectly drained lower-lying areas on level plains. Sandy loam.			
Vegetation community description	4c1: <i>Acacia ancistrocarpa</i> ± <i>Melaleuca viridiflora</i> tall shrubland, over <i>Triodia bitextura</i> , <i>Schizachyrium fragile</i> mid high hummock grassland			
Habitat condition	Good - Flowering plants common. Fire damage moderate >2years ago. No erosion. No cattle impacts. Termite mounds sparse. Ground cover: 100% vegetation, 0% litter, 0% bare soil.			
Dominant flora species	Upper Stratum Tall shrubland dominated by <i>Acacia ancistrocarpa</i> (fq 100%)	Mid Stratum Tall shrubland dominated by <i>Acacia ancistrocarpa</i> (fq 50%) ± <i>Melaleuca viridiflora</i> (fq 50%)	Ground Stratum Mid high hummock grassland dominated by <i>Triodia bitextura</i> (fq 100%), <i>Schizachyrium fragile</i> (fq 50%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Red Goshawk <i>Erythrorhynchus radiatus</i> (Endangered EPBC Act, Vulnerable TPWC Act), Grey Falcon <i>Falco hypoleucos</i> (Vulnerable EPBC Act and TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Greater Bilby <i>Macrotis lagotis</i> (Vulnerable EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 11: Summary of existing environment and surrounds – vegetation community 4c2

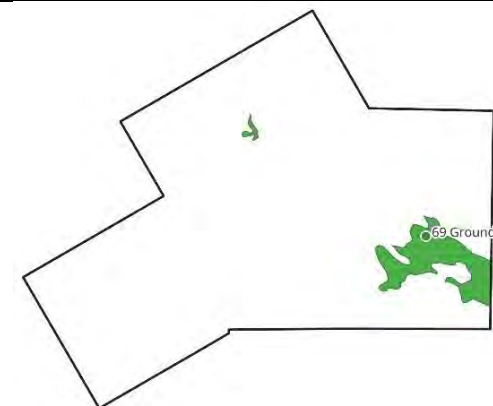
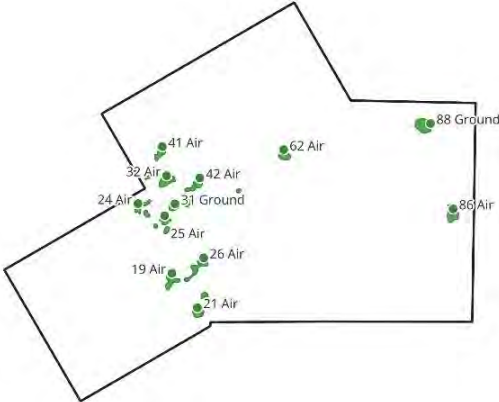
Shenandoah South 3D Seismic – Vegetation Community 4c2		Survey photo of the vegetation/habitat		
Location				
Landform and soil	Broad, imperfectly drained lower-lying areas on level plains. Sandy clay loam.			
Vegetation community description	4c2: <i>Melaleuca viridiflora</i> , <i>Terminalia canescens</i> low sparse shrubland, over <i>Eulalia aurea</i> , <i>Eriachne obtusa</i> open tussock grassland			
Habitat condition	Moderate - tree hollows, Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion. Moderate cattle impacts. Termite mounds sparse. Ground cover: 45% vegetation, 25% litter, 30% bare soil.			
Dominant flora species	Upper Stratum Low sparse shrubland dominated by <i>Melaleuca viridiflora</i>	Mid Stratum Low sparse shrubland dominated by <i>Melaleuca viridiflora</i> , <i>Terminalia canescens</i>	Ground Stratum Mid high open tussock grassland dominated by <i>Eulalia aurea</i> , <i>Eriachne obtusa</i>	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebea gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Red Goshawk <i>Erythrotriorchis radiatus</i> (Endangered EPBC Act, Vulnerable TPWC Act), Grey Falcon <i>Falco hypoleucos</i> (Vulnerable EPBC Act and TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Greater Bilby <i>Macrotis lagotis</i> (Vulnerable EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 12: Summary of existing environment and surrounds – vegetation community 5

Shenandoah South 3D Seismic – Vegetation Community 5		Survey photo of the vegetation/habitat		
Location				
Landform and soil	Localised shallow, level closed depressions and seasonal swamps. Sandy clay loam.			
Vegetation community description	5: <i>Lophostemon grandiflorus</i> , <i>Eucalyptus microtheca</i> ± <i>Eucalyptus camaldulensis</i> low open woodland, over <i>Lophostemon grandiflorus</i> , <i>Acacia difficilis</i> mid high open shrubland, over <i>Eragrostis speciosa</i> , <i>Eragrostis fallax</i> mid high sparse tussock grassland			
Habitat condition	Moderate - tree hollows, holding water following wet season. Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No evidence of erosion or cattle impacts. Ground cover: 55% vegetation, 25% litter, 20% bare soil.			
Dominant flora species	Upper Stratum Low open woodland dominated by <i>Lophostemon grandiflorus</i> (fq 100%), <i>Eucalyptus microtheca</i> (fq 100%) ± <i>Eucalyptus camaldulensis</i> (fq 50%)	Mid Stratum Mid high open shrubland dominated by <i>Lophostemon grandiflorus</i> (fq 50%), <i>Acacia difficilis</i> (fq 50%)	Ground Stratum Mid high sparse tussock grassland dominated by <i>Eragrostis speciosa</i> (fq 50%), <i>Eragrostis fallax</i> (fq 50%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Key environmental risks

The environmental, heritage and social risks associated with the activities have been assessed using the Tamboran risk assessment framework. The risk assessment presents the range of potential impacts, corresponding mitigation measures and risk ratings based on their assessed worst-case consequence and likelihood of occurrence. Key risks assessed under this EMP include:

- managing cultural heritage sites and finds
- managing soil impacts from compaction, erosion and sediment movement and dust
- managing disturbance of surface water bodies and associated sensitive vegetation communities (as described by the SREBA Terrestrial Ecosystems Baseline Report (DEPWS, 2022))
- managing vegetation and habitat disturbance
- managing the risk of bushfire in the area
- mitigating the introduction and spread of weeds.

It was considered that with the appropriate controls implemented to mitigate the impacts there were no residual risks above a rating of medium (Table 13).

Table 13: Summary of risk ratings with environmental controls applied

	Environmental risk rating with applied controls			
	Low	Medium	High	Very high
Total - 26	22	4	0	0

The low and medium risks identified were consistent with standard project and pastoral activities conducted throughout the NT. The residual risk sources assessed under this EMP include:

1. Disturbance of sacred site or culturally sensitive areas and the decline in environmental value of area used for cultural purposes through the preparation of the seismic lines and the accidental ignition of fire by the regulated activity – risk ID 22, risk ID 23 and risk ID 24
2. Disturbance of surface water bodies and associated sensitive vegetation communities (i.e. drainage lines / drainage depressions / claypans / ephemeral waterholes) within the seismic survey area – risk ID 15
3. Loss of long-term soil productivity and viability due to soil compaction and erosion along the seismic lines – risk ID 1
4. Soil, groundwater and surface water contamination due to spills and leaks of chemicals (fuels, oils and lubricants) – risk ID 2, risk ID 12, risk ID 13, risk ID 14
5. Impact to listed threatened habitats and listed threatened flora and fauna, including any ground dwelling or borrowing species and non-listed fauna and livestock during seismic survey – risk ID 4, risk ID 6, risk ID 7, risk ID 8 and risk ID 15
6. Reduction in agriculture productivity through the introduction and spread of weeds in the area or accidental ignition (bushfire) from surface activities – risk ID 3, risk ID 5 and risk ID 20
7. Increased nuisance from dust, noise, vibration and greenhouse gas emissions associated with the activities – risk ID 16, risk ID 17 and risk ID 19.

The environmental risk assessment demonstrates that the risks associated with SS 3D seismic program, are of “low to moderate consequence, low likelihood” risks. The rating is achieved through the application of multiple controls³, which reduce the risk rating to as low as reasonably practicable (ALARP) and acceptable.

The environmental outcomes to be achieved during the proposed activities include no significant impacts to the following aspects:

- The protection and enhancement of community and cultural values, places and amenity.
- Ecological function and productivity of soils.
- Ecological function of surface water bodies and associated sensitive vegetation communities (as described by the SREBA Terrestrial Ecosystems Baseline Report (2022)).
- The protection of high valued habitats and threatened flora and fauna.
- The maintenance of air quality.

At completion of SS 3D seismic activities, the area will be returned to a safe, stable and non-polluting form consistent with pre-disturbed conditions.

Stakeholder engagement

Stakeholder engagement for Tamboran’s SS 3D seismic program has focused on the host traditional owners (facilitated by the NLC) and host pastoralists directly affected by the proposed activity. Contact details are as follows:

NLC			
Hayfield / Shenandoah Pastoral Station			

Detailed community and stakeholder engagement is ongoing and covers Tamboran’s activities on a broader level and includes the information required under the Regulations. This includes providing the stakeholders of the activity description, location, impacts, potential risk, proposed environmental controls and potential impacts to the stakeholders’ rights.

Further information on stakeholder engagement is provided in section 5.

Key objectives of this EMP

The scope covered in this EMP is considered an important step in confirming the technical and commercial feasibility of the underlying shale resources. The SS 3D seismic program within the Shenandoah South E&A area aims to further understand the lateral continuity of the shale resource in the area. This data will be used to increased reserve bookings (through assessment of shale continuity and thickness etc.) and will aid in designing wells to ensure horizontal wells stay within the shale intervals.

To mitigate the intrusiveness of the seismic activity, low impact seismic acquisition is proposed. The aim of low impact seismic acquisition is to minimise vegetation clearing requirements to the greatest extent possible, while still maintaining data integrity that will achieve the appraisal objectives.

³ Mandatory standards and processes applied to the regulated activities are described in the Code, which is designed to ensure that the risk to public, workers and the environment are reduced to a level that is ALARP and acceptable (CI 1).

1 Introduction

1.1 Purpose

Tamboran B2 Pty Ltd (Tamboran) is a registered holder and the operator of Exploration Permit (EP) 76. 98 and 117, located in the Beetaloo Sub-basin. This Environment Management Plan (EMP) forms the basis of Tamboran's application to the Northern Territory (NT) Minister for Environment for a series of exploration activities proposed in the Shenandoah South E&A area on EPs 98 and 117 to be undertaken over a period of 5 years.

The Shenandoah South three dimensional (3D) Seismic Program (SS 3D seismic program) is designed to collect data to assist in the determination of the future technical and commercial viability of the underlying shales within EP 98 and EP 117. The SS 3D Seismic EMP is specifically restricted to exploration and appraisal activities and does not cover production as defined in the NT *Petroleum Act 1984*.

The regulated activities proposed in this EMP include:

- **3D seismic acquisition** covering a total of 640 km (221 ha) of seismic lines in the Shenandoah South E&A program area.
- **Rehabilitation of 3D seismic lines** to meet the mandatory requirements described in CI A.3.9 of the Code of Practice: Onshore Petroleum Activities in the Northern Territory (the Code).

This EMP has been prepared in compliance with the Petroleum (Environment) Regulations 2016 (the Regulations), the Code and the Exploration Agreement(s) between Tamboran, native title holders and the Northern Land Council (NLC).

The overall objective of the EMP is to ensure that the proposed activities are carried out in such a manner that the environmental impacts and risks will be reduced to a level that is as low as reasonably and practicable (ALARP) and acceptable.

Specifically, this EMP aims to:

- Address regulatory requirements.
- Provide site-specific impact management strategies to assist Tamboran in maintaining a positive position in the local community throughout its program.
- Align with the principles of Ecological Sustainable Development (ESD) through the adoption of responsible development practices that are designed to maximise social benefit, while minimising the level of impact on the surrounding ecosystems.
- Provide a description of site-specific aspects of the existing environment (physical, biological, social and cultural).
- Provide site-specific plans for monitoring and rehabilitation.
- Be a practical and usable document, with environmental management principles that are easily implemented and effective.

While every effort has been made to ensure current and accurate information in this EMP, it is intended to be adaptive by design while fulfilling the need for sufficient controls. However, it must remain responsive to fluctuations and alterations in field conditions.

1.2 Proponent

Attribute	Details
Name:	Matt Kernke
Position:	Vice President, Environment and Approvals
Company:	Tamboran B2 Pty Ltd
Address:	C/- Tower One, International Towers, Suite 1, Level 39, 100 Barangaroo Avenue, Barangaroo NSW 2000 Australia
Contact details:	Tamboran.contact@tamboran.com +61 2 8330 6626
Non-operating proponent	
Name:	Anne Flynn
Position:	Director
Company	Falcon Oil & Gas Australia Limited
Address:	C/- 17 Phoenix Street, Nightcliff, Northern Territory 0814 Australia
Contact details	aflynn@falconoilandgas.com

2 Environmental legislation and other requirements

Key NT and Commonwealth legislation, agreements, operating consents, guidelines and Codes of Practice relevant to the activities described in this EMP are summarised in Table 14. This EMP has been prepared in relation to these requirements.

Table 14: Key legislation

Legislation	Requirement	How Tamboran meets the requirement	Administered by
Northern Territory			
<i>Petroleum Act 1984</i>	Petroleum exploration licences are required in the areas where activities are proposed.	Exploration permits obtained. Minister provides the final sign off authorising Petroleum activities.	Department of Mining and Energy (DME) ⁴ Department Lands, Planning and Environment (DLPE) ⁵ Department of Treasury and Finance ⁶
	Compensation to be paid to native title holders and owners/occupiers of land where petroleum activities are proposed.	Exploration Agreements obtained with native title holders. Compensation paid to pastoralists for all activities proposed under this EMP.	
	Prescribes the provisions of the Financial Assurance Framework, which introduces mandatory environmental remediation and petroleum infrastructure decommissioning securities as well as mandatory insurance requirements for all petroleum interests.	Environmental security is assessed by the DLPE and paid to DME. Petroleum infrastructure decommissioning securities is assessed by DME and paid to DME	DLPE and DME
	Outlines the framework for the fees and levies prescribed in the Petroleum Regulations 2020 (below), including publication.	Fees are paid to DME but in some cases assessment of the fees is undertaken by DLPE	DLPE and DME

⁴ Except provisions about royalties, provisions relating to environmental regulation of exploration and production of petroleum and Part V, Division 2.

⁵ Part V, Division 2 and provisions relating to environmental regulation of exploration and production of petroleum.

⁶ Provisions about royalties.

Legislation	Requirement	How Tamboran meets the requirement	Administered by
NT Petroleum (Environment) Regulations 2016	Ensuring all regulated activities have an approved EMP.	This EMP has been developed to satisfy this requirement.	DLPE
	That the EMP is developed in accordance with the NT Petroleum (Environment) Regulations 2016 (the Regulations).	Tamboran has developed this EMP in accordance with the Regulations.	
	That stakeholder engagement for the regulated activities is undertaken.	Tamboran has completed stakeholder engagement in accordance with the Regulations, as summarised in section 5 of this EMP.	
	That activities are conducted in accordance with the Code.	The EMP outlines how the activities will be conducted in accordance with the Code.	
	Reporting requirements for incidents and hydraulic fracturing.	The EMP summarises how incidents will be reported. This EMP does not cover hydraulic fracturing activities.	
Petroleum (Transitional) Regulations 2023	Provides clarity around how and when new arrangements will apply to existing titles, applications, approvals and requirements, including a current insurance policy, new fees, levies and securities.	Fees are paid to DME. Copy of insurance policy is submitted to DME.	DME
Petroleum Regulations 2020	Provides for land access agreements between interest holders and owners or occupiers of the land.	Land access agreements in place for the regulated activities described in this EMP.	DME
	Prescribes the fees relating to the general administration of petroleum titles, including those for the grant, renewal and variation of exploration permits, retention licences and production licences (Schedule 1).	Fees are paid to DME for the administration of all titles, permits and licences.	DME
	Prescribes the fees for resource management, activity and infrastructure plans (Schedule 1A).	Fees are paid to DME.	
	Describes fees and calculation processes for EMPs based on complexity of the regulated activity described in an EMP (Schedule 1B).	Fees are paid to DLPE for all regulated activities proposed under this EMP.	DLPE

Legislation	Requirement	How Tamboran meets the requirement	Administered by
	Prescribes the monitoring and compliance levy intended to recover the costs of a range of DME and DLPE monitoring and compliance activities (Schedule 4A).	A calculation tool is submitted to DLPE, then approved and invoiced by the Energy Development Branch, DME on the advice of DLPE.	DLPE and DME
	That the WOMP must be developed in accordance with Regulation 66AA Schedule 4B.	Not applicable for SS 3D seismic program.	DME
	That the field management plan must be developed in accordance with Regulation 66AAB and Schedule 4C.	Requirements addressed in the field management plan.	
	Prescribes the information that must be included in a petroleum surface infrastructure plan in accordance with Regulation 66AAD and Schedule 4D.	Requirements addressed in the surface infrastructure plan.	
	Reporting requirements prescribed under Regulation 66AAN (Schedule 4E) to Regulation 66AAX(2) (Schedule 4R).	Requirements addressed through various reports provided to the regulator that are relevant to the regulated activities described in this EMP.	
<i>Bushfires Management Act 2016 and Regulations</i>	Compliance with total fire bans and fire permitting.	Tamboran will not light fires during periods of total fire bans and will obtain a permit where occurs during declared fire danger periods.	Bushfires NT
	Requirements for occupiers to prevent and control fires.	Addressed through Tamboran's Bushfire Management Plan (Appendix C) which includes bushfire preventative and response measures.	
	Aerial burning permits.	Tamboran will acquire permits where aerial burning to manage fuel loads is proposed as a part of its ongoing bushfire management activities. Tamboran does not consider that aerial burning will be required.	
<i>Control of Roads Act 1953 and Northern Territory Traffic Act 1987</i>	Any proposed development which may affect the NT road network, including traffic, operation, management, capacity or safety, or result in the construction or installation of new infrastructure within the NTG road network, requires assessment and Road Agency Approval.	Tamboran will continue to engage with the Department of Logistics and Infrastructure (DLI) regarding proposed and ongoing traffic management.	DLI

Legislation	Requirement	How Tamboran meets the requirement	Administered by
<i>Emergency Management Act 2013</i>	Establishes the requirements for local, regional and Territory emergency management plans. Describes the functions and powers of the Northern Territory Emergency Service (NTFES), Territory Emergency Controller, Territory Recovery Controller and Territory Emergency Management Committee.	Tamboran complies with the Act through the development of an emergency response plan and the identification of NTFES as a stakeholder.	NTFES
<i>Environment Protection Act 2019</i>	Activities which have the potential to cause a significant impact to the environment are required to be referred to the NT EPA for assessment under the <i>Environment Protection Act 2019</i> .	Tamboran has completed a self-assessment. The level of potential environmental impact is not considered significant.	Northern Territory Environment Protection Authority (NT EPA) DLPE
<i>Heritage Act 2011</i>	Requirements to avoid impacts to heritage places and objects.	Tamboran completed desktop studies and field scouts to confirm the presence / absence of heritage places and objects within the vicinity of the proposed activities. Unexpected finds procedure to be implemented during activities (Appendix B)	Heritage Branch, DLPE
<i>Medicines, Poisons and Therapeutic Goods Act 2012</i>	Establishes the requirements for minimising harm from scheduled substances and therapeutic goods. Regulates the possession, supply or administration of drugs and poisons.	Tamboran will abide by the limitations of use of any potent medicines, drugs and poisons to ensure their safe and effective use and protection of humans and the environment.	Department of Health
<i>Northern Territory Aboriginal Sacred Sites Act 1989</i>	The legislation establishes a procedure for the protection and registration of sacred sites and the issuing of sacred site clearance certificates. Access and work within sacred sites require authorisation.	All areas of Tamboran's proposed activities have had sacred site clearances completed by traditional owners. Aboriginal Areas Protection Authority (AAPA) certificates for all exploration activities have been obtained for all activities proposed in this EMP.	AAPA
<i>Public and Environmental Health Act 2011</i>	Requirements for camp kitchens and wastewater (sewage and greywater) management and permitting in the NT.	Tamboran's camps are registered, and a wastewater works design approval for the camps sewage treatment plan irrigation area has been obtained.	Department of Health

Legislation	Requirement	How Tamboran meets the requirement	Administered by
<i>Territory Parks and Wildlife Conservation Act 1976</i>	Prohibits impacts to protected places, impacts to threatened flora and fauna and interference with protected wildlife.	Tamboran complies with the Act through the avoidance of impacts to protected places (essential habitat, sanctuaries, parks etc.) and flora and fauna. This is completed through ecological surveys and the controls implemented to limit the impact on wildlife.	Parks and Wildlife DLPE
Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Regulations 2011	Regulations stipulating the transportation requirements for dangerous goods by road and rail. This includes implementing all required signage, spill management, reporting and licencing requirements for chemical transportation during drilling and stimulation activities.	Any chemical transported and stored for exploration activities is undertaken in a manner that will comply with these requirements.	NT WorkSafe, Department of the Attorney-General and Justice
<i>Waste Management and Pollution Control Act 1998</i> (WMPCA)	Requirements covering general environmental duty, waste management, including waste management hierarchy, waste transportation and waste disposal requirements.	The storage, transportation and disposal of wastes will comply with the requirements of this Act. The transportation and disposal of listed wastes will only be completed by a licenced contractor and at a licenced disposal facility. Any interstate disposal will be completed with an approved consignment authority.	NT EPA
	S12 General environmental duty: Applies to activities outside of the lease area, or if a spill or leak occurs that leaves the lease area, or 1 km from the centreline of a pipeline.	Tamboran will conduct all activities outside the approved disturbance area (camp area, lease pad, access tracks authorised in the EMP) in a manner that prevents environmental harm.	
	S14 Duty to notify of incidents causing or threatening to cause pollution: Applies if an incident occurs outside of the lease area, or if a spill or leak occurs that leaves the lease area, or 1 km from the centreline of a pipeline, that causes or threatens to cause material or serious environmental harm.	Tamboran will report all incidents that causes or threatens to cause pollution beyond the boundary of the authorised activity (beyond the lease or camp pad), in accordance with Section 14 of the WMPCA.	
<i>Water Act 1992</i> and <i>Water Regulations 1992</i>	The Act requires that all groundwater take in the Beetaloo Sub-basin must have obtained a Water Extraction Licence (WEL).	Tamboran has obtained a WEL GRF 10285 (450 ML/year) covering water usage for exploration activities.	DLPE

Legislation	Requirement	How Tamboran meets the requirement	Administered by
		WELs are renewed periodically to support operational activities. The WEL has sufficient volume to cover the SS 3D seismic program and future proposed exploration activities in the Shenandoah South E&A area. This application is covered under the Water Act and is separate to this EMP.	
	The take of surface water for petroleum activities is prohibited.	No surface water take is proposed under this activity.	
	Prohibits wastewater releases to surface water bodies or reinjection.	No wastewater release to surface water proposed.	
	The Act requires an interest holder to obtain a permit if activities undertaken under the Act all result in interference with a waterway.	Floodplains and drainage depressions occur within the SS 3D seismic program area but are not considered to be high value wetlands, however they do have important ecological values for the local flora and fauna. The floodplains, drainage depressions and run-on areas that occur within the program area are generally not considered sensitive to impacts from adjacent land use due to the relatively large spatial extent (DEPWS 2022). Tamboran seismic exploration activities will be conducted to minimise the extent and duration of any disturbances on significant vegetation communities. Specifically, clearing will be minimised to the greatest extent practicable for the key habitat features (i.e. large habitat trees with hollows). In accordance with the NT <i>Water Act</i> 1992 and associated <i>Interference with a Waterway Guideline</i> (June 2023), it is considered that the seismic program would not cause a material change or alteration to the waterway and a permit would therefore not be required.	

Legislation	Requirement	How Tamboran meets the requirement	Administered by
		In the event a proposed impact was assessed to be material, it would likely occur in a lower tier stream order (i.e. Stream Order 1 or 2) and would therefore be considered a 'low impact' and a permit to interfere with a waterway would be required from DLPE Water Resources Branch.	
	The Act requires an interest holder to obtain a bore work permit for any new groundwater bores.	No new groundwater bores are proposed for the SS 3D seismic program.	
<i>Weeds Management Act 2001</i>	Requires the occupier of the land (in this case Tamboran) to: (a) to prevent the spread of weeds in, into and out of the Territory; and (ab) to minimise the impact of weeds in the Territory; and (ac) to ensure that the management of the spread of weeds is an integral component of land management; and (ad) to ensure that the management of the impact of weeds is an integral component of land management; and (b) to ensure there is community consultation in the creation of weed management plans; and (c) to ensure that there is community responsibility in implementing weed management plans.	Tamboran will comply with the requirement of this Act through the implementation of weed prevention, detection and eradication controls through its approved Weed Management Plan (Appendix D).	DLPE
<i>Work Health and Safety (National Uniform Legislation) Act 2011</i>	Provides for a nationally consistent framework to secure the health and safety of workers and workplaces. Includes requirements for hazardous chemical assessments, hazardous chemical register, access to safety data sheets, labelling, and the use, handling, generation and storage of hazardous chemicals at a workplace.	Tamboran has a Safety Management Plan that outlines how the requirements of the Act are achieved. This includes the management of chemical storage dossiers, safety data sheets (SDS) and appropriate procedures and controls to prevent worker exposure to hazards.	NT WorkSafe, Department of the Attorney-General and Justice

Legislation	Requirement	How Tamboran meets the requirement	Administered by
Commonwealth			
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Requires approvals for any activity likely to have an impact on a Matter of National Environmental Significance (MNES).	A self-assessment was completed as a part of this EMP to determine whether a MNES is likely to be impacted by the proposed activities within this EMP. Impacts to MNES are not anticipated to occur.	Department of Climate Change, Energy, the Environment and Water (DCCEEW)
<i>National Greenhouse and Energy Reporting Act 2007</i>	An Act that requires operators who generate emissions over a threshold to report information related to greenhouse gas emissions, greenhouse gas projects, energy consumption and energy productions of corporations. The Act also introduces a Safeguard Mechanism aimed to reducing emission from large industrial facilities. It sets legislated limits—known as baselines—on the greenhouse gas emissions of these facilities. The Safeguard Mechanism applies to industrial facilities emitting more than 100,000 tonnes of carbon dioxide equivalent (CO ₂ -e) per year. The safeguard requires that all emissions from the Beetaloo basin be offset with ACCU's once the 100,000 tonnes CO ₂ -trigger is exceeded.	All energy consumption and greenhouse gas data used/generated from this activity will be reported as required in accordance with this Act. Upon exceeding the 100,000 tonnes CO ₂ - trigger in a given financial year, all emissions in that financial year and subsequent financial years will be required to be offset.	DCCEEW
National Environment Protection Council Act 1994 (National Environment Protection (Assessment of Site Contamination) Measure 1999) (NEPM)	This Act provides a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices to protect human health and the environment.	Tamboran uses the NEPM to assess risk of contamination and determine disposal requirements.	DCCEEW
<i>Native Title Act 1993</i>	Legislation that provides for ways in which future dealings affecting native title may proceed and the recognition and protection of native title. The Right to Negotiate requirements are the most relevant provisions applying to Tamboran's exploration activities.	The Right to Negotiate process was applied to the grant of Tamboran's permits, resulting in Section 31 Agreements and Exploration (Ancillary) Agreements covering Tamboran's permits. The traditional owners were and continue to be represented by the NLC.	Prime Minister and Cabinet (Divisions 6 and 7 of Part 2, and Part 11) Attorney-General's Department (except to the extent administered by the

Legislation	Requirement	How Tamboran meets the requirement	Administered by
		Tamboran continues to implement the Exploration Agreements, with all work programs being reviewed and approved by traditional owners. This includes engagement with the NLC as the nominated representative of the Native Title Holders (NTH). Tamboran has engaged with traditional owners on the activities proposed in this EMP in accordance with the requirements of the Exploration Agreement. This includes on country meetings where the proposed activities covered under this plan have been discussed.	Minister responsible for Indigenous Affairs)

2.1 Ecologically Sustainable Development (ESD)

The EMP is consistent with the principles of ESD through the adoption of responsible practices that are designed to maximise social benefit, while minimising the level of impact on the surrounding ecosystems.⁷

Tamboran's exploration activities align with the principles of ESD:

- Exploration activities are an essential step in defining a potential future commercial resource which can generate sustainable, long-term benefits to the local community, to the Barkly region generally and more broadly into the rest of the NT (principles 1, 2, 3 and 5).
- Complying with the Code and industry best practice to reduce the risk to the environment and communities to an acceptable level. Noting the Inquiry Panel's Final Report Statement that "... provided that all of the recommendations made in this Report are adopted and implemented in their entirety, not only should the risks associated with an onshore shale gas industry be minimised to an acceptable level, in some instances, they can be avoided altogether." (Scientific Inquiry into Hydraulic Fracturing in the Northern Territory 2018) (all ESD principles).
- The activities that are the subject of the EMP do not constitute threats of serious or irreversible environmental damage and there is no impact on the conservation of biological diversity and ecological integrity (principles 2, 4, 6 and 7). This has been confirmed through various inquiries/ research program including the independent Scientific Inquiry into Hydraulic Fracturing of Onshore Unconventional Reservoirs in the Northern Territory and Commonwealth Geological and Bioregional Assessment Program.
- Beyond royalty payments to the NT Government (as owner of the natural resource), and payments to Native title holders (as per Exploration Agreements) and host pastoralists (as per Access and Compensation Agreements), Tamboran seeks to maximise broad-based local participation in education, training, employment and enterprise opportunities engendered by its presence (principles 1 and 5).
- Prioritising the use of local employment to deliver exploration activities (principles 1 and 5).
- Obtaining sacred site clearances from host traditional owners through open engagement with custodians, the Statutory Representative body – the NLC and AAPA (Principles 1, 4 and 5).
- Obtaining Land Access Agreements with host pastoralists (principles 1 and 5).

⁷ Referred to in the NT Petroleum (Environment) Regulations 2016 and the *Petroleum Act 1984* and set out in sections 18 to 24 of the [Environment Protection Act 2019](#).

3 Description of regulated activities

3.1 Activity summary

This EMP covers the regulated activities required to enable Tamboran to complete SS 3D seismic program within the Shenandoah South E&A program area over the next 5 years, as summarised in Table 15 and shown in Figure 3.

The planned activities include:

- low disturbance 3D seismic acquisition survey consisting of 42 source lines, spaced 500 m apart (length 640 km x 3.5 m wide) across an area of 31,418 ha on EP 98 and EP 117.
- Rehabilitation of 3D seismic lines to meet the mandatory requirements described in Cl A.3.9 of the *Code of Practice: Onshore Petroleum Activities in the Northern Territory* (the Code).

Table 15: Site activity summary

Activity	Parameter	Description
3D seismic line preparation	640 km (221 ha ⁸) of 3D seismic lines	• 3D seismic program to occur within the Shenandoah South E&A area located on Shenandoah, Shenandoah East and Hayfield pastoral stations. • Line preparation that prioritises the avoidance of vegetation clearing by locating source lines that avoid large trees and dense vegetation areas. • Minimal clearing of vegetation along source lines to allow site access and data capture. • A 3.5 m wide working corridor for the source lines exclude felled vegetation and soil, which will be pushed and spread into the surrounding area. • Movement of vehicles for line preparation will use existing pastoral fencelines / access tracks as connection lines to minimise creation of additional disturbances. Minor additional clearing has been included where there is a need to avoid areas identified as sensitive (refer Figure 3).
Seismic acquisition	42 source lines ranging in length of 1.4 km to 22.4 km, 500 m between each line.	• The 3D seismic program will primarily use “low impact”⁹ energy sources: accelerated weight drop (AWD) and seismic charges which uses dynamite. • The use of low impact vehicles (i.e. tractor, positrak or tracked machine) to deploy the energy sources will be a priority. Vibroseis trucks may also be used as required. • Light vehicle or on foot to be used only in areas identified as sensitive such as thicker vegetation (i.e. denser Lancewood/Bullwaddy vegetation communities), heritage sites and drainage lines / drainage depressions / claypans / ephemeral waterholes (refer section 3.7.8). • Installation of seismic charges (where utilised) using a small auger, push tube or rig.

⁸ 221 ha based on total length of seismic program by 3.5 m wide seismic lines. Of the 221 ha, worse-case scenario of 56.25 ha (plus 20 ha contingency) will be cleared.

⁹ “low impact” in terms of delivering a 3D seismic program is defined as survey that minimises ground and vegetation disturbance to the greatest extent possible while still obtaining high quality seismic data to inform future technical and commercial viability of the underlying shales. Low impact seismic survey methods aim to avoid large trees, dense vegetation and sensitive flora and use machinery and equipment that have a much small footprint than traditional seismic survey method.

Activity	Parameter	Description
		- Receiver nodes deployed at regular intervals (~10-50 m) by hand and can be placed in and around riparian vegetation, thick vegetation and other sensitive areas to avoid damage. - Movement of vehicles for seismic acquisition will use existing pastoral fencelines / access tracks as connection lines to minimise creation of additional disturbances. Minor additional clearing has been included where there is a need to avoid areas identified as sensitive (refer Figure 3). - Seismic data recording following the start of line preparation.
Seismic Line Rehabilitation	Seismic survey area to be rehabilitated at completion of data acquisition.	- Progressive rehabilitation of seismic lines and shot holes to be conducted upon completion of seismic activities. - In accordance with clause A.3.9(d), final rehabilitation activities will return all seismic lines back to a safe, stable and non-polluting form consistent with pre-disturbed condition.
Field explosive storage magazine	~0.01 ha each	Permitted explosive storage magazines (AS2187) will be placed at centralised locations along the cleared lines.
Seismic camp	Camp operations	Existing Shenandoah South E&A EMP (TAM1-3) approved camp to be used as a centralised camp to reduce mobilisations / new disturbance for the work program.
	Fuel and material storage areas	- A fuel, oil and lubricant and material storage area will be in designated area at camp pad to support the 3D seismic program. - Fuel, oil and lubricants storage and use will be in accordance with Australian Standards and relevant SDS.
	Traffic	- Approximately 8 traffic movements per day during site mobilisation and demobilisation (over 2 to 3 days). - Up to 4 traffic movements per day during seismic acquisition.
Groundwater extraction (average)	~1-2 ML	- Water will be required during the seismic survey for line preparation, seismic charge installation, bushfire prevention and rehabilitation activities. - Groundwater extraction will be under existing groundwater extraction licence (WEL GRF 10285).
Greenhouse gas emissions	Peak emission 4,393 tCO ₂	- All emissions associated with all of Tamboran's activities in a financial year (FY) will be offset where the 100K tCO₂ safeguard trigger is exceeded - Tamboran will offset a % of residual emissions in alignment with the NT Net Zero Policy
Environmental monitoring	3D seismic program area	- Monitoring activities (including vegetation clearing, soils, weeds, groundwater extraction and all other low impact ancillary data collection programs). - Rehabilitation monitoring annually.

3.2 Vehicle and Workforce

The estimated workforce numbers for the SS 3D seismic activities are provided in Table 16.

Table 16: Workforce numbers for 3D seismic program

Activity	Workforce
Advance line preparation and survey crew	6
Line preparation crew	6
Data recording crew	
Recording crew	30
Dynamite drilling crew	10
Rehabilitation and line restoration crew	6
Support operations (i.e. camp operations crew, paramedic, environmental monitoring etc.)	6
Cultural managers	4
Total workforce	68

The 3D seismic workforce will be a 30:70 split between interstate and local hire, respectively.

The estimated number of vehicles required to conduct the SS 3D seismic activities are provided in Table 17:

Table 17: Vehicle type and numbers for 3D seismic program

Vehicle	Workforce
Line preparation	
4x4 tray top light vehicle	2
Dozer/Positrak	1
4x4 support vehicle	2
Water truck (fire tender and dust suppression)	1
Total	6
Recording crew – layout and pickup	
4x4 dual cab vehicle	5
4x4 tray top – line manager	1
4x4 tray top – line crew	1
Tilt tray or flatbed truck	2
Buggy/ATV	5
Water truck (fire tender and dust suppression)	1
Total	15
Recording crew – vibroseis/weight drop	
Posi-track / AWD / Vibroseis	4
4x4 dual cab vehicle	2
4x4 tray top – line manager	1
4x4 tray top – line crew	1
Total	8

Vehicle	Workforce
Dynamite drilling	
Drilling rig	4
4x4 support vehicle	2
Water truck (fire tender)	1
Total	7
Line restoration/rehabilitation	
Dozer/Positrak	2
4x4 support vehicle	1
Water truck (fire tender, dust suppression and ground stabilisation)	1
Total	4
Total vehicles	40

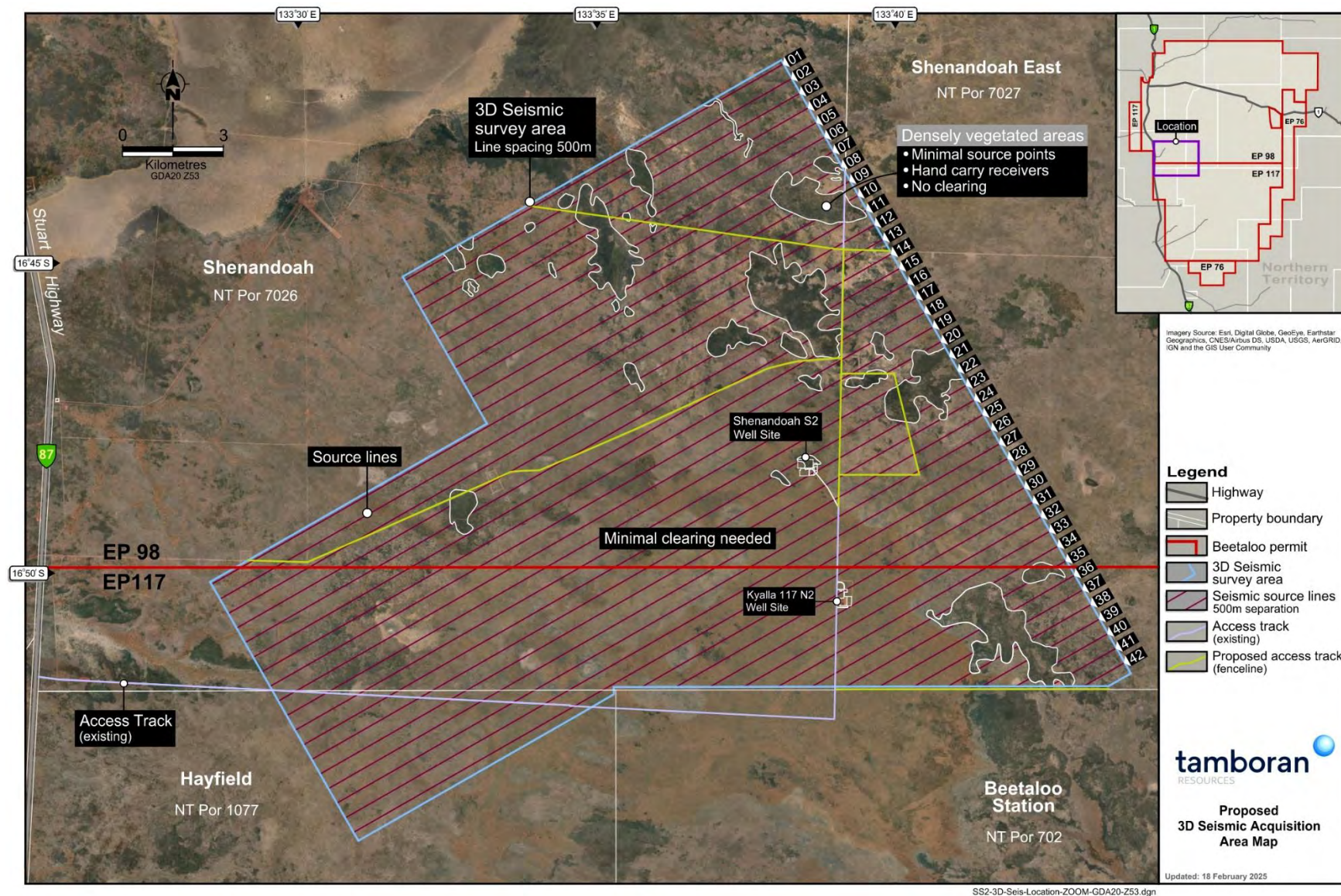


Figure 3: Shenandoah South 3D seismic program area

3.3 Schedule

The indicative activity dates for the SS 3D seismic program are provided in Figure 4.

It should be noted that the below timeframes and order of activities are indicative, with final dates and decision to complete activities dependent on a range of additional considerations, including access, commercial and joint venture constraints. An update on the project schedule will be provided to DLPE as required.

The SS 3D seismic survey program is estimated to take up to 18 to 20 weeks to complete:

- Line preparation: 4 weeks, with contingency of 1 week
- Data recording: 10 weeks, with contingency of 2 weeks
- Line rehabilitation: progressively over 4-6 weeks, with contingency of 2 weeks.

The SS 3D seismic program will have overlap of the line preparation, data recording and progressive rehabilitation activities as presented in Table 18. Upon completion of the seismic data recording and line rehabilitation, an ongoing monitoring program will be conducted to ensure successful restoration of the disturbance areas. Ongoing monitoring program will be required for at least 5 years post activity.

Table 18: Indicative 3D Seismic Program

Activity	Estimated Duration	2025 Scenario
Mobilisation	2-4 days	May 2025
Line preparation	4 weeks	May-June 2025
Data recording	8 weeks	June – July 2025
Progressive Rehabilitation	4-6 weeks	July – August 2025
Demobilisation	2-4 days	August 2025
Rehabilitation Monitoring*	Every 6 months for first 12 months, then every 12 months over 5 years	Annually 2025 to 2030

*Dependent on success of rehabilitation. If data obtained confirms early rehabilitation success, 5-year duration could be reduced based on scientific report identifying that rehabilitation has met final success criteria detailed in Appendix G and is authored by a suitably qualified person. The final decision on handing back rehabilitated area will be subject to approval by the DLPE Petroleum Operations team (the Regulator).

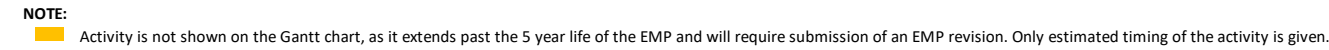


Figure 4: Indicative schedule of 3D seismic activities

3.4 Location and disturbance summary of activity

The SS 3D seismic program area is located on Shenandoah, Shenandoah East and Hayfield pastoral stations, within EP 98 and EP 117. The proposed location and disturbance area is summarised in Table 19 below, with the location of the regulated activities is illustrated in Figure 5. It is expected that no more than 56.25 ha of vegetation clearing will be required for the 3D seismic program, with the remaining line areas being traversed with minimal removal of any vegetation. A contingent disturbance area of 20 ha (total 76.25 ha) has also been included in event some lines will require vibroseis or need to traverse around the edge of sensitive areas such as areas with heritage places/objects, dense Lancewood/Bullwaddy vegetation community or riparian woodland (ephemeral streams).

The estimated vegetation clearing has been calculated from GIS modelling of shrub and tree vegetation types only, excluding bare earth, grass and dry grass areas, as well as Tamboran's planned no clearing areas (refer Figure 5 and Appendix A). It is anticipated that the calculated disturbance area presented in Table 19 will be further reduced through optimisation of the program using high resolution aerial imagery (i.e. LIDAR) acquired in July 2024 which is currently being processed.

It is noted that the disturbance summary is based on the seismic line width of 3.5 m and does not include incidental disturbance associated with felled vegetation that may be pushed beyond the line width. As the felled vegetation will be returned back over the line, it is anticipated that this disturbance will be minimal.

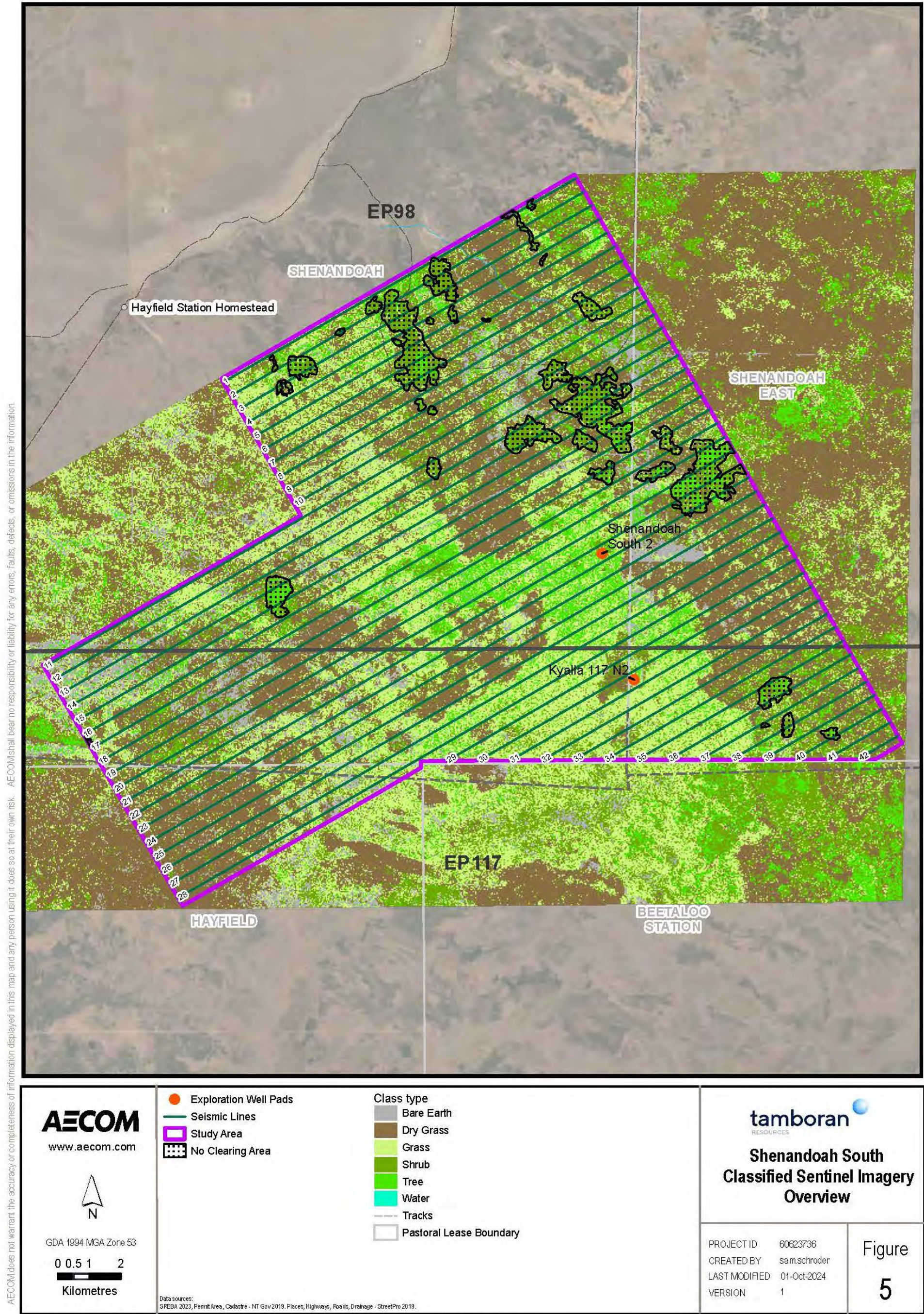


Figure 5: Location and disturbance of 3D seismic program covered by this EMP

Table 19: Location and disturbance summary of 3D seismic program on EP 98 and EP 117

Infrastructure	EP	Zone*	Easting (approx.)	Northing (approx.)	Total length of 3D seismic lines (km)	Total line survey area (ha)**	Estimated vegetation clearing seismic line (ha)^	Estimated % of vegetation clearing extent for seismic line
Line 1	98	53	343278	8146979	12.95	4.53	1.91	42.20
			354493	8153454				
Line 2	98	53	343528	8146546	12.95	4.53	2.00	44.22
			354743	8153021				
Line 3	98	53	343778	8146113	12.95	4.53	1.66	36.60
			354993	8152588				
Line 4	98	53	344028	8145680	12.95	4.53	1.45	31.93
			355243	8152155				
Line 5	98	53	344278	8145247	12.95	4.53	1.45	31.96
			355493	8151722				
Line 6	98	53	344528	8144814	12.95	4.53	1.07	23.64
			355743	8151289				
Line 7	98	53	344778	8144381	12.95	4.53	1.18	25.97
			355993	8150856				
Line 8	98	53	345028	8143948	12.95	4.53	0.79	17.48
			356243	8150423				
Line 9	98	53	345300	8143527	12.93	4.52	1.14	25.26
			356493	8149990				
Line 10	98	53	345550	8143094	12.93	4.52	0.99	21.87
			356743	8149557				
Line 11	98	53	337573	8137911	22.43	7.85	1.59	20.27
			356993	8149124				

Infrastructure	EP	Zone*	Easting (approx.)	Northing (approx.)	Total length of 3D seismic lines (km)	Total line survey area (ha)**	Estimated vegetation clearing seismic line (ha)^	Estimated % of vegetation clearing extent for seismic line
Line 12	98	53	337823	8137478	22.43	7.85	1.56	19.92
			357243	8148691				
Line 13	98	53	338073	8137045	22.43	7.85	2.00	25.51
			357493	8148258				
Line 14	98	53	338323	8136612	22.43	7.85	2.39	30.39
			357743	8147825				
Line 15	98	53	338573	8136179	22.43	7.85	2.05	26.10
			357993	8147392				
Line 16	98	53	338823	8135746	22.43	7.85	1.69	21.49
			358243	8146959				
Line 17	98	53	339073	8135313	22.43	7.85	2.22	28.25
			358493	8146526				
Line 18	98/117	53	339323	8134880	22.43	7.85	1.90	24.24
			358743	8146093				
Line 19	98/117	53	339573	8134447	22.43	7.85	1.68	21.42
			358993	8145660				
Line 20	98/117	53	339823	8134014	22.43	7.85	2.42	30.81
			359243	8145227				
Line 21	98/117	53	340073	8133581	22.43	7.85	2.49	31.67
			359493	8144794				
Line 22	98/117	53	340323	8133148	22.43	7.85	2.60	33.16
			359743	8144361				
Line 23	98/117	53	340594	8132728	22.40	7.84	1.71	21.76
			359993	8143928				

Infrastructure	EP	Zone*	Easting (approx.)	Northing (approx.)	Total length of 3D seismic lines (km)	Total line survey area (ha)**	Estimated vegetation clearing seismic line (ha)^	Estimated % of vegetation clearing extent for seismic line
Line 24	98/117	53	340844	8132295	22.40	7.84	1.47	18.80
			360243	8143495				
Line 25	98/117	53	341094	8131862	22.40	7.84	1.31	16.72
			360493	8143062				
Line 26	98/117	53	341344	8131429	22.40	7.84	1.05	13.33
			360743	8142629				
Line 27	98/117	53	341594	8130996	22.40	7.84	1.52	19.37
			360993	8142196				
Line 28	98/117	53	341844	8130563	22.40	7.84	1.70	21.74
			361243	8141763				
Line 29	98/117	53	350408	8134930	12.80	4.48	1.19	26.64
			361493	8141330				
Line 30	98/117	53	351416	8134934	11.93	4.17	0.92	21.94
			361743	8140897				
Line 31	98/117	53	352424	8134938	11.05	3.87	0.68	17.55
			361993	8140463				
Line 32	98/117	53	353431	8134943	10.18	3.56	0.63	17.72
			362243	8140030				
Line 33	98/117	53	354439	8134947	9.30	3.26	0.39	11.97
			362493	8139597				
Line 34	98/117	53	355447	8134952	8.42	2.95	0.78	26.38
			362743	8139164				
Line 35	98/117	53	356455	8134956	7.55	2.64	0.95	36.12
			362993	8138731				

Infrastructure	EP	Zone*	Easting (approx.)	Northing (approx.)	Total length of 3D seismic lines (km)	Total line survey area (ha)**	Estimated vegetation clearing seismic line (ha)^	Estimated % of vegetation clearing extent for seismic line
Line 36	98/117	53	357484	8134973	6.65	2.33	0.89	38.23
			363243	8138298				
Line 37	98/117	53	358492	8134978	5.77	2.02	0.81	40.10
			363493	8137865				
Line 38	98/117	53	359500	8134982	4.90	1.72	0.53	30.76
			363743	8137432				
Line 39	98/117	53	360507	8134987	4.03	1.41	0.52	37.03
			363993	8136999				
Line 40	98/117	53	361515	8134991	3.15	1.10	0.49	44.47
			364243	8136566				
Line 41	98/117	53	362523	8134996	2.28	0.80	0.41	51.84
			364493	8136133				
Line 42	98/117	53	363531	8135000	1.40	0.49	0.06	11.96
			364743	8135700				
Total footprint					632.35	221.36	56.25 [#]	25.41

*Universal Transverse Mercator (UTM) geographic coordinate system is Geocentric Datum of Australia (GDA) 94.

**Footprint area for 3D seismic based on 'worse-case scenario' of 3.5 m wide seismic lines. It is noted that soil and vegetation will be pushed up into nearby bushland.

^ Estimated vegetation clearing and % of vegetation disturbance required has been calculated from GIS modelling of shrub and tree vegetation types only (excluded bare earth, grass and dry grass areas) and Tamboran no clearing areas (refer Figure 5 and Appendix A). It is expected that no more than 56.25 ha of vegetation clearing will be required for the 3D seismic program.

It is anticipated that clearing will be 56.25 ha, however a 20 ha contingency allowance included to accommodate seasonal regrowth variability in the survey area from the wet season.

3.5 Land clearing – regional context

Although the 3D seismic will not conduct land clearing activities, the 3D seismic program allows for new disturbance in the form of worse-case scenario vegetation clearing (tree and shrub layer only) of ~56.25 ha plus 20 ha contingency (total 76.25 ha). The combined surface disturbance from all Tamboran B2 Pty Ltd activities is ~396.5 ha across three EPs (1,855,500 ha/18,555 km²), or ~0.024% of the total surface area.

Table 20 shows the estimated cumulative clearing across Tamboran's and neighbouring EPs by onshore petroleum operators. Onshore petroleum activities have a disturbance below <0.028% of the total surface area of all current operational EPs. This figure (~1,101.2 ha) is highly conservative, as it indicates approved clearing levels and not actual clearing levels. Compared to the approved clearing (2003 – 2024) on neighbouring pastoral stations within the Barkly/Gulf districts (~26,000 ha), land clearing for onshore petroleum activities is negligible.¹⁰

Table 20: Approximate cumulative surface disturbance (%) vs EPs (all interest holders)

Interest holder	EP	Exploration permit areas		Clearing ha	Land clearing %
		km ²	Ha		
Tamboran	117	6,375	637,500	171.6	0.027
	98	10,300	1,030,000	224.9	0.022
	76	1,880	188,000	7.7	0.004
Sweetpea (a wholly owned subsidiary of Tamboran)	136	4,181	418,100	212.0	0.051
Santos	161	13,350	1,335,000	233.0	0.017
Imperial	187	2,998	299,800	252.0	0.084
TOTAL		39,084	3,908,400	1,101.2	0.028

3.6 Proximity to sensitive receptors

The SS 3D seismic program predominantly consists of open woodlands consisting of mixed Eucalyptus/Corymbia species with a mixed tussock grass understorey. Large, scattered stands of Lancewood (*Acacia shirleyi*) and Bullwaddy (*Macropteranthus kekwickii*) vegetation communities also occur throughout, along with individuals of each species dispersed throughout. In the wider landscape, additional vegetation communities associated with drainage lines, grasslands/floodplains and *Acacia* sp. shrublands also occur and are well represented across the region.

The worst-case scenario for total disturbance from the SS 3D seismic program is estimated as 56 ha based on 3.5 m wide seismic line using 'low impact' survey methods and avoiding large habitat trees or sensitive flora (i.e. dense vegetation patches). Line preparation for the planned SS 3D seismic program is discussed further in section 3.7.1. It is anticipated that clearing will be 56.25 ha, with a 20-ha contingency to accommodate seasonal regrowth variability in the survey area from the wet season.

Approximate separation distances to the nearest environmental and community receptors are illustrated in Figure 6 and summarised in Table 21.

¹⁰ See pastoral land clearing applications and permits: <https://nt.gov.au/property/land-clearing/pastoral-land/pastoral-land-clearing-applications-and-permits>.

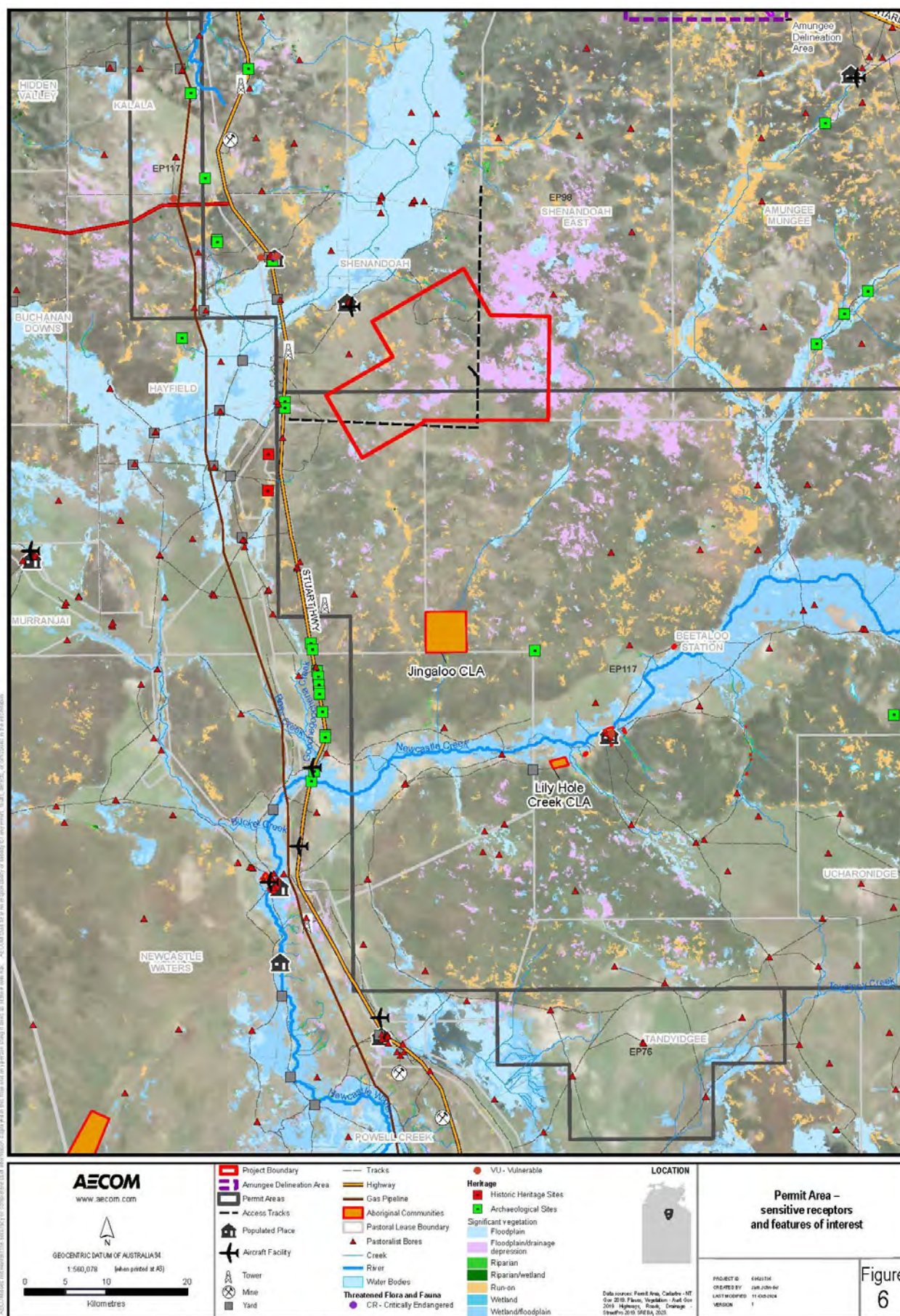


Figure 6: Proximity of exploration sites to sensitive receptors and features of interest

Table 21: 3D seismic program area environmental and community receptors

Sensitive Receptor	Distance from Shenandoah South E&A 3D seismic 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
Jingaloo community living area	25 to 45 km south
Lily Hole community living area	45 to 65 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 and F = Floodplain system)	Seismic lines intersect with floodplains (low sensitivity) throughout the SS 3D seismic area.

3.7 Seismic survey

Tamboran are proposing to implement a 'low impact' 3D seismic survey by designing the program to minimise ground and vegetation disturbance to the greatest extent possible while still obtaining high quality seismic data to inform future technical and commercial viability of the underlying shales within EP 98 and 117.

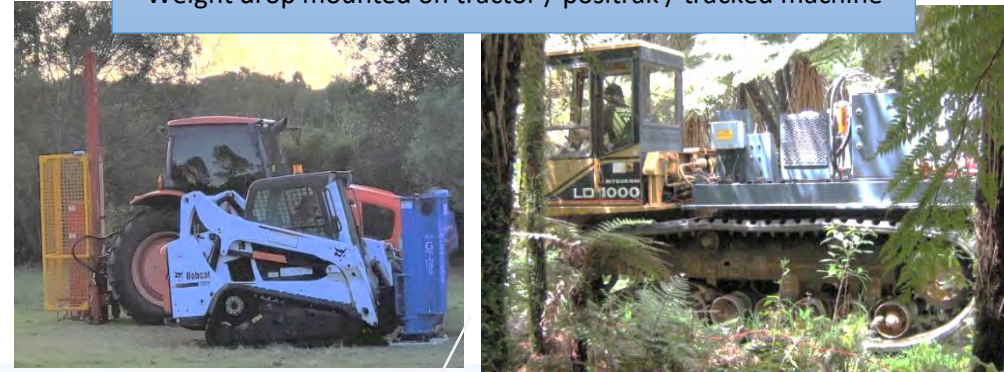
The 3D seismic survey is approximately 640 km long, comprising of 42 lines ranging from 1.4 km to 22.4 km in the Shenandoah South E&A area. This equates to an area of 221.4 ha based on a 3.5 m wide seismic line (Figure 5). The predicted disturbance level of the activity is anticipated to be 56.25 ha, which is restricted to the area required to clear the shrub and tree layer. The remaining area will be traversed by equipment, with minimal removal of vegetation required. The cumulative impact of surface disturbance across the EPs is discussed further in section 3.5 and 3.8.8.

Seismic survey uses a sound wave source from an energy source at the surface to propagate sound waves into the earth. The sound waves that reflect off underground rock formations are captured by recording sensors called geophones. Analysing the time sound waves take to return provides valuable information about rock types and an estimate of depth for rock formations. The returning reflections are recorded in a digital format and sent to a seismic data processing centre to produce a cross-section image of the layers of the earth's crust (process seismic image). The collection of the seismic data will characterise the underlying shales to better understand formation depth, thickness, variability and lateral continuity.

Tamboran SS 3D seismic program is proposing to use two different energy sources, accelerated weight drop (AWD) and seismic charges which use dynamite. Both energy sources use a much smaller vehicle than the traditional vibroseis truck. A test trial of the AWD was completed in late 2024 with results pending. Further testing may be completed on seismic charges; however, testing has not been completed to date. Depending on outcome of the test trial(s), vibroseis methods may also be used as an energy source. The calculated disturbance described in this section of the EMP is based off the vibroseis method as worst-case. Figure 7 provides an overview schematic of the 3D seismic activities proposed.

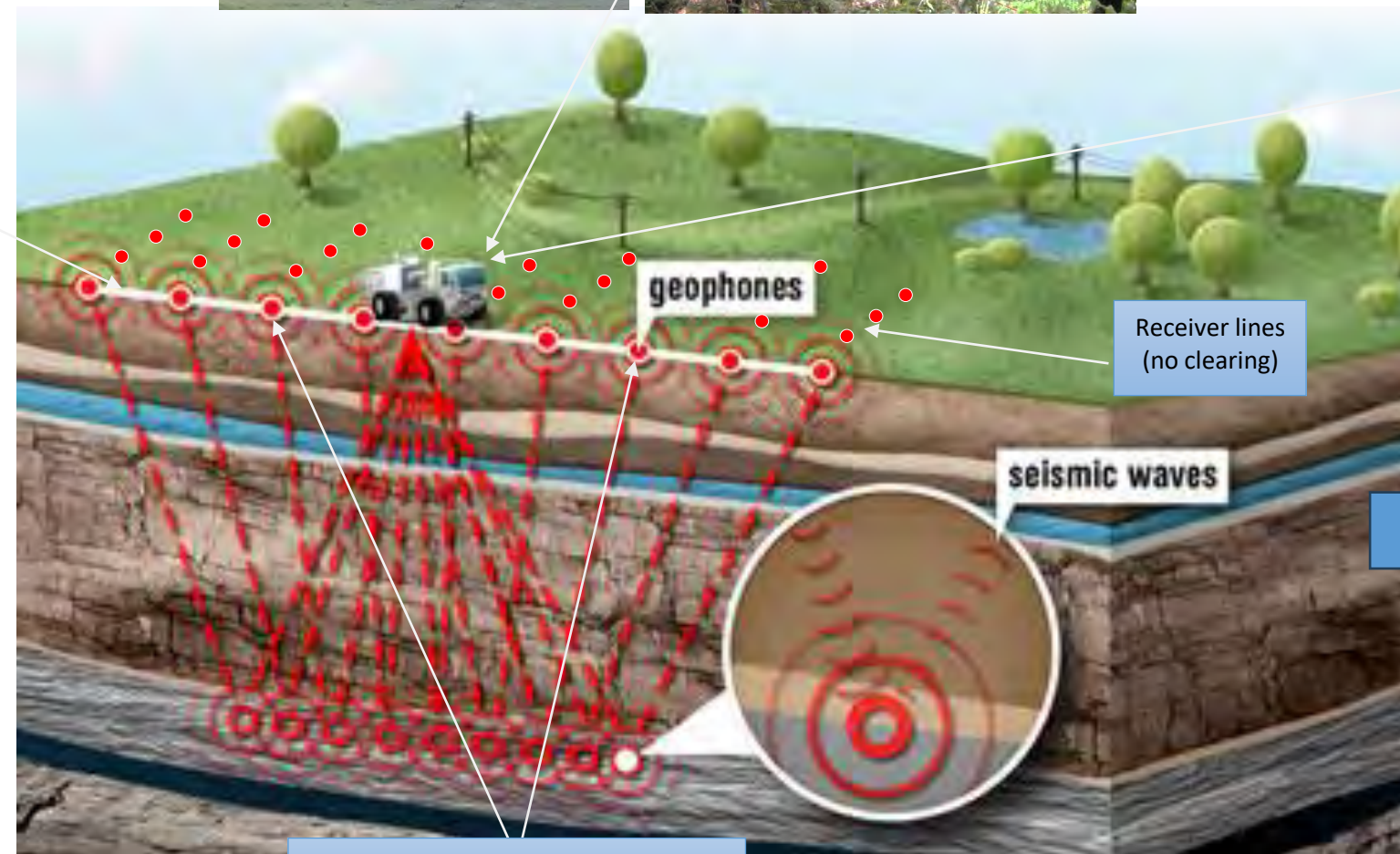
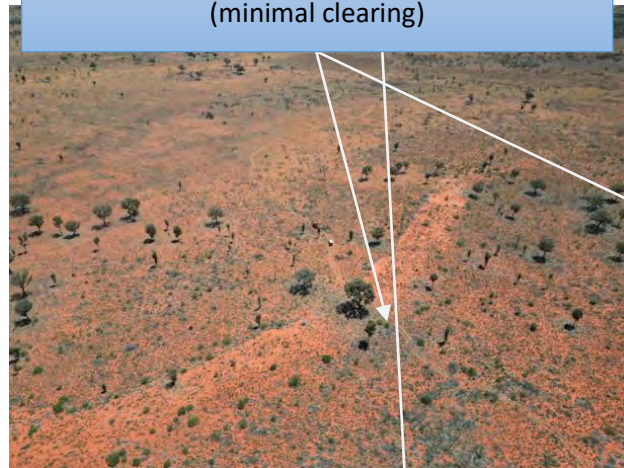
3D Seismic Overview

Energy Source
Weight drop mounted on tractor / positrak / tracked machine



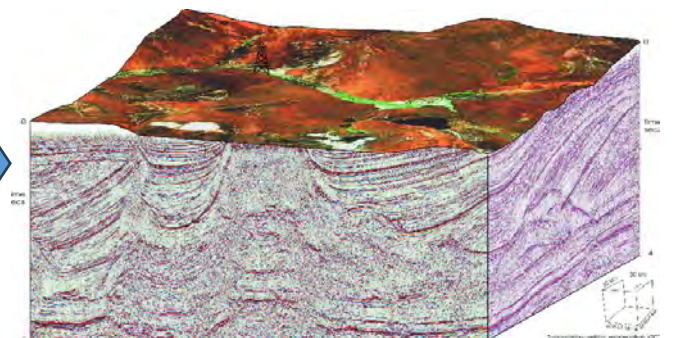
Energy Source
seismic charges

Source lines
(minimal clearing)



Receiver- Geophones / Nodes

Production of 3D subsurface
model



Seismic Line Rehabilitation

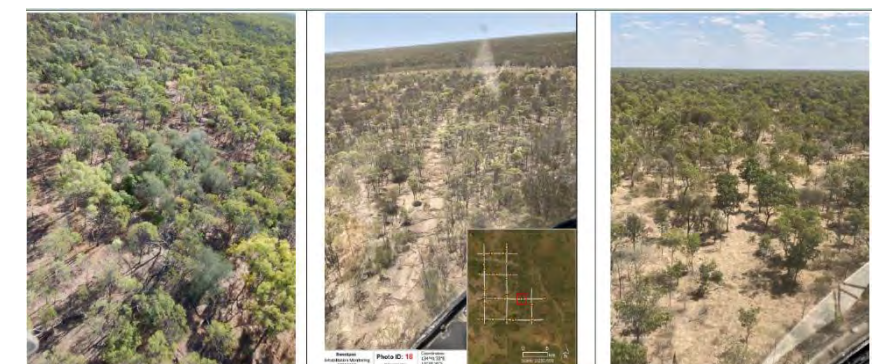
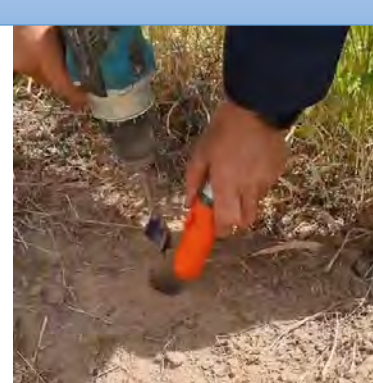


Figure 7: 3D seismic activity overview

3.7.1 Line preparation

A line pointer/surveyor, along with the Cultural Managers, will be the first to access any unprepared seismic lines. This team will record access routes, create mud maps and mark hazards and obstacles with water-based, biodegradable paint or flagging tape for the seismic acquisition team to follow.

The 3D seismic area will be broken down into paddock sections to coincide with the existing pastoral access tracks and fence lines which will then be used to gain access to the seismic line. Where the seismic line ends, the vehicles will return the way they came to the existing access track/fence line. However, where encounter the no clear areas or an obstacle (e.g. heritage place, water hole), options would include to either stop the line at that point and return the way they came, or manoeuvre around the obstacle (taking into consideration any buffers) with detours up to 50 m – 150 m.

Seismic lines will need to be prepared to a width of 3.5 m to allow access and safe passage for the seismic vehicles and support vehicles. This activity is the greatest source of environmental impact because of associated loss of vegetation, loss of habitat and the possibility of soil destabilisation, creating increased risk of erosion and sedimentation, compaction, as well as weed establishment locations if no controls were implemented.

Tamboran have designed the 3D seismic acquisition to:

8. avoid preparation of seismic lines in areas of denser vegetation communities (i.e. Lancewood/Bullwaddy vegetation communities) through pre-deployment planning (i.e. refer to 'no clearing areas' identified in Figure 5)
9. reduce surface disturbance by having the seismic acquisition vehicles and 4WD support vehicles stay within the 3.5 m wide corridor and minimise the number of vehicle passes along the line
10. line preparation and seismic vehicles will traverse over and around vegetation, crushing vegetation in the immediate area to avoid the removal of vegetation, rootstock, topsoil and seed-load which thus reduces the risk of erosion and increases the rate of vegetation recovery
 - where vegetation needs to be pushed outside the 3.5 m wide corridor for safe operations, will be respread across the disturbance area following completion of seismic acquisition as part of rehabilitation
 - avoid clearing of all large trees >25cm diameter at 1.3 m high and vegetated area through weaving around trees and any trees with active hollows or nests
 - using lower impact energy sources such as accelerated weight drop (AWD) and seismic charges to reduce compaction and clearing requirements
11. only traversing sensitive vegetation communities (drainage lines / drainage depressions / claypans / ephemeral waterholes) and in close proximity to heritage places and objects on foot
 - avoid entering saturated and waterlogged areas
 - implement the buffers as per section 3.7.8.

The 3D seismic program is not proposing conventional vegetation clearing in the sense of the NTG Land Clearing Guidelines (2024) but are proposing to leave minimal surface disturbance within the 3.5 m wide line. The key step to avoiding vegetation clearing is through early project planning, to ensure the seismic program is designed to avoid vegetated areas as much as possible. An interactive supervised classification method was used to optimise the proposed 3D seismic line location to minimise clearing. The interactive supervised classification method used Sentinel 10 m resolution satellite imagery with infrared band, captured on 24 December 2023, to identify vegetated areas.

An assessment of ground type was completed (i.e. bare earth, dry grass, grass, shrubs and trees) along each seismic line, with lines modified or removed to avoid densely vegetated areas. Results of the supervised classification are presented in Table 22 and shown in Figure 5 (refer to section 3.3.1). Full details of the assessment are presented in Appendix A, noting the Land Condition Assessment was based on 5 m and refined further in preparing this EMP.

Table 22: Ground condition description of planned 3D seismic disturbance area

Line	Ground Condition Disturbance (ha)					
	Bare Earth	Dry Grass	Grass	Shrub	Tree*	Total
Line 1	0.06	1.48	1.08	1.28	0.63	4.53
Line 2	0.10	1.42	1.02	1.36	0.64	4.53
Line 3	0.19	1.54	1.15	1.17	0.49	4.53
Line 4	0.18	1.55	1.35	0.96	0.49	4.53
Line 5	0.11	1.72	1.26	0.91	0.54	4.53
Line 6	0.12	2.04	1.31	0.81	0.26	4.53
Line 7	0.26	2.11	0.98	0.95	0.22	4.53
Line 8	0.27	2.09	1.38	0.71	0.08	4.53
Line 9	0.42	1.64	1.32	0.98	0.16	4.52
Line 10	0.61	1.75	1.18	0.86	0.13	4.52
Line 11	1.09	2.45	2.72	1.23	0.36	7.85
Line 12	1.05	2.84	2.40	1.23	0.33	7.85
Line 13	1.24	2.53	2.08	1.58	0.43	7.85
Line 14	1.26	2.36	1.84	1.67	0.71	7.85
Line 15	0.64	3.33	1.83	1.44	0.61	7.85
Line 16	0.48	3.28	2.40	1.20	0.49	7.85
Line 17	0.47	2.83	2.33	1.33	0.89	7.85
Line 18	0.93	3.40	1.62	1.14	0.77	7.85
Line 19	0.73	3.48	1.95	0.77	0.91	7.85
Line 20	0.45	2.73	2.25	1.06	1.36	7.85
Line 21	0.59	2.16	2.61	0.83	1.66	7.85
Line 22	0.47	2.30	2.48	1.08	1.52	7.85
Line 23	0.80	3.27	2.06	0.79	0.92	7.84
Line 24	0.84	3.36	2.17	0.74	0.74	7.84
Line 25	0.71	3.75	2.07	0.79	0.52	7.84
Line 26	0.56	3.79	2.44	0.59	0.46	7.84
Line 27	0.54	2.68	3.10	0.62	0.90	7.84
Line 28	0.79	2.39	2.96	0.82	0.89	7.84
Line 29	0.09	1.26	1.93	0.69	0.50	4.48
Line 30	0.16	1.39	1.71	0.56	0.35	4.17
Line 31	0.21	1.14	1.83	0.43	0.25	3.87
Line 32	0.12	1.04	1.78	0.38	0.25	3.56

Line	Ground Condition Disturbance (ha)					
	Bare Earth	Dry Grass	Grass	Shrub	Tree*	Total
Line 33	0.07	1.41	1.39	0.27	0.12	3.26
Line 34	0.06	0.94	1.17	0.57	0.21	2.95
Line 35	0.02	0.62	1.04	0.73	0.23	2.64
Line 36	0.03	0.55	0.86	0.62	0.27	2.33
Line 37	0.04	0.37	0.81	0.67	0.14	2.02
Line 38	0.03	0.61	0.54	0.45	0.08	1.72
Line 39	0.05	0.55	0.30	0.45	0.07	1.41
Line 40	0.00	0.44	0.17	0.44	0.05	1.10
Line 41	0.05	0.20	0.14	0.39	0.02	0.80
Line 42	0.0	0.39	0.04	0.06	0.00	0.49
Total disturbance	16.9	81.2	67.0	35.6	20.6	221.4
% of 3D seismic survey area^	8	37	30	16	9	100
% of Shenandoah South E&A area^	0.05	0.26	0.21	0.11	0.07	0.18

* Tree classification based on >25 cm diameter; 1.3 m high

^ Percentage calculated based on total 3D seismic survey area of 221.36 ha (at 3.5 m wide seismic lines) and total Shenandoah South E&A area of 31,418 ha.

The seismic line disturbance area, based on worse-case scenario of 3.5 m wide lines, indicates 75% of the seismic survey area occur within bare earth, dry grass and grass land classification (8%, 37% and 37% respectively). Within these land classification areas, line preparation would be blade-up dozer or positrak or similar that sole purpose is to push over the grasses to reduce fire hazard in engine bays and remove large rocks or fallen branches to provide safe access to the survey crew and provide effective access to the seismic source. It is not anticipated that additional tracks to access seismic lines will be required by using the existing pastoral tracks and fencelines that intersect the survey area and the seismic lines themselves (refer Figure 3).

The shrub and tree land classification areas assessed along the seismic line will require a level of smaller trees and shrub clearance (>25cm diameter at 1.3 m high), where avoidance is not possible. The area of tree and shrub disturbance was calculated to be approximately 25% of the seismic survey area (or 16% of shrub layer and 9% of tree layer). It is anticipated that these clearing levels will be further reduced during the execution of the seismic program, where equipment will avoid large trees/ densely vegetated areas through weaving around them. Minimising the removal of vegetation, rootstock, topsoil and seed-load reduces the risk of erosion and increases the rate of vegetation recovery post the seismic survey acquisition.

Where vegetation clearance is unavoidable, the felled vegetation will be pushed temporarily into the nearby bushland and pulled back across the line during rehabilitation, along with the removal of any windrows. It is noted that the overall total percent disturbance from the 3D seismic program across the entire Shenandoah South E&A area of 31,418 ha is only 0.18%, meaning there is 99.8% of the area that will remain untouched by the seismic program.

There are no creeks that will be intersected during the SS 3D seismic program and one small intermittent stream (stream order 1) located in the north of the survey area (Figure 6). In addition, there are some occurrences of palustrine (non-riverine or non-channel systems) and floodplain systems, with shallow depressions and gullies as expected in an ephemeral wetland area. As per section 4.1.5 the wetlands that occur in the SS 3D seismic program are considered low value wetlands. Regardless, where it is necessary to have stream crossings the following controls will be implemented:

- no vegetation clearing within 25 m of the outer edge of the drainage depression
- detours will be made to find the least sensitive crossing point (up to 50 m diversion)
- crossing of waterways are to be on straight sections, avoiding bends and trees

12. crossings of waterways will be as close as practicable to right angles

- ongoing monitoring of waterway condition, prior to, during and at completion of rehabilitation
- Reinstatement crossing points to the original topography as part of rehabilitation.

During the SS 3D seismic survey, Tamboran will implement measures in areas of intermittent streams and the broader wetland area that will minimise impacts by avoiding activities in a waterway that will not materially change the shape of the waterway, the volume, speed or direction, divert local water or cause change to the bed or bank stability (refer to section 6.6 and Appendix E).

To reduce the risk of bushfire, a spotter vehicle with a fire tender will be used during all seismic acquisition activities within the permit area. Any fires detected will be promptly extinguished.

3.7.2 Accelerated weight drop

The AWD is a low impact seismic energy source mounted on a tractor/ positrak / tracked machine which has a smaller surface footprint than the more traditional vibroseis trucks. The AWD generally require low to no vegetation clearing to access the seismic lines. The AWD is anticipated to be used in combination with seismic charges to access hard to get to areas and reduce vegetation clearing (refer to section 3.4.3). The AWD is a technology that uses high pressure air or elastomer rubber bands to accelerate a heavy weight hammer to hit a base plate coupled to the ground from a distance of 2 to 3 m. The force acting on the ground produces shock pulses which then propagate as seismic waves and detected by the geophones (Alfian *et al.* 2019) (section 3.4.4).

Figure 8 provides examples of the AWD mounted on a positrak or tracked machine.



Figure 8: Example of accelerated weight drop mounted on tractor / positrak / tracked machine

The AWD source points are more densely spaced than larger sources such as vibroseis trucks and may be in the order of 5 to 20 m along a seismic line. Source lines will typically be separated by 500 m. Seismic charges will be used to infill areas with restricted access such as densely vegetated areas.

3.7.3 Seismic charge installation

Where access to densely vegetated areas or hard to survey areas is required, the seismic survey will be undertaken using seismic charges to minimise the clearing of vegetation. Seismic charges which use dynamite create a larger energy source, which can extend the seismic wave further than AWD. In such surveys, additional nodes will be installed within the dense vegetation or watercourses by foot to minimise data gaps (section 3.7.5).

Seismic acquisition using small dynamite charges reduces the required land clearing substantially (~90% less clearing). Small charges are placed at 10 to 15 m below the ground surface using a small ATV/4WD mounted auger (Figure 9).



Figure 9: Example of a small rig that could be used for installing dynamite charges during a seismic survey

This approach reduces the need to clear vegetation, with the charges being able to be placed around vegetation to reduce clearing. Small amount of clearing may still be required to access extremely dense vegetation, but this is anticipated to be minimal.

A 200 g to 1,000 g high performance pentolite charge will be used. This charge is specifically designed for seismic surveying. The charges are packed in place within each shot hole, with the blast contained within the subsurface (i.e. no expulsion of earth from the surface). Figure 10 is an example of a typical small seismic charge used during a New Zealand seismic shoot.



Figure 10: Example of loaded charge in hole ready for detonation and example of a charge used in seismic survey acquisition; charge length is approximately 400 – 500 mm

Charges will be offset from sensitive sights and infrastructure. Offsetting distances are guided by Australian Standards. When detonation occurs all personnel under the instruction of the shot firer are to observe safe set back distances (20 to 25 m). A short sharp thud will be heard, and potential small level of vibration felt within 1-2 km of charge going off.

Misfires are considered rare and are likely to have a rate of less than 1%. In the event of a misfire a drill rig will be on standby to drill and load a new charge offset at approximately 2 m. This will provide replacement data and likely sympathetic detonation or at a minimum break the plastic seal to accelerate bioremediation of the charge. Explosives will be stored on existing cleared areas or on seismic line in permitted magazine which adheres to Australian Standards (AS2187).

All misfires and the success of sympathetic detonations will be logged during the seismic survey, including Global Positioning System (GPS) coordinates and depth. Where sympathetic detonation cannot be validated, a small metal cattle proof marker shall be installed to inform the land users of the location of the hazard. These will be provided to DLPE and the pastoralists.

3.7.4 Vibroseis

If the use of AWD or shot hole is not feasible, vibroseis trucks maybe used for the seismic source. A vibroseis survey involves the establishment of cleared source lines for the vibroseis trucks to operate on. For the 3D seismic survey, it is not anticipated that the seismic line will need to be increased should vibroseis trucks be required then what is already proposed width of 3.5 m. The 20 ha contingency allowance has been incorporated in event vibroseis is needed.

Line preparation will be implemented in a manner that minimises the removal of vegetation, rootstock, topsoil and seed-load, although vegetation clearing will be required so that the vibroseis trucks can drive and operate over the survey area (Figure 11). Source lines will be prepared by a dozer/positrak to a width of 3.5 m. The line position, plus tolerances for weaving the line around vegetation are pre-programmed into GPS units.

Seismic lines will still be located to avoid dense vegetation patches (i.e. Lancewood/Bullwaddy vegetation community), avoid large habitat trees or sensitive flora, with no vegetation clearing in watercourses and associated riparian vegetation. In areas with low vegetation density (such as *Corymbia* / *Erythrophleum* open woodland) ground disturbance will be restricted to the removal of rocks and fallen branches and the pushing over or slashing of grasses and shrubs to provide effective ground contact of the seismic vibro-source and the geophones and minimise the risk of fire (Figure 12).



Figure 11: Example of a vibroseis truck used during seismic acquisition



Figure 12: Data recording van used during seismic acquisition

3.7.5 Geophone installation

The receivers (nodal geophones) will be hand carried along lines and put into the ground, usually deployed with a handheld drill and auger bit, light 4WD vehicles or ATVs. The nodal geophones are autonomous units, containing the actual geophone as well as battery and data storage in one unit. These nodes are deployed at regular intervals along the non-cleared lines perpendicular to the source lines, these may be able to be carried through areas of riparian vegetation to avoid any damage to vegetation where access permits. The installation of nodes requires minimal disturbance (Figure 13).



Figure 13: Example of a deployed node

3.7.6 Survey execution and data collection

Data recording normally commences two to three weeks after the start of line preparation. This operation is the largest part of the seismic operation in terms of personnel and vehicles. The size of the crew will vary depending on the recording technique used, terrain and season. Recording is generally restricted to daylight hours.

After the energy source is finished the geophones are collected and line rehabilitation and data analysis commence.

In relation to potential impacts of seismic on livestock, cattle will be mustered away from the seismic area prior to commencement of the activity, in consultation with pastoralist. From a noise and vibration perspective, the vibroseis does not create an intrusive level of noise and vibration. The vibration is of less intensity than a cattle truck crossing a cattle grid. As discussed above, a short sharp thud will be heard, and potential small level of vibration felt within 1 km of charge going off; however, with cattle being mustered away from the activity, this should not result in any significant impact.

3.7.7 Rehabilitation

Upon completion of seismic acquisition, the seismic survey area (lines and shot holes) will be rehabilitated. Areas along the seismic lines that have compacted soil surface will be lightly ripped to break up the hardened surface, increase infiltration of water and provide a roughened surface where windblown seeds, rainwater and topsoil can accumulate.

Seismic lines will be inspected prior to commencement of rehabilitation following the completion of the seismic survey to identify areas of concern, including areas where vehicle wheel tracks are deeper than 15 cm or where wheel ruts or could concentrate water flow during rainfall events, or windrows which could leading to rill and gully erosion. These areas will be treated by ripping the site perpendicular to the flow direction, to reduce water flow concentration during rainfall and prevents formation of rills and/or gullies. The depth of ripping is on the degree of compaction and the soil type. Ripping will be carried out on dry soil, rather than moist soil.

It is anticipated that vegetation clearing will be 56.25 ha, however an additional 20 ha contingency (total of 76 ha) is included to accommodate seasonal variations. For example, wet season regrowth may increase the shrub layer or reduce in drier conditions.

Any felled vegetation will be returned across the seismic line upon completion of seismic activities to aid in assist in erosion and sediment control. Root stocks are to be left in place as much as practicable to allow for rapid re-establishment of vegetation.

Seismic charge drill holes will be progressively remediated after firing. Detonation wires will be pulled out and the hole and remaining cuttings will be returned down the hole. A cap will be emplaced 50 cm down the hole and the hole will be backfilled to ensure load bearing and no surface depression is left that might cause injury to cattle or native fauna.

Based on previous experience in the region, most areas will naturally regenerate following rehabilitation. Rehabilitation monitoring will occur on an annual basis until the vegetation has become re-instated, with maintenance on rehabilitated area undertaken as required (refer Appendix G).

In accordance with clause A.3.9(d) of the Code, final rehabilitation activities will return all seismic lines back to a safe, stable and non-polluting form on a trajectory towards pre-disturbance condition refer Appendix G Rehabilitation Plan. For areas that previously contained native vegetation, native vegetation must be re-established such that the corridors become ecologically integrated into the surrounding landscape.

3.7.8 Buffer zones

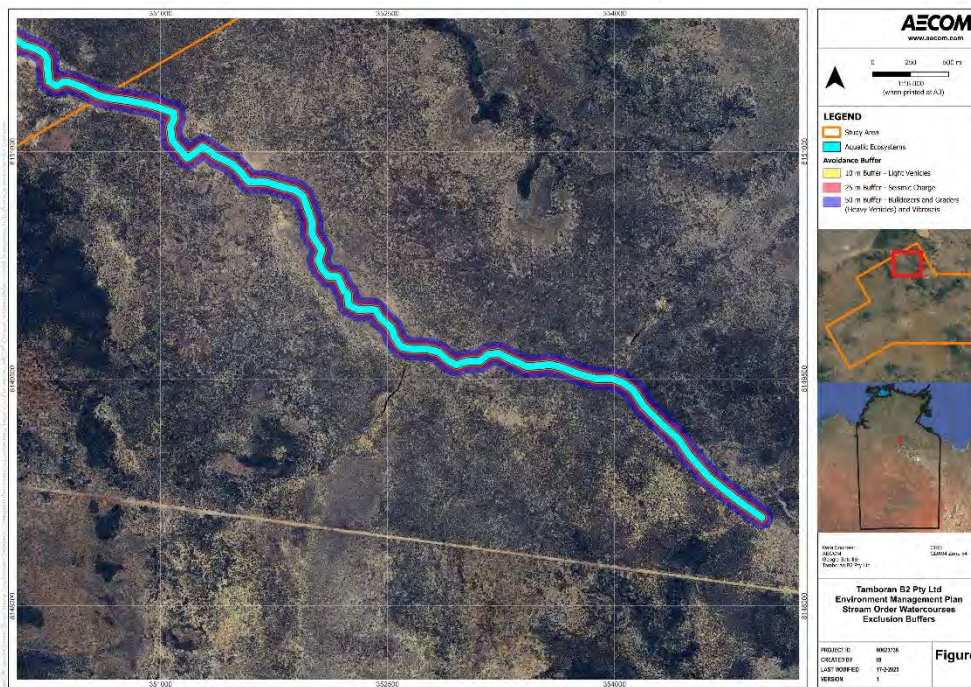
Buffer zones are applied around infrastructure and sensitive areas to minimise the impacts from the SS 3D seismic survey. These are summarised in Table 23 associated with the different activities that may occur during the program. The wetland buffer zones, vegetation buffer zones and heritage artefact areas mean no vegetation clearing can occur and no vehicles to enter, however access on foot to deploy geophones or charges can be done. Cultural managers will be onsite during the 3D seismic survey and an unexpected heritage finds protocol will be in place (Appendix B.2).

Table 23: Seismic survey buffer zones for different access scenarios

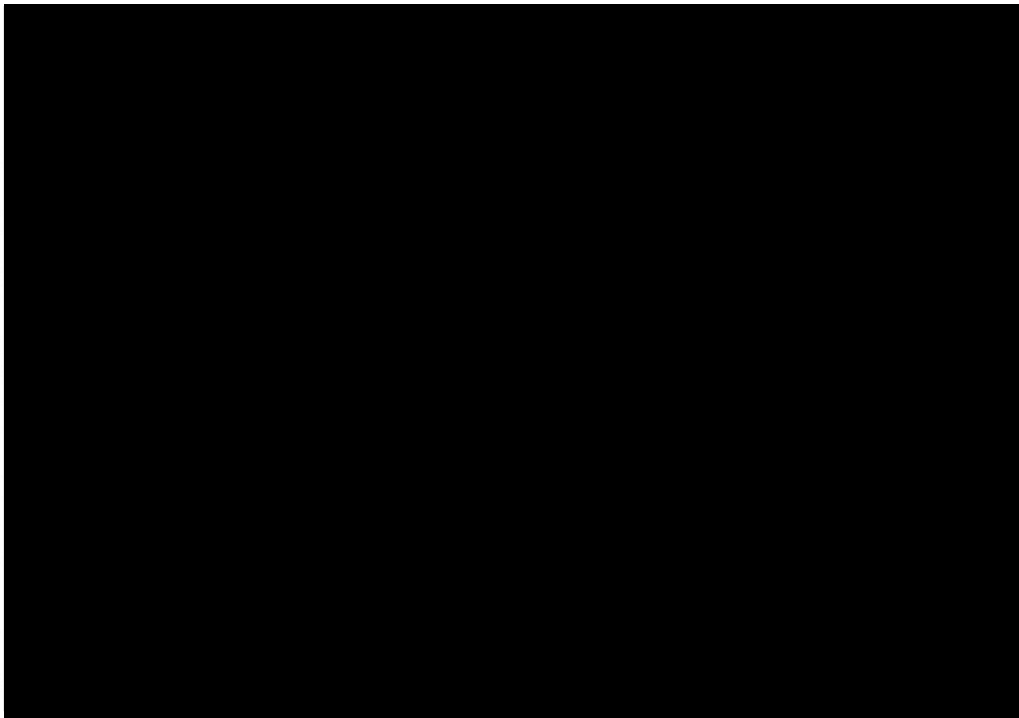
Description	Buffer (m)				
	Dozer/Grader	Vibroseis	Light vehicle*	Seismic charge	Pedestrian
Pastoral property boundaries (vegetation buffer)	200	200	200	200	200
NTG road reserve	50	50	50	50	50
Pipeline	50	50	50	100	-
Water bore	100	100	100	250	-
Active cattle holding yard	100	100	100	250	-
Wetland (drainage lines / drainage depressions / claypans / ephemeral waterholes)	50	50	10	25	-
Archaeological High Priority Area and Heritage Places	50	50	10	25	25
Isolated heritage object	50	50	10	25	5
Grey Falcon active nests	150	150	150	300	-

* Light vehicle means – dual or single tray 4WD, tractor / positrak / tracked machine / ATV and no vegetation clearing required.

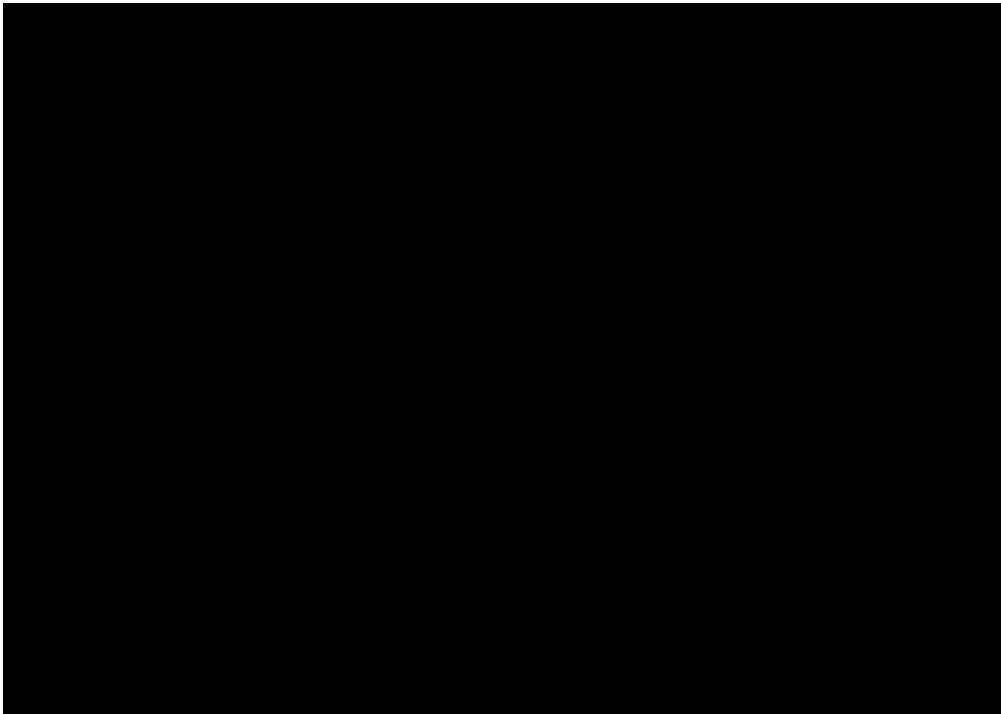
Tamboran will prepare a Field Map Book in addition to providing GIS data to the seismic contractor as part of the Work Instruction development to identify all no-clearing and buffer zone areas. A sample of the Field Maps have been prepared and provided in the below examples.



e.g. of Exclusion Buffer for Stream Order 1 Water Course located in northern 3D seismic area.



e.g. Exclusion buffer of a Archaeological High Priority Area



e.g. Exclusion buffer of Archaeological Place and Object.

3.8 Support activities

The following presents all support activities for the SS 3D seismic program.

3.8.1 Seismic camp operation

Camp accommodation will be required to support the crew from the 3D seismic program. Tamboran propose that the crew will be accommodated at one of the existing main camps located in the Shenandoah South E&A area (i.e. at either Kyalla 117 N2, Shenandoah South 2 or any other established camp within EP 98 or EP 117).

The camp will provide up to 30 to 60 people to be on accommodated over the course of the seismic program. The camp will support two crews that will work 12-hour shifts, plus any additional camp staff, supervisory staff and service company personnel on an as-required basis.

The camp operations will be operated under the Shenandoah South E&A EMP (TAM1-3) and as such will already have sewage treatment plant and wastewater treatment plant approved to operate.

3.8.2 Water supply and use

Water sourced for the SS 3D Seismic EMP activities will be extracted from the existing Gum Ridge Formation bores within the Shenandoah South E&A area. It is estimated that up to 5,000 L/day of non-potable water will be required for dust suppression and track maintenance, and an additional 6,000 L/day of potable water to support the camp operations. Based on assumed 84 days (12 weeks) to conduct the seismic survey it is estimated the total groundwater take will be ~1 ML to support the SS 3D seismic survey.

The anticipated breakdown of groundwater take for the proposed 3D seismic activities consists of the following breakdown per activity:

- 1.0 ML for seismic acquisition – for dust suppression, shot installation and fire tender
- 0.5 ML for seismic line rehabilitation.

Any bores used to support the exploration activities will be registered and covered by an existing Water Extraction Licence (WEL). The current WEL statement of reason is available from DLPE Water Resources website at <http://www.ntlis.nt.gov.au/walaps-portal/report/current/gwel>.

All groundwater take will be metered with continuous flow meters and reported to DLPE as per the WEL conditions. Water take records will be kept and updated weekly during seismic operations, to ensure the water take volumes are not exceeded. Groundwater will be used to supply potable water, with on-site water treatment used to provide water in accordance with the Australian Drinking Water Guidelines.

3.8.3 Chemical and fuel management

Any chemical storage and/or use required to conduct the 3D seismic activities will have all reasonable and practicable measures in place to prevent or minimise pollution or environmental harm; and reduce waste (refer to Appendix H). Chemicals will be stored within designated areas on portable bunding within the camp pad and will be routinely inspected.

Any refuelling or field servicing will have dedicated spill containment on the field servicing truck.

Double-lined diesel storage tanks will be used as per AS 1940:2004 The storage and handling of flammable and combustible liquids. These will be stored within designated areas on the existing camp pad.

Portable storage bunds used will create a temporary relocatable watertight bund that is manufacture to size required for the storage area and meet the relevant Australian Standards. The storage bunds will be able to contain a volume not less than 120% of total stored volume.

Bulk fuel will be used during the SS 3D seismic activities. A summary of expected chemicals is provided in Table 24 and include the following chemical types:

- Bulk diesel: to fuel vehicles and equipment, as well as generate power for camp operations
- Typical workshop and maintenance chemicals including hydraulic oil, coolant, greases, paints, solvents and engine oils
- Degreasers and domestic cleaning chemicals.

Table 24: Anticipated chemical volume and storage for seismic program

Material name	Typical volume	Maximum volume	Unit	Storage area
Diesel	400	800	KL	Diesel storage tanks
Hydraulic oil	1,000	3,000	L	Workshop/Service Truck
Engine oil	1,000	3,000	L	Workshop
Degreasers	100	300	L	Workshop
Pentolite	1,000	2,000	Kg	Permitted magazine on seismic area

3.8.4 Wet season operations

Ground conditions following rainfall events across the region can make access to the survey area impossible. The SS 3D seismic program is anticipated to occur predominantly during the dry season. However, in the event the SS 3D seismic program activities are push out into the wet season, as defined by the Code of the 1 October to 30 April inclusive, the following wet weather contingencies have been identified in the erosion and sediment control plan (ESCP) (Appendix E) and below:

- Wet weather contingency procedures to be implemented from 1 October to 30 April.
- 7-day forecast from the Bureau of Meteorology (BOM) to be monitored, and seismic exploration activities planned around the forecast.
- Weather monitoring to commence prior to mobilisation to site and continue daily from commencement of site works.

- Where forecasts indicate rainfall is likely to result in an event that has potential to limit access to the work area, seismic contractor will stabilise the current work areas and go into standby mode until such time they can assess ground conditions to recommence activities.
- Emergency response – a post-rainfall/flood damage reconnaissance and assessment will be completed once area is accessible. Any damage observed would be repaired as soon as practicable after the event.

3.8.5 Waste management

Waste management methods for the SS 3D seismic program are summarised in Table 25. Waste is managed in accordance with the internationally accepted guide for prioritising waste management practices, with the objective of achieving optimal environmental outcomes. The remote location of the 3D seismic program and limited volume of several of the waste streams that will be generated dictates the practical waste management options available.

Waste will be managed in accordance with the following hierarchy principals:

- **Avoid:** eliminate the generation of wastes through design modification
- **Reduce:** reduce unnecessary resource use or substitute a less resource intensive product or service
- **Re-use:** reuse a waste without further processing
- **Recycle:** recover resources from a waste
- **Treatment:** treat the waste to reduce the hazard of the waste prior to disposal
- **Disposal:** dispose of waste if there is no viable alternative

Waste transfer certificates will be retained and provided to DLPE upon completion of the project.

The volume of waste produced is likely to be small, in the order of less than a 5,000 kg in total. All wastes, specifically listed wastes (as described in Schedule 2 of the Waste Management and Pollution Control (Administration) Regulations 1998) generated as part of the regulated activity will be removed from the activity area, for disposal or recycling at a licensed facility authorised to receive those wastes (as summarised in the NT Listed Waste Company summary spreadsheet).

Waste management methods for the proposed seismic program are summarised in Table 25. It is noted that existing exploration camps will be used for the duration of the 3D seismic program and as such waste and disposal are covered under applicable EMP for the camp operations.

Table 25: Waste and disposal methods

Activity	Disposal method
Sewage, grey and stormwater	Treatment: Sewage, grey water and stormwater treatment covered under separate EMP for camp operations.
Food waste, paper and plastic	Disposal: Collected in dedicated waste bins for back-loading to an approved landfill under separate EMP for camp operations.
Glass and cans	Recycled: Collected in separate waste bins for recycling at an off-site facility under separate EMP for camp operations.
Chemical bags and cardboard packaging materials	Recycled: Collected in separate waste bins for recycling at an off-site facility under separate EMP for camp operations.
Used chemical and fuel drums	Recycled: Collected in designated skip for recycling at an approved location under separate EMP for camp operations.
Vehicle tyres	Disposal: Disposed of at an approved landfill.

Activity	Disposal method
Oily rags, oil-contaminated material, filters and any hydrocarbon material	Recycled/disposal: Oil from machinery will be collected in suitable containers for disposal at approved landfill or recycled at an approved recycling facility.
Spill contaminated soils and water	Disposal: All contaminated material (solids and liquids) will be disposed of off-site at a licenced facility.

3.8.6 Traffic

The periods of highest traffic generated from the SS 3D seismic activities will generally occur over a short duration and are associated with the mobilisation and demobilisation of staff and equipment. The 3D seismic acquisition is expected to be undertaken over a 12-week period or 84 days.

To assess the potential impact on pastoralist and tourism amenity and experience, a Traffic Impact Assessment (TIA) is discussed below. This assessment includes heavy equipment mobilisation to and from site and is a suitable conservative scenario to assess the potential associated traffic impacts and considers existing exploration activities with the Shenandoah South E&A program area.

The TIA involved the following steps:

- Identification of project traffic movements including approach and departure direction
- Existing traffic levels and road level of service
- Assessment of total traffic levels and potential impacts
- Determine required impact-mitigating treatments

The results of the TIA are discussed below.

3.8.6.1 Identification of project traffic movements

Access to the SS 3D seismic area is via the Stuart Highway, approximately 23 km south of the town of Dunmarra. The Stuart Highway is a 130 km/h posted speed limit in the vicinity of the project. The Stuart Highway is also being upgraded and sealed to DLI specifications. A road corridor permit and traffic control will mitigate the risk to road users.

The peak maximum anticipated traffic flow increase associated with the SS 3D seismic activity will be approximately 8 vehicles per day, during mobilisation and demobilisation to and from site and no more than 4 vehicles per day during the main seismic survey. The SS 3D seismic program is proposed over a 12-week period.

Daily transport volumes will largely be reduced by using on-site/regional camps, with busses used to facilitate crew change overs during the peak seismic program period.

3.8.6.2 Existing traffic levels, road capacity and level of service

Existing traffic figures were obtained from station RTVDC020 in the DLI Annual Traffic Report 2023 (DIPL 2023), showing Average Annual Daily Traffic (AADT) figures for the Stuart Highway. The station is located approximately 20 km north of Elliott and 65 km south of the turn-in to the Kyalla 117 access track. It can be assumed that the traffic figures at the Kyalla 117 access turn-in will be like RTVDC020 station.

The total daily traffic flows on the Stuart Highway from the 2023 annual survey data are estimated as 398. The total traffic flows are split relatively evenly between north and south bound traffic (Figure 14). For previous traffic impact assessments, Tamboran inflated the annual traffic figures to account of peak dry season traffic. However, given the estimated daily traffic numbers for the SS 3D seismic program account for a small increase in the number of vehicles per day (i.e. <4 vehicles per day), this assessment uses the existing traffic, approved EMP traffic volumes associated with the Shenandoah South EMP (TAM1-3) and the SPCF EMP (TAM2-3) and the slight increase in traffic volume in the vicinity of the Kyalla 117 turn-in associated with the SS 3D seismic EMP.

AUSTROADS guidelines (Austroads 2020) were used to determine the typical capacity that would be expected by traffic on the Stuart Highway to maintain a free-flow level of service (LOS). The capacity of roads is based on the maximum rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of lane or roadway during a given timeframe. The LOS relates to the operating conditions encountered by traffic as defined in the AUSTROADS guidelines (Austroads 2020). This data was then used to determine the capacity of the Stuart Highway to maintain a Category A (free flowing) LOS for the site. A conservative 700 – 1,000 vehicle/hr/lane figure was used to determine the vehicle movement capacity.

In an urban situation it can be assumed that the peak hour volumes will be about 10% of the daily traffic volumes. However, the remoteness of this site means that a peak hour is not realistic and has not been considered. Due to the low volumes that are likely to be spread over the duration of the day, this is considered appropriate.

Rural Coverage Count Stations
Table: 4.1 AADT For Coverage Stations - 10 Year Period

Year: 2023
Region: Tennant Creek

Road Name / Location	ADT Station	Direction	Units	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Carpentaria Highway 5km East of Tablelands Highway	RTVDC033	Inbound	Veh	51		42		46		41		50	
		Outbound	Veh	46		42		47		37		48	
		Both	Veh	97		84		93		78		98	
Nathan River Road 2km North of Ryans Bend Road	RTVDC034	Inbound	Veh	9		4		6		11		14	
		Outbound	Veh	7		5		6		9		18	
		Both	Veh	16		9		12		20		32	
Newcastle Waters Road 2km West of Stuart Highway	RTVDC037	Inbound	Veh		40		39		29		52		75
		Outbound	Veh		50		51		33		45		68
		Both	Veh		90		90		62		97		143
Old Bing Bong Road 5km North of Borrooloola	RTVDC035	Inbound	Veh	73		59		67		38		75	
		Outbound	Veh	75		49		68		39		74	
		Both	Veh	148		108		135		77		149	
Ranken Road 5km East of Brunette Downs	RTVDC028	Inbound	Veh		1		2		3		1		4
		Outbound	Veh		2		3		1		1		4
		Both	Veh		3		5		4		2		8
Stuart Highway 20km North of Elliott	RTVDC020	Inbound	Veh	222	229	223	280	262	233	174	284	292	220
		Outbound	Veh	213	213	222	271	247	227	167	263	273	178
		Both	Veh	435	442	445	551	509	460	341	547	565	398
Stuart Highway 15km South of Wauchope	RTVDC021	Inbound	Veh	206	183	198	185	225	235	152	151	216	189
		Outbound	Veh	192	170	186	161	213	195	154	143	273	180
		Both	Veh	398	353	384	346	438	430	306	294	489	369
Stuart Highway 30km North of Barrow Creek	RTVDC022	Inbound	Veh	189	163	208	197	197	189	129	206	202	213
		Outbound	Veh	188	142	191	171	184	150	133	211	175	188
		Both	Veh	377	305	399	368	381	339	262	417	377	401

Figure 14: Traffic flows on the Stuart Highway at ADT station RTVOC020, approximately 65 km south of the site access turn-in (DIPL, 2023)

3.8.6.3 Assessment of total traffic levels and reduction to road capacity and level of service

The total anticipated peak traffic volume for the Stuart Highway – Kyalla 117 turn-in for the 3D seismic program has been determined at 4 vehicles per day, with a slight increase to 8 vehicles during the initial mobilisation (~2-3 days) and demobilisation (~2-3 days). This consists of a temporary additional peak project vehicle movement level of 4-8 vehicles per day in addition to the existing peak dry season traffic volumes of 398 vehicles per day.

The total volume of traffic is considerably lower than the capacity of the Stuart Highway, with any reduction in LOS from the volume of the 3D seismic traffic considered extremely unlikely.

Traffic LOS may also be impacted through changes in traffic compositions, with the volume of trucks affecting the road capacity greater than light vehicles. To assess the changes in traffic composition, vehicle category data obtained from the [DIPL Annual Traffic Report 2023](#) were assessed against expected total project traffic figures. These figures were then increased by 50% to represent peak dry season traffic volumes. The assessment is provided in Table 26.

Table 26: Traffic impact summary for the Stuart Highway – existing versus proposed additional based on 50% increase

Vehicle category	Existing vehicles per day (vpd) and % (approx.)	TAM1-2 and TAM2-2 additional vpd	3D Seismic additional vdp	Total vpd during activity and % (approx.)
Short (light vehicles)	468 (78%)	23	4	495 vpd (74%)
Medium (heavy vehicles or short towing)	92 (15%)	6	0	98 vpd (15%)
Long (heavy vehicles)	13 (2%)	6	0	19 vpd (3%)
Medium combination (heavy vehicles)	24 (4%)	1	0	25 vpd (4%)
Large combination (heavy vehicles)	0 (0%)	30	0	30 vpd (4%)

(adapted from DIPL 2023)

The results in Table 26 demonstrate that there are no significant changes in traffic composition associated with the SS 3D seismic program, and there is unlikely to be any significantly impact upon the road's capacity and LOS.

3.8.6.4 Traffic risk management strategies

The management of risks of injury to staff, contractors and the community is a key focus of every Tamboran activity. To reduce the risks associated transport, all vehicle movements undertaken as a part of Tamboran activities must comply with the National Land Transport Directive. Mandatory controls include:

- Avoiding vehicle movements where possible (by using buses and aircraft to transport personnel)
- Driving at night to be avoided
- All drivers hold appropriate drivers' licence
- Zero alcohol and drug policy – with all staff breath tested when on-site and random drug tests completed.
- Fatigue management policy – with mandatory breaks required for every 2 hours and maximum 10 hours in a single 24-hour period working hours (unless the driver of a fatigue regulated heavy vehicle, where the driver must then comply with the applicable law for fatigue management where the vehicle is operated).
- Chain of responsibility training for all logistics/supply chain roles to ensure they understand their obligations to ensure the safety of their transport activities under the Heavy Vehicle National Law
- Journey management plan requirements for all remote journeys, with all journeys lodged with the Tamboran HSE team
- Requirements to comply with the National Transport Code Load Restraint Guide

- Contractor and employee driver performance tracking and reporting, with all breaches investigated, formally documented and disciplinary actions taken.

In addition to the above requirements, Tamboran has also implemented the following additional controls:

- Current use of the intersection of the site access track with the Stuart Highway was previously approved by DLI with traffic management in place where required. Ongoing engagement with DLI is underway covering all future exploration activities and intersection upgrades, including obtaining approval under the Planning Scheme 2020, which is separate to the approval required under the Petroleum (Environment) Regulation 2016.
- Communication with pastoralists when /multiple transports are likely to occur.
- Peak transport period to be restricted to mobilisation and demobilisation of 3D seismic acquisition equipment and personnel, with most mobilisations occurring via internal access tracks.
- The use of existing Tamboran camps in the exploration permit area reduces vehicle movements between site and the local communities.

Other potential risks and controls associated with traffic are discussed further in section 6.0.

3.8.7 Greenhouse gas emissions

The greenhouse gas (GHG) emissions estimates from the 3D seismic program are provided in Table 27. The emissions associated with the 3D seismic program is restricted to emissions associated with vegetation clearing and from fuel consumption. Emissions from the camp operations have been excluded as these are captured under the existing EMP TAM 1-3.

Table 27: Greenhouse gas calculation for the proposed activities

Activity	Anticipated volume	Anticipated (tCO ₂ -e)	Estimate methodology and assumptions
Diesel combustion – seismic program	200 KL	543	Diesel estimates multiplied by NGERs emission factor from NGER Determination: Division 2.4.2 Method 1 emissions of carbon dioxide, methane and nitrous oxide from liquid fuels other than petroleum-based oils or greases, section 2.41 Method 1—emissions of carbon dioxide, methane and nitrous oxide and Part 3—Fuel combustion—liquid fuels and certain petroleum-based products for stationary energy purposes item 40: - Energy Content Factor (GJ/kg) 38.6 - CO₂ Factor 69.9 kgCO₂-e/ GJ of diesel - CH₄ Factor 0.1 kgO₂-e/ GJ of diesel - N₂O Factor 0.2 kgCO₂-e/ GJ of diesel
Land disturbance as part of line preparation and seismic survey (56.25 ha)	56.25 ha land clearing (77 tCO ₂ e/ ha)	4,331	Transport Authorities Greenhouse Group 2013 Appendix I vegetation clearing methodology, Table 6, assumed maximum potential biomass class = 1.
Total over 3D seismic program (tCO₂-e)		4,875	

3.8.7.1 GHG cumulative emissions

The cumulative annual emissions for Tamboran's activities are predicted to be 197,941 tCO₂-e in FY 2025 (Table 28), largely attributed to existing approved activities associated with TAM1-3. This peak in emissions during 2025 is associated with the proposed well testing approved under the TAM1-3 EMP, prior to the operation of the TAM2-3 Sturt Plateau Compression Facility. In the FY 26/27/28 and 29 periods, the cumulative emissions total are predicted to fall under the 100 KtCO₂-e thresholds, with emissions under the TAM1-3 EMP reducing due to the decreasing in flaring associated with appraisal gas sale. Emissions associated with the 3D seismic program represents an increase of 0.85% compared to the existing approved activities.

The potential (residual - not offset) maximum scope 1 emissions (for FY 2025) of Tamboran's activities represent 1.15%¹¹ of the total NT GHG emissions for 2022 or 0.05% of Australia's total emission for the March 2024 quarter¹². Tamboran's total contributions will fall to 0.58% in FY 2026 demonstrating the reduction in scope 1 emissions associated with the sale of appraisal gas.

Based on the life cycle analysis of a similar (but different) unconventional gas development in Australia completed by the Gas Industry Social and Environmental Research Alliance (GISERA) (Heinz 2019), the current net climate benefits of using natural gas in replacing coal for electricity generation is up to 50% less emissions (Heinz 2019). This life cycle analysis is based upon the existing QLD Coal Seam Gas industry, which does not include abatement of LNG emissions or the deployment of substantial upstream emission reduction technology (other than electrification of gas processing facilities).

A future Beetaloo shale gas development will be net zero scope 1 and 2 emissions, through the utilisation of world's best practice emission reduction technology, such as field electrification, flare minimisation strategies, use of renewable energy sources and procurement of emission offsets. Scope 3 emissions will also be reduced through investigation in low emission technologies, such as carbon capture and sequestration (CCS) and blue ammonia/ hydrogen and electricity export. This would further reduce the emission intensity of a future gas developments and highlights the role of natural gas as a transition or 'firming' fuel to support the roll out of large-scale renewables in the future. This is reflected by Tamboran's ongoing commitment to invest in both renewable energy sources and firming fuels such as natural gas.

Table 28: Cumulative 2023-2027 financial year worst case greenhouse gas emission assessment by period for approved, proposed and potential future exploration activities

Activity	FY 25	FY26	FY27	FY28	FY29	Comments
Beetaloo W-1 EMP	46	46	46	46	46	No material emissions anticipated.
Velkerri 76 S2 civil construction	46	46	46	46	46	No material emissions anticipated.
Velkerri 76 S2-1H drilling, stimulation and well testing ¹³	0	0	0	0	0	No material emissions anticipated. Emissions included in the Velkerri civil construction EMP.
Amungee Multi-well (Amungee NW-2H and NW-3H; Velkerri 76 S2-2H and S2-3H)	46	46	46	46	46	No material emissions anticipated – activities restricted to ongoing wastewater management.
Amungee Delineation EMP	0	0	0	0	0	No material emissions anticipated.

¹¹ <https://www.greenhouseaccounts.climatechange.gov.au/>

¹² Quarterly Update of Australia's National Greenhouse Gas Inventory: March 2024 (dcceew.gov.au).

¹³ Based on the drilling of a horizontal and 90 day well test @4.5TJ/day.

Activity	FY 25	FY26	FY27	FY28	FY29	Comments
Shenandoah South E&A Program EMP	188,847	45,928	38,826	36,208	57,705	Activities include all those required to construct, drill, stimulate and well test the E&A wells over the FY 2025-2029 period. Wells drilled in FY 2026/27/28 and 29 will have limited flaring – restricted to initial well clean up where gathering lines are not available.
Sturt Plateau Appraisal Gas Compression Facility EMP	4,081	50,709	58,078	58,077	29,935	Activities associated with the construction, commissioning and operation of the SPCF facility.
Emissions related to activities introduced by this EMP						
Shenandoah South 3D Seismic Program (TAM3-2)	4,875	0	0	0	0	Activities associated with seismic line preparation (vegetation clearing) and diesel consumption.
Total annual emissions (tCO₂e)	197,941	96,775	97,042	94,423	87,778	

3.8.7.2 Residual emissions offsets-

Table 29 provides a summary of cumulative anticipated greenhouse gas emissions breakdown per financial year, along with the estimated offset requirements and total residual emissions.

In accordance with the updated NGERs safeguard mechanism requirements released in 2023, an activity becomes a “facility” once the emission threshold has been triggered. The safeguard mechanism requires a facility to have all scope 1 emissions offset in the year triggered, using Australian Carbon Credit Units (ACCU’s) granted under the Commonwealth Carbon Credits (Carbon Farming Initiative) Act 2011.

Tamboran also proposes to offset a percentage of residual greenhouse gas emissions where they are generated below the safeguard trigger level to meet the NT net zero by 2050 target. Tamboran will offset any residual emissions as per the following:

- That residual emissions be offset using carbon credit units approved by the Commonwealth Clean Energy Regulator or the Commonwealth’s Climate Active Carbon Neutral Standard.
- Minimum offset levels shall increase year-on-year by 3.7% (based on a baseline financial year of 2023) to result in a linear decrease in residual emission levels to net zero by 2050 as per the following schedule:
 - Financial year 2025: 11.1% of total emissions offset
 - Financial year 2026: 14.7% of total emissions offset
 - Financial year 2027: 18.4% of total emissions offset
 - Financial year 2028: 22.1% of total emissions offset
 - Financial year 2029: 25.8% of total emissions offset
- Actual emission levels produced during a financial year must be estimated in accordance with the National Greenhouse and Energy Reporting Scheme (NGERS) reporting methodology.
- Offsets volumes shall be calculated retrospectively, by multiplying the actual emission volumes generated during a financial year with the corresponding financial year offset % requirement level.

- Offsets shall be secured and retired within 6 months of the end of a financial year. Noting any emission offset under the NGERs Safeguard mechanism will satisfy any obligation under the NT Large emitters policy and vice versa. This will avoid double counting.
- An appropriately qualified independent person with extensive carbon accounting experience shall verify the actual emission levels generated, the procurement and retirement of the required offset volumes for emission generated in the specified financial year.
- A report from the appropriately qualified independent person shall be provided to DLPE by October 31 each year verifying the actual emission levels estimated and confirming the required offset for the previous financial year have been acquired and retired.
- That the GGAP is updated annually based on actual emissions from the preceding year to ensure currency.

Table 29: Estimated cumulative greenhouse gas emissions, offsets and residual emission levels

Emission period	Cumulative tCO ₂ -e	Potential emission offset requirements (tCO ₂)	Total cumulative residual emissions tCO ₂ (Total emissions minus offsets)
FY 2025	197,941	197,941*	0*
FY 2026	96,775	14,226	82,549
FY 2027	97,042	17,856	79,186
FY 2028	94,423	20,867	73,556
FY 2029	87,778	22,646	65,132
Total	573,959	273,536*	300,423*

*Assumes the NGERs safeguard 100 ktCO₂ trigger has been reached and offset requirements triggered.

3.8.8 Cumulative impact summary

This section provides a summary of the cumulative impacts associated with the proposed activity in accordance with Section 3b of the Regulations. These include cumulative impacts associated with groundwater extraction, flora and fauna, greenhouse gas generation, traffic and social impacts. The assessment of cumulative impacts is summarised in Table 30.

Table 30: Summary of cumulative impacts addressed within the EMP

Aspect	Summary	EMP section
Water	Groundwater extraction cumulative impacts assessed under the WEL GRF 10285. This includes water use for Tamboran's future exploration program, adjacent petroleum operators and surrounding users. No material impacts on surrounding users expected from Tamboran's activities associated with the 3D seismic EMP.	Section 3.8.2
Flora and fauna	Estimated clearing associated with this EMP, is estimated less than 56.25 ha (with additional 20 ha contingency) by using tread lightly approach for line preparation that prioritises the avoidance of vegetation clearing by locating source lines to avoid large trees and dense vegetation areas. Impacts associated with the introduction of weeds are managed through the weed management plan. All	Section 3.4 Section 3.5 Section 3.7.1 Section 4.2

Aspect	Summary	EMP section
	other petroleum operators and pastoralists are required to have a weed management plan.	
Greenhouse gases	Cumulative emissions from all of Tamboran's FY 2025-2029 activities have been provided. Emission levels are mainly attributed to activities under separate EMPs that include flaring. In a development scenario, gas production is likely to have 50% less emissions than coal, thus playing an important role as a transition or firming fuel to support large scale renewable energy supply. Emissions for the 3D seismic program are 4,393 tCO ₂ -e which is 2.46% of the proposed 2025 emissions.	Section 3.8.7
Traffic	Impacts of traffic are anticipated to be minor, with no reduction in level of service of the Stuart Highway. Maximum peak traffic level assessment considers cumulative user traffic load, with project movements anticipated to be no more than 8 movements per day during mobilisation and demobilisation (2-week period), and 4 movements per day during the seismic survey delivery.	Section 0
Social	Risk associated with increased competition for labour from exploration activities, including other petroleum operators is low and well within the capacity of existing service providers. Ongoing engagement with local and regional businesses is underway, providing information and updates on the status of any future projects. Increased industrialisation of landscape resulting in a loss of amenity and tourism value considered low due to limited extent of petroleum activities, including from other petroleum or mining operators.	Section 4.4

3.8.9 Monitoring

A series of monitoring programs has been developed under this EMP to:

- monitor and detect changes in environmental values associated with Tamboran's activities, such as groundwater extraction, erosion and sedimentation and weed establishment
- report on rehabilitation progress.

An overview of each of the monitoring programs is provided in Table 31. A summary of the SS 3D seismic program commitment register is provided in Appendix F.

Table 31: Monitoring program summary

Monitoring program	Purpose	Monitoring points	Parameters	Frequency	Investigation thresholds	Reference document
Groundwater take	Groundwater volume	Groundwater extraction bore	Litres	Continuous flow meter	450 ML/yr ¹⁴	NT Water Act
Local weather conditions	To identify potential for rainfall events and bushfire risk that may impact seismic work program	Bureau of Meteorology (BoM)	% chance of rainfall (mm)	7-day forecast from (BOM) from 1 October to 30 April	50% chance greater than 20 mm	section 3.8.4
		North Australia Fire Index (NAFI)/Secure NT	Bushfire Alerts and Warnings	Subscribe to Bushfire NT for alerts, warnings and advice including total ban declaration	Alerts and warnings indicate bush fire within 20 km of site	section 3.7 Tamboran's BMP (Appendix C)
Weeds	Identify weeds potentially introduced or spread by Tamboran's activities	Inspection of all the 3D seismic program disturbance areas, including access tracks, laydown areas, seismic lines.	Visual inspection (aerial and/or onground)	Visual inspections during line preparation Visual inspections pre- and post-wet season	Positive confirmation of the detection of a weed of national significance or any weed species declared under the NT Weed Management Act or environmental weed that are known to threaten native vegetation communities within Tamboran's disturbance footprint	Tamboran's WMP (Appendix D)

¹⁴ Tamboran's water extraction licence GRF10285 allows for maximum annual entitlement of 450 ML/yr. Groundwater take for 3D Seismic EMP is estimated to be this Project is estimated to be approximately 1.5 ML total.

Monitoring program	Purpose	Monitoring points	Parameters	Frequency	Investigation thresholds	Reference document
					An increase in existing weed density and spatial extent	
Heritage	Avoidance of impact to identified cultural heritage sites	Inspection by Cultural Managers prior to ground disturbance activities.	Visual inspection	During 3D seismic program	Positive confirmation of unexpected heritage finds	Cultural Heritage Assessment Report (Appendix B) - <i>Appendix E</i> sub appendix in the Cultural Heritage Assessment report
Post rehabilitation	Monitor ongoing rehabilitation success	Inspection of all rehabilitated areas, including seismic lines	Visual inspections of: • Canopy cover % • Ground cover % • Species diversity • Erosion	Annually	Decline in rehabilitation criteria value compared to previous year results	Section 7.5 and RMP (Appendix G)

3.8.10 Investigation and response framework

Where an exceedance of a monitoring program investigation trigger is observed from one of the monitoring programs outlined in Table 31, an investigation and response will be implemented as summarised in Figure 15.

The investigation and response process will be divided into the following components:

- Verification – is the result real?
- Evaluation – is the result related to petroleum activities?
- Remediation or management – what is the potential impact?
- Ongoing monitoring.

The initial step in the process is *verification* of the measurement. This process begins with a check on integrity of the measurement, including a review of the protocol used to collect the measurement, calibration of equipment and the integrity of the monitoring infrastructure itself (such as the integrity of a monitoring bore). If the original data point is found to be correct, then a risk-based (appropriate to the scale and nature of the exceedances) investigation of the results is conducted, and an evaluation phase is initiated.

The *evaluation* phase will have two major goals; to identify the origin or source of the trigger exceedance and characterise the potential effects on environmental factors to reduce or eliminate negative consequences. This phase of investigation is conducted in a manner consistent with the type of threshold exceedance observed. Simple exceedances of water quality triggers during stormwater releases for example, may require simple investigations into the procedures and processes contributing to the event. Groundwater threshold exceedances may require more detailed assessment, whereby a comprehensive set of information is accessed and utilised, including a review of operational activities, the influence of other regional activities (e.g. mining or pastoral activities), changes in climatic conditions etc. Detailed investigation may include the identification of knowledge and/or data gaps and collection of additional data to fill these gaps and bring the issue into proper context.

If the *evaluation* phase of the investigation identifies the issue as being natural or not associated with petroleum activities, then the result is documented, and monitoring continues. This may lead to the revision of a trigger or threshold. However, if the results indicate an influence of a petroleum activity, an assessment of risks is undertaken to assess the potential impact on environmental factors. This will involve a more in-depth evaluation or characterisation of the affected area and potential source. Regulatory notification may be required in accordance with section 8.6.

If the *evaluation* phase of the investigation indicates the influence of a petroleum activity, then mitigation measures may need to be implemented to prevent ongoing impacts to an environmental factor. These mitigation measures will be appropriate to the nature of the incident and will be based upon a risk assessment and technical feasibility assessments. Such mitigation measures may include:

- Stopping the activity and/or
- Modifying the activity to directly address the source of harm (i.e. additional procedures, training, ceasing or redesigning an activity) and/or
- Implementation of mitigation measures to reduce the potential effects (i.e. make good agreements, direct removal and treatment of contaminants etc.).

Upon implementation of mitigation measures, further *evaluation* through increased monitoring is undertaken to determine the success of the mitigation measures. If a positive result is observed, and trends begin to stabilise or reverse, then the result is documented and a return to regular monitoring occurs. If not, then the continued operation of the identified activity or activities causing the effected may need to be reviewed and adjusted in consultation with the regulator and other affected parties, such as the Native Title Holders.

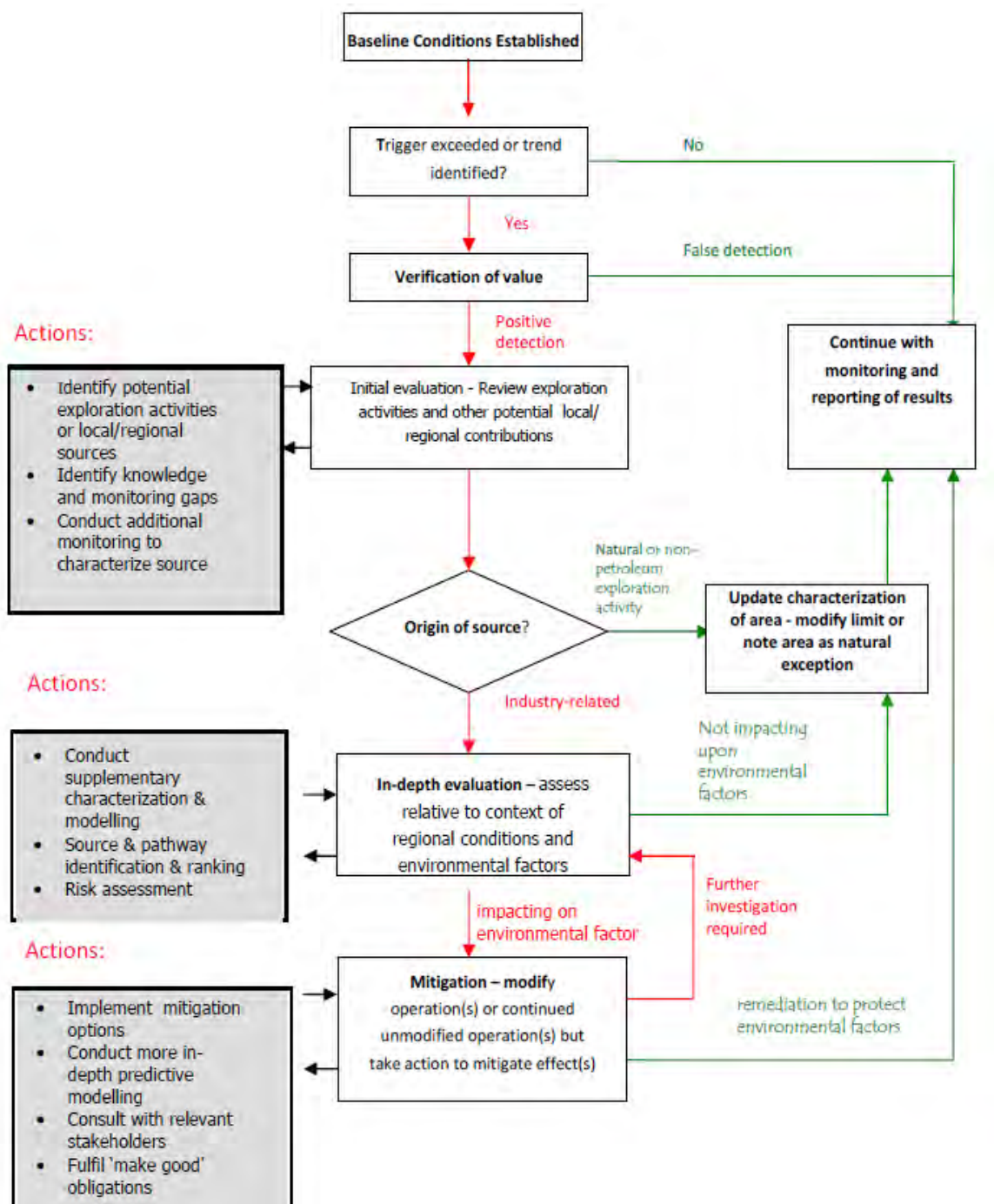


Figure 15: Investigation and response process

4 Description of the existing environment

The full description of the biological environment of the Shenandoah South 3D seismic program is provided in the land condition report completed by AECOM (2024) in Appendix A. Broader information on the existing environment, including the 3D seismic program, are provided in the following sections with an overview of the survey sites shown in Figure 16.

At the end of this section, a summary of all the matters of national environmental significance under the EPBC Act has been summarised (section 4.5).

4.1 Physical environment

4.1.1 Climate

The climate of the permit areas is arid to semi-arid, with rainfall decreasing in frequency and quantity from north to south. The climate is monsoon influenced, with a distinctive wet summer between October and April, and a dry winter season between May and September, with September and April being transitional months with occasional rainfall.

Mean annual rainfall in the north of the Beetaloo exploration area is recorded at 678 mm at Daly Waters (SREBA, 2022). The southern portion of the permit areas records an average annual rainfall of 536 mm at Newcastle Waters and 602 mm at Elliott. Approximately 90% of the rainfall occurs during the wet season from November to April but primarily in December to March (SREBA, 2022).

The Shenandoah South E&A program area is characterised by a net precipitation deficit of between -1,800 mm and -2,150 mm per year.

4.1.2 Geology

The Beetaloo Sub-basin comprises a thick sequence of mudstone and sandstone formations (Roper Group) that were deposited during the Mesoproterozoic era¹⁵, approximately 1,500 – 1,300 million years ago (Ma). The Roper Group is estimated to reach more than 5,000 m in thickness in the centre of the Sub-basin and estimated to be thinner outside the formally defined Beetaloo Sub-basin. The Roper Group is overlain unconformably by Neoproterozoic sediments. Unconformably overlying the Neoproterozoic section is the Georgina Basin (Cambrian) sedimentary package, which includes widespread extrusive flood basalts and a thick limestone sequence that forms the Cambrian Limestone Aquifer (CLA), a significant water supply aquifer. The Georgina Basin is capped unconformably by a thin section of Cretaceous mudstone and sandstone (Albian aged ~100-113 Ma) and recent alluvial and laterite deposits. The shale and sandstone layers of the Beetaloo Sub-basin - specifically the Kyalla Formation and Velkerri Formation — host the gas plays that are the target for petroleum exploration activities in the area (SREBA, 2022).

Tamboran's exploration and appraisal activities are targeting the Roper Group Velkerri Formation, specifically the organically enriched shale intervals within the Velkerri's Amungee Member. These intervals are found at a depth of approximately 3,000 m within the proposed 3D seismic area.

The Amungee Member is overlain with a thick series of low permeability units (mudstone, siltstones, tight sandstone and volcanic units) which include the Velkerri Formation Wyworrie Member, Kyalla Formation, Cox Formation, and Antrim Plateau Volcanics. These thick, stacked successions provide more than 1500m of geological barriers, effectively separating the deep target formations from the shallow Cambrian Limestone Aquifer system above. The SS 3D seismic program data will provide a higher resolution view of the subsurface geology for current and future drilling and stimulation activities.

¹⁵ A geologic era that occurred from 1,600 to 1,000 million years ago.

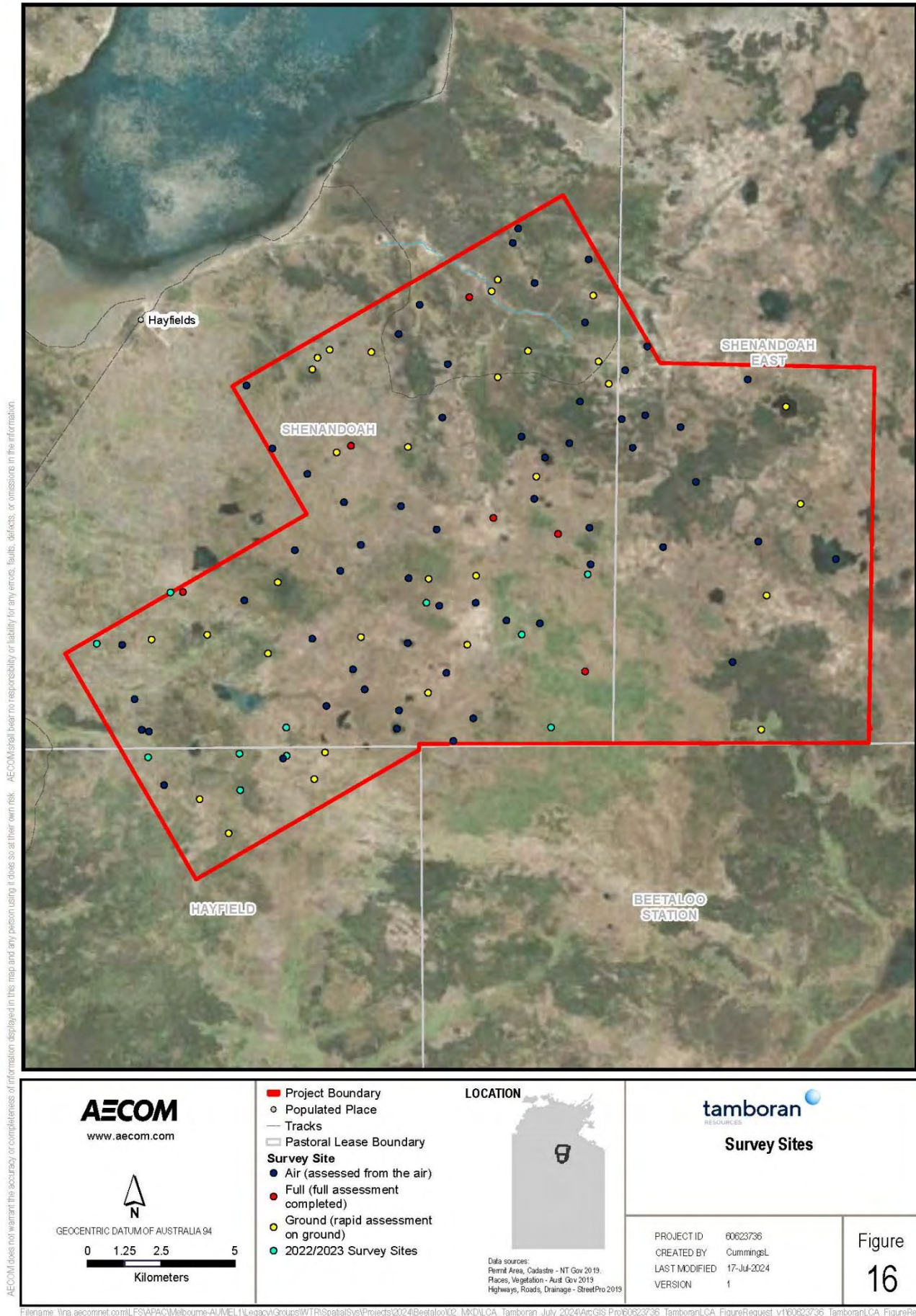


Figure 16: Shenandoah South 3D seismic program survey area

4.1.3 Soils

The Sturt Plateau bioregion covers an area of 103,857 km² and comprises undulating plains on sandstones, with mostly neutral sandy red and yellow earth soils (ANRA, 2008; SREBA, 2022).

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, through to cracking clays in the south-east.

The lateritic plains, located with the permit area, are classed as very strongly leached soils of the Tertiary land surface. The three main soil types located within the permit area, include:

1. Tertiary Lateritic Red Earths: which occur on the gently undulating topography. The soil profile can be described as:
 - A-Horizon Grey-brown sandy loam
 - B-Horizon Reddish-brown sandy clay loam
 - C-Horizon Red-brown to red light clay, overlying heavy ferruginous gravel and massive laterite
2. Tertiary Lateritic Red Sands: which occur on gently undulating to undulating topography of the Tertiary Lateritic Plain, formed from sandstones and complex parent materials of the deep sandy soils. The soil profile can be described as
 - A-Horizon Grey-brown to brown sand
 - B-Horizon Brown sand
 - C-Horizon Red-brown to yellow-brown sand overlying pisolitic ferruginous gravel and massive laterite. Altered colouring of highly siliceous parent sandstone is only evident in the mottled and pallid zones
3. Tertiary Lateritic Podzolic Soils: formed on the gently undulating topography over a variety of rocks. These soils are located in the northern section of the Barkly Basin. The soil profile can be described as
 - A-Horizon Grey sand
 - B-Horizon Yellowish-grey sand
 - C-Horizon Yellow-grey sandy loam with ferruginous gravel overlying massive laterite, mottled and pallid zones

Table 32 and Table 33 present the erosion risk rating based on average monthly rainfall for Daly Waters and Newcastle Waters, using the rating system provided in the IECA (2008) Table 4.4.2. The SS 3D seismic program will implement controls to minimise potential for erosion and sedimentation in accordance with section 6.6 and Appendix E. The overall risk of erosion with the SS E&A area is considered very low.

Table 32: Erosion risk rating based on average monthly rainfall at Daly Waters

Item	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	165.4	165.4	120.1	23.6	5.0	5.6	1.5	1.7	4.9	22.5	59.4	110
Erosion Risk*	H	H	H	VL	VL	VL	VL	VL	VL	VL	M	H
* E = Extreme (>225 mm); 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)												

Table 33: Erosion risk rating based on average monthly rainfall at Newcastle Waters

Item	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Rainfall (mm)	125.5	130.9	93.7	24.6	9.3	5.3	3.4	1.0	5.4	20.9	35.7	77.3
Erosion Risk*	H	H	M	VL	VL	VL	VL	VL	VL	VL	L	M

* **E** = extreme (>225 mm); **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)

4.1.4 Seismicity

Large earthquakes are relatively rare in Australia with an earthquake exceeding magnitude 7 on the Richter scale occurring somewhere in Australia every 100 years (SRC 2017). Earthquakes are comparably rare in the NT, aside from limited areas around Tennant Creek and west of Alice Springs (Figure 17) where several earthquakes with a magnitude of 6.2-6.4 occurred in a 12-hour period. Thousands of aftershocks have occurred since and whilst the rate has decreased, it has not yet returned to its pre-1987 level (McCue 2013).

In the Beetaloo, there have been no earthquakes over magnitude 3 measured since records began. The area is not prone to seismic activity and there is no evidence of recent earthquake activity as most faults and the major subsurface structure are confined to Cambrian or older strata.

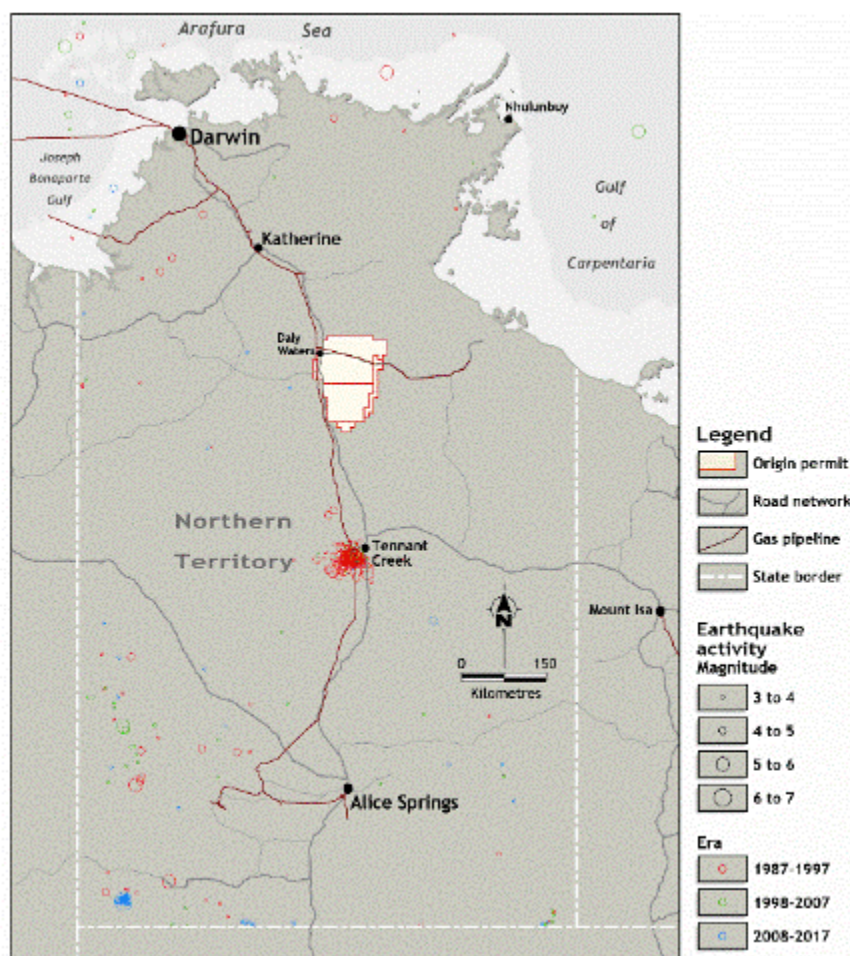


Figure 17: Earthquakes greater than magnitude 3 from 1987 to 2017 across the NT showing an absence of seismic activity in the Beetaloo area

4.1.5 Hydrology

The Shenandoah South 3D seismic program area falls within the Wiso River Basin (Figure 18). The Wiso River Basin covers the southern half of EP 98 (south of the Carpentaria Highway) and the majority of EP 76 and a large portion of EP 117 and is internally drained by Newcastle Creek and several small ephemeral creeks (DEPWS, 2022a).

Newcastle Creek ultimately flows into Lake Woods, which is located south of the Newcastle Waters Station, approximately 87-110 km south of the Shenandoah South E&A area. 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 and is listed on the NT Government Sites of Conservation Significance and on the Directory of Important Wetlands in Australia (DIWA: NT013 Lake Woods) (DEPWS, 2022a). Some semi-permanent and many ephemeral waterholes are located across the permit area.

Across the Shenandoah South 3D seismic program area there are no creeks that will be intersected and one intermittent stream (stream order 1) located to the north (Figure 19). In addition, there are some occurrences of palustrine (non-riverine or non-channel systems) and floodplain systems, with shallow depressions and gullies as expected in an ephemeral wetland area. In accordance with the NT Land Clearing Guideline (2024) the wetlands that occur in the SS 3D seismic program are considered low value wetland because:

- the area does not have any permanent waterbodies
- the area only intermittently flows during a good wet season
- the area is only a small part of the much larger wetland system of the Newcastle Creek Catchment which has a large diversity of habitat for native plants and animals
- the area is not part of the Directory of Important Wetlands in Australia (DIWA) nor is it listed as a RAMSAR site.

During the SS 3D seismic survey, Tamboran will implement mitigation measures for in areas of intermittent stream and the broader wetland area that will minimise impacts by avoiding activities in a waterway that will not materially change the shape of the water way, the volume, speed or direction, divert local water or cause change to the bed or bank stability (refer to section 6.6 and Appendix E).

Where avoidance is not achievable Tamboran will seek a permit to Interfere with a Waterway under the NT *Water Act 1992*. Due to the nature of the activity for the seismic program, Tamboran believe a permit to Interfere with a Waterway under the NT *Water Act 1992* will not be required. The timing of the seismic survey will be completed when the intermittent stream, drainage lines and depressions are dry (refer Section 3.3), in addition to the proposed low impact line preparation required.

Based on SREBA Environmental Health Baseline Report (DEPWS, 2022a) 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 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.

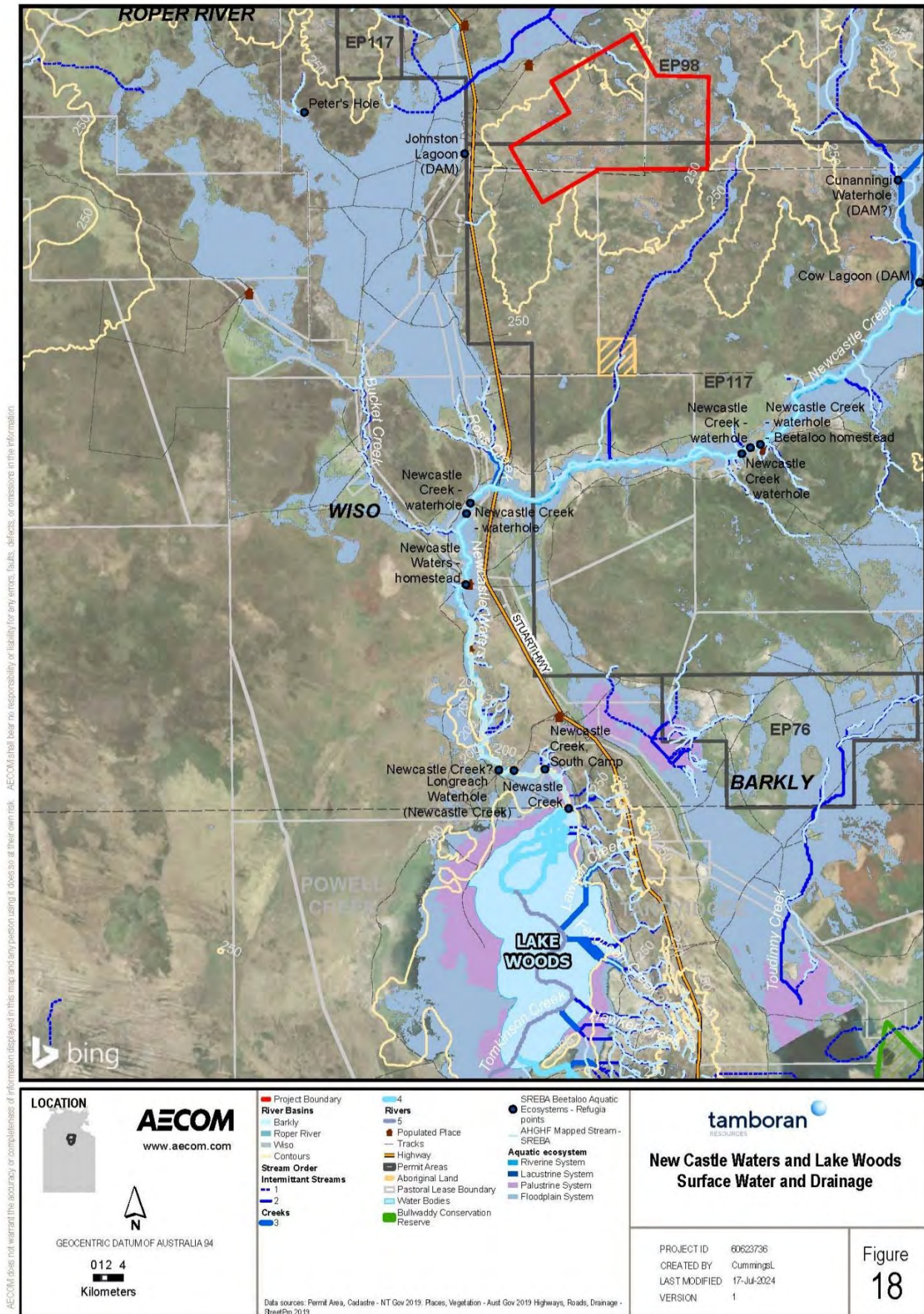


Figure 18: Regional surface water and drainage

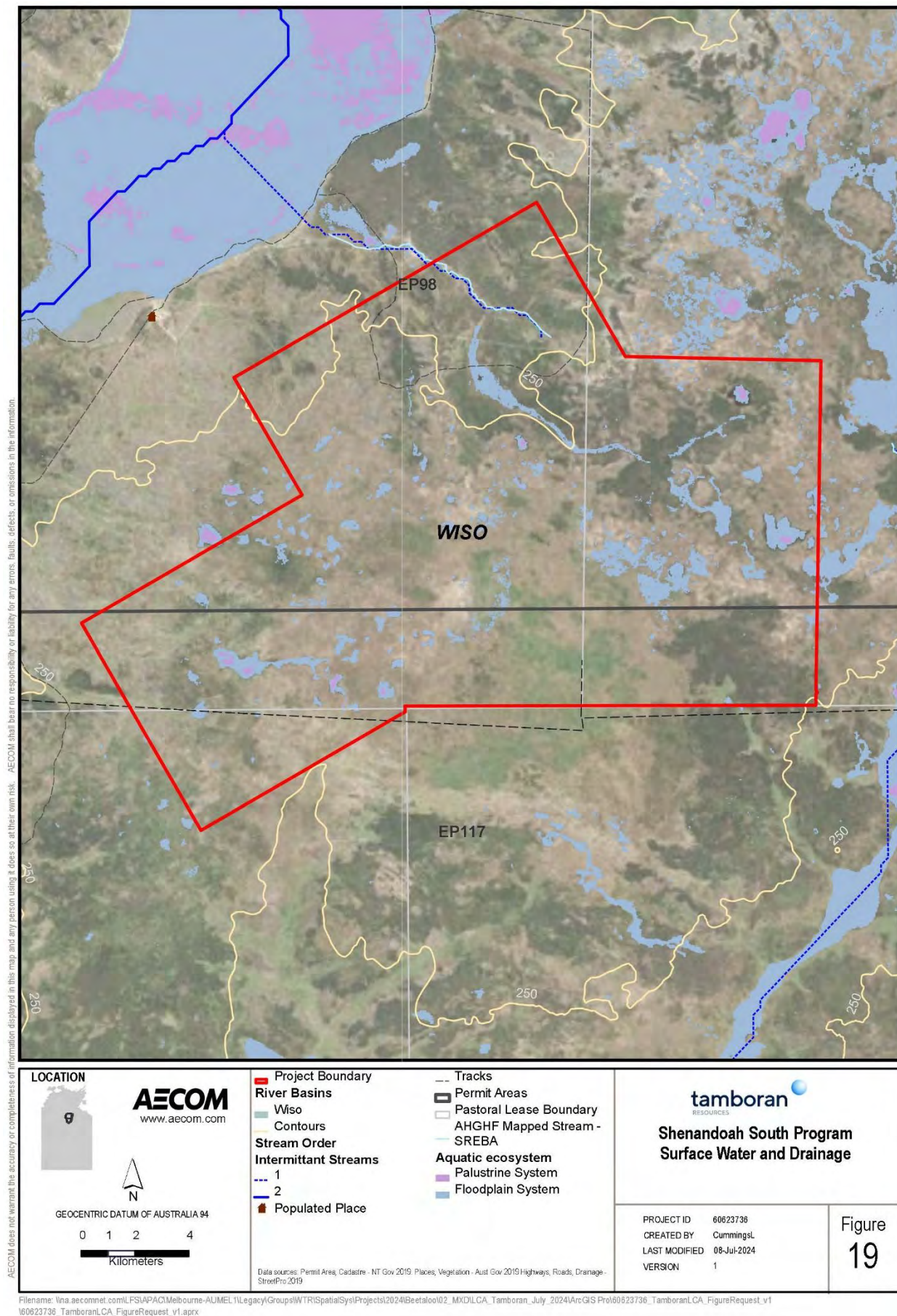


Figure 19: Shenandoah South 3D program area - surface water and drainage

4.1.6 Flood risk assessment

The extent of inundation within the permit area depends on the severity of the wet season and can range from remaining completely dry to widespread flooding. As part of the preparation of the LCA, AECOM assessed the 1% Annual Exceedance Probability (AEP) flood depths to determine the risk of flood inundation during the 100-year flood event from a local or a regional flooding using the TUFLOW.

Figure 20 shows a 1% AEP flood depth. The result raster has been filtered to exclude areas with flooding depth less than 50 mm given the TUFLOW uses a Rain on Grid (ROG) approach. The project location is subject to inundation from localised flooding depths generally 0.25 m, and up to 3 m floodwater pooling in low-lying, flatter areas.

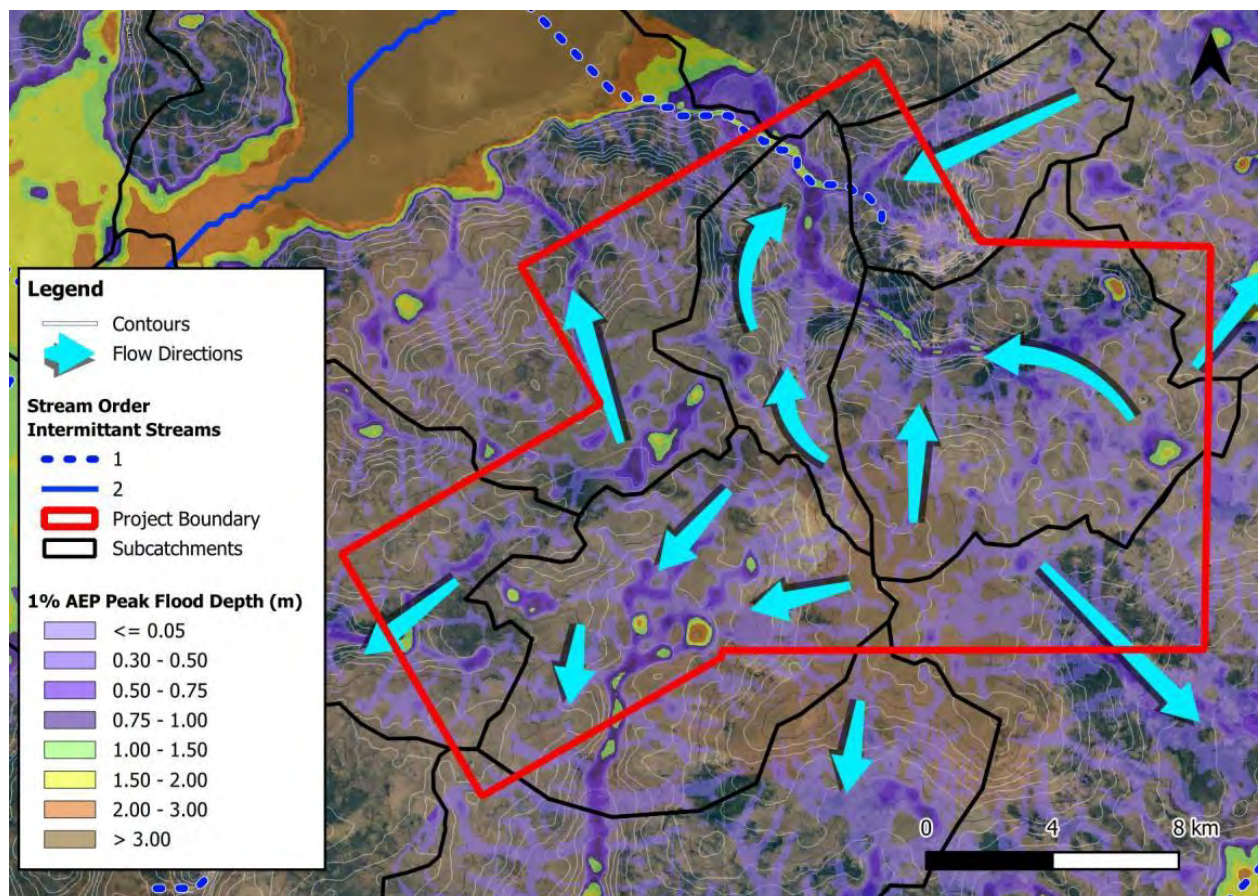


Figure 20: Shenandoah South 3D program area – 1% AEP flood depth

One non-perennial stream (Stream Order 1) associated with Newcastle Creek catchment passes through the northern section of the Shenandoah South E&A program area and intersects the 3D seismic line 1 through to line 12. The intermittent stream would flow for only a short period of the wet season, with waterholes potentially forming at the beginning of the dry season. It is anticipated that low to no water will be across the permit area with the 3D seismic program planned to occur before the onset of rainfall.

4.1.7 Hydrogeology

Within the Beetaloo exploration area, groundwater use is primarily from the Cambrian Limestone Aquifer (CLA) with minor, localised use from formations where shallower groundwater is intersected, where the CLA is too deep, or where the CLA is absent from erosion. This includes:

- Overlying Cretaceous sediments where it is saturated in the central-south of the Beetaloo Sub-basin.
- Antrim Plateau Volcanics in the north-west.
- Bukalara Sandstone in the north-east.

Table 34 summarises the stratigraphy based on previous drilling at the Kyalla 117 N2. Descriptions of the stratigraphic units have been revised to align with the generalised hydrostratigraphy presented in SREBA (2022a).

The CLA, comprising the Gum Ridge Formation and the Anthony Lagoon Beds, is an extensive, multi-layered regional aquifer system covering at least 200,000 km² that forms the principal water resource in the Beetaloo Sub-basin, (SREBA, 2022).

The CLA is a highly productive aquifer that has high regional connectivity due to the development of significant fracture and karstic secondary porosity (SREBA, 2022). Across parts of the Beetaloo Sub-Basin, undifferentiated Cretaceous deposits form the uppermost aquifer are targeted for stock use. Notably, a basal sandstone unit immediately overlying the CLA produces yields of at least 10 L/s (SREBA, 2023). Shallow, perched groundwater has also been recorded in the laterised zone within the permit area with groundwater levels recorded between 1 and 6 mBGL. These systems are dynamic with periodic saturation resulting from recharge during the wet season with no documented groundwater use. The CLA, comprising the Gum Ridge Formation and the Anthony Lagoon Formation, is an extensive regional aquifer system that forms the principal water resource in the Beetaloo Sub-Basin. Near the Kyalla 117 N2 site, for example, both aquifer units have a standing water level of approximately 114 m below top of casing. The limestone in the CLA is commonly fractured and cavernous; in the Katherine region, bore yields of up to 100 L/s have been recorded from this aquifer (SREBA, 2023). Such high yielding sections were encountered when drilling the Kyalla 117 N2-1 E&A well through the Anthony Lagoon and Gum Ridge Formation, with total losses of drilling fluid circulation at specific intervals.

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 Elliott, 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 (NALWTF, 2009). Existing groundwater use in the Beetaloo Sub-basin is estimated at 6,000 ML/year, primarily used for agricultural production (Foulton and Knapton 2015).

The Antrim Plateau Volcanics conformably underlies the CLA in the north and central part of the Beetaloo Sub-basin. Across much of the Basin it consists of sequences of massive basalt flows with negligible primary porosity. In the north-west of the Basin, where the formation is shallow and fractured, it forms a marginal aquifer, however, reported use is primarily from a sandstone sequence at the contact with the Gum Ridge Formation. There is no reported use within the 3 petroleum EPs held by Tamboran.

The Bukalara Sandstone forms a fractured and weathered aquifer where it outcrops beyond the north-east margin of the Beetaloo Sub-basin. The formation consists of quartz sandstone with shale interbeds and probable enhanced permeability in these areas due to jointing within the sandstone. No use is reported from the formation away from the north-east margin of the Beetaloo Sub-basin where it is at considerable depth. This unit, if present, will be protected through intermediate casing and cement.

Table 34: Summary hydrostratigraphy based on encountered depths at Kyalla 117 N2 located in Shenandoah South E&A area

Province	Period / age	Formation		Aquifer status	Encountered Depths ¹ (approx. top and bottom) (m)	Regional yield (L/s)	Avg regional EC (µs/cm)
CARPENTARIA BASIN	CRETACEOUS 145 – 66 Ms	Undifferentiated		Local-scale aquifer	0 – 70.0	0.3 – 4.0	1,800
GEORGINA BASIN	CAMBRIAN 497 – 630 Ma	Cambrian Limestone Aquifer (CLA)	Anthony Lagoon Formation	Regional aquifer	70.0 – 191.4	1.0 – 10.0	1,600
			Gum Ridge Formation	Regional aquifer	191.4 – 399.5	>20.0	1,400
		Antrim Plateau Volcanics		Regional aquitard	399.5 – 499.0	<2.0	900
		Bukalara Sandstone		Local aquifer (not regionally connected)	499.0 – 506.7	0.3 – 5.0	1,000
BEETALOO SUB-BASIN (ROPER GROUP)	UNKNOWN	Hayfield formation		Regional aquifer	506.7 – 899.33	ID	32,000
		Jamison Sandstone		Local aquifer (not regionally connected)	891.33 – 988.97	ID	138,000
	MESO PROTEROZOIC 1,430-1,500 Ma	Kyalla Formation		Regional aquitard	988.97 – 1851.75	ID	ID
		Moroak Sandstone		Local aquifer (not regionally connected)	1851.75 – not determined	0.5 – 5.0	131,000
		Velkerri Formation		Regional aquitard	700 – 900	–	–
		Bessie Creek Sandstone		Local aquifer (not regionally connected)	450	0.5 – 5.0	–

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 (aquatic, riparian and floodplain) 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 Sub-basin. Dry season flow in the Roper River has been gauged at 95,000 – 126,000 ML/yr 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 Sub-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.

Based on the most recent studies as part of the Beetaloo Geological and Bioregional Assessment Program (Beetaloo GBA), the SS 3D seismic area does not have any sinkholes recorded. The closest recorded sinkholes are located more than 8 km east of the eastern edge of the planned seismic area (Geological and Bioregional Assessment Program, 2021).

Limited information exists on the hydrogeological characteristics of the deeper Roper Group and undefined Neoproterozoic group sequence is available as it occurs at depth within the Beetaloo Sub-basin. This unit lies below the Georgina Basin which contains the CLA and other important aquifers. The deeper sandstone dominated formations may behave as aquifers, however, drilling results suggest these formations have limited potential as groundwater resources due to their depth and very high salinity. Groundwater in the Roper Group and undefined Neoproterozoic group is highly saline (>100,000 mg/L chlorides) and contrasts with the shallower, utilised aquifers of the Georgina Basin sediments in which groundwater is generally of drinking water quality.

4.2 Biological environment

4.2.1 Bioregions

The SS 3D seismic program area falls within the Stuart Plateau Bioregion. The bioregion is characterised by undulating plains on sandstone with predominantly neutral sandy red and yellow earth soils. Dominant vegetation is eucalypt woodland, which include extensive areas of Lancewood (*Acacia shirleyi*), Bullwaddy (*Macropteranthes kekwickii*) vegetation and associated fauna, including the Spectacled Hare-Wallaby (*Lagorchestes conspicillatus*). Land condition in the bioregion is moderate to good but is threatened by impacts from weeds, feral animals, pastoralism and changed fire regimes.

4.2.2 Vegetation communities

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 SS 3D seismic program area. These include wetland, floodplains/drainage depressions and run-on areas which may be intersected by seismic lines (Figure 21).

Eleven vegetation communities were identified within the Shenandoah South E&A program area from 50 vegetation sites (AECOM, 2024). Of these, 37 sites were recorded during the May 2024 survey and a further 13 sites were incorporated from previous land condition surveys undertaken within the study 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 referenced to confirm the location of vegetation communities within the study area (AECOM, 2024).

The proposed SS 3D seismic program area has been evaluated through detailed vegetation and habitat assessments which included identification of vegetation community, dominant flora species at each strata, habitat condition, disturbance factors (fire, weeds, erosion, feral fauna species), and fauna attributes (e.g. tree hollows, logs, grass cover, mistletoe abundance).

A summary of the land condition assessment (LCA) for the Shenandoah South E&A program area are provided in Table 35 to Table 45. All vegetation communities are intersected by the SS 3D seismic program.

A summary of the vegetation communities is presented in Table 46 and shown in Figure 22. Community 2a, is the most widespread vegetation community within the SS 3D seismic program area and provides ample opportunity to weave through the trees and shrubs to minimise vegetation clearing during the survey.

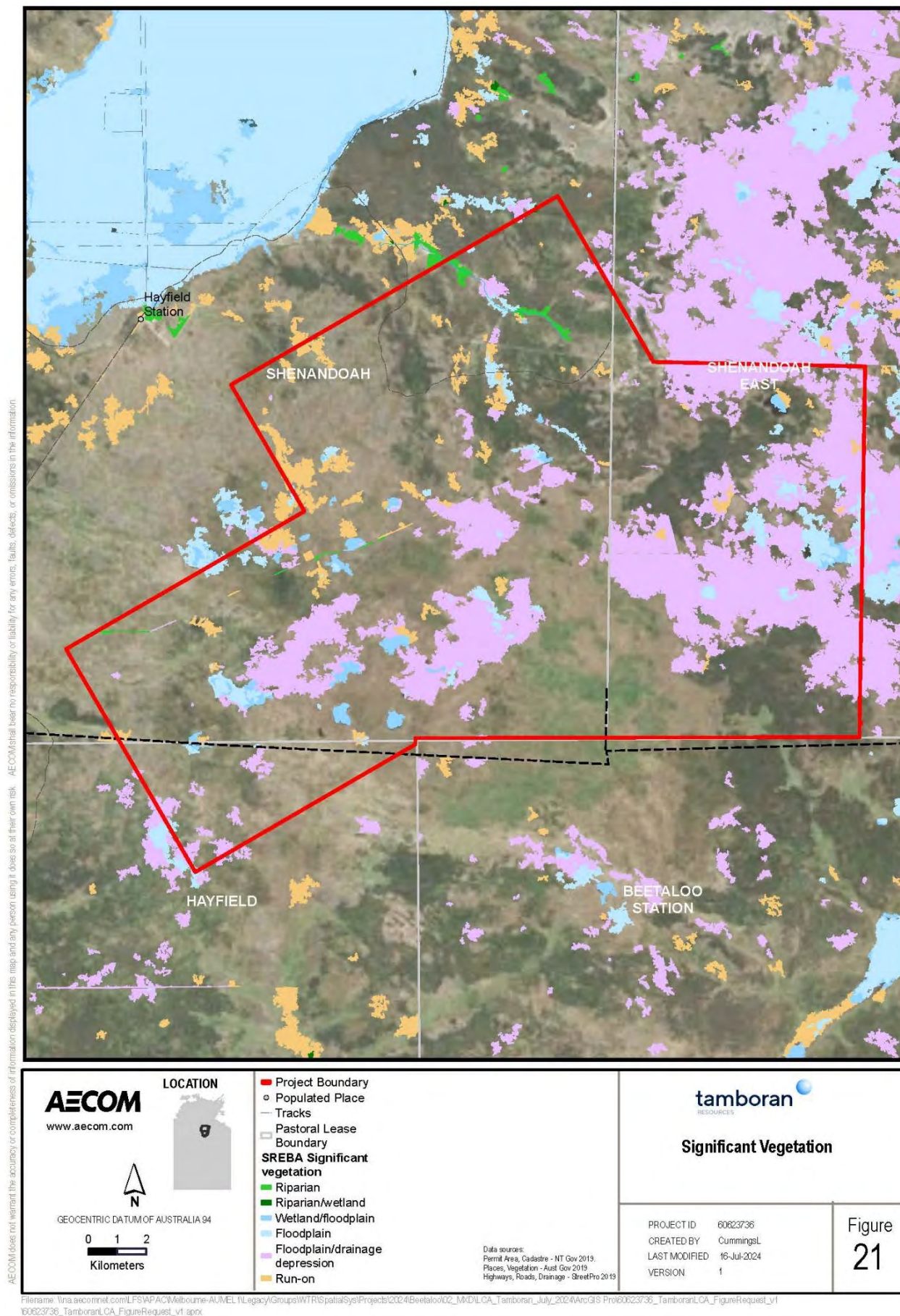


Figure 21: Shenandoah 3D seismic program area – SREBA significant vegetation communities

Table 35: Summary of existing environment and surrounds – vegetation community 1a

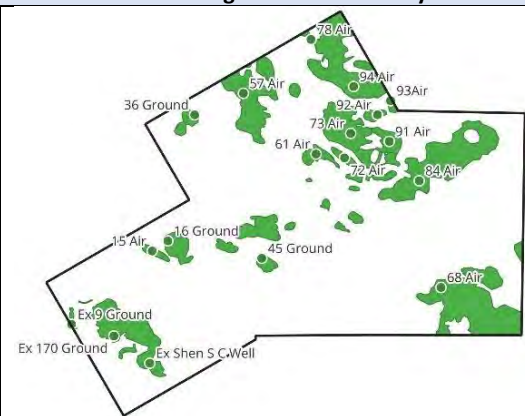
Shenandoah South 3D Seismic Area – Vegetation Community 1a		Survey photos of the vegetation/habitat		
Location				
Landform and soil	Level plains of residual plateau surface. Sandy loam.			
Vegetation community description	1a: <i>Acacia shirleyi</i> mid high woodland over, <i>Macropteranthes kekwickii</i> , <i>Terminalia volucris</i> mid high open shrubland, over <i>Eragrostis fallax</i> , <i>Sorghum intrans</i> , <i>Waltheria indica</i> mid high open tussock grassland			
Habitat condition	Good – Common tree hollows and falling logs. Flowering plants present. Shallow leaf litter. Termite mounds: Nil. Fire damage > 2 years ago. No erosion. Minor cattle impacts. Ground cover: 55% vegetation, 2% leaf litter, 43% bare.			
Dominant flora species	Upper Stratum Mid high woodland dominated by <i>Acacia shirleyi</i> (fq 100%)	Mid Stratum Mid high open shrubland dominated by <i>Macropteranthes kekwickii</i> (fq 66.67%), <i>Terminalia volucris</i> (fq 66.67%)	Ground Stratum Mid high open tussock grassland dominated by <i>Eragrostis fallax</i> (fq 33.3%), <i>Sorghum intrans</i> (fq 16.67%), <i>Waltheria indica</i> (fq 33.3%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 36: Summary of existing environment and surrounds – vegetation community 2a

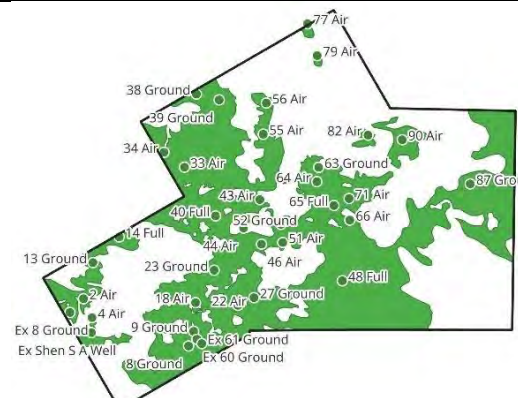
Shenandoah South 3D Seismic – Vegetation Community 2a		Survey photos of the vegetation/habitat		
Location				
Landform and soil	Level plains of residual plateau surface. Sandy loam.			
Vegetation community description	2a: <i>Corymbia dichromophloia</i> ± <i>Erythrophleum chlorostachys</i> mid high open woodland, over <i>Acacia difficilis</i> , <i>Terminalia canescens</i> , 9g-1 <i>Dodonea</i> sp. 1 mid high open shrubland, over <i>Triodia bitextura</i> ± <i>Chrysopogon fallax</i> , <i>Schizachyrium fragile</i> mid high hummock grassland			
Habitat condition	Good – Scattered tree hollows and flowering plants common. Fallen logs common. Mistletoe absent. Shallow leaf litter. Fire damage low > 2 years ago. No erosion. Minor cattle impacts. Termite mounds sparse. Ground cover: 50% vegetation, 20% litter, 30% bare soil.			
Dominant flora species	Upper Stratum Mid high open woodland dominated by <i>Corymbia dichromophloia</i> (fq 100%) ± <i>Erythrophleum chlorostachys</i> (fq 27.78%)	Mid Stratum Mid high open shrubland dominated by <i>Acacia difficilis</i> (fq 61.11%), <i>Terminalia canescens</i> (fq 38.89%), <i>Dodonea hispidula</i> (fq 33.33%)	Ground Stratum Mid high hummock grassland dominated by <i>Triodia bitextura</i> (fq 83.33%) ± <i>Chrysopogon fallax</i> (fq 50%), <i>Schizachyrium fragile</i> (fq 44.44%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebeia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 37: Summary of existing environment and surrounds – vegetation community 2b

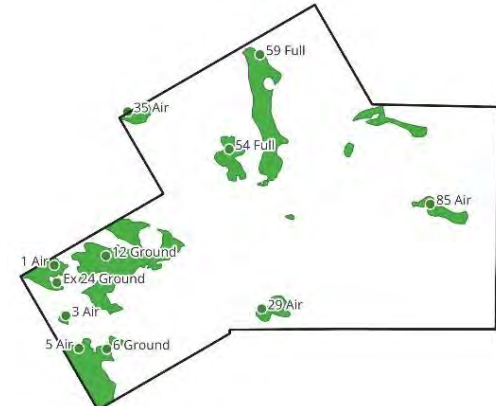
Shenandoah South 3D Seismic – Vegetation Community 2b		Survey photo of the vegetation/habitat	
Location			
Landform and soil	Level plains of residual plateau surface. Sandy loam.		
Vegetation community description	2b: <i>Acacia shirleyi</i> , <i>Corymbia dichromophloia</i> ± <i>Corymbia polycarpa</i> mid high open woodland, over <i>Terminalia canescens</i> , <i>Macropteranthes kekwickii</i> ± 12g-1 <i>Petalostigma</i> sp1 <i>pubescens</i> mid high open shrubland, over <i>Triodia bitextura</i> , <i>Schizachyrium fragile</i> , <i>Chrysopogon fallax</i> mid high hummock grassland		
Habitat condition	Moderate -Scattered tree hollows, fallen logs and flowering plants common. Mistletoe and leaf litter absent. Fire damage low > 2 years ago. No erosion or cattle impacts. Termite mounds sparse.		
Dominant flora species	Upper Stratum Mid high open woodland dominated by <i>Acacia shirleyi</i> (fq 100%), <i>Corymbia dichromophloia</i> (fq 80%) ± <i>Corymbia polycarpa</i> (fq 60%)	Mid Stratum Mid high open shrubland dominated by <i>Terminalia canescens</i> (fq 80%), <i>Macropteranthes kekwickii</i> (fq 80%) ± <i>Petalostigma pubescens</i> (fq 40%)	Ground Stratum Mid high hummock grassland dominated by <i>Triodia bitextura</i> (fq 80%), <i>Schizachyrium fragile</i> (fq 80%), <i>Chrysopogon fallax</i> (fq 60%)
Weeds	No weeds of national significance or NT declared weeds present.		
Potential listed threatened species (SREBA 2023)	Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).		

Table 38: Summary of existing environment and surrounds – vegetation community 2c

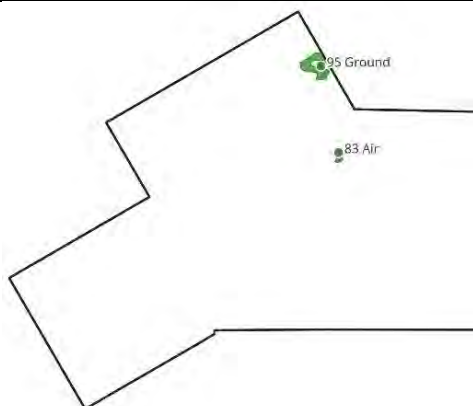
Shenandoah South 3D Seismic – Vegetation Community 2c		Survey photos of the vegetation/habitat		
Location				
Landform and soil	Level plains of residual plateau surface. Sandy Loam.			
Vegetation community description	2c: <i>Eucalyptus leucophloia</i> low open woodland, over 95g-2 <i>Acacia</i> sp. 7, <i>Melaleuca viridiflora</i> , <i>Terminalia canescens</i> mid high open shrubland, over 95g-1 <i>Eriachne</i> sp. 6., <i>Eulalia aurea</i> mid high open tussock grassland			
Habitat condition	Good - tree hollows, Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion. Minor cattle impacts. Termite mounds sparse. Ground cover: 40% vegetation, 40% litter, 20% bare soil.			
Dominant flora species	Upper Stratum Low open woodland dominated by <i>Eucalyptus leucophloia</i>	Mid Stratum Mid high open shrubland dominated by <i>Acacia gonoclada</i> , <i>Melaleuca viridiflora</i> , <i>Terminalia canescens</i>	Ground Stratum Mid high open tussock grassland dominated by <i>Eriachne armittii</i> , <i>Eulalia aurea</i>	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 39: Summary of existing environment and surrounds – vegetation community 3a

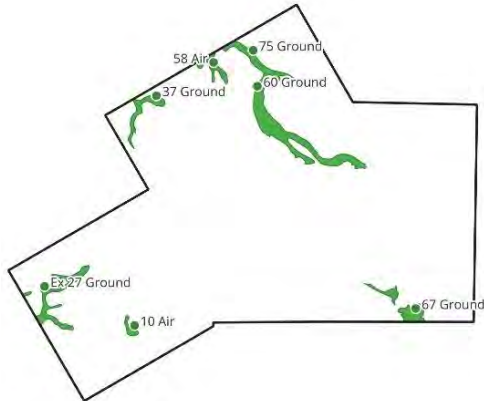
Shenandoah South 3D Seismic – Vegetation Community 3a		Survey photo of the vegetation/habitat	
Location			
Landform and soil	Level, imperfectly drained, colluvial valley flats and margins within relict drainage features. Sandy clay loam.		
Vegetation community description	3a: <i>Corymbia polycarpa</i> , ± <i>Erythrophleum chlorostachys</i> mid high open woodland, over <i>Acacia difficilis</i> ± <i>Atalaya hemiglauca</i> mid high open shrubland, over <i>Chrysopogon fallax</i> , <i>Sehima nervosum</i> mid high tussock grassland		
Habitat condition	Moderate - tree hollows, Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion. Moderate cattle impacts. Termite mounds sparse. Ground cover: 70% vegetation, 15% litter, 15% bare soil.		
Dominant flora species	Upper Stratum Mid high open woodland dominated by <i>Corymbia polycarpa</i> (fq 100%), ± <i>Erythrophleum chlorostachys</i> (fq 40%)	Mid Stratum Mid high open shrubland dominated by <i>Acacia difficilis</i> (fq 80%) ± <i>Atalaya hemiglauca</i> (fq 40%)	Ground Stratum Mid high tussock grassland dominated by <i>Chrysopogon fallax</i> (fq 40%), <i>Sehima nervosum</i> (fq 40%)
Weeds	No weeds of national significance or NT declared weeds present.		
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebeia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).		

Table 40: Summary of existing environment and surrounds – vegetation community 3b

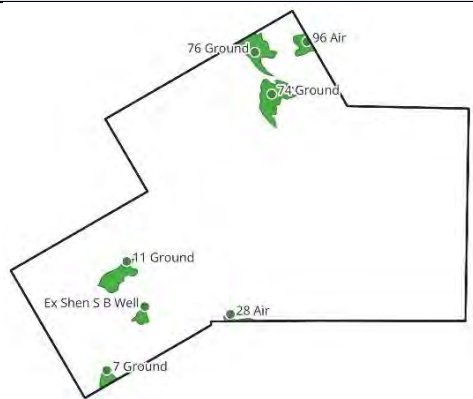
Shenandoah South 3D Seismic – Vegetation Community 3b		Survey photo of the vegetation/habitat	
Location			
Landform and soil	Broad, imperfectly drained lower-lying areas on level plains. Sandy clay loam.		
Vegetation community description	3b: <i>Eucalyptus chlorophylla</i> , <i>Acacia shirleyi</i> mid high open woodland, over <i>Acacia difficilis</i> , <i>Macropteranthes kekwickii</i> , <i>Bauhinia cunninghamii</i> mid high open shrubland, over <i>Chrysopogon fallax</i> , <i>Schizachyrium fragile</i> , 7g-2 <i>Eragrostis</i> sp. 1 mid high tussock grassland		
Habitat condition	Moderate - tree hollows, Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion. Moderate cattle impacts. Termite mounds sparse. Ground cover: 80% vegetation, 10% litter, 10% bare soil.		
Dominant flora species	Upper Stratum Mid high open woodland dominated by <i>Eucalyptus chlorophylla</i> (fq 100%), <i>Acacia shirleyi</i> (fq 80%)	Mid Stratum Mid high open shrubland dominated by <i>Acacia difficilis</i> (fq 40%), <i>Macropteranthes kekwickii</i> (fq 40%), <i>Bauhinia cunninghamii</i> (fq 40%)	Ground Stratum Mid high tussock grassland dominated by <i>Chrysopogon fallax</i> (fq 40%), <i>Schizachyrium fragile</i> (fq 40%), 7g-2 <i>Eragrostis</i> sp. 1 (fq 40%)
Weeds	No weeds of national significance or NT declared weeds present.		
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Red Goshawk <i>Erythrotriorchis radiatus</i> (Endangered EPBC Act, Vulnerable TPWC Act), Grey Falcon <i>Falco hypoleucos</i> (Vulnerable EPBC Act and TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Greater Bilby <i>Macrotis lagotis</i> (Vulnerable EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).		

Table 41: Summary of existing environment and surrounds – vegetation community 4a

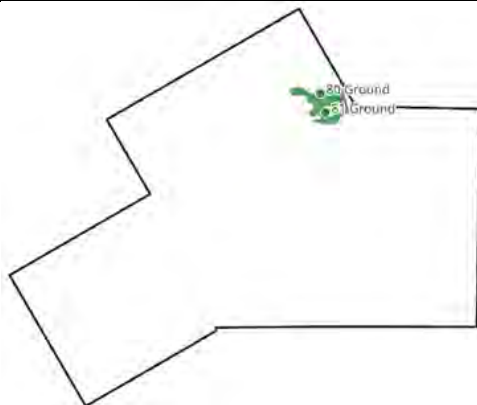
Shenandoah South 3D Seismic – Vegetation Community 4a		Survey photo of the vegetation/habitat		
Location				
Landform and soil	Broad, imperfectly drained lower-lying areas on level plains. Sandy clay loam.			
Vegetation community description	4a: <i>Eucalyptus pruinosa</i> ± <i>Eucalyptus chlorophylla</i> , <i>Atalaya hemiglauca</i> low open woodland, over <i>Carissa lanceolata</i> , <i>Terminalia canescens</i> mid high open shrubland, over <i>Eulalia aurea</i> , <i>Chrysopogon fallax</i> mid high tussock grassland			
Habitat condition	Moderate - Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion and minor cattle impacts. Termite mounds sparse. Ground cover: 75% vegetation, 10% litter, 10% bare soil.			
Dominant flora species	Upper Stratum Low open woodland dominated by <i>Eucalyptus pruinosa</i> (fq 100%) ± <i>Eucalyptus chlorophylla</i> (fq 50%), <i>Atalaya hemiglauca</i> (fq 50%)	Mid Stratum Mid high open shrubland dominated <i>Carissa lanceolata</i> (fq 50%), <i>Terminalia canescens</i> (fq 50%)	Ground Stratum Mid high tussock grassland dominated by <i>Eulalia aurea</i> (fq 100%), <i>Chrysopogon fallax</i> (fq 100%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Red Goshawk <i>Erythrotriorchis radiatus</i> (Endangered EPBC Act, Vulnerable TPWC Act), Grey Falcon <i>Falco hypoleucos</i> (Vulnerable EPBC Act and TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Greater Bilby <i>Macrotis lagotis</i> (Vulnerable EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 42: Summary of existing environment and surrounds – vegetation community 4b

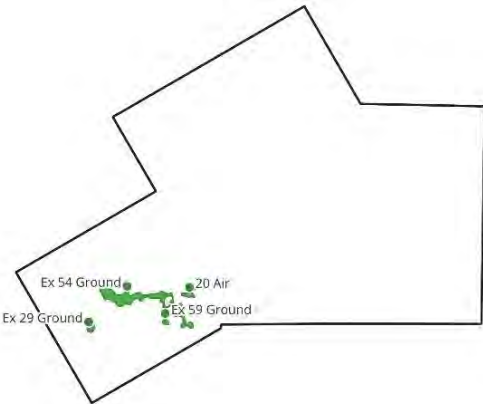
Shenandoah South 3D Seismic – Vegetation Community 4b		Survey photo of the vegetation/habitat		
Location				
Landform and soil	Broad, imperfectly drained lower-lying areas on level plains. Sandy clay loam.			
Vegetation community	4b: <i>Corymbia polycarpa</i> , <i>Eucalyptus microtheca</i> mid high open woodland, over <i>Hakea arborescens</i> , <i>Melaleuca nervosa</i> mid high open shrubland, over <i>Aristida contorta</i> , <i>Waltheria indica</i> mid high open tussock grassland			
Habitat condition	Good - tree hollows, Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion. No cattle impacts. Termite mounds sparse. Ground cover: 80% vegetation, 5% litter, 10% bare soil.			
Dominant flora species	Upper Stratum Mid high open woodland dominated by <i>Corymbia polycarpa</i> (fq 66.67%), <i>Eucalyptus microtheca</i> (fq 66.67%)	Mid Stratum Mid high open shrubland dominated by <i>Hakea arborescens</i> (fq 66.67%), <i>Melaleuca nervosa</i> (fq 66.67%)	Ground Stratum Open tussock grassland dominated by <i>Aristida contorta</i> (fq 66.67%), <i>Waltheria indica</i> (fq 66.67%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebeia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act, Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Greater Bilby <i>Macrotis lagotis</i> (Vulnerable EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 43: Summary of existing environment and surrounds – vegetation community 4c1

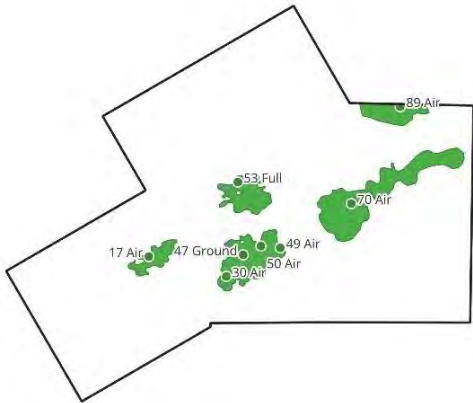
Shenandoah South 3D Seismic – Vegetation Community 4c1		Survey photo of the vegetation/habitat		
Location				
Landform and soil	Broad, imperfectly drained lower-lying areas on level plains. Sandy loam.			
Vegetation community description	4c1: <i>Acacia ancistrocarpa</i> ± <i>Melaleuca viridiflora</i> tall shrubland, over <i>Triodia bitextura</i> , <i>Schizachyrium fragile</i> mid high hummock grassland			
Habitat condition	Good - Flowering plants common. Fire damage moderate >2years ago. No erosion. No cattle impacts. Termite mounds sparse. Ground cover: 100% vegetation, 0% litter, 0% bare soil.			
Dominant flora species	Upper Stratum Tall shrubland dominated by <i>Acacia ancistrocarpa</i> (fq 100%)	Mid Stratum Tall shrubland dominated by <i>Acacia ancistrocarpa</i> (fq 50%) ± <i>Melaleuca viridiflora</i> (fq 50%)	Ground Stratum Mid high hummock grassland dominated by <i>Triodia bitextura</i> (fq 100%), <i>Schizachyrium fragile</i> (fq 50%)	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebeia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Red Goshawk <i>Erythroriorchis radiatus</i> (Endangered EPBC Act, Vulnerable TPWC Act), Grey Falcon <i>Falco hypoleucos</i> (Vulnerable EPBC Act and TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Greater Bilby <i>Macrotis lagotis</i> (Vulnerable EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 44: Summary of existing environment and surrounds – vegetation community 4c2

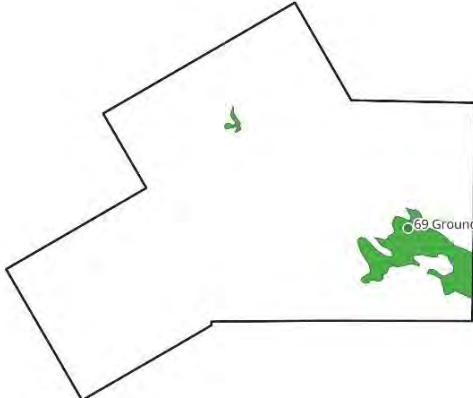
Shenandoah South 3D Seismic – Vegetation Community 4c2		Survey photo of the vegetation/habitat		
Location				
Landform and soil	Broad, imperfectly drained lower-lying areas on level plains. Sandy clay loam.			
Vegetation community description	4c2: <i>Melaleuca viridiflora</i> , <i>Terminalia canescens</i> low sparse shrubland, over <i>Eulalia aurea</i> , <i>Eriachne obtusa</i> open tussock grassland			
Habitat condition	Moderate - tree hollows, Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No erosion. Moderate cattle impacts. Termite mounds sparse. Ground cover: 45% vegetation, 25% litter, 30% bare soil.			
Dominant flora species	Upper Stratum Low sparse shrubland dominated by <i>Melaleuca viridiflora</i>	Mid Stratum Low sparse shrubland dominated by <i>Melaleuca viridiflora</i> , <i>Terminalia canescens</i>	Ground Stratum Mid high open tussock grassland dominated by <i>Eulalia aurea</i> , <i>Eriachne obtusa</i>	
Weeds	No weeds of national significance or NT declared weeds present.			
Potential listed threatened species (SREBA 2023)	Gouldian Finch <i>Chloebeia gouldiae</i> (Endangered EPBC Act, Vulnerable TPWC Act), Red Goshawk <i>Erythrotriorchis radiatus</i> (Endangered EPBC Act, Vulnerable TPWC Act), Grey Falcon <i>Falco hypoleucos</i> (Vulnerable EPBC Act and TPWC Act), Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Painted Honeyeater <i>Grantiella picta</i> (Vulnerable EPBC Act and TPWC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Greater Bilby <i>Macrotis lagotis</i> (Vulnerable EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC ACT and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).			

Table 45: Summary of existing environment and surrounds – vegetation community 5

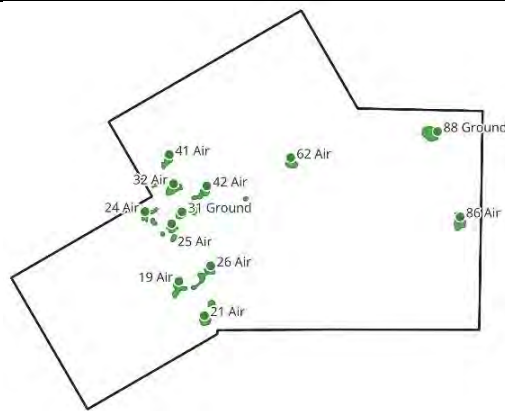
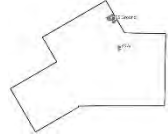
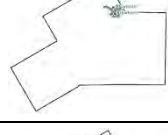
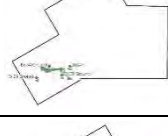
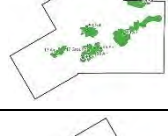
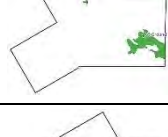
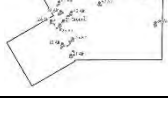
Shenandoah South 3D Seismic – Vegetation Community 5		Survey photo of the vegetation/habitat	
Location			
Landform and soil	Localised shallow, level closed depressions and seasonal swamps. Sandy clay loam.		
Vegetation community description	5: <i>Lophostemon grandiflorus</i> , <i>Eucalyptus microtheca</i> ± <i>Eucalyptus camaldulensis</i> low open woodland, over <i>Lophostemon grandiflorus</i> , <i>Acacia difficilis</i> mid high open shrubland, over <i>Eragrostis speciosa</i> , <i>Eragrostis fallax</i> mid high sparse tussock grassland		
Habitat condition	Moderate - tree hollows, holding water following wet season. Mistletoe and leaf litter absent, fallen logs and flowering plants common. Fire damage moderate >2years ago. No evidence of erosion or cattle impacts. Ground cover: 55% vegetation, 25% litter, 20% bare soil.		
Dominant flora species	Upper Stratum Low open woodland dominated by <i>Lophostemon grandiflorus</i> (fq 100%), <i>Eucalyptus microtheca</i> (fq 100%) ± <i>Eucalyptus camaldulensis</i> (fq 50%)	Mid Stratum Mid high open shrubland dominated by <i>Lophostemon grandiflorus</i> (fq 50%), <i>Acacia difficilis</i> (fq 50%)	Ground Stratum Mid high sparse tussock grassland dominated by <i>Eragrostis speciosa</i> (fq 50%), <i>Eragrostis fallax</i> (fq 50%)
Weeds	No weeds of national significance or NT declared weeds present.		
Potential listed threatened species (SREBA 2023)	Northern Shrike-tit <i>Falcunculus whitei</i> (Vulnerable EPBC Act), Australian Painted Snipe <i>Rostratula australis</i> (Endangered EPBC Act and TPWC Act), Pale Field-rat <i>Rattus tunneyi</i> (Vulnerable TPWC Act), Common Brushtail Possum (northern) <i>Trichosurus vulpecula arnhemensis</i> (Vulnerable EPBC Act), Plains Death Adder <i>Acanthopsis hawkei</i> (Vulnerable EPBC Act and TPWC Act), Northern Blue-tongue Skink <i>Tiliqua scincoides intermedia</i> (Critically Endangered EPBC Act), Yellow-spotted Monitor <i>Varanus panoptes</i> (Vulnerable TPWC Act).		

Table 46: Shenandoah South E&A Program – adapted from LCA (Appendix A)

Vegetation community		Area (ha)	% of vegetation community
	1a: <i>Acacia shirleyi</i> mid high woodland over, <i>Macropteranthes kekwickii</i> , <i>Terminalia volucris</i> mid high open shrubland, over <i>Eragrostis fallax</i> , <i>Sorghum intrans</i> , <i>Waltheria indica</i> mid high open tussock grassland	7,121.47	19.84
	2a: <i>Corymbia dichromophloia</i> ± <i>Erythrophleum chlorostachys</i> mid high open woodland, over <i>Acacia difficilis</i> , <i>Terminalia canescens</i> , 9g-1 <i>Dodonea</i> sp. 1 mid high open shrubland, over <i>Triodia bitextura</i> ± <i>Chrysopogon fallax</i> , <i>Schizachyrium fragile</i> mid high hummock grassland	16,578.52	46.18
	2b: <i>Acacia shirleyi</i> , <i>Corymbia dichromophloia</i> ± <i>Corymbia polycarpa</i> mid high open woodland, over <i>Terminalia canescens</i> , <i>Macropteranthes kekwickii</i> ± 12g-1 <i>Petalostigma</i> sp1 <i>pubescens</i> mid high open shrubland, over <i>Triodia bitextura</i> , <i>Schizachyrium fragile</i> , <i>Chrysopogon fallax</i> mid high hummock grassland	3,953.55	11.01
	2c: <i>Eucalyptus leucophloia</i> low open woodland, over 95g-2 <i>Acacia</i> sp. 7, <i>Melaleuca viridiflora</i> , <i>Terminalia canescens</i> mid high open shrubland, over 95g-1 <i>Eriachne</i> sp. 6., <i>Eulalia aurea</i> mid high open tussock grassland	146.47	0.41
	3a: <i>Corymbia polycarpa</i> , ± <i>Erythrophleum chlorostachys</i> mid high open woodland, over <i>Acacia difficilis</i> ± <i>Atalaya hemiglauc</i> a mid high open shrubland, over <i>Chrysopogon fallax</i> , <i>Sehima nervosum</i> mid high tussock grassland	1,341.03	3.47
	3b: <i>Eucalyptus chlorophylla</i> , <i>Acacia shirleyi</i> mid high open woodland, over <i>Acacia difficilis</i> , <i>Macropteranthes kekwickii</i> , <i>Bauhinia cunninghamii</i> mid high open shrubland, over <i>Chrysopogon fallax</i> , <i>Schizachyrium fragile</i> , 7g-2 <i>Eragrostis</i> sp. 1 mid high tussock grassland	1,019.41	2.84%
	4a: <i>Eucalyptus pruinosa</i> ± <i>Eucalyptus chlorophylla</i> , <i>Atalaya hemiglauc</i> a low open woodland, over <i>Carissa lanceolata</i> , <i>Terminalia canescens</i> mid high open shrubland, over <i>Eulalia aurea</i> , <i>Chrysopogon fallax</i> mid high tussock grassland	309.72	0.86
	4b: <i>Corymbia polycarpa</i> , <i>Eucalyptus microtheca</i> mid high open woodland, over <i>Hakea arborescens</i> , <i>Melaleuca nervosa</i> mid high open shrubland, over <i>Aristida contorta</i> , <i>Waltheria indica</i> mid high open tussock grassland	322.47	0.90
	4c1: <i>Acacia ancistrocarpa</i> ± <i>Melaleuca viridiflora</i> tall shrubland, over <i>Triodia bitextura</i> , <i>Schizachyrium fragile</i> mid high hummock grassland	3,136.72	8.74
	4c2: <i>Melaleuca viridiflora</i> , <i>Terminalia canescens</i> low sparse shrubland, over <i>Eulalia aurea</i> , <i>Eriachne obtusa</i> open tussock grassland	1,507.11	4.20
	5: <i>Lophostemon grandiflorus</i> , <i>Eucalyptus microtheca</i> ± <i>Eucalyptus camaldulensis</i> low open woodland, over <i>Lophostemon grandiflorus</i> , <i>Acacia difficilis</i> mid high open shrubland, over <i>Eragrostis speciosa</i> , <i>Eragrostis fallax</i> mid high sparse tussock grassland	461.56	1.29

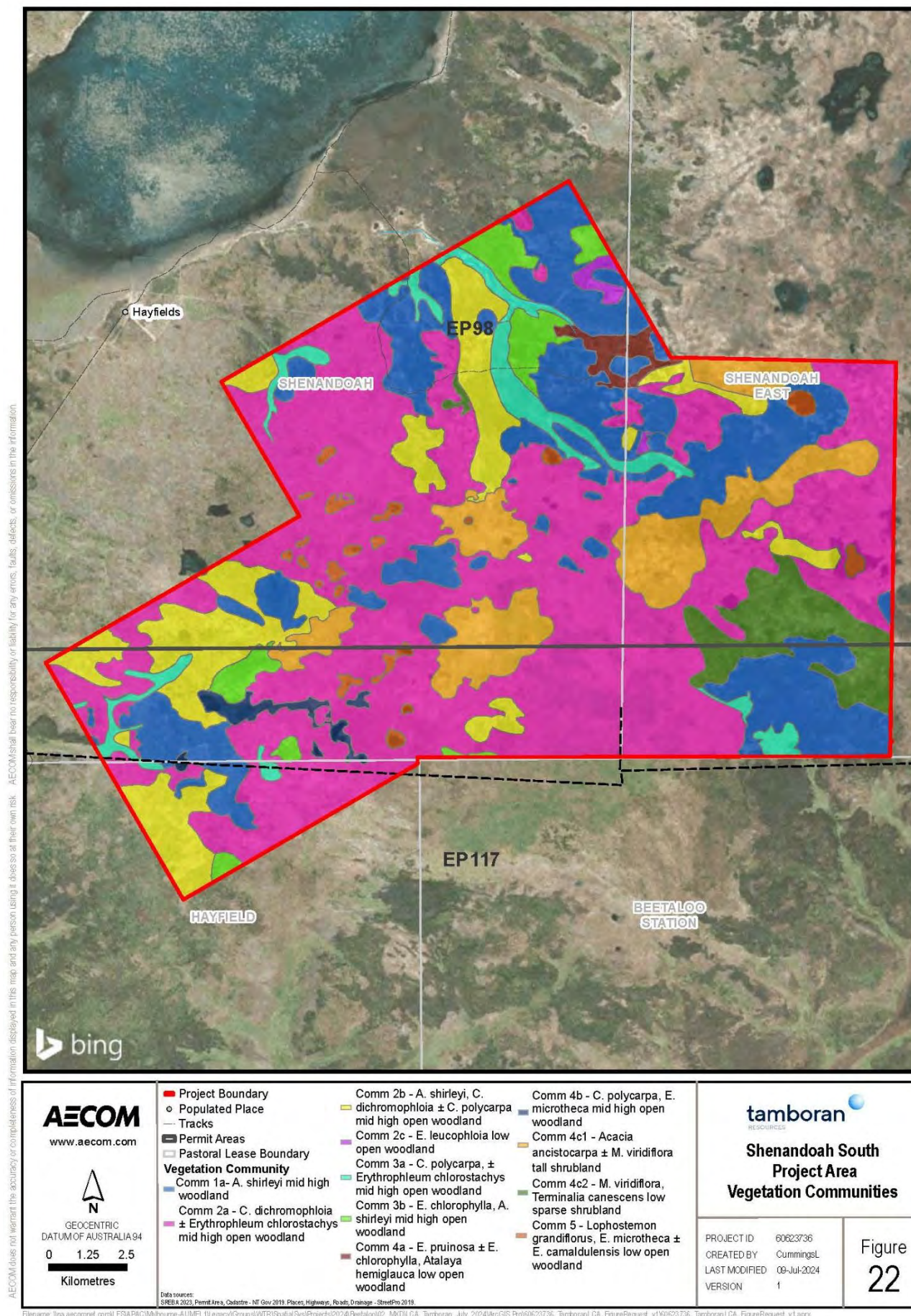


Figure 22: Shenandoah South 3D seismic program area - Field vegetation community classification

Potential risks and impacts to the environment have been identified based on environmental conditions observed during the field survey. The overall disturbance footprint for the SS 3D seismic program area is ~221 ha. However, with the development of mitigation measures to minimise impacts to the environment (e.g. weaving around trees and shrubs, access areas on foot or light vehicle and avoiding sensitive receptors), Tamboran can substantially reduce disturbance during seismic acquisition to approximately 56.25 ha (refer to section 3.4).

During the LCA the Shenandoah South E&A program area was assessed to be in generally good condition with nil to minor evidence of weeds, erosion and disturbance from cattle.

The vegetation communities are considered regionally extensive and not subjected to extensive clearing. Further detail regarding the individual sites assessed within the Shenandoah South E&A program is provided in the LCA, Appendix A.

4.2.2.1 Flora

The SREBA Terrestrial Ecosystem Report (Young *et al*, 2022) indicated that flora surveys completed over 2021-2022 contributed 15,419 new plant records within the Beetaloo sub-basin. Disturbance was prevalent across all broad vegetation groups, despite efforts to select “best on offer” vegetation sites. Primary contributors to disturbance include fire, cattle, pigs and weeds.

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.

The field survey undertaken during May 2024 recorded 79 individual flora species. Full details of the field survey are presented in the LCA (Appendix A).

4.2.2.2 Threatened Flora

A search of the DCCEEW Protected Matters database of nationally significant flora (PMST) and the NT Government flora atlas database was undertaken for the SS 3D seismic program area, with a 10 km and 50 km buffer applied. No threatened vegetation communities are listed as likely to occur within the SS 3D seismic program area, which is supported by the SREBA (DEPWS, 2022) surveys.

The desktop analysis of flora in the region did indicate two NT threatened flora species that may occur in the Shenandoah South E&A program area. *Carex fascicularis* (Tassel Sedge) a densely-tufted perennial sedge (Vulnerable; TPWC Act) and *Spermacoce reticulata* an annual herb (restricted range species) which have both been recorded on Hayfield Station (SREBA 2022) approximately 30 – 34 km south-west of the SS 3D seismic program area. *Carex fascicularis* was recorded near a flowing creek (HAY18); *Spermacoce reticulata* was recorded in a Lancewood low open forest (HAY01).

Carex fascicularis 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 SS 3D seismic program area. Minimising ground disturbance to pedestrian traffic only within these habitat areas during the 3D seismic program will reduce potential impact on these species.

4.2.2.3 Habitat fragmentation

As outlined in DEPWS (2022) “...vegetation communities and habitats may vary in their sensitivity to degradation, fragmentation and loss as a result of onshore gas and other development.”

Impacts identified in SREBA (DEPWS, 2022a), include land clearing, inappropriate fire regimes, weed incursion and grazing by introduced herbivores, which can lead to long term loss of species abundance and richness. The cumulative impacts of clearing from a regional perspective have been discussed in section 3.5. Currently onshore gas development represents <0.028% of all clearing in the Barkly/Gulf Region (2003 – 2024).

Nevertheless, Tamboran continues to minimise its impacts and reduce the potential for habitat fragmentation, through key mitigations including tread lightly approach for the temporary construction of seismic lines, centralising sites; construction of multi well pads; using existing pastoral access tracks; active fire management; and active weed management.

4.2.2.4 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 during the March-April 2023 or in May 2024 field surveys (AECOM, 2024). However, Tamboran weed inspections following the end of the 2023-2024 wet season encountered a single Gamba Grass (*Andropogon gayanus*) plant on the Kyalla 117 N2 well site. This individual was removed immediately, noting it had not gone to seed (Mills, N. pers comms. July 2024).

High-risk weeds have been determined through consideration of the following criteria:

- Weed species that has been confirmed in the area within the relevant [Regional Weed Strategies and Plans](#), or through field surveys
- Weed species listed in a statutory plan that are near Tamboran tenure
- Weed species that are at risk of introduction using machinery sourced from other regions in the NT or from other states

Since the 8 July 2024, there are now five classes of weeds under the NT *Weed Management Act 2001*. The classes are described as:

- it is necessary to eradicate the plant*
- it is necessary to prevent the growing and spreading of the plant*
- it is necessary to prevent the introduction of the plant into the Territory or a part of the Territory*
- it is necessary to prevent the plant being spread by the actions of persons*

Unclassified. Declared but not classified as A, B, C or D.

Table 47 provides a list of weed species that are known to occur or likely to occur within the Shenandoah South 3D seismic program area based on a desktop review of the following sources:

- Mapping data provided by the Weed Management Branch, DLPE.
- 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.

Table 47: NT listed weeds known or likely to occur within Shenandoah South 3D seismic program area

Scientific Name	Common Name	Category of priority	Status*
<i>Alternanthera pungens</i>	Khaki Weed	4	Declared, Class B and C
<i>Andropogon gayanus</i>	Gamba Grass	1	Declared, Class A and C, WoNS
<i>Azadirachta indica</i>	Neem	2	Declared, Class B and C
<i>Calotropis procera</i>	Rubber Bush	1	Declared, Class B and C (south of 16°30' S latitude)

Scientific Name	Common Name	Category of priority	Status*
<i>Cenchrus ciliaris</i>	Buffel Grass	3	Declared, Unclassified
<i>Cenchrus echinatus</i>	Mossman River Grass	3	Declared, Class B and C
<i>Datura ferox</i>	Fierce Thornapple	3	Declared, Class A and C
<i>Mesosphaerum suaveolens</i>	Hyptis	4	Declared, Class B and C
<i>Jatropha gossypifolia</i>	Bellyache Bush	1	Declared, Class A/B and C, WoNS
<i>Parkinsonia aculeata</i>	Parkinsonia	2	Declared, Class B and C, WoNS
<i>Sida acuta</i>	Spinyhead Sida	4	Declared, Class B and C
<i>Sida cordifolia</i>	Flannel Weed	4	Declared, Class B and C
<i>Sida rhombifolia</i>	Paddy's Lucerne	4	Declared, Class B and C
<i>Tamarix aphylla</i>	Athel Pine	2	Declared, Class A/B and C, WoNS
<i>Themeda quadrivalvis</i>	Grader Grass	5	Declared, Class B and C, WoNS
<i>Tribulus terrestris</i>	Caltrop	4	Declared, Class B and C
<i>Vachellia nilotica</i>	Prickly Acacia	1	Declared, Class A and C, WoNS
* All Class A and B weeds are also Class C weeds.			

Weed surveys undertaken within previously during May 2022 field survey focused on the edge of tracks, disturbance areas and along the Stuart and Carpentaria Highway. The following weeds were recorded during the May 2022 field survey:

- Hyptis (*Mesosphaerum suaveolens*)
- Sida (*Sida acuta*)
- Annual Mission grass (*Cenchrus pedicellatus*) - Environmental weed of concern

The class B weed Hyptis was observed along the Carpentaria Highway and along fence line tracks. Sida was observed predominantly in areas heavily disturbed by cattle, such as where drinking troughs were located.

No weeds were identified in the SS 3D Seismic program area during the May/June 2024 survey. The area traversed during field surveys are displayed in Figure 23.

Additional information on the full list of weeds and control measures implemented across Tamboran's EPs is provided in the LCA (Appendix A) and WMP (Appendix D) and the Code.

4.2.2.5 Fire regime

Fire is a natural occurrence in most Australian ecosystems and plays an important role in their ecology. Fire is generally excluded from Mitchell grasslands by pastoral management to maintain forage throughout the dry season (HLA, 2005), whereas fire is more frequent in the Stuart Plateau.

Historically most high intensity fires within EP 98 and 117 occur during the dry season (HLA, 2005). Wet season fires have occurred within the EPs; however, these fires are likely to be patchy and of lower intensity, depending on the state of curing of the fuel load.

Land condition assessments undertaken for the Shenandoah South E&A program area 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 E&A program area. Ten-year fire data (2014 to 2024) 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 23 shows the fire frequency within the exploration areas over the past 10 years (2014 to 2024).

A BMP has been developed to manage bushfire risks associated with the proposed 3D seismic program (Appendix C). The plan provides the hazard reduction strategies, resources and response to bushfire emergencies.

4.2.3 Fauna

A review of the SREBA (Young, 2022) reveals that a total of 354 vertebrate species were recorded from all surveys and incidental observations during the SREBA and GBA studies in the Beetaloo Sub-basin, indicating relatively high total vertebrate species richness but no species endemism within the SREBA study area. Species consisted of 202 bird, 99 reptiles, 39 mammals and 14 amphibians (Young, 2022).

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

Eucalyptus/Corymbia sp. woodland provides habitat for a range of species. The proposed disturbance areas 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 Crested Shrike-tit (*Falcunculus frontatus 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 EPs.

A targeted bird survey was undertaken for 10-15 minutes at each survey site during May 2024. Surveys were undertaken by two AECOM staff, each with a pair of binoculars. A total of 42 species were identified during the surveys. Birds recorded during the survey are provide in the LCA, Appendix A.

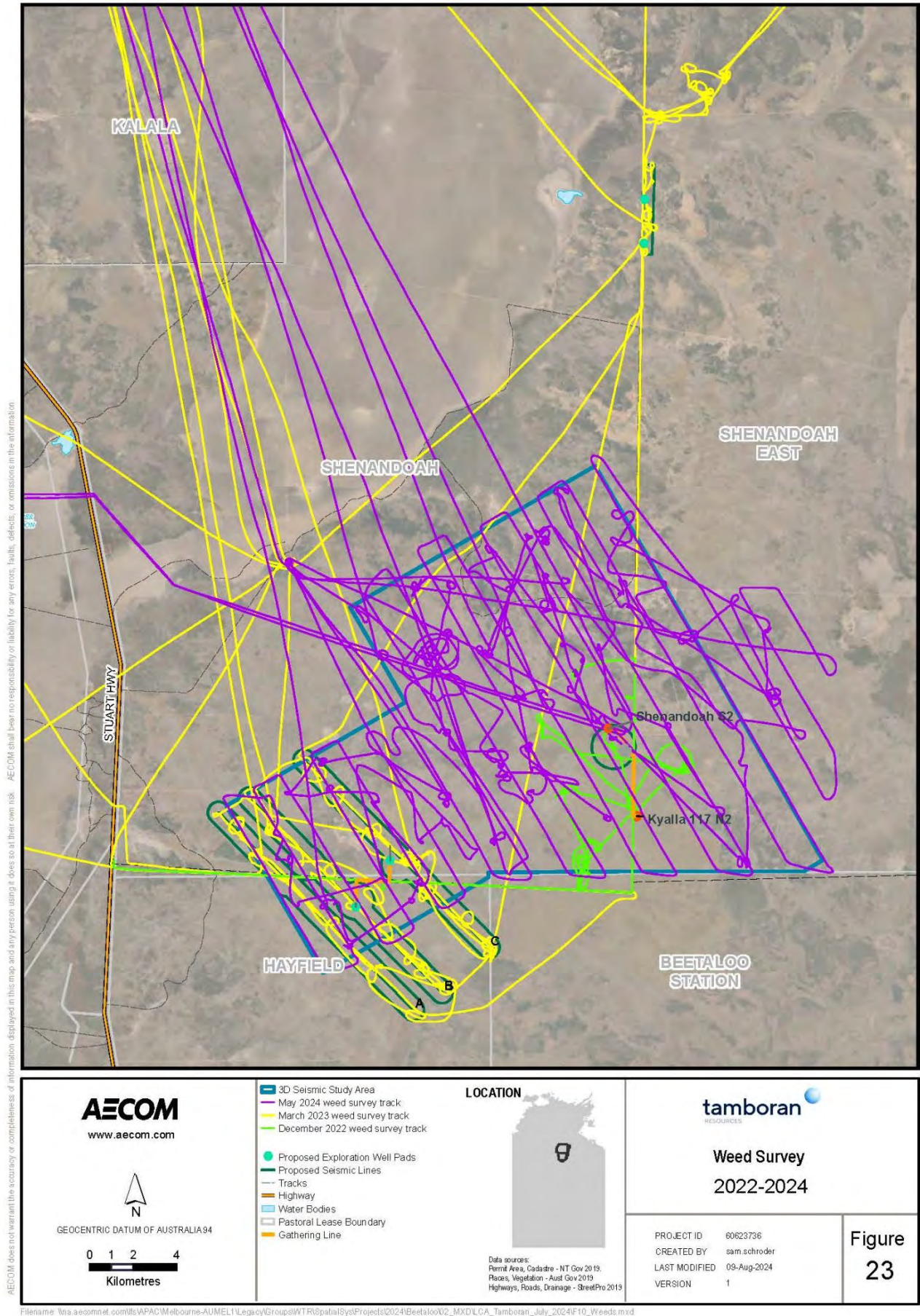
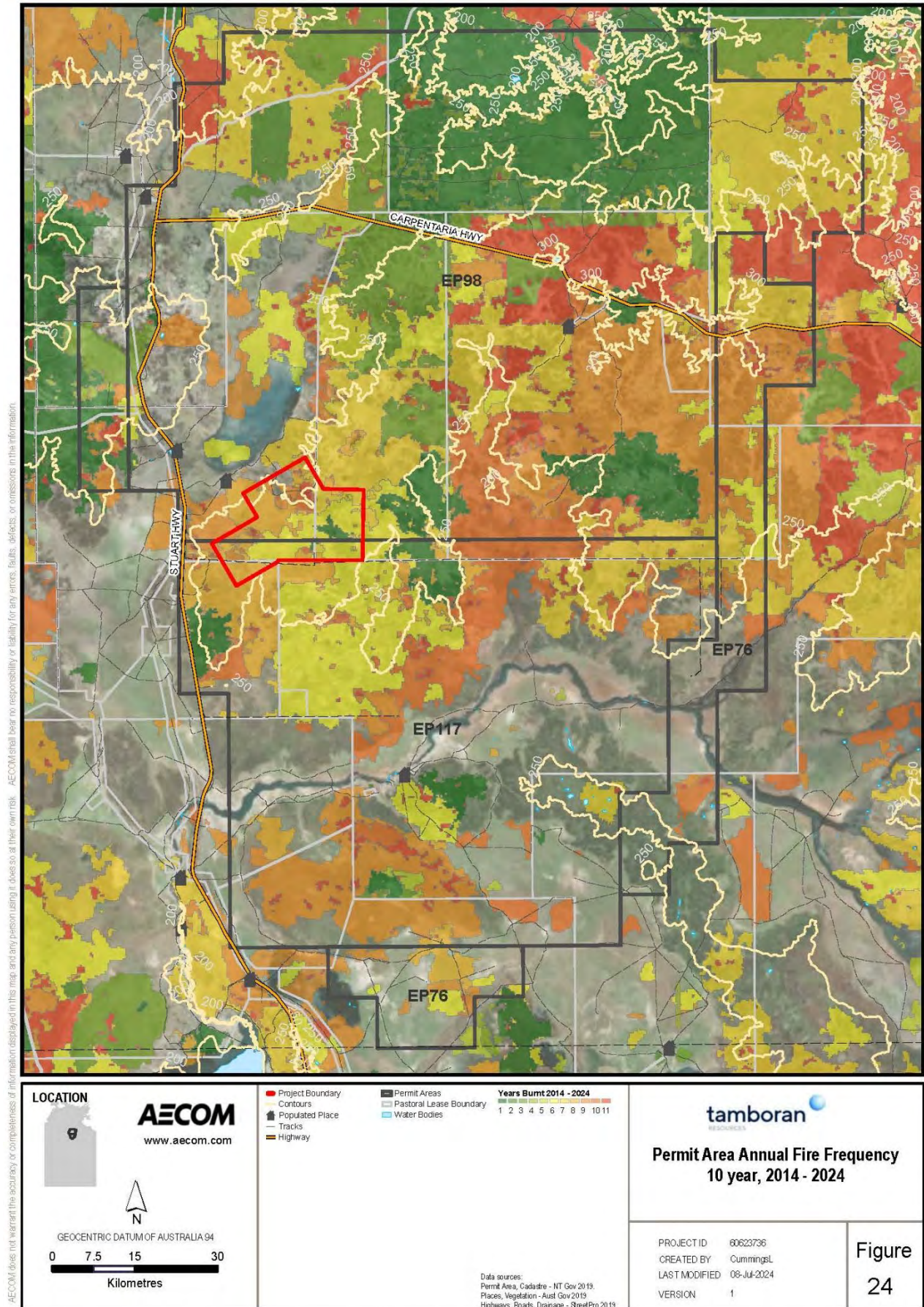


Figure 23: Shenandoah South 3D seismic program area – 2022-2024 weed survey tracks



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Figure 24: Tamboran Permit Areas – Annual fire frequency map – 10 years (2014-2024)

4.2.3.1 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 area. The search results indicate the potential presence of 24 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 11 are unlikely to occur within the SS 3D seismic program area.

One threatened fauna was confirmed to occur, specifically the Grey Falcon (*Falco hypoleucos*) was recorded during the field survey in May 2024 following an extended 2023/2024 wet season.

The likelihood of occurrence assessment 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 project area. As some areas in the proposed SS 3D seismic 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 provided below and in Table 48.

Some species may occur and are known to occur in the wider landscape. Threatened species that potentially occur include:

- Sharp-tailed Sandpiper *Calidris acuminata* (Vulnerable EPBC Act)
- Gouldian Finch *Chloebia gouldiae* (Endangered EPBC Act, Vulnerable TPWC Act)
- Red Goshawk *Erythrorhynchus 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 threatened 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.

Table 48: Commonwealth EPBC and Territory TPWC listed threatened species and likelihood occurrence assessment within the SS 3D seismic area

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Birds					
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	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 <i>Calidris ferruginea</i>	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 <i>Erythroriorchis radiatus</i>	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 <i>Chloebia gouldiae</i>	EN	VU	Widespread across northern Australia. In the NT they are found in the Top End south past Daly Waters (Palmer <i>et al.</i> , 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 they are found in lowland drainages to feed on suitable perennial grasses (Dostine & Franklin, 2002).	Possible The closest record occurs 75 km east of the Shenandoah South E&A program area. Suitable foraging habitat is present. A small patch of <i>Eucalyptus leucophloia</i> which is known to be used for nesting was identified in the north-east of the 3D seismic area, although was not associated with a hillside. No Gouldian Finch were observed during the survey.

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Grey Falcon <i>Falco hypoleucos</i>	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 <i>Falcunculus whitei</i>	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).	Unlikely The SREBA species distribution model for Northern Shrike-tit indicates that the species does not occur within the Shenandoah South E&A program area (see below). Various distribution maps of the species indicate that the species does not occur south of 16.5 °latitude.
Painted Honeyeater <i>Grantiella picta</i>	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 <i>et al.</i> , 2011).	Possible No recent records occur close to the Shenandoah South E&A program area; however suitable habitat is present.
Night Parrot <i>Pezoporus occidentalis</i>	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 western Queensland and Western Australia (DEPWS, 2021f).	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 within the Shenandoah South E&A program area.
Princess Parrot, Alexandra's Parrot <i>Polytelis alexandrae</i>	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	Unlikely No recent records occur close to the Shenandoah South E&A program area.

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
				flowering shrubs and trees (Higgins 1999; Pavey <i>et al.</i> 2014)	
Australian Painted Snipe <i>Rostratula australis</i>	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 <i>et al.</i> , 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) <i>Tyto novaehollandiae kimberli</i>	VU	VU	The subspecies occurs in northern Australia, although its distribution is not well known. In the NT, occurs from Cobourg south to Katherine and the VRD and east to the McArthur River (DoE, 2014).	This species inhabits tall open eucalypt forest in the NT, especially those associated with <i>Eucalyptus miniata</i> and <i>E. tetradonta</i> (Woinarski, 2007). Also found in riparian and monsoonal forest and rainforest (DoE, 2014).	Unlikely No recent records occur close to the Shenandoah South E&A program area and suitable habitat is not present
Mammals					
Northern Quoll <i>Dasyurus hallucatus</i>	CE	EN	The species once occurred throughout most of Northern Australia although it 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 <i>Macroderma gigas</i>	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

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Greater Bilby <i>Macrotis lagotis</i>	VU	VU	This species occurs in south-western Queensland and in arid north-western Australia (Western Australia and Northern Territory). This species was previously widespread in arid and semi-arid Australia (Pavey, 2006). The most northern records are from Newcastle Waters and Wave Hill (Southgate & Paltridge, 1998).	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 <i>et al.</i> , 2021).	Unlikely No recent records, occur in the vicinity of the Shenandoah South E&A program area. However, 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. However, evidence from experienced ecologists who authored the SREBA Terrestrial Ecosystem Report (Young, 2022) determined that based on species' habitat requirements and on-ground knowledge of the attributes in the area, the likelihood of occurrence was considered very low.
Bare-rumped Sheath-tailed Bat <i>Saccolaimus saccolaimus nudiclunatus</i>	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 <i>Pandanus</i> woodland fringing the sedgeland 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 <i>Trichosurus vulpecula arnhemensis</i>	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.

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
Pale Field-rat <i>Rattus tunneyi</i>	-	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 Shenandoah South E&A program area.
Reptiles					
Plains Death Adder <i>Acanthophs hawkei</i>	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 <i>Elseya lavarackorum</i>	-	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 <i>Tiliqua scincoides intermedia</i>	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 Territory (NT), to approximately the Gregory Downs / Cloncurry area in western Queensland (DCCEEW, 2023).	The Northern Blue-tongue Skink occurs in a wide variety of ecosystems, including riparian forest, vine scrub, monsoon rainforest, pandanus-lined 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	Possible Recent records occur nearby, and suitable habitat occurs within the Shenandoah South E&A program area.

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
				time in small, fragmented patches of relatively dense vegetation that provide cool, shaded, and damp conditions (DCCEEW, 2023a).	
Mertens' Water Monitor <i>Varanus mertensi</i>	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.
Mitchell's Water Monitor <i>Varanus mitchelli</i>	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 <i>Varanus panoptes</i>	-	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 <i>et al.</i> , 2012).	Occupies a variety of habitats including coastal beaches, floodplains, grasslands and woodlands (Ward <i>et al.</i> , 2012).	Possible 2017 records occur approximately 20 km from the Shenandoah South E&A program area and suitable habitat is present.
Shark					
Large-tooth Sawfish <i>Pristis pristis</i>	VU	VU	Large-tooth 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	This species in northern Australia appears to be confined to freshwater drainages and the upper reaches of estuaries, occasionally being found as far	Unlikely No rivers or large permanent water bodies occur within the

Species	Status		Distribution	Habitat	Likelihood
	EPBC	TPWC			
			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).	as 400 km from the sea (Thorburn <i>et al.</i> 2007; Whitty <i>et al.</i> 2008).	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).

A small patch of *Eucalyptus leucophloia* (Snappy Gum) was recorded in the north-east side of the 3D seismic area (Vegetation Community 2c - 0.41% of the area) and was considered to have a moderate probability of presence based on the SREBA species distribution model (Young, 2022) (Figure 25). The vegetation community 2c within the Shenandoah South E&A area is not associated with rocky hillslopes and as such is unlikely to be considered a key nesting area.

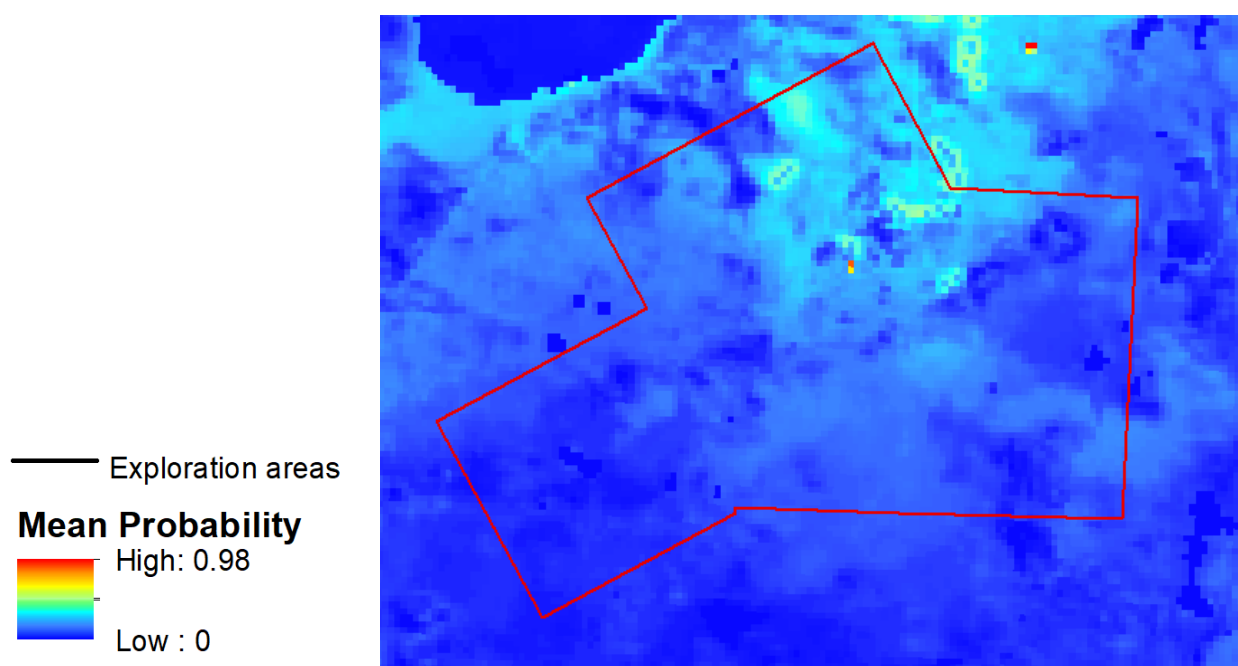


Figure 25: Mean probability of presence of Gouldian Finch within the Shenandoah South E&A program area (Young et al., 2022)

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 25. Only one area was identified as high probability of presence which is an ephemeral waterhole located adjacent to an existing pastoral access track. It is likely Gouldian Finch would use this area for a water source. It is noted that this area has also been identified as an area with cultural heritage values (refer section 4.3.2) and as such will be avoided.

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). These perennial grasses were recorded during the survey which does indicate potential foraging habitat is present; however, there are limited records in the vicinity.

The Shenandoah South E&A program area vegetation sites were surveyed for Gouldian Finch, congruent with the Northern Shrike-tit surveys. Call playback was not undertaken for Gouldian Finch. No Gouldian Finch were observed during the bird surveys.

The main threats to Gouldian Finch are associated with grazing pressures and unfavourable fire regimes. The measures proposed by the 3D seismic survey aim to minimise impacts through mitigations such as restricting width of the seismic line to 3.5 m, avoid clearing of trees >25cm trunk @ 1.3 m) and fire

protection measures while undertaking the survey. It is considered unlikely the proposed 3D seismic activities will result in significant impact to the Gouldian Finch.

Red Goshawk

The Red Goshawk has a large home range of up to 200 km² (Aumann & Baker-Gabb 1991), and recent satellite tracking of individuals has shown them to travel distances of over 1,500 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 3D seismic 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.

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 3D seismic 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 24) 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).

Evidence from the experienced ecologists who authored the SREBA Terrestrial Ecosystem Report (Young, 2022) determined that based on species' habitat requirements and on-ground knowledge of the attributes in the Shenandoah South E&A area, the likelihood of occurrence of the Greater Bilby was considered very low.

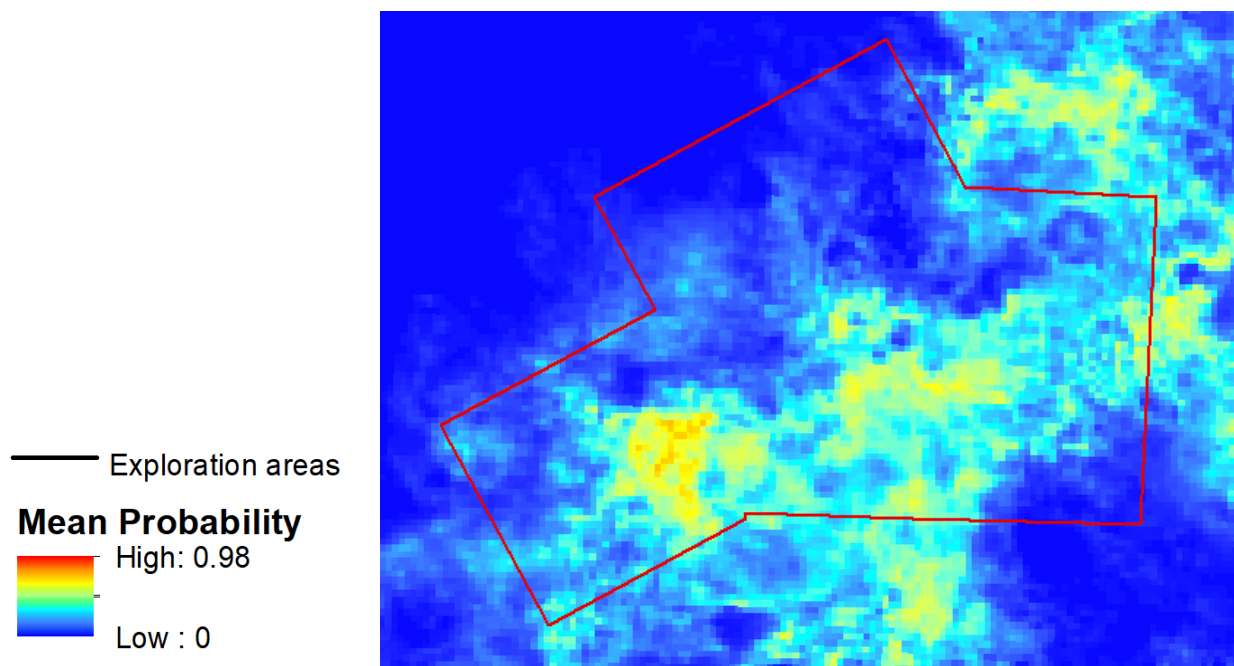


Figure 26: Mean probability of presence of Greater Bilby within the Shenandoah South E&A program area (Young et al., 2022)

Although the area of the Shenandoah South E&A program has some moderate likelihood of containing suitable habitat, the SREBA survey showed no sign of Greater Bilby during on-ground track plot surveys.

Grey Falcon

The Grey Falcon (*Falco hypoleucos*) is a widespread species listed as Vulnerable in the NT and possibly occurs in the study 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 area 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 arastrata*) 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 survey effort of 109 call playback surveys across 3 survey periods between 2020 and 2022. Surveys for Northern Shrike-tit for SREBA detected the species at 26 out of the 109 call-playback survey sites, 10 locations incidentally and one fauna inventory site. The SREBA distribution model (Figure 27) suggests that the entire project has a low likelihood of the species occurring (DEPWS, 2022b).

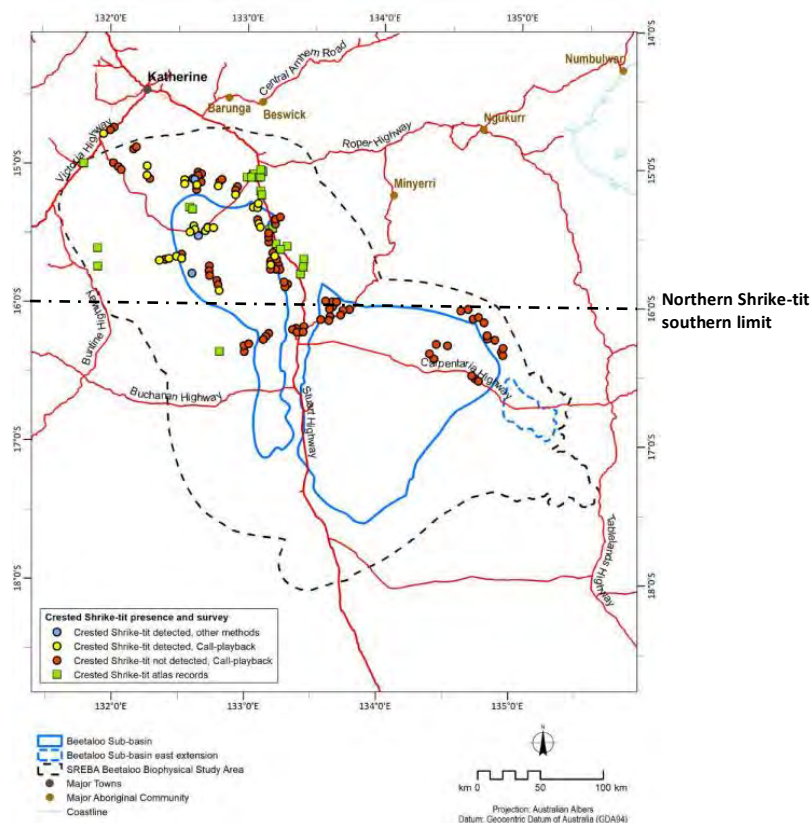


Figure 27: SREBA species distribution model for Northern Shrike-tit in the Beetaloo Sub-basin (extract from DEPWS, 2022b)

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 area. The area proposed for clearance is 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 May 2024, indicating that the species visits the region ([Australian Painted-snipe - Tracking, News & Information \(paintedsnipe.com.au\)](https://paintedsnipe.com.au)).

Tamboran's proposed activities are unlikely to result in an impact to the Australian Painted Snipe due to the proposed methods of seismic acquisition. Access to any wetland areas will be restricted to pedestrian and low impact seismic acquisition methods as described in section 3.7.

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 impact 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 (ALA, 2024). 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. Access to wetland areas within the SS 3D seismic program area will be restricted to pedestrian and low impact seismic acquisition methods as described in section 3.7.

The SREBA species distribution for Yellow-spotted Monitor (Figure 28) 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).

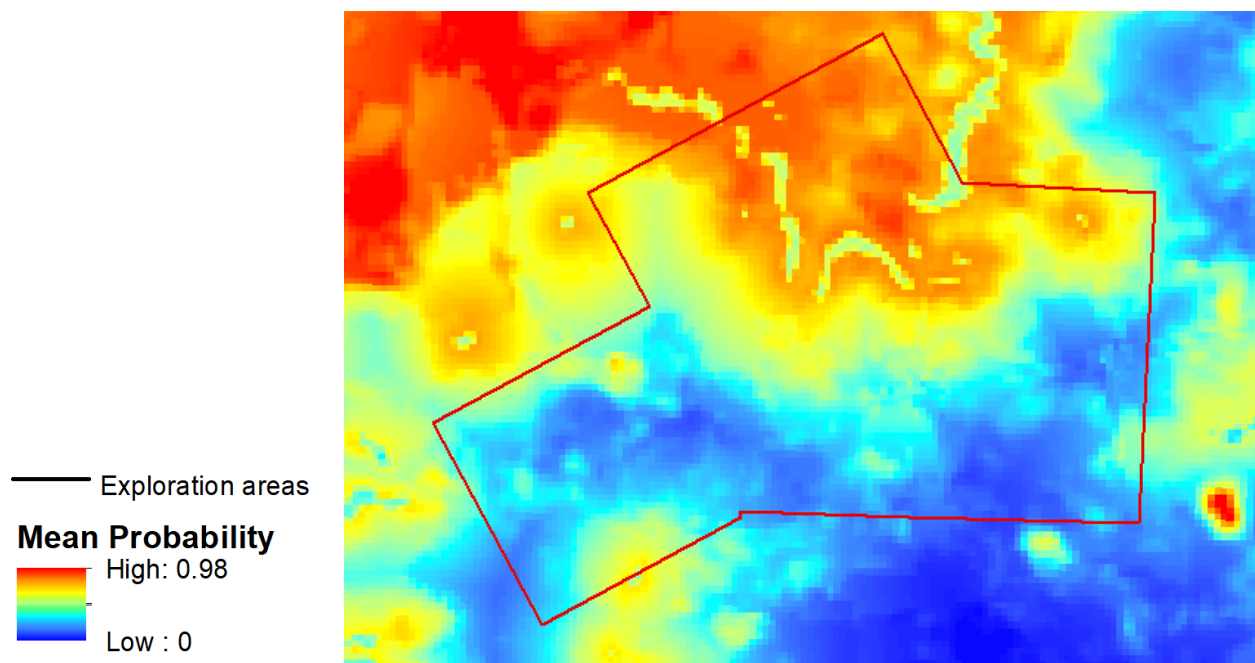


Figure 28: Mean probability of presence of Yellow-spotted Monitor within the Shenandoah South E&A program area (Young et al., 2022)

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 threatened species such as wetland birds (including migratory species).

4.2.3.2 Migratory and Marine Species

The EPBC Protected Matters database indicated the potential presence of 13 migratory and 18 marine listed species within the SS 3D seismic program area (Table 49). Of these species, three are considered likely to occur, nine possibly occur and eight are unlikely to occur within the SS 3D seismic program area. Several migratory wetland bird would possibly occur within the area in ephemeral wetlands that would fill up following wet season rainfall. The SS 3D seismic program area does not contain critical habitat for any migratory or marine listed species.

Table 49: Migratory listed species potentially occurring within the new sites

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

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

4.2.3.3 Feral and pest animals

Feral animals known to occur within the region include pig (*Sus scrofa*), wild dog (*Canis lupus familiaris*), feral cat (*Felis catus*), cane toad (*Bufo marinus*), horse (*Equus caballus*), donkey (*Equus asinus*), water buffalo (*Bubalus bubalis*), camel (*Camelus dromedarius*), black rat (*Rattus rattus*), and 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 many of the assessed sites.

The cane toad is known to be present in the SS 3D seismic program area and the Commonwealth DCCEE 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 including the Plains Death Adder (*Acanthophis hawkei*), King Brown Snake (*Pseudechis australis*) and *Varanus* spp. (Smith & Phillips, 2006).

Pest predators such as cats likely occur within the SS 3D seismic 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 SS 3D seismic program area due to an increase in human activities in the area. Pest species controls are included in the EMP to discourage attraction to the exploration areas, in particular camp operations where there is a high potential for food waste to be encountered and minimising the creation of corridors that pest species (i.e. feral cats) may use for hunting.

4.2.3.4 Groundwater dependent ecosystems

A search of the National Groundwater Dependent Ecosystems (GDE) has been conducted previously, indicating 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 SS 3D seismic 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 20 km west of the SS 3D seismic program area respectively.

Until recently, all known and moderate potential GDE locations occurred at distances >20 km from the vicinity of the proposed regulated activities. The impact on these units from Tamboran's total water extraction across the Beetaloo exploration area was assessed during the granting of WEL GRF 10285.

It is unlikely the size and duration of the SS 3D seismic program activities will impact on GDE and further reduced through implementation of mitigations described in section 6.6.2.

4.3 Environmental and cultural sensitivities

4.3.1 Native Title

Two native title determinations have been finalised across the SS 3D seismic program area. These are described in Table 50.

Table 50: Native title determinations current for Shenandoah South E&A program area

Name	Summary
NTD21/2010 Shenandoah pastoral lease and Shenandoah East pastoral lease	Native title exists in parts of the determination area and is held by the Kinbininggu and Bamarrngganja groups, including persons who are members of the estate group in accordance with cl. 6 of the Determination and other Aboriginal people with rights and interests in respect of the Determination Area, in accordance with cl. 7 and cl. 8 of the Determination.
NTD26/2010 Hayfield pastoral lease	Native title exists in parts of the determination area and is held by the Kinbininggu, Warranangku and Marlinja groups, including persons who are members of the estate group in accordance with cl. 6 of the Determination and other Aboriginal people with rights and interests in respect of the Determination Area, in accordance with cl. 7 and cl. 8 of the Determination.

The Native Title Petroleum Exploration Agreement between Tamboran and the NLC includes clauses for the protection of sacred sites, objects and sensitive areas related to Aboriginal activities in the area, including cultural, hunting and foraging activities. The Native Title Agreement also includes clauses for the protection of the sacred sites, environment, site rehabilitation and local employment opportunities. Tamboran is committed to maximising local Aboriginal employment opportunities including engagement of Cultural Managers for disturbance activities, scouting support, environmental monitoring, site maintenance and waste management. There is also opportunity for a range of additional support services including Rehabilitation.

4.3.2 Archaeology assessment

Archaeological assessments were completed by AECOM in April 2023 and May 2024 within the SS 3D seismic program area. The assessment involved a desktop review of existing heritage data from the Australian Heritage Database, the NT Heritage Register (NTHR) and the Aboriginal Areas Protection Authority (AAPA) certifications, previous archaeological survey reports prepared for the local area, as well as consultation with traditional owners and a field inspection.

In addition, AECOM undertook a detailed desktop assessment of the SS 3D seismic program area using satellite imagery to identify the presence of landforms with Aboriginal cultural heritage sensitivity (sensitive landforms). The desktop assessment was informed by a predictive model developed by HLA-Envirosciences Pty Ltd (HLA) and AECOM in 2006 and further refined during subsequent AECOM surveys (AECOM, 2012; AECOM, 2023; HLA-Envirosciences Pty Ltd, 2006a). A total of 25 areas were mapped as sensitive landforms and confirmed during aerial observations, and targeted pedestrian surveys of four of the areas.

The field surveys were conducted by AECOM Archaeologist and traditional custodians to identify sensitive landforms that may have cultural significance. The archaeological surveys involved aerial surveys of the broader Shenandoah South E&A program area, inclusive of the proposed 3D seismic program.

During the inspection, notes were taken on landform, ground surface visibility and areas of exposure. The aim of the inspection was to identify any surface expressions of Aboriginal archaeological and cultural heritage values within the proposal area. Photographic records were taken at each proposed disturbance location. A copy of the archaeological assessment report and methods is provided in Appendix B.

The field results of the Shenandoah South E&A program area indicate 12 cultural heritage sites that will require mitigations to reduce impact. The cultural heritage sites consisted of:

- ten artefact scatters
- nine isolated artefacts
- one landscape features (ochre resource area)
- one waterhole (identified as having intangible cultural significance).

The majority of the cultural heritage sites were in proximity to the identified high priority areas (i.e. areas of water sources with standing or running water associated with a waterhole, soakage or channelised drainage lines).

No tangible cultural heritage sites were identified in areas not associated with sensitive landforms, including two random sample locations and 15 areas where sensitive landforms were identified by the predictive model. This provided broad support for the predictive model's ability to accurately identify areas that are unlikely to contain Aboriginal archaeological sites.

Areas identified as high priority will be avoided during the 3D seismic survey. In addition, an unexpected finds procedure which has been developed over the Tamboran's exploration program in the area will be used to respond to any potential additional artifact or sacred site finds during Tamboran's 3D seismic program. A copy of the finds procedure is presented as Appendix E in the cultural heritage assessment report (Appendix B).

Cultural heritage sites identified during the AECOM survey, including the areas Tamboran have identified to avoid using vehicles in (i.e. the no clear areas) are presented in Figure 29.

4.3.3 Areas of cultural significance

Sacred sites in the study area are primarily associated with drainage lines; natural landform features and stock routes, but there are also concentrations of sites nearby to old homesteads. The distribution of these sites may reflect historical patterns of Indigenous movements along drainage lines and subsequent development of stock routes on old Indigenous walking trails, or they may merely be indicative of the site clearance work undertaken along roads and tracks in the area. It is suspected that there will be a range of other sites also within the area, either not yet recorded, or known but not reported for cultural reasons.

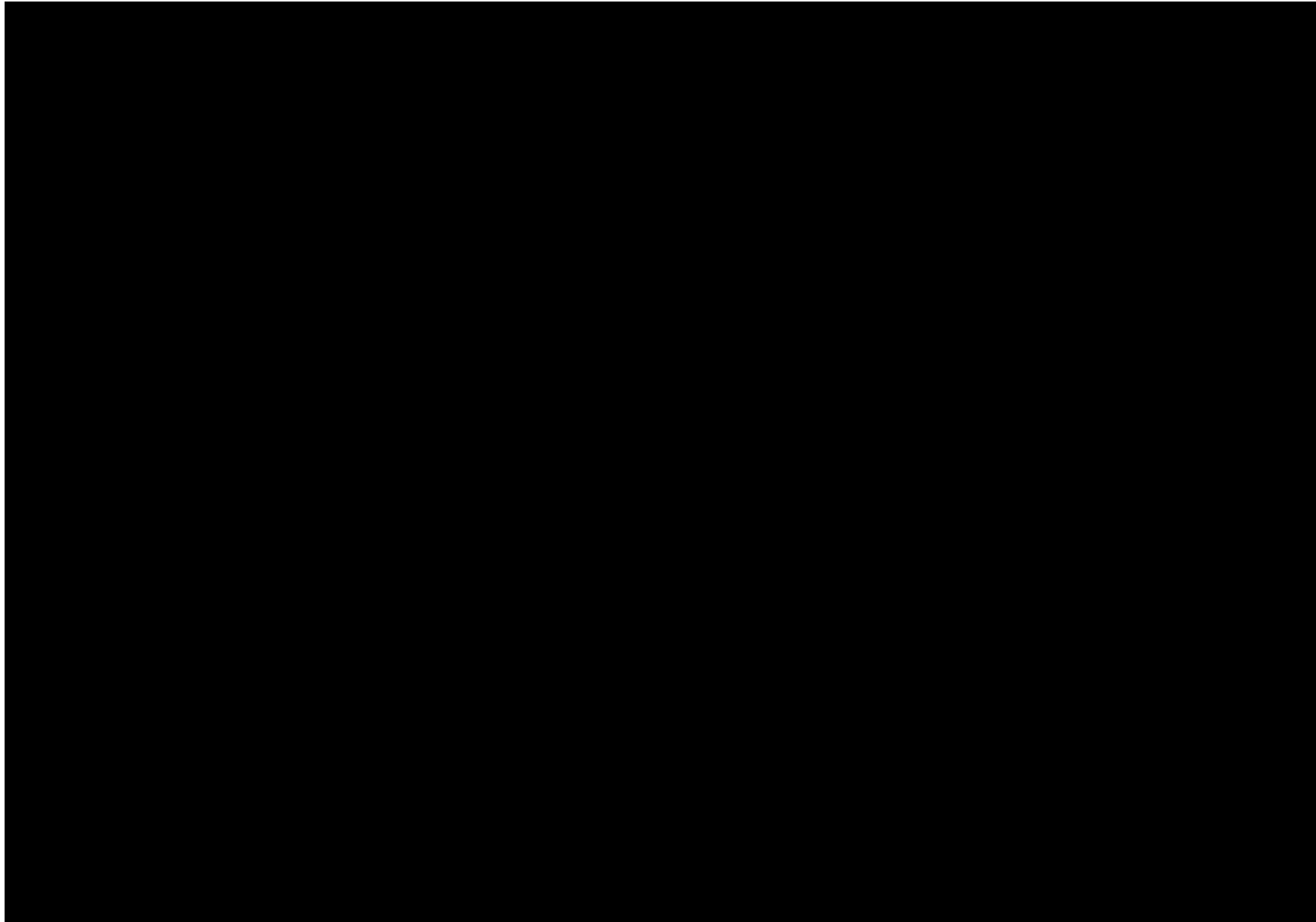


Figure 29: Shenandoah South 3D seismic program area - heritage sites

The proposed activities for the SS 3D seismic program will occur within the subject land area which has been approved by the native title holders and the NLC and assessment by AAPA. AAPA certificate C2024/031 covers the entire Shenandoah South E&A program area, inclusive of the collection of seismic data, including line clearing, preparation, operation, data acquisition, and vegetation reinstatement.

No Restricted Work Areas (RWA) are identified within the Shenandoah South E&A program area and the proposed 3D seismic areas.

4.3.4 Non-indigenous heritage

In 1860, explorer John McDougall Stuart was the first European to penetrate the area now known as the 'Centre'. The first written descriptions of the area come from Stuart during his second attempt to cross the continent from south to north (HLA, 2005).

Development in the area began as pastoral lands with an increased interest in land settlement following the completion of the Overland Telegraph Line in 1873. Most attempts were unsuccessful with the Lancewood-Bullwaddy vegetation found to be impenetrable and the lack of surface water making the land unsuitable for cattle. Daly Waters was thus recognised as one of the last watering stops on the Murrarji Stock Route.

It wasn't until the 1930s to 1950s, that the area saw regional economic growth with Daly Waters becoming a significant hub of air and mail services into the Northern Territory. The wartime years saw this role increase with Daly Waters again playing a major role in cross country transport and communication. This role continued until the early 1970s when the airport was closed to commercial traffic. The town and surrounding areas subsequently reverted to a primarily agriculture-based existence following the decline of air travel, but in recent times has seen commercial interest from the exploration for gas in the Beetaloo Sub-basin and the growth of the 'grey nomad' tourism market.

4.3.5 Heritage assessment

A search of the Australia Heritage Database identified that no statutory listed heritage places were present within the proposed Shenandoah South E&A program.

Frew Ponds, a reserve paying tribute to the building and joining of the Overland Telegraph Line is located approximately 20 km west south-west of the proposed Shenandoah South E&A program and approximately 16 km south of the access track turn-in from the Stuart Highway.

No heritage places or artefacts are registered within the proposed SS 3D seismic program area.

4.3.6 Protected or conservation areas

There are no conservation reserves, national parks, world heritage places, Commonwealth land, heritage places or critical habitat areas listed under the EPBC Act located within or adjacent to the SS 3D seismic program area.

The Bullwaddy Conservation Reserve lies 70 – 87 km to the north-east of the Shenandoah South E&A program area. The EPBC Listed Lake Woods is located approximately 90 – 100 km south of the Shenandoah South E&A Program area and is listed on the National directory of important Wetlands.

The risks to Lake Woods through aquifer contamination, spills, sediment release, habitat destruction have been addressed in the risk assessment presented in Appendix I. The main mitigation measures/ factors include:

- As the proposed site are 100 km (direct) from Lake Woods, contamination is not likely to reach the area at any undiluted impactable state.
- Surface water flow is to the south into a tributary of Newcastle Creek which flows into Lake Woods via Newcastle Waters. Any spill would need to travel over approximately 100 km to reach Lake Woods and it is unlikely the SS 3D seismic program will have significant storage of chemicals other than what is needed to undertake the survey.

- Groundwater depth throughout the SS 3D seismic program area is expected to be greater than 70 m deep with vegetation not being able to access groundwater at this depth. The flow path (north-west) is not in alignment with the conservation area, meaning a valid contamination pathway does not exist.

4.4 Social environment

4.4.1 Social context

The proposed SS 3D activities will occur within the Roper Gulf Regional Council area, which covers 201,000 km². The approximate population is estimated for the Roper Gulf region of 5,592 people (Roper Gulf Council Regional Plan 2022-23).

The potential social and economic effects associated with the proposed exploration activities are minor and predominantly positive.

The closest neighbouring regional towns and communities identified as being within proximity to these regulated activities include:

- Dunmarra (~30 km)
- Elliott (~80 km)
- Daly Waters (~70 km)
- Newcastle Waters (~60 km)

There is one small area of Aboriginal freehold land known as Jingaloo on EP 117, which is located approximately 80 km from the SS 3D Seismic program area.

4.4.2 Pastoral activity

The SS 3D seismic program area is located on Shenandoah, Shenandoah East and Hayfield pastoral stations. Within the Tamboran's Beetaloo exploration permit area there are nine pastoral properties (Table 51). All the land within the permit area is a perpetual pastoral lease.

Table 51: Pastoral properties in the permit area

Pastoral property	Permit areas			Contacts
	EP 76	EP 98	EP 117	
Amungee Mungee	✓	✓	✓	N/A
Hayfield / Shenandoah / Shenandoah East		✓	✓	Val Dyer PMB 168 Katherine, NT, 0850 Email: val.dyer@bigpond.com Phone: (08) 8975 9920
Kalala		✓	✓	N/A
Tanumbirini	✓	✓		
Beetaloo ¹⁶	✓		✓	N/A
Ucharonidge	✓		✓	N/A
Tandyidgee	✓	✓		
Nutwood Downs		✓		

¹⁶ As per previous engagement covering approved Beetaloo W regulated activities and EMPs.

Pastoral property	Permit areas			Contacts
	EP 76	EP 98	EP 117	
Newcastle Waters			✓	

4.4.3 Other land uses in the area

A range of other land uses exist in the permit area or in the larger region, including a range of public utilities and facilities. These include the following:

- Tourism – Tourism is an important regional industry with the Stuart Highway being a major thoroughfare for tourists travelling in the area during the dry season. The local townships of Daily Waters, Dunmarra and Elliott provide consumables (food, fuel etc.) and accommodation. Several heritage areas of importance to regional tourism are in the broader region, including Elliott, Newcastle Waters and other heritage listed homesteads.
- Road networks – The Stuart Highway will be used to access the sites. In addition, there are numerous gravel roads connecting properties, and internal property tracks. All properties also have firebreaks on their boundaries and internally.
- Gas pipeline – A gas pipeline runs to the west of the Stuart Highway, along the eastern boundary of EP 117 and crosses the boundary of one part of EP 98. It also runs parallel with the Carpentaria Highway to the Gulf of Carpentaria, through EP 98 and EP 76.
- Alice Springs to Darwin Railway – The railway line runs to the west of the gas pipeline and Stuart Highway and does not cross into any of the permit areas.
- Townships – The townships of Daly Waters and Dunmarra neighbour EP 98 to the west.
- Conservation areas – including the Bullwaddy Conservation Reserve, which lies within EP 98, and Lake Woods and the Junction Stock Reserve outside EP 117, approximately 100 km south.
- Heritage – There are 7 heritage sites within the exploration permit area and several heritage areas of importance to regional tourism located in the broader region, including Elliott, Newcastle Waters and heritage-listed homesteads.
- Archaeological sites – The permit areas have a long history of Aboriginal association, and a number of archaeological sites have previously been recorded within the permit areas, as well as registered sacred sites and areas of significance.

The proposed activities covered under this plan have been specifically designed to avoid impacts to these receptors.

4.5 Matters of National Environmental Significance

4.5.1 Potential EPBC Act Controlling Provisions

Actions such as the proposed SS 3D seismic 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 Water resources.

Potential triggers under the EPBC Act for onshore gas exploration 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 an unconventional gas development and large coal mining development.

4.5.2 Protected Matters Search

An EPBC Protected Matters Search was generated on the 8 March 2024 to identify whether MNES or other matters protected by the EPBC Act are likely to occur on or in the near vicinity of the SS 3D Seismic program area. Results of the search are provided below in Table 52.

Table 52: Summary of EPBC Aspects for SS 3D Seismic Program

Aspect	Located within the SS 3D Seismic 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
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

Total clearing for 3D seismic is predicted to be 56.25 ha – 76.25 ha. This represents between 25 – 34% of the total surface area planned to be surveyed. There are no recorded critical habitat¹⁷, forests / reserves or nationally important wetlands identified within the project area.

Section 4.2.2 and section 4.2.3 provides details on threatened species that potentially occur within the 3D seismic program area. Based on the predicated area of disturbance, assessment of the likelihood of occurrence of threatened and migratory species that potentially occur within the SS 3D seismic program area, and mitigation measures such as avoidance of large trees, intermittent streams and wetlands, these species are unlikely to be significantly impacted by the exploration activities. In addition, the seismic survey is short term activity planned to occur during the dry season when majority of migratory species have left the area.

5 Stakeholder engagement

5.1 Purpose and objectives

Tamboran's stakeholder engagement is focused on building respectful relationships with key stakeholders and developing a positive reputation founded on Tamboran's core values. Tamboran's consistent approach to stakeholder engagement has been to ensure that those persons and/or groups directly impacted/affected and/or influenced by permit commitments have received Tamboran's full attention. Tamboran views the social acceptance and informed consent of these primary stakeholders of critical importance and relevance during this stage of low impact and small-scale exploration activities.

A stakeholder engagement plan has been implemented, which guides the way Tamboran undertakes stakeholder engagement above and beyond the requirements outlined in the Regulations.

Stakeholder engagement records for the new activities are provided in Appendix J (the Stakeholder Engagement Logs Part A and Part B); Appendix J.1.1 (pastoral) and Appendix J.1.2 (NLC). Historic stakeholder engagement records for approved regulated activities incorporated into this EMP, relating to the SS 3D seismic program area are provided in Appendix J.1.3 have been provided as supporting information to the EMP.

5.2 Identification of stakeholders

The Regulations define stakeholder as meaning:

- a) *a person or body whose rights or activities may be directly affected by the environmental impacts or environmental risks of the regulated activity proposed to be carried out; or*
- b) *an agent or representative of a person or body mentioned in paragraph (a).¹⁸*

Tamboran's directly affected stakeholders have been, and will continue to be, consulted in a respectful, open and consistent manner. This has been the case since 2014, when the previous operator, Origin, assumed operatorship of EP 98, EP 117 and EP 76 and again in November 2022 when Tamboran assumed operatorship of EPs 98, 117 and 76.

For this EMP, Tamboran identifies its stakeholders, in compliance with the regulations as:

- **Host traditional owners** recognised as the native title holders and/or claimants and their representative, the NLC, as described in Exploration Agreements between the parties for EP 98, EP 117 and EP 76; and

¹⁷ Critical habitat: "...habitat critical to the survival of a listed threatened species or ecological community."

https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Completed_inquiries/2010-13/threatenedspecies/report/c05

¹⁸ Refer section 7(3) of the Regulations.

- **Host pastoralists** recognised as the landholders of the nine pastoral stations (Table 51). For the 3D seismic acquisition described in this EMP, the owners of the pastoral leases for Shenandoah, Shenandoah East and Hayfield pastoral stations are recognised as the pastoralist stakeholders directly impacted.

Stakeholder and community engagement for the proposed work program has been held with host pastoralists and traditional owners directly affected by the proposed activities. Activities performed on EPs will be conducted in a manner consistent with the Code, which Tamboran considers an appropriate regulatory instrument for ensuring Tamboran's activities are in line with community expectations and legislative requirements.

Tamboran also recognises and engages, where appropriate with other interested parties that are not classified as directly affected under the Regulations. These include government agencies, land councils, local and regional suppliers, non-government organisations, councils and peak industry bodies.

5.3 Pastoralist stakeholder engagement

Tamboran has engaged with the pastoral stakeholders identified previously (Table 51) on an ongoing basis, including engagement with the leaseholders and/or representatives of the Hayfield / Shenandoah / Shenandoah East Stations, regarding the full range of exploration activities outlined in this EMP. Key engagement efforts Tamboran has undertaken include:

- Ongoing regular engagement with pastoralist about Tamboran's general activities.
- Providing the landholder with copies of a Stakeholder Engagement Pack (SEP) covering exploration activities and providing opportunity for the landholder to comment.

The Stakeholder Engagement Logs Part A and Part B (Appendix J) summarise Tamboran's engagement with the leaseholders of Shenandoah, Shenandoah East and Hayfield pastoral stations as a relevant stakeholder and provide information in accordance with section 7(2)(a) of the Regulations.

Appendix J.1.1 provides the detailed records of communication between Tamboran and the pastoralist regarding the proposed activities, which are provided separate to the EMP.

5.4 Host traditional owner(s) engagement

Tamboran has undertaken detailed engagement with the host traditional owners through the NLC to facilitate an ongoing relationship between Tamboran and their host traditional owners. Engagement efforts undertaken by Tamboran include:

- Execution of Exploration Agreement(s) between Tamboran and native title holders for all EPs. This includes a range of additional reporting and environmental protection measures, in addition to the minimum statutory requirements outlined in the NT Petroleum (Environment) regulations.
- Provision of annual work program updates and sacred site clearances providing detailed information on the proposed regulated activities, including description, location, impacts, risks and controls.
- Execution of Sacred Site clearance and avoidance surveys on the specific areas of land. A formal NLC Sacred Site Avoidance and Anthropological Report is generated by the NLC and submitted to the AAPA to assist with the issuing of an Authority Certificate in compliance with the NT's *Aboriginal Sacred Sites Act*.
- In person consultation between Tamboran, host traditional owners and their statutory representative body, the NLC regarding Tamboran's proposed exploration activities as a part of annual work program update meetings.

- On country meetings held with NLC and traditional owners to discuss proposed activities, schedule and address any questions. The on-country meetings conclude the engagement and consultation necessary with traditional owners prior to commencement of each years' activities.
- Ongoing consultation regarding Tamboran work programs and proposed exploration activities, including the location(s) of all areas of disturbance and answering any questions or comments on the activity and its related impacts.
- Regular site visits to walk through activities underway (including vegetation clearing activities, drilling and stimulation) and answer any questions regarding any of Tamboran's E&A activities that are underway.

The traditional owner stakeholder engagement is summarised in Appendix J, Part A & B. Detailed records of communication between Tamboran and the host traditional owners (via NLC), regarding the proposed activities is provided in Appendix J.1.3, which are provided separate to the EMP.

The NLC is the contact point for all native title holders:

[REDACTED]

5.5 Stakeholder activities

Key considerations when understanding the consequences to pastoral operations and traditional owners include:

- Understanding pastoralist operations and determined native title holder custodianship of the proposed area to ensure petroleum activities can sustainably co-exist.
- Provision of payments and/or benefits to the pastoral lessee(s) and native title holders for the impact of regulated activities on the proposed activity area in accordance with the relevant agreements.

A summary of the potential consequences of the activity on stakeholders' activities and mitigation controls is provided in Table 53.

Table 53: Potential consequences of Tamboran's activities on stakeholders' activities and control measures which are outlined in the SEPs

Activity	Potential consequence to activities	Mitigations
Pastoralists		
Pastoral time	• Impact to pastoralist time as they are required to engage with Tamboran as a part of the planning and approval for the proposed activity.	• Tamboran undertakes engagement in good faith, with information provided in a variety of formats to reduce time pressures as far as reasonably practicable
Pastoralist site access	• Exploration vehicles along access track may interact with pastoralist activities- mustering and pastoralist vehicles. • Restricted access to exploration well and fenced area during the length of proposed activities. • Restricted access during seismic surveys.	• Pastoralist engaged throughout exploration activity planning to incorporate pastoralist feedback into activity to reduce impacts. • Camps with workers bussed to site (where possible) to minimise vehicle movements. • Hazardous areas to be fenced and signed to communicate potential safety hazards. • Compensation to be paid for loss of available grazing land and disturbance.

Activity	Potential consequence to activities	Mitigations
Pastoral activities grazing and mustering	- Minor elevated levels of noise in the immediate vicinity of the exploration activities (limited noise at all other times). - Potential elevated noise and vibration within vicinity of seismic shoot (typically within 200-500 m of activity). - Disturbance of cattle in the immediate vicinity of the activity when works are undertaken. - Dust impacts on immediate adjacent vegetation has the potential to temporarily reduce yield, similar to existing pastoral tracks. - Reduction in pastoral productivity through poor rehabilitation. - Potential introduction or spread of weeds. - Helicopter movements in vicinity of pastoral activities may disturb cattle/ mustering operations. - Potential impacts on cattle and pastoral business where gates are left open.	- Pastoralist engaged throughout exploration activity planning to minimise impact on cattle and pastoral activities. - Compensation to be paid for loss of available grazing land and disturbance. - Full fencing of well pad to restrict cattle. - Speed limits restricted to 60 km/hr, unless otherwise agreed. - Dust control utilised to reduce dust emissions. - Site to be rehabilitated back to pre-existing state, with security bond in place if company fails to rehabilitate. - Weed management plan implemented, including requirements for weed hygiene inspections and certificates on all equipment and vehicles. 6 monthly weed monitoring and spraying of weeds using a NT Government approved treatment. - Pastoralist to notified and engaged prior to commencing helicopter movements to mitigate interference. - Induction with all exploration contractors and staff in relation to pastoral operations. This induction to be developed with input from pastoralist. - Use of grids, gate signage, inductions and regular gate monitoring and reporting to pastoralist to minimise occurrence of gates being left open. - On-going liaising with pastoralist throughout on ground operations
Pastoralists ongoing productivity of area post rehabilitation	- Reduction in productivity due to erosion and sediment releases. - Reduction in productivity due to wastewater, chemical/fuel spills. - Reduction in pastoral productivity through poor rehabilitation. - Potential introduction or spread of weeds.	- Routine site maintenance completed to ensure functioning of erosion and sediment control. - All fuels and chemicals to be stored within secondary containment. - All spills remediated as required in the EMP/spill management plan. - End of life rehabilitation to return land back to pre-existing state or as agreed to with pastoralist. - Rehabilitation security with NTG retained. - Weed management plan implemented, including requirements for weed hygiene inspections and certificates on all equipment and vehicles. 6 monthly weed monitoring and spraying of weeds using a NT Government approved treatment.
Pastoral access to groundwater	No anticipated impacts as proposed groundwater take is to be covered under a WEL.	- All groundwater take to be authorised under a WEL. - Water extraction from pastoralist bores not proposed, unless specifically approved by pastoralist through an agreement

Activity	Potential consequence to activities	Mitigations
Pastoral access to surface water	- No anticipated impacts as no surface water take or wastewater discharges proposed. - No anticipated impacts on surface water bodies through interference with a waterway.	- No surface water proposed to be taken. - No discharge of wastewater part of the SS 3D seismic program. - The SS 3D seismic program would either not cause a material change or alteration to the waterway or occur generally in a lower tier stream order (i.e. Stream Order 1) using low impact seismic acquisition methods.
Pastoralist's amenity	- During seismic charge detonation, noise is infrequent and typically a dull thud. - Visual presence of infrastructure within pastoralist lease.	- Site to be located away from main pastoralist entry points and homestead. - Noise and vibration from seismic surveys is typically a dull thud not felt outside of 200 m or heard outside of 2 km.
Native Title Holder		
Native Title Holder time	Impact to Native title holder time as they are required to engage with Tamboran as a part of the planning and approval for the proposed activity.	- Exploration agreements are in place outlining how engagement with Native Title Holders is to occur. - Royalties paid in accordance with Exploration agreements. - Tamboran works closely with the NLC to provide information in a manner to reduce time pressures as far as reasonably practicable. - For scouting and/or activities requiring cultural managers, compensation for time is provided.
Native Title Holder site access	Restricted access during seismic surveys.	- Native Title Holders are provided updates on proposed activities annually via the NLC. - Royalties paid in accordance with Exploration agreements. - Operational staff are in direct contact with Native Title Holders who may request access to any site. Tamboran will facilitate each access request. - Cultural Managers used for scouting to identify and avoid culturally significant areas - including areas regularly used for hunting, gathering or for cultural purposes. - Camps with workers bussed to site (where possible) to minimise vehicle movements. - Hazardous areas to be fenced and signed to communicate potential safety hazards.
Native Title Holder amenity and enjoyment	- Potential elevated noise and vibration within vicinity of seismic shoot (typically within 200 – 500 m of activity). - Disturbance of wildlife in the immediate vicinity of the activity when works are undertaken. - Dust impacts on immediate adjacent vegetation has the potential to temporarily	- Exploration agreements are in place outlining how engagement with Native Title Holders is to occur. - Royalties paid in accordance with Exploration agreements. - Speed limits restricted to 60 km/hr, unless otherwise agreed. - Dust control utilised to reduce dust emissions. - Site to be rehabilitated back to pre-existing state, with security bond in place if company fails to rehabilitate.

Activity	Potential consequence to activities	Mitigations
	reduce yield, similar to existing pastoral tracks. - Reduction in productivity through poor rehabilitation. - Potential introduction or spread of weeds. - Helicopter movements in vicinity of activities may disturb wildlife/ access/ hunting.	- Weed management plan implemented, including requirements for weed hygiene inspections and certificates on all equipment and vehicles. 6 monthly weed monitoring and spraying of weeds using a NT Government approved treatment. - Annual work program meetings and reports provided to native title holder outlining the proposed activities and locations. - Induction with all exploration contractors and staff in relation to native title holders and sacred sites. This induction to be developed with input from pastoralist. - Operational staff are in direct contact with Native Title holders who may request access to any site. Tamboran will facilitate each access request
Native Title Holder's ongoing productivity of area post rehabilitation	- Reduction in productivity of country due to erosion and sediment releases. - Impact to country from wastewater, chemical/fuel spills. - Impact to country from poor rehabilitation. - Potential introduction or spread of weeds.	- Routine site maintenance completed to ensure functioning of erosion and sediment control. - All fuels and chemicals to be stored within secondary containment. - All spills remediated as required in the EMP/spill management plan. - End of life rehabilitation to return land back to pre-existing state and as agreed with Native Title Holders. - Rehabilitation security with NTG retained. - Weed management plan implemented, including requirements for weed hygiene inspections and certificates on all equipment and vehicles. 6 monthly weed monitoring and spraying of weeds using a NT Government approved treatment.
Native Title Holder access to groundwater	- No anticipated impacts as proposed groundwater take is to be covered under a WEL. - No anticipated impact to sacred sites from groundwater take.	- All groundwater take to be authorised under a WEL. - No long-term groundwater reductions anticipated. - No sacred sites in area that are groundwater dependent based on hydrogeological setting (unsaturated zone between Anthony Lagoon Formation and surface water bodies) and sacred site clearance completed under the Exploration Agreement by NTH.
Native Title Holder access to surface water	- No anticipated impacts as no surface water take or wastewater discharges proposed. - No anticipated impacts on surface water bodies through interference with a waterway.	- No surface water proposed to be taken. - No discharge of wastewater part of the SS 3D seismic program. - The SS 3D seismic program would either not cause a material change or alteration to the waterway or occur generally in a lower tier stream order (i.e. Stream Order 1) using low impact seismic acquisition methods.

Activity	Potential consequence to activities	Mitigations
Native Title Holder sacred sites/ protected features	Access and/or damage to sacred sites.	- No access to sacred sites proposed. - All activities to occur in areas cleared by Native Title holders of Sacred Sites. - AAPA certificates granted covering proposed activities, which has identified no sacred sites in the 3D seismic program area.

5.6 Northern Territory business engagement

Broader engagement has occurred with local and regional business within the local communities of Daly Waters, Elliott, Katherine and the broader Northern Territory region.

Northern Territory businesses have been engaged on the scope of Tamboran's activities through information sessions and tender opportunities covering a range of material supply and support services, such as:

- people transport and logistics
- accommodation and food
- provision of temporary camps and camp services
- civil construction work
- freight and transport
- water bore drilling
- water carting and waste management
- site maintenance and inspections
- weed management and control
- equipment and materials storage
- oil country tubular goods
- environmental and civil consulting
- surveying and geotechnical assessments
- general provisions of goods and services (such as personal protective equipment and hire cars).

5.7 Ongoing stakeholder and community engagement

Tamboran is committed to continuing to engage with stakeholders regarding the exploration activities under EP 98, EP 117 and EP 76, and any associated environmental outcomes prior to, during and after performance of exploration activities.

Tamboran recognises the growing community interest in ensuring onshore natural gas development takes place in a safe and environmentally sound way and are committed to delivering operational excellence (which encapsulates our health, safety and environmental performance standards).

Tamboran has further committed to ongoing engagement with the relevant traditional owners, including annual work plan meetings and provision of draft work programs for future years of activity.

Detailed community and stakeholder engagement are underway, covering future exploration activities. This includes the following engagement activities:

Pastoralists:

- Weekly-monthly engagement with host pastoralists for which activity is proposed within the immediate timeframe. With the engagement frequency agreed to with the pastoralist.
- Quarterly engagement with future host pastoralists for which activity is proposed within the preceding year.
- Annual consultation with all pastoralists, including surrounding pastoralists with no immediate proposed activities.

Native title holders of the area in which the activity is occurring:

- Ad hoc updates for the NLC when required, informing them of progress of exploration activities underway.
- Quarterly project status updates to the NLC informing them of progress of exploration activities underway.
- Site visits by traditional owners during exploration activity so that traditional owners can have first-hand observation of key activities.
- Work program surveys conducted by traditional owners, with the support of the NLC, to review work programs and ensure protection of sacred sites and objects.
- Annual on country meetings with native title holders to discuss current work program status and future exploration activities.
- Broader community engagement that is in addition to the requirements outlined in Reg 7 of the Regulations will continue.

6 Environmental risk assessment

6.1 Tamboran's risk management approach

Tamboran uses a robust risk management process for all its activities to achieve the following key outcomes:

- Risks are understood, eliminated or reduced and controlled to an acceptable level
- Controls are owned, assured and continuously reviewed for effectiveness
- All activities are compliant with regulatory standards and are guided by best practice
- Tamboran and its stakeholders are confident in the way activities are conducted to manage risks
- The approach aligns with the findings of the NT Inquiry Final Report and associated recommendations (as implemented via the Code or legislation).

Tamboran's risk assessment process is undertaken in accordance with section 5.4.3 of ISO 31000. Assessment of risk is completed using Tamboran's risk matrix (Figure 30) to assess and rate risks by assessing the combination of frequency of occurrence and the severity of the outcome of a potential event, including a worst-case scenario event. This allows quantification of a risk and determination can then be made about whether the risk can be accepted, or whether further mitigation is required.

Tamboran risk management processes require regular assessment of all risks once controls are applied, the effectiveness of controls (Table 54) and the likelihood and consequence of a risk event.¹⁹ A residual risk is either accepted in accordance with strict delegations of authority or the activity does not proceed.

Tamboran also includes site specific controls for each identified risk, which further demonstrates how it achieves a residual risk that meets its ALARP and acceptable criteria. When applying the existing controls during the risk analysis (as per ISO 31000), there is very often little material change to most risk profiles identified in the risk register (Appendix I). This is a function of the comprehensive nature of the Code, which was designed to mandate a high level of environmental performance and minimise environmental risk.

Table 54: Risk assessment ratings

Rating	Explanation
Effective	• All controls are well designed and address the cause/s of the risk. • All controls operate to the required level. • Ongoing monitoring required.
Can be improved	• Majority of controls are well designed and address the cause/s of the risk. • Majority of controls operate to the required level. • Certain controls can be improved. • Ongoing monitoring required.
Must be improved	• Majority of controls are not well designed and do not address the root cause/s of the risk. • Majority of controls do not operate to the required level. • All the controls require improvement.

¹⁹ Includes applying existing controls, such as compliance with regulatory requirements which are mandatory (e.g. the Code, Regulations Schedule 1, etc),

RISK MATRIX

						LIKELIHOOD					
						1 REMOTE	2 HIGHLY UNLIKELY	3 UNLIKELY	4 POSSIBLE	5 LIKELY	6 HIGHLY LIKELY
						<1% chance of occurring within the next year. Occurs as a '100-year event' or less frequent.	<10% chance of occurring within the next year. Could occur within decades.	<30% chance of occurring within the next year. Could occur within the next few years.	<60% chance of occurring within the next year. Could occur within months to years.	<90% chance of occurring within the next year. Could occur within weeks to months.	Likely to happen multiple times a year
CONSEQUENCES	IMPACT ON TAMBORAN			EXTERNAL RESPONSE		6 CATASTROPHIC	HIGH	HIGH	VERY HIGH	VERY HIGH	VERY HIGH
	PEOPLE	ENVIRONMENT, HERITAGE & COMMUNITY	FINANCIAL (\$A)	STAKEHOLDER	LAWS, REGULATION AND CIVIL ACTIONS						
	Multiple fatalities >4 or life-threatening illness or total permanent disability to a large, exposed group (≥10 people).	Extensive, permanent damage to the environment, including species, habitats, ecosystems or area/s of cultural significance. Long-term social unrest and outrage within community.	>\$100m	Multiple stakeholder groups taking coordinated action, as reflected in media channels with significant reach and influence (e.g. blockade/boycott negatively impacts substantial aspects of operations and are covered in media for more than 1 week).	Criminal charges against any director or senior executive involving jail or loss of right to manage the company. Public inquiry – requiring considerable resources and Executive Leadership time. Loss of licence to operate.						
	1 – 3 fatalities or life-threatening illness or total permanent disability to a small, exposed group (<10 people).	Extensive, long-term, partially reversible damage to the environment, including species, habitats, ecosystems or area/s of cultural significance. Prolonged community outrage.	>\$25-100m	Multiple stakeholder groups mobilising and encouraging others to act, as reflected in media channels with significant reach and influence with substantial negative influence (e.g. social media campaign calling for protest, escalating over several days).	Criminal charges against any director, senior executive or senior manager not involving jail or loss of right to manage the company. Prolonged major litigation – exposure to significant damages / fines / costs. Suspension / restriction to operate an asset.						
	Injury or illness to one or more persons, resulting in permanent partial disability.	Long-term, reversible damage to the environment, including species, habitats, ecosystems or area/s of cultural significance. High levels of tension within the community.	>\$10-25m	More than one stakeholder group's opinion or view influencing other stakeholders, reported through media channels with some reach and influence (e.g. government comments in national media or in Parliament).	Criminal charges against any employee (not described above) Major litigation – exposure to damages / fines / costs.						
	Injury or illness that requires treatment as an in-patient in a hospital OR immediate treatment for a serious injury OR medical treatment within 48 hours of exposure to a substance.	Serious, medium-term, reversible impacts to the environment, including species, habitats, ecosystems or area/s of cultural significance. Moderate levels of community tension.	>\$1-10m	More than one group offering an opinion or view, reported through media channels with reach and influence (commentary lasting one 24-hour media cycle across internet, print, television, radio).	Non-compliance with conditions of licence to operate an asset or to conduct an activity. Litigation and exposure to damages / fines / costs.						
2 MODERATE	Injury or illness to 1 or more persons resulting in medical treatment, up to 5 days lost time or alternative / restricted duties for up to 1 month.	Moderate short-term impacts to the environment, including species, habitat, ecosystems or area of cultural significance. Isolated examples of community tension.	>\$250k-\$1m	A single stakeholder group drawing attention to an incident, issue or approach, conveyed through media channels with potential reach and influence (e.g. some social media complaints or local media reports).	Moderate non-compliance with external mandatory obligations or breach of contractual or other legal obligations (not described above).	2 MODERATE	LOW	LOW	MEDIUM	MEDIUM	MEDIUM
	Injury or illness requiring first aid to 1 or more persons, or a no treatment case.	Limited environmental or cultural heritage impact- readily dealt with and contained on site. Individual community member voicing concern.	<\$100k	A person or organisation signalling interest in an incident or event using channels with limited reach or influence (e.g. letter of complaint).	Minor non-compliance with external mandatory obligations or breach of contractual or other legal obligations.						
1 MINOR						1 LOW	LOW	LOW	MEDIUM	MEDIUM	MEDIUM

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Figure 30: Tamboran's risk matrix

6.2 ALARP

The risk management process requires risks to be managed to ALARP. A risk can be considered to have been reduced to ALARP when all reasonably practicable control measures (both preventative and mitigative) have been identified and implemented to reduce the risk of identified events. A key element of demonstrating ALARP is that good practice is followed, where good practice is defined as the recognised risk management practices and measures that are used by competent organisations to manage well understood hazards arising from their activities. This definition incorporates good practice as defined in codes and standards, and a consensus of good practice within the industry. ALARP is not a final position over the life of an asset or project.

The practicability and the reasonability of control measures can change over time due to changes in technology (that can make measures more readily available), industry standards (that can commoditise once-cutting-edge technology) and the socio-technical landscape (that can modify societal expectations).

In the NT context, ALARP and the definition of acceptable risk levels was a key feature of the NT Inquiry Final Report. For each aspect, acceptability criteria were defined, with recommendations outlined to reduce the potential risk to below the acceptable level. With the adoption of all recommendations by the NTG, the Code and associated regulatory changes provides a high level of inherent protection to ensure activities are undertaken in a safe and consistent manner.

Tamboran considers ALARP to be achieved where the residual risk is low, whereby any additional control measures applied will not reduce the risk any further.

If the residual risk of low is not achieved, Tamboran considers ALARP to be achieved where the following criteria have been met:

- the requirements of the Code have been met
- all reasonably practicable site-specific controls have been identified and implemented and
- the cost of further reducing the risk is unreasonable compared to the environmental benefit gained from implementing the control measure.

6.3 Risk acceptability

Tamboran uses a series of criteria (Table 55) to determine the acceptability of a risk once all controls are identified / implemented. Each risk event and final risk rating outlined in Appendix I is assessed against these criteria to determine whether Tamboran believes it is acceptable.

Table 55: Risk acceptability criteria

#	Criteria	Tamboran's acceptance threshold
1	Risk level after treatments / controls are applied	Consistent with Tamboran's risk acceptance criteria: Very high risk – Not acceptable High risk – Residual risk may be conditionally accepted where the residual risk is ALARP and the risk is signed off by a General Manager with risk treatment applied to improve, control or further modify risk. Risk reviews are to occur annually with the intent to reduce the risk severity lower. Medium-low risk – Residual risk is accepted when ALARP is demonstrated
2	Legislative requirements and regional strategies and conservation plans	1. Consistent with legislative requirements, including Code 2. Consistent with regional strategies and conservation/threat abatement plans
3	Stakeholder expectations	Consistent with the commitments made in stakeholder engagement and/or agreements

#	Criteria	Tamboran's acceptance threshold
4	Industry guidelines and best practice	Is consistent with petroleum standards (such as API and the Oil and Gas UK standards), best practice and controls used in other NT industries
5	Scientific uncertainty in the data used to determine the environmental impact or risk	Low uncertainty: Accepted risks are well understood, and uncertainty is minimal. Moderate uncertainty: Accepted using well-established data and assessment methods. Some uncertainty exists, with routine monitoring and performance criteria in place to detect and respond to any impacts arising from a risk. High: Conditional acceptance – Significant uncertainty exists with data and assessment methodologies unproven. A precautionary approach will mean that uncertainty is replaced by conservative assumptions that will require additional control measures being implemented to prevent, detect and respond to any impacts arising from a risk.
6	ESD Principles	Risk is consistent with the principles of ESD as defined in section 2.1. This also includes weighting to consider the social and economic benefits of the project.

6.4 Assessment of scientific uncertainty

The Regulations require an assessment of uncertainty as a part of the risk assessment process. The assessment of potential impacts and effectiveness of controls must demonstrate that the activities are carried out in a manner consistent with the principles of ESD and the precautionary principle.

Impact and risk identification must include consideration of uncertainty regarding impacts and risks for the activity where a precautionary approach is appropriate. Uncertainty is high where confidence in the available information is low in identifying risk or the effectiveness of a management control. Additional baseline studies or other safeguards may be required to increase the accuracy of an assessment to determine the acceptability of a risk.

As per the EMP Guidelines, scientific certainty is qualitatively assessed using a generic means of ranking the data available in accordance with Table 56. Considerations of uncertainty have been included in the risk assessment discussed in section 6.5.

Table 56: Scoring system and ranking for scientific uncertainty (DEFRA, 2013)

Score	Description
Low (1)	- Comprehensive data with strong evidence in multiple peer reviewed data - Little disagreement between authors or experts - Considerable and consistent on-ground experience and/or monitoring
Medium (2)	- Some or incomplete data available - Evidence provided based on a small number of references - Authors or experts conclusions vary - Limited on-ground experience and/or monitoring
High (3)	- Scarce or no data available; evidence provided in unpublished reports - Few on-ground observations - Authors and experts conclusions vary considerably

6.5 Risk assessment outcomes

The environmental, heritage and social risks associated with the activities covered under this EMP have been assessed using the Tamboran risk assessment framework described in section 6.1. The risk assessment presents the range of potential impact-causing activities, corresponding mitigation measures and residual risk ratings based on their assessed worst-case consequence and likelihood of occurrence. The assessment also cross-references the various risk assessment outcomes in the NT Inquiry Final Report, to ensure consistency.

Site specific conditions and cumulative impacts have also been considered during the assessment. Cumulative impacts include the following:

- Activities covering 16 future E&A wells (15 new horizontals and 1 vertical wells) and 3 existing E&A wells (Beetaloo W-1, Kyalla 117 N2-1H and Shenandoah S- 1H) for the 2023 - 2028 period, as per the current approved tenure work plan.
- 2D seismic acquisition.
- 3D seismic acquisition specific to this EMP.
- Existing land users (predominately pastoralists).

There were no residual risks above a 'Medium' risk ranking, with 26 risk scenarios and sources which may potentially result in a risk occurring. Of the 26 risk sources, 4 were ranked as 'Moderate' with the remaining 22 were ranked as 'Low'. The residual risks sources identified through the risk assessment include:

- Disturbance of sacred site or culturally sensitive areas and the decline in environmental value of area used for cultural purposes through the preparation of the seismic lines and the accidental ignition of fire by the regulated activity – risk ID 22, risk ID 23 and risk ID 24
- Disturbance of surface water bodies and associated sensitive vegetation communities (i.e. drainage lines / drainage depressions / claypans / ephemeral waterholes) within the seismic survey area – risk ID 15
- Loss of long-term soil productivity and viability due to soil compaction and erosion along the seismic lines – risk ID 1
- Soil, groundwater and surface water contamination due to spills and leaks of chemicals (fuels, oils and lubricants) – risk ID 2, risk ID 12, risk ID 13, risk ID 14
- Impact to listed threatened habitats and listed threatened flora and fauna, including any ground dwelling or borrowing species and non-listed fauna and livestock during seismic survey – risk ID 4, risk ID 6, risk ID 7, risk ID 8 and risk ID 15
- Reduction in agriculture productivity through the introduction and spread of weeds in the area or accidental ignition (bushfire) from surface activities – risk ID 3, risk ID 5 and risk ID 20
- Increased nuisance from dust, noise, vibration and greenhouse gas emissions associated with the activities – risk ID 16, risk ID 17 and risk ID 19.

The environmental risk assessment demonstrates that the risks associated with SS 3D seismic program, have been determined to be "low to moderate consequence, low likelihood" risks. The rating is achieved through the application of multiple controls²⁰, which reduces the risk rating to as low as reasonably practicable (ALARP) and acceptable.

²⁰ Mandatory standards and processes applied to the regulated activities are described in the Code, which is designed to ensure that the risk to public, workers and the environment are reduced to a level that is ALARP and acceptable (CI 1).

The environmental outcomes to be achieved during the proposed activities include no significant impacts to the following aspects:

- The protection and enhancement of community and cultural values, places and amenity.
- Ecological function and productivity of soils.
- Ecological function of surface water bodies and associated sensitive vegetation communities (as described by the SREBA Terrestrial Ecosystems Baseline Report (2022)).
- The protection of high valued habitats and threatened flora and fauna.
- The maintenance of air quality.

At completion of SS 3D seismic activities, the area will be returned to a safe, stable and non-polluting form consistent with pre-disturbed conditions.

The 'Low' and 'Medium' risks identified were consistent with standard industry surface activities and/or pastoralist activities carried out across the NT, being the potential interference with culturally sensitive areas, spread of weeds, erosion and sediment control, and ignition of bushfires from the proposed activities. The reduced risk profile associated with seismic survey activities is reflective of the stringent regulatory requirements in the Code.

The level of uncertainty for each risk was also assessed. There was no uncertainty level above 'Low', which is consistent with the scale of the activity and the knowledge of impacts associated with gas exploration activities demonstrated in the Inquiry Final Report and through the various reports published by the US EPA (such as USEPA 2016- U.S. EPA. Hydraulic Fracturing for Oil and Gas: Impacts from the Hydraulic Fracturing Water Cycle on Drinking Water Resources in the United States (Final Report)).

A count of the post-treatment environmental risks associated with this EMP is provided in Table 57. A copy of the risk assessment is provided in Appendix I.

Table 57: Count of environmental risks for the Shenandoah South 3D seismic program

	Environmental risk rating with applied controls			
	Low	Medium	High	Very high
Total - 26	22	4	0	0

6.6 Environmental outcomes, performance standards and measurement criteria

The following section provides the environmental outcomes, performance standards and measurement criteria of each environmental aspect, based on the risk assessment presented in Appendix I. Table 58 to Table 63 provide the environmental outcomes, performance standards and measurement criteria, based on the NT EPA's environmental factors and objectives, to demonstrate whether controls have been effective during the activity and that the stated environmental outcomes have been achieved.

6.6.1 Land

Table 58: Environmental outcomes, performance standards and measurement criteria – landforms and terrestrial environmental quality

Environmental performance measures – landforms and terrestrial environmental quality				
Environmental outcome	Environmental performance standards		Measurement criteria	Records
No adverse impact to the ecological function and productivity of surrounding soils or distinctive physical landforms resulting from Tamboran's exploration activities.	L-1	No loss in long-term soil productivity and viability through soil destabilisation, increased risk of erosion and sedimentation, compaction and dust.	No vehicle activities in areas that are saturated and waterlogged at time of the 3D seismic program. Post rehabilitation confirms retention of soil productivity. Less than 5 % erosion evident after the first 12 months and no subsidence or erosion evident 5 years after completion	Weekly records of site inspections retained during line preparation, data acquisition and initial rehabilitation activities.
				Records retained of where avoided areas of saturated and waterlogged soils.
				Records retained of seismic charges during seismic acquisition.
				Annual rehabilitation report.
	L-2	No spills that result in potential residual contamination of soils.	No recorded spills of level 1 or greater during the activity as per the Spill Management Plan (Appendix H).	Records of all incidents relating to spills during seismic program are retained in Tamboran's incident management system, including but not limited to volumes of spilled material/ substances. Evidence of spill clean-up time retained within incident records.
	L-3	Stabilisation of soils post seismic program with no material evidence of compaction, windrows, erosion or sediment releases	Annual rehabilitation report confirms no material evidence of compaction, windrows, erosion or sediment releases.	Annual rehabilitation report.
	L-4		Evidence of maintenance/rectification where encounter areas of compaction, windrows, erosion and sediment releases during annual rehabilitation survey. Any extenuating circumstance (such as access to location) are to be document where maintenance cannot be practicably performed (i.e. impact to gain access is greater than value of maintenance).	Annual rehabilitation report. Maintenance records retained.

Environmental performance measures – landforms and terrestrial environmental quality				
Environmental outcome	Environmental performance standards		Measurement criteria	Records
	L-5	Disturbed seismic lines are reinstated to 60% of the analogue site by year 5 and considered safe, stable and non-polluting on a trajectory towards pre-disturbance condition	Seismic line reinstatement commences within 4 weeks upon completion of seismic data acquisition. Annual rehabilitation monitoring completed, with recommended maintenance within 3 months (contingent on weather and access). The Rehabilitation Plan final success criteria achieved (i.e. dominant flora species in the mid and ground layers (strata) equivalent to 60% of the analogue site (refer Appendix G).	Annual rehabilitation report. Spatial data confirm stayed within survey parameters, including vegetation clearing of 56 ha, with contingency of additional 20 ha (76 ha in total).
	L-6	Vegetated material returned across the seismic lines to establish ground cover to reduce erosion.	Seismic lines to be reinstated within 4 weeks of completion of data acquisition.	Daily seismic activity reports during line preparation, data acquisition and initial rehabilitation activities.
	L-7	No uncontrolled bushfire as result of Tamboran’s activities.	No incidents of incorrectly stored, handled or used explosives outside the Australian Standard, Tamboran procedures and the shot firers instructions. No incidents of fire as result of vehicle traversing vegetated areas.	Records retained on Tamboran’s incident management system of bushfires. Records retained of routine inspection of vehicles for build-up of vegetation in engine bay.
Risk sources	• Loss in long-term soil productivity and viability through soil destabilisation, increased risk of erosion and sedimentation, compaction and dust (Risk ID 1). • Erosion and sedimentation from seismic line preparation impacting on down gradient sensitive receptors including Jingaloo and Lily Hole community living areas (Risk ID 11). • Seismic line preparation and access to the area may alter the aquatic ecosystems where erosion and sediment controls are not effectively implemented, or seismic lines are not appropriately stabilised post rehabilitation (Risk ID 15). • Spills/leaks from in-field servicing of seismic equipment and machinery and storage (Risk ID 2) • Unexploded ordinance impacts future pastoralist and native title holder activity (Risk ID 26)			

Table 59: Environmental outcomes, performance standards and measurement criteria –terrestrial ecosystems

Environmental performance measures – terrestrial ecosystems				
Environmental outcome	Environmental performance standards		Measurement criteria	Records
No significant impact to high valued habitats and listed threatened flora and fauna from Tamboran's exploration activities.	TE-1	Weeds are not spread or introduced due to Tamboran's activities and weeds identified are controlled as soon as possible.	6-monthly pre and post-wet season weed surveys completed on all Tamboran controlled disturbed areas. Weed monitoring does not identify any newly introduced Class A and Class C WONS Weed control applied as per the Weed Management Plan (Appendix D).	Annual weed monitoring and management report. Weed mate record.
	TE-2	Year-on-year decline in the size and density of all weed infestations introduced because of Tamboran's activities.	Annual report demonstrates weed infestation size and density of weed outbreaks introduced by Tamboran's activities are reducing each year.	Annual weed monitoring and management report.
	TE-3	Disturbed seismic lines are reinstated promptly to promote revegetation.	Seismic reinstatement commences within 4 weeks upon completion of seismic data acquisition.	Daily seismic activity reports during line preparation, data acquisition and initial rehabilitation activities.
	TE-4			Spatial data confirm stayed within survey parameters. Annual rehabilitation report.
	TE-5	No unauthorised clearing.	No clearing outside parameters described in this EMP (refer section 3.7.1).	Survey and spatial data collected confirms disturbance levels within approved limits and areas.
	TE-6	No damage to ephemeral wetlands or watercourses located in the 3D seismic area.	No vegetation clearing within formed watercourses (i.e. stream order 1 and above) or drainage depressions as indicated in Figure 19.	Clearing spatial data confirms no vegetation clearing occurred within mapped watercourses or drainage depressions identified in Figure 19. Records, including spatial data of possible sinkholes encountered and avoidance.

Environmental performance measures – terrestrial ecosystems				
Environmental outcome	Environmental performance standards		Measurement criteria	Records
	TE-7	Impacts to large trees (>25cm trunk @ 1.3 m) to be avoided.	No large trees cleared for the 3D seismic program.	Large tree clearing log to be retained including trees cleared and trees avoided.
	TE-8	No disturbance to Grey Falcon active nesting sites.	Cultural managers engaged to identify active Grey Falcon nesting sites, with any nests encountered documented. No clearing of Grey Falcon nest or suspected nest trees. During breeding season, no activities to occur within 300 m buffer from Grey Falcon nesting sites and no seismic charges deployed within 300 m.	Records of pre-clearance surveys retained documenting evidence of Grey Falcon active nesting sites.
	TE-9	No uncontrolled bushfires caused by Tamboran's 3D seismic program	Zero reported incidents of uncontrolled bushfire caused by Tamboran's activities.	Fire incident data to be retained for all Tamboran unplanned fires on Tamboran's incident management system.
Risk sources	• Introduction and spread of weeds in the area (Risk ID 3) • Poor rehabilitation of the seismic area reduces regional habitat and promotes weed invasions (Risk ID 4) • Accidental ignition of fire during 3D seismic acquisition and general access (Risk ID 5) • Impact to listed threatened ecological communities and threatened flora and fauna, including any ground dwelling or borrowing species and non-listed fauna and livestock during 3D seismic activities (vehicle, machinery and seismic charge detonation) creating noise and vibration (Risk ID 6) • Vehicle collisions with fauna – fauna mortality results in a localised decline in species abundance (Risk ID 7) • Cumulative impacts on terrestrial ecology (Risk ID 8)			

6.6.2 Water

Table 60: Environmental outcomes, performance standards and measurement criteria – hydrological processes, Inland water environmental quality and aquatic ecosystems

Environmental performance measure – hydrological processes				
Environmental outcome	Environmental performance standards		Measurement criteria	Records
Tamboran's exploration activities do not reduce the environmental values of the underlying groundwater resources.	GW-1	All groundwater take within the sustainable yield of the Gum Ridge Formation.	Total groundwater extraction volume below the approved water extraction licence take.	Groundwater take records retained during line preparation, data acquisition and initial rehabilitation activities.
Protect the quality of surface water and aquatic ecosystems from any adverse impacts from Tamboran's exploration activities.	SW-1	No spills that result in potential residual contamination of surface water and/or aquatic ecosystems.	No recorded spills of level 1 or greater during the activity as per the Spill Management Plan (Appendix H).	Records of all incidents relating to spills during seismic program are retained in Tamboran's incident management system, including but not limited to volumes of spilled material/ substances. Evidence of spill clean-up time retained within incident records.
	SW-2	No damage to ephemeral wetlands or watercourses located in the 3D seismic area.	No clearing within watercourses (stream order 1 and above) or wetlands	Clearing spatial data confirms no clearing occurred within mapped watercourses or wetlands.
	SW-3	Erosion and sediment control in place and working effectively.	All material erosion and sedimentation identified during annual rehabilitation inspection are rectified immediately (wet season) and prior to the wet season upon identification.	ESC inspection records retained during line preparation, data acquisition and as a part of the rehabilitation inspections.
Risk sources	• Unsustainable groundwater extraction impacts landholders and groundwater dependent ecosystems (Risk ID 9). • Cumulative impacts on groundwater quantity (Risk ID 10) • Seismic survey activities impact on nearby surface water systems (i.e. drainage lines / drainage depressions / claypans / ephemeral waterholes), groundwater dependent ecosystems and Jingaloo or Lily Hole community living area (Risk ID 11) • Cumulative impact on surface water quantity (Risk ID 12) • Surface spills from the storage, handling and transportation fuels impacting on groundwater (Risk ID 13) and surface waters (Risk ID 14) • Damage to the ephemeral wetlands, which are considered sensitive vegetation areas in the 3D seismic area, from seismic line preparation, data acquisition and rehabilitation, altering aquatic ecosystems (Risk ID 15).			

Environmental performance measure – hydrological processes			
Environmental outcome	Environmental performance standards	Measurement criteria	Records
Instrument calibration	Groundwater volume: approved DLPE meter used (calibration not required). Surface water quality: pH and EC instrument calibrated before use.		

6.6.3 Air

Table 61: Environmental outcomes, performance standards and measurement criteria – air quality and atmospheric processes

Environmental performance measures – air quality and atmospheric processes				
Environmental outcome	Environmental performance standards		Measurement criteria	Records
No significant impact on air quality and no excess greenhouse gas emissions resulting from Tamboran's exploration activities.	AQ-1	No significant impact to air quality at sensitive receptors because of the 3D seismic program.	No nuisance-related complaints regarding dust / air quality resulting from exploration activities. All complaints responded to and corrective actions taken.	All complaints and subsequent actions are to be recorded in the Tamboran's incident management system.
	AQ-2	All greenhouse gases reporting in accordance with NGERS requirements.	NGER emissions reporting completed including fuel usage data and submitted to DEPWS annually.	Emission related data (fuel use, clearing extent) retained for seismic line preparation, data acquisition and rehabilitation activities and included in Tamboran's annual emissions report for EP76, EP98 and EP117.
Risk sources	• Increase in dust during site preparation (seismic lines and access tracks) and resulting from vehicular traffic during line preparation and data recording (Risk Reference 16). • 3D seismic emissions from the combustion of diesel, vegetation clearing and detonation of charges (Risk ID 17) • Bushfire from accidental ignition by site activities (seismic, detonation) or personnel (Risk ID 5 and Risk ID 24)			

6.6.4 People

Table 62: Environmental outcomes, performance standards and measurement criteria – community and economy, and human health

Environmental performance measures – community and economy, and human health				
Environmental outcome	Environmental performance standards		Measurement criteria	Records
No adverse impacts to the community resulting from Tamboran's exploration activities.	CO-1	All valid community complaints of nuisance investigated and resolved.	All community complaints responded to within 24 hours with actions to remedy any confirmed nuisance implemented as soon as practicable (depending on the nature of the complaint).	Records of community complaints and actions completed.
	CO-2	>60% of addressable spend ²¹ to be from NT businesses.	Project expenditure data confirms the NT business spend on the Beetaloo exploration project exceeds >60% of addressable spend ²¹ of the project.	Data on NT business spend retained.
	CO-3	All vehicle accidents investigated and reported in accordance with NT Police, Fire and Emergency Services requirements.	Zero incidents requiring an external emergency response.	Records retained in the Tamboran's incident management system.
Risk sources	- Industrialisation of the landscape (Risk ID 18) - Noise and vibration emissions from activities, including use of accelerated weight drop or seismic charges (Risk ID 19) - Ongoing access, traffic and helicopter access to pastoral station impacts agricultural activities (Risk ID 20) - Cumulative impacts on amenity (Risk ID 21) - Increased risk of vehicle accident (Risk ID 25) - Unexploded ordnance impacts future pastoralist and native title holder activity (Risk ID 26) - Cumulative impact on traffic on public roads (Risk ID 27)			

²¹ Addressable spend: a service or material that can be reasonably provided by an NT business at similar quality, timeliness and cost.

Table 63: Environmental outcomes, performance standards and measurement criteria – cultural heritage

Environmental performance measures – cultural heritage				
Environmental outcome	Environmental performance standards		Measurement criteria	Records
No significant impact on sacred sites and cultural heritage values because of Tamboran’s exploration activities.	CH-1	No non-compliances with Native Title Holder Exploration Agreements and AAPA certificate conditions.	No non-compliances with AAPA certificate conditions including unauthorised work within Restricted Work Areas (RWA).	Incidents retained where unauthorised activities are identified.
	CH -2		No breaches of native title holders’ exploration agreements.	Incidents retained where unauthorised activities are identified.
Protection of culture and heritage.	CH -3	Native title holders are actively engaged on Tamboran’s work program, including understanding of Tamboran’s current and future exploration activities.	Annual work program update report completed and submitted as per Exploration Agreement	Records of annual work program update report retained.
	CH -4		On country meetings completed providing status of work program and future activities- including ongoing presentation of story boards and other activity information.	Records of on country meetings retained.
	CH -5		Engagement and presence of local cultural managers during 3D seismic program.	Records of native title holders attending disturbance activities. All occurrences of archaeological sites identified during baseline survey and the 3D seismic program to be recorded and provided to relevant agencies required by law and/or agreement.
	CH-6		Indigenous business involved in at least 3 environmental monitoring programs, such as weed monitoring, cultural heritage monitoring and site stability monitoring.	Records of environmental programs completed by indigenous contractors retained.
Risk sources	• Cultural heritage sites disturbed directly by 3D seismic activities (Risk ID 22) • Personnel unauthorised access to scared sites during 3D seismic program (Risk ID 23) • Bushfire from accidental ignition by site activities (seismic, charges) or personnel (Risk ID 24) • Cumulative impact on amenity (Risk ID 21)			

7 Management plans

The following section provides a high-level summary of the various management plans required to be implemented in accordance with the Code.

7.1 Unexpected heritage finds procedure

An unexpected heritage finds procedure has been developed for Tamboran's activities within EP 76, EP 98 and EP 117 (Appendix B.2). It provides the actions to be taken by Tamboran staff and subcontractors where encounter a suspected Aboriginal and non-Aboriginal cultural heritage find.

7.2 Bushfire management plan

A Bushfire Management Plan (BMP) has been developed for the SS 3D seismic program (Appendix C). The BMP outlines the controls to prevent, detect and respond to fires associated with Tamboran's activities. Controls implemented include:

- Monitoring during periods of high fire danger.
- Fire response and reporting.

7.3 Weed management plan

Exploration activities are undertaken in accordance with Tamboran's Beetaloo Weed Management Plan (Appendix D). This plan has been developed in accordance with the *Weed Management Planning Guide: Onshore Shale Gas Developments Project*.

Weed surveys have confirmed the proposed area of activity has an extremely low presence of weeds. Efforts will therefore focus on both eliminating the potential introduction of weeds into the region and preventing the spread of existing weeds.

From a cumulative impact perspective, the risks of increasing weed pressure in the area is reduced through the mandated use of weed hygiene inspections/certification for all equipment and vehicles and routine weed monitoring and maintenance. Any weeds that are introduced into the activity areas will be promptly identified and managed, reducing the potential additional stress to the region.

7.4 Erosion and sediment control plan

Tamboran Beetaloo Sub-basin Erosion and Sediment Control Plan (ESCP) has been updated to include the SS 3D seismic program and how the seismic survey activities will be completed to minimise the risk of erosion and sediment releases to the surrounding environment (Appendix E). The ESCP has been developed by suitably qualified persons including:

- **Senior Environmental Manager** – BEnvSci, PGDipEnvMgt. Environmental Scientist, Manager and Auditor with over 24 years' experience. Completing the IECA erosion and sediment control training in 2013 and has extensive experience advising on managing the environment in the Beetaloo Sub-basin including erosion and sediment control.
- **Senior Environmental Manager** – BSc (Ecology & Environmental Biology), Master of Environmental Law with over 20 years' experience working in the mining and onshore petroleum industries, drafting environment management plans, reports and environmental impact statements across these industries.
- **AECOM Team Leader – Civil** - BEng, RPEQ, CPEng. Civil Engineer with over 30 years' experience in the design and documentation of civil engineering projects.

The ESCP has been reviewed by a Certified Professional in Erosion and Sediment Control (CPESC) with a MAgSc, BAgSc (Hons), CPESC (#2723), CEnvP (#002). As per Table 12 of the ECSP (Appendix E), CPESC review is only required where permanent ESC measures require change or removal. The 3D Seismic program does not materially change the activities or the ecological system that are described in the ESCP and that the activity is considered a temporary, short term activity.

7.5 Rehabilitation management plan

Once a determination has been that the 3D seismic activities have been completed, a site-specific rehabilitation strategy will be developed in detail for the disturbed areas, based on the criteria and methodology outlined in the RMP (Appendix G). A specific strategy is required to ensure the operational history of the activity is considered during rehabilitation planning (such as spills etc.). As per the Code, rehabilitation will commence within 12 months of determining an asset is no longer required.

All remaining assets with a residual beneficial use (such as water bores, laydown yards, gates, fences, freshwater tanks etc.) will be offered for transfer to the pastoralist and/or Native Title Holders, subject to DLPE approval and compliance with the Code. Prior to considering the transfer of ownership, Tamboran will:

- Undertake an assessment of the status of the asset and whether it can be beneficially used by the local pastoralist and/or Native Title Holders. Where a beneficial use is anticipated, identify works required to be undertaken to ready the asset for transfer (i.e. any repairs, site remediation, equipment removal etc.)
- Obtain written agreement from the pastoralist and/or Native Title Holder to take ownership of the asset and document any stipulated liabilities.
- Where an asset cannot be beneficially utilised, the site will be rehabilitated to the pre-existing condition using assisted natural regeneration. This will include:
 - Removal of all surface facilities
 - Removal of all weeds and contaminated materials/wastes
 - Re-spreading of stockpiled topsoil/windrows
 - Reshaping the site to as close to natural form as possible
 - Ripping or scarifying any compacted surface
 - Spreading of stockpiled vegetation to aid in surface water flow control
 - Spreading seed of suitable local native species which has been determined through analogue sites representative surrounding vegetation communities
 - Source native seed supply and rehabilitation services from indigenous suppliers (where available).
- Undertake yearly monitoring of the rehabilitation success requirements to assess the rehabilitation status of a site and determine where additional remedial works are required.

Tamboran confirm that the RMP was prepared by suitably qualified persons (title and skill set):

- **Senior Environmental Manager** – BEnvSci, PGDipEnvMgt. Environmental Scientist, Manager and Auditor with over 24 years' experience across a range of industries and clients including but not limited to Oil and Gas, Mining, Northern Territory Government and Department of Defence. Her experience covers undertaking baseline environmental assessments and preparing and implementing rehabilitation plans in the Northern Territory and specifically in the Beetaloo Sub-basin for oil and gas development.

- **Senior Environmental Manager** – BSc (Ecology & Environmental Biology), Master of Environmental Law with over 20 years' experience working in the mining and onshore petroleum industries, drafting environment management plans, reports and environmental impact statements across these industries.
- **Vice President (VP), Environment and Permit Approvals** - BEnvMgt. Environmental manager with over 20 years' experience in the environmental field, with 15 years within the onshore gas industry, with 10 years operating in the Northern Territory. VP-Environment and Permit Approvals person has extensive understanding of petroleum infrastructure rehabilitation, participating in the development and execution of infrastructure rehabilitation programs within the Surat and Bowen Basin, and the Beetaloo Sub-basin.

7.6 Spill management plan

A spill management plan (SMP) has been prepared to support Tamboran's exploration program in the Beetaloo Sub-basin (Appendix H). The SMP is a mandatory requirement prepared in accordance with the Code of Practice for Petroleum Activities in the Northern Territory (the Code). This SMP is designed to provide the strategy for the management of spills across Tamboran's Beetaloo exploration activities.

The SMP has been revised to incorporate the 3D seismic program activities.

8 Implementation strategy

8.1 Environment, health and safety management system

Tamboran's activities are governed by a Health, Safety and Environment (HSE) policy (Figure 31). Tamboran will implement a HSEMS, which ensures we conduct our business in line with all the elements of this policy, including but not limited to:

- Risk management and compliance
- Training and competency
- Contractor management
- Safety management and emergency response.



Health, Safety and Environment Policy

Tamboran Resources Corporation (**Tamboran**) is committed to operating in a manner that prioritizes the safety of our people and the community and places an emphasis on preventing unforeseen environmental harm.

Tamboran will achieve this through:

- Creating a culture of work where it is understood that no task is too important that time cannot be taken to ensure it is performed safely and efficiently.
- Empowering our workforce (including contractors) to “stop the job” whenever they believe a task is unsafe or there is an unacceptable risk to people, the environment, or the safe operation of assets.
- Implementation of a contractor management process to ensure alignment of HSE values and safe execution of work.
- Compliance with all applicable legislative requirements, company policies, plans and processes.
- The application of our risk management framework, ensuring that all risks are identified, controlled, or eliminated where practicable.
- Ensuring HSE considerations are an integral part of planning, design, and procurement processes.
- Developing and managing our assets in an environmentally responsible manner and in accordance with ecologically sustainable development principals.
- Ensuring our people are trained and competent for the work they are undertaking.
- Managing all HSE incidents through reporting, investigation and learning with the aim of preventing re-occurrence.
- Effective communication, consultation, and promotion of worker participation to encourage all personnel to be actively engaged in HSE matters.
- Setting objectives aimed at preventing serious harm and improving HSE performance.
- Monitoring and improvement of the HSE management system that supports our people and the way we work.

Tamboran’s Executive Leadership Team is committed to leading by example to influence our culture. By upholding health and safety as a core workplace value, Tamboran Resources will achieve positive outcomes for our people and the environment.

Authorised by

CEO
Joel Riddle

28 March 2024

COO
Faron Thibodeaux

28 March 2024

Governance – This policy will be reviewed every 2 years to ensure it remains relevant and effective for Tamboran Resources operations and risk profile. The Nomination and Governance Committee is responsible for undertaking this review.

Figure 31: Tamboran’s Health, Safety, Security and Environment (HSSE) Policy

8.2 Roles and responsibilities

Overall roles and responsibilities for the implementation of the regulated activities described in this EMP are outlined in Table 64. There are two primary streams of responsibility which sit under the Chief Operating Officer and the Executive Vice President, Strategy and Sustainability.

Table 64: Roles and responsibilities

Role		Responsibility
Stream 1	Chief Operating Officer	Tamboran employee responsible for the overall program.
	Senior Manager Geoscience and Technical Advisor.	Ensures all areas of the seismic acquisition are carried out in accordance with the EMP and work instruction(s).
	Manager Field Operations Senior HSE Manager Operating Company Representative Field HSE Advisor(s) Contract Administrator	Tamboran employees/consultants responsible executing operations in accordance with the EMP, Tamboran's HSEMS, contractual agreements and the exploration quality controls. These roles are ultimately responsible for ensuring all other parties are working within the HSE guidelines and provide guidance and advice to site personnel on: - Day-to-day management of the environment and implementation of this EMP, including reporting, monitoring compliance of operations of all regulated and associated activities. - Planning and implementation of Tamboran monitoring requirements including weeds, groundwater, soil and erosion, bushfire and emergency response
	Specialist contractors	Contractors engaged by Tamboran to deliver on elements of the seismic program. They are responsible for compliance with this EMP at all times during execution of their work.
Stream 2	Vice President- Environment and Approvals	Tamboran employee responsible for managing regulatory approvals and program changes and reporting and supporting operations (including HSE). Also responsible for notifying the responsible Minister(s) and the owner/occupier of the land on which the activity is to be carried out; and for communications with the regulator and key stakeholders.
	Cultural managers	NLC representatives to provide cultural clearances during clearing and grubbing activities to ensure activities are conducted to avoid areas of cultural significance.

8.3 Contractor management

Most of the work executed under this EMP is done via contractors with oversight from a Tamboran Representative. Assessing the level of capability and competency of the contractors is a major focus of the execution strategy.

The interfaces between Tamboran and contractors HSEMS are formalised and documented within the HSE bridging document. This is an operational document which is used on site to identify the systems / processes that take precedence during the execution of a work scope.

Figure 32 provides an overview of the EMP implementation process.

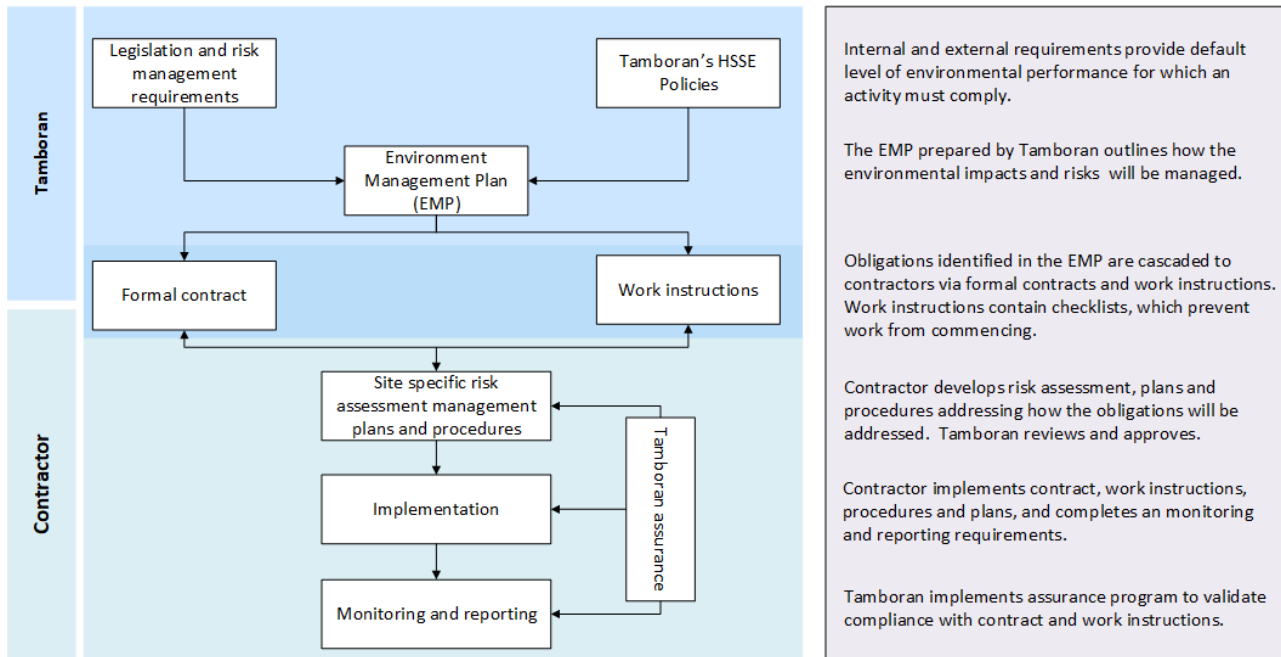


Figure 32: EMP implementation overview flowchart

8.4 Environmental commitment summary

The program environmental commitments outlined in Appendix F are sourced from the risk assessment (Appendix I) and environmental outcomes, performance standards and measurement criteria tables (Table 58 to Table 63). The implementation and compliance against these risk controls will be assessed as part of the annual environmental report (refer in section 8.10).

Specific commitments will be to:

- Record information to track performance, including non-conformances and corrective actions.
- Inspect and monitor operational controls on-site via regular environmental monitoring.
- Assess the level of conformance with objectives and targets detailed in this EMP.
- The operating company representative/HSE advisor will undertake site inspections and direct such action as may be considered necessary to protect, minimise or rectify any environmental concerns.

8.5 Work instructions

An instrument referred to as a 'work instruction' is the mechanism used to cascade the relevant environmental commitments to Tamboran personnel and contractors. It outlines the minimum compliance requirements that must be implemented and includes:

- Key compliance and system documents.
- A list of compliance commitments with responsible parties allocated.
- A list of inspections, procedures and other tools required to implement the content of the EMP.
- Monitoring and reporting requirements.

8.6 Incident reporting and investigation

All personnel working on site (including visitors) are required to report incidents and near-misses that have the potential to, or do, affect the environment.

All environmental incidents and near misses are managed as per Tamboran's Incident Management Procedure and tracked through an online incident reporting system. Incidents are investigated with the level of investigation and methodology (5 whys, ICAM etc) dependent on actual and potential consequence.

Personnel are also encouraged to submit hazard / observation cards to maintain a level of awareness of environmental risk and to ensure a cycle of continual improvement.

8.7 Reportable environmental incident reporting

The Regulations define a reportable incident as an incident arising from a regulated activity that has caused, or has the potential to cause, material environmental harm or serious environmental harm as defined under the Petroleum Act. This also includes any potential or actual damage to a sacred site. Environmental offences and penalties that meet this criteria are defined in s. 117AAB of the Petroleum Act.

Tamboran will assess incidents as they occur to determine if they are reportable. Where an incident is reportable, DLPE will be contacted (this may be verbal or in writing) as soon as practicable but no later than two hours after the first occurrence of the incident or after the time the interest holder becomes aware of the incident.

The Regulations define a recordable incident as an incident arising from a regulated activity that:

1. Has resulted in an environmental impact or environmental risk not specified in the current plan for the activity; or
2. Has resulted in a contravention of an environmental performance standard specified in the current plan for the activity; or
3. Is inconsistent with an environmental outcome specified in the current plan for the activity; and
4. Is not a reportable incident.

Tamboran will notify (this may be oral or in writing) DLPE of a recordable incident as soon as practicable but no later than 15-days after the reporting period (agreed period or each 90-day period after the day on which the EMP is approved).

8.7.1 NT Waste Management and Pollution Control Act 1998 incident reporting

In accordance with the *NT Waste Management and Pollution Control (WMPC) Act 1998*, where contaminants or waste is not confined within the land on which the petroleum activities are undertaken (i.e. the approved disturbance areas where the petroleum activity is occurring), Tamboran has a duty to notify of incidents causing or threatening to cause pollution as soon as practicable, but no less than 24-hours after becoming aware of the incident.

A notifiable incident is defined as an incident that causes, or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm.

A notification must include:

- a) the incident causing or threatening to cause pollution
 - b) the place where the incident occurred
 - c) the date and time of the incident
14. how the pollution has occurred, is occurring or may occur
- d) the attempts made to prevent, reduce, control, rectify or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident
 - e) the identity of the person notifying

Tamboran shall make all notification under the WMPCA via the NT EPA Pollution Hotline 1800 064 567 and Petroleum Operations via the DLPE email: onshoregas.depws@nt.gov.au.

8.8 Monitoring, assurance and non-conformance management

In addition to regular monitoring as set out in this document, audits assessing compliance with this EMP, and associated work instruction will be undertaken by Tamboran during the execution of the activity. System deficiencies/non-compliances arising from activities will have corrective actions agreed and assigned to the relevant personnel and may be the subject of a formal non-conformance. These non-conformances or corrective actions shall be logged, and remedial actions identified and implemented. The status of corrective actions will be tracked through to closure and reported in the annual environmental report.

Audits assessing the implementation of the EMP commitments will be completed for each activity (Table 65). The results will be included in the annual environmental report.

Table 65: EMP audit schedule

Audit Type	Scope of audit	Frequency	Responsibility
Operational assurance	Operational compliance checks to ensure risk management controls are implemented	Monthly	Tamboran HSE representative
Annual assurance	Compliance against EMP commitments and risk management controls	Annually	Tamboran HSE representative

8.9 Emergency response plan

An Emergency Response Plan (ERP) has been developed and supports all Tamboran's activities within the Beetaloo Sub-basin. The ERP provides the framework for managing emergencies (i.e. spills, bushfires, medical emergencies) to minimise the impacts to personnel health and safety, and the environment. The ERP is provided in Appendix K.

8.10 Reporting

Internal and government reporting on performance standards will be carried out by the Tamboran authorised representative, and distributed to Tamboran management and the DLPE, in accordance with Section 35 of the Regulations. Quarterly and annual reports will be completed to summarise the compliance with this EMP, whether the environmental outcomes and performance standards in the plan were met and the details of any recordable and reportable incidents (Table 66).

Table 66: EMP reporting schedule

Frequency	Report detail	Recipient
Prior to the commencement of 3D seismic activity	A commencement of 3D seismic activity notification.	a) Minister for Lands, Planning and Environment (via DLPE) b) Occupier of the land in which the activity is carried out c) Owner for the land for which the activity is to be carried out
Only if required	Incident report summarising reportable incidents.	DLPE
Monthly	Monthly activity summary report.	DLPE
Quarterly	Quarterly incident report summarising recordable incidents during the period (during operational activities) and groundwater monitoring data.	DLPE
Annually	An annual environment performance report will be prepared and submitted to the Minister covering the following:	Tamboran management DLPE

Frequency	Report detail	Recipient
	- Summary of the works completed under the EMP during the reporting period. - Summary of performance against measurement criteria. - A summary of environmental incidents that occurred during the year (i.e. reportable and recordable incidents that occurred). - Any environmental studies or research associated with the activity. - Technical improvements. - Consultation undertaken. - Annual weed management performance reporting - Results of related research or of an ongoing monitoring program. - The relevant records outlined with section 8.11.	
Geospatial information	As per A.3.5 of the Code, geospatial information must be provided to the Minister. Geospatial data of all areas cleared and rehabilitated will be provided annually as a part of the Annual Environmental Performance Report.	Minister for Lands, Planning and Environment (via DLPE)

8.11 Record keeping

The following records will be retained within Tamboran's document management system for a period of five years:

- Records linked to measurement criteria, commitments and statutory reporting requirements.
- Induction records.
- Waste records.
- Hazardous goods manifests.
- Fuel usage.
- Weed inspections.
- Non-compliances and corrective action records.
- Internal audits and inspection records.
- Management of change records.

To the extent these documents are 'prescribed records' for the purpose of the Regulations, they will be kept for the longer of five years following the period during which the petroleum interest is in force and 15-years after the record comes into existence.

8.12 Management of change

A management of change process will be implemented to ensure any changes to the regulated activities described in this EMP are assessed and communicated to ensure no new or unintended environmental risks or impacts are introduced. This allows adaptive management and the ability to use appropriate technologies.

It should be noted that changes can only be implemented where there is no new regulated activity, risk (including risk level) or impact is introduced. Where a new regulated activity, risk (including risk level) or impact is introduced, then a Revision of the EMP is required under the Regulations.

Examples of changes in the location of the regulated activity that may need to be considered in the future, include, a well pad, gathering lines, access, track, seismic line, gravel pit, laydowns etc. For changes in location of the regulated activities listed in this EMP, the following processes will be completed:

- Stakeholder engagement.
- A land condition assessment for the new location, including ecological and heritage scouting.
- An AAPA certificate granted covering the new location (if applicable).

The relevant management plans outlined in Section 7 of this EMP will be updated as required.

A Regulation 22 will be submitted to DLPE to modify the EMP, where the change to the location of the regulated activity does not introduce a new or increased environmental risk or impact not provided for in the EMP.

A Regulation 17 will be submitted to DLPE to revise the EMP where the change to the location of the regulated activity has the potential to introduce a new or increased environmental risk or impact not provided for in the EMP.

8.13 EMP review

Implementation of this EMP will be continually monitored and revised as required based on monitoring and audit results, complaints, employee and stakeholder feedback, change to the proposed work program or a material increase in risk level.

A formal review, update and resubmission of this EMP will be undertaken every five years.

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10 Acronyms and Abbreviations

Acronym	Meaning
3D	Three dimensional
°C	degrees Celsius
%	Percentage
AAPA	Aboriginal Areas Protection Authority
ABS	Australian Bureau of Statistics
ALA	Atlas of Living Australia
ALARP	as low as reasonably practicable
ANZECC	Australian and New Zealand Environment Conservation Council
ANRA	Australian Natural Resources Atlas
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
ASRIS	Australian Soil Resource Information System
AS	Australian Standard
AWD	accelerated weight drop
BoM	Bureau of Meteorology
BMP	Bushfire Management Plan
BPESC	Best Practice Erosion and Sediment Control
CE, E, V, or NT	Critically Endangered, Endangered, Vulnerable and Near Threatened
CLA	Cambrian Limestone Aquifer
CPESC	Certified Professional in Erosion and Sediment Control
Code	Code of Practice: Onshore Petroleum Activities in the Northern Territory
Cth	Commonwealth
CY	calendar year
DAWE	Department of Agriculture, Water and the Environment (Cth); now the Department of Climate Change, Energy, the Environment and Water
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEPWS/DLPE	Department of Environment, Parks and Water Security; now the Department of Lands, Planning and Environment
DIPL/DLI	Department of Infrastructure, Planning and Logistics; now Department of Logistics and Infrastructure

Acronym	Meaning
DITT/DME	Department of Industry, Trade and Tourism; now the Department of Mining and Energy
DoH	Department of Health (NT)
EIS	Environment Impact Statement
EO	Environmental Outcome
EMP	Environment Management Plan
EP	exploration permit (e.g. EP 76, EP 98 and EP 117)
EPA	Environment Protection Authority (NT)
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth)
EPS	Environmental Performance Standard
ERP	Emergency Response Plan
ESC	erosion and sediment controls
ESCP	Erosion and Sediment Control Plan
GDE	Groundwater Dependent Ecosystems
GHG	Greenhouse gas
GPS	Global Positioning Device
ha	hectare
HSE	Health, Safety and Environment
HSEMPs	Health, Safety and Environment Management Plans
HSEMS	Health, Safety and Environment Management System
IBA	Important Bird Area
IECA	International Erosion Control Association
ILUA	Indigenous Land Use Agreement
ISO	International Organisation for Standardisation
JV	Joint venture
km	kilometre
km ²	square kilometres
km/hr	kilometres per hour
LOS	Level of Service
m	metre

Acronym	Meaning
Mya	millions of years ago
MD	measured depth
ML	megalitre
MI	Local magnitude
mm	millimetre
MNES	Matters of National Environmental Significance
SDS	Safety Data Sheet
NAFI	Northern Australian Fire Information
NATA	National Association of Testing Authorities
NEPM	National Environmental Protection Measure
NGERS	National Greenhouse and Energy Reporting Scheme
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NLC	Northern Land Council
NPI	National Pollutant Inventory
NT	Northern Territory
NT Por	NT Portion (Parcel Reference Table)
NTG	Northern Territory Government
NVIS	National Vegetation Information System
OHS	Occupational Health and Safety
ppm	parts per million
PER	Public Environment Report
PPE	Personal Protective Equipment
PPL	Perpetual Pastoral Lease
RMP	Rehabilitation Management Plan
RUSLE	Revised Universal Soil Loss Equation
RWA	Restricted Work Area
SWL	Standing Water Level
tCO ₂ e	tonnes of carbon dioxide equivalent
TDS	Total Dissolved Solids

Acronym	Meaning
TIA	Traffic Impact Assessment
TMP	Traffic Management Plan
TO	Traditional Owner
TPWC Act	<i>Territory Parks and Wildlife Conservation Act (NTG)</i>
WEL	Water Extraction Licence
WMP	Weed Management Plan
WoNS	Weed of National Significance
WWMP	Wastewater Management Plan