# Ecological Assessment

# Appendix 01

# Environmental Management Plan: EP161 2D Seismic and Ground Gravity Survey Program

# STO7-4

# NT Exploration Permit 161

# Santos QNT PTY Ltd

# EP161
# ENVIRONMENTAL ASSESSMENT REPORT

Client: Ingauge

STATUS: Final

REPORT No: IN-01

ISSUE DATE: September 2023



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# EXECUTIVE SUMMARY

Santos QNT Pty Ltd (Santos) proposes to undertake an exploration program on Exploration Permit (EP) 161 located approximately 130km east-southeast of Daly Waters, Northern Territory. The proposed program is located north and south of the Carpentaria Highway on the Tanumbirini Pastoral Lease, located in the Gulf Fall and Uplands (GFU) geographical bioregion.

A desktop assessment and targeted ecological surveys were undertaken in July 2023 with specific focus on Santos's proposed seismic lines. The ecological assessment was carried out to identify weeds, key ecological characteristics and potential constraints to the proposed seismic activities on EP161 in the Northern Territory.

No threatened fauna or flora species were observed during on-ground surveys. Two near threatened (NT) fauna species were identified (Northern Nailtail Wallaby and Australian Bustard). Habitat exists for some conservation significant species in the area, however given the narrow linear nature of disturbance, species habitat requirements and likelihood of occurrence, impacts from proposed seismic activities are considered low.

## Acronyms and Abbreviations

| Acronyms/Abbreviation | Description |
|---|---|
| DCCEEW | Department of Climate Change, Energy, the Environment and Water (Formerly DAWE/DoE) – Australian Government |
| DEPWS | Department of Environment, Parks and Water Security (Formerly DENR) – Northern Territory Government |
| EPBC Act | Environment Protection and Biodiversity Conservation Act 1999 |
| GFU | Gulf Fall and Uplands |
| SREBA | Strategic Regional Environmental and Baseline Assessment |
| TPWC Act | Territory Parks and Wildlife Conservation Act 1976 |
| WMP | Weed Management Plan |

This report was prepared by Mr P. Fox (BSc (App. Env Sci)(Hons)). Mr Fox is a Principal Ecologist with over 20 years' experience in undertaken environmental assessments across Australia and Papua New Guinea. He has undertaken numerous surveys in the Northern Territory since 2011.

# 1 INTRODUCTION

Santos QNT Pty Ltd (Santos) proposes to undertake an exploration program on Exploration Permit (EP) 161 located approximately 130km east-southeast of Daly Waters, Northern Territory. The proposed program is located north and south of the Carpentaria Highway on the Tanumbirini Pastoral Lease, located in the Gulf Fall and Uplands (GFU) geographical bioregion.

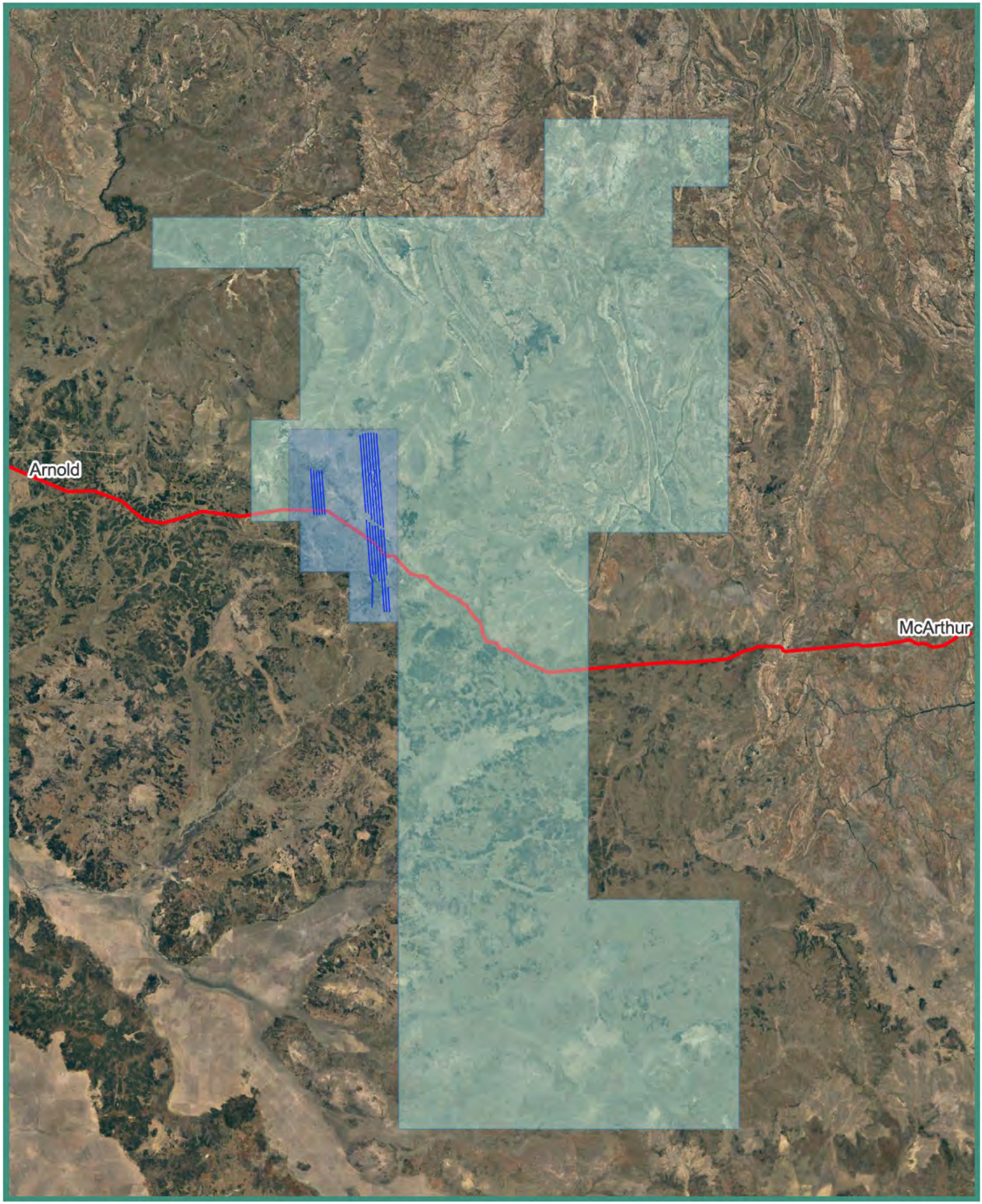
A desktop investigation and ecological assessment was carried out to identify key ecological characteristics and potential constraints to the proposed seismic activities. The scope of the study was to provide:

- habitat and vegetation community descriptions;
- locations and photos of communities and species present;
- locations of fauna breeding places and other habitat features;
- watercourse assessments;
- baseline weed assessment; and
- likelihood of targeted threatened species to occur within or adjacent to the proposed seismic and drilling activities.

This report presents the field survey methods and the results of desktop and field investigations.

## 1.1 LOCATION

EP161 is located approximately 130km east-southeast of Daly Waters, Northern Territory (refer Figure 1). The project area within EP161 is situated on the Tanumbirini Pastoral Lease, which has ongoing cattle grazing activities. The project area refers to the 12 proposed seismic lines running north – south, dissected by the Carpentaria Highway as shown on Figure 1.




TITLE

## Location

MAP NO. Figure 1

PROJECT EP161 Seismic

LEGEND

- Proposed Seismic Lines
- Study Area
- EP161
- Carpentaria Hwy

0 10 20 30 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid

## 1.2 PROPOSED SEISMIC PROGRAM LOCATION

The proposed exploration activities include:

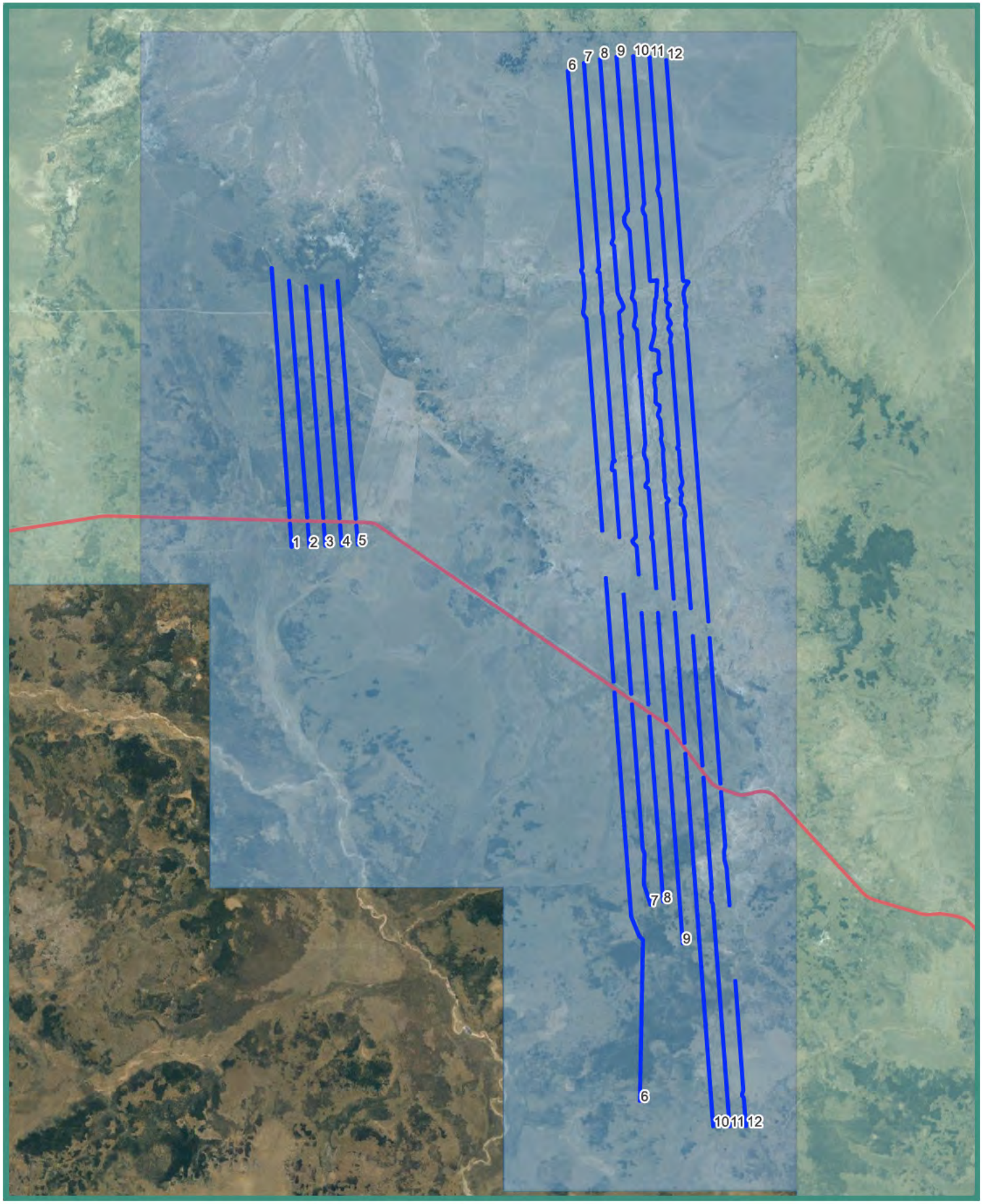
- Acquisition of 239km of 2 D Seismic data
    - 5 lines x approximately 8km (Lines 1 – 5)
    - 7 lines x 23-32 km (Lines 6 – 12)
    - Conduct 2D seismic acquisition operations
    - Rehabilitate cleared seismic acquisition lines

Error! Reference source not found. provides the latitude and longitude coordinates of the start and end of the seismic lines.

**Table 1 Seismic Line Coordinates for Start and End**

| Line | Name | Easting | Northing | Length (m) | Line Length (m) |
|---|---|---|---|---|---|
| Line 1 | MCSAN23-01A | 457541.1 | 8185473.6 | 7620 | 8368 |
| | MCSAN23-01A | 458086.4 | 8177876.1 | | |
| | MCSAN23-01B | 458096.8 | 8177720.9 | 748 | |
| | MCSAN23-01B | 458149.6 | 8176975.1 | | |
| Line 2 | MCSAN23-02A | 458066.1 | 8185088.8 | 7247 | 7959 |
| | MCSAN23-02A | 458623.3 | 8177866.1 | | |
| | MCSAN23-02B | 458635.5 | 8177693.9 | 712 | |
| | MCSAN23-02B | 458687.8 | 8176984.5 | | |
| Line 3 | MCSAN23-03A | 458582.1 | 8184918.8 | 7090 | 7772 |
| | MCSAN23-03A | 459111.8 | 8177851.7 | | |
| | MCSAN23-03B | 459121.5 | 8177689.3 | 682 | |
| | MCSAN23-03B | 459174 | 8177009.4 | | |
| Line 4 | MCSAN23-04A | 459063.9 | 8184932.8 | 7117 | 7773 |
| | MCSAN23-04A | 459601.8 | 8177838.6 | | |
| | MCSAN23-04B | 459616 | 8177674.2 | 656 | |
| | MCSAN23-04B | 459666 | 8177020.2 | | |
| Line 5 | MCSAN23-05A | 459540.8 | 8185083.8 | 7281 | 7901 |
| | MCSAN23-05A | 460095.7 | 8177827.1 | | |
| | MCSAN23-05B | 460109.2 | 8177663 | 620 | |
| | MCSAN23-05B | 460158 | 8177045.2 | | |
| Line 6 | MCSAN23-06A | 466522.4 | 8191457 | 14098 | 29849 |
| | MCSAN23-06A | 467571.1 | 8177465.2 | | |
| | MCSAN23-06B | 467674.1 | 8176073.9 | 3198 | |
| | MCSAN23-06B | 467914.4 | 8172886.1 | | |
| | MCSAN23-06C | 467934.8 | 8172601 | 12553 | |
| | MCSAN23-06C | 468708.3 | 8160168.8 | | |
| Line 7 | MCSAN23-07A | 467012.1 | 8191697.4 | 14659 | 23904 |
| | MCSAN23-07A | 468089.2 | 8177267.3 | | |
| | MCSAN23-07B | 468215.5 | 8175575.2 | 3067 | |
| | MCSAN23-07B | 468448.9 | 8172517.9 | | |
| | MCSAN23-07C | 468465.1 | 8172239.2 | 6178 | |
| | MCSAN23-07C | 469035.8 | 8166120.1 | | |

| Line | Name | Easting | Northing | Length (m) | Line Length (m) |
|---|---|---|---|---|---|
| Line 8 | MCSAN23-08A | 467498.2 | 8191815.3 | 15987 | 24485 |
| | MCSAN23-08A | 468673.5 | 8176139.1 | | |
| | MCSAN23-08B | 468758.7 | 8175012 | 2828 | |
| | MCSAN23-08B | 468969.3 | 8172193 | | |
| | MCSAN23-08C | 468994 | 8171869.8 | 5670 | |
| | MCSAN23-08C | 469418.2 | 8166218.1 | | |
| Line 9 | MCSAN23-09A | 467999.4 | 8191886 | 16508 | 26315 |
| | MCSAN23-09A | 469204.3 | 8175718.1 | | |
| | MCSAN23-09B | 469256.8 | 8175014 | 3305 | |
| | MCSAN23-09B | 469503.2 | 8171719.8 | | |
| | MCSAN23-09C | 469530.4 | 8171434.6 | 6502 | |
| | MCSAN23-09C | 470010.3 | 8164952.8 | | |
| Line 10 | MCSAN23-10A | 468503.4 | 8191903.7 | 17285 | 32663 |
| | MCSAN23-10A | 469737.4 | 8175403.9 | | |
| | MCSAN23-10B | 469767.3 | 8175021.5 | 4005 | |
| | MCSAN23-10B | 470065.4 | 8171029.1 | | |
| | MCSAN23-10C | 470086 | 8170738.2 | 11373 | |
| | MCSAN23-10C | 470932.9 | 8159401.2 | | |
| Line 11 | MCSAN23-11A | 470253.8 | 8175113.2 | 17127 | 31777 |
| | MCSAN23-11A | 469001.6 | 8191873.9 | | |
| | MCSAN23-11B | 470313.6 | 8174314.9 | 3986 | |
| | MCSAN23-11B | 470610.5 | 8170341.5 | | |
| | MCSAN23-11C | 470634.7 | 8170013.9 | 10664 | |
| | MCSAN23-11C | 471430.8 | 8159401 | | |
| Line 12 | MCSAN23-12A | 469508.9 | 8191784.3 | 17315 | 29782 |
| | MCSAN23-12A | 470790.4 | 8174711.2 | | |
| | MCSAN23-12B | 470821.7 | 8174253.9 | 4475 | |
| | MCSAN23-12B | 471154.8 | 8169793 | | |
| | MCSAN23-12C | 471169.1 | 8169580 | 3505 | |
| | MCSAN23-12C | 471432 | 8166097.1 | | |
| | MCSAN23-12D | 471925.8 | 8159401.7 | 4487 | |
| | MCSAN23-12D | 471601.3 | 8163851.2 | | |




| | |
|---|---|
| TITLE | **Exploration Program** |
| MAP NO. | Figure 2 |
| PROJECT | EP161 Seismic |

LEGEND

- Proposed Seismic Lines
- Study Area
- EP161
- Carpentaria Hwy

0 2.5 5 7.5 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid

### 1.2.1 VEGETATION AND FLORA SURVEYS

The surveys were undertaken to ground-truth mapped vegetation, identify flora species, including threatened flora.

Surveys undertaken involved meander surveys and field-verification vegetation assessments. This involves collecting information on structure, canopy height, dominant and co-dominant canopy species, subdominant, associated species and additional notes such as presence of hollow bearing trees (HBT).

# 2 METHOD

This section outlines the methods undertaken to describe the existing environmental values of the seismic lines. A combination of desktop assessment and field survey was conducted as part of this study. The desktop assessments included a review of previous investigations on EP161, relevant literature, mapping, database searches and the Strategic Regional Environmental and Baseline Assessment (SREBA) for the Beetaloo Sub-basin. The field survey obtained ecological information and opportunistic observations relevant to the seismic lines.

## 2.1 DESKTOP ASSESSMENT

Desktop assessments of available Northern Territory and Commonwealth databases were undertaken prior to the commencement of the field survey to identify records or potential occurrences of conservation significant species and vegetation communities within the study area. A review of previous desktop assessments was undertaken in addition to a revised search of the following databases:

- Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) protected matters search tool (-16.804167, 135.174167)
- The Atlas of Living Australia (ALA) database
- Australia's Virtual Herbarium (AVH)
- Online Zoological Collections of Australian Museums (OZCAM)
- BirdLife Australia's Birdata
- Northern Territory Government Department of Environment, Parks and Water Security (DEPWS) NR Maps
- Strategic Regional Environmental and Baseline Assessment (SREBA) for the Beetaloo Sub-basin.

## 2.2 LIKELIHOOD OF OCCURRENCE

An assessment was undertaken of the likelihood of occurrence for threatened fauna and flora species identified through the desktop review. The field survey further informed and verified this likelihood of occurrence assessment. The DCCEEW and the Northern Territory DEPWS do not have prescriptive likelihood of occurrence guidelines within their policies but rather clarify the scale of assessment required to determine the level of impact (e.g. level of assessment, previous record searches, and distribution maps). The below criteria have been developed with the aim of considering this scale of assessment in order to identify the likelihood of occurrence for threatened species:

- **Low potential to occur** – the species has not been recorded in the region (no records from desktop searches) and/or current known distribution does not encompass study area and/or suitable habitat is generally lacking from the study area.

- **Moderate potential to occur** – the species has been recorded in the region (desktop searches) however suitable habitat is generally lacking from the study area or species has not been recorded in the region (no records from desktop searches) however potentially suitable habitat occurs at the study area.
- **High potential to occur** – the species has been recorded in the region (desktop searches) and suitable habitat is present at the study area.
- **Known to occur** – the species has been recorded on-site in the recent past (i.e. last 5-10 years) and the site provides suitable habitat for it.

## 2.3 FIELD ASSESSMENTS

Targeted surveys were undertaken in relation to the proposed seismic activities on EP161 in July 2023 during optimal dry-season conditions.

Surveys were undertaken with a Fox & Co principal ecologist (Paul Fox), an archeologist and a Santos representative and were undertaken on foot and all-terrain vehicles (ATV).

Survey effort undertaken is considered suitable for the level and scale of proposed activity, with the aim of identifying potential threatened species and habitat to support threatened species; thereby identifying, mitigating and managing potential impacts.

### 2.3.1 FAUNA ASSESSMENTS

#### 2.3.1.1 HABITAT ASSESSMENTS

Detailed habitat assessments were undertaken to describe fauna habitats within the study area including their potential suitability for conservation significant species. This involved collecting information such as structural complexity of vegetation, description of habitat features such as hollows, sources of disturbance and any characteristics specific to the target conservation significant species identified by the desktop assessment. Using the habitat assessment in conjunction with the other detection methods and desktop information, an assessment has been conducted of the conservation significant species likely to use the site.

Furthermore, the likelihood of occurrence assessments (Tables 7, 8 and 9) were drafted prior to field surveys. The habitat assessments, in addition to targeted field surveys described below, provide field-verified assessments of EVNT species considered likely to occur. This further informs the field-verified likelihood of occurrence tables provided in Appendix A.

#### 2.3.1.2 AVIFAUNA SURVEYS

Targeted bird surveys were undertaken in in areas considered potential habitat for listed EVNT species.

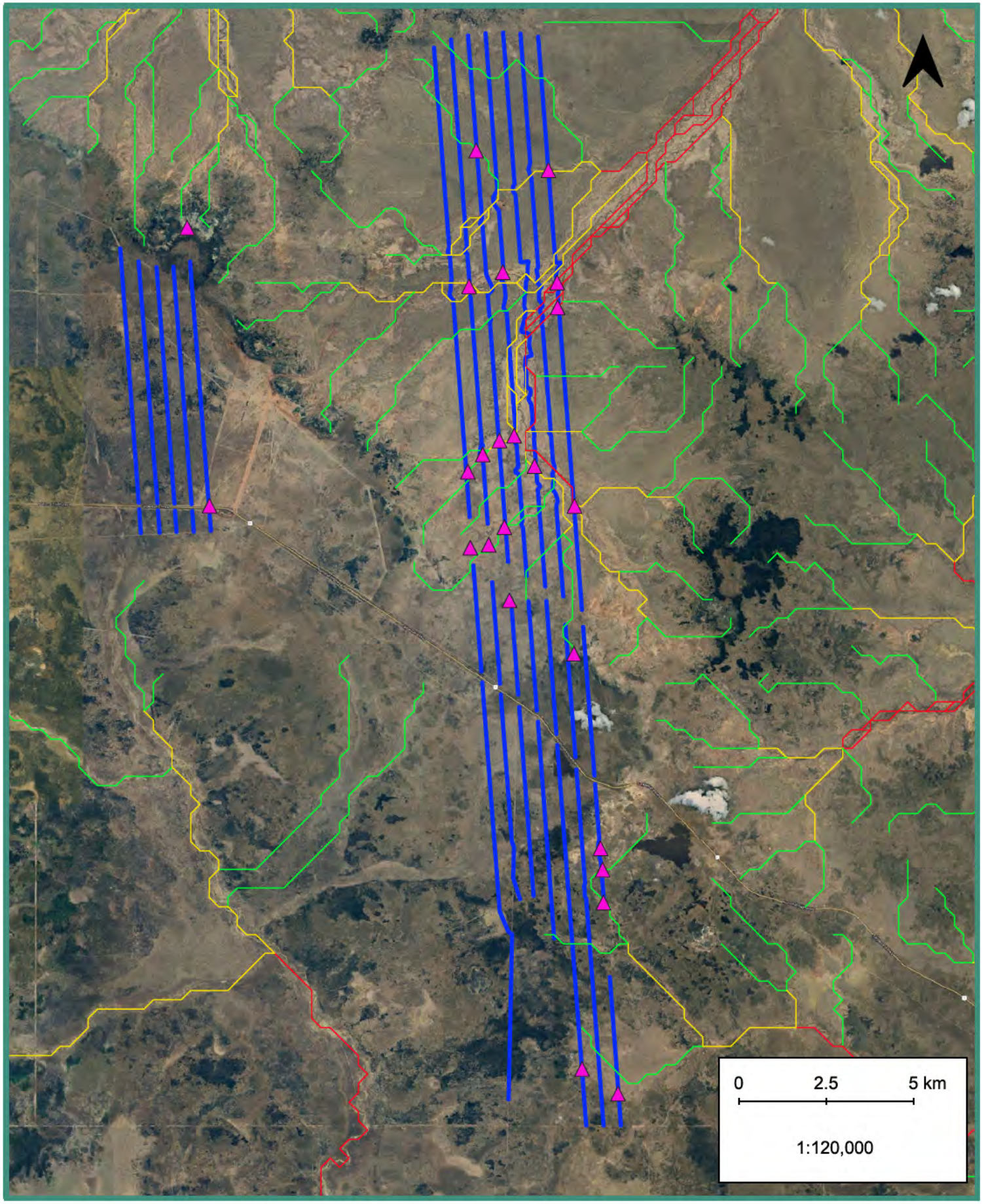
Whilst traversing each seismic line, avifauna surveys were undertaken in each main fauna habitat present, however particularly in areas considered potential habitat for EVNT species (as identified on ground at the time and also to verify the preliminary likelihood of occurrence assessment undertaken prior to on-ground surveys; i.e., additional field-verification). Locations associated with riparian areas with hollows were particularly targeted for Gouldian Finch. Only 2 areas with standing water (pools) were identified over all of the seismic lines. Systematic surveys were undertaken at both of these locations. Each targeted systematic bird survey involved:

- A 20-minute census of birds per unbounded 1 ha area.
- Birds detected visually (with the aid of binoculars) and/or aurally were recorded.
- Relevant weather details and the time of the surveys were noted.
- All opportunistic observations of birds outside of systematic surveys were also recorded.

Bird survey locations are shown on Figure 3. Birds were also recorded from incidental locations.

#### 2.3.1.3 TERRESTRIAL FAUNA

Surveys were undertaken which involved slow driving of seismic lines and meander foot surveys. Opportunistic and targeted searches for terrestrial fauna were conducted by raking leaf and bark litter drifts, overturning logs and stones, searching under bark of dead or exfoliating trees, investigating burrows and recording tracks. All species encountered during diurnal sampling were recorded.




| | |
|---|---|
| TITLE | **Avifauna Survey Locations** |
| MAP NO. | Figure 3 |
| PROJECT | EP161 Seismic |

LEGEND

- Avifauna Survey Sites

Water Drainage Stream Order

- 1
- 2
- 3

- Proposed Seismic Lines

FOX & CO ENVIRONMENTAL

Date: 01 03 2024 Base Imagery: Google Satellite Spatial File Path: C:\Users\ecofo\OneDrive - Fox & Co Environmental\Clients\Ingauge\Tanumbirini\4 Maps

# 3 EXISTING ENVIRONMENT

The following provides a detailed assessment of the areas relevant to the proposed seismic program.

## 3.1 VEGETATION COMMUNITIES

The vegetation is comprised of bullwaddy / lancewood thickets, tussock grasslands, open eucalypt / acacia woodlands, and rocky scarps / plateaus.

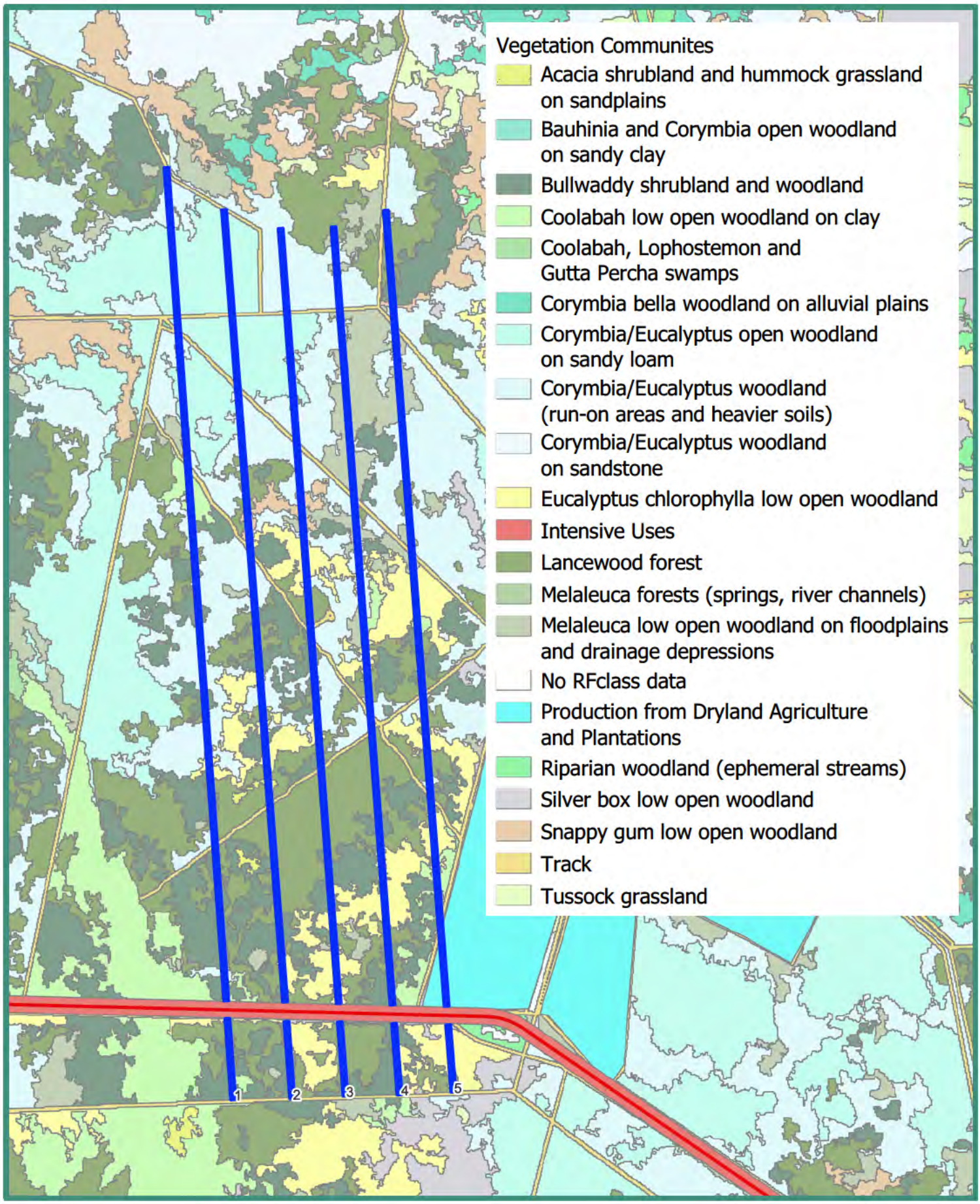
Table 2 provides a summary of vegetation communities within the project area. Figure 4, Figure 5 and Figure 6 provides detailed ground-truthed vegetation mapping for the project area. Figure 7 shows locations of vegetation as described in Table 2.

**Table 2 Vegetation Descriptions**

| Vegetation Description | Typical Photo Description |
|---|---|
| Bullwaddy (*Macropteranthes kekwickii*) / Lancewood (*Acacia shirleyi*) forests.<br><br>Bullwaddy and lancewood form dense thickets with little to no shrub layer and minimal grass cover; whilst other areas contain open bullwaddy and lancewood with a grassy groundcover. |  <br>**Vegetation Description Plate 1**<br>Location: -16.4807, 134.6069 |
| Eucalypt and Corymbia woodland with acacia shrub layer.<br><br>Dominant canopy species include variable-barked bloodwood *(Corymbia dichromophloia)* and snappy gum (*Eucalyptus leucophloia*). Often with dense shrub layer of turpentine *(Acacia lysiphloia)*. |  <br>**Vegetation Description Plate 2**<br>Location: -16.6373, 134.7172 |

| Vegetation Description | Typical Photo Description |
|---|---|
| Eucalypt woodland with native tussock grassland groundcover.<br><br>Dominant canopy species include silver box (*Eucalyptus pruinosa*), snappy gum (*Eucalyptus leucophloia)* and coolabah (*Eucalyptus microtheca*). Some areas contain monoculture stands of silver box. |  <br>**Vegetation Description Plate 3**<br>Location: -16.4923, 134.696, |
| Melaleuca and eucalypt floodplains. Canopy is low and open and often consists of coolabah (*Eucalyptus microtheca*) with broad-leaved paperbark (*Melaleuca viridiflora*) secondary layer / shrub layer. |  <br>**Vegetation Description Plate 4**<br>Location: -16.4576, 134.7222 |
| Low rocky hills with snappy gum (*Eucalyptus leucophloia*) and spinifex. Rocky ridges / scarps with snappy gum. |  <br>**Vegetation Description Plate 5**<br>Location -16.5137 134.7267 |

| Vegetation Description | Typical Photo Description |
|---|---|
| Riparian vegetation along ephemeral waterways. Larger waterways often contain sparsely scattered river red gum (*Eucalyptus camaldulensis*) along the banks. |  <br>**Vegetation Description Plate 6**<br>Location: 134.7125, -16.3903 |
| Tussock grassland |  <br>**Vegetation Description Plate 7**<br>Location: -16.4788, 134.7006 |




| | |
|---|---|
| TITLE | **Vegetation Communites Lines 1-5** |
| MAP NO. | Figure 4 |
| PROJECT | EP161 Seismic |

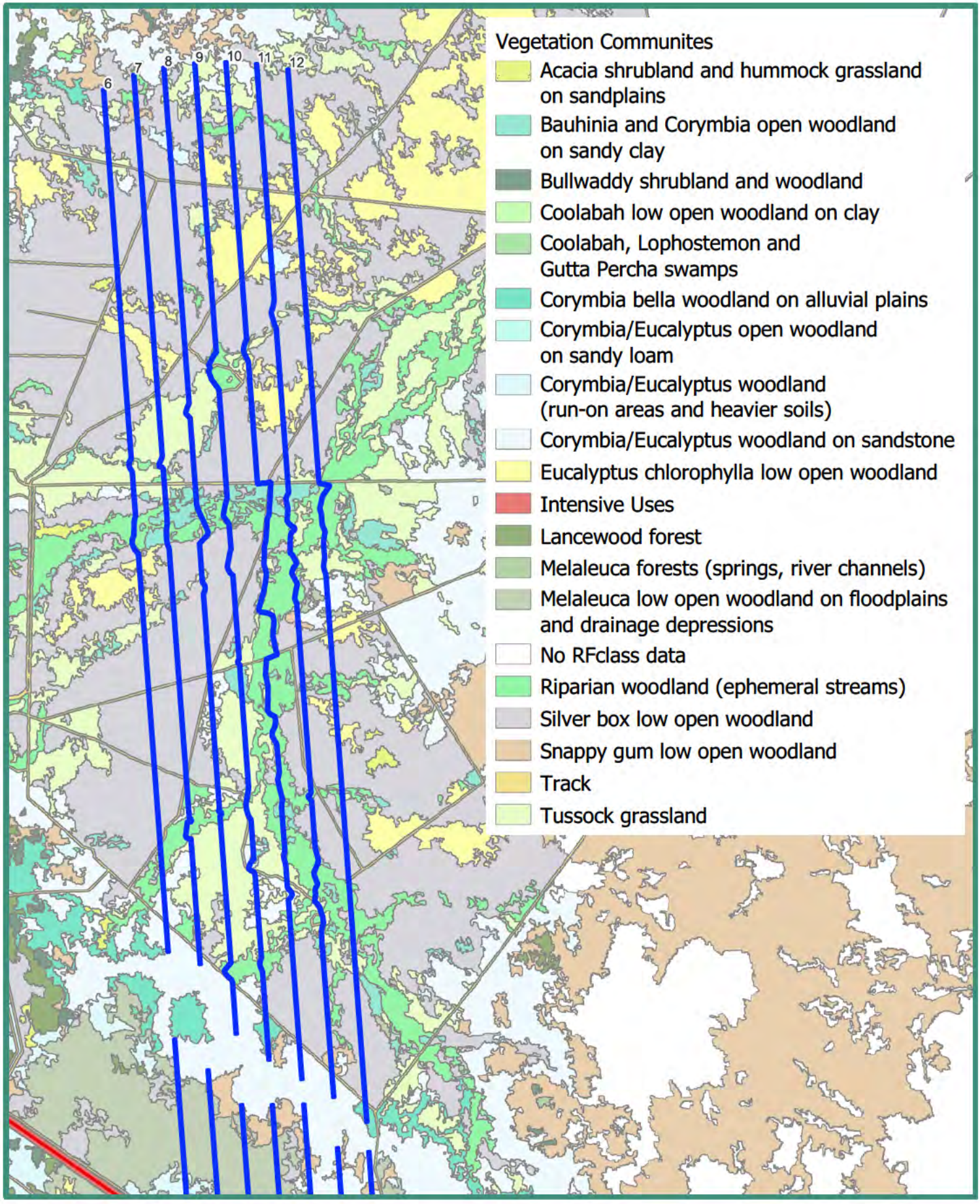
LEGEND

- Proposed Seismic Lines
- Carpentaria Hwy

0 0.75 1.5 2.25 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid Spatial Data: https://srebadata.nt.gov.au/datatype/NTG-SPA




| | |
|---|---|
| TITLE | **Vegetation Communites Lines 6-12 (North)** |
| MAP NO. | Figure 5 |
| PROJECT | EP161 Seismic |

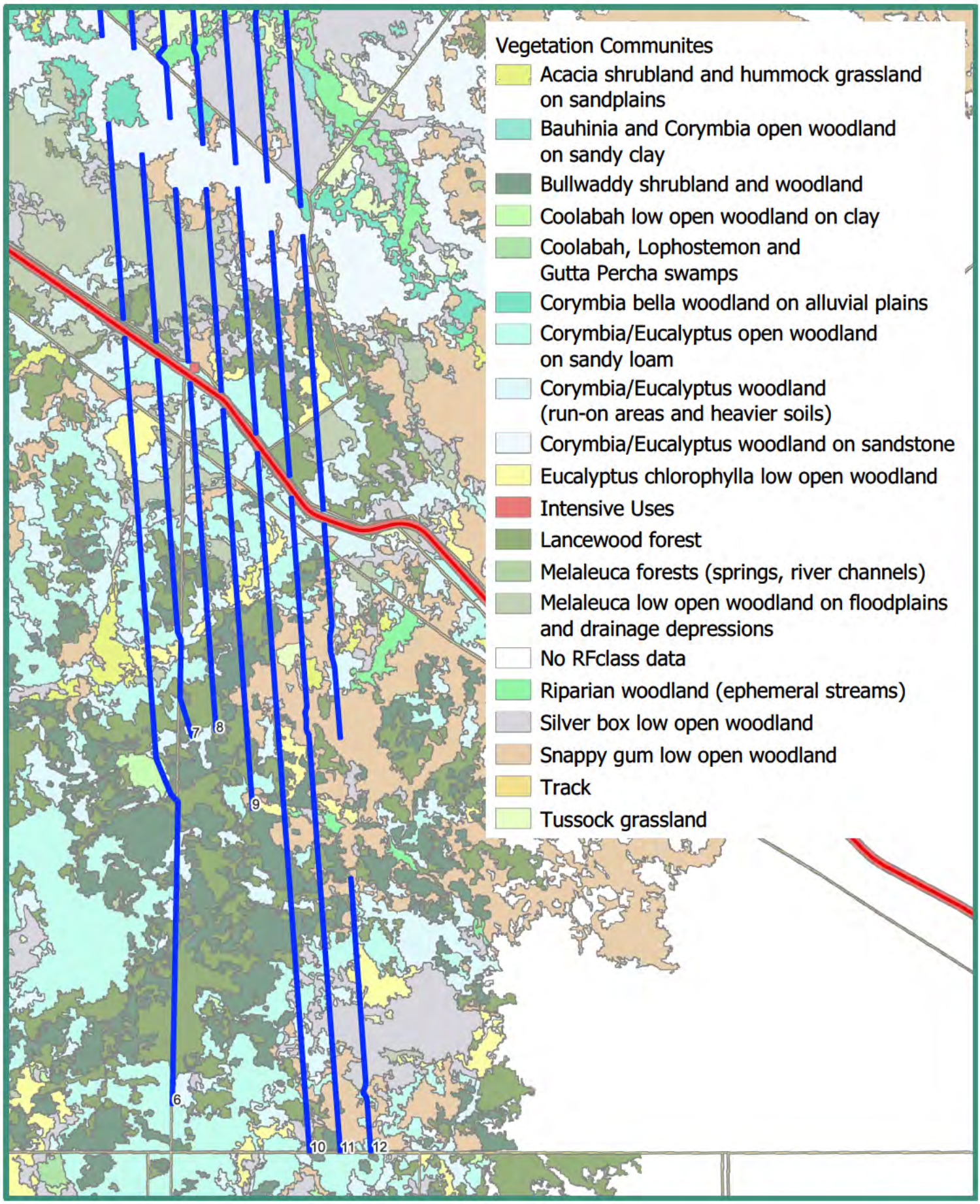
LEGEND

- Proposed Seismic Lines
- Carpentaria Hwy

0 1 2 3 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid




| | |
|---|---|
| TITLE | **Vegetation Communites Lines 6-12 South** |
| MAP NO. | Figure 6 |
| PROJECT | EP161 Seismic |

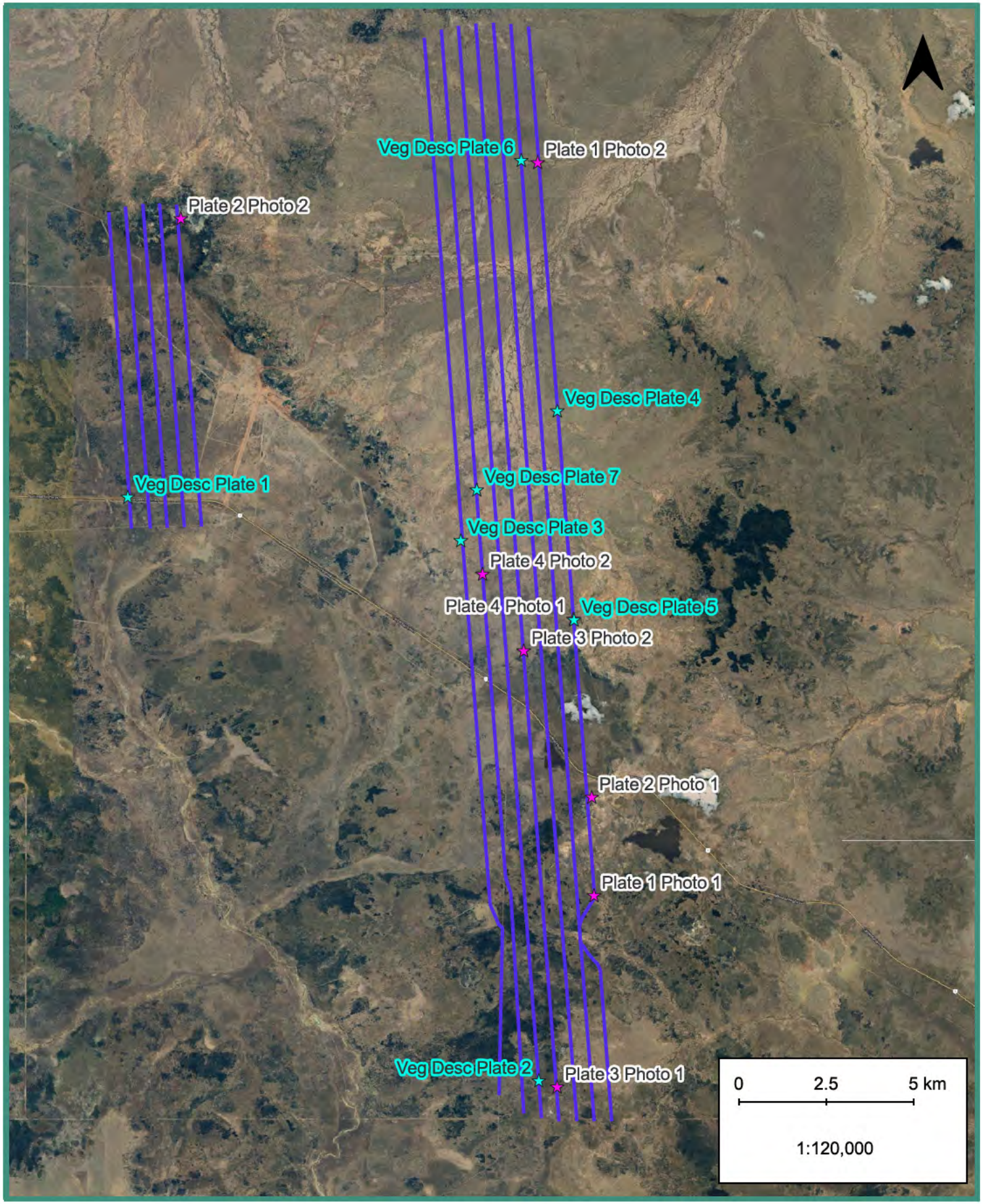
LEGEND

- Proposed Seismic Lines
- Carpentaria Hwy

0 1 2 3 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid Spatial Data: https://srebadata.nt.gov.au/datatype/NTG-SPA




| | |
|---|---|
| TITLE | **Vegetation & Habitat Description Photo Locations** |
| MAP NO. | Figure 7 |
| PROJECT | EP161 Seismic |

LEGEND

- Vegetation Description Photo Locations
- Habitat Description Photo Locations
- Proposed Seismic Lines

Google Hybrid

FOX & CO ENVIRONMENTAL

Date: 01 03 2024 Base Imagery: Google Satellite Spatial File Path: C:\Users\ecofo\OneDrive - Fox & Co Environmental\Clients\Ingauge\Tanumbirini\4 Maps

## 3.2 CONSERVATION SIGNIFICANT SPECIES

Conservation significant flora and fauna species are those species listed under the provisions of the *Commonwealth EPBC Act* and/or the *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act) including threatened species as well as internationally protected wildlife and migratory species. Threatened species include those with conservation status listed as Extinct in the Wild, Critically Endangered, Endangered or Vulnerable (CE, E, V) under the EPBC Act and/or TPWC Act.

The Northern Territory DEPWS also lists Data Deficient (DD) flora and fauna species. Data Deficient species are those for which there is not sufficient data on population size or trend to unambiguously determine the conservation status. Data deficient species while not considered threatened species under the EPBC Act or TPWC Act, are considered Significant Species under the TPWC Act and are therefore included in the assessment. Least Concern (LC) species are those that do not meet the International Union for the Conservation of Nature (IUCN) criteria for listing as threatened.

Potentially occurring threatened flora and fauna species are listed in **Appendix B** with an account of their likelihood of presence within the study area based on known records, species biology and ecology and habitats available within the study area. Not all of the threatened species indicated through desktop information are expected to occur within the study area due to the absence of suitable habitat for some species.

One (1) threatened fauna species, Mertens' Water Monitor (*Varanus mertensi*) has been previously recorded within the search area. This record is south of the Carpentaria Highway and not associated with a mapped watercourse or water feature. This species is rarely far from water, which therefore casts doubt on the validity of this record. Six (6) significant fauna species have previously been recorded within the study area, including Australian Bustard, Bush-stone curlew, Hooded Parrot, Pictorella Mannikin and Spectacled Hare-wallaby, which are all listed as Near Threatened (NT) under the TPWC Act. No threatened fauna species have previously been recorded in the study area. Two (2) significant species flora species have previously been recorded within the study area. Both of these species, *Acrachne racemosa* and Sida sp. *Excedentifolia,* are listed as DD under the TPWC Act.

Table 3 lists the threatened (or significant) fauna and flora species that have previously been recorded within the study area.

Table 4 lists the migratory fauna species that are at least moderately likely to occur within the study area based on the likelihood of occurrence assessment. Species which are specialists of tidal areas are not included.

The following sections summarise findings from each of the databases.

### 3.2.1 EPBC PROTECTED MATTERS

A Protected Matters Search Tool (PMST) has been undertaken and included in the attached.

The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters search tool (PMST) was used to identify threatened species and vegetation communities listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) that may occur within the search area. The PMST is a predictive database that identifies EPBC Act listed flora and fauna species with a Moderate Potential to Occur in a given search area based on bioclimatic modelling. The search area was defined by the study area with a 20 km buffer.

The EPBC PMST identified the search area as having potential habitat for no nationally threatened flora species, 14 threatened terrestrial species and 14 migratory species listed under the EPBC Act (**Appendix A**). Two (2) of the 14 migratory species are specialist marine species and have therefore been excluded from the assessment (including Saltwater crocodiles and Freshwater

Sawfish as no suitable habitat exists within the study area). Shorebirds have also been excluded from the assessment due to lack of suitable habitat in the study area.

No Threatened Ecological Communities (TEC), World Heritage Properties, National Heritage Places, Wetlands of International Importance, Great Barrier Reef Marine Park or Commonwealth Marine Area's occur within the study area.

### 3.2.2 BIRDATA

BirdLife Australia's Birdata (**Appendix A**) shows records of 69 bird species observed within the search area. Of those, 2 species *Ardeotis australis* (Australian bustard) and *Burhinus grallarius* (Bush Stone-curlew) are listed as Near Threatened (NT) under TPWC Act and 8 species *Accipiter fasciatus* (Brown Goshawk), *Chalcites basalis* (Horsfield's Bronze-Cuckoo), *Coracina novaehollandiae* (Black-faced Cuckoo-shrike), *Coracina papuensis* (White-bellied Cuckoo-shrike), *Falco cenchroides* (Nankeen Kestrel), *Grallina cyanoleuca* (Magpie-lark), *Haliastur sphenurus* (Whistling Kite) and *Merops ornatus* (Rainbow Bee-eater) are listed as migratory species under the EPBC Act.

### 3.2.3 ATLAS OF LIVING AUSTRALIA

The ALA database returned records for 1 significant and/or threatened fauna species *Varanus mertensi* (Mertens' Water Monitor) listed under the EPBC Act and/or TPWC Act within the search area.

### 3.2.4 DEPWS NR MAPS

The Northern Territory Government NR Maps (NT Govt. Department of Environment, Parks and Water Security, 2023) was used to identify threatened flora and fauna species, sites of conservation significance and sites of botanical significance recorded in the study area, and the broader region.

A query of the DEPWS NR Maps database returned two (2) Data Deficient (DD) plant species. There are no historical records for threatened flora species within the search area. Data Deficient species while not considered threatened species under the EPBC Act or TPWC Act, they are considered Significant Species under the TPWC Act. One (1) threatened fauna species, *Varanus mertensi* (Mertens' Water Monitor) and six (6) significant fauna species have been historically recorded within the study area.

### 3.2.5 SREBA

The Northern Territory Government Strategic Regional Environmental and Baseline Assessment (SREBA) data sets were analysed, identifying records of threatened flora and fauna species found during the targeted SREBA surveys. No SREBA records were found within the study area, however the SREBA surveys did identify species within the broader region, refer to Figure 8, Figure 9 and Figure 10.

**Table 3 Threatened & Significant species previously recorded in the project area**

| Class | Species Name | Common Name | EPBC Act Status | TPWC Act Status |
|---|---|---|---|---|
| Birds | *Ardeotis australis* | Australian bustard | - | NT |
| Birds | *Burhinus grallarius* | Bush Stone-curlew | - | NT |
| Birds | *Heteromunia pectoralis* | Pictorella Mannikin | - | NT |
| Birds | *Merops ornatus* | Rainbow bee-eater | Migratory (LM) | LC |

| Class | Species Name | Common Name | EPBC Act Status | TPWC Act Status |
|---|---|---|---|---|
| Birds | *Psephotellus dissimilis* | Hooded Parrot | - | NT |
| Mammal | *Lagorchestes conspicillatus* | Spectacled Hare-wallaby | - | NT |
| Reptiles | *Varanus mertensi* | Mertens' Water Monitor | - | VU |
| Plant | *Acrachne racemosa* | Acrachne | - | DD |
| Plant | *Sida sp. excedentifolia* | Sida | - | DD |

EPBC Act (species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Aust.): CE = Critically Endangered, E = Endangered, V = Vulnerable, LM = Listed Marine
TPWC Act (species listed under the *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act), NT): CE = Critically Endangered, E = Endangered, V = Vulnerable, NT=Near Threatened, DD = Data Deficient

**Table 4 Migratory species likely to occur within the project area (PMST)**

| Class | Species Name | Common Name | EPBC Act Status | TPWC Act Status |
|---|---|---|---|---|
| Birds | *Apus pacificus* | Fork-tailed Swift | MM, LM | |
| Birds | *Cecropis daurica* | Red-rumped Swallow | MT, LM | |
| Birds | *Cuculus optatus* | Oriental Cuckoo, Horsfield's Cuckoo | MT, LM | |
| Birds | *Glareola maldivarum* | Oriental Pratincole | MW, LM | |
| Birds | *Hirundo rustica* | Barn Swallow | MT, LM | |
| Birds | *Motacilla cinerea* | Grey Wagtail | MT, LM | |
| Birds | *Motacilla flava* | Yellow Wagtail | MT, LM | |

EPBC Act (species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Aust.): MM = Migratory Marine, MT = Migratory Terrestrial, MW = Migratory Wetlands, LM = Listed Marine, MI=Listed Migratory
TPWC Act (species listed under the *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act), NT): NT=Near Threatened

**Appendix B** provides a table of the species reported in search results with an assessment of their likelihood of occurrence within the seismic areas.

### 3.2.6 WEEDS AND PESTS

Details of the weeds occurring in relation to the proposed seismic are included in the Weed Management Plan (WMP) prepared by Fox & Co Environmental (Fox & Co Environmental, 2023).

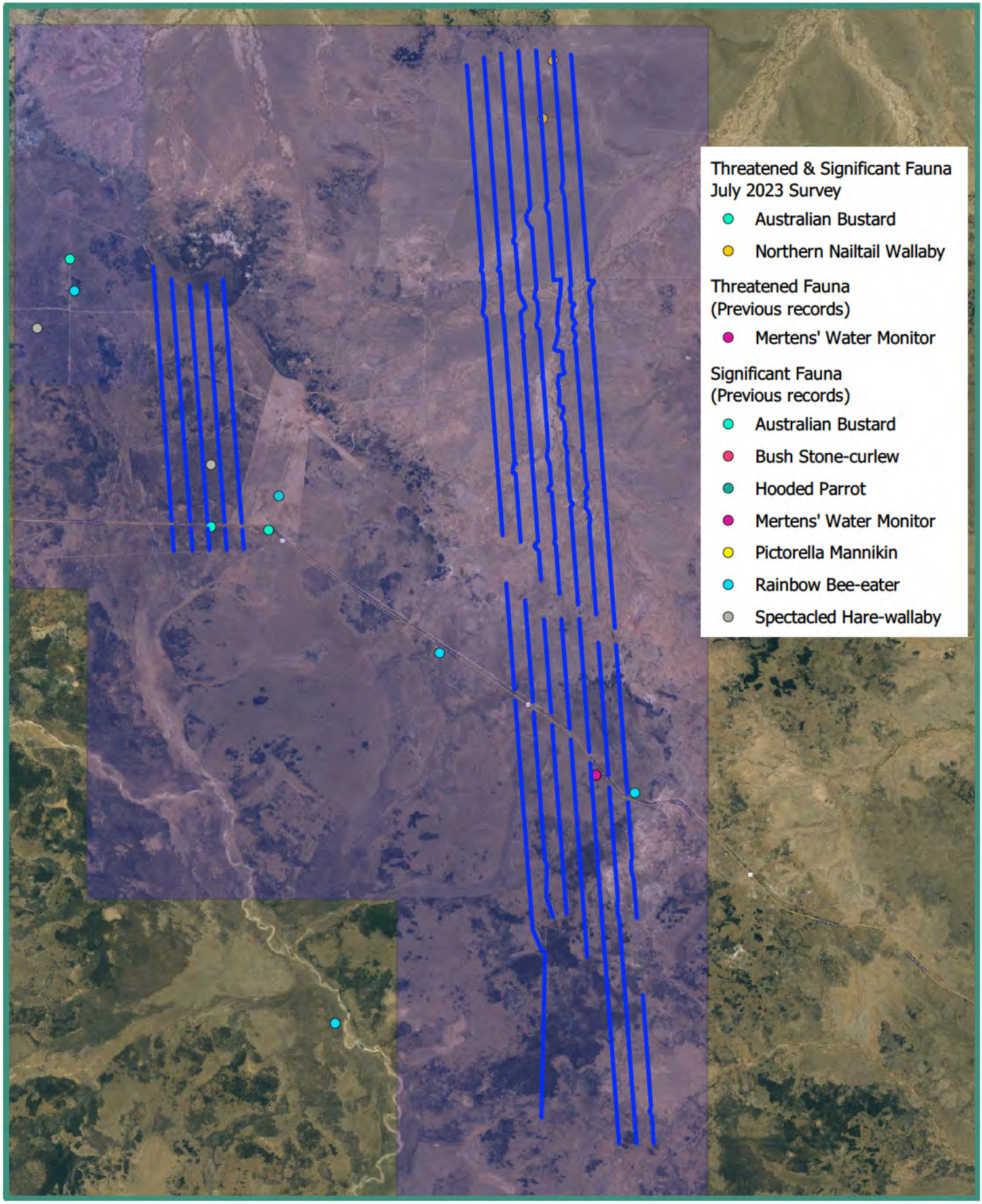
Table 5 provides the weeds reported in the study area during weed surveys undertaken in July 2023. The Carpentaria Highway and existing cattle operations represents the greatest threat for weed migration into the study area.

**Table 5 Weeds known to occur in the study area**

| Species | Common Name | WONS | NT Class |
|---|---|---|---|
| *Calotropis procera* | Rubber bush | - | B* |
| *Hyptis suaveolens* | Hyptis | - | B |
| *Sida acuta* | Spinyhead sida | - | B |

* only declared Class B: South of 16°30' S latitude

Cane Toads (*Bufo marinus*) and Pigs (*Sus scrofa*) were identified during the field surveys.




| | |
|---|---|
| TITLE | **Threatened & Significant Fauna** |
| MAP NO. | Figure 8 |
| PROJECT | EP161 Seismic |

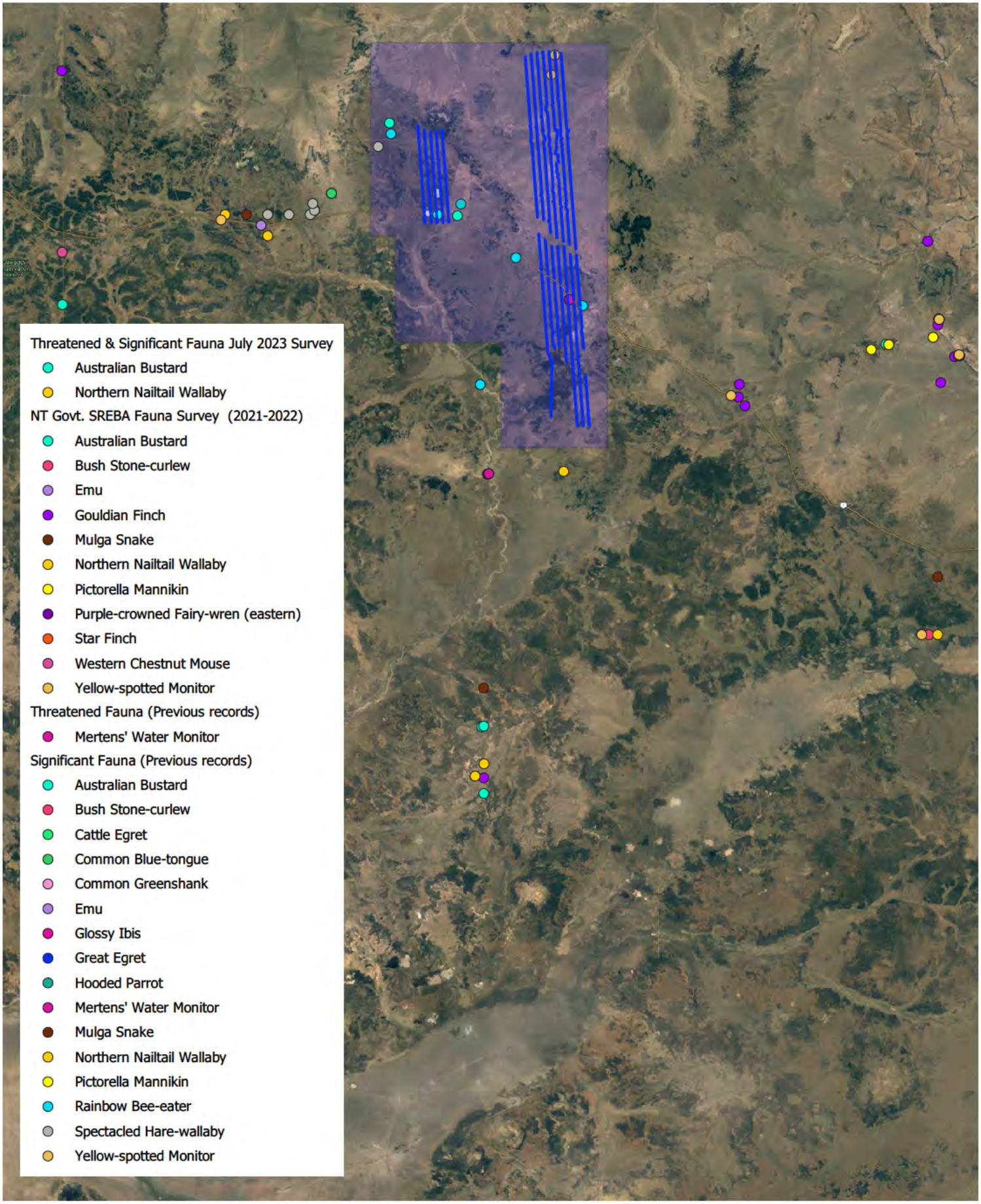
LEGEND

- Proposed Seismic Lines
- Study Area

0 2.5 5 7.5 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid Spatial Data: https://nrmaps.nt.gov.au/nrmaps.html




TITLE **Threatened & Significant Fauna (Regional Scale)**

MAP NO. Figure 9

PROJECT EP161 Seismic

LEGEND

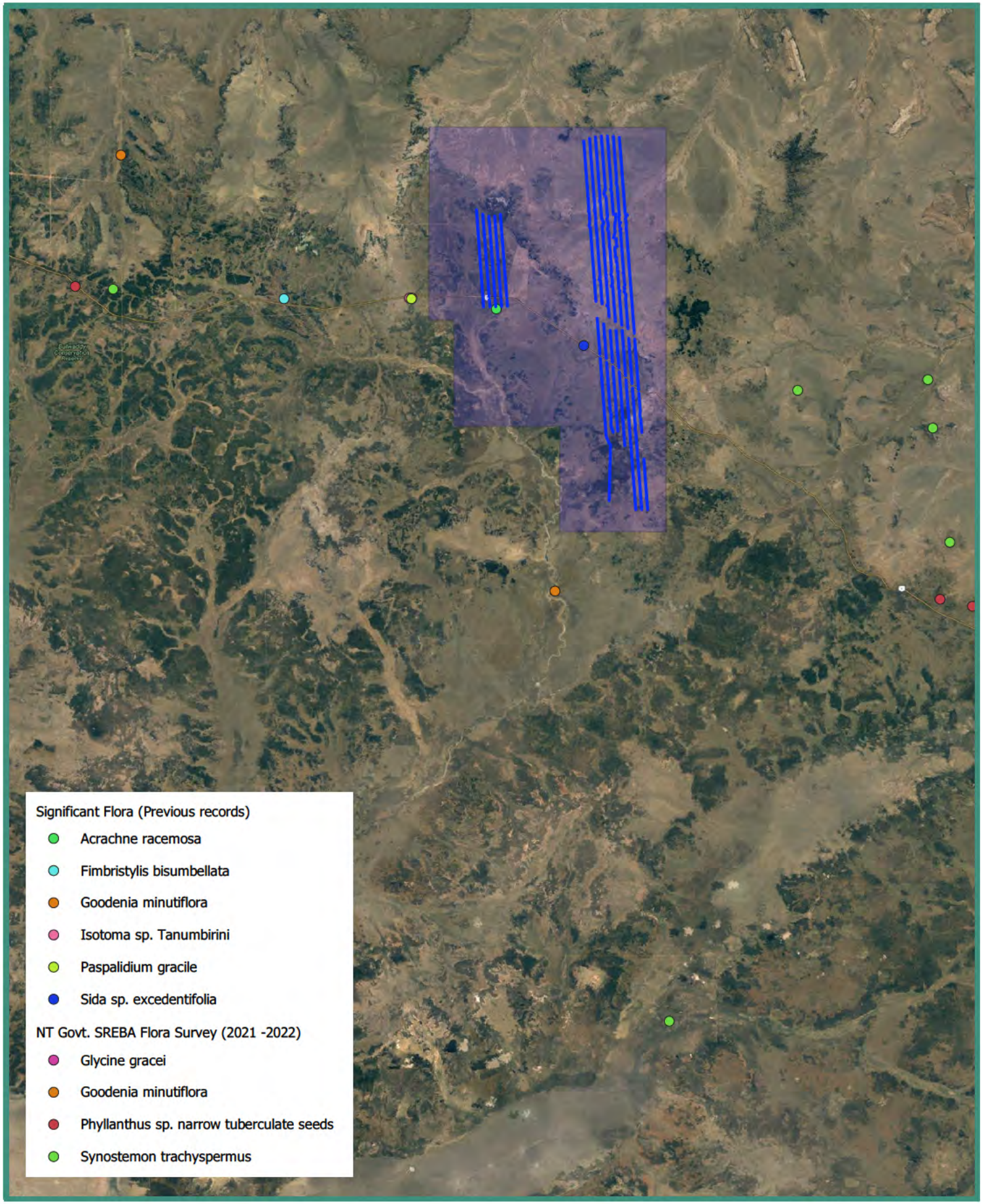
Proposed Seismic Lines

Study Area

0 7.5 15 22.5 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid Spatial Data: https://srebadata.nt.gov.au/datatype/NTG-SPA & https://nrmaps.nt.gov.au/nrmaps.html




TITLE **Significant Flora**

MAP NO. Figure 10

PROJECT EP161 Seismic

LEGEND

Proposed Seismic Lines

Study Area

0 7.5 15 22.5 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid Spatial Data: https://srebadata.nt.gov.au/datatype/NTG-SPA https://nrmaps.nt.gov.au/nrmaps.html

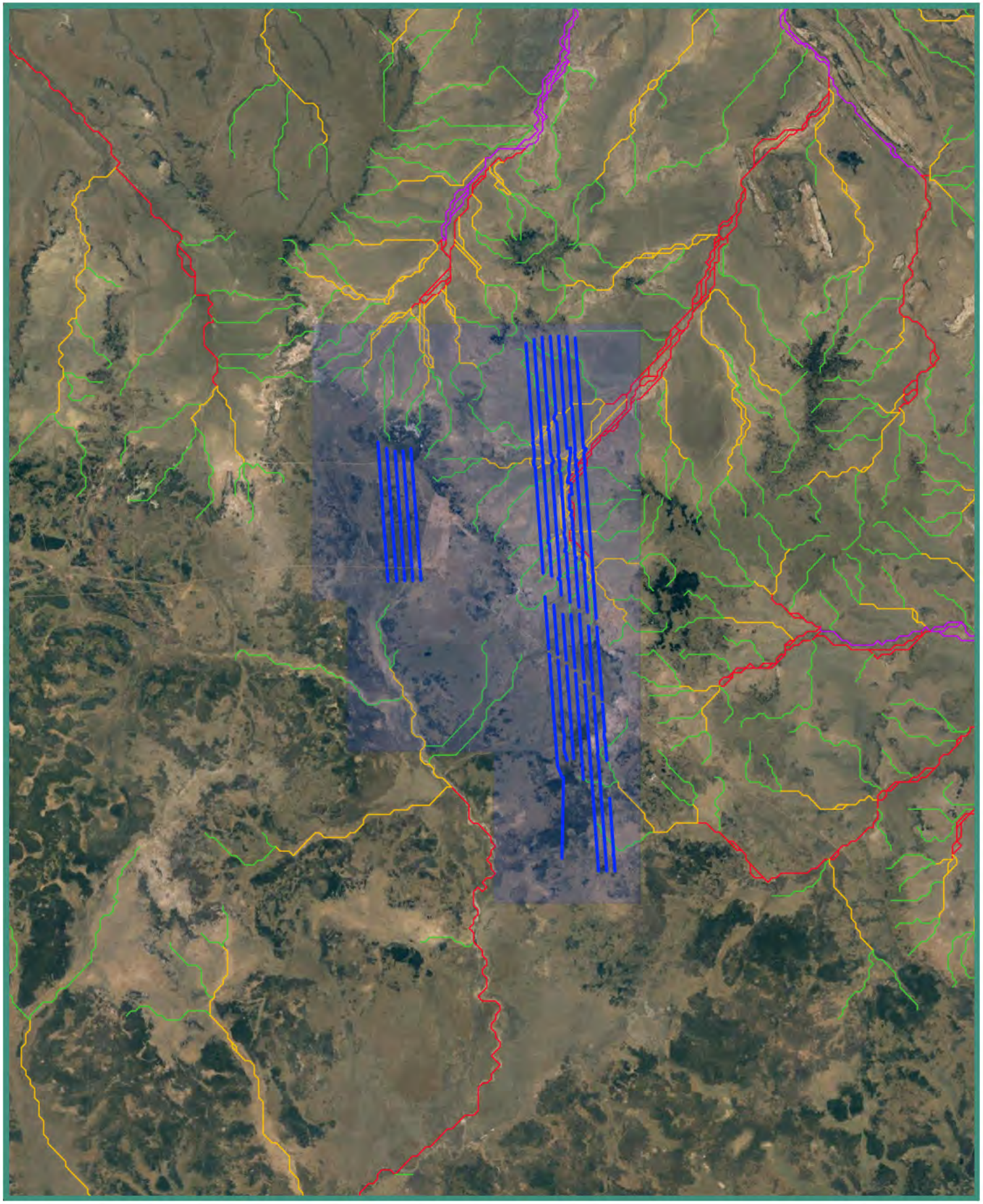
# 4 FIELD ASSESSMENT RESULTS

## 4.1 THREATENED SPECIES

No threatened flora or fauna species were observed during the July 2023 baseline survey. Two near threatened (NT) fauna species were identified (Northern Nailtail Wallaby and Australian Bustard). These species are highly mobile and are unlikely to be impacted by proposed seismic activities.

## 4.2 WATERWAYS

There are several Stream Order 1 and 2 ephemeral waterways and one (1) Stream Order 3 (Buggy Creek) within the proposed exploration areas (refer Figure 11). Disturbance from cattle was observed on most waterways and drainage lines across the exploration areas. The stream order 2 and 3 (amber and red on Figure 11) waterways, often contains riparian vegetation, including *eucalypt camaldulensis* (river red gum) vegetation with hollows which will be avoided by adhering to the protocols and procedures detailed in the *Decision Tree for Mulching Mature Trees* (Figure 12) and the *Decision Tree for Riparian Areas* (Figure 13).



TITLE **Waterways**

MAP NO. Figure 11

PROJECT EP161 Seismic

LEGEND

Proposed Seismic Lines
Study Area

0 5 10 15 km

Water Drainage Stream Order
1
2
3
4

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid Spatial Data: https://srebadata.nt.gov.au/datatype/NTG-SPA

## 4.3 HABITAT DESCRIPTIONS

The following table describes the habitats that occur within the exploration areas, including adjacent areas. The areas of intact vegetation provide a range of habitats that may support a diversity of fauna species. Refer to Figure 7 for Habitat Description Photo Locations.

**Table 6 Habitat Descriptions**

| **Ephemeral Waterways and Riparian Vegetation** | |
|---|---|
| **Plate 1 Ephemeral waterway and riparian vegetation** | |
|  |  |
| Plate 1 Photo 1 Location 134.7169555,-16.390943 | Plate 1 Photo 2 Location 134.7169555,-16.390943 |
| Riparian areas often have significantly higher fauna diversity than surrounding areas. Whilst the riparian vegetation in the study area is predominantly sparse woodland (as per the above photo), habitat values include:<br>• Provides water (in wet season) and larger pools in the dry season. Supports flowering and seeding vegetation as well as prey (aquatic species, invertebrates and small vertebrates) for small mammals, birds and reptiles<br>• Riparian vegetation provides refuge, sheltered movement corridors for fauna<br>• Riparian vegetation includes sparse *E. camaldulensis* (river red gum) which have some hollows which are important for hollow-dependent animals (e.g. parrots, bats, finches (eg. Gouldian Finch))<br>• Drainage lines and waterways were impacted by cattle<br>• Potential habitat for Gouldian finch (*Erythrura gouldiae*) where eucalypt and paperbark woodlands, usually with a grassy understorey, occur in the vicinity<br>• Riparian *E. camaldulensis* vegetation along the Stream Order 2 and 3 waterways, is likely a Groundwater Dependent Ecosystem (GDE), which is typical in highly monsoonal environments with prolonged dry seasons. These will not be impacted as the exploration will adhere to the | |

protocols and procedures detailed in the Decision Tree for Mulching Mature Trees (Figure 12) and the Decision Tree for Riparian Areas (Figure 13).

## Bullwaddy and Lancewood Thickets

**Plate 2 Bullwaddy and Lancewood thickets**



Plate 2 Photo 1 Location 134.7314592,-16.56127361



Plate 2 Photo 2 Location 134.6211507,-16.405975

Bullwaddy (*Macropteranthes kekwickii*) and lancewood (*Acacia shirleyi*) provide the thickest vegetation cover in the landscape and therefore provides:

- Shade and refuge for a variety of fauna species
- Fallen branches provide ground cover and refugia for small mammals and reptiles

## Woodlands

**Plate 3 Eucalypt and Corymbia woodlands**




Plate 3 Photo 1 Location 134.7221692,-16.63905739



Plate 3 Photo 2 Location 134.7132057,-16.52199461

Woodland or shrubland habitat values include:

- Woodland trees and shrubs provide food for sap and nectar eaters and supports prey (invertebrates and small vertebrates) for small mammals, birds and reptiles
- Provide shelter and protected areas for breeding for a variety of fauna, including live vegetation and fallen woody debris
- Woodlands with hollow bearing trees are of critical importance for hollow-dependent animals (e.g. parrots, bats)
- Potential habitat for spectacled hare-wallaby (*Lagorchestes conspicillatus leichardti*) and yellow-spotted monitor (*Varanus panoptes*). Dry *Eucalyptus* and *Acacia* in open forests, open woodland, tall shrublands, tussock grasslands and hummock grasslands.
- Large termitaria provide nesting habitat for some goanna and bird species.

## Rocky Ridges and Scarps

**Plate 2 Rocky ridges and scarps**



Plate 4 Photo 1 Location 134.7265297,-16.51346831



Plate 4 Photo 2 Location -16.5007, 134.7015

Rocky ridges and scarps provide:

- Rocky crevices and ridges provides refuge for reptiles, amphibians and mammals
- Often associated with *Eucalyptus leuocophloia* (snappy gum) which provides abundant hollows and nesting / breeding habitat for small bird, microbat and reptile species.

# 5 CONCLUSION

The ecological assessment was carried out to identify weeds (refer Weed Management Plan, August 2023), key ecological characteristics such as habitat for significant and threatened species, and potential constraints to the proposed seismic activities on EP161 in the Northern Territory.

A large network of braided waterways is present in the northeastern portion of the proposed seismic area, particularly Lines 9 – 12. Decision tree protocols for vegetation and habitat associated with these waterways have been prepared (Figures 12 and 13) and will be implemented to manage and mitigate impacts to these areas.

Weed infestations were recorded and mapped. This informed the preparation of a project specific Weed Management Plan (WMP, 2023). The two (2) main weed species recorded were Hyptis (*Hyptis suaveolens*) and Spinyhead Sida (*Sida acuta*). These weeds were associated with existing infrastructure (e.g., access tracks, fence lines), areas of high cattle disturbance such as water points and also some drainage lines / waterways.

No threatened fauna or flora species were observed within EP161 during the July 2023 baseline survey. Two near threatened (NT) fauna species were identified (Northern Nailtail Wallaby and Australian Bustard). These species are highly mobile and are unlikely to be impacted by proposed seismic activities.

Habitat exists for some conservation significant species in the area, however given the narrow linear nature of disturbance, habitat requirements and likelihood of occurrence, impacts from proposed seismic operations are considered low.

The seismic and connection lines have been selected based on third-party desktop surveys as well as civil, ecological, archaeological, and field surveys.

85% of the seismic corridor is highly traversable and therefore will not require mulching (based on SREBA vegetation dataset and field-verification).

# 6 RECOMMENDATIONS

The following is recommended to ensure compliance with regulatory provisions:

- Undertake post-exploration rehabilitation surveys.
- Waterways will be crossed at right angles and at existing cleared locations identified during pre-clearance field-surveys.
- Undertake works in accordance with approved clearing permits and environmental management plans.
- A corridor is established that allows navigation around critical habitats.
- Additional ground truthing and pre-clearance surveys will occur along the seismic and connection line routes to identify significant trees and riparian vegetation. All significant trees will be marked and GPS files provided.
- A decision tree for mulching mature trees with hollows is established prior to commencing (refer below).
- A decision tree for riparian areas is implemented and clearly communicated prior to works commencing (refer below).

**Figure 12 Decision tree for mulching mature trees**

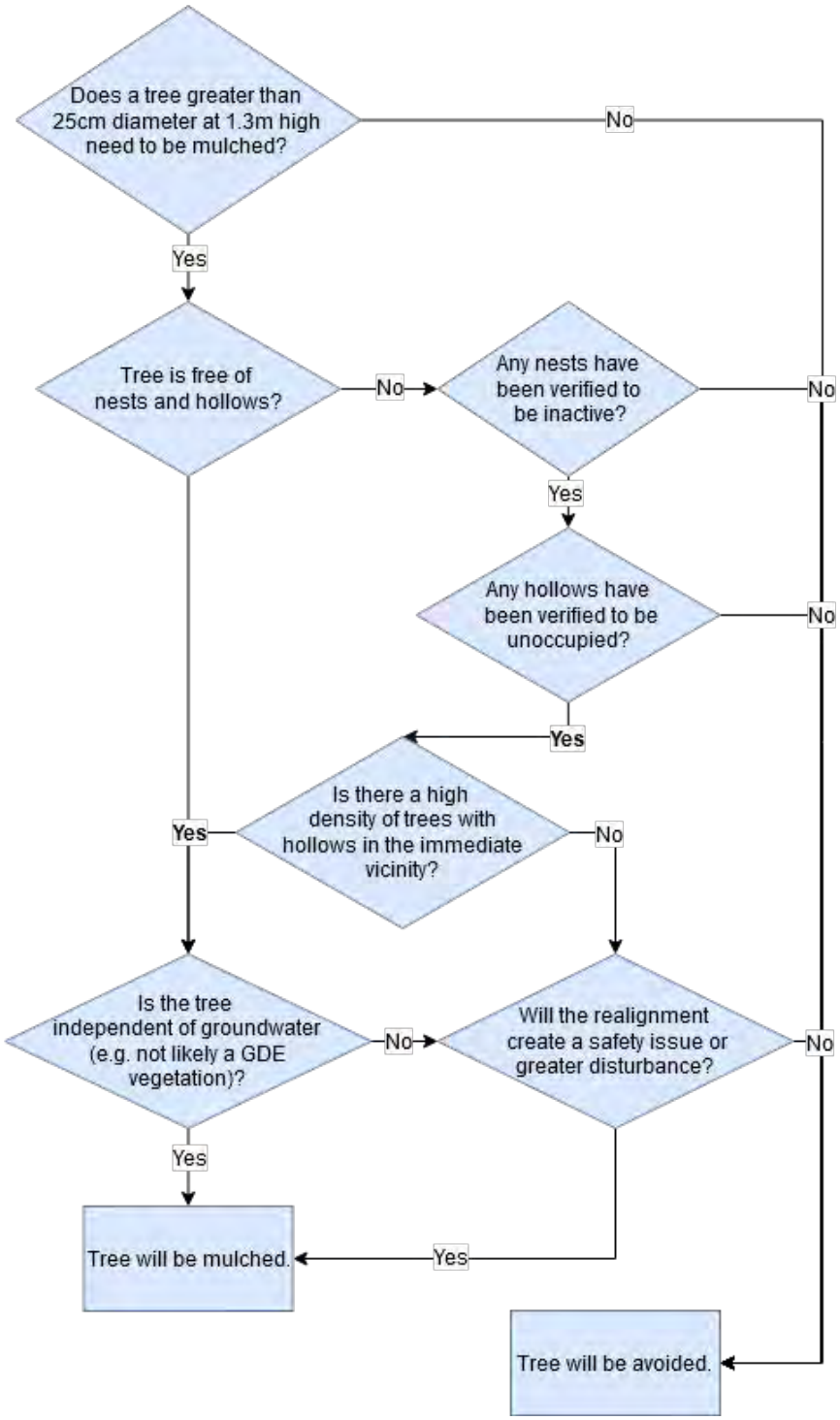
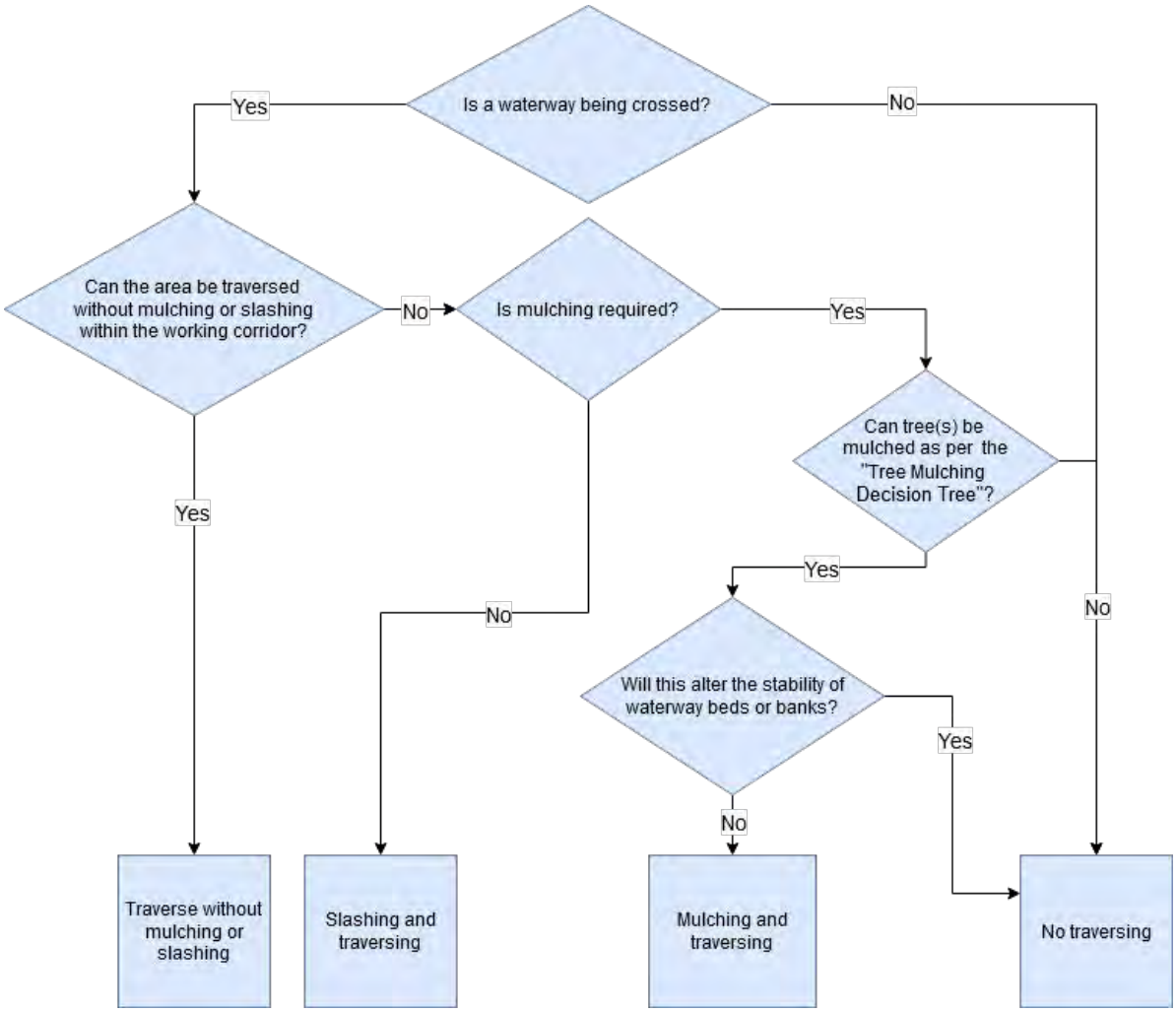


**Figure 13 Decision tree for riparian areas**



# 7 WORKS CITED AND RELEVANT REFERENCE DOCUMENTS


Atlas of Living Australia. (2023, Aug 9). *Fimbristylis bisumbellata (Forssk.) Bubani*. Retrieved from Atlas of Living Australia: https://bie.ala.org.au/species/https://id.biodiversity.org.au/node/apni/2903907

Atlas of Living Australia. (2023, Aug 9). *Goodenia minutiflora F.Muell.* Retrieved from Atlas of Living Australia: https://bie.ala.org.au/species/https://id.biodiversity.org.au/node/apni/7390279

Atlas of Living Australia. (2023, July 25). *Lagorchestes conspicillatus Gould, 1842*. Retrieved from Atlas of Living Australia: https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/da0043ca-6e2c-433d-97d3-dae59bc24cdc#:~:text=Lagorchestes%20conspicillatus%20%3A%20Spectacled%20Hare%2DWallaby%20%7C%20Atlas%20of%20Living%20Australia

Atlas of Living Australia. (2023, Aug 9). *Lepturus xerophilus Domin*. Retrieved from Atlas of Living Australia: https://bie.ala.org.au/species/https://id.biodiversity.org.au/node/apni/2900815

Atlas of Living Australia. (2023, Aug 9). *Pandanus spiralis R.Br.* Retrieved from Atlas of LIving Australia: https://bie.ala.org.au/species/https://id.biodiversity.org.au/node/apni/7730426

Atlas of Living Australia. (2023, Aug 9). *Panicum latzii R.D.Webster*. Retrieved from Atlas of Living Australia: https://bie.ala.org.au/species/https://id.biodiversity.org.au/node/apni/2910570

Atlas of Living Australia. (2023, Aug 9). *Paspalidium gracile (R.Br.) Hughes*. Retrieved from Atlas of Living Australia: https://bie.ala.org.au/species/https://id.biodiversity.org.au/node/apni/2907256

Atlas of Living Australia. (2023, Aug 9). *Sida sp. Excedentifolia (J.L.Egan 1925) WA Herbarium*. Retrieved from Atlas of Living Australia: https://bie.ala.org.au/species/https://id.biodiversity.org.au/node/apni/2917435

Atlas of Living Australia. (2023, Aug 4). *Tiliqua scincoides (White, 1790)*. Retrieved from Atlas of Living Australia: https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/78d80a58-c9ee-42d4-a0e1-c43bcccf9d56

AusGrass. (2023, Aug 9). *Yakirra muelleri*. Retrieved from AusGrass: https://keys.lucidcentral.org/keys/v3/AusGrass/key/AusGrass/Media/Html/YAKIRRA/YACMUE.HTML

AusGrass2. (2023, July 16). *Acrachne racemosa*. Retrieved from https://ausgrass2.myspecies.info/content/acrachne-racemosa

Australian Museum. (2023, Aug 4). *Eastern Blue-tongue Lizard*. Retrieved from Australian Museum: https://australian.museum/learn/animals/reptiles/eastern-blue-tongue-lizard/

Australian Museum. (2023, July 25). *Emu*. Retrieved from Australian Museum: https://australian.museum/learn/animals/birds/emu/

Australian Museum. (2023, Aug 4). *Mulga Snake*. Retrieved from Australian Museaum: https://australian.museum/learn/animals/reptiles/mulga-snake/

Bamford, M., Watkins, D., Bancroft, W., Tischler, G., & Wahl, J. (2008). *MIGRATORY SHOREBIRDS OF THE EAST ASIAN - AUSTRALASIAN FLYWAY: Population Estimates and Internationally Important Sites.* Canberra, Australia: Wetlands International - Oceania.

Birdlife. (2020). *Bird-profile/black-eared-cuckoo*. Retrieved October 13, 2020, from https://birdlife.org.au/bird-profile/black-eared-cuckoo

Birdlife. (2023, July 25). *Australian Bustard*. Retrieved from Birdlife Australia: https://birdlife.org.au/bird-profiles/australian-bustard/

Birdlife. (2023, July 25). *Bush Stone-curlew*. Retrieved from Birdlife Australia: https://birdlife.org.au/bird-profiles/bush-stone-curlew/

Birdlife Australia. (2021, March 26). *Painted Honeyeater*. Retrieved from Birdlife Australia: https://birdlife.org.au/bird-profile/painted-honeyeater

Cogger, H. G. (2014). *Reptiles & amphibians of Australia .* Collingwood: CSIRO Publishing.

Department of Agriculture, Water and the Environment. (2021). *Conservation Advice Trichosurus vulpecula arnhemensis Northern Brushtail Possum.* Retrieved from Threatened Species Scientific Committee : https://www.environment.gov.au/biodiversity/threatened/species/pubs/83091-conservation-advice-11052021.pdf

Department of the Environment . (2020). *Apus pacificus in Species Profile and Threats Database*. Retrieved October 13, 2020, from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=678

Department of the Environment . (2020). *Calidris acuminata in Species Profile and Threats Database*. Retrieved July 28, 2020, from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=874

Department of the Environment . (2020). *Calidris melanotos in Species Profile and Threats Database*. Retrieved July 29, 2020, from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=858

Department of the Environment . (2021, 26 March). *Falcunculus frontatus whitei in Species Profile and Threats Database*. Retrieved from Department of the Environment SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26013

Department of the Environment . (2021, March 26). *Macrotis lagotis in Species Profile and Threats Database*. Retrieved from Department of the Environment SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=282

Department of the Environment . (2023, Aug 10). *Charadrius veredus in Species Profile and Threats Database*. Retrieved from Department of the Environment : http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=882

Department of the Environment . (2023, Aug 10). *Glareola maldivarum in Species Profile and Threats Database*. Retrieved from Department of the Environment : http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=840

Department of the Environment . (2023, Aug 10). *Hirundo rustica in Species Profile and Threats Database*. Retrieved from Department of the Environment : https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=662

Department of the Environment . (2023, July 25). *Rostratula australis in Species Profile and Threats Database*. Retrieved from Department of the Environment : http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=77037

Department of the Environment. (2014). *Thesium australe*. Retrieved June 18, 2014, from Species Profile and Threats Database: http://www.environment.gov.au/sprat

Department of the Environment. (2015). *Appendix A: Supporting information for each of the 14 migratory listed birds*. Retrieved October 13, 2020, from

http://www.environment.gov.au/system/files/resources/c05f5b87-0a99-4998-897e-7072c236cf83/files/appendixa-migratory-birds.pdf

Department of the Environment. (2015). *Appendix A: Supporting information for each of the 14 migratory listed birds.* Retrieved from Draft referral guideline for 14 birds listed as migratory species under the EPBC Act: https://www.dcceew.gov.au/sites/default/files/documents/appendixa-migratory-birds.pdf

Department of the Environment. (2015). *Draft Referral guideline for 14 birds listed as migratory species under the EPBC Act*. Retrieved October 13, 2020, from http://www.environment.gov.au/system/files/resources/c05f5b87-0a99-4998-897e-7072c236cf83/files/migratory-birds-draft-referral-guideline.pdf

Department of the Environment. (2020). *Actitis hypoleucos in Species Profile and Threats Database*. Retrieved Jul 28, 2020, from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59309

Department of the Environment. (2020). *Ardea ibis in Species Profile and Threats Database*. Retrieved July 31, 2020, from https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=59542

Department of the Environment. (2020). *Ardea modesta in Species Profile and Threats Database*. Retrieved July 31, 2020, from https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82410

Department of the Environment. (2020). *Gallinago hardwickii in Species Profile and Threats Database*. Retrieved July 29, 2020, from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=863

Department of the Environment. (2020). *Haliaeetus leucogaster in Species Profile and Threats Database*. Retrieved July 31, 2020, from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?showprofile=Y&taxon_id=943

Department of the Environment. (2020). *Hirundapus caudacutus in Species Profile and Threats Database*. Retrieved October 13, 2020, from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=682

Department of the Environment. (2020). *Rostratula australis in Species Profile and Threats Database*. Retrieved Oct 13, 2020, from http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=77037

Department of the Environment. (2021, March 26). *Erythrotriorchis radiatus in Species Profile and Threats Database*. Retrieved from Department of the Environment SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=942

Department of the Environment. (2021, March 26). *Erythrura gouldiae in Species Profile and Threats Database*. Retrieved from Department of Environment SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=413

Department of the Environment. (2021, March 26). *Macroderma gigas in Species Profile and Threats Database,*. Retrieved from Department of the Environment SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/spratlookupspecies.pl?name=Macroderma+gigas&searchtype=Wildcard

Department of the Environment. (2021, March 26). *Mesembriomys macrurus in Species Profile and Threats Database*. Retrieved from Department of the Environment SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=119

Department of the Environment. (2021, March 26). *Saccolaimus saccolaimus nudicluniatus in Species Profile and Threats Database*. Retrieved from Department of the Environment SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66889

Department of the Environment. (2021, March 26). *Tyto novaehollandiae kimberli in Species Profile and Threats Database*. Retrieved from Department of the Environment SPRAT: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=26048

Department of the Environment. (2023, July 25). *Calidris ferruginea in Species Profile and Threats Database*. Retrieved from Department of the Environment: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=856

Department of the Environment. (2023, July 25). *Dasyurus hallucatus in Species Profile and Threats Database*. Retrieved from Department of the Environment: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=331

Department of the Environment. (2023, Aug 4). *Elseya lavarackorum in Species Profile and Threats Database*. Retrieved from Species Profile and Threats Database: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=67197

Department of the Environment. (2023, Aug 4). *Pristis pristis in Species Profile and Threats Database,*. Retrieved from Department of the Environment: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=66182

DoE. (2013, Nov 15). *Samadera bidwillii SPRAT profile*. Retrieved Nov 15, 2013, from Department of Environment: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=29708

eBird. (2023, July 25). *Pictorella Mannikin*. Retrieved from eBird: https://ebird.org/species/picmun1?siteLanguage=en_AU#:~:text=Identification&text=Small%2C%20grayish%2Dbrown%20bird%20with,wanders%20far%20from%20core%20range

Fox & Co Environmental. (2023). *Weed Management Plan IN-02.* Fox & Co.

Higgins, P. J. (1999). *Handbook of Australian, New Zealand and Antarctic Birds Volume 4: Parrots to Dollarbird.* Melbourne: Oxford University Press.

Higgins, P. J., & Davies, S. J. (1996). *Handbook of Australian, New Zealand & Antarctic Birds.* Oxford University Press.

Ingleby, S., & Westoby, M. (1992). Habitat requirements of the spectacled hare-wallaby (Lagorchestes conspicillatus) in the Northern Territory and Western Australia. *Wildlife Research* , 19(6) 721 - 741.

Morcombe, M. (2004). *Field Guide to Australian Birds* (2 ed.). Pascal Press.

Morcombe, M. (2004). *Steve Parish Field Guide: Australian Birds.* Steve Parish.

National Herbarium of NSW. (2023, Aug 9). *Genus Isotoma*. Retrieved from New South Wales Flora Online: https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&showsyn=&dist=&constat=&lvl=gn&name=Isotoma

NESP Threatened Species Recovery Hub. (2021). *Arid Zone Monitoring Species Profile Northern nailtail wallaby.* Retrieved from Threatened Species Recovery Hub: https://www.nespthreatenedspecies.edu.au/media/vjjbvnzc/azm_species-profile_northern-nailtail-wallaby_v1.pdf

New South Wales Flora Online. (2023, July 16). *Centipeda nidiformis N.G.Walsh*. Retrieved from NSW Flora Online: https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Centipeda~nidiformis#:~:text=Distribution%20and%20occurrence%3A%20Most%20common%20in%20northern%20Australia,areas%20of%20reliable%20rainfall%2C%20but%20relatively%20warm%20climate.

New South Wales Flora Online. (2023, July 16). *Fimbristylis bisumbellata (Forssk.) Bubani*. Retrieved from NSW Flora Online: https://plantnet.rbgsyd.nsw.gov.au/cgi-bin/NSWfl.pl?page=nswfl&lvl=sp&name=Fimbristylis~bisumbellata

Northern Territory Government. (2012). *Grey falcon.* Retrieved from Threatened Species of the Northern Territory: https://nt.gov.au/__data/assets/pdf_file/0020/206354/grey-falcon.pdf

Northern Territory Government. (2013). *Goodenia minutiflora F.Muell.* Retrieved from Flora NT Northern Territory Flora Online: http://eflora.nt.gov.au/factsheet?id=24281

NT Department of Environment, Parks and Water Security. (2021, Nov). *Threatened species of the Northern Territory Bare-rumped sheath-tailed bat.* Retrieved from Threatened species of the Northern Territory: https://nt.gov.au/__data/assets/pdf_file/0007/376117/bare-rumped-sheath-tailed-bat.pdf

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

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

NT Govt. Department of Environment, Parks and Water Security. (2023, Aug 9). *NR Maps*. Retrieved from NR Maps: https://nrmaps.nt.gov.au/nrmaps.html

Parks and Wildlife Commission of the Northern Territory. (2005). *Bullwaddy Conservation Reserve - Plan of Management.* Katherine .

Simpson, K., & Day, N. (2004). *Field Guide to the Birds of Australia.* Camberwell: Penguin.

Territory Native Plants. (2023, July 16). *Pandanus Spiralis (Screw Palm)*. Retrieved from https://www.territorynativeplants.com.au/pandanus-spiralis-screw-palm

# APPENDIX A

Search Results

# APPENDIX A

Search Results

# EPBC Act Protected Matters Report

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

Report created: 16-Jul-2023

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

# Summary

## Matters of National Environment Significance

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

| | |
|---|---|
| World Heritage Properties: | None |
| National Heritage Places: | None |
| Wetlands of International Importance (Ramsar | None |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | None |
| Listed Threatened Ecological Communities: | None |
| Listed Threatened Species: | 14 |
| Listed Migratory Species: | 14 |

## Other Matters Protected by the EPBC Act

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

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

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

| | |
|---|---|
| Commonwealth Lands: | None |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 19 |
| Whales and Other Cetaceans: | None |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | None |
| Habitat Critical to the Survival of Marine Turtles: | None |

## Extra Information

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

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

# Details

## Matters of National Environmental Significance

| Listed Threatened Species | | [ Resource Information ] |
|---|---|---|
| Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.<br>Number is the current name ID. | | |
| Scientific Name | Threatened Category | Presence Text |
| BIRD | | |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area |
| Erythrotriorchis radiatus<br>Red Goshawk [942] | Endangered | Species or species habitat may occur within area |
| Erythrura gouldiae<br>Gouldian Finch [413] | Endangered | Species or species habitat known to occur within area |
| Falco hypoleucos<br>Grey Falcon [929] | Vulnerable | Species or species habitat may occur within area |
| Falcunculus frontatus whitei<br>Crested Shrike-tit (northern), Northern Shrike-tit [26013] | Vulnerable | Species or species habitat likely to occur within area |
| Rostratula australis<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat may occur within area |
| Tyto novaehollandiae kimberli<br>Masked Owl (northern) [26048] | Vulnerable | Species or species habitat likely to occur within area |
| MAMMAL | | |
| Dasyurus hallucatus<br>Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331] | Endangered | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Macroderma gigas | | |
| Ghost Bat [174] | Vulnerable | Species or species habitat may occur within area |
| Macrotis lagotis | | |
| Greater Bilby [282] | Vulnerable | Species or species habitat may occur within area |
| Saccolaimus saccolaimus nudicluniatus | | |
| Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889] | Vulnerable | Species or species habitat may occur within area |
| Trichosurus vulpecula arnhemensis | | |
| Northern Brushtail Possum [83091] | Vulnerable | Species or species habitat may occur within area |
| REPTILE | | |
| Elseya lavarackorum | | |
| Gulf Snapping Turtle [67197] | Endangered | Species or species habitat may occur within area |
| SHARK | | |
| Pristis pristis | | |
| Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756] | Vulnerable | Species or species habitat may occur within area |

| Listed Migratory Species | | [ Resource Information ] |
|---|---|---|
| Scientific Name | Threatened Category | Presence Text |
| Migratory Marine Birds | | |
| Apus pacificus | | |
| Fork-tailed Swift [678] | | Species or species habitat likely to occur within area |
| Migratory Marine Species | | |
| Crocodylus porosus | | |
| Salt-water Crocodile, Estuarine Crocodile [1774] | | Species or species habitat likely to occur within area |
| Pristis pristis | | |
| Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756] | Vulnerable | Species or species habitat may occur within area |
| Migratory Terrestrial Species | | |
| Cecropis daurica | | |
| Red-rumped Swallow [80610] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Cuculus optatus](#)<br>Oriental Cuckoo, Horsfield's Cuckoo [86651] | | Species or species habitat may occur within area |
| [Hirundo rustica](#)<br>Barn Swallow [662] | | Species or species habitat may occur within area |
| [Motacilla cinerea](#)<br>Grey Wagtail [642] | | Species or species habitat may occur within area |
| [Motacilla flava](#)<br>Yellow Wagtail [644] | | Species or species habitat may occur within area |
| **Migratory Wetlands Species** | | |
| [Actitis hypoleucos](#)<br>Common Sandpiper [59309] | | Species or species habitat may occur within area |
| [Calidris acuminata](#)<br>Sharp-tailed Sandpiper [874] | | Species or species habitat may occur within area |
| [Calidris ferruginea](#)<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area |
| [Calidris melanotos](#)<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area |
| [Charadrius veredus](#)<br>Oriental Plover, Oriental Dotterel [882] | | Species or species habitat may occur within area |
| [Glareola maldivarum](#)<br>Oriental Pratincole [840] | | Species or species habitat may occur within area |

## Other Matters Protected by the EPBC Act

| Listed Marine Species | | [ Resource Information ] |
|---|---|---|
| Scientific Name | Threatened Category | Presence Text |
| Bird | | |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat may occur within area |
| Anseranas semipalmata<br>Magpie Goose [978] | | Species or species habitat may occur within area overfly marine area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area |
| Bubulcus ibis as Ardea ibis<br>Cattle Egret [66521] | | Species or species habitat may occur within area overfly marine area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | | Species or species habitat may occur within area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area overfly marine area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area overfly marine area |
| Cecropis daurica as Hirundo daurica<br>Red-rumped Swallow [80610] | | Species or species habitat may occur within area overfly marine area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Chalcites osculans as Chrysococcyx osculans | | |
| Black-eared Cuckoo [83425] | | Species or species habitat may occur within area overfly marine area |
| Charadrius veredus | | |
| Oriental Plover, Oriental Dotterel [882] | | Species or species habitat may occur within area overfly marine area |
| Glareola maldivarum | | |
| Oriental Pratincole [840] | | Species or species habitat may occur within area overfly marine area |
| Haliaeetus leucogaster | | |
| White-bellied Sea-Eagle [943] | | Species or species habitat likely to occur within area |
| Hirundo rustica | | |
| Barn Swallow [662] | | Species or species habitat may occur within area overfly marine area |
| Merops ornatus | | |
| Rainbow Bee-eater [670] | | Species or species habitat may occur within area overfly marine area |
| Motacilla cinerea | | |
| Grey Wagtail [642] | | Species or species habitat may occur within area overfly marine area |
| Motacilla flava | | |
| Yellow Wagtail [644] | | Species or species habitat may occur within area overfly marine area |
| Rostratula australis as Rostratula benghalensis (sensu lato) | | |
| Australian Painted Snipe [77037] | Endangered | Species or species habitat may occur within area overfly marine area |
| Reptile | | |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Crocodylus johnstoni<br>Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773] | | Species or species habitat may occur within area |
| Crocodylus porosus<br>Salt-water Crocodile, Estuarine Crocodile [1774] | | Species or species habitat likely to occur within area |

## Extra Information

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

| Geological and Bioregional Assessments | | |
|---|---|---|
| Name | State | Website |
| Beetaloo GBA region | NT | GBA website |

# Caveat

## 1 PURPOSE

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

The report contains the mapped locations of:

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

## 2 DISCLAIMER

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

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

## 3 DATA SOURCES

Threatened ecological communities

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

Threatened, migratory and marine species

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

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

## 4 LIMITATIONS

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

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

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

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

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

# Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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

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

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Fauna Survey SREBA

| ID | ORGANISA | ORIGINAL_ | LATITUDE | LONGITUD | COMMONNAME | SCIENTIFICNAME | QUANTITY | TPWCA | EPBCA |
|---|---|---|---|---|---|---|---|---|---|
| 6432016 | DEPWS - Fl | SREBA syst | -16.9359 | 134.654 | Australian Bustard | Ardeotis australis | 4 | NT | (not lis |
| 6428576 | DEPWS - Fl | SREBA syst | -16.9223 | 134.6472 | Australian Bustard | Ardeotis australis | 1 | NT | (not lis |
| 6428734 | DEPWS - Fl | SREBA syst | -16.8836 | 134.6523 | Australian Bustard | Ardeotis australis | 1 | NT | (not lis |
| 6432122 | DEPWS - Fl | SREBA syst | -16.8831 | 134.654 | Australian Bustard | Ardeotis australis | 12 | NT | (not lis |
| 6432282 | DEPWS - Fl | SREBA syst | -16.5916 | 134.2594 | Australian Bustard | Ardeotis australis | 1 | NT | (not lis |
| 6432343 | DEPWS - Fl | SREBA syst | -16.5837 | 134.9696 | Australian Bustard | Ardeotis australis | 1 | NT | (not lis |
| 6431852 | DEPWS - Fl | SREBA syst | -16.5698 | 134.2527 | Australian Bustard | Ardeotis australis | 1 | NT | (not lis |
| 6431597 | DEPWS - Fl | SREBA syst | -16.5525 | 134.3235 | Australian Bustard | Ardeotis australis | 1 | NT | (not lis |
| 6432250 | DEPWS - Fl | SREBA syst | -16.8114 | 135.003 | Bush Stone-curlew | Burhinus grallarius | 1 | NT | (not lis |
| 6432411 | DEPWS - Fl | SREBA syst | -16.6167 | 135.0521 | Bush Stone-curlew | Burhinus grallarius | 2 | NT | (not lis |
| 6432395 | DEPWS - Fl | SREBA syst | -16.6141 | 135.0503 | Bush Stone-curlew | Burhinus grallarius | 1 | NT | (not lis |
| 6432281 | DEPWS - Fl | SREBA syst | -16.4903 | 134.4793 | Emu | Dromaius novaehollandiae | 1 | NT | (not lis |
| 6427567 | DEPWS - Fl | SREBA syst | -16.517 | 134.2432 | Flock Bronzewing | Phaps histrionica | 20 | NT | (not lis |
| 6432013 | DEPWS - Fl | SREBA syst | -16.9238 | 134.654 | Gouldian Finch | Chloebia gouldiae | 3 | VU | EN |
| 6432322 | DEPWS - Fl | SREBA syst | -16.6319 | 134.8589 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6431116 | DEPWS - Fl | SREBA syst | -16.625 | 134.8537 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6432379 | DEPWS - Fl | SREBA syst | -16.6165 | 135.0537 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6431110 | DEPWS - Fl | SREBA syst | -16.6151 | 134.8545 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6432374 | DEPWS - Fl | SREBA syst | -16.6137 | 135.0124 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6431007 | DEPWS - Fl | SREBA syst | -16.5933 | 135.0232 | Gouldian Finch | Chloebia gouldiae | 3 | VU | EN |
| 6432352 | DEPWS - Fl | SREBA syst | -16.5926 | 135.0262 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6432351 | DEPWS - Fl | SREBA syst | -16.5926 | 135.0263 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6432353 | DEPWS - Fl | SREBA syst | -16.5926 | 135.0262 | Gouldian Finch | Chloebia gouldiae | 2 | VU | EN |
| 6432370 | DEPWS - Fl | SREBA syst | -16.5919 | 135.0267 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6432341 | DEPWS - Fl | SREBA syst | -16.584 | 134.9716 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6432215 | DEPWS - Fl | SREBA syst | -16.5782 | 135.0065 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6430320 | DEPWS - Fl | SREBA syst | -16.5684 | 135.0101 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6432235 | DEPWS - Fl | SREBA syst | -16.5641 | 135.0112 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6432214 | DEPWS - Fl | SREBA syst | -16.5638 | 135.0108 | Gouldian Finch | Chloebia gouldiae | 2 | VU | EN |
| 6432213 | DEPWS - Fl | SREBA syst | -16.5637 | 135.0109 | Gouldian Finch | Chloebia gouldiae | 2 | VU | EN |
| 6431052 | DEPWS - Fl | SREBA syst | -16.5029 | 135.0023 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6432340 | DEPWS - Fl | SREBA syst | -16.5028 | 135.0023 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6431897 | DEPWS - Fl | SREBA syst | -16.369 | 134.323 | Gouldian Finch | Chloebia gouldiae | 1 | VU | EN |
| 6432123 | DEPWS - Fl | SREBA syst | -16.8533 | 134.654 | Mulga Snake | Pseudechis australis | 1 | NT | (not lis |
| 6432244 | DEPWS - Fl | SREBA syst | -16.7661 | 135.01 | Mulga Snake | Pseudechis australis | 1 | NT | (not lis |
| 6432199 | DEPWS - Fl | SREBA syst | -17.0177 | 134.1359 | Northern Nailtail Wallaby | Onychogalea unguifera | 1 | NT | (not lis |
| 6432619 | DEPWS - Fl | SREBA syst | -16.9223 | 134.6472 | Northern Nailtail Wallaby | Onychogalea unguifera | 1 | NT | (not lis |
| 6432014 | DEPWS - Fl | SREBA syst | -16.9127 | 134.6542 | Northern Nailtail Wallaby | Onychogalea unguifera | 1 | NT | (not lis |
| 6432249 | DEPWS - Fl | SREBA syst | -16.8114 | 135.01 | Northern Nailtail Wallaby | Onychogalea unguifera | 1 | NT | (not lis |
| 6432350 | DEPWS - Fl | SREBA syst | -16.5926 | 135.0263 | Pictorella Mannikin | Heteromunia pectoralis | 1 | NT | (not lis |
| 6431143 | DEPWS - Fl | SREBA syst | -16.5878 | 134.9579 | Pictorella Mannikin | Heteromunia pectoralis | 30 | NT | (not lis |
| 6432349 | DEPWS - Fl | SREBA syst | -16.5839 | 134.9717 | Pictorella Mannikin | Heteromunia pectoralis | 2 | NT | (not lis |
| 6432217 | DEPWS - Fl | SREBA syst | -16.5781 | 135.0065 | Pictorella Mannikin | Heteromunia pectoralis | 1 | NT | (not lis |
| 6432233 | DEPWS - Fl | SREBA syst | -16.5641 | 135.0112 | Pictorella Mannikin | Heteromunia pectoralis | 1 | NT | (not lis |
| 6432398 | DEPWS - Fl | SREBA syst | -16.6147 | 135.0511 | Purple-crowned Fairy-wren (eastern) | Malurus coronatus macgillivrayi | 2 | NT | (not lis |
| 6432393 | DEPWS - Fl | SREBA syst | -16.6139 | 135.0502 | Purple-crowned Fairy-wren (eastern) | Malurus coronatus macgillivrayi | 1 | NT | (not lis |
| 6430957 | DEPWS - Fl | SREBA syst | -16.5927 | 135.0274 | Purple-crowned Fairy-wren (eastern) | Malurus coronatus macgillivrayi | 1 | NT | (not lis |
| 6432234 | DEPWS - Fl | SREBA syst | -16.5641 | 135.0112 | Star Finch | Neochmia ruficauda | 1 | NT | (not lis |
| 6431856 | DEPWS - Fl | SREBA syst | -16.5385 | 134.2465 | Star Finch | Neochmia ruficauda | 4 | NT | (not lis |
| 6432327 | DEPWS - Fl | SREBA syst | -16.4427 | 135.0749 | Tree Dtella | Gehyra variegata | 1 | NE | (not lis |
| 6432336 | DEPWS - Fl | SREBA syst | -16.4421 | 135.0759 | Tree Dtella | Gehyra variegata | 1 | NE | (not lis |
| 6433194 | DEPWS - Fl | SREBA syst | -16.55 | 134.2466 | Western Chestnut Mouse | Pseudomys nanus | 1 | NT | (not lis |
| 6432283 | DEPWS - Fl | SREBA syst | -16.5114 | 134.3233 | Western Chestnut Mouse | Pseudomys nanus | 1 | NT | (not lis |
| 6432242 | DEPWS - Fl | SREBA syst | -16.8114 | 134.9975 | Yellow-spotted Monitor | Varanus panoptes | 1 | VU | (not lis |
| 6432413 | DEPWS - Fl | SREBA syst | -16.6238 | 134.848 | Yellow-spotted Monitor | Varanus panoptes | 1 | VU | (not lis |
| 6432419 | DEPWS - Fl | SREBA syst | -16.5919 | 135.0268 | Yellow-spotted Monitor | Varanus panoptes | 1 | VU | (not lis |
| 6432239 | DEPWS - Fl | SREBA syst | -16.5641 | 135.0112 | Yellow-spotted Monitor | Varanus panoptes | 1 | VU | (not lis |

SREBA Flora Regional Scale

| DATE_ | SITE_CODE | LATITUDE | LONGITUD | FAMILY | GENUS | SPECIES | SCIENTIFIC | TPWCA | EPBCA | ENDEMIC |
|---|---|---|---|---|---|---|---|---|---|---|
| 10/06/2021 | SREBA:SREBA2021_AMU_A01 | -16.3691 | 134.3232 | FABACEAE | Glycine | gracei | Glycine gra | DD | | Yes |
| 4/04/2022 | SREBA:SREBA2022_BEE05 | -16.7114 | 134.664 | GOODENIA | Goodenia | minutiflora | Goodenia ı | DD | | No |
| 10/06/2021 | SREBA:SREBA2021_AMU_A01 | -16.3691 | 134.3232 | GOODENIA | Goodenia | minutiflora | Goodenia ı | DD | | No |
| 17/02/2022 | SREBA:SREBA2022_BEE13 | -16.7471 | 135.0023 | PHYLLANTI | Phyllanthus | sp. narrow tuberculate seeds | Phyllanthu | DD | | No |
| 18/02/2022 | SREBA:SREBA2022_BEE09 | -16.7379 | 135.0116 | PHYLLANTI | Phyllanthus | sp. narrow tuberculate seeds | Phyllanthu | DD | | No |
| 17/02/2022 | SREBA:SREBA2022_BEE16 | -16.7233 | 134.9918 | PHYLLANTI | Phyllanthus | sp. narrow tuberculate seeds | Phyllanthu | DD | | No |
| 16/02/2022 | SREBA:SREBA2022_BEE18 | -16.7178 | 134.9664 | PHYLLANTI | Phyllanthus | sp. narrow tuberculate seeds | Phyllanthu | DD | | No |
| 20/02/2022 | SREBA:SREBA2022_BUL06 | -16.4722 | 134.2873 | PHYLLANTI | Phyllanthus | sp. narrow tuberculate seeds | Phyllanthu | DD | | No |
| 5/04/2022 | SREBA:SREBA2022_MUN09 | -17.0491 | 134.7537 | PHYLLANTI | Synostemon | trachyspermus | Synostemc | DD | | No |
| 2/04/2022 | SREBA:SREBA2022_BEE02 | -16.8031 | 135.0086 | PHYLLANTI | Synostemon | trachyspermus | Synostemc | DD | | No |
| 2/04/2022 | SREBA:SREBA2022_BEE01 | -16.7572 | 135.0153 | PHYLLANTI | Synostemon | trachyspermus | Synostemc | DD | | No |
| 18/02/2022 | SREBA:SREBA2022_BEE10 | -16.7365 | 135.0183 | PHYLLANTI | Synostemon | trachyspermus | Synostemc | DD | | No |
| 9/03/2022 | SREBA:SREBA2022_BEE81 | -16.6731 | 134.974 | PHYLLANTI | Synostemon | trachyspermus | Synostemc | DD | | No |
| 11/03/2022 | SREBA:SREBA2022_BEE72 | -16.5834 | 134.9607 | PHYLLANTI | Synostemon | trachyspermus | Synostemc | DD | | No |
| 10/03/2022 | SREBA:SREBA2022_BEE65 | -16.5538 | 134.8546 | PHYLLANTI | Synostemon | trachyspermus | Synostemc | DD | | No |
| 11/03/2022 | SREBA:SREBA2022_BEE51 | -16.5454 | 134.9568 | PHYLLANTI | Synostemon | trachyspermus | Synostemc | DD | | No |
| 22/02/2022 | SREBA:SREBA2022_BUL13 | -16.4744 | 134.317 | PHYLLANTI | Synostemon | trachyspermus | Synostemc | DD | | No |

Birdlife birddata species list

| Common Name | Scientific Name | Count | Reporting | NT | EPBC |
|---|---|---|---|---|---|
| Collared Sparrowhawk | Accipiter cirrocephalus | 1 | 3.33% | | |
| Brown Goshawk | Accipiter fasciatus | 1 | 3.33% | | Marine |
| Brolga | Antigone rubicunda | 1 | 3.33% | | |
| Red-winged Parrot | Aprosmictus erythropterus | 3 | 10.00% | | |
| Wedge-tailed Eagle | Aquila audax | 3 | 10.00% | | |
| Australian Bustard | Ardeotis australis | 1 | 3.33% | NT | |
| Black-faced Woodswallow | Artamus cinereus | 3 | 10.00% | | |
| Little Woodswallow | Artamus minor | 1 | 3.33% | | |
| Masked Woodswallow | Artamus personatus | 1 | 3.33% | | |
| Bush Stone-curlew | Burhinus grallarius | 1 | 3.33% | NT | |
| Red-tailed Black-Cockatoo | Calyptorhynchus banksii | 3 | 10.00% | | |
| Horsfield's Bronze-Cuckoo | Chalcites basalis | 1 | 3.33% | | Marine |
| Rufous Songlark | Cincloramphus mathewsi | 2 | 6.67% | | |
| Spotted Harrier | Circus assimilis | 1 | 3.33% | | |
| Black-tailed Treecreeper | Climacteris melanurus | 2 | 6.67% | | |
| Grey Shrike-thrush | Colluricincla harmonica | 2 | 6.67% | | |
| Rufous-throated Honeyeater | Conopophila rufogularis | 3 | 10.00% | | |
| Black-faced Cuckoo-shrike | Coracina novaehollandiae | 3 | 10.00% | | Marine |
| White-bellied Cuckoo-shrike | Coracina papuensis | 1 | 3.33% | | Marine |
| Torresian Crow | Corvus orru | 5 | 16.67% | | |
| Pied Butcherbird | Cracticus nigrogularis | 4 | 13.33% | | |
| Varied Sittella | Daphoenositta chrysoptera | 2 | 6.67% | | |
| Mistletoebird | Dicaeum hirundinaceum | 1 | 3.33% | | |
| Galah | Eolophus roseicapilla | 2 | 6.67% | | |
| Brown Falcon | Falco berigora | 3 | 10.00% | | |
| Nankeen Kestrel | Falco cenchroides | 1 | 3.33% | | Marine |
| Australian Hobby | Falco longipennis | 1 | 3.33% | | |
| Singing Honeyeater | Gavicalis virescens | 2 | 6.67% | | |
| Diamond Dove | Geopelia cuneata | 7 | 23.33% | | |
| Bar-shouldered Dove | Geopelia humeralis | 2 | 6.67% | | |
| Peaceful Dove | Geopelia placida | 10 | 33.33% | | |
| White-throated Gerygone | Gerygone olivacea | 1 | 3.33% | | |
| Magpie-lark | Grallina cyanoleuca | 2 | 6.67% | | Marine |
| Australian Magpie | Gymnorhina tibicen | 3 | 10.00% | | |
| Whistling Kite | Haliastur sphenurus | 4 | 13.33% | | Marine |
| White-winged Triller | Lalage tricolor | 3 | 10.00% | | |
| Brown Honeyeater | Lichmera indistincta | 3 | 10.00% | | |
| Variegated Fairy-wren | Malurus lamberti | 3 | 10.00% | | |
| Red-backed Fairy-wren | Malurus melanocephalus | 6 | 20.00% | | |
| Yellow-throated Miner | Manorina flavigula | 2 | 6.67% | | |
| White-throated Honeyeater | Melithreptus albogularis | 3 | 10.00% | | |
| Budgerigar | Melopsittacus undulatus | 2 | 6.67% | | |
| Rainbow Bee-eater | Merops ornatus | 2 | 6.67% | | Migratory |
| Jacky Winter | Microeca fascinans | 4 | 13.33% | | |
| Black Kite | Milvus migrans | 4 | 13.33% | | |
| Restless Flycatcher | Myiagra inquieta | 4 | 13.33% | | |
| Leaden Flycatcher | Myiagra rubecula | 2 | 6.67% | | |
| Cockatiel | Nymphicus hollandicus | 1 | 3.33% | | |
| Crested Pigeon | Ocyphaps lophotes | 3 | 10.00% | | |

Birdlife birddata species list

| Common Name | Scientific Name | Count | Reporting | NT | EPBC |
|---|---|---|---|---|---|
| Crested Bellbird | Oreoica gutturalis | 1 | 3.33% | | |
| Olive-backed Oriole | Oriolus sagittatus | 1 | 3.33% | | |
| Rufous Whistler | Pachycephala rufiventris | 5 | 16.67% | | |
| Striated Pardalote | Pardalotus striatus | 5 | 16.67% | | |
| Little Friarbird | Philemon citreogularis | 3 | 10.00% | | |
| Tawny Frogmouth | Podargus strigoides | 1 | 3.33% | | |
| Long-tailed Finch | Poephila acuticauda | 3 | 10.00% | | |
| Masked Finch | Poephila personata | 1 | 3.33% | | |
| Grey-crowned Babbler | Pomatostomus temporalis | 4 | 13.33% | | |
| Varied Lorikeet | Psitteuteles versicolor | 1 | 3.33% | | |
| Great Bowerbird | Ptilonorhynchus nuchalis | 1 | 3.33% | | |
| Grey-headed Honeyeater | Ptilotula keartlandi | 1 | 3.33% | | |
| Grey-fronted Honeyeater | Ptilotula plumula | 1 | 3.33% | | |
| Willie Wagtail | Rhipidura leucophrys | 13 | 43.33% | | |
| Weebill | Smicrornis brevirostris | 2 | 6.67% | | |
| Apostlebird | Struthidea cinerea | 4 | 13.33% | | |
| Brown Quail | Synoicus ypsilophora | 2 | 6.67% | | |
| Double-barred Finch | Taeniopygia bichenovii | 4 | 13.33% | | |
| Zebra Finch | Taeniopygia guttata | 3 | 10.00% | | |
| Red-backed Kingfisher | Todiramphus pyrrhopygius | 2 | 6.67% | | |

Significant Fauna- NT MAPS

| Id | Scientific Name | Common Name | Latitude | Longitude | TWPCATW | EPBCA | EPBCA Mig | Threa | Sign | Intr | Introduced | Sensitive St |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10777306 | Ardeotis australis | Australian Bustard | -16.4828 | 134.6333 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 8362 | Ardeotis australis | Australian Bustard | -16.4819 | 134.4845 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 8383 | Ardeotis australis | Australian Bustard | -16.4819 | 134.6179 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 8377 | Ardeotis australis | Australian Bustard | -16.4186 | 134.5812 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 10778589 | Ardeotis australis | Australian Bustard | -16.41 | 134.58 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 313758 | Burhinus grallarius | Bush Stone-curlew | -16.5486 | 134.7212 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 8806299 | Bubulcus ibis | Cattle Egret | -16.6855 | 134.6571 | LC | (not listed) | 1 | 0 | 1 | 1 | Native to the N.T. | |
| 276503 | Tiliqua scincoides | Common Blue-tongue | -16.4652 | 134.5345 | DD | Pos (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 152737 | Tiliqua scincoides | Common Blue-tongue | -16.4652 | 134.5345 | DD | Pos (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 8806605 | Tringa nebularia | Common Greenshank | -16.6855 | 134.6571 | LC | (not listed) | 1 | 0 | 1 | 1 | Native to the N.T. | |
| 8794970 | Dromaius novaehollandiae | Emu | -16.4903 | 134.4793 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 8806600 | Plegadis falcinellus | Glossy Ibis | -16.6855 | 134.6571 | LC | (not listed) | 1 | 0 | 1 | 1 | Native to the N.T. | |
| 8801094 | Chloebia gouldiae | Gouldian Finch | -16.2951 | 134.4843 | VU | EN | | 1 | 1 | 1 | Native to the N.T. | |
| 8806960 | Ardea alba | Great Egret | -16.6855 | 134.6571 | LC | (not listed) | 1 | 0 | 1 | 1 | Native to the N.T. | |
| 314334 | Psephotellus dissimilis | Hooded Parrot | -16.5486 | 134.7212 | NT | (not listed) | | 0 | 1 | 2 | Endemic to the N.T. | |
| 8808581 | Varanus mertensi | Mertens' Water Monitor | -16.6851 | 134.6579 | VU | (not listed) | | 1 | 1 | 1 | Native to the N.T. | |
| 314373 | Varanus mertensi | Mertens' Water Monitor | -16.5486 | 134.7212 | VU | (not listed) | | 1 | 1 | 1 | Native to the N.T. | |
| 135751 | Pseudechis australis | Mulga Snake | -16.4819 | 134.4679 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 8876177 | Onychogalea unguifera | Northern Nailtail Wallaby | -16.6833 | 134.7167 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 121173 | Onychogalea unguifera | Northern Nailtail Wallaby | -16.4986 | 134.4845 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 271804 | Onychogalea unguifera | Northern Nailtail Wallaby | -16.4819 | 134.4512 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 121176 | Onychogalea unguifera | Northern Nailtail Wallaby | -16.4819 | 134.4512 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 299436 | Onychogalea unguifera | Northern Nailtail Wallaby | -16.4786 | 134.5212 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 88347 | Heteromunia pectoralis | Pictorella Mannikin | -16.6152 | 134.6512 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 314245 | Heteromunia pectoralis | Pictorella Mannikin | -16.5486 | 134.7212 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 8804039 | Heteromunia pectoralis | Pictorella Mannikin | -16.3033 | 134.4962 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 8801106 | Heteromunia pectoralis | Pictorella Mannikin | -16.2951 | 134.4843 | NT | (not listed) | | 0 | 1 | 1 | Native to the N.T. | |
| 112698 | Merops ornatus | Rainbow Bee-eater | -16.6152 | 134.6512 | LC | (not listed) | 1 | 0 | 1 | 1 | Native to the N.T. | |
| 8804608 | Merops ornatus | Rainbow Bee-eater | -16.5533 | 134.7316 | LC | (not listed) | 1 | 0 | 1 | 1 | Native to the N.T. | |
| 8804626 | Merops ornatus | Rainbow Bee-eater | -16.5158 | 134.6792 | LC | (not listed) | 1 | 0 | 1 | 1 | Native to the N.T. | |
| 332572 | Merops ornatus | Rainbow Bee-eater | -16.4186 | 134.5812 | LC | (not listed) | 1 | 0 | 1 | 1 | Native to the N.T. | |
| 8804077 | Merops ornatus | Rainbow Bee-eater | -16.3033 | 134.4962 | LC | (not listed) | 1 | 0 | 1 | 1 | Native to the N.T. | |

Significant Fauna- NT MAPS

| Id | Scientific Name | Common Name | Latitude | Longitude | TWPCA | TW EPBCA | EPBCA Mig | Threa | Sign | Intr | Introduced | Sensitive St |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 275888 | Lagorchestes conspicillatus | Spectacled Hare-wallaby | -16.4819 | 134.4845 | NT | (not listed) | 0 | 1 | 1 | Native to the N.T. | | |
| 275889 | Lagorchestes conspicillatus | Spectacled Hare-wallaby | -16.4819 | 134.5012 | NT | (not listed) | 0 | 1 | 1 | Native to the N.T. | | |
| 94257 | Lagorchestes conspicillatus | Spectacled Hare-wallaby | -16.4819 | 134.4845 | NT | (not listed) | 0 | 1 | 1 | Native to the N.T. | | |
| 94258 | Lagorchestes conspicillatus | Spectacled Hare-wallaby | -16.4819 | 134.5012 | NT | (not listed) | 0 | 1 | 1 | Native to the N.T. | | |
| 1250423 | Lagorchestes conspicillatus | Spectacled Hare-wallaby | -16.4819 | 134.5179 | NT | (not listed) | 0 | 1 | 1 | Native to the N.T. | | |
| 304887 | Lagorchestes conspicillatus | Spectacled Hare-wallaby | -16.4786 | 134.5212 | NT | (not listed) | 0 | 1 | 1 | Native to the N.T. | | |
| 268977 | Lagorchestes conspicillatus | Spectacled Hare-wallaby | -16.4732 | 134.5199 | NT | (not listed) | 0 | 1 | 1 | Native to the N.T. | | |
| 94261 | Lagorchestes conspicillatus | Spectacled Hare-wallaby | -16.4652 | 134.6179 | NT | (not listed) | 0 | 1 | 1 | Native to the N.T. | | |
| 275892 | Lagorchestes conspicillatus | Spectacled Hare-wallaby | -16.4652 | 134.6179 | NT | (not listed) | 0 | 1 | 1 | Native to the N.T. | | |
| 257649 | Lagorchestes conspicillatus | Spectacled Hare-wallaby | -16.4286 | 134.5712 | NT | (not listed) | 0 | 1 | 1 | Native to the N.T. | | |
| 10174753 | Varanus panoptes | Yellow-spotted Monitor | -16.4861 | 134.448 | VU | (not listed) | 1 | 1 | 1 | Native to the N.T. | | |

Significant Flora- NT MAPS

| Id | Genus | Species | Latitude | Longitude | Family | Scientific N | Common N | TPWC | EPBCA | Threatene | Significant | Endemic to NT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4197747 | Acrachne | racemosa | -16.49 | 134.6179 | POACEAE | Acrachne r | Acrachne | DD | | No | Yes | No |
| 1568046 | Fimbristylis | bisumbella | -16.4819 | 134.4512 | CYPERACEAE | Fimbristyli | Fimbristyli | DD | | No | Yes | No |
| 5639241 | Goodenia | minutiflora | -16.7114 | 134.664 | GOODENIACEAE | Goodenia r | Goodenia | DD | | No | Yes | No |
| 1597206 | Isotoma | sp. Tanuml | -16.4814 | 134.5497 | CAMPANULACEAE | Isotoma sp | Isotoma | DD | | No | Yes | No |
| 1930128 | Isotoma | sp. Tanuml | -16.4814 | 134.5517 | CAMPANULACEAE | Isotoma sp | Isotoma | DD | | No | Yes | No |
| 1715622 | Paspalidium | gracile | -16.4819 | 134.5512 | POACEAE | Paspalidiur | Paspalidiur | DD | | No | Yes | No |
| 1939620 | Sida | sp. excede | -16.5187 | 134.6866 | MALVACEAE | Sida sp. ex | Sida | DD | | No | Yes | No |

# Threatened Fauna-NT MAPS

| Id | Scientific Name | Common Name | Latitude | Longitude | TWPCA | TWPC | EPBCA | EPBCA | EPBCA | Thre | Signific | Introd | Introduced Status Text |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8801093 | Chloebia gouldiae | Gouldian Finch | -16.2951 | 134.4843 | VU | | EN | | | 1 | 1 | 1 | Native to the N.T. |
| 8808581 | Varanus mertensi | Mertens' Water Monitor | -16.6851 | 134.6579 | VU | | (not listed) | | | 1 | 1 | 1 | Native to the N.T. |
| 1237060 | Varanus mertensi | Mertens' Water Monitor | -16.5486 | 134.7212 | VU | | (not listed) | | | 1 | 1 | 1 | Native to the N.T. |

# APPENDIX B

Likelihood of Occurrence

**Table 7 Likelihood of Occurrence**

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| **AVES** | | | | | |
| *Ardeotis australis*<br>Australian Bustard | - | NT | LC | This species is a ground-dwelling bird, found on dry plains, grasslands and open woodland. They were once widespread in open habitats across much of mainland Australia, they are still widespread in the inland and tropical north, however are increasingly rare or extinct in the south (Birdlife, 2023). | **Known to occur**<br>Recorded in July 2023 Surveys |
| *Burhinus grallarius*<br>Bush Stone-curlew | - | NT | LC | Bush Stone-curlews occur throughout mainland Australia. They are a ground-dwelling bird found throughout grasslands, heathlands and sometimes found in cemeteries and golf courses (Birdlife, 2023). | **High potential to occur**<br>Suitable habitat occurs and a previous record within study area (old record 1993) |
| *Calidris ferruginea*<br>Curlew Sandpiper<br>(also in Migratory spp.) | CE<br>(Mig. Marine) | V | NT | In Australia, this species occurs around the coasts and are also quite widespread inland, though in smaller numbers. They are mainly found on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They occur in both fresh and brackish waters and occasionally are recorded around floodwaters (Department of the Environment, 2023). | **Low potential to occur**<br>Lack of suitable habitat and no previous records |
| *Dromaius novaehollandiae*<br>Emu | - | NT | LC | Emu are mainly found in sclerophyll forest and savanna woodland, across most of mainland Australia, from coastal regions to highlands, including the Snowy Mountains (Australian Museum, 2023). | **High potential to occur**<br>Suitable habitat occurs and a previous record within 15 kms of study area (recent record 2022) |

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Erythrotriorchis radiatus*<br>Red Goshawk | E | V | EN | Occurs in coastal and sub-coastal areas in riverine, wooded and forested lands of tropical and warm-temperate Australia.<br>Known to prefer forest and woodland with a mosaic of vegetation types, large prey populations (birds), and permanent water. The vegetation types include eucalypt woodland, open forest, tall open forest, gallery rainforest, swamp sclerophyll forest, and rainforest margins. The Red Goshawk nests in large trees, frequently the tallest and most massive in a tall stand, and nest trees are invariably within one km of permanent water (Department of the Environment, 2021). | **Low potential to occur**<br>No previous records and no suitable habitat |
| *Erythrura gouldiae*<br>Gouldian Finch | E | V | LC | Inhabits open woodlands that are dominated by Eucalyptus trees and support a ground cover of Sorghum and other grasses. Often found in vegetation along watercourses and mangrove edges. Critical components of suitable core habitat for the Gouldian Finch include the presence of favoured annual and perennial grasses (especially Sorghum), a nearby source of surface water and, in the breeding season, unburnt hollow-bearing Eucalyptus trees (especially *E. tintinnans, E. brevifolia* and *E. leucophloia*) Its breeding habitat is usually confined to ridges and rocky foothills, probably due to the presence of Sorghumgrasses (Department of the Environment, 2021) (Morcombe, Steve Parish Field Guide: Australian Birds, 2004) | **High potential to occur**<br>Suitable habitat occurs and a previous record within 20kms of study area. |
| *Falco hypoleucos*<br>Grey Falcon | V | V | VU | Grey Falcons live in areas of lightly-timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm. They use | **Moderate potential to occur**<br>Suitable habitat exists, however no recent previous records. Given the |

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| | | | | nests built by other species and prefer nests in the tallest trees along watercourses.<br>The majority of records from the Northern Territory (NT) are from the southern half, but there are records all the way up to Darwin and also a record from Groote Eylandt (Northern Territory Government, 2012). | narrow linear nature of mulching or line preparation, the likelihood of impact is considered low, should this species occur. |
| *Falcunculus frontatus whitei*<br>Crested Shrike-tit (northern), Northern Shrike-tit | V | NT | - | Generally found in open Eucalypt woodlands dominated by Bloodwood, Darwin Box and Roughleaf Cabbage Gum. Species has been recorded in areas with grassy and shrubby understoreys. Seasonally waterlogged areas may attract the species (Department of the Environment , 2021). | **Moderate potential to occur**<br>Suitable habitat exists, however no recent previous records.<br>Species has not been recorded in the seismic project area (no records from desktop searches). Minimal mulching or line preparation of suitable habitat and therefore considered low risk of impact |
| *Heteromunia pectoralis*<br>Pictorella Mannikin | - | NT | LC | This species is found across northern Australia, inhabiting dry grasslands and edges of wetlands, including spinifex (eBird, 2023). | **Known to occur**<br>Previous record within study area (recent record 2020) |
| *Psephotellus dissimilis*<br>Hooded Parrot | | NT | LC | This species is found in savannah woodlands with termite mounds in the north of the Northern Territory, with some scattered records from the centre of the NT and far northern Queensland (Simpson & Day, 2004). | **High potential to occur**<br>Suitable habitat occurs and a previous record within study area (however the record is 30 years old (1993)) |
| *Rostratula australis*<br>Australian Painted Snipe | E | V | EN | This species has been recorded at wetlands in all states of Australia. They are generally found in shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans. They also are found to use inundated or waterlogged grassland or | **Low potential to occur**<br>No previous records and no suitable habitat |

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| | | | | saltmarsh, dams, rice crops, sewage farms and bore drains. Typically, this species are found in sites that include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (Department of the Environment , 2023). | |
| *Tyto novaehollandiae kimberli*<br>Masked Owl (northern) | V | V | | Inhabits tall, open Eucalypt forests (particularly those dominated by *Eucalyptus miniata* and E. tetrodonta). Forages in open vegetation and grasslands and typically roosts and nests in tree hollows, though there are recordings of roostings in monsoon rainforests. Home range is estimated to be 5-10 $km^2$.<br>Very similar in appearance to the Barn Owl (*Tyto alba*), though the Masked Owl is larger, darker and has more feathering on the feet (Department of the Environment, 2021) (Higgins, Handbook of Australian, New Zealand and Antarctic Birds Volume 4: Parrots to Dollarbird, 1999). | **Low potential to occur**<br>No suitable habitat and lack of previous records in study area. |
| **MAMMALIA** | | | | | |
| *Dasyurus hallucatus*<br>Northern Quoll | E | CE | EN | The Northern Quoll occurs in five regional populations across QLD, the NT and WA, both on the mainland and on offshore islands. In the NT, species records show that Northern Quolls have been found as far south east as Borroloola and as far west as the NT/WA border. They are found in diverse habitats across their range including rocky areas, eucalypt forest and woodlands, rainforests, sandy lowlands and beaches, shrubland, grasslands and desert (Department of the Environment, 2023). | **Moderate potential to occur**<br>Suitable habitat occurs, however lack of previous records |

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Lagorchestes conspicillatus*<br>Spectacled Hare-wallaby | - | NT | LC | This species of-wallaby is found across northern Australia from QLD to WA in tropical tussock or spinifex habitats (Atlas of Living Australia, 2023). They can be found in forests, woodlands, and arid grasslands, preferring areas with shrubs, grass tussocks, or spinifex hummocks for shelter (Ingleby & Westoby, 1992). | **High potential to occur**<br>Suitable habitat and a previous record within study area (however the record is 32 years old (1991)) |
| *Macroderma gigas*<br>Ghost Bat | V | NT | | Ghost bats use several roosts or perches each night but often return to the same daytime roost, often in a deep crack or cave.<br>Territory they have been recorded throughout the mainland Top End north of approximately 17º latitude (north of the study area which is 16º latitude) as well as Elcho Island, Groote Eylandt and other nearby islands (Department of the Environment, 2021). | **Low potential to occur**<br>No suitable habitat and lack of previous records in study area. |
| *Macrotis lagotis*<br>Greater Bilby | V | V | V | Bilby occur in a variety of habitats, usually on landforms with level to low slope topography and light to medium soils. It occupies three major vegetation types; open tussock grassland on uplands and hills, mulga woodland/shrubland growing on ridges and rises, and hummock grassland in plains and alluvial areas. Laterite and rock feature substrates are an important part of Greater Bilby habitat. These habitat support shrub species, such as *Acacia kempeana, A. hilliana* and *A. rhodophylla*, which have root-dwelling larvae that provide a constant food source for the Greater Bilby. They also contain Spinifex hummocks which are quite uniform and discrete, providing runways between hummocks, enabling easier movement and foraging. Greater bilbies occurrence is strongly associated with higher rainfalls and temperatures, particularly as these conditions may not be favoured by foxes, which are one | **Low potential to occur**<br>No suitable habitat and lack of previous records in study area. |

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| | | | | of their main threats (Department of the Environment , 2021). | |
| *Onychogalea unguifera*<br>Northern Nailtail Wallaby | - | NT | LC | This species inhabits Acacia woodlands and shrublands with tussock grasses or spinifex, especially at the edges of blacksoil plains. They are found across northern Australia from the tropical north of QLD through to the Kimberley region of WA (NESP Threatened Species Recovery Hub, 2021). | **Known to occur**<br>Recorded in July 2023 baseline surveys |
| *Saccolaimus saccolaimus nudicluniatus*<br>Bare-rumped Sheath-tailed Bat | V | NT | - | This species of bat has a wide distribution from India through SE Asia to the Solomon Islands, NE QLD and the NT. Records of the species in the NT are sparsely scattered across the Top End, with records from open Pandanus woodland and from eucalypt woodlands and forests extending from coastal and adjacent inland areas (NT Department of Environment, Parks and Water Security, 2021). | **Moderate potential to occur**<br>Suitable habitat occurs, however lack of previous records |
| *Trichosurus vulpecula arnhemensis*<br>Northern Brushtail Possum | V | - | - | This subspecies occurs discontinuously from the Gulf of Carpentaria hinterland through to the Kimberley region. They are found mainly in tall eucalypt open forests with large hollow-bearing trees, particularly where the understorey includes some shrubs that bear fleshy fruits They also occur in some mangrove communities, some rainforests and some semi-urban areas (Department of Agriculture, Water and the Environment, 2021). | **Low potential to occur**<br>No suitable habitat and lack of previous records in study area. |
| **REPTILIA** | | | | | |
| *Elseya lavarackorum*<br>Gulf Snapping Turtle | E | | - | The Gulf Snapping Turtle distribution is restricted to rivers draining into the Gulf of Carpentaria. This species is found in deep pools in the upper catchments of permanently flowing spring-fed river systems, particularly in areas with intact riparian vegetation. They inhabit large rivers and their associated overflow lagoons and oxbow lakes and are found in deeper permanent pools most often with muddy, sandy or rocky bottoms. The species is also found in the middle | **Low potential to occur**<br>No suitable habitat and lack of previous records in study area. |

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| | | | | reaches of rivers, upstream of saline regions and downstream of escarpments, including plunge pools, particularly food plants, such as the Cluster Fig Ficus racemosa and Pandanus aquaticus are found (Department of the Environment, 2023) (NT Govt. Department of Environment, Parks and Water Security, 2021). | |
| *Pseudechis australis*<br>Mulga Snake | - | NT | LC | This species has the widest distribution of any snake species in Australia, ranging throughout the continent (except for the very south/SE areas). They are found across a wide variety of habitats, including highly disturbed areas such as wheat fields (Australian Museum, 2023). | **Moderate potential to occur**<br>Suitable habitat occurs, however no previous records |
| *Tiliqua scincoides intermedia*<br>Northern Blue-tongue | CE | DD | LC | Northern Blue-tongue Lizard occurs across the wet–dry tropics of northern Australia, from north-western Queensland west of Cape York, as far as the Mt Isa districts (Atlas of Living Australia, 2023). Northern Blue-tongue Lizards move widely across the savannah landscape but spend most of their time in small, fragmented patches of habitat that offer cooler moister conditions. Individuals spend long periods within small and distinctive habitat patches, interspersed with longer directional relocations from one patch to the next. | **High potential to occur**<br>Suitable habitat occurs, however no previous records |
| *Varanus mertensi*<br>*Mertens' Water Monitor* | - | VU | EN | This species has a broad distribution across coastal and inland waters in the far north of Australia, from the Kimberley to the western side of Cape York Peninsula. In the NT the species has been recorded across most of the Top End and the Gulf Region. Mertens' Water Monitor is semi-aquatic and is seldom seen far from water (NT Govt. Department of Environment, Parks and Water Security, 2021). | **Low potential to occur**<br>Although there is a previous record within study area, this record is considered dubious given the lack of permanent water near the record. No suitable habitat occurs within the study area. |
| *Varanus panoptes* | - | VU | LC | Ground dwelling lizard, feeds mainly on insects and small vertebrates. Can grow to 1.2 metres. Occupies a | **Moderate potential to occur** |

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| Yellow-spotted Monitor | | | | range of habitats such as coastal beaches, grasslands, floodplains and woodlands (Cogger, 2014). | Suitable habitat occurs, although no previous records in the study area. |

EPBC Act (species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Aust.): CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory, Ma = Marine
TPWC Act (species listed under the *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act), NT): CE = Critically Endangered, E = Endangered, V = Vulnerable, NT=Near Threatened
IUCN (species listed under the International Union for Conservation of Nature (IUCN) Red List of Threatened Species): EX= Extinct, EW= Extinct in the Wild, CR= Critically Endangered, EN= Endangered, VU= Vulnerable, NT=Near Threatened, LC= Least Concern

**Table 8 Likelihood of Occurrence – Migratory Species**

| Species Name | EPBC Act Status | NC Act Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|
| **Migratory Marine** | | | | |
| *Apus pacificus*<br>Fork-tailed swift | LM, MM | SLC | Summer migrant (October – April). Occurs in low to very high airspace over variety of habitats including rainforest and semi-arid areas. Known to be most active in front of summer storm fronts (Morcombe, Field Guide to Australian Birds, 2004). They are almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. In Australia, they mostly occur over inland plains but sometimes above foothills or in coastal areas. (Department of the Environment , 2020). | **Moderate potential to occur**<br>No previous records however they likely fly-over (yet would not land based on behaviour) |
| **Migratory Terrestrial** | | | | |
| *Cecropis daurica*<br>Red-rumped Swallow | LM, MI | - | This summer migrant is found in the north of Australia, around Cairns, Gulf of Carpentaria, Darwin and Broome. This species forages mainly over wetlands: e.g. swamps, rivers, dams etc. or open areas such as golf courses or cane fields (Department of the Environment, 2015). | **Moderate potential to occur**<br>Suitable habitat occurs, however no previous records |

| Species Name | EPBC Act Status | NC Act Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|
| *Cuculus optatus*<br>Oriental Cuckoo, Horsfield's Cuckoo | MI | - | The this species is a regular migrant to Australia, where it spends the non-breeding season (Sept- May) in coastal regions across northern and eastern Australia as well as offshore islands. In the NT records are widespread across the Top End, from Darwin, north to Melville and South Goulburn Islands, east to Gove Peninsula, Groote Eylandt and Sir Edward Pellew Group and south to Roper River. The species uses a range of vegetated habitats including monsoon rainforest, wet sclerophyll forest, open woodland (Department of the Environment, 2015). | **Moderate potential to occur**<br>Suitable habitat occurs, however no previous records |
| *Hirundo rustica*<br>Barn Swallow | LM, MI | LC | This migratory species usually occurs in northern Australia, on Cocos-Keeling Island, Christmas Island, Ashmore Reef and across the northern coast, from the Pilbara region, through to Fraser Island in Queensland. They have been recorded in open country, coastal lowlands, often near water, towns and cities, often recorded perched on overhead wires, and also in or over freshwater wetlands, paperbark Melaleuca woodland, mesophyll shrub thickets and tussock grassland (Department of the Environment , 2023). | **Moderate potential to occur**<br>Suitable habitat occurs, however no previous records |
| *Motacilla cinerea*<br>Grey Wagtail | LM, MI | - | This species is a scarce but regular visitor to northern Australia. found across a variety of wetlands, especially water courses, but also on the banks of lakes and marshes, as well as artificial wetlands including sewage farms, reservoirs and fishponds (Department of the Environment, 2015). | **Low potential to occur**<br>Lack of suitable habitat and no previous records |
| *Motacilla flava*<br>Yellow Wagtail | LM, MT | - | The Yellow Wagtail is a regular wet season visitor to northern Australia.<br>Habitat requirements for the Yellow Wagtail are highly variable, but typically include open grassy flats near water. They are found in open areas with low vegetation such as grasslands, airstrips, pastures, sports fields; damp open areas such as muddy or grassy edges of wetlands, rivers, irrigated farmland, dams, waterholes; sewage farms, sometimes utilise tidal mudflats and edges of mangroves (Department of the Environment, 2015). | **Moderate potential to occur**<br>Potential habitat occurs in the wet season. However no previous records |

| Species Name | EPBC Act Status | NC Act Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|
| **Migratory Wetlands** | | | | |
| *Actitis hypoleucos*<br><br>Common Sandpiper | MW, LM | SLC | The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The Common Sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. The muddy margins utilised by the species are often narrow and may be steep. The species is often associated with mangroves, and sometimes found in areas of mud littered with rocks or snags (Department of the Environment, 2020).<br><br>Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The population, when in Australia, is concentrated in northern and western Australia<br><br>Global population size for Common sandpipers has been estimated at between 2,455,000 – 4,030,000 individuals (Bamford, Watkins, Bancroft, Tischler, & Wahl, 2008)<br><br>The Sandpiper is listed as Least Concern on the ICUN redlist of Threatened Species. (Department of the Environment, 2020) | **Low potential to occur**<br><br>Lack of suitable habitat and no previous records |
| *Calidris acuminata*<br><br>Sharp-tailed Sandpiper | MW, LM | SLC | The Sharp-tailed Sandpiper spends the non-breeding season in Australia, with over 90% of the population occurring. (Bamford, Watkins, Bancroft, Tischler, & Wahl, 2008)<br><br>Records from the NT mostly occur in the north coastal regions, east to Groote Eylandt and Gove Peninsula but also around McArthur River and east of Borroloola. Other inland records occur south to northern Tanami Desert, and in the southern NT, from Alice Springs, north to Napabie Lakes and south to Uluru National Park (Department of the Environment , 2020) | **Low potential to occur**<br><br>Lack of suitable habitat and no previous records |

| Species Name | EPBC Act Status | NC Act Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|
| | | | All the important sites during the non-breeding period were recorded in Southern Australia. (Bamford, Watkins, Bancroft, Tischler, & Wahl, 2008). | |
| *Calidris ferruginea*<br><br>Curlew sandpiper | CE, MI, LM | E | Mainly occur in both fresh and brackish waters on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms but are also recorded inland, though less often, including around ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand (Higgins & Davies, Handbook of Australian, New Zealand & Antarctic Birds, 1996).<br>Curlew Sandpipers forage on mudflats and nearby shallow water and generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh (Higgins & Davies, Handbook of Australian, New Zealand & Antarctic Birds, 1996)<br>In Queensland, scattered records occur in the Gulf of Carpentaria, with widespread records along the coast south of Cairns. The global population size of the Curlew Sandpiper is 1,350,000 with an estimated 115,000 migrating to Australia during the non-breeding period (Bamford, Watkins, Bancroft, Tischler, & Wahl, 2008). | **Low potential to occur**<br>Lack of suitable habitat and no previous records |
| *Calidris melanotos*<br>Pectoral sandpiper | MW, LM | | In Queensland, most records for the Pectoral Sandpiper occur around Cairns. They prefer shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The Pectoral Sandpiper is omnivorous, consuming algae, seeds, crustaceans, arachnids and insects (Department of the Environment , 2020).<br>The species is listed as Least Concern on the IUCN redlist, | **Low potential to occur**<br>Lack of suitable habitat and no previous records |

| Species Name | EPBC Act Status | NC Act Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|
| Charadrius veredus<br>*Oriental Plover* | LM, MI | | The Oriental Plover is a non-breeding visitor to Australia. The species occurs in both coastal and inland areas, mostly in northern Australia. They can be found in coastal habitats such as estuarine mudflats and sandbanks, on sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands, before dispersing further inland, where they usually inhabit flat, open, semi-arid or arid grasslands, Most records of this species are along the north-western coast, between Exmouth Gulf and Derby in Western Australia, as well as scattered sites elsewhere, mainly along the northern coast, the Top End, the Gulf of Carpentaria and Cape York Peninsula. The species also often occurs further inland on the 'blacksoil' plains of northern Western Australia, the Northern Territory and north-western Queensland (Department of the Environment , 2023). | **Low potential to occur**<br>Lack of suitable habitat and no previous records |
| Glareola maldivarum<br>*Oriental Pratincole* | LM, MI | LC | When in Australia this species can be found in northern areas, especially along the coasts of the Pilbara Region and the Kimberley Division in Western Australia, the Top End of the Northern Territory and the Gulf of Carpentaria. They usually inhabit open plains, floodplains or short grassland and often occur near terrestrial wetlands, such as billabongs, lakes or creeks, and artificial wetlands such as reservoirs, saltworks and sewage farms, especially around the margins They have also been recorded along the coast, including beaches, mudflats, islands and coastal lagoons (Department of the Environment , 2023). | **Low potential to occur**<br>Lack of suitable habitat and no previous records |

EPBC Act (species listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), Aust.): Ex= Extinct CE = Critically Endangered E = Endangered, V = Vulnerable, MM = Migratory Marine, MT = Migratory Terrestrial, MW = Migratory Wetlands, LM = Listed Marine MI=Listed Migratory

NC Act (species listed under the Nature Conservation (Wildlife) Regulation 2006 Act (NC Act), QLD):PE: Extinct in the Wild CE: Critically Endangered E = Endangered, V = Vulnerable, NT = Near Threatened, SLC = Special Least Concern, C = Least Concern

**Table 9 Likelihood of Occurrence - Flora**

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| *Acrachne racemosa*<br>Acrachne | - | DD | - | This species is known from records from the Pilbara and Kimberley Regions of W.A., the Darwin area and Barkly Tableland of the N.T., and central eastern Qld. It occurs in brown, sandy loam over loamy clay on coastal flats in association with low, deciduous, vine thickets in the Kimberley Region of W.A, In other regions it is found in monsoonal areas usually along creek lines on sandy or skeletal soils, with Eucalyptus, Acacia or Atalaya species (AusGrass2, 2023). | |
| *Centipeda nidiformis*<br>Cotton Sneezeweed | - | DD | - | An annual daisy, growing to 15cm. Although this species occurs in all mainland Australian states, its distribution is disjunct in the Northern Territory. *Centipeda nidiformis* is conserved only in Bullwaddy Conservation Reserve (also conserved in the federally managed Kakadu National Park) (Parks and Wildlife Commission of the Northern Territory, 2005)<br>Most common in northern Australia and rarer in the south, found in margins of streams, waterholes etc. on usually clay or clay-loam soils, in areas of reliable rainfall, but relatively warm climate (New South Wales Flora Online, 2023). | **High potential to occur**<br>Suitable habitat occurs and previously recorded in Bullwaddy Conservation Reserve. |
| *Fimbristylis bisumbellata*<br>Fimbristylis, Fringe-rush | - | DD | LC | Known from scattered records across the north of the NT, accross QLD and into north east NSW. Grows on stream banks, on sandy soil (New South Wales Flora Online, 2023) (Atlas of Living Australia, 2023) | **High potential to occur**<br>Suitable habitat occurs and previously recorded in the region. |
| *Goodenia minutiflora*<br>Goodenia | - | DD | - | Goodenia minutiflora is an annual herb that typically grows to a height of up to 20 cm with linear to lance-shaped leaves, and loose groups of tiny white or purplish flowers. | **High potential to occur** |

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| | | | | It is known from records across the north of the NT across to far north-western QLD. In the NT it is found in the Einasleigh Uplands, Gulf Coastal, Gulf Fall and Uplands, Gulf Plains, Sturt Plateau and Tanami bioregions (Atlas of Living Australia, 2023) (Northern Territory Government, 2013). | Suitable habitat occurs and previously recorded in the region. |
| *Isotoma sp. Tanumbirini* Isotoma | - | DD | - | Isotomas are a genus of annual or perennial herbs native to Australia and New Zealand (National Herbarium of NSW, 2023). Limited records and data exist for this species. | **High potential to occur** Suitable habitat occurs and previously recorded in the region. |
| *Lepturus xerophilus* | - | DD | - | A delicate annual grass, growing to 20cm, occurring occasionally under bullwaddy. It is known from limited records across far northern Australia (Atlas of Living Australia, 2023). In the NT this species is conserved only in Bullwaddy Conservation Reserve and known from only four locations which all fall within the Sturt Plateau; (Parks and Wildlife Commission of the Northern Territory, 2005) | **High potential to occur** Suitable habitat occurs and previously recorded in Bullwaddy Conservation Reserve. |
| *Pandanus spiralis* | - | DD | LC | Iconic multi-branched Darwin pandanus palm. Distinctive spiralling leaves and large pleasantly scented fragrant woody fruits. (Territory Native Plants, 2023). Found across far northern Australia, from the Kimberly region in WA, across the Top End of the NT to far north QLD (Atlas of Living Australia, 2023). | **Moderate potential to occur** Suitable habitat occurs however no previous records |
| *Panicum latzii* | - | DD | | An erect annual grass which grows on clay soils. It is known from records across the north of the NT and into far western QLD (Atlas of Living Australia, 2023). In the NT, this species is conserved only in Bullwaddy Conservation Reserve. (Parks and Wildlife Commission of the Northern Territory, 2005). | **High potential to occur** Suitable habitat occurs and previously recorded in Bullwaddy Conservation Reserve. |
| *Paspalidium gracile* | - | DD | - | A fine annual grass, growing to 20cm. This species is widely distributed across eastern Australia, with scattered | **High potential to occur** |

| Species Name | EPBC Act Status | TPWC Act Status | IUCN Status | Habitat Preference | Likelihood of Occurrence |
|---|---|---|---|---|---|
| Paspalidium<br>Graceful Panic Grass | | | | records across the continent westward into WA (Atlas of Living Australia, 2023). In the NT, it is conserved only in Bullwaddy Conservation Reserve and known from only five locations which all fall within the north east Sturt Plateau region; (Parks and Wildlife Commission of the Northern Territory, 2005) | Suitable habitat occurs and previously recorded in Bullwaddy Conservation Reserve. |
| *Sida sp. Excedentifolia*<br>*Sida* | - | DD | - | This herbacious species is known from scattered records throughout central Australia (Atlas of Living Australia, 2023). | **Moderate potential to occur**<br>Suitable habitat occurs however no previous records |
| *Yakirra muelleri* | - | DD | - | A slender grass, growing to 25 cm, it is known from a small number of specimens scattered from the semi-arid areas of western Qld, eastern NT and through to the western Kimberley region of WA. In the NT it is found in the Bullwaddy conservation reserve and also in Nitmiluk National Park (Parks and Wildlife Commission of the Northern Territory, 2005) (AusGrass, 2023) | **High potential to occur**<br>Suitable habitat occurs and previously recorded in Bullwaddy Conservation Reserve. |

EPBC Act (species listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), Aust.): CE = Critically Endangered, E = Endangered, V = Vulnerable, M = Migratory, Ma = Marine
TPWC Act (species listed under the *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act), NT): CE = Critically Endangered, E = Endangered, V = Vulnerable, NT=Near Threatened
IUCN (species listed under the International Union for Conservation of Nature (IUCN) Red List of Threatened Species): EX= Extinct, EW= Extinct in the Wild, CR= Critically Endangered, EN= Endangered, VU= Vulnerable, NT=Near Threatened, LC= Least Concern

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# Archaeological Assessment

# Appendix 02

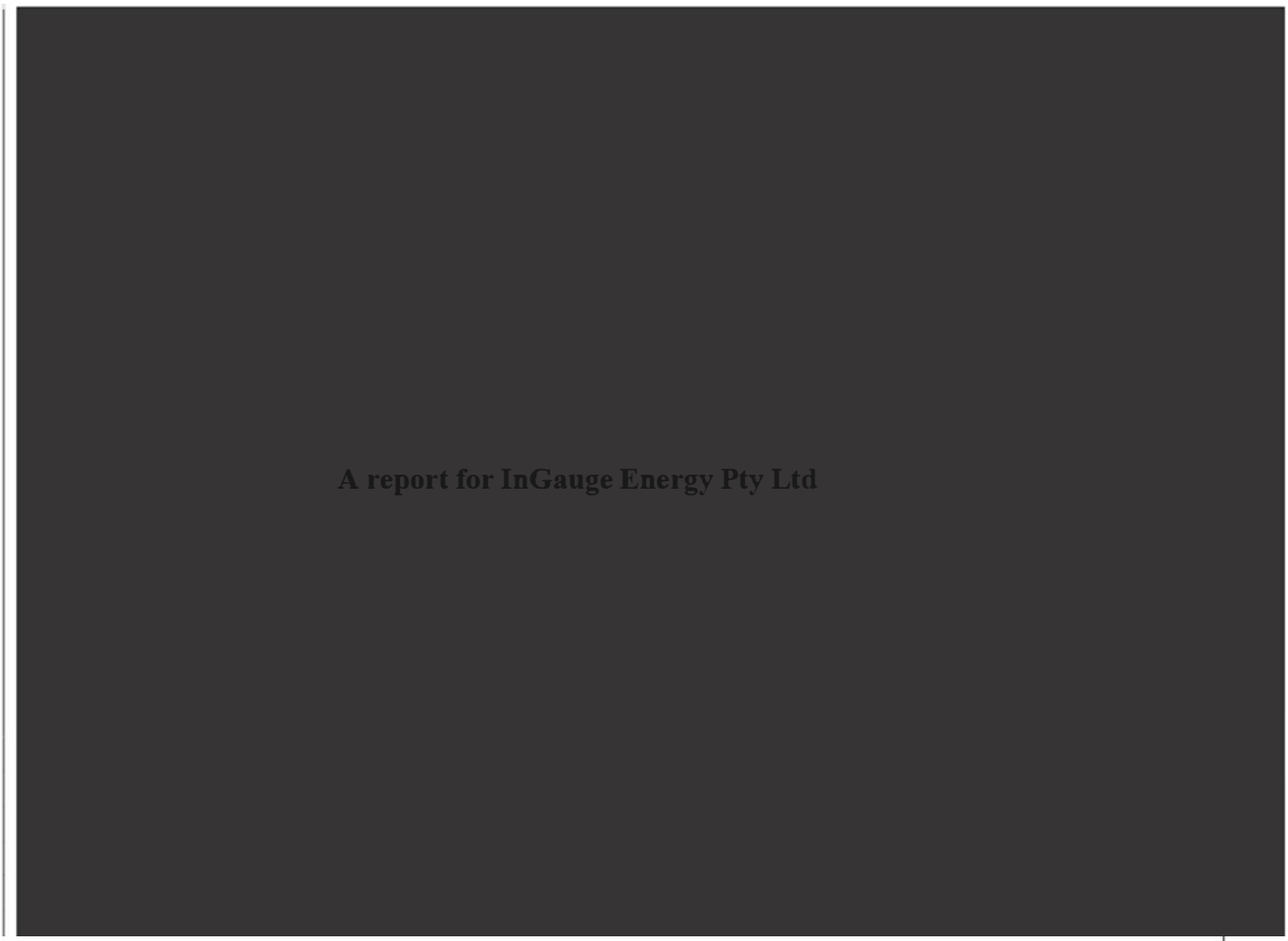
# Environmental Management Plan: EP161 2D Seismic and Ground Gravity Survey Program

# STO7-4

# NT Exploration Permit 161

# Santos QNT PTY Ltd

# ARCHAEOLOGICAL SURVEY REPORT:
# EP 161 TANUMBIRINI STATION, NT




**Dr. Silvano Jung**
**Principal**
**Ellengowan Enterprises – archaeological consultant**
**ABN: 47 208 214 348**

**August 2023**

# EXECUTIVE SUMMARY

Ellengowan Enterprises was contracted by InGauge Energy to undertake a cultural heritage (archaeology) survey of 274 kilometres of seismic lines for Santos' EP 161 lease on Tanumbirini Station in the Northern Territory. The survey was conducted in August 2023 in conjunction with an ecological and weed study over a seven-day period using ATVs. The survey recorded four archaeological sites and four background scatters, or isoliths. The sites, except for one, are all low-density artefact scatters. The exceptional site is a high-density artefact scatter with high significance.

The following table surmises the mitigation measures to eliminate the threat to cultural heritage by the proposed works. The mitigation strategy is to avoid all cultural heritage sites by re-routing the seismic lines around the low-density sites and isolated stone artefacts and to stop the survey lines prior to their encroachment on the highly significant site. The proposed works on EP 161 for the Santos seismic line programme requires no further action and is cleared for works.

**Summary of recommendations and mitigation schedule:**

| [redacted] | **Recommendation/s** |
|---|---|
| | Option 1. Avoid. 50m radius buffer from the site centroid. Skirt around the site on either side east or west up to 100m radius from the site centroid.<br>Option 2. Seek permit to disturb from Heritage Branch if avoidance is not possible. |
| | Option 1. Avoid. 20m radius buffer from the site centroid. |
| | Option 1. Avoid. 20m radius buffer from the site centroid. |
| | Option 1. Avoid. Handheld equipment only should be used north of the stop points. |
| | Option 1. Avoid. 10m radius buffer from the site centroids. |

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# 1.0 INTRODUCTION

## 1.1 Background and consultancy brief

Santos is proposing a 274km seismic line programme at EP 161 on Tanumbirini Station in the Northern Territory. InGauge Energy Pty Ltd contracted Ellengowan Enterprises to conduct an archaeological survey of the proposed seismic lines.

A seven-day survey was conducted from 18 to 24 July 2023 with Paul Fox, an ecologist, Nathanael Mills (Weed Management Branch, NTG) and a Santos representative James 'Lavo' Laverty. The survey was conducted with two All-Terrain Vehicles (ATVs). The consultancy brief was specifically to:

- Identify any prescribed archaeological objects or places as defined under the Northern Territory *Heritage Act* (2011*)*, and any archaeological sites located within the entire survey area.

- Assess the nature, distribution and significance of these objects or places and discuss possible constraints to the works posed by the presence of archaeological and historic sites and an indication of what sites are likely to be the most sensitive in this respect.

- Present a final report including a summary of survey results, determination of significance of sites and the likely impact of the proposed development, and recommendations regarding management strategies or mitigation procedures as appropriate under the Northern Territory *Heritage Act* (2011).

Four archaeological sites and four background scatters (or isoliths) were recorded. All the archaeological finds were artefact scatters. Three of the four archaeological sites are assessed as low-density artefact scatters with low significance. They may represent singular knapping events. One of the sites, however, represents a highly significant home camp where people were continuously revisiting for millennia and is of high significance. The following documents the archaeology and proposes the best options to mitigate the impact the proposed works may have on them.

## 1.2 Location of the study areas and brief environmental description

Tanumbirini Station is approximately 730km from Darwin on the Carpentaria Highway, virtually between Daly Waters and Borroloola in the Beetaloo Sub Basin (Fig. 1). There are 12 seismic lines in total to be surveyed and these are distributed in two different sections, the first contains five lines of approximately 9km in length and the second section contains seven lines of approximately 32km long. These are referred to in this report as the western and eastern survey blocks respectively. A 25m wide corridor is to be archeologically surveyed on either side of the seismic line, with surveys of up to 50m from the centre line at creeks and other waterways, such as drainage lines and erosion gullies. Figure 2 maps the surveyed lines.

The terrain in the survey area is relatively flat south of the highway, with outcropping of low stoney ridges towards the eastern seismic lines. Numerous drainage lines occur there, running off the stoney ridges. To the north of the highway in the eastern block of lines, there is an escarpment, the end of the Favenc Range, approximately 20-30m in height that relatively gently falls away to flood plans below that contained two major braided creek systems, Tanumbirini Creek in the eastern block survey area and Lagoon Creek in the western block survey area. The western block survey area is relatively flat.

Low ridges on eastern transects, creeks with defined banks, grevillea sp. spinifex under story, lancewood (*Acacia shirleyi*), bullwaddy (*Macropteranthes kekwickii*) dominate the survey area south of the highway and both the southern and northern sections of the highway in the western survey block. Bloodwoods (*E. bleeseri)* are dominant, with a turpentine (*Eremophila sturtii*) understory. Broad leaf paper bark (*Melaleuca quinquenervi*) is mainly on the north side of road. Silver box (*Eucalyptus pruinose)* (north of highway) River Red gum (*Eucalyptus camaldulensis obtuse*) also occur.

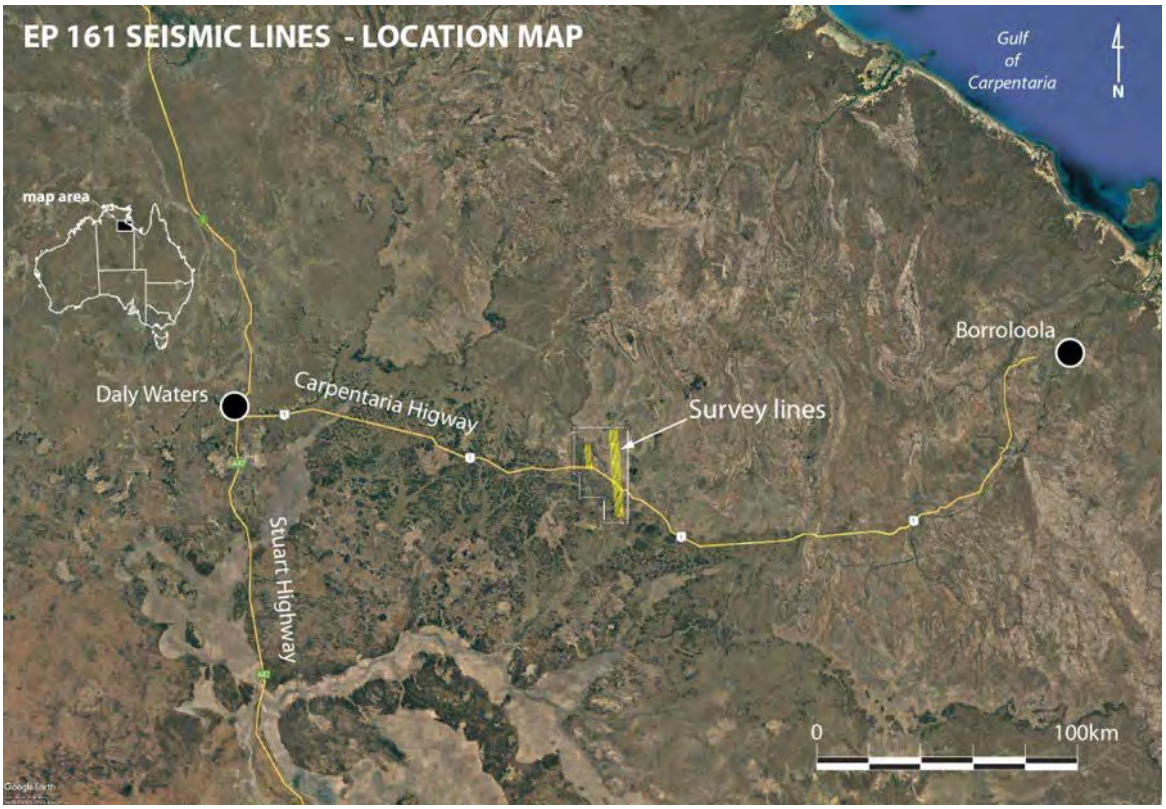



*Figure 1. EP 161 seismic survey lines – location map.*

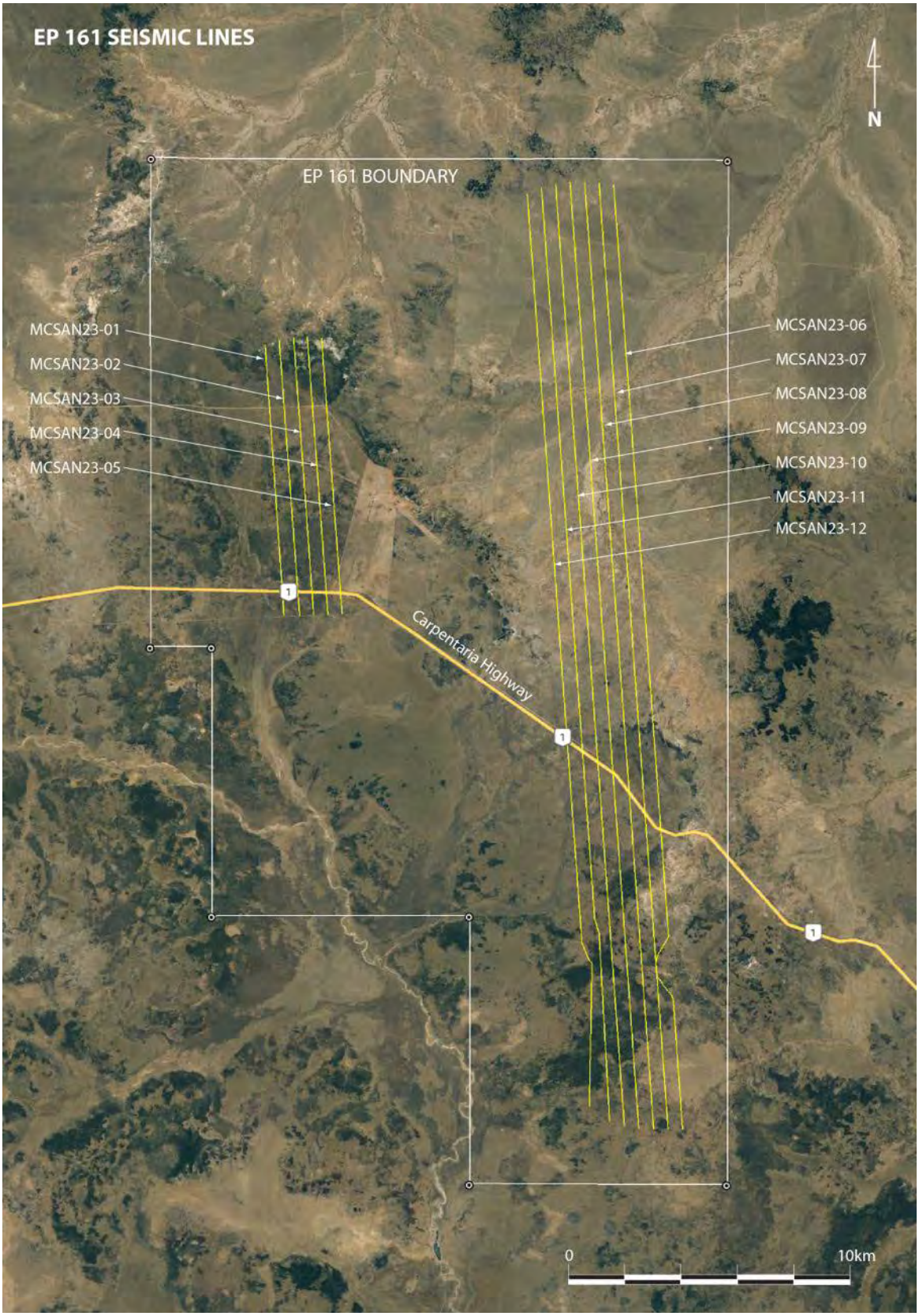



*Figure 2. Location of the study area on the Carpentaria Highway showing details of the two seismic survey blocks west and east on Tanumbirini Station (After Google Earth).*

# 2.0 HERITAGE LEGISLATIVE FRAMEWORK

## 2.1. Northern Territory legislation

There are two kinds of heritage sites protected under the Northern Territory *Heritage Act* (2011), hereafter referred to as the *Act*, declared and prescribed places and objects. The *Act* places legal constraints on owners of private property, local government and the Crown:

- Places or objects listed on the Northern Territory Heritage Register are declared heritage places and objects that are protected under section 33 of the *Act*, and

- Prescribed archaeological places and objects, which may or may not be declared, are protected under sections 29 and 39 of the *Act*.

It is an offence under the *Act* to damage, destroy, alter or carry out work of any sort on declared or prescribed sites without the written consent of the Minister or Minister's delegate. If considered appropriate, the Heritage Branch may on occasion utilise the discretion available in the *Act* to give permission for small-scale disturbance (such as the relocation of isolated stone artefacts) without the need for a formal application. The discretion is allowed under s148 of the *Act*, which in effect says that a heritage officer (such as an archaeologist) may undertake actions (or authorize actions), not construed as an offence.

### *2.1.1 Declared heritage places and objects*

Categories, which describe the status of each site on the Northern Territory Heritage Register database, are listed in Table 1.

**Table 1. Site status on the Northern Territory Heritage Register database**

| Status | Description |
|---|---|
| D | Declared heritage place. |
| NR | Not recommended. HC* determined that the place did not meet heritage assessment criteria and did not hold sufficient value to warrant declaration under the *Act*. |
| RF | Refused by the Minister. HC* recommended for declaration and Minister refused to do so. |
| P | Proposed. HC* has determined that the place warrants declaration under the *Act* but has not yet made its recommendations to the minister. |
| RV | Revoked. Declaration as a heritage place pursuant to Section 26(1) of the *Act* is revoked. |
| N | Nominated. HC* has yet to complete its assessment of the heritage value of the place. |

*Heritage Council

### *2.1.2 Prescribed archaeological places and objects*

No places listed on the National Heritage List, nor the Commonwealth Heritage list occurs along the proposed seismic line survey routes, nor any places under the *Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act* (1984). A search of the Archaeological Sites Register held by the Heritage Branch, Northern Territory Government revealed no previously recorded archaeological sites in the survey area.

## 2.2. Constraints

### *2.2.1 Ground Integrity (GI)*

Assessing ground surface integrity provides an indicator of whether the landscape under study has been modified, and if so the degree of disturbance encountered. It then becomes possible to gauge the degree to which modification has influenced the environmental context within which artefacts and/or places of cultural and/or scientific interest are located. Ground surface integrity must also be assessed from the perspective of the current legislation.

The *Aboriginal Cultural Heritage Act 2003* (in Queensland, but equally applicable to the Northern Territory) provides a definition for GI that includes the removal of native vegetation as inferring the ground has been subjected to 'significant ground disturbance'. Under these criteria of modification, therefore, the *Act* assumes that archaeological integrity and significance is greatly reduced, is negligible, or even extinguished completely.

Contrary to this however, archaeologists are continually finding evidence that important cultural heritage material and/or places regularly survive not only land clearing activities but also invasive farming techniques such as ploughing.

Combined with this is the fact that, regardless of levels of GI, significant Aboriginal objects and/or significant Aboriginal areas can be defined on entirely cultural grounds, by Traditional Owners, not requiring any assessment of ground surface integrity.

Levels of GI are determined using a percentage range between 0-100% where 0% indicates all GI is gone, and 100% represents excellent preservation of the original context. Zero – 0%; Poor – 1-25%; Moderate- 26-50 %; Fair – 51-75 %; Good – 76-85%; Excellent 86-100%.

### *2.2.2 Ground Surface Visibility (GSV)*

Assessments of ground surface visibility provide an indication of how much of the ground surface can be seen.

Ground surface visibility (GSV) is most inhibited by vegetation, but other inhibitors may include concrete, gravel and bitumen. Levels are determined using a percentage scale like that used for the calculation of Ground Integrity (GI), in that 0% represents zero visibility and 100% represents maximum visibility (bare ground). Zero – 0%; Poor – 1-25%; Moderate – 26-50 %; Fair – 51-75 %; Good – 76-85%; Excellent – 86-100%. The better the visibility, the more potential there is for locating cultural/archaeological material.

# 3.0 PREVIOUS RESEARCH

## 3.1 Literature review

The survey areas occur in the traditional estates of two tribal groups, the Jingili and Alawa People (Tindale 1974; Sharpe 1969). The magazine *Walkabout* (1941) reports on a story of murder at Tanumbirini. Mick Mummum was killed with a shovel spear by Jimberriemudgee. Jimberriemudgee was later acquitted of the crime on the basis that he was acting under tribal law, for Mick had stolen a ceremonial token (Walkabout, 1941:20). The article indicates that Aboriginal people were still living a traditional lifestyle at least until the 1940s in the area. A photo believed to be of Jimberriemudgee is shown below, although it is not stipulated in the article (Fig. 3). This was the only account found not only of a traditional man in newspapers at Tanumbirini, which also names him and purports to show his photograph.



*Figure 3. Photograph believed to be of Jimberriemudgee (The Bulletin, 1937:12).*

Of another historical note is that the famous Dr. Clyde Fenton had crashed his aircraft while assisting a patient at Tanumbirini Station in 1937:

> Fenton's last call was to Tanumbirini Station. It lies between the O.T. line and the Gulf. I is so remote that nobody but a Territorian knows how to pronounce its name – Tanum*birini* is the way to say it – and all the newspaper maps mark it inaccurately. Round about it run all the the waters from north-of-the-Barkly and beyond as they swirl to the sea in a mze of flood-torn creeks. Nature has piled a little of every kind of fauna, flora and geology in tis vicinity – lancewood, spinifex, jagged limestone outcrops alive with death-adders, flats covered with long grass which are a snare and a delusion, since they are cross-runned with hidden gullies among the turkey bush.
>
> Tanumbirini itself looks, on the map, like a major town. I remember it as a hut of rough- piled stone with an iron shanty beside it. Bullterrier mongrels were tied, yelping, at every corner. Balsc from beyond the Roper wer to be heard 'lu-luing' in the distance as they made a leisurely way home from their annual walkabout to the Weiran …
>
> … Fenton set out on that long lead to help one patient as an ordinary medico would leave on a suburban trip. He was discovered after a week in the wilderness, alone, walking round in circles, in country in which all the distinctive seasonal and directional landmarks of further

> inland are missing. It was good shooting, in a region where compasses behave like teetotums. He was, fortunately, safe (The Bulletin, 1937:12).

Upon being rescued by the RAAF, Dr Fenton subsequently flew is own aircraft back to Darwin:

> DR. FENTON FLYING BACK.
> Escorted by Air Force Plane.
>
> Darwin, Oct 1. – Despite the gruelling experience he underwent after his forced landing near Tanumbirini station last week, Dr. C. Fenton, the flying doctor of the Northern Territory, yesterday flew his own plane from Newcastle Waters to Katherine by Flight-Lieutenant Hely in an air force plane. Although it was realised that he was quite capable of handling his own machine, it was felt that such a precautionary step was essential.
>
> Although nothing definite is known, it is believed that Dr. Fenton will fly to Darwin during the week-end (West Australian, 1937:20) (see Fig. 4).



*Figure 4. 'Dr Clyde Fenton, the flying doctor of the Northern Territory Medical Services, who had been missing for a week, was found yesterday near Tanumbirini Station' (Sydney Morning Herald, 1937:18).*

*Archaeology*

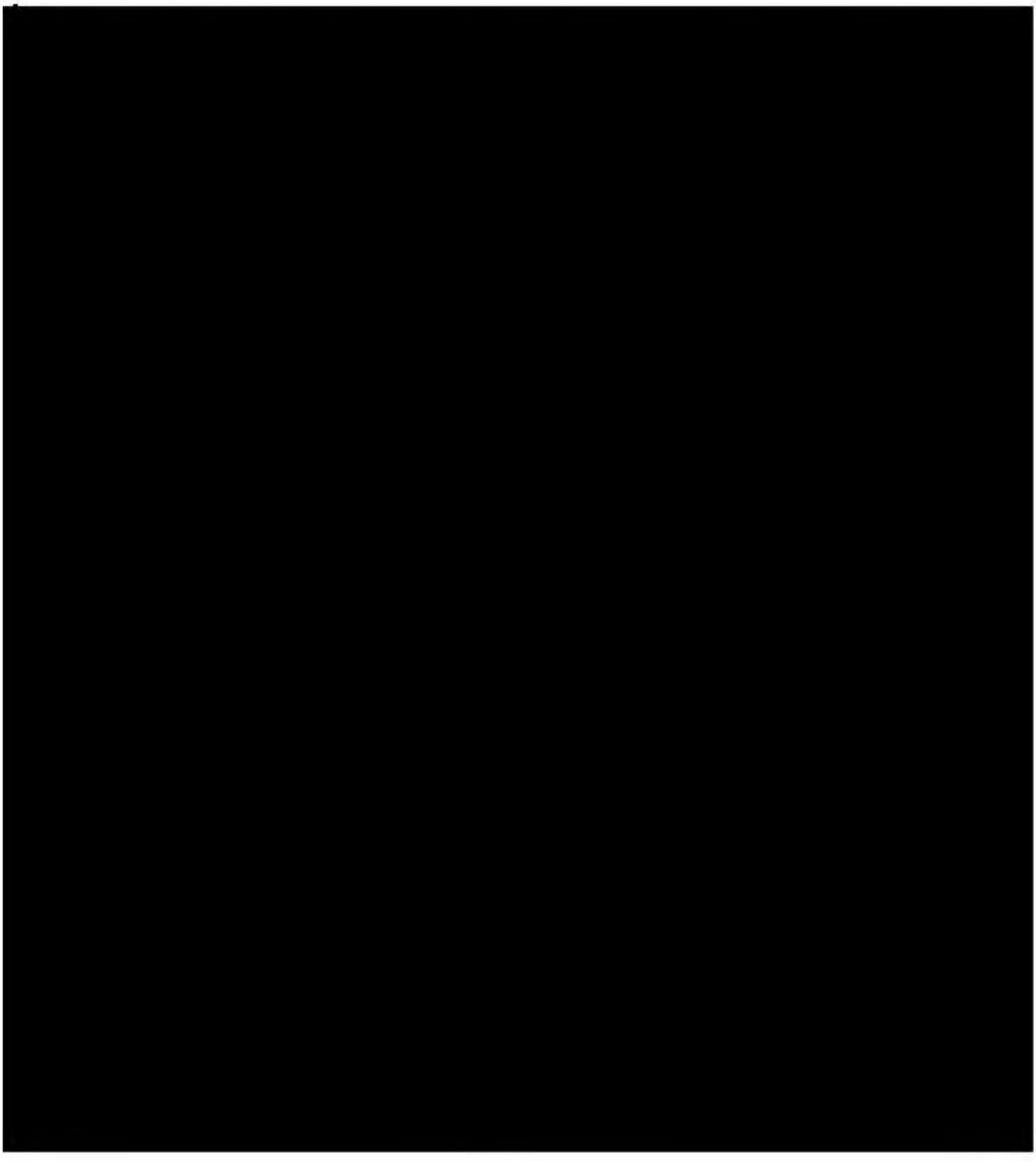
As noted in Section 2.1.2, no previously recorded archaeological sites in the survey area occur on the Northern Territory Sites' Register. Santos, however, provided a report by Lance (2019) that did overlap with some of the areas investigated in this report. In that report, 22 sites were recorded. These are listed in Table 2 and mapped in Figure 5. Of main interest to this report are the sites recorded at Lagoon Creek, in the western survey block, which represent the only high-density artefact scatter sites found in that survey.

The surveys in 2019 made the following observations:

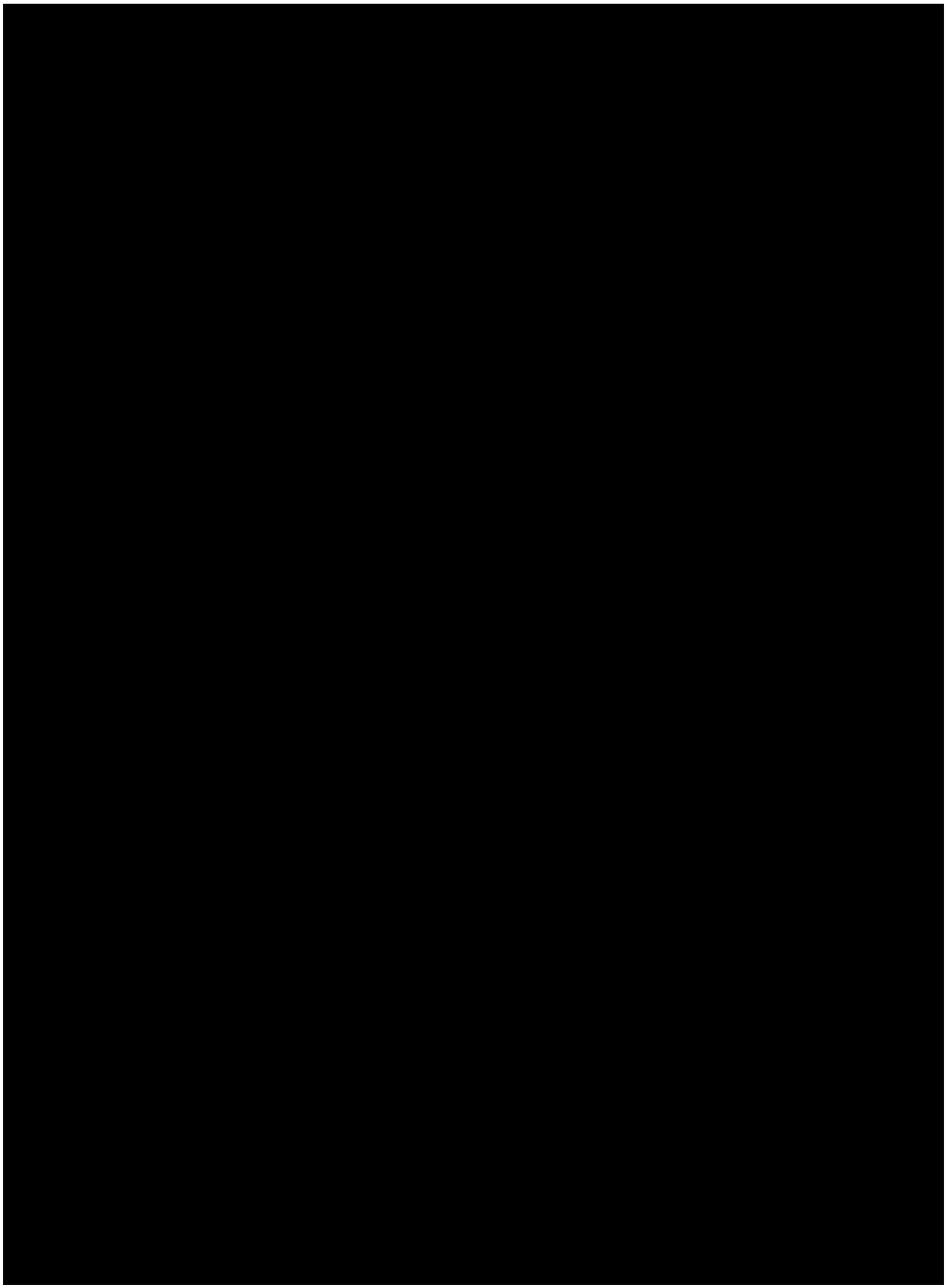
> The isolated stone artefacts included a range of different types, including cores and unmodified flakes, flake tools, grinding stones and mortars and bifacial spear points (both

> broken during use and incompletely made). The original investigation in May 2019 concluded that there were no locally available sources of stone suitable for tool-making. The present study corroborates this finding, although a small range of different raw material types were found, including quartzite, silcrete, chert and volcanic rock. The small stone artefact size and the presence of similar stone varieties in a number of different locations across the project area, does suggest that the materials had come from a small number of sources located some distance away (Lance, 2019:25).

The archaeology in the survey areas is, therefore, predicted to be characterised by low-density artefact scatters and isoliths. No suitable stone, or very little, for stone tool production was previously found implying that all artefacts had been brought in from elsewhere. The only significant sites would occur at Lagoon Creek, through which several of the seismic lines would pass through.







# 4.0 METHODS

## 4.1 Survey method

Archaeological survey methods are often based on sampling strategies. These strategies can be 'purposive', where specific areas are targeted, or 'probabilistic', where decisions are made to survey without any prior knowledge or predictive model of what heritage resources might exist in the landscape to be surveyed. Cultural heritage survey strategies generally involve transects across project areas chosen at random (probabilistic) to avoid possible bias in the results or transects within particular areas (purposive) known to potentially contain Indigenous cultural heritage or contain sites that were identified in previous research or surveys.

The survey was conducted using ATVs, as helicopter access was denied by the station owners. The ATVs provide a finer survey resolution by moving slowing over terrain. Their low height also provides an excellent platform to see the ground.

Water is a key determinate as to where people were in the environment. Waterways are, hence, targeted as well as stony outcrops that may have been utilised for stone tool production. Formal tool types are to be photographed and a GPS grid reference recorded for each find greater than three metres apart i.e., the accuracy reading of the GPS unit. A UAV was used to obtain aerial perspectives of sites and to scout out areas of high archaeological potential. The survey consisted of pedestrian inspections of areas with a high likelihood of archaeological finds. Other areas were inspected that had a low probability of finds as a control to determine if any archaeological material did indeed occur there or not.

### *4.1.1 Identification of archaeological material*

Stone artefacts, including tools and debitage, the by-product of manufacture, are identified on the following criteria after McCarthy (1976), Holdaway and Stern (2004):

- Bulb of percussion
- Erailure scar (on the ventral surface)
- Waves of force
- Point of force application (PFA) and associated ring crack
- Termination types (e.g., feathered, stepped, hinged, plunge, bending initiation)
- Flake scars (dorsal scars and ridges)
- Cores (identified by the presence of negative flake scars)
- Hammer stones (identified by the presence of end-crushing on pebble stones)
- Retouch (reworking of flake margins)
- Raw material type
- Grinding stones (very smooth wear on upper surface)

List of artefact type abbreviations:

- Ad – Adze (Burrens, Tulas etc.)
- An – Anvil
- B – Blade
- C – core
- Cp– Core piece
- Ct – Core tool
- F – flake
- Fp – flake piece
- Gs – Grindstone/Grinding plate
- Gh – Grinding hollow

- Hs – Hammer stone
- M – Manuport
- Mp – Multi platform core
- Rtf – retouched flake
- S – Scraper
- Sp – Single platform core
- Ts – Top stone
- X – Axe/wasted cobble
- Z – Other e.g., ceremonial

List of artefact raw material abbreviations:

- B – Basalt
- C – Chert
- D – Dolerite
- Ch – Chalcedony
- G – Greywacke
- Gr – Granite
- Hs – Hornsfel
- Im – Indurated mudstone
- J – Jasper
- SS – Sandstone
- S – Silcrete
- Q – Quartz
- Qz – Quartzite

### *4.1.2 Definition of archaeological sites*

#### *4.1.2.1 Historical Sites*

Historical sites in north Australia are those that have physical evidence of European and non-European activities. These range from Macassan sites to military sites of WWII. These sites may overlap with Aboriginal heritage sites.

#### *4.1.2.2 Aboriginal Heritage Sites*

Aboriginal archaeological sites can be classified by seven main types: 1) stone knapping sites, including quarries, 2) background scatters, including isoliths, 3) stone arrangements, such as mounds, walls, fish traps or stone motifs, 4) shell middens, 5) burials, 6) scarred trees and 7) rock art sites.

Burke and Smith (2004:63) define an archaeological site as ‘any place that contains the physical evidence of past human activity. Australia, however, has what has been referred to as a background scatter of stone artefacts, which refers to low-density artefact scatters that either represent singular knapping events (‘dinner-time’ camps or ‘hunting camps’), or larger sites that have been buried or disturbed. To differentiate this site type from larger sites that may contain thousands of artefacts, the term Archaeological Site (AS) is used to describe home-camps or quarries i.e., places where people have been returning to for millennia, as opposed to sites that have very low artefact densities that represent sporadic visits i.e., background scatters (BS). Others have called these sites persistent occupation sites, whereby people have return to frequently, or visit sporadically over a long period of time (Schlanger, 1992).

## 4.2 Assessment of archaeological significance

From personal observations, Aboriginal people regard all material cultural heritages as significant. They are, after all, the tangible reminders of their culture and represent a finite resource. It is a western construct to assess sites and objects as a hierarchy. Significance assessment in archaeology, therefore, is complex, dependent on a range of factors. These can be classified as low, moderate, or high significance, following the International Council on Sites and Monuments (ICOMOS) Charter for the Conservation of Places of Cultural Significance, or the Burra Charter (Maquis-Kyle and Walker, 1992).

Archaeological significance, however, very much depends on the research questions being posed (see Sullivan and Bowdler, 1984; Moratto and Kelly, 1981; Sullivan, 1983). Generally low significance finds have poor diversity of artefact types and in very low densities. Sites that are likely to be particularly valuable in answering archaeological research questions are given moderate archaeological significance. High archaeological significance sites have very high artefact densities per metre squared, with rare and unique finds that is well preserved and has high ground integrity. The concept of significance in cultural heritage assessments is often irrelevant, whereby the client merely seeks to determine absence or presence of cultural material on their proposed works area and how best to mitigate their impact on those finds to comply with the *Act*.

# 5.0 RESULTS

## 5.1 Archaeology

The survey in areas south of the highway were constrained by bullwaddy and lancewood stands that were impenetrable to the ATVs and even to pedestrian access (Fig. 6). Nonetheless the survey skirted around these impenetrable areas. Four archaeological sites and four background scatters were recorded. [redacted]. [redacted]
The archaeology was characterised by isoliths and low-density artefact scatters on creek lines and at the edges of black soil plains. The main archaeological sites, or home camps, were the same as those recorded in the Lance (2019) survey, although their boundaries have been extended in all encapsulating Tanumbirini Station Site 4 (TAS4).

Tanumbirini Creek is a braided creek system that was predicted to have higher archaeological potential, but field observations indicated that the opposite is true. The northern areas of the western survey block flood during the wet season, obliterating any archaeological site. Furthermore, the escarpment country to the north of the highway was found to consist of shaley and conglomerate rock, not suitable for rock art shelters (see Figs 7 and 8).

Photographs of the isolated artefacts are shown in Appendix 1. The survey transect recordings are presented in Appendix 2, which describe the landscape and recorded GSV and GI values. GSV was mostly between <5 to 20%, while GI was mostly 81-100% (Figs 9 and 10). GSV was, therefore, overall poor while GI was overall very good, with the main disturbance caused by cattle.

The raw material types were predominantly silcretes, quartz and quartzite. No fine grained materials such as chert was seen. The tool types were points, scrapers, an adze and grind stones, while flakes and flake pieces made up the majority of finds. Table 3 list the finds and Figure 11 maps their location. The following subheadings describe the archaeological sites.

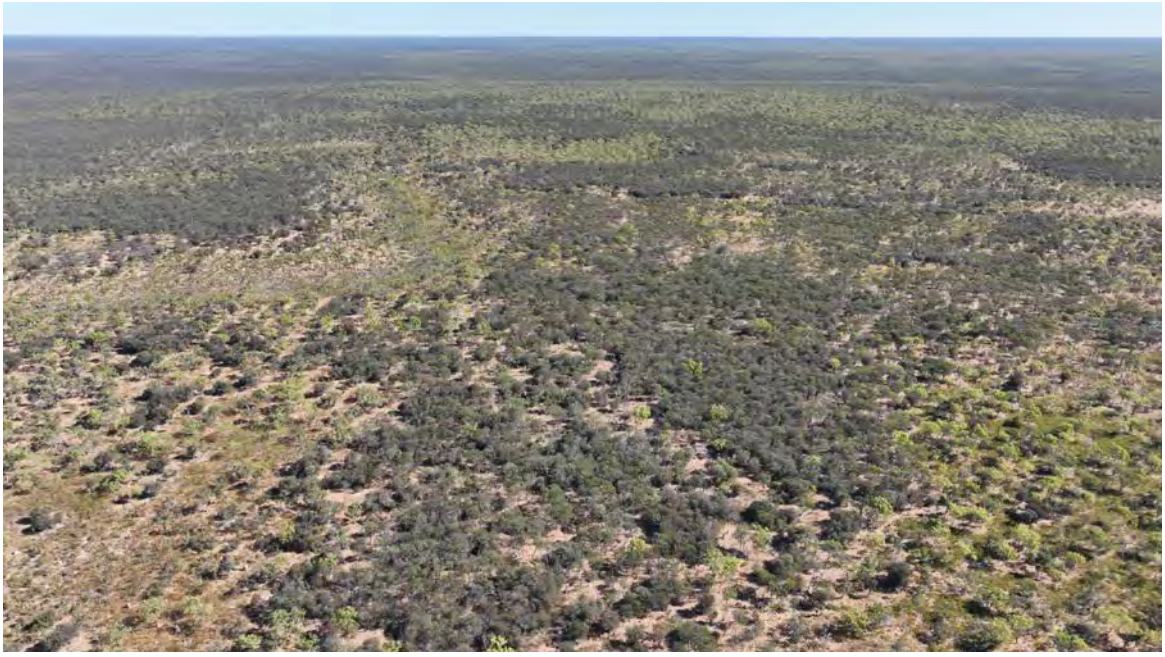


*Figure 6. Bullwaddy UAV view on line MCSAN23-03.*



*Figure 7. Tanumbiri Creek UAV imagery.*



*Figure 8. Escarpment along MCSAN23-07.*

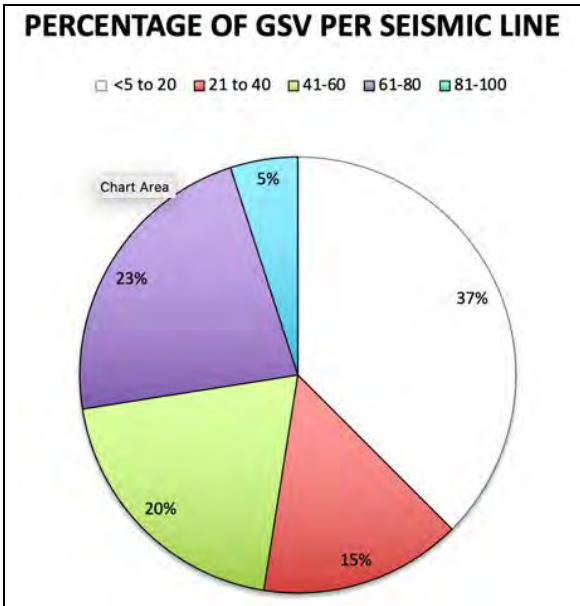



*Figure 9. Percentage of GSV per seismic line. Total number of observations: 40.*

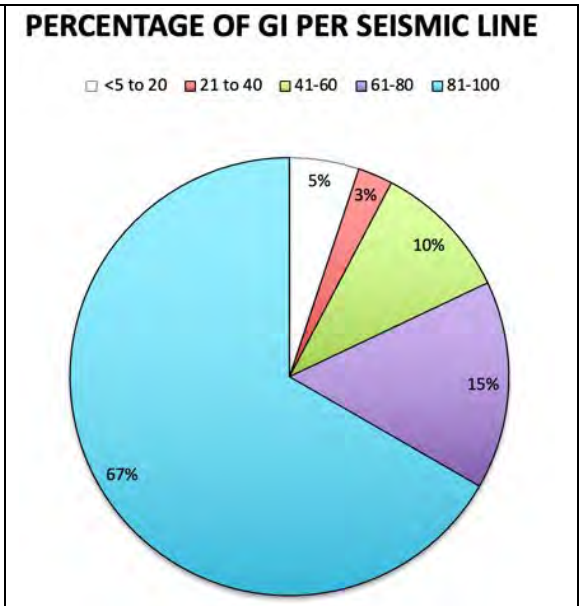
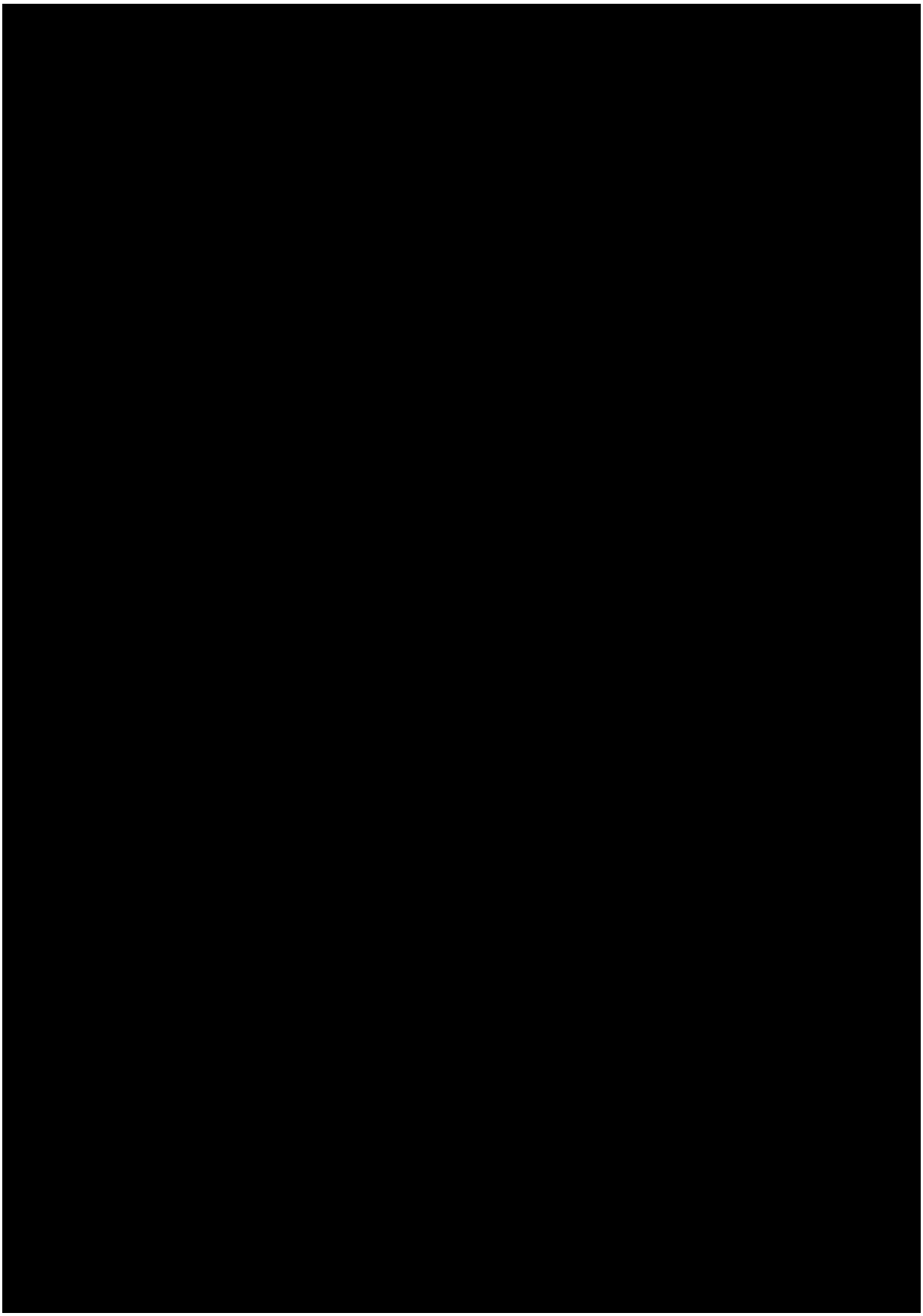



*Figure 10. Percentage of GI per seismic line. Total number of observations: 40.*

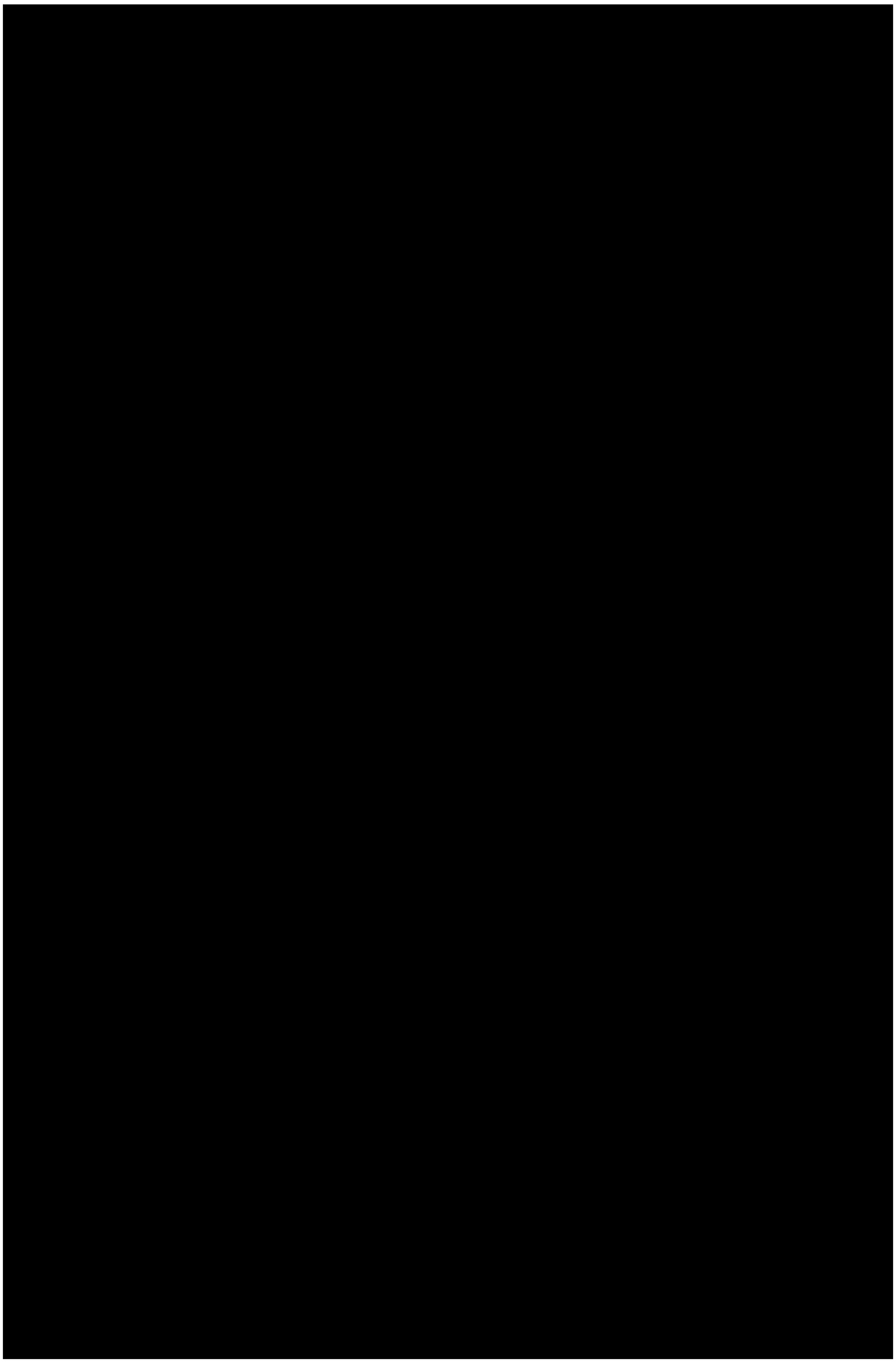
[redacted]



### *5.1.1 Tanumbirini Archaeological Site 1 (TAS1)*

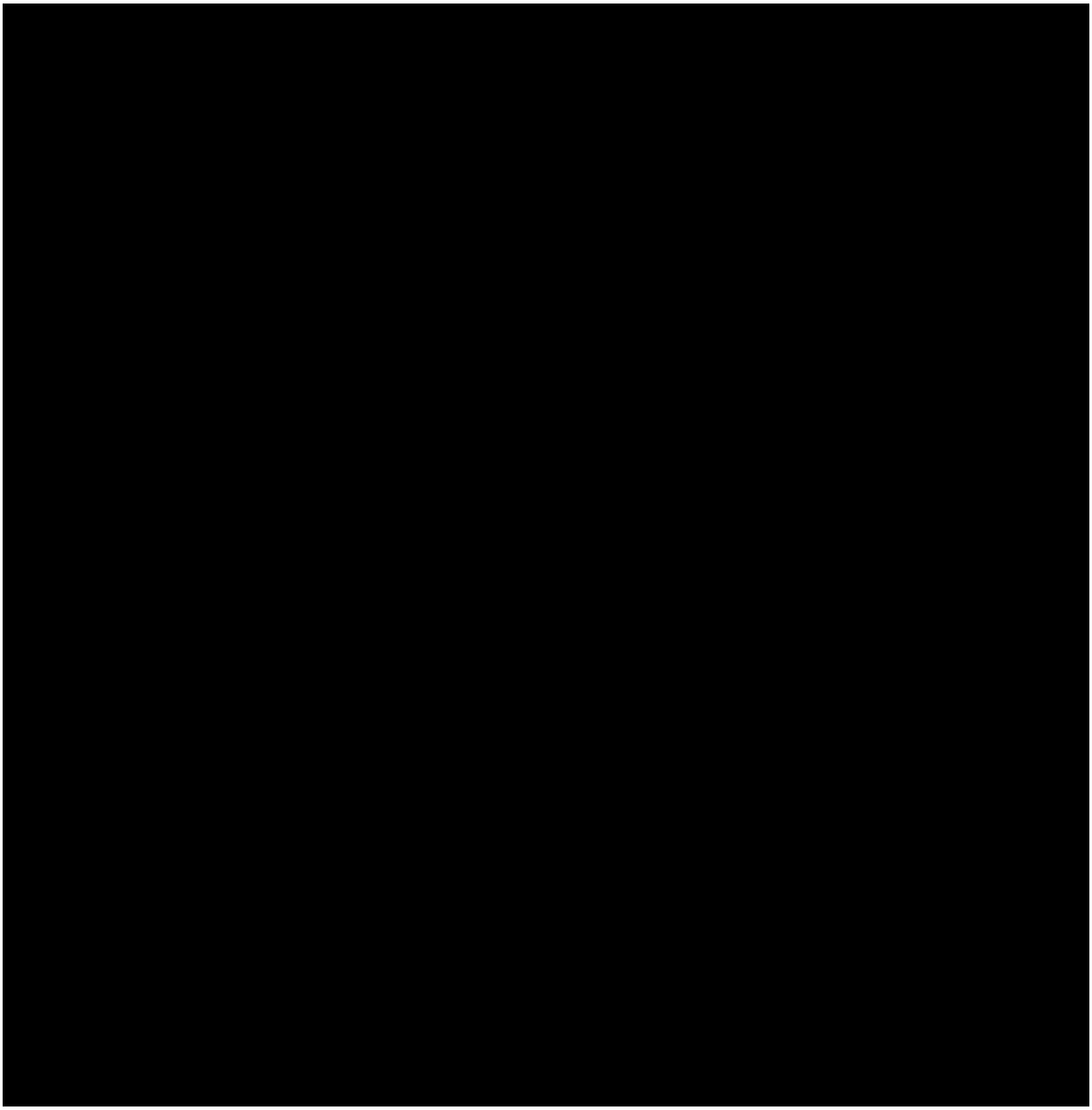
Tanumbirini Archaeological Site 1 (TAS1) is a low-density artefact scatter consisting of five stone artefacts associated with a small drainage line. The site occurs in flat, open woodland on laterite soils. The site may represent a singular knapping event. Finds are spaced out by over 50m and due to low GSV, there may be other material there. Figure 12 maps the site. The width of the restricted zone virtually covers the width of the seismic line corridor i.e., 25m either side of the site centroid. As a result, deviation around the site has been extended to a 100m radius from the site centroid, as the immediate area is assessed as having low archaeological potential. The artefacts are shown in Figure 13, all made on quartz or silcrete and the site context view is shown in Figure 14.

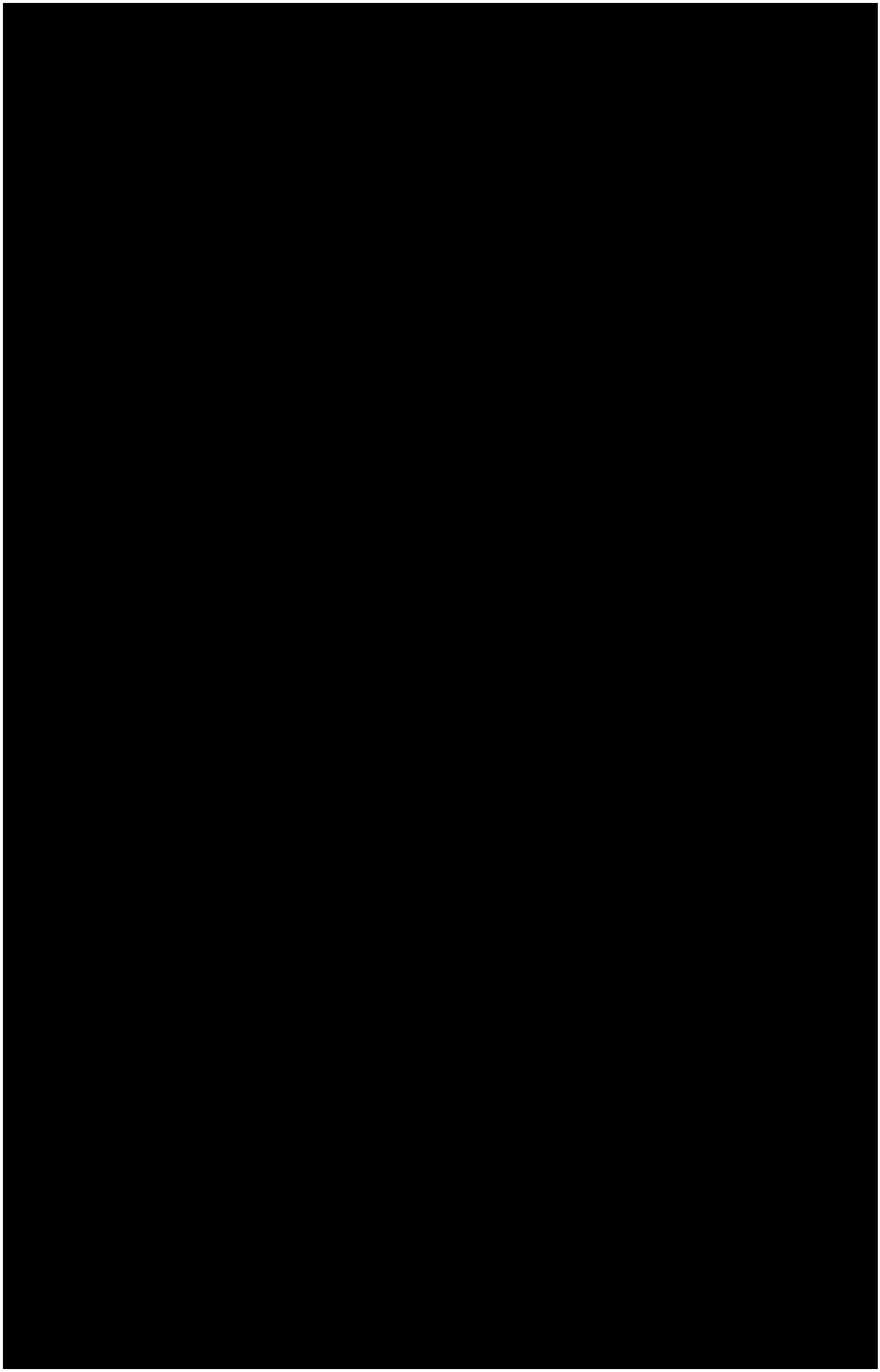




### *5.1.2 Tanumbirini Archaeological Site 2 (TAS2)*

Four artefacts were found at Tanumbirini Archaeological Site 2 (TAS2), which represents a low-density artefact scatter. The site occurs on an ephemeral creek and is relatively flat, with a gentle slope down towards the creek. Figure 15 maps the site and Figure 16 is of a typical silcrete flake. The site may represent a singular knapping event. Figure 17 shows the site context view.

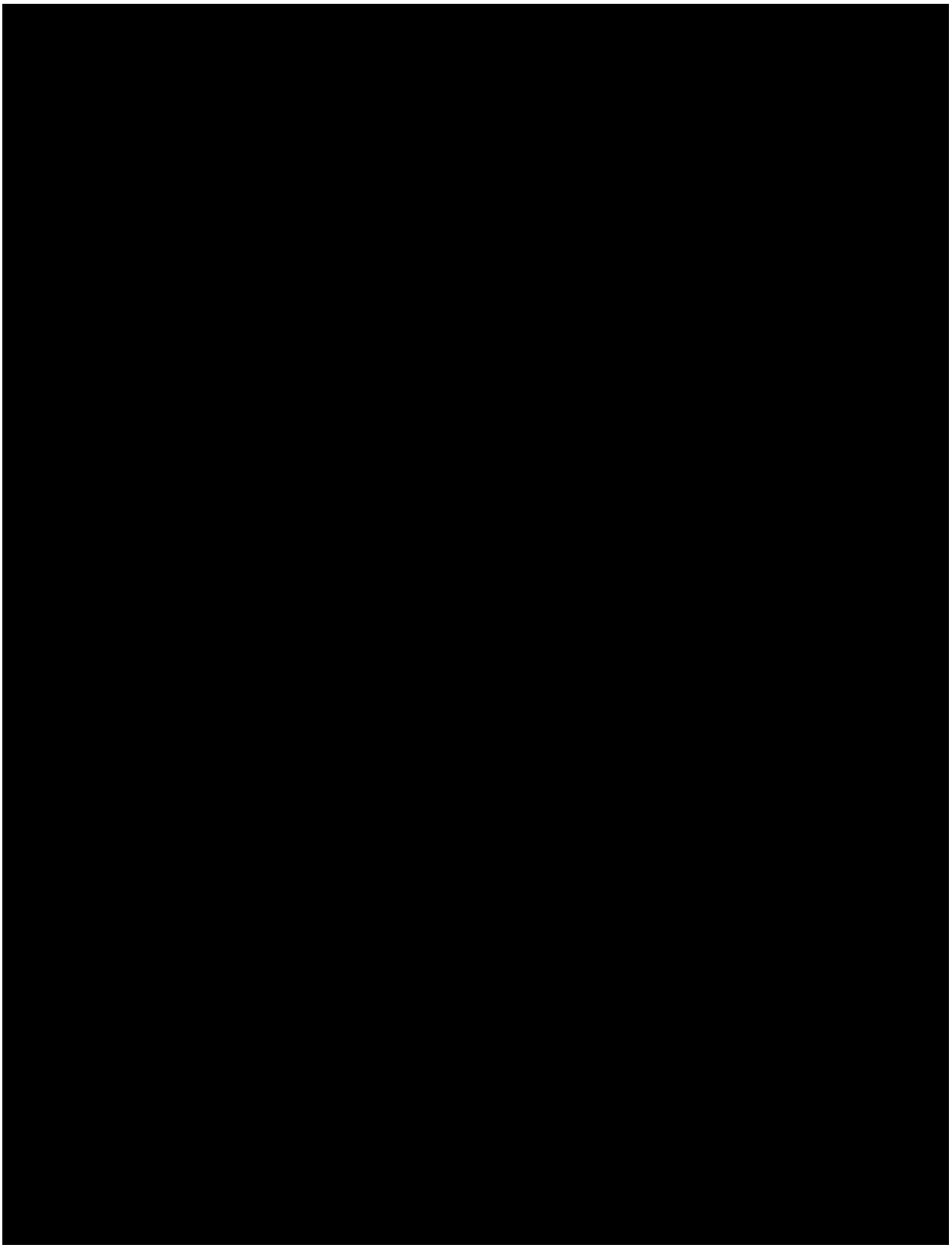


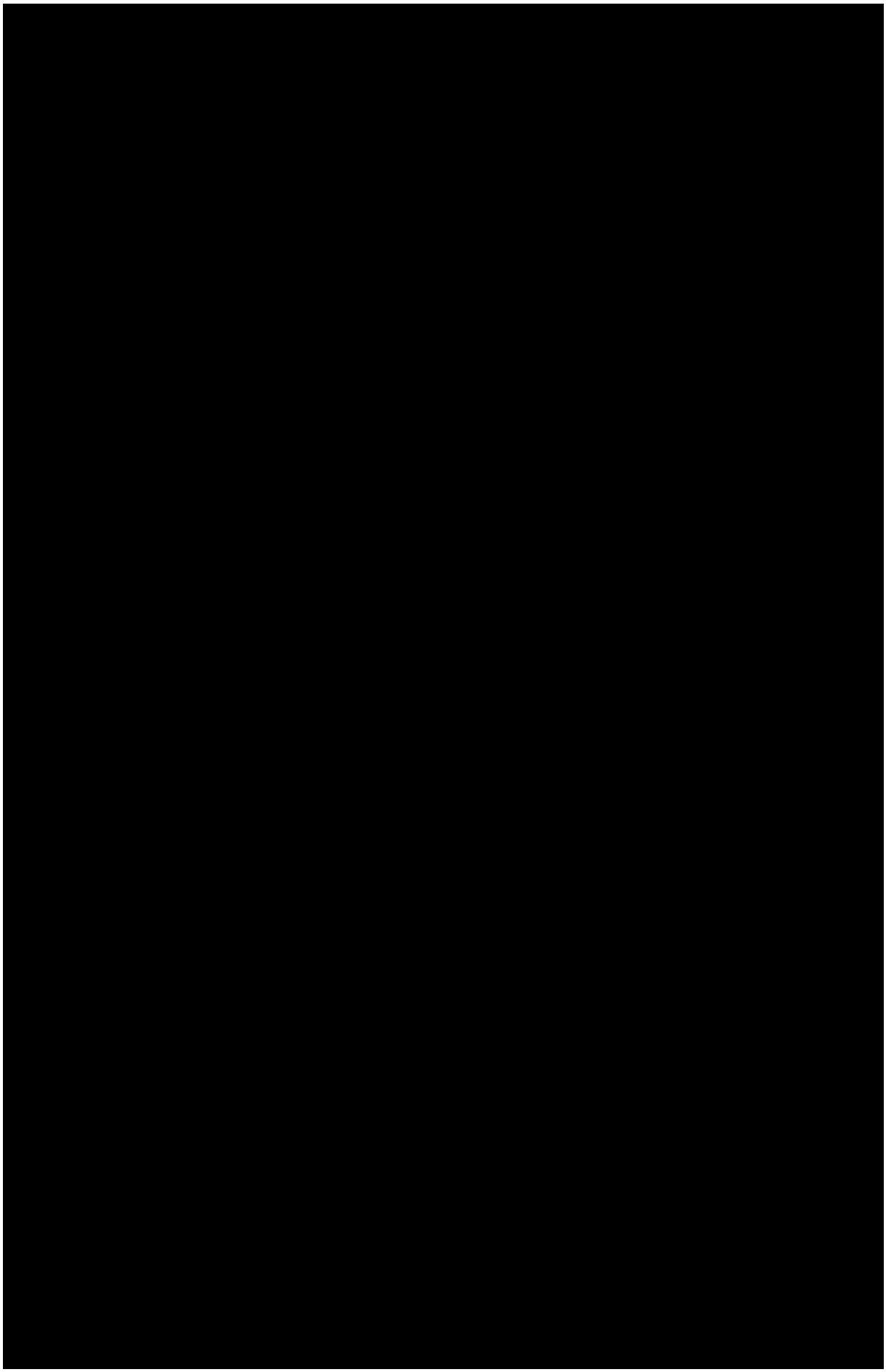


### *5.1.3 Tanumbirini Archaeological Site 3 (TAS3)*

Tanumbirini Archaeological Site 3 (TAS3) is a low-density artefact scatter consisting of flakes and flake pieces on quartzite. The site occurs on high ground on the southern bank of an adjacent low energy creek. The northern bank is much lower and floods reducing site preservation. Adjacent to black soil plain, approximately 200m to the west. Figure 18 maps the site. The artefacts are shown in Figures 19 and 20. The site context views are shown in Figures 21 and 22.







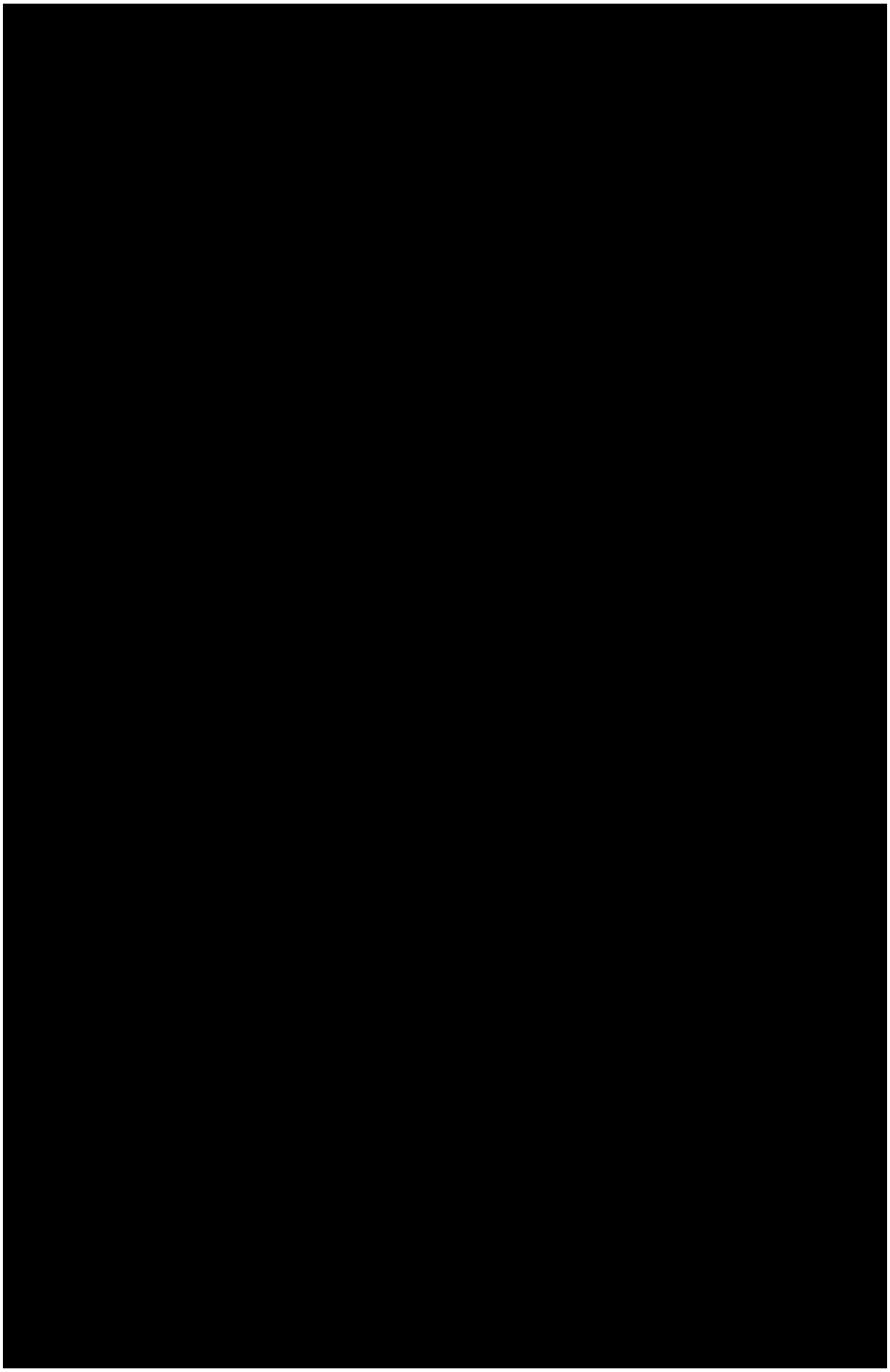
### *5.1.4 Tanumbirini Archaeological Site 4 (TAS4)*

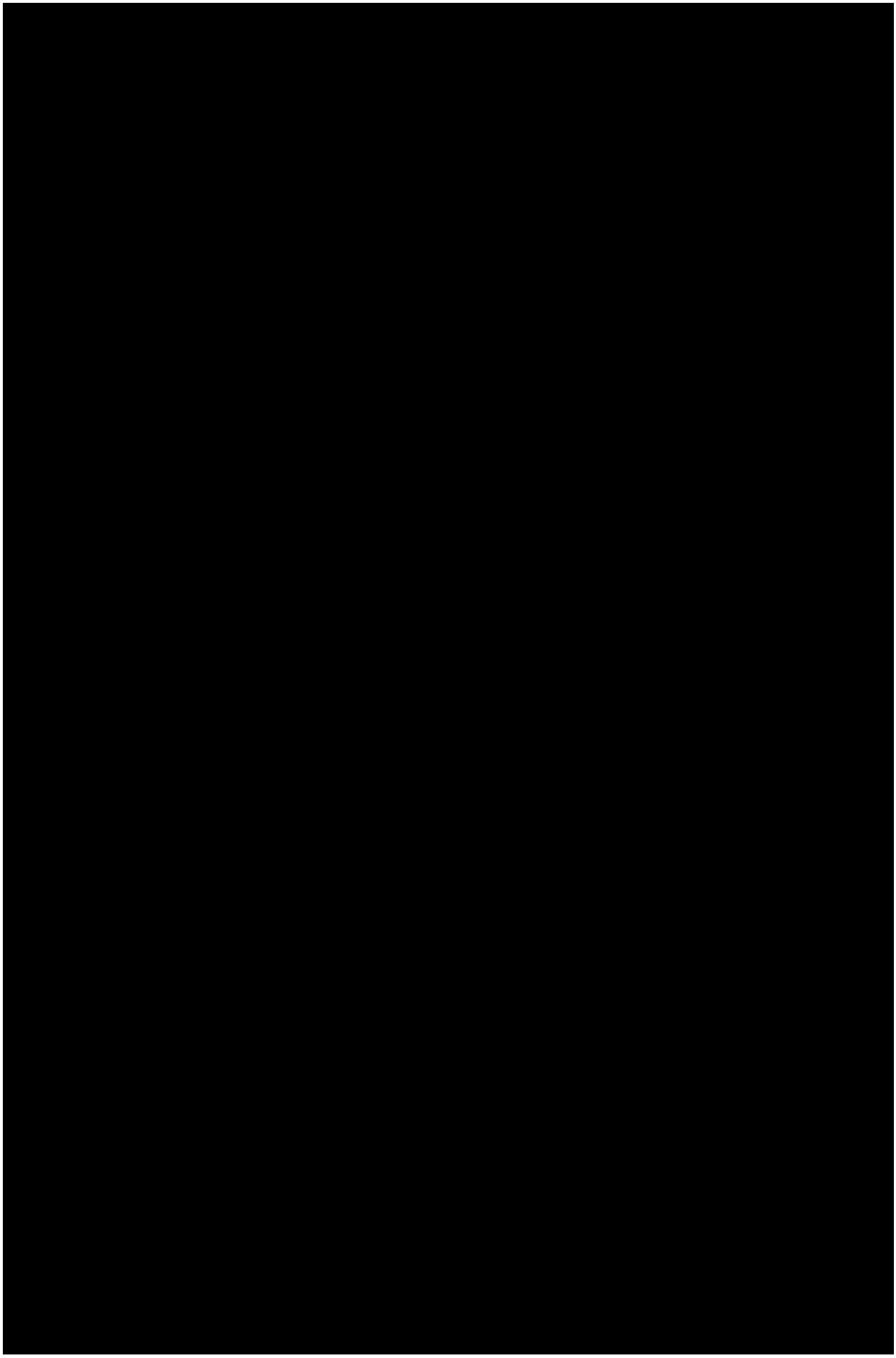
Tanumbirini Archaeological Site 4 (TAS4) is a high-density artefact scatter with a range of stone tool types, particularly intact grinding stones and spear points. Two previously recorded sites were recorded in the vicinity of [redacted] (see Lance, 2019). These sites both represent high density artefact scatters and are essentially home camps, or the main occupation sites found in the survey area. The sites were inspected and found to be much larger than first recorded, particularly [redacted] The site occurs on flat ground adjacent to a lancewood forest. There are patches of cleared ground along the creek, which may have been produced by erosion.

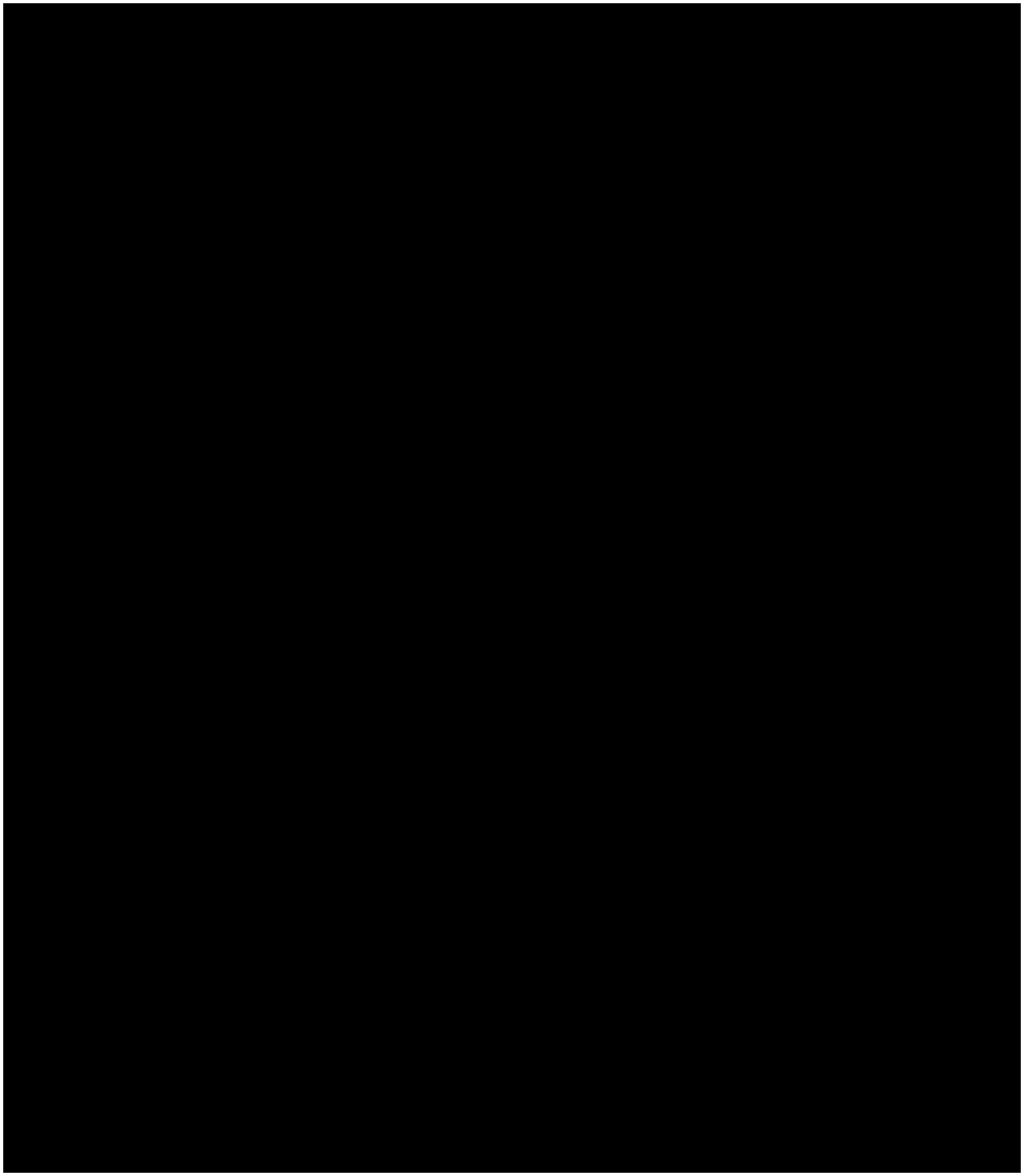
Additional artefactual material was found at the end of [redacted] suggesting that artefacts are quite likely to be all around the area. Figure 23 maps the site and for the purposes of this study, [redacted]. The site quite likely is a complex of knapping floors throughout the lancewood and along the banks of [redacted] The occurrence of lancewood and bullwaddy on [redacted] prevented their surveys.

Figure 24 [redacted], an example of the [redacted] (see Fig. 25). Figures 26 and 27show some of the [redacted]. The occurrence of grindstones continues at the end of line [redacted] (Fig. 28). Spear points are typically made on quartzite and are unifacially retouched on both margins. Figure 29 shows the context view of TAS4, while aerial perspectives are shown in Figures 30 and Figure 31.

[redacted]







# 6.0 CONCLUSIONS AND RECOMMENDATIONS

## 6.1 Conclusions

The proposed 274km of seismic lines by Santos on their EP 161 at Tanumbirini Station required a cultural heritage assessment. Ellengowan Enterprises was contracted by InGauge Energy to undertake an archaeological survey with a multi-disciplinary team consisting of an ecologist and weed management personnel. The survey was conducted using ATVs, which provided a good resolution over the ground. The survey, however, was severely constrained by stands of impenetrable bullwaddy and lancewood. Nonetheless, the results of the survey show that the proposed works will have an impact on cultural heritage sites.

Four archaeological sites were found, three of which are low-density artefact scatters found on creek and drainage lines. One high-density artefact scatter was found in association with a previously recorded site [redacted]. The site was determined to extend even further amongst the lancewood, which prompted an extension of its boundaries to include [redacted].

Several isolated stone artefacts, or isoliths were also recorded. The overall results of this survey concur with a previous study of the area that indicates no suitable stone for making stone tools occurs within the survey area and that raw material had been brought in for that purpose. All the stone artefacts recorded in this survey are made on materials, particularly quartzite and silcretes that were not seen in the survey area.

The following recommendations arise from this report to best mitigate the impacts of the proposed works on the archaeology. Adherence to this mitigation schedule would require no further actions by Santos. Further surveys through bullwaddy and lancewood are not required as no water sources occur in those areas and are considered to have low archaeological potential.

## 6.2 Recommendations

### *6.2.1 Recommendation 1: Archaeological sites*

- All archaeological sites are to be avoided. A radial site exclusion zone is suggested for archaeological sites as defined by their site centroids. These vary from 20m (site TAS2 and TAS3) to 50m radii exclusion zones for TAS1. Stop points are provide for seismic lines MCSAN23-01 to MCSAN23-05 to avoid TAS4. Handheld equipment only should be used north of the stop points.
- Walking/hand-carry of geophones through archaeological sites is permitted. No mulcher machine or driving through sites is permitted.
- TAS1 is cleared by 100m either side (east to west) from the centre line as no other artefacts were seen outside of its exclusion zone. This will enable the seismic team to deviate around the 50m radius exclusion zone around the site.

### *6.2.2 Recommendation 2: Background scatters and isoliths.*

- All background scatters (isoliths) are to be avoided. An exclusion zone of 10m from the site centroid is suggested for all isoliths.

# REFERENCES

Burke, H. and Smith, C. 2004. *The archaeologist's field handbook*. Allen and Unwin, N.S.W.

Holdaway, S. and Stern, N. 2004. A record in stone: the study of Australia's flaked stone artefacts. Museum Victoria and AIATSIS, Melbourne.

Lance, A. 2019. An Aboriginal and non-Indigenous archaeological assessment of proposed works in EP161, Southern Scope, McArthur Basin, Northern Territory. Unpublished report for Santos Ltd.

Maquis-Kyle, P. and M. Walker, 1992. *The Illustrated Burra Charter: Making good decisions about the care of important places*. Australian Heritage Commission, Canberra.

McCarthy, F. 1976. *Australian Aboriginal stone implements*. Australian Museum Trust, Sydney.

Moratto, M. and Kelly, R. 1981. 'Optimizing strategies for evaluating archaeological significance'. In Schiffer, M. *Advances in archaeological method and theory*. Volume 1. Academic Press, New York: 1 – 30.

Schlanger, N. 1992. 'Recognising Persistent Places in Anasazi Settlement Systems'. In Rossignol, J. and Wandsnider, L. (eds). *Space, Time and Archaeological Landscapes.* Plenum Press, New York: 91 – 112.

Sharpe, M. 1969. Alawa phonology and grammar. PhD Thesis, School of English, Media Studies and Art History, The University of Queensland.

Sullivan, M. and Bowdler, S. 1984. *Site Surveys and Significance Assessment in Australian Archaeology*. Department of Prehistory, Research School of Pacific Studies, ANU, Canberra.

Sullivan, S. 1983. 'Making a discovery: the finding and reporting of Aboriginal sites'. In Connah, G. (ed.) 1983. *Australian field archaeology, a guide to techniques*. Australian Institute of Aboriginal Studies, Canberra.

Tindale, N. 1974. *Aboriginal Tribes of Australia: their terrain, environmental controls, distribution, limits, and proper names*. University of California Press, Berkeley.

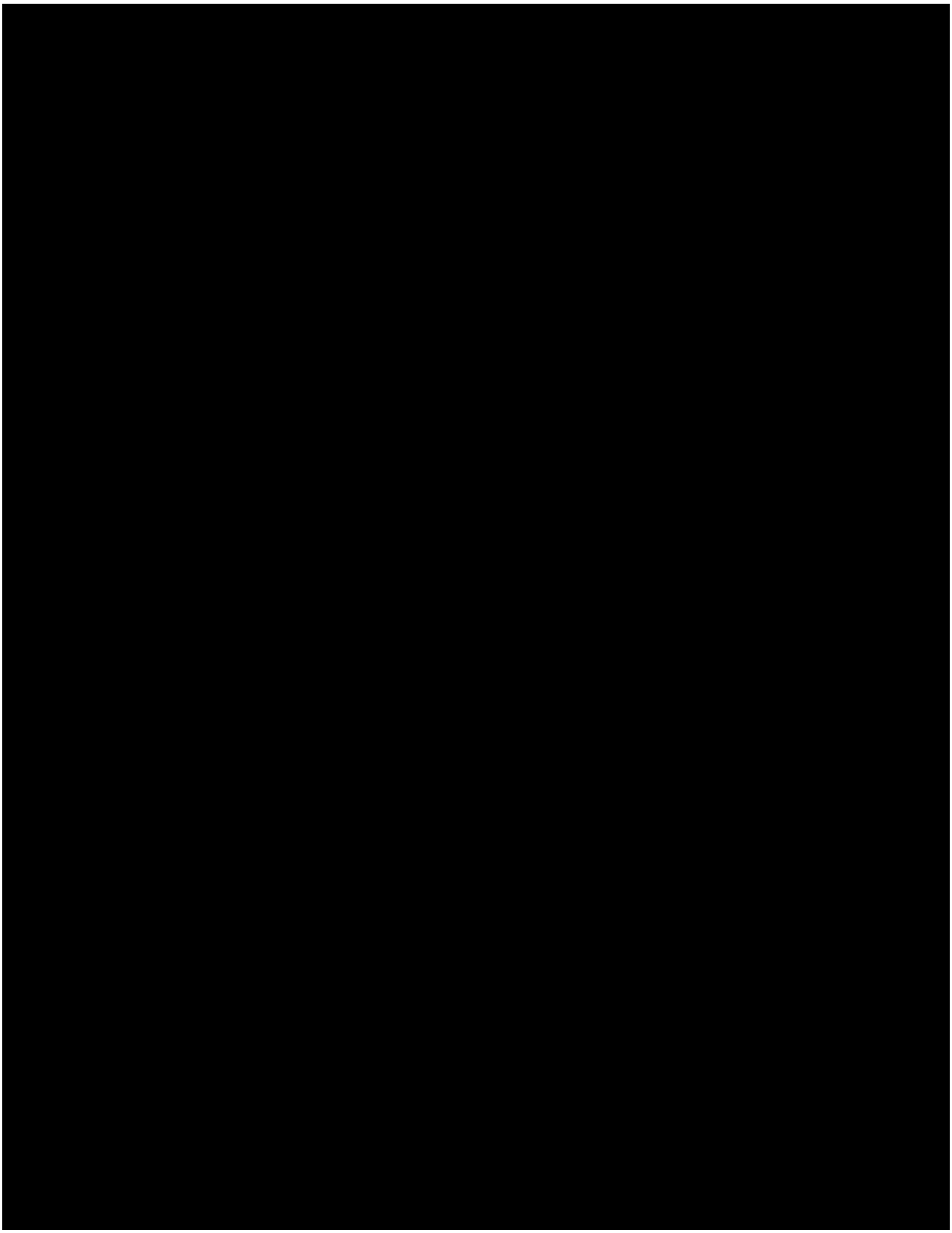
*Newspapers*

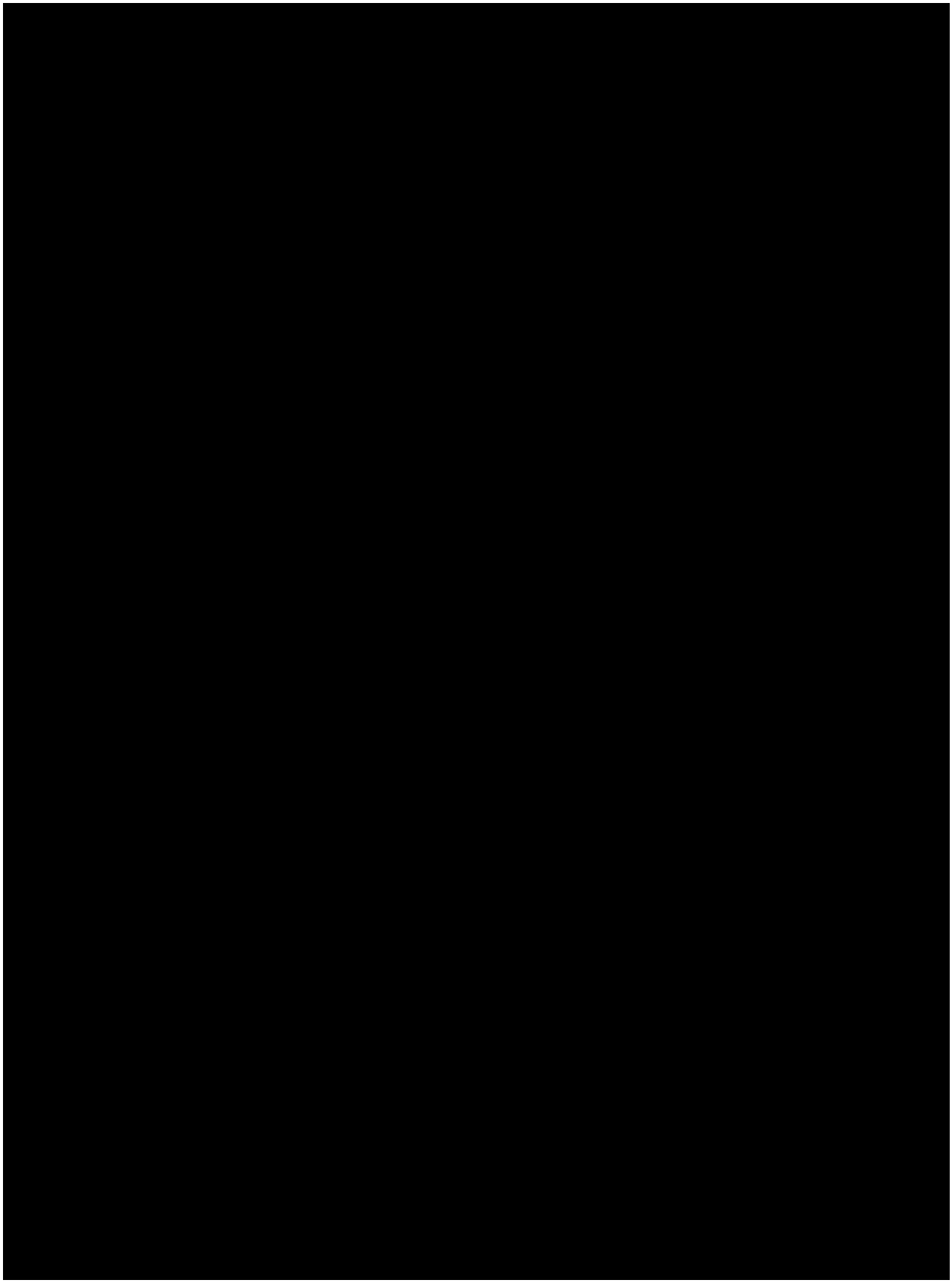
The Bulletin. 1937. 'Just a Pioneer Unit'. *The Bulletin*, 1937:12.

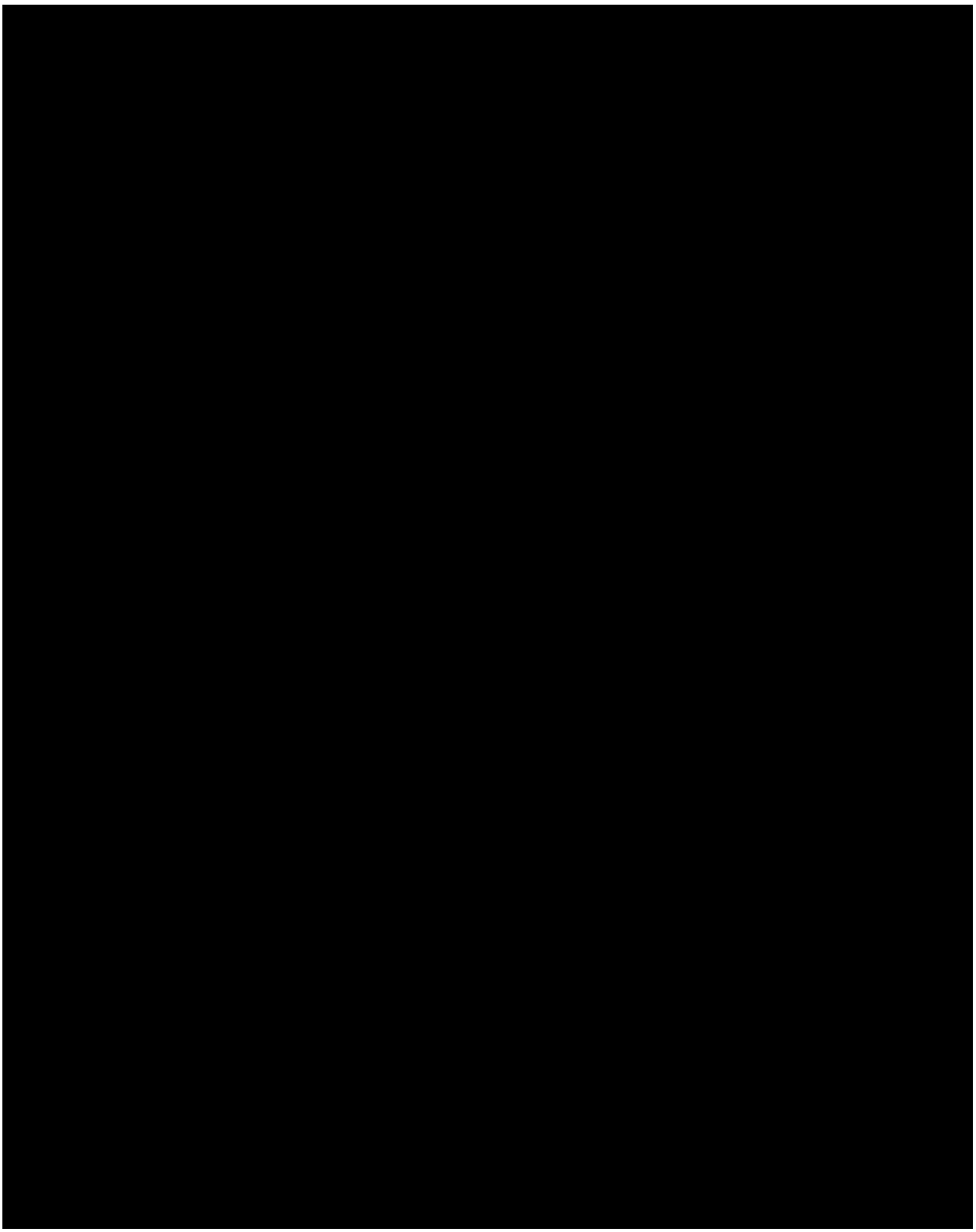
Sydney Morning Herald. 1937. 'Flying Doctor Found'. *Sydney Morning Herald*, 1937:18.

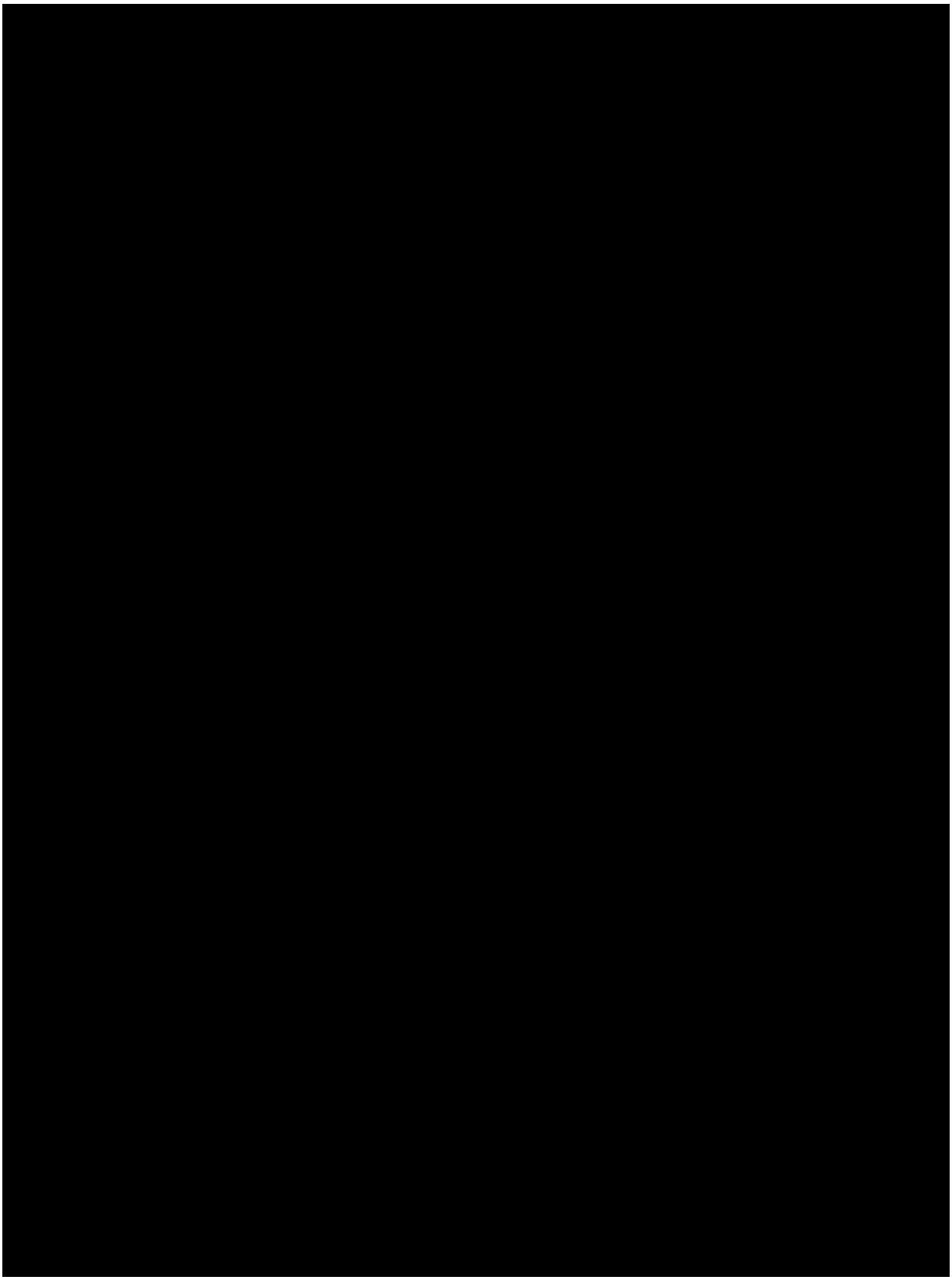
Walkabout. 1941. 'The Law and the Aboriginal'. *Walkabout*, 1941:20.

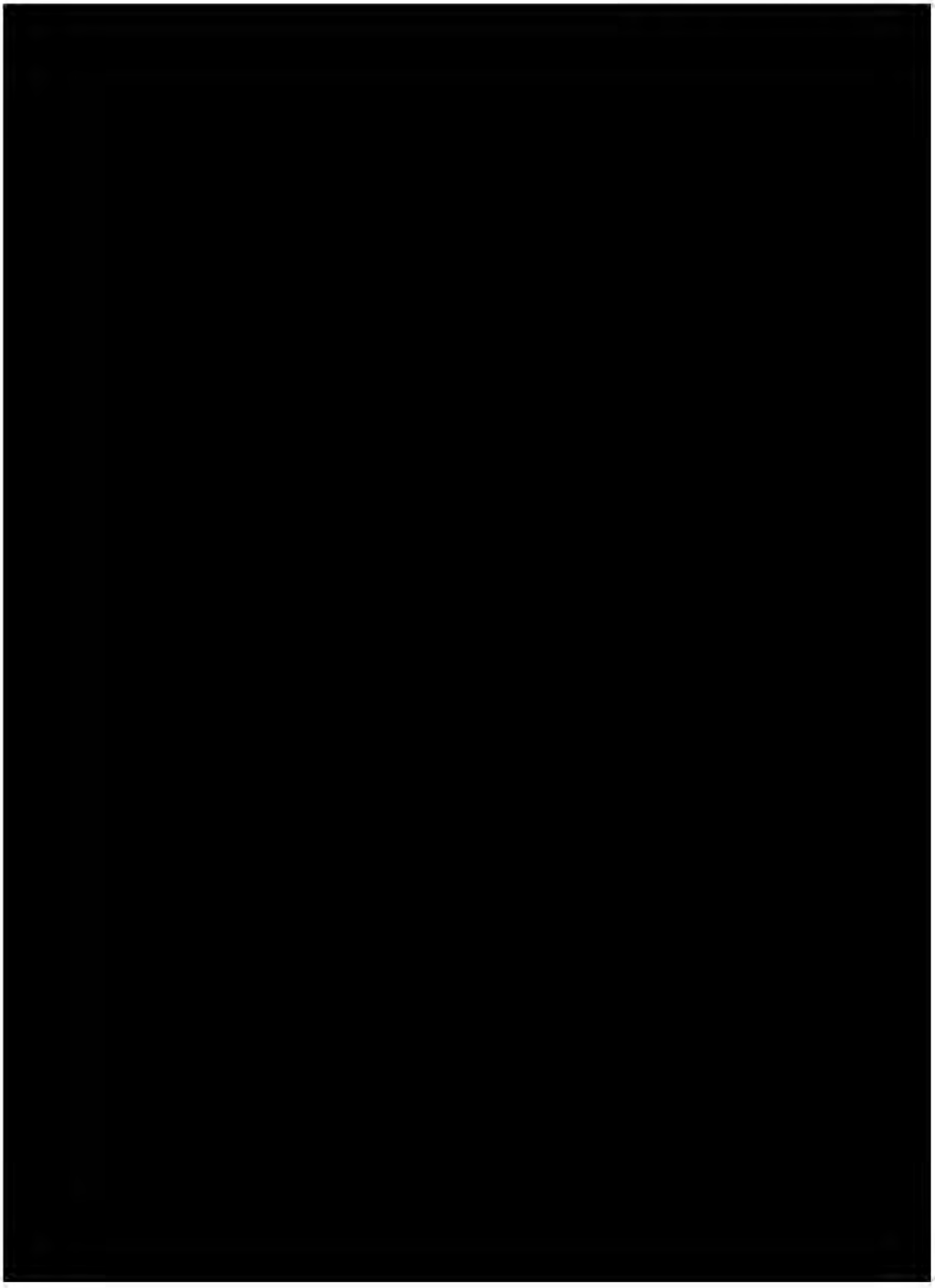
West Australian. 1937. 'DR. Fenton flying back. Escorted by Air Force Plane. *West Australian*, 1937:20.

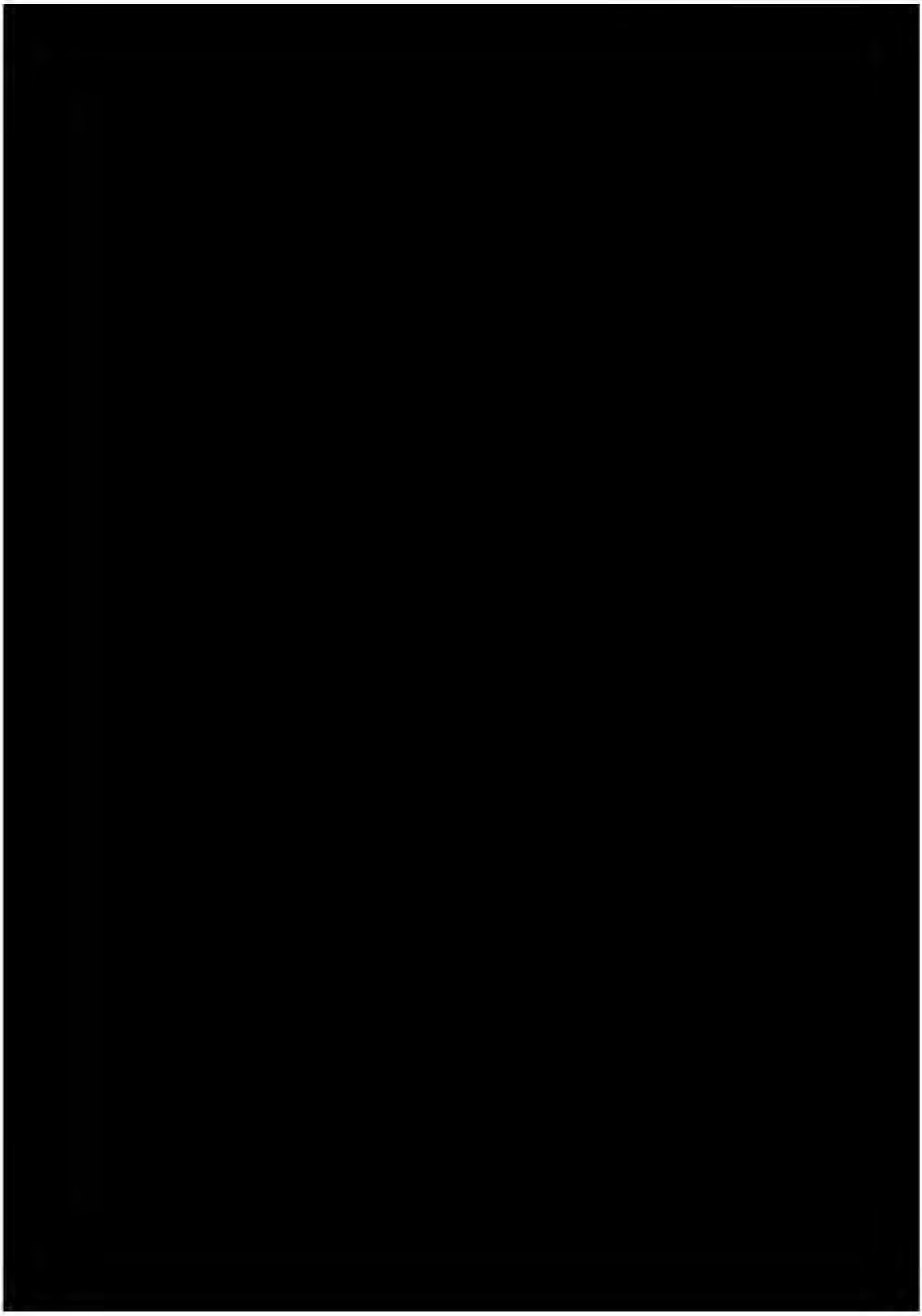


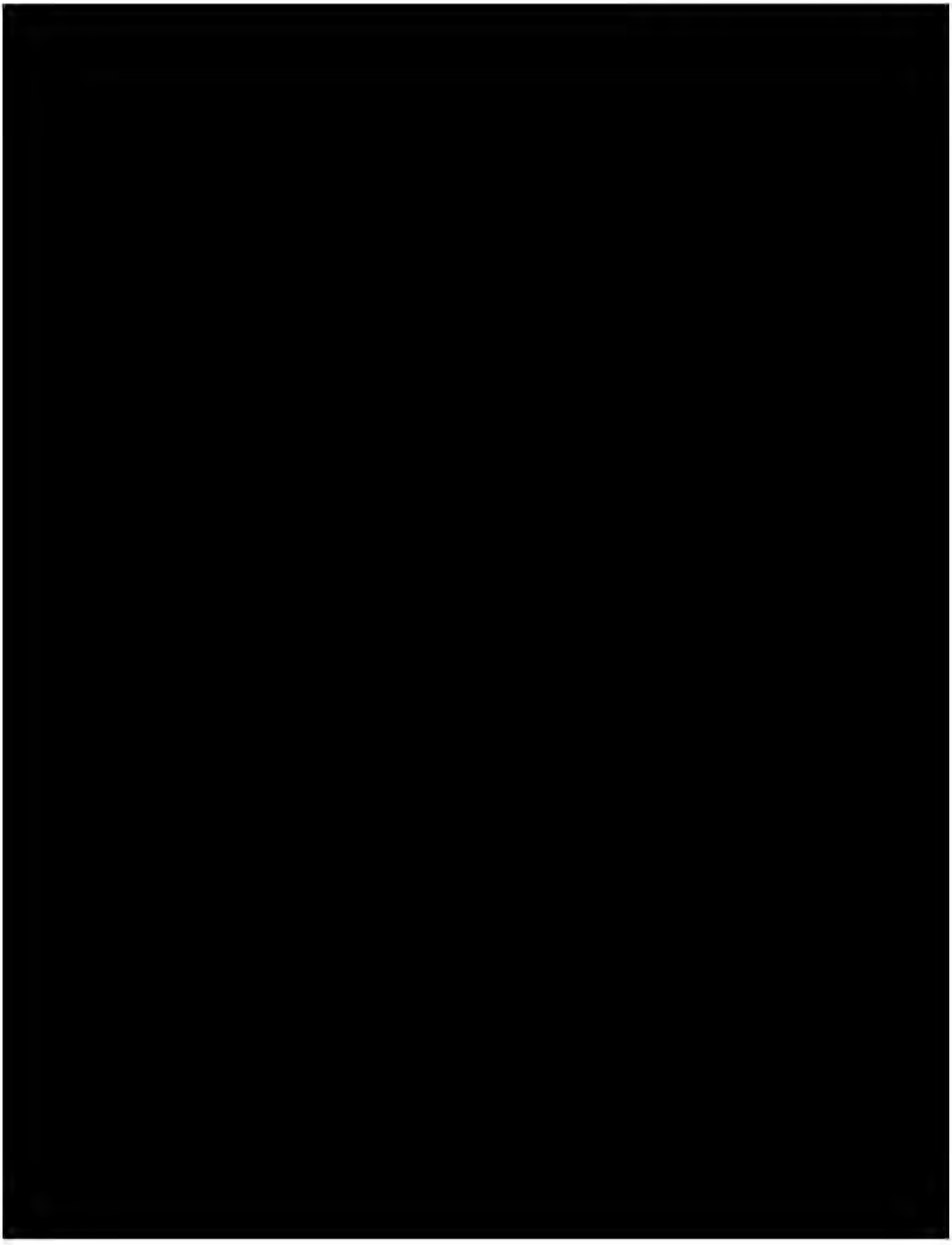


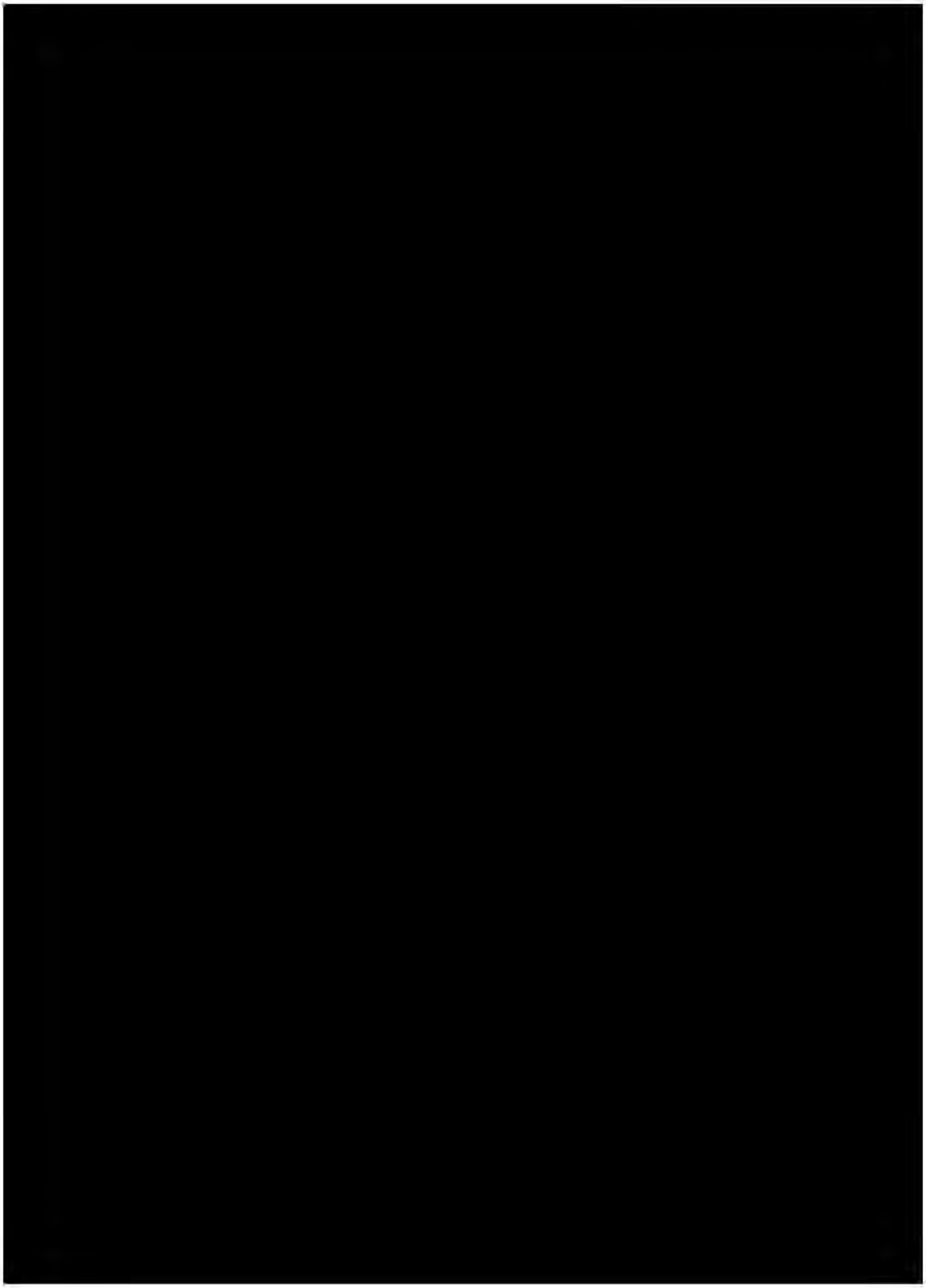


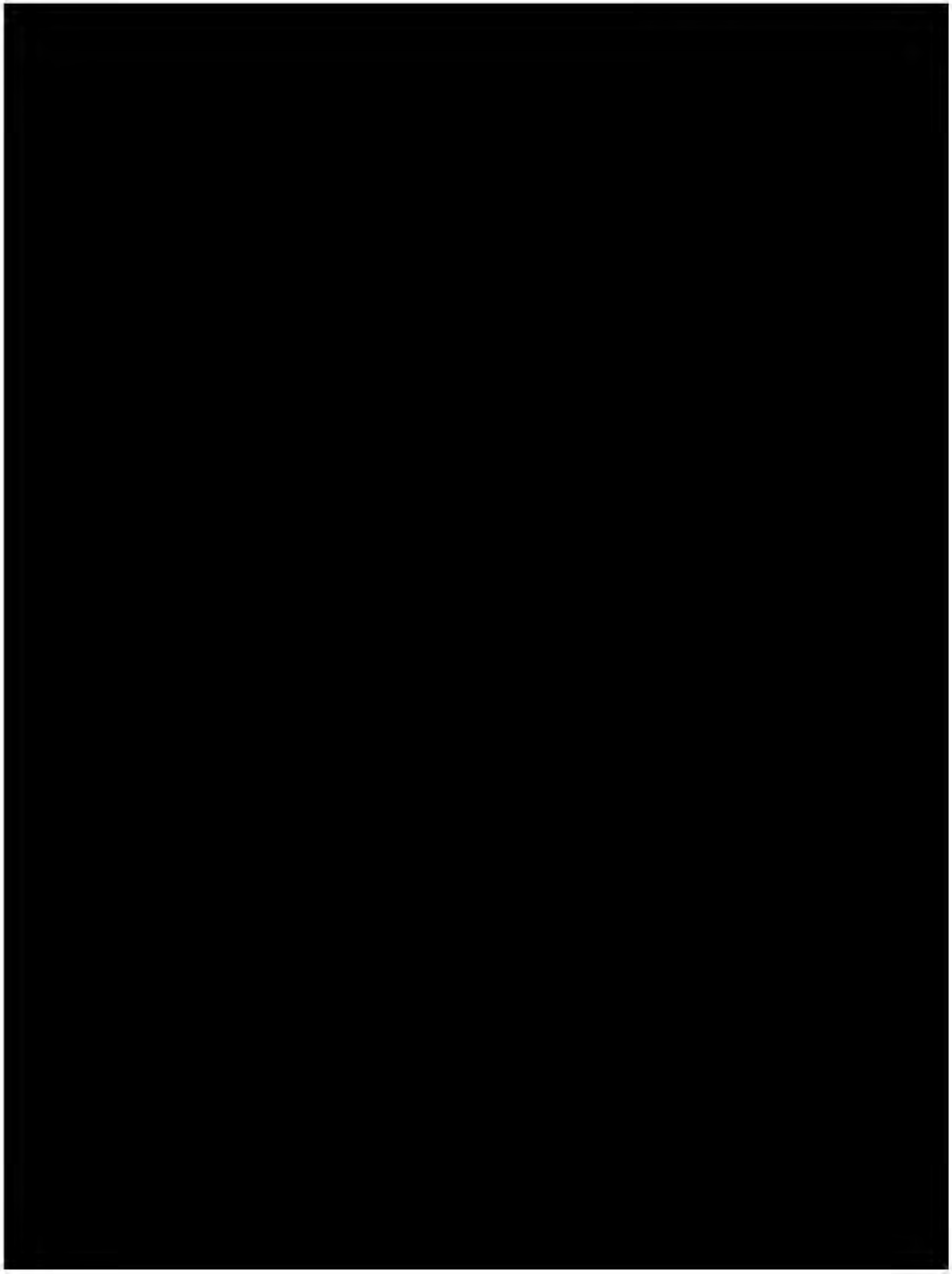


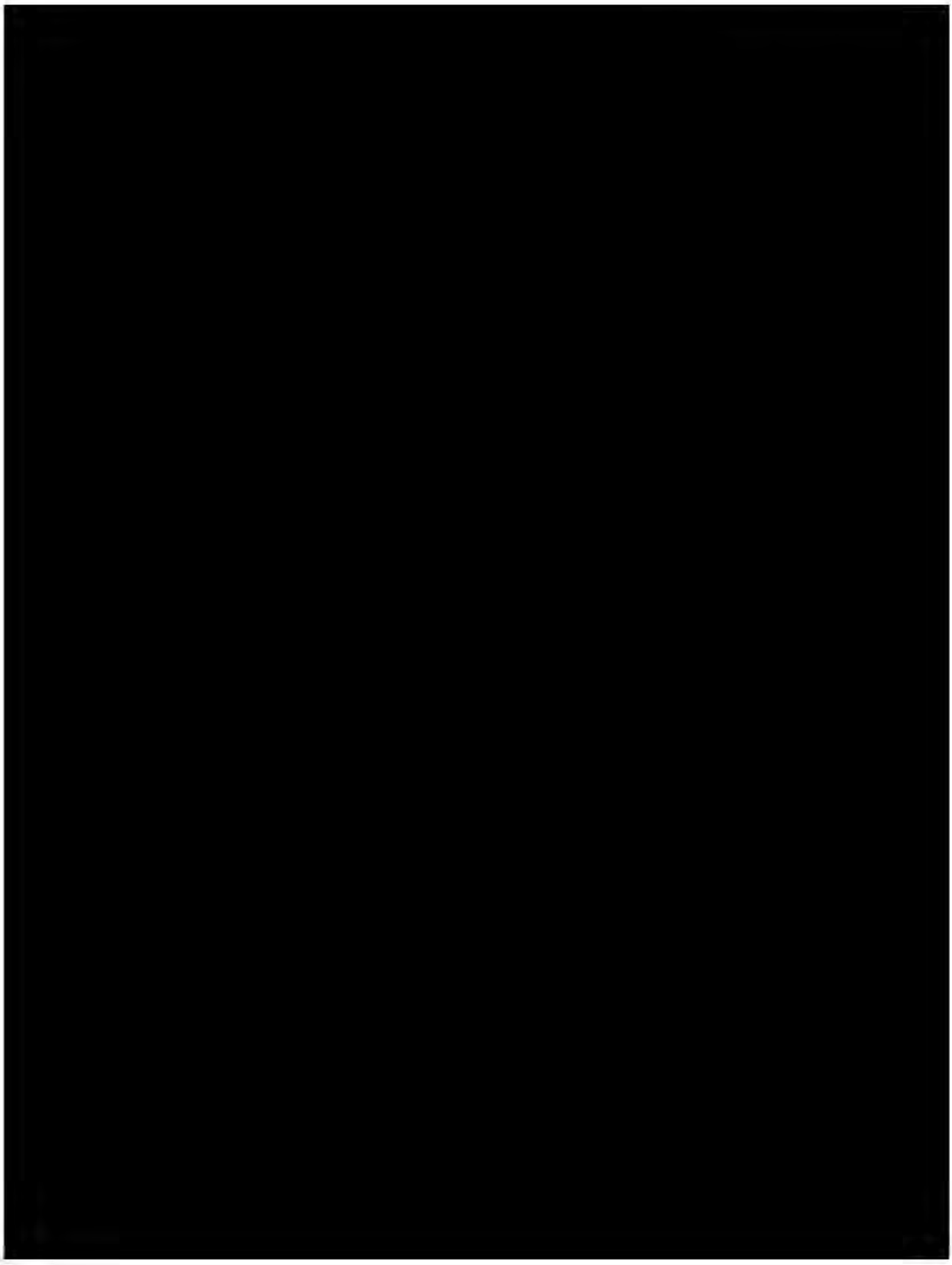


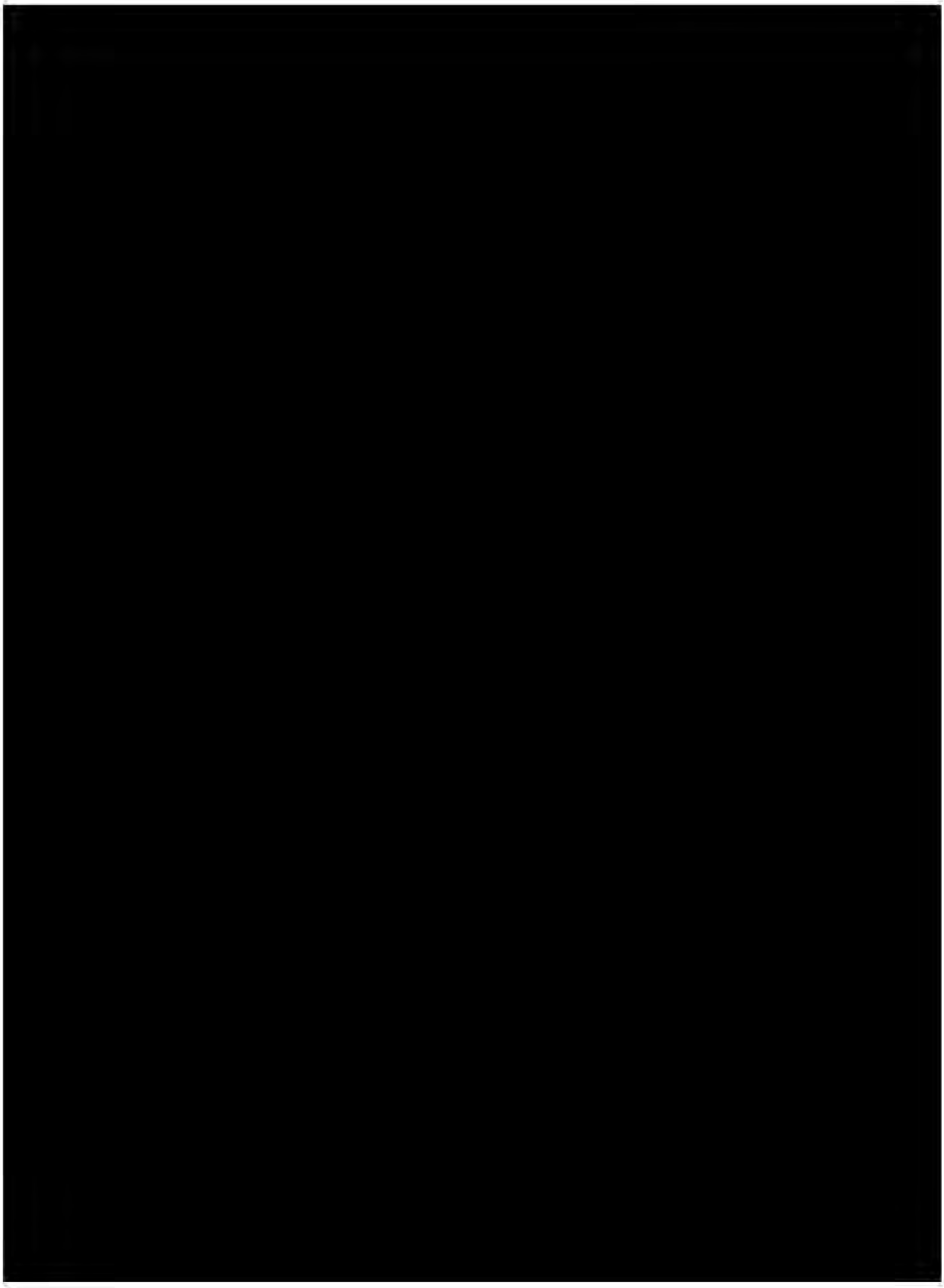














# APPENDIX 3: Stop points grid references for TAS04

| Format: UTM M/D/Y H:M:S 9.50 hrs Datum[037]: GDA 2020 | | | | |
|---|---|---|---|---|
| Name | Zone | Zone | Easting | Northing |
| MCSAN23-01 STOP | [redacted] | | | |
| MCSAN23-02 STOP | | | | |
| MCSAN23-03 STOP | | | | |
| MCSAN23-04 STOP | | | | |
| MCSAN23-05 STOP | | | | |

# Weed Management Plan

# Appendix 03

# Environmental Management Plan: EP161 2D Seismic and Ground Gravity Survey Program

# STO7-4

# NT Exploration Permit 161

# Santos QNT PTY Ltd

# WEED MANAGEMENT PLAN
# EP161

Client: Santos

STATUS: Final

REPORT No: IN-02

ISSUE DATE: September 2023



FOX & CO
ENVIRONMENTAL

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|---|---|---|---|---|---|
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| Final | - | P. Fox | A. F | Minor seismic deviations |  |
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# EXECUTIVE SUMMARY

Santos QNT Pty Ltd (Santos) proposes to undertake an exploration program on Exploration Permit (EP) 161 located approximately 130km east-southeast of Daly Waters, Northern Territory. The proposed program is located north and south of the Carpentaria Highway on the Tanumbirini Pastoral Lease, located in the Gulf Fall and Uplands (GFU) geographical bioregion.

A baseline weed survey was undertaken in July 2023 over the proposed seismic project area.

Several weed species were identified in the proposed project area. The main two (2) weed species recorded during the baseline survey was *Hyptis suaveolens* (Hyptis) and *Sida acuta* (Spinyhead sida). Both weeds are a Class B declared weed in the Northern Territory. A small area containing *Calotropis procera* (Rubber bush) was identified. This area is not on any of the proposed seismic lines, however seismic vehicular traffic may traverse through the area, so it is also included in this WMP.

A range of mitigation measures and monitoring protocols have been recommended to reduce the risk and associated impacts of new weed introductions on the tenement.

# ACRONYMS AND ABBREVIATIONS

| Acronyms/Abbreviation | Description |
|---|---|
| DEPWS | DEPARTMENT OF ENVIRONMENT, PARKS AND WATER SECURITY (FORMERLY DENR) |
| LCP | LAND CLEARING PERMITS |
| LCG | NT LAND CLEARING GUIDELINES LCG |
| WMP | WEED MANAGEMENT PLAN |
| WONS | WEEDS OF NATIONAL SIGNIFICANCE |

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# 1. INTRODUCTION

Fox & Co Environmental Pty Ltd (Fox & Co) conducted a baseline (pre seismic) weed survey for Santos' proposed exploration activities on EP161. This report details weed survey activities, field data and proposed management / mitigation measures.

A desktop assessment and review were undertaken prior to the survey to familiarise with existing information. Literature reviewed included:

- DEPWS known weed records;
- DEPWS information alerts;
- Strategic Regional Environmental and Baseline Assessment (SREBA) data for the Beetaloo Sub-basin (SREBA)

Weeds considered prime concern in relation to Santos' proposed seismic operations, based on known occurrence and threat of introduction include:

Mesquite (*Prosopis spp.*), Prickly acacia (*Vachellia nilotica*), Parkinsonia (*Parkinsonia aculeata*), Chinee apple (*Ziziphus mauritiana*), Mimosa (*Mimosa pigra*), Bellyache bush (*Jatropha gossypiifolia*), Gamba grass (*Andropogon gayanus*), Neem (*Azadirachta indica*), Grader grass (*Themeda quadrivalvis*), Snake weed (*Stachytarpheta spp.*), Devils claw (*Martynia annua*), Hyptis (*Hyptis suaveolens*), Khaki weed (*Alternanthera pungens*), Sida (*Sida acuta, Sida cordifolia, Sida rhombifolia*), Lion's tail (*Leonotis nepetifolia*), Parthenium (*Parthenium hysterophorus*) and Rubber vine (*Cryptostegia spp.*).

A weed is defined as any plant that requires some form of action to reduce its harmful effects on the economy, the environment, human health, and amenity. (Australian Government Department of Agriculture, Water and the Environment, 2017). There are two types of invasions: introduction of exotic plants and movement by native species into new areas well outside their native range. Weeds have an adverse effect on an area's environmental values and ecological functioning for the following reasons:

- Competition with native species;
- Change in the structure of a plant community through addition or removal of strata;
- Repress recruitment of native species;
- Change the natural fire fuel characteristics, which can change the natural fire regime to the detriment of native species, often resulting in the loss of native species;
- Change the food sources and habitat values available to native fauna, reducing some and increasing others;
- May change geomorphological processes such as erosion; and
- May lead to changes in the hydrological cycle.

Weed species considered to be of greatest threat to natural and economic values on a national basis have been ranked as Weeds of National Significance (WONS) (Thorp & Lynch, 2000). Weed significance at a national level was assessed using four major criteria:

- Invasiveness;
- Impacts;
- Potential for spread; and
- Socio-economic and environmental impacts.

At the Northern Territory level, the Weeds Management Act (the Act) (Northern Territory Government, 2001) identifies those weed species that represent a threat to primary industries, natural resources and the environment. The Act enables the following weed declaration classes:

- Class A – to be eradicated
- Class B – growth and spread to be controlled
- Class C* –Not to be introduced into the Northern Territory

*All Class A and B weeds are also Class C

## 1.1 Location

EP161 is located approximately 130km east-southeast of Daly Waters, Northern Territory. The proposed program is located north and south of the Carpentaria Highway on the Tanumbirini Pastoral Lease, located in the Gulf Fall and Uplands (GFU) geographical bioregion.

Figure 1 displays the location of proposed seismic lines within the tenement area. Access within the tenement is along the Carpentaria Highway and existing pastoral tracks.

## 1.2 Proposed Seismic Program Location

The proposed exploration activities include:

- Acquisition of 239km of 2 D Seismic data
    - 5 lines x approximately 8km (Lines 1 – 5)
    - 7 lines x 23-32 km (Lines 6 – 12)
    - Conduct 2D seismic acquisition operations
    - Rehabilitate cleared seismic acquisition lines

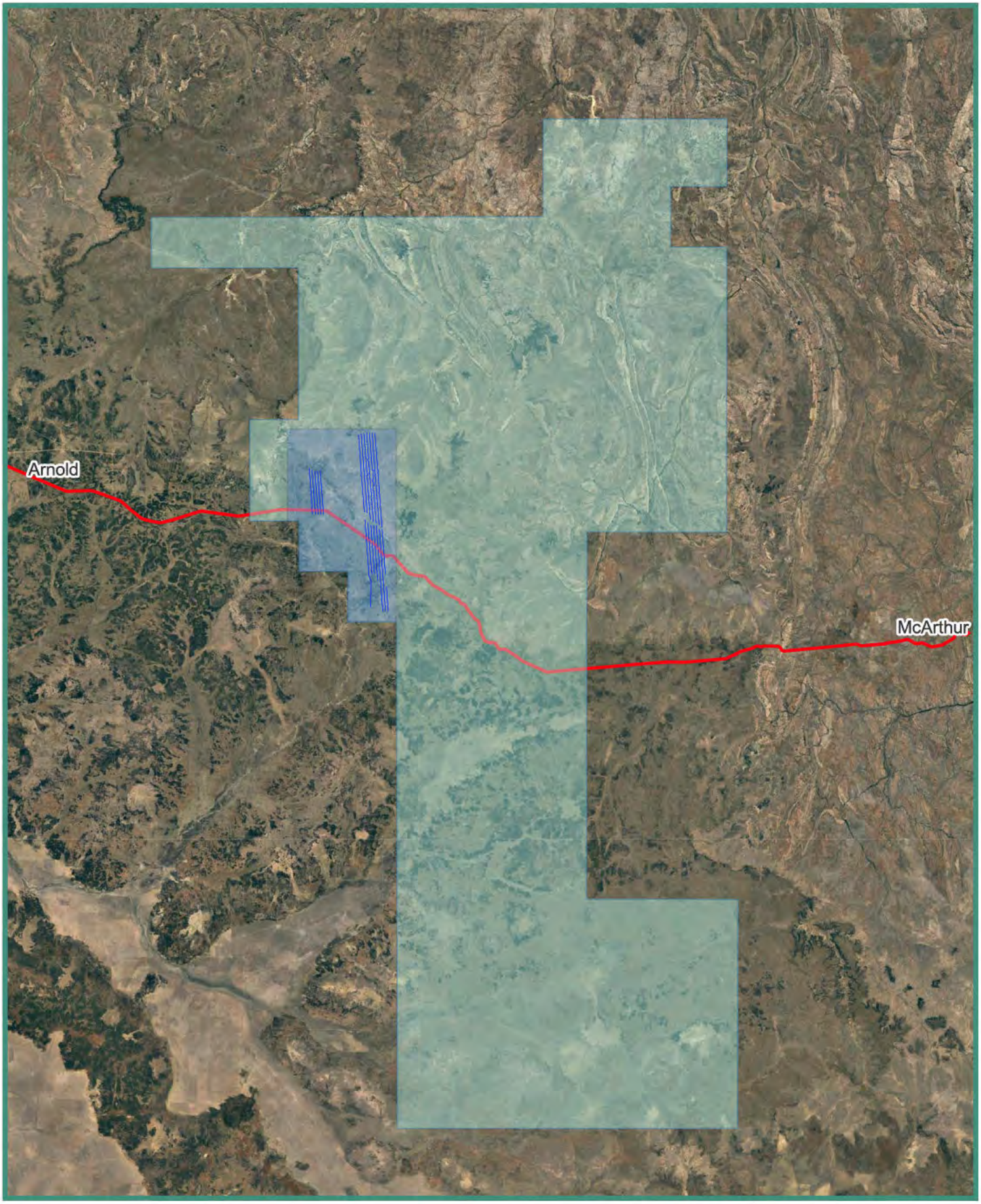
Table 1 provides the latitude and longitude coordinates of the start (north) and end (south) of the seismic lines.

**Table 1 Seismic line coordinates for start and end**

| Line | Name | Easting | Northing | Length (m) | Line Length (m) |
|---|---|---|---|---|---|
| Line 1 | MCSAN23-01A | 457541.1 | 8185473.6 | 7620 | 8368 |
| | MCSAN23-01A | 458086.4 | 8177876.1 | | |
| | MCSAN23-01B | 458096.8 | 8177720.9 | 748 | |
| | MCSAN23-01B | 458149.6 | 8176975.1 | | |
| Line 2 | MCSAN23-02A | 458066.1 | 8185088.8 | 7247 | 7959 |
| | MCSAN23-02A | 458623.3 | 8177866.1 | | |
| | MCSAN23-02B | 458635.5 | 8177693.9 | 712 | |
| | MCSAN23-02B | 458687.8 | 8176984.5 | | |
| Line 3 | MCSAN23-03A | 458582.1 | 8184918.8 | 7090 | 7772 |
| | MCSAN23-03A | 459111.8 | 8177851.7 | | |
| | MCSAN23-03B | 459121.5 | 8177689.3 | 682 | |
| | MCSAN23-03B | 459174 | 8177009.4 | | |
| Line 4 | MCSAN23-04A | 459063.9 | 8184932.8 | 7117 | 7773 |
| | MCSAN23-04A | 459601.8 | 8177838.6 | | |
| | MCSAN23-04B | 459616 | 8177674.2 | 656 | |
| | MCSAN23-04B | 459666 | 8177020.2 | | |

| Line | Name | Easting | Northing | Length (m) | Line Length (m) |
|---|---|---|---|---|---|
| Line 5 | MCSAN23-05A | 459540.8 | 8185083.8 | 7281 | 7901 |
| | MCSAN23-05A | 460095.7 | 8177827.1 | | |
| | MCSAN23-05B | 460109.2 | 8177663 | 620 | |
| | MCSAN23-05B | 460158 | 8177045.2 | | |
| Line 6 | MCSAN23-06A | 466522.4 | 8191457 | 14098 | 29849 |
| | MCSAN23-06A | 467571.1 | 8177465.2 | | |
| | MCSAN23-06B | 467674.1 | 8176073.9 | 3198 | |
| | MCSAN23-06B | 467914.4 | 8172886.1 | | |
| | MCSAN23-06C | 467934.8 | 8172601 | 12553 | |
| | MCSAN23-06C | 468708.3 | 8160168.8 | | |
| Line 7 | MCSAN23-07A | 467012.1 | 8191697.4 | 14659 | 23904 |
| | MCSAN23-07A | 468089.2 | 8177267.3 | | |
| | MCSAN23-07B | 468215.5 | 8175575.2 | 3067 | |
| | MCSAN23-07B | 468448.9 | 8172517.9 | | |
| | MCSAN23-07C | 468465.1 | 8172239.2 | 6178 | |
| | MCSAN23-07C | 469035.8 | 8166120.1 | | |
| Line 8 | MCSAN23-08A | 467498.2 | 8191815.3 | 15987 | 24485 |
| | MCSAN23-08A | 468673.5 | 8176139.1 | | |
| | MCSAN23-08B | 468758.7 | 8175012 | 2828 | |
| | MCSAN23-08B | 468969.3 | 8172193 | | |
| | MCSAN23-08C | 468994 | 8171869.8 | 5670 | |
| | MCSAN23-08C | 469418.2 | 8166218.1 | | |
| Line 9 | MCSAN23-09A | 467999.4 | 8191886 | 16508 | 26315 |
| | MCSAN23-09A | 469204.3 | 8175718.1 | | |
| | MCSAN23-09B | 469256.8 | 8175014 | 3305 | |
| | MCSAN23-09B | 469503.2 | 8171719.8 | | |
| | MCSAN23-09C | 469530.4 | 8171434.6 | 6502 | |
| | MCSAN23-09C | 470010.3 | 8164952.8 | | |
| Line 10 | MCSAN23-10A | 468503.4 | 8191903.7 | 17285 | 32663 |
| | MCSAN23-10A | 469737.4 | 8175403.9 | | |
| | MCSAN23-10B | 469767.3 | 8175021.5 | 4005 | |
| | MCSAN23-10B | 470065.4 | 8171029.1 | | |
| | MCSAN23-10C | 470086 | 8170738.2 | 11373 | |
| | MCSAN23-10C | 470932.9 | 8159401.2 | | |
| Line 11 | MCSAN23-11A | 470253.8 | 8175113.2 | 17127 | 31777 |
| | MCSAN23-11A | 469001.6 | 8191873.9 | | |
| | MCSAN23-11B | 470313.6 | 8174314.9 | 3986 | |
| | MCSAN23-11B | 470610.5 | 8170341.5 | | |
| | MCSAN23-11C | 470634.7 | 8170013.9 | 10664 | |
| | MCSAN23-11C | 471430.8 | 8159401 | | |
| Line 12 | MCSAN23-12A | 469508.9 | 8191784.3 | 17315 | 29782 |
| | MCSAN23-12A | 470790.4 | 8174711.2 | | |
| | MCSAN23-12B | 470821.7 | 8174253.9 | 4475 | |
| | MCSAN23-12B | 471154.8 | 8169793 | | |

| Line | Name | Easting | Northing | Length (m) | Line Length (m) |
|---|---|---|---|---|---|
| | MCSAN23-12C | 471169.1 | 8169580 | 3505 | |
| | MCSAN23-12C | 471432 | 8166097.1 | | |
| | MCSAN23-12D | 471925.8 | 8159401.7 | 4487 | |
| | MCSAN23-12D | 471601.3 | 8163851.2 | | |




TITLE

## Location

MAP NO. Figure 1

PROJECT EP161 Seismic

LEGEND

- Proposed Seismic Lines
- Study Area
- EP161
- Carpentaria Hwy

0 10 20 30 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid

## 1.3 Legal Requirements

Of particular relevance to this WMP is the Northern Territory *Weeds Management Act 2001* (the Act).

A project specific weed management plan must be developed as part of the EMP which meets the requirements of the NT Weed Management Planning Guide: Onshore Petroleum Projects (DENR, 2019) and it must provide at least for the following:

(a) baseline weed assessments prior to regulated activities being undertaken;

(b) ongoing weed monitoring;

(c) provision of a dedicated weed officer; and

(d) consistency with statutory requirements including any relevant threat abatement plans under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

### 1.3.1 Weeds Management Act

The purpose of the Act is:

I. to prevent the spread of weeds in, into and out of the Territory and to ensure that the management of weeds is an integral component of land management in accordance with the Northern Territory Weeds Management Strategy 1996 – 2005 or any other strategy adopted to control weeds in the Territory

II. to ensure there is community consultation in the creation of weed management plans; and

III. to ensure that there is community responsibility in implementing weed management plans. The Act enables the following weed declaration classes:

- Class A – to be eradicated
- Class B – growth and spread to be controlled
- Class C* –Not to be introduced into the Northern Territory
- All Class A and B weeds are also Class C

## 1.4 Recommendations from Scientific Enquiry

### 1.4.1 Santos Weed Officer

As per recommendation 8.3 of the Scientific Inquiry into Hydraulic Fracturing, gas companies must have a dedicated weed officer for each gas field. To ensure the required weed management outcomes, the weed officer must have relevant skills and experience and availability to successfully manage weed related issues for the project, including:

- Knowledge of the biology/ecology of local weeds including but not limited to gamba and grader grass
- Knowledge of relevant weed management frameworks including NT legislation and plans, the EPBC Act; and
- Understanding of existing weed management arrangements being undertaken by landholders As per Section 7 of the EMP, the Site Coordinator (SC) will be responsible for weed related issues.

Contact: James Laverty

Title: Santos SC

Location: Tanumbiri

Contact Details: [redacted]@santos.com

### 1.4.2 DEPWS Weed Officer

Recommendation 8.3 of the Scientific Inquiry into Hydraulic Fracturing requires a dedicated Government weed officer who is responsible for:

- coordinating regional weed baseline assessments and subsequent weed surveillance; and
- overseeing strategic and effective management of any weed incursions by gas companies. This WMP has been prepared in consultation with the Northern Territory (DEPWS).

Contact: [redacted]

Title: DEPWS Onshore Petroleum Weed Management Officer

Location: 33 Leichhardt Street, Tennant Creek, NT, 0861

Contact Details: [redacted]

# 2. WEED INTRODUCTION AND RISKS

Section 1 of the EMP describes the exploration scope and all the ancillary activities (the Activity).

**Table 2 Weed introduction risks and mitigation measures**

| Project Stage | Risk | | Mitigation Measures |
|---|---|---|---|
| | Introduction of new weeds | Spread existing weeds | |
| Seismic Operations | Machinery and equipment sourced from other locations infested with weed species not found in or around EP area | Traversing of weed infested areas with machinery | Machinery wash/blow down plans agreed with land owner / manager and implemented.<br>Hygiene: vehicle wash down and inspection/certification of process adhered to and documented. All machinery will be inspected and certified as clean before entry into the project area. All contractors will be required to adhere to this process. Records of the certification will be retained by Santos and made available immediately should it be requested.<br>Mark no-go areas if infestations of WONS and/or Class A/C weeds are found within the seismic lines.<br>GPS marking of blown down sites. GPS records of all wash and blow down sites will be recorded by all operators in the field. These GPS records will be retained by Santos and the sites inspected as soon as practicable |

| Project Stage | Risk | | Mitigation Measures |
|---|---|---|---|
| | Introduction of new weeds | Spread existing weeds | |
| | | | following the wet season to check for weed incursions and to undertake management actions as required. |
| | Personnel unable to identify weeds or unaware of weed species present in areas where machinery and equipment is sourced from | Existing weed distribution not known due to: insufficient survey effort, survey effort conducted at wrong time of year, persons undertaking survey not familiar with / unable to identify declared weed species | Fox & Co and DEPWS baseline weed survey undertaken in July 2023 prior to seismic to map known weed distribution.<br>Fox & Co Environmental personnel proposed for post-seismic monitoring to retain site specific knowledge and consistency.<br>Site operators to undergo weed identification training and reporting (onsite training delivered by DEPWS weed officer). |
| | Mulching or slashing tracks off from the Carpentaria Highway and existing gas pipeline (south of Carpentaria Hwy) into weed free areas | Pushing tracks from identified weed areas into clean weed free areas. Hyptis and sida observed in disturbed areas along fence lines and existing gas pipeline | Ensure to push tracks towards disturbed areas from clean weed free areas.<br>Clearing, stick raking and slashing off known areas of infestations is undertaken last to avoid spreading weeds from the existing weed areas to weed free areas.<br>Wet season spray operations to occur along the known weed areas to mitigate potential of hyptis and sida spread. |

# 3. WEED SPECIES

The DEPWS Natural Resource (NR) maps database and SREBA database was used to identify all introduced flora species that have previously been recorded within the area of the tenement associated with the proposed seismic program.

Figure 2 shows the historical weed locations and weeds identified during the 2023 baseline survey.

Figure 3 shows the track data for the 2023 baseline weed survey.

## 3.1 Regional Priorities

The DEPWS Katherine Regional Weed Strategy 2021-2026 has been developed in line with the DEPWS Strategic Plan 2021 – 2024 and the Australian Weeds Strategy 2017 – 2027. The Katherine Regional Weed Strategy identifies three (3) regional priorities to manage weeds. These are:

I. Priority weeds;

II. Priority landscape areas; and

III. Priority pathways of spread

The below table lists weeds that have previously been recorded in the area and also priority weed species as per the Katherine Regional Weed Strategy 2021-2026 (Departmemt of Environment, Parks & Water Safety, 2021).

**Table 3 Previously recorded and priority weed species**

| Scientific Name | Common Name | Declaration | Where located (e.g. on EP, machinery source location, extractive proppant/s, corridors) |
|---|---|---|---|
| *Prosopis spp.** | Mesquite* | WONS, Class A,Class C, Statutory Weed Management Plan | Not recorded within Study Area. Priority weed |
| *Vachellia nilotica* *(previously Acacia nilotica)** | Prickly acacia | WONS, Class A,Class C, Statutory Weed Management Plan | Not recorded within Study Area. Priority weed |
| *Parkinsonia aculeata* | Parkinsonia | WONS, Class B | Not recorded within Study Area. Priority weed |
| *Ziziphus mauritiana** | Chinee apple | Class A, Class C, Statutory Weed Management Plan | Not recorded within Study Area. Priority weed |
| *Mimosa pigra** | Mimosa | WONS, Class A, Class C, Statutory Weed Management Plan | Not recorded within Study Area. Priority weed |
| *Jatropha gossypiifolia** | Bellyache bush | WONS, Class A,Class C, Statutory Weed Management Plan | Not recorded within Study Area. Priority weed |
| *Andropogon gayanus** | Gamba grass | WONS, Class A, Class C, Statutory Weed Management Plan | Not recorded within Study Area. Priority weed |
| *Azadirachta indica* | Neem | Class B, Statutory Weed Management Plan | Not recorded within Study Area. Priority weed |
| *Themeda quadrivalvis* | Grader grass | WONS, Class B, Statutory Weed Management Plan | Not recorded within Study Area. Priority weed |

| Scientific Name | Common Name | Declaration | Where located (e.g. on EP, machinery source location, extractive proppant/s, corridors) |
|---|---|---|---|
| *Stachytarpheta spp* | Snake weed | Class B | Not recorded within Study Area. Priority weed |
| *Martynia annua* | Devils claw | Class A | Not recorded within Study Area. Priority weed |
| *Hyptis suaveolens* | Hyptis | Class B | Recorded during 2023 baseline survey |
| *Alternanthera pungens* | Khaki weed | Class B | Not recorded within Study Area. Priority weed |
| *Sida acuta, Sida cordifolia, Sida rhombifolia* | Sida | Class B | Recorded during 2023 baseline survey |
| *Leonotis nepetifolia* | Lion's tail | | Not recorded within Study Area. Priority weed |
| *Tribulus sp.* | Caltrop | Class B | Recent record in Study Area (2021)- Tribulus terrestris |

Table 4 lists priority weeds for strategic control as per the Katherine Regional Weed Strategy 2021-2026. These species warrant strategic control across the Katherine Region due to their high impact on land managers, and other economic and environmental values.

**Table 4 Weed Alert Species**

| Scientific Name | Common Name | Declaration |
|---|---|---|
| *Ziziphus mauritiana* | Chinee apple | Class A, Class C, Statutory Weed Management Plan |
| *Jatropha gossypiifoli* | Bellyache bush | WONS, Class A, B and C |
| *Andropogon gayanus* | Gamba grass | WONS, Class A, B and C, Statutory Weed Management Plan |
| *Cryptostegia madagascariensis* | Ornamental rubber vine | Class A and C |
| *Azadirachta indica* | Neem | Class A and C, Statutory Weed Management Plan |
| *Themeda quadrivalvis* | Grader grass | Class B and C, Statutory Weed Management Plan |

| Scientific Name | Common Name | Declaration |
|---|---|---|
| *Tamarix aphylla* | Athel pine | Class A and B, Statutory Weed Management Plan |
| *Martynia annua* | Devils claw | Class A |

*Parthenium hysterophorus* (parthenium) and *Cryptostegia spp* (rubber vine) are of particular concern as they are considered to be a very high risk of introduction to this area of the Northern Territory. This area of the Northern Territory is often accessed from Queensland where these two (2) weed species are well established and have had detrimental impacts to the Queensland beef industry.

## 3.2 2023 Baseline Weed Survey Results

The main two (2) weed species recorded during the baseline survey was *Hyptis suaveolens* (Hyptis) and *Sida acuta* (Spinyhead sida). Both weeds are a Class B declared weed in the Northern Territory. A small area containing *Calotropis procera* (Rubber bush) was identified. This area is not on any of the proposed seismic lines, however seismic vehicular traffic may traverse through the area, so it is also included in this WMP.

**Figure 2** shows the baseline weed results.

**Appendix A** provides a table of the baseline survey results. These results have been supplied to the DEPWS in the required format.

**Table 5** provides a summary of the weed survey observations recorded during the pre-exploration baseline weed survey on EP161.

**Table 5 Weed Survey Observations**

| Weed | Details | Location | Plate |
|---|---|---|---|
| *Hyptis suaveolens* (Hyptis). | Hyptis was recorded along the existing gas pipeline running east-west south of the Carpentaria Highway.<br>It was also recorded along some drainage lines south of the Carpentaria Highway, particularly along proposed seismic line 12. | Refer Figure 2 |  |

| Weed | Details | Location | Plate |
|---|---|---|---|
| *Sida acuta* (Sida) | Sida was recorded along ephemeral drainage lines and areas of high cattle activity such as water points. It was mostly recorded north of the Carpentaria Highway where more cattle operations occur. | Refer Figure 2 |  |
| *Calotropis procera* (Rubber bush) | An area containing rubber bush was recorded 800 m east of proposed Seismic Line 5. The area is either side of an existing pastoral track and fence line. | Refer Figure 2 |  |

# 4. ANNUAL ACTION PLAN

Control options will be undertaken in accordance with the species-specific Statutory Weed Management Plans, and the NT Government's Weeds in the NT" database (Northern Territory Government, 2020).

Table 6 Action Plan

| Weed Management Area | Weed Species | Management Objective | Survey Time/s | Treatment Time/s | Control Method/s | Herbicide |
|---|---|---|---|---|---|---|
| Seismic Lines 1 – 12 in identified areas on Figure 2 | Hyptis (*H. suaveolens*) | No spread.<br>No introduction of new weed species. | End of wet season | Immediately upon identification | Foliarspray | 2, 4-D amine (Various trade names) or Glyphosate (Various trade names and formulations) |
| Seismic Lines 1 – 12 in identified areas on Figure 2 | Sida (*Sida acuta*) | No spread.<br>No introduction of new weed species. | End of wet season | Immediately upon identification | Foliarspray | 2, 4-D amine (Various trade names) or Glyphosate (Various trade names and formulations) |
| 800m east of Seismic Line 5. | Rubber bush (*Calotropis procera*) | No spread.<br>No introduction of new weed species. | End of wet season | Immediately upon identification | Foliarspray | Triclopyr 300 g/L + Picloram 100 g/L<br>Conqueror®<br>+ Aminopyralid 8 g/L<br>Grazon™ Extra |

Treatment times and control methods are provided on the NT Government's "Weeds in the NT" database.

# 5. MITIGATION MONITORING

A post-seismic monitoring program should be undertaken to actively determine weed presence (if any) within the exploration areas. Follow-up monitoring (e.g. timeframes following treatment) is species specific and will be undertaken in accordance with the species-specific Statutory Weed Management Plans for the priority weeds (if identified on site).

All baseline data was supplied to DEPWS.

## 5.1 Mitigation

Weed mitigation measures should include hygiene protocols to minimise the likelihood of introduction and spread of environmental, agricultural, and declared weeds. These should include:

- Vehicle wash-down procedures and facilities to avoid the potential for weed spread including inspection by a certified weed inspector and certification.

- Requirement that all equipment/machinery arrives on site clean of plant and soil matter. This will include inspection by a certified weed inspector and records of weed hygiene certificates for all vehicles and plant arriving on site.
- Require that all equipment/machinery is clean of plant and soil matter before demobilising from one site and working on another.
- Restrict movement of topsoil from sites where significant or declared weeds are known to exist to prevent the spread of weeds on the lot.
- Immediately control and/or remove all weeds that have been introduced or exacerbated by the works.
- Develop weed identification material to be made available to staff and contractors while working on the lot. Problem weeds can be defined during pre-work toolboxes.
- Compulsory site inductions will present information to staff and contractors working on site on problem weed species and protocols to minimise risk of introduction including wash down locations and procedures, certification of plant and machinery before entering site, weed hygiene measures, non-compliance and reporting procedures
- Use existing and designated tracks where possible. Restrict access to areas outside of the cleared footprint to limit the disturbance area to within the approved footprint
- Conduct post-wet season weed surveys to determine whether any weed introductions have occurred and to monitor existing weed populations. Take the appropriate and government authority preferred corrective actions where necessary.
- Rehabilitate seismic lines and tracks.
- Monitoring data of weed populations based on pre-seismic presence and abundance around the seismic lines and tracks.

If weed monitoring indicates new introductions and/or detrimental changes in existing weed species density and abundance, the following should be undertaken:

- Notification to DEPWS
- Determine the cause of the incident and review the process to ensure that the incident does not re-occur.
- Assess and implement the appropriate course of action in consultation with relevant authorities and landholder.

# 6. NOTIFICATION PROCEDURE

Should a new weed species in the project area be identified, the DEPWS Onshore Petroleum Weeds Officer (refer Section 1.4.2) will be contacted within 14 days of discovery. Initial notification will be via telephone and subsequently followed up with an email (written notification) within seven (7) working days with details of species, location (latitude and longitude), abundance and any other relevant details such as life stage.

# 7. RECORDING

During weed surveys over the proposed EP161 seismic lines, weed data was collected using Avenza Maps in accordance with the DEPWS Weed Data Collection Field Guide.

All weed data was supplied to the DEPWS Onshore Petroleum Weed Management Branch.

# 8. REPORTING

Following the post-wet / post-exploration weed survey, an annual report will be submitted to DEPWS. The report will include the following:

a) Details of activities implemented to address weed spread and introduction risks (e.g. vehicle wash down / blow down locations)
b) Submission of all weed data collected
c) Details of survey and monitoring events, including dates, personnel, maps and track data; and
d) Overview of weed control events and success rates (weed control should be captured in detail through the data collection process and submitted as a component of (a)).

# 9. WORKS CITED AND RELEVANT REFERENCE LIST


Australian Government Department of Agriculture, Water and the Environment. (2017). *Australian Weeds Strategy 2017-2027.* Retrieved from Pest animals and weeds in Australia: https://www.agriculture.gov.au/sites/default/files/sitecollectiondocuments/pests-diseases-weeds/consultation/aws-final.pdf

Departmemt of Environment, Parks & Water Safety. (2021, Nov 17). *Katherine Regional Weeds Strategy 2021-2026*. Retrieved from Northern Territory Governmet: https://depws.nt.gov.au/__data/assets/pdf_file/0006/269286/Katherine-Regional-Weeds-Strategy-2021-2026.pdf

Department of Environment, Parks ad Water Security. (2015). *Katherine regional weed management plan.* Retrieved from Weed Management Plans: https://depws.nt.gov.au/__data/assets/pdf_file/0006/269286/Katherine-Regional-Weed-Management-Plan-2015-2020.pdf

Northern Territory Government. (2001). *Weeds Management Act 2001.* Retrieved from Northern Territory Legislation: https://legislation.nt.gov.au/Legislation/WEEDS-MANAGEMENT-ACT-2001

Northern Territory Government. (2015). *Chinee apple management plan.* Retrieved from A-Z list of weeds in the NT: https://nt.gov.au/__data/assets/pdf_file/0020/231419/chinee-apple-management-plan.pdf

Northern Territory Government. (2015). *Neem management plan.* Retrieved from A-Z list of weeds in the NT: https://nt.gov.au/__data/assets/pdf_file/0020/231428/neem-management-plan.pdf

Northern Territory Government. (2016). *Grader grass weed management plan.* Retrieved from A-Z list of weeds in the NT: https://nt.gov.au/__data/assets/pdf_file/0014/330035/grader-grass-weed-management-plan.pdf

Northern Territory Government. (2018). *Northern Territory Weed Management Handbook.* Retrieved from Weeds: https://nt.gov.au/__data/assets/pdf_file/0004/233833/NT-Weedmanagement_handbook_2018.pdf

Northern Territory Government. (2020). *A-Z list of weeds in the NT*. Retrieved from Weeds: https://nt.gov.au/environment/weeds/weeds-in-the-nt/A-Z-list-of-weeds-in-the-NT

Northern Territory Government. (2020). *Hyptis*. Retrieved from A-Z list of weeds in the NT: https://nt.gov.au/environment/weeds/weeds-in-the-nt/A-Z-list-of-weeds-in-the-NT/hyptis

Northern Territory Government. (2020). *Khaki weed.* Retrieved from A-Z list of weeds in the NT: https://nt.gov.au/environment/weeds/weeds-in-the-nt/A-Z-list-of-weeds-in-the-NT/khaki-weed

Northern Territory Government. (2020). *Parkinsonia*. Retrieved from A-Z list of weeds in the NT: https://nt.gov.au/environment/weeds/weeds-in-the-nt/A-Z-list-of-weeds-in-the-NT/parkinsonia

Northern Territory Government. (2020 Revision). *Weed management plan for mesquite 2012 to 2022.* Retrieved from A-Z list of Weeds in the NT: https://nt.gov.au/__data/assets/pdf_file/0018/231426/mesquite-management-plan.pdf

Northern Territory Government. (2020). *Weed management plan for prickly acacia 2012 to 2022.* Retrieved from A-Z list of weeds in the NT: https://nt.gov.au/__data/assets/pdf_file/0003/231429/prickly-acacia-management-plan.pdf

Northern Territory Government. (2020). *Weed Management Plan Gamba Grass 2020-2030.* Retrieved from A-Z list of weeds in the NT: https://nt.gov.au/__data/assets/pdf_file/0006/954789/weed-management-plan-for-gamba-grass-2020-2030.PDF

Thorp, J. R., & Lynch, R. (2000). *The Determination of Weeds of National Significance.* Canberra: National Weeds Strategy Executive Committee.

# APPENDIX A WEED DATA

| RECORDER: | Paul Fox | | | PROJECT: | Onshore Shale Gas Baseline Weed Survey | | | | | LOCALITY: | EP161 Santos | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ORG_NAME: | Fox & Co Environmental | | | GPS NAME/MODEL: | iPad - Avenza Maps | | | | | RECORDING METHOD : | Other digital device | |

| SITE_ID | DATE_REC | LAT_G94 | LONG_G94 | WEED_NAME | SIZE_DIA_M | DENS_CAT | SEEDLINGS | JUVENILES | ADULTS | SEED_PRES | PAST_TREAT | TREATMENT | HERBICIDE | COMMENTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20/07/2023 | -16.54576099 | 134.7199953 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | on fence line |
| | 19/07/2023 | -16.56631364 | 134.7313971 | Hyptis suaveolens | 20 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | No treatment | Not applicable | |
| | 19/07/2023 | -16.55003428 | 134.7174313 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | along gas pipeline easement |
| | 19/07/2023 | -16.5790971 | 134.731869 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | along waterway |
| | 18/07/2023 | -16.58687107 | 134.7073082 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Telstra bore |
| | 19/07/2023 | -16.57302913 | 134.7311599 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | on drainage line |
| | 19/07/2023 | -16.57420738 | 134.7313126 | Hyptis suaveolens | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 19/07/2023 | -16.55087095 | 134.7186129 | Hyptis suaveolens | 20 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | along existing gas pipeline easement |
| | 18/07/2023 | -16.58984033 | 134.7045339 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 19/07/2023 | -16.53489993 | 134.7090975 | Hyptis suaveolens | 20 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 19/07/2023 | -16.57629787 | 134.7314029 | Hyptis suaveolens | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Along waterway |
| | 19/07/2023 | -16.58778981 | 134.7323776 | Hyptis suaveolens | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 19/07/2023 | -16.57822049 | 134.7269998 | Hyptis suaveolens | 20 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Along waterway |
| | 18/07/2023 | -16.58889378 | 134.7045833 | Hyptis suaveolens | 50 | 4 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 18/07/2023 | -16.58815684 | 134.7047141 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 18/07/2023 | -16.58850833 | 134.7041916 | Hyptis suaveolens | 5 | 1 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 19/07/2023 | -16.56516385 | 134.7320809 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | along drainage line |
| | 21/07/2023 | -16.47463326 | 134.6952481 | | 5 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Bidens pilosa |
| | 21/07/2023 | -16.46633635 | 134.6996242 | | 5 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Bidens pilosa |
| | 21/07/2023 | -16.4277413 | 134.7196835 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Desicated. Likely Sida acuta for all. |
| | 21/07/2023 | -16.42499702 | 134.7200212 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.42234047 | 134.7198412 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.41961088 | 134.7193001 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.41561544 | 134.7202461 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.41252796 | 134.7141856 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.41579233 | 134.7152331 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Along old fence line |
| | 21/07/2023 | -16.42156617 | 134.7147187 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.42675698 | 134.7148252 | | 20 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Bidens pilosa |
| | 21/07/2023 | -16.42671275 | 134.7148174 | Sida sp | 20 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.42740176 | 134.715081 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.42875405 | 134.715052 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | with some bidens pilosa |
| | 21/07/2023 | -16.42988085 | 134.715682 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.44480104 | 134.716585 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Near waterway |
| | 21/07/2023 | -16.47845775 | 134.719321 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.48175359 | 134.7146311 | Sida sp | 20 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |

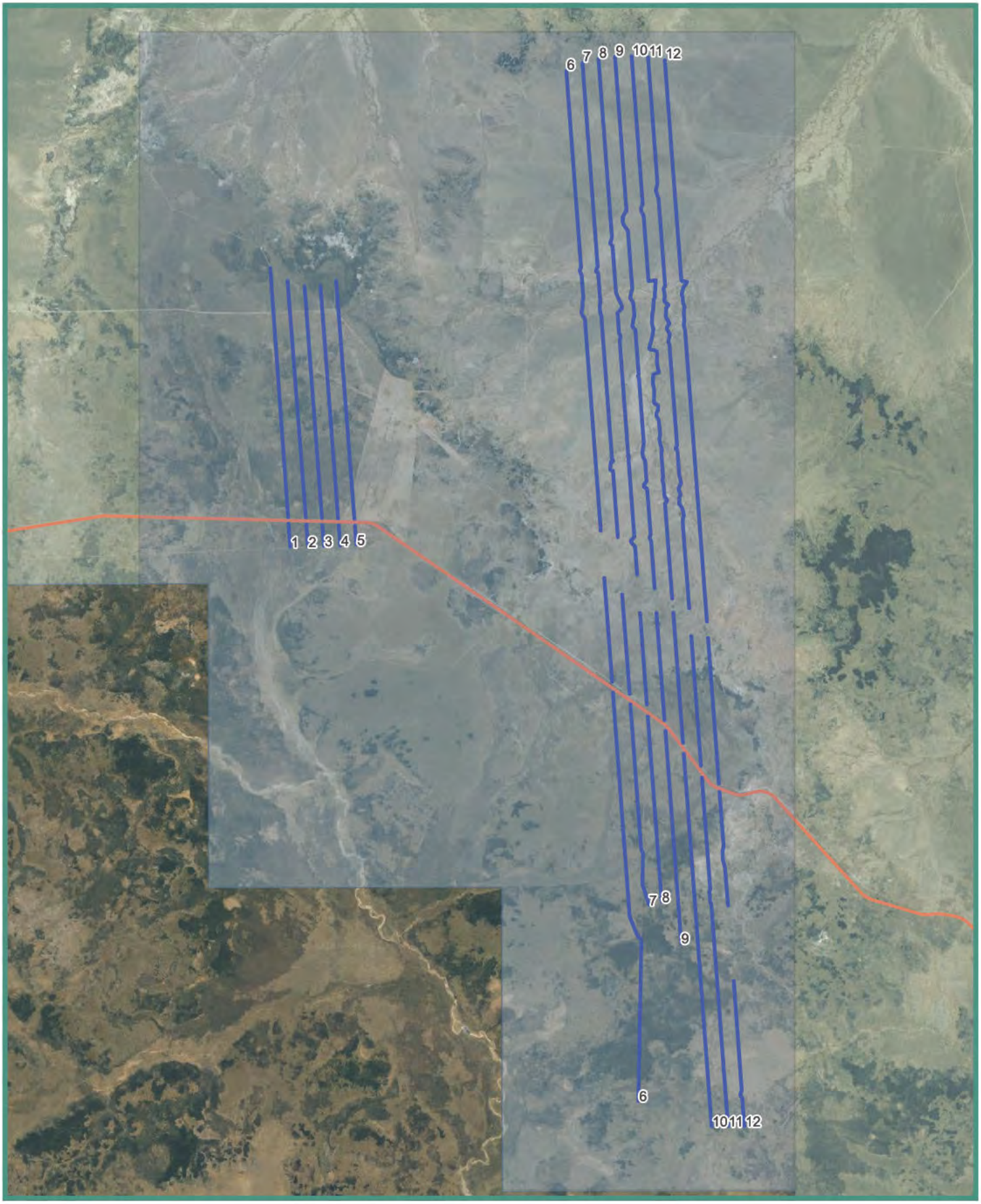
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 21/07/2023 | -16.473178 | 134.7141361 | Sida sp | 20 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.46291661 | 134.7133296 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.43639917 | 134.7117843 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.43363434 | 134.7115948 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.42978534 | 134.7108767 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 21/07/2023 | -16.42776254 | 134.711187 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.42744434 | 134.705455 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.45195276 | 134.7077219 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | in open grassland. Cattle grazing present. |
| | 22/07/2023 | -16.45579146 | 134.7079922 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.44342474 | 134.7027731 | Sida sp | 100 | 4 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.44364511 | 134.7014614 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.41287817 | 134.6906791 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Along waterway |
| | 22/07/2023 | -16.41519573 | 134.6904364 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.42356243 | 134.6910306 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.39078944 | 134.7172334 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.39153672 | 134.7125543 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.39665873 | 134.7077183 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.39351695 | 134.7032346 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.39783314 | 134.7028636 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.40208739 | 134.6994012 | Sida sp | 20 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.40425957 | 134.699275 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.40605224 | 134.6994641 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.41315456 | 134.6948421 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 22/07/2023 | -16.40840082 | 134.6948257 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 23/07/2023 | -16.38568782 | 134.6978907 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 23/07/2023 | -16.37959889 | 134.6930168 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Along drainage line |
| | 23/07/2023 | -16.373512 | 134.6877183 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 23/07/2023 | -16.36474775 | 134.6869454 | Sida sp | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 23/07/2023 | -16.43921378 | 134.6183999 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 23/07/2023 | -16.42545957 | 134.6030957 | Sida sp | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 23/07/2023 | -16.42420225 | 134.6021529 | Hyptis suaveolens | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 23/07/2023 | -16.41212134 | 134.6025133 | Hyptis suaveolens | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Along existing track and fence line |
| | 23/07/2023 | -16.42383149 | 134.6126025 | Hyptis suaveolens | 100 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Around water tank |
| | 23/07/2023 | -16.42352794 | 134.6205182 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 24/07/2023 | -16.48111184 | 134.6263348 | Hyptis suaveolens | 50 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | Along fence line |
| | 24/07/2023 | -16.48105276 | 134.6214213 | Hyptis suaveolens | 20 | 3 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | 24/07/2023 | -16.45109762 | 134.6317586 | Rubber bush | 5 | 1 | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not recorded | Not applicable | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |

# APPENDIX B FIGURES

**Figure 2 Exploration Program**

**Figure 3 Baseline weed survey (2023)**

**Figure 4 2023 Baseline Weed Survey Track Data**




| | |
|---|---|
| TITLE | **Exploration Program** |
| MAP NO. | Figure 2 |
| PROJECT | EP161 Seismic |

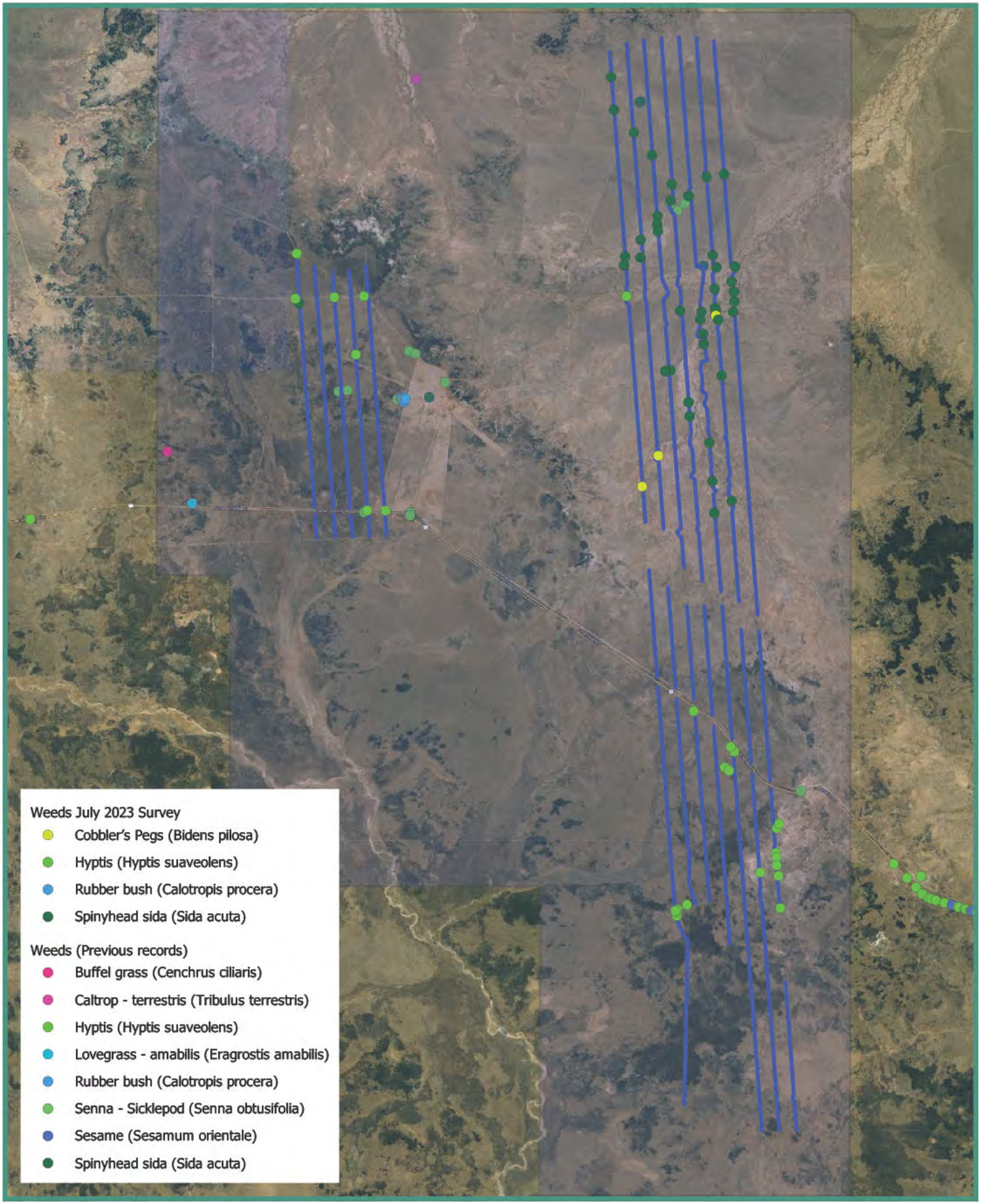
LEGEND

- Proposed Seismic Lines
- Study Area
- EP161
- Carpentaria Hwy

0 2.5 5 7.5 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid




| | |
|---|---|
| TITLE | **Weeds July Survey 2023** |
| MAP NO. | Figure 2 |
| PROJECT | EP161 Seismic |

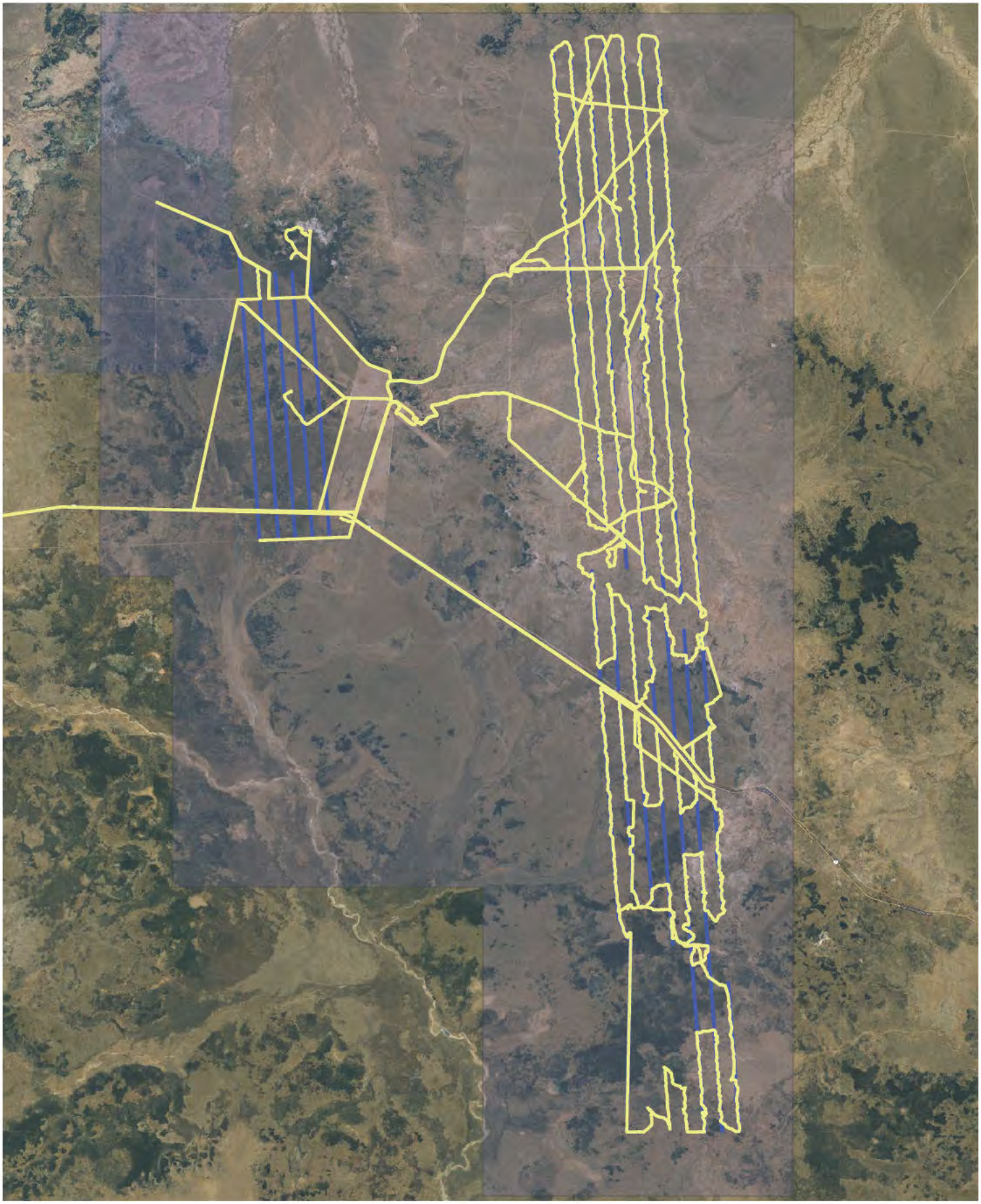
LEGEND

- Proposed Seismic Lines
- Study Area

0 2.5 5 7.5 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid Spatial Data: https://nrmaps.nt.gov.au/nrmaps.html



| | |
|---|---|
| TITLE | **Tracks** |
| MAP NO. | Figure 4 |
| PROJECT | EP161 Seismic |

LEGEND

- July 2023 Survey Tracks
- Proposed Seismic Lines
- Study Area

0 2.5 5 7.5 km

FOX & CO ENVIRONMENTAL

Date: 13 09 2023 Base Imagery: Google Satellite Hybrid



FOX & CO
ENVIRONMENTAL

# Stakeholder Engagement Log

# Appendix 04

# Environmental Management Plan: EP161 2D Seismic and Ground Gravity Survey Program

# STO7-4

# NT Exploration Permit 161

# Santos QNT PTY Ltd

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# 1. Overview

This appendix contains a log of communications with Stakeholders, in relation to EP 161, to the date of submission. See **Table 2.1—1** for a legislation summary and locations as to where this can be found.

**Table 2.1—1 Legislation Requirements**

| Legislation Items | | Location |
|---|---|---|
| **Petroleum (Environmental) Regulations (*PER*)** | | |
| **Stakeholder List** | **Regulation 8(4) (f)**<br>1. *The summary of a plan must include the following:*<br>f) *a list of stakeholders with whom the interest holder has carried out stakeholder engagement;*<br><br>**Schedule 1 Clause 9(1) (a)**<br>1. *A plan must include information about the stakeholder engagement carried out by the interest holder that includes the following:*<br>a) *a list of the stakeholders and the stakeholder's contact details.* | **Table 2.1—1** |
| **Engagement Conducted** | **Regulations 7(1) and 7(2) (b)**<br>1. *During the preparation of an environment management plan, an interest holder for the plan must carry out stakeholder engagement in accordance with this regulation.*<br>2. *The interest holder must:*<br>b) *allow a reasonable period for the stakeholder to respond to the information given by the interest holder.*<br><br>**Regulation 8(4) (g)**<br>4. *The summary of a plan must include the following:*<br>g) *the stakeholder engagement carried out and information about future stakeholder engagement.*<br><br>**Schedule 1 Clause 9(1) (c)-(g)**<br>1. *A plan must include information about the stakeholder engagement carried out by the interest holder that includes the following:*<br>c) *if written responses have been received from stakeholders – a summary and copy of each response*<br>d) *an assessment of the merits of any objection or claim made by a stakeholder about the anticipated environmental impact of the proposed regulated activity;*<br>e) *a statement of the interest holder's response, or proposed response, to each objection or claim made by a stakeholder*<br>f) *a record of communications with stakeholders that is not mentioned in paragraph (b), (c) or (e), (for example, telephone discussions)*<br>g) *details of changes the interest holder made as a result of the stakeholder engagement.*<br><br>**Schedule 1 Clause 12**<br>*A plan must specify arrangements for the interest holder to notify the following persons before the proposed date of commencement of construction, drilling, or seismic surveys:*<br>a) *the Minister;*<br>b) *the occupier of the land on which the activity is to be carried out;*<br>c) *the owner of the land on which the activity is to be carried out (unless the owner is also the occupier).* | **Table 2.1—1**<br>**Table 2.2—1**<br>**Table 2.3—1**<br>**Table 2.4—1**<br>**Table 2.5—1** |
| **Copies of Information Provided** | **Schedule 1 Clause 9(1) (b)**<br>1. *A plan must include information about the stakeholder engagement carried out by the interest holder that includes the following:*<br>b) *a copy of the information provided to the stakeholders by the interest holder.*<br><br>**Regulation 36(1) and (3) (h)**<br>1. *An interest holder for a regulated activity must keep the prescribed records for the activity;*<br>3. *For subregulation (1), the prescribed records for the activity are the following documents:*<br>h) *information or records relating to stakeholder engagement;* | **Section 5** |
| **Engagement Contents** | **Regulations 7(1) and 7(2) (a)** | **Section 5** |

| Legislation Items | | Location |
|---|---|---|
| | 1. *During the preparation of an environment management plan, an interest holder for the plan must carry out stakeholder engagement in accordance with this regulation.*<br>2. *The interest holder must:*<br>a) *give each stakeholder information about:*<br>i) *the regulated activity the interest holder proposes to carry out; and*<br>ii) *the location (or locations) where it is proposed to carry out the activity; and*<br>iii) *the anticipated environmental impacts and environmental risks of the activity; and*<br>iv) *the proposed environmental outcomes in relation to the activity; and*<br>v) *the possible consequences of carrying out the activity to the stakeholder's rights or activities; and* | |
| **Future Stakeholder Engagement** | **Regulation 8(4) (g)**<br>4. *The summary of a plan must include the following:*<br>g) *the stakeholder engagement carried out and information about future stakeholder engagement.*<br><br>**Schedule 1 Clause 9(2)**<br>2. *A plan must also include information about future stakeholder engagement to be carried out by the interest holder.* | **EMP Section 9.4** |

**Table 2.1—2 Stakeholder Contact Details**

| Stakeholder | Role / Position | Phone Number | Email / Other Contact |
|---|---|---|---|
| **Landholder** | | | |
| [redacted] | Landholder<br>Tanumbirini Station (Rallen Australia) | [redacted] | [redacted] |
| [redacted] | Legal Representation | [redacted] | [redacted] |
| **Northern Land Council** | | | |
| [redacted] | Senior Project Officer | [redacted] | [redacted] |
| [redacted] | Senior Project Officer | [redacted] | [redacted] |
| [redacted] | Petroleum Manager | [redacted] | [redacted] |
| **Nurrdalinji Native Title Aboriginal Corporation** | | | |
| [redacted] | N/A | N/A | [redacted] |
| **Mineral / Mining Title Holders** | | | |
| [redacted] | Managed by:<br>Australian Mining & Exploration Title Services Pty Ltd | [redacted] | [redacted] |
| **Services** | | | |
| Power and Water Corporation | [redacted] | [redacted] | [redacted] |
| Telstra | [redacted] | [redacted] | [redacted] |
| Department of Infrastructure, Planning and Logistics (DIPL) | [redacted] | [redacted] | [redacted] |
| **Additional Parties (Non-Stakeholder)** | | | |
| [redacted] | Landholder<br>Beetaloo Station | [redacted] | [redacted] |

# 2. Engagement Logs

## 2.1 Landholder Engagement Log

**Table 2.1—1 Landholder Engagement Log**

| **Stakeholder:** | **Landholder – Rallen Australia** |
|---|---|
| **Topic(s): Access track locations, use of open-topped pits, notice of entry, and engagement pack** | |

| *** *PER* Schedule 1. Part 3.** | | **Reg 9(1) (f)*** | ***PER* Division 1. Reg 8(4) (g)** | **Reg 9(1) (c)*** | **Reg 9(1) (d)*** | **Reg 9(1) (e)*** | **Reg 9(1) (g)*** |
|---|---|---|---|---|---|---|---|
| **Date** | **Sender → Recipient** | **Method & Type** | **Content (and associated records)** | **Stakeholder Written Response(s)** | **Assessment of Objection's Merit(s)** | **Interest Holder's Response to Objection(s)** | **Changes Made** |
| **2022.05.21** | Landholder → Santos | Email | Raises concerns regarding access track location. | **Section 5.1.1.1**. | - | - | N/A |
| **2022.05.23** | Santos → Landholder | Email | Clarifies that the access track locations are indicative only. Would like to organise a discussion time. | - | **Section 5.1.1.1**<br>Environmental impact: see **Table 3.1—1**. | **Section 5.1.1.1** & **Table 3.1—1**.<br>Confirms access track locations are indicative. | Location of access tracks changed. |
| **2022.05.31** | Landholder → Santos<br><br>Santos → Landholder | Email<br><br>Email | Raises concerns over use of open topped pits. Wishes to organise a meeting.<br><br>Responds to concerns, noting discussions with Operations Team to better understand. | **Section 5.1.1.2**.<br><br>- | -<br><br>**Section 5.1.1.2**<br>Environmental impact: see **Table 3.1—1**. | -<br><br>**Section 5.1.1.2** & **Table 3.1—1**.<br>Discussions outlining the scope of the Activity, confirming no open-topped pits are anticipated to be used. | -<br><br>N/A |
| **2022.10.26** | Santos + Landholder | In Person | Onsite at Tanumbirini Station. Discussions of seismic acquisition and rehabilitation. | - | - | The Interest Holder committed to mulching seismic lines and utilising existing tracks where possible. | - |
| **2023.10.20** | Santos → Landholder | Email | Email outlining the below attachments, and acknowledgement of query regarding renaming the well [**Section 5.1.1.3**].<br>Attached files:<br>• EP 161 Seismic – Pastoralist Engagement Pack [**Section 5.4.1**].<br>• Letter Santos Confirmation of Registration Access Agreement. .A Deputy Chief Executive Signed – Notice of Approved Access Agreement. | - | - | - | - |

## 2.2 NLC Engagement Log

**Table 2.2—1 NLC Engagement Log**

| | |
|---|---|
| **Stakeholder:** | **Members of the Northern Land Council (NLC) on behalf of the Traditional Owners.** |
| **Topic(s): Work Program Submission and Meeting** | |

| * *PER* Schedule 1. Part 3. | | Reg 9(1) (f)* | *PER* Division 1. Reg 8(4) (g) | Reg 9(1) (c)* | Reg 9(1) (d)* | Reg 9(1) (e)* | Reg 9(1) (g)* |
|---|---|---|---|---|---|---|---|
| **Date** | **Sender → Recipient** | **Method & Type** | **Content** | **Stakeholder Written Response(s)** | **Assessment of Objection's Merit(s)** | **Interest Holder's Response to Objection(s)** | **Changes Made** |
| **2022.09.26** | Santos → NLC | Email | Work program, cover letter, and attachments [**Sections 5.1.2.1** and **5.2**].<br>• Cover Letter<br>• Attachment 1 - Work Program.<br>• Attachment 2 – Annexures.<br>• Spatial files (shp.) with attributes for cross referencing. | - | - | - | - |
| **2023.04.05** | Santos → NLC | Email | Work Program meeting information and expected agenda [**Section 5.1.2.2**].<br>Attachments:<br>• Meeting Agenda 2023 Work Program Meeting Santos EP 161<br>• Mataranka presentation pack_NLC_EP 161 Meeting_12 April 2023 [**Section 5.3**]. | - | - | - | - |
| | Santos & NLC | Video Conference | Discussion of On-Country Meeting agenda and presentation pack. | - | - | - | - |
| **2023.04.12** | Santos & NLC | In-person | On-Country Meeting – Mataranka. **Section 5.3** for presentation material. | - | - | - | - |
| **2023.04.14** | Santos → NLC | Email | Outlines AAPA certificates [**Section 5.1.2.3**]. | - | - | - | - |
| | NLC → Santos | Email | Concerns with seismic lines in relation to sacred sites. | **Section 5.1.2.3**. | **Section 5.1.2.3** & **Table 3.1—1**. | **Section 5.1.2.3**. | - |
| | Santos → NLC | Email | Clarification that AAPA certificates are not based on Santos' processes, and that Santos is not in a position to approve access to country. | - | - | **Section 5.1.2.3**. | - |
| | NLC → Santos | Email | Concerned that this wasn't clear during the meeting. | **Section 5.1.2.3**. | - | - | - |

## 2.3 Nurrdalinji TO Engagement Log

**Table 2.3—1 Nurrdalinji Native Title Aboriginal Corporation Engagement Log**

| | |
|---|---|
| **Stakeholder:** | **Nurrdalinji Native Title Aboriginal Corporation (NNTAC)** |
| **Topic(s): General Work Program Concerns** | |

| * *PER* Schedule 1. Part 3. | | Reg 9(1) (f)* | *PER* Division 1. Reg 8(4) (g) | Reg 9(1) (c)* | Reg 9(1) (d)* | Reg 9(1) (e)* | Reg 9(1) (g)* |
|---|---|---|---|---|---|---|---|
| **Date** | **Sender → Recipient** | **Method & Type** | **Content** | **Stakeholder Written Response(s)** | **Assessment of Objection's Merit(s)** | **Interest Holder's Response to Objection(s)** | **Changes Made** |
| **2023.08.17** | Santos → NNTAC | Email | Outlines the purpose of the exploration program. Attached a copy of the Work Program. Provides a contact email for further questions **[Section 5.1.3.1]**. | - | - | - | - |
| **2023.08.28** | NNTAC → Santos | Email | Acknowledgement of email. Commits to sending further questions to Santos contact the following week. | **Section 5.1.3.1.** | - | - | - |
| **2023.08.31** | NNTAC → Santos | Email | Provides a list of questions and concerns regarding the Work Program. | **Section 5.1.3.1.** | **Section 5.1.3.1.** | - | N/A |
| **2023.09.21** | NNTAC → Santos | Email | Nurrdalinji Aboriginal Corporation invite Santos to a meeting. | **Section 5.1.3.2** | | | |
| **2023.09.26** | Santos → NNTAC | Email | Submits responses to questions. | - | **Section 5.1.3.1** & **Table 3.1—1.** | **Section 5.1.3.1.** | - |
| **2023.10.07** | Santos & NNTAC | Video Conference | Whilst Santos did prepared content associated with the proposed 2D seismic and future planned activities to present to the NNTAC the meeting took a different direction.<br>The meeting focused on consent and the inclusion of the NTTAC in future discussion. It was identified that 10 members of NNTAC (including 2 board members) were at the NLC led meeting at Mataranka in April 2023. | **-** | **Table 3.1—1.** | - | - |

## 2.4 Mineral / Mining Title Holders Engagement Log

**Table 2.4—1 Mineral / Mining Title Holders Engagement Log**

| Stakeholder: | NT Australian Mining & Exploration Title Services (on behalf of Pennant Resources) |
|---|---|
| **Topic(s): Notification of Intended Activity** | |

| * *PER* Schedule 1. Part 3. | | Reg 9(1) (f)* | *PER* Division 1. Reg 8(4) (g) | Reg 9(1) (c)* | Reg 9(1) (d)* | Reg 9(1) (e)* | Reg 9(1) (g)* |
|---|---|---|---|---|---|---|---|
| **Date** | **Sender → Recipient** | **Method & Type** | **Content** | **Stakeholder Written Response(s)** | **Assessment of Objection's Merit(s)** | **Interest Holder's Response to Objection(s)** | **Changes Made** |
| **2023.10.10** | Santos → NT Australian Mining & Exploration Title Services | Email | Email with map attachments outlining Santos' intention to seek approval to conduct a seismic survey [**Section 5.1.4.1**]. | No Response. | - | - | - |

## 2.5 Services & Infrastructure Engagement Log

**Table 2.5—1 Services and Infrastructure Engagement Log**

| Stakeholder(s): | Services & Infrastructure (Telstra, Power & Water, DIPL) |
|---|---|
| **Topic(s): Notification of Intended Activity** | |

| * *PER* Schedule 1. Part 3. | | Reg 9(1) (f)* | *PER* Division 1. Reg 8(4) (g) | Reg 9(1) (c)* | Reg 9(1) (d)* | Reg 9(1) (e)* | Reg 9(1) (g)* |
|---|---|---|---|---|---|---|---|
| **Date** | **Sender → Recipient** | **Method & Type** | **Content** | **Stakeholder Written Response(s)** | **Assessment of Objection's Merit(s)** | **Interest Holder's Response to Objection(s)** | **Changes Made** |
| **Telstra** | | | | | | | |
| **2023.08.02** | Santos → Telstra | Email | Enquiry into preferred contact for notice of proposed works on Tanumbirini Station [**Section 5.1.5.1.1**]. | - | - | - | - |
| **2023.09.06** | Santos → Telstra | Phone + Email | Phone: discussed details and potential impacts of proposed 2024 Seismic Program and potential future works.<br>Email: summarises contents of phone call. Outlines the potential name of the Telstra Tower. Attaches a GIS map with coordinates. | **Section 5.1.5.1.2**. | - | - | - |
| | Telstra → Santos | Email | Confirms site name and references. | **Section 5.1.5.1.2**. | - | - | - |
| **2023.10.09** | Santos → Telstra | Email | Acknowledgement that there are no issues in regard to the Telstra Tower. Provides formal notification of intended works, with two map attachments [**Section 5.1.5.1.2**].<br>• EP161 – Location Map – Project Area. | - | - | - | - |

| Stakeholder(s): | Services & Infrastructure (Telstra, Power & Water, DIPL) |
|---|---|
| **Topic(s): Notification of Intended Activity** | |

| * *PER* Schedule 1. Part 3. | | Reg 9(1) (f)* | *PER* Division 1. Reg 8(4) (g) | Reg 9(1) (c)* | Reg 9(1) (d)* | Reg 9(1) (e)* | Reg 9(1) (g)* |
|---|---|---|---|---|---|---|---|
| **Date** | **Sender → Recipient** | **Method & Type** | **Content** | **Stakeholder Written Response(s)** | **Assessment of Objection's Merit(s)** | **Interest Holder's Response to Objection(s)** | **Changes Made** |
| | | | • EP161 – Location Map – Regional. | | | | |
| **Power & Water / Vebrec** | | | | | | | |
| **2023.10.03** | Santos → Power & Water | Email | Intentions of works notification [**Section 5.1.5.1**]. | **Section 5.1.5.2**. | - | - | - |
| **2023.10.26** | Power & Water + Santos | Phone + Email | Email: Provides a general outline of phone discussion and follows up on the request for a copy of previously sent attachments/maps for proposed seismic lines.<br>Outlines weight restrictions on Vibroseis trucks as well as buffer distances and maximum peak particle velocity (PPV) values. | **Section 5.1.5.2**. | **Section 5.1.5.2** & **Table 3.1—1**. | - | - |
| **2023.10.31** | Santos → Power & Wate | Email | Outlines the clearance distances between the Vibroseis trucks and pipeline. Confirms the contractors can take independent verification measurements. Confirmation that onsite testing will occur to ensure PPV will be below 10 mm/sec [**Section 5.1.5.2**].<br>• Attaches a copy of the Stakeholder Engagement Pack [**Section 5.4.2**]. | - | **Section 5.1.5.2** & **Table 3.1—1**. | **Section 5.1.5.2**. | - |
| **DIPL** | | | | | | | |
| **2023.10.03** | Santos → DIPL | Email | Intentions of works notification [**Section 5.1.5.3**]. | - | - | - | - |

## 2.6 Additional Parties Engagement Log

**Table 2.6—1 Additional Parties Engagement Log**

| Additional Party: | Beetaloo Station (Jane & Scott Armstrong) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Topic(s): Notification of Intended Activity** | | | | | | | | |
| *** *PER* Schedule 1. Part 3.** | | | **Reg 9(1) (f)*** | ***PER* Division 1. Reg 8(4) (g)** | **Reg 9(1) (c)*** | **Reg 9(1) (d)*** | **Reg 9(1) (e)*** | **Reg 9(1) (g)*** |
| **Date** | **Time** | **Sender → Recipient** | **Method & Type** | **Content** | **Stakeholder Written Response(s)** | **Assessment of Objection's Merit(s)** | **Interest Holder's Response to Objection(s)** | **Changes Made** |
| **2023.10.10** | 12:12pm | Santos → Beetaloo Station | Email | Advice of intended Activity on Tanumbirini Station **[Section 5.1.6.1]**.<br>• Map: EP 161 – Location Map – Regional<br>• Map: EP 161 – Location Map – Project Area | - | - | - | - |

# *3.* Assessment of Merits of Objections and Claims

## 3.1 Summary of Assessment of Merits of Objections and Claims

**Table 3.1—1 Assessment of Merits**

| Date | Concerns, Objections, and Claims | Assessment of Merits | Interest Holder's Response | Changes to EMP |
|---|---|---|---|---|
| **Landholders** | | | | |
| **2022.05.21** | Email (**Section 5.1.1.1**):<br>• Position of the access tracks (in the draft AA).<br>• Paddocks will become un-usable. | Environmental Impact:<br>Position of access tracks disrupts landowner's regular use of land, resulting in the inability to meet the environmental outcome of 'use of land meets the conditions of Land Access Agreement' (EMP **Table 8.1–1**).<br><br>Considerations & Notes:<br>Access tracks outlined as part of the draft LAA are indicative only. | Response Email (**Section 5.1.1.1**):<br>• Confirmation that the proposed access tracks in the draft LAA are indicative locations only.<br>• Communicated that Santos is open to discussions as to the preferred to location of access tracks.<br><br>In-person Discussions:<br>Meeting held on site (Tanumbirini) between Santos and Rallen discussed the use of mulching to prepare seismic lines. Option was agreed verbally by Rallen as acceptable. | No change required. The Activity does not propose the construction of access tracks. |
| **2022.05.31** | Email (**Section 5.1.1.2**):<br>• Raises concerns over use of open pits. | Environmental Impact:<br>No impact on environmental outcomes. | Response Email (**Section 5.1.1.2**):<br>• Agree to organise a discussion with the Operations Team. | No change required. The Activity does not propose the handling or storage of wastewater. |

| Date | Concerns, Objections, and Claims | Assessment of Merits | Interest Holder's Response | Changes to EMP |
|---|---|---|---|---|
| | | Considerations & Notes:<br>The Interest Holder does not propose to use open pits as part of this Activity. | Ongoing Actions:<br>Santos is working with DEPWS to devise an approved strategy for burial of drilling material and the ultimate rehabilitation of the pits. | |
| **Northern Land Council (NLC)** | | | | |
| **2023.04.14** | Email (**Section 5.1.2.3**):<br>Concerns with seismic lines in relation to sacred sites and access granted via AAPA Authority Certificates. | Environmental Impact:<br>Concerns align with an identified risk associated with the successful outcome of protecting sacred sites, culture, and heritage whilst conducting the Activity (EMP **Table 8.1–1**).<br><br>Considerations & Notes:<br>Santos has received three approved AAPA Authority Certificates which identify both sacred sites (excluded areas), and areas which are cleared for use as part of the Activity.<br>Santos is guided by AAPA's ability to identify sacred sites and fully adheres to the directions provided. | Response Email (**Section 5.1.2.3**):<br>• AAPA Authority Certificates are granted by an independent body and provide guidance to Santos regarding sacred sites in relation to proposed Activity locations.<br>• Access to country is determined by the host pastoralists, not Santos. | No change required. Seismic line locations presented at the OCM were the preliminary 'concept line' locations. The purpose of these indicative preliminary seismic lines was to provide an indicative survey location, based on borehole breakout data, fracture orientation, and to integrate previous seismic surveys and possibly future well locations.<br>Whilst the preliminary seismic lines did intersect a Restricted Work Area (RWA), the Interest Holder has committed to avoiding RWAs. The proposed seismic lines in the EMP avoid the RWAs and this is evident in figures. |
| **Nurrdalinji Native Title Aboriginal Corporation (NNTAC)** | | | | |
| **2023.08.30** | Email (**Section 5.1.3.1**):<br>• List of question submitted.<br><br>General themes:<br>• Location of works in relation to sacred sites.<br>• Communication with community and Activity schedule.<br>• Infrastructure:<br>  ○ Borrow pit size.<br>  ○ Potential pipelines.<br>• Hydraulic fracturing, recovery, and sale of exploratory appraisal gas.<br>• Bushfire season and use of equipment which poses a fire risk. | Environmental Impact:<br>Concerns align with identified risks associated with the successful outcome of protecting sacred sites, culture, and heritage plus avoiding permanent degradation of native flora and fauna (through fire) whilst conducting the Activity (EMP **Table 8.1–1**).<br><br>Considerations & Notes:<br>• Protection of Sacred Sites:<br>  ○ Santos has received three approved AAPA Authority Certificates which identify both sacred sites (excluded areas), and areas which are cleared for use as part of the Activity.<br>  ○ Santos is guided by AAPA's ability to identify sacred sites and fully adheres to the directions provided.<br>• Avoiding permanent degradation to native flora and fauna: | Response Email (**Section 5.1.3.1**):<br>• Responses to each question provided.<br><br>Summary of response to the general question themes:<br>• Location of works in relation to sacred sites.<br>  ○ The requirements outlined in the AAPA Authority Certificate will be met. Protection measures will be implemented to ensure identified sacred sites are not damaged.<br>• Community communication and Activity schedule:<br>  ○ List provided of stakeholders and other relevant parties who have been engaged.<br>  ○ Summary of On-Country meeting with NLC and Traditional Owners.<br>  ○ Confirmed that scouting for civils, anthropological, ecological, and weed surveys had already been undertaken.<br>  ○ Santos will notify the regulator and the pastoralist of commencement and cessation of the Activity.<br>• Infrastructure: | No change required. The EMP includes a bushfire management plan, and a fire tender is part of the support vehicles for the Activity. |

| Date | Concerns, Objections, and Claims | Assessment of Merits | Interest Holder's Response | Changes to EMP |
|---|---|---|---|---|
| | | ○ Santos has developed a Fire Management Plan and Emergency Response Plan, which once approved, will be publicly available via as part of the EMP.<br>○ Daily operational reports show preparedness to fight fire. Bushfire risk is considered prior to commencing the Activity.<br>○ Firefighting equipment will be available during operations. | ○ Borrow pits: confirmed no borrow pits will be constructed under this EMP – areas on maps are indicative only and are the results of previous scouting trips which have highlighted regions which may contain suitable material for civils works. The size of any borrow pit will be dictated by the volume of material which is required.<br>○ Pipelines: No pipelines are associated with the Activity.<br>• Hydraulic fracturing, recovery, and sale of exploratory appraisal gas:<br>○ The Activity does not propose any HF and no hydrocarbons will be produced or recovered.<br>• Bushfires:<br>○ A bushfire management plan, approved by the regulator, will be made public with the approved EMP and enacted. | |
| **2023.10.07** | Video Conference<br><br>General themes:<br>• Consultation<br>• NLC legitimacy | Environmental Impact:<br>No impact on environmental outcomes.<br><br>Considerations & Notes:<br>• The Interest holder is required to engage the NLC as part of the consultation process with Traditional Owners.<br>• Several members of the NNTAC were present at the OCM in Mataranka.<br>• The Interest Holder is engaging with the NNTAC. | Meeting Outcome:<br>Invitation extended to the Interest Holder to accompany TOs On Country. | No change required. |
| **Services Infrastructure (Power & Water / Vebrec)** | | | | |
| **2023.10.31** | Email (**Section 5.1.5.2**):<br>Outlines weight restrictions on Vibroseis trucks as well as buffer distances and maximum peak particle velocity (PPV) values. | Environmental Impact:<br>No impact on environmental outcomes.<br><br>Considerations & Notes:<br>Agrees with buffer distances. Will comply with weight restrictions and PPV values. | Response Email (**Section 5.1.5.2**):<br>• Acknowledges concerns.<br>• Outlines the clearance distances between the Vibroseis trucks and pipeline.<br>• Confirms the contractors can take independent verification measurements.<br>• Confirmation that onsite testing will occur to ensure PPV will be below 10 mm/sec | EMP includes commitments to maintaining clearance distances between the vibroseis trucks and pipeline. |

# 4. References

DTF, DITT, & DEPWS. (2016). *Petroleum (Environment) Regulations 2016*. (REPP044R3).Department of Industry Department of Treasury and Finance, Tourism and Trade, Department of Environment, Parks and Water Security Northern Territory Government: Northern Territory Government. Retrieved from **https://legislation.nt.gov.au/en/Legislation/PETROLEUM-ENVIRONMENT-REGULATIONS-2016**

# 5. Appendices

## 5.1 Stakeholder Correspondence Emails

### 5.1.1 Landholder

#### 5.1.1.1 2022.05.23 – Access Track Discussion

**From:** [redacted]
**Sent:** Saturday, 21 May 2022 7:33 AM
**To** [redacted]
**Subject:** ![EXT]: RE: Tanumbirini - Draft Land Access Agreement and Negotiation Notice

Morning [redacted]

As per my email dated yesterday I have started looking at your proposed draft AA.

My first comments are that Santos have to relook at their positioning of new access roads, marked yellow in the attached map to the draft AA. The proposed new access track are cutting our paddocks into unmanageable blocks and will severely interfere with our infrastructure and the managing of our cattle. For example, looking at the current location of Tanumbirini 1, Santos is proposing to add 5 new access track through a very small paddock, in doing so that paddock becomes useless to Rallen.

Looking forward to your comments.

Regards,
[redacted]

**From:** [redacted]
**To:** [redacted]
**Subject:** RE: Tanumbirini - Draft Land Access Agreement and Negotiation Notice
**Date:** Monday, 23 May 2022 9:38:10 AM

Morning [redacted]

Thank you for the feedback. The location of the proposed access roads on the maps provided are only indicative for discussion and we would work with you and your team to identify the most suitable locations to minimise impacts on your operations.

If we could organise an initial discussion in the next couple of weeks we could flesh out some of these initial concerns that you may have.

[redacted]

### 5.1.1.2 2022.05.31 – Concerns over Pits

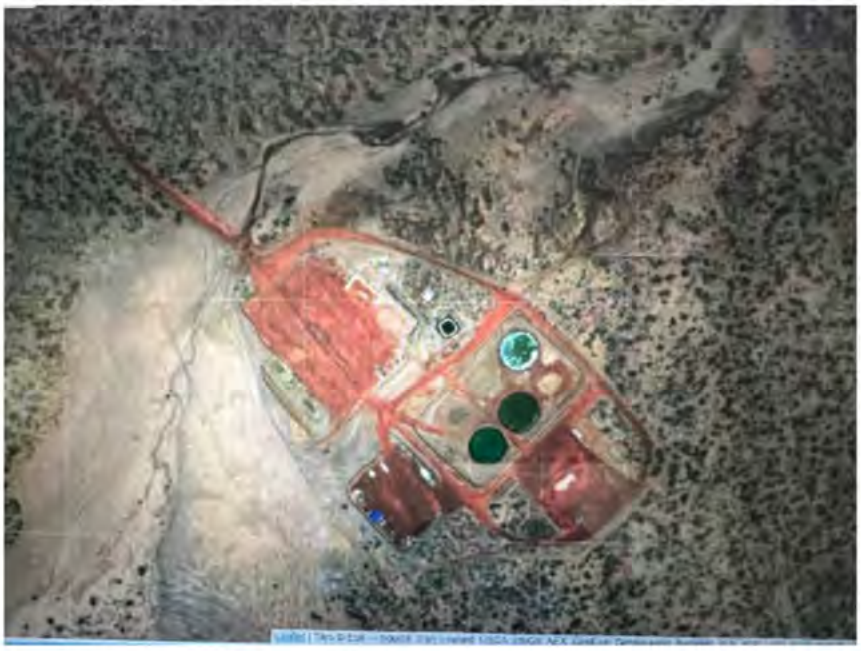
**From:** [redacted]
**Sent** T d 31 M 2022 7 22 AM
**To:** [redacted]
**Cc:**
**Subject:** ![EXT]: Santos Land Access

Mornin [redacted]

Replying to you email of Friday 27th 3:21pm. I'm sure you are aware of your fellow stake holder Tamboran's actions toward Rallen. It has occupied my time for the last few months and still does. I'm travelling to the Territory on the 3rd of June returning the 10th. I can meet in Sydney on Tuesday the 14th or Wednesday the 15th June in Sydney.

Please have a look at the images below, what happens to the open pits, hopefully they don't get filled in onsite? Could you please let me know.

[redacted]





Sent from my iPhone

Santos Ltd A.B.N. 80 007 550 923
Disclaimer: The information contained in this email is intended only for the use of the person(s) to whom it is addressed and may be confidential or contain privileged information. If you are not the intended recipient you are hereby notified that any perusal, use, distribution, copying or disclosure is strictly prohibited. If you have received this email in error please immediately advise us by return email and delete the email without making a copy. **Please consider the environment before printing this email.**

**From** [redacted]
**Subject: RE: Santos Land Access**
**Date:** 31 May 2022 at 11:41:43 am AEST
**To**
**Cc** [redacted]

H [redacted]

Thanks for your email. I'm talking to the operations people to try to understand your concerns and will be in touch about that.

I'm heading over to the UK today and Perene, who's copied to this email, will look after this matter until I return on 4 July 2022. I will be monitoring my emails whilst away.

The business would like to meet with you on 14 or 15 June in Sydney. Where would you like to hold that meeting and who will be attending?

Looking forward to hearing from you.

[redacted]

### 5.1.1.3 2023.10.20 – Engagement Pack & Well Name Query*

**From:** [redacted]
**Sent:** Friday, 20 October 2023 12:56 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** Rallen - Pastoral Engagement pack
**Attachments:** EP 161 2D Seismic - Pastoralist Engagement Pack.pdf; Letter Santos Confirmation of Regisration of LAA0022.pdf; ADeputy Chief Executive Signed - Notice of Approved Access Agreement LAA0022.PDF

Afternoon [redacted]

Hope you are well.

As part of our commitment to ongoing engagement and discussion with landholders, we wish to provide you with the **attached** information regarding the proposed activities planned to occur on Tanumbirini Station in 2024.

These activities will be carried out pursuant to the recently registered Land Access Agreement – refer to attached confirmation of registration.

We note the attached Engagement Pack provides a description of Santos' activities and how Santos proposes to manage the environmental impacts and risks associated with its activities, including how it will address its regulatory obligations.

We are pleased to report that Santos staff on the ground have been providing their assistance with the recent bushfires affecting the Tanumbirini property. Not only did they assist with the firefighting, but they also assisted with the evacuation of a Tanumbirini staff member who was bitten by a snake.

Should any further assistance be required, please do not hesitate to let us know, and we will be happy to accommodate this where we can.

We understand you had enquired about the renaming of the wells. Whilst we do not have an update on this just yet, we are continuing to follow up with our Project Team, who are working on this for you.

Should you have any questions or wish to discuss further the information contained in this email and the Engagement Pack, NT Senior Land Access Adviser Vanessa Lu and I will be available to meet with you.

Please let us know if you would like to meet in person (Sydney, Darwin, or Tanumbirini Station) or via an online meeting, and we will be happy to accommodate this.

Otherwise we are contactable via phone and email.

Kind regards,

[redacted]

Santos.com | Follow us on LinkedIn, Facebook and Twitter

Santos acknowledges the Traditional Owners and Custodians of the lands on which we operate. We pay our respects to their Elders past, present and emerging.

* LAA attachments not included. See **Section** for Engagement Pack.

## 5.1.2 Northern Land Council (NLC)

### 5.1.2.1 2022.09.26 – Work Program*

**From:** [redacted]
**To:**
**Cc:**
**Subject:** EP 161 - 2023 Work Program Submission
**Date:** Monday, 26 September 2022 9:05:06 AM
**Attachments:** Santos_WP-210094-001_EP 161_Work Program Cover Letter.pdf
Santos_WP-210094-0001_EP 161_ Attachment 1_Work Program.pdf
Santos_WP-210094-001_EP 161_Attachment 2_Annexures.pdf
EP161_Attachment 3 - 2023 Work Program_Spatial Files.zip

Dear [redacted]

In accordance with clause 5.1(c) of the EP 161 Co-operation and Exploration Agreement Santos provides this Work Program and supporting spatial files with respect to areas within EP 161 where it proposes to undertake activities.

Attached is the following:

- Cover Letter
- Attachment 1 - Work Program
- Attachment 2 – Annexures
- Spatial files (shp.) with attributes for cross referencing

Please advise any specific queries or additional requirements.

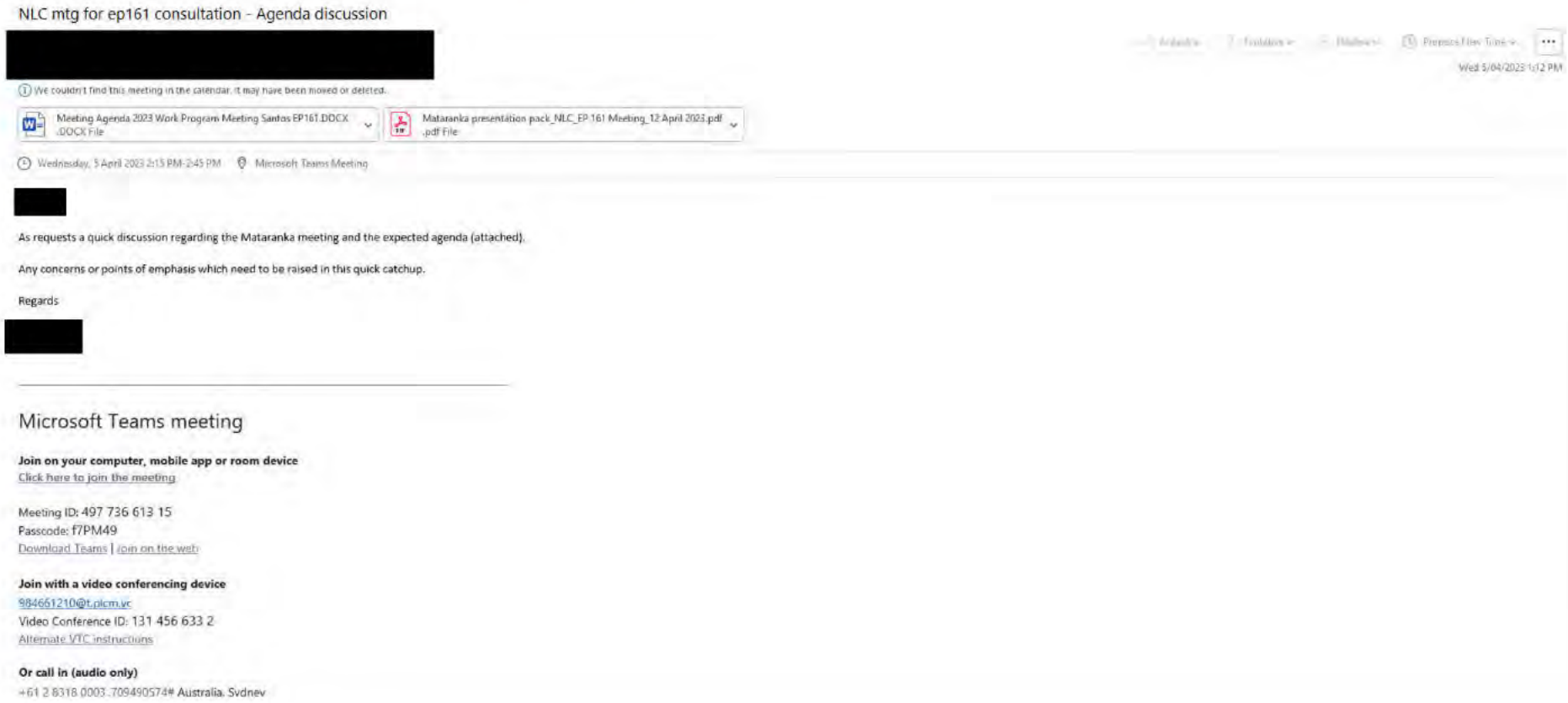
We look forward to progressing the work program and associated community consultation arrangements as per the terms of the EP 161 Co-operation and Exploration Agreement.

Please advise a suitable time to meet regarding logistics and planning for the community consultation scheduled for 26 October.

[redacted]

* See **Section 5.2** for attachments.

### 5.1.2.2 2023.04.05 – Agenda for On-Country Meeting*



NLC mtg for ep161 consultation - Agenda discussion

[redacted]

Wed 5/04/2023 1:12 PM

We couldn't find this meeting in the calendar. It may have been moved or deleted.

Meeting Agenda 2023 Work Program Meeting Santos EP161.DOCX
.DOCX File

Mataranka presentation pack_NLC_EP 161 Meeting_12 April 2023.pdf
.pdf File

Wednesday, 5 April 2023 2:15 PM-2:45 PM Microsoft Teams Meeting

[redacted]

As requests a quick discussion regarding the Mataranka meeting and the expected agenda (attached).

Any concerns or points of emphasis which need to be raised in this quick catchup.

Regards

[redacted]

---

Microsoft Teams meeting

**Join on your computer, mobile app or room device**
Click here to join the meeting

Meeting ID: 497 736 613 15
Passcode: f7PM49
Download Teams | Join on the web

**Join with a video conferencing device**
98466210@t.plcm.vc
Video Conference ID: 131 456 633 2
Alternate VTC instructions

**Or call in (audio only)**
+61 2 8318 0003 ,709490574# Australia, Sydney

* See **Section 5.3** for Presentation Pack.

NORTHERN LAND COUNCIL

# MEETING AGENDA

## WORK PROGRAM - INFORMATION MEETING

EP 161

## Santos

[redacted]

Email: [redacted]

### Agenda

| TIME | ITEM | PRESENTER |
|---|---|---|
| 10:00 – 10:20 am | Welcome and Introduction (attendance list circulated) | **NLC (Anthro)** |
| 10:20 – 10:30 am | Meeting Protocol & General Housekeeping | **NLC** |
| 10:30 – 11:00 am | NLC Update<br>• Discussion of country subject to proposed exploration activities – estates/ sacred sites<br>• History of consultations and overview of Exploration Agreement with Santos | **NLC (R&E)**<br>– Santos leave |
| 11:00 – 11:30 am | Project Update<br>• Overview<br>• Exploration activities undertaken to date<br>• Work completed since the last meeting | **Santos return** |
| 11:30 – 12:30 pm | What's next for the Project<br>• Proposed Work<br>• Environmental Management<br>• Cultural Management<br>• Potential activities over the next 12 months<br>• Employment Opportunities<br>• Other future work to consider | **Santos** |
| 12.30 – 1.00 pm | Lunch | |
| 1:00 – 3pm | • Native tittle discussions | TOs & NLC **(Anthropology branch)** |
| | | |
| | | |

1




# MEETING AGENDA

2

### 5.1.2.3 2023.04.14 – On Country Meeting: AAPA Concerns

**From:** [redacted]
**Sent:** Friday, 14 April 2023 3:16 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** AAPA certificates obtained by SANTOS concerning EP 161
Good Afternoon [redacted]
I have attached, as the discussed, the relevant AAPA certificates describing the activities approved to occur on EP 161. These certificates were referenced in our correspondence to the NLC on 23 September 2022.
These AAP certificates are noted below –
20 Feb 2020 // RA2019/122 – **C2020/011** authority certificate for exploration wells, well development and 2d seismic survey within ep161 – southern location
13 Dec 2019 // RA2019/8 – **C2019/043** issue of authority certificate for variation to c2014/053 exploration wells, well development and 2d seismic survey within EP161
10 Dec 2018 // RA2018/108 – **C2018/105** issue of authority certificate for variation to c2018/102 - water bores for environmental monitoring within ep161
23 July 2013 // 2013/783 – **C2013/142** issue of authority certificate for proposed seismic survey over ep161
Kind regards
[redacted]

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**From:** [redacted]
**Sent:** Friday, 14 April 2023 4:03 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: AAPA certificates obtained by SANTOS concerning EP 161
Hi [redacted]
The maps in the certificates come from AAPA and their approval is based on their processes. The appropriate conditions outlined in each of the certificates provide guidance and warning. Santos can only proceed based on what information is provided.
Access to the specific areas of country within EP 161 is decision by the pastoralist.
Santos is not in a position to approve access to country.
regards
[redacted]

**From:** [redacted]
**Sent:** Friday, 14 April 2023 4:43 PM
**To:** [redacted]
**Cc:**
**Subject:** ![EXT]: RE: AAPA certificates obtained by SANTOS concerning EP 161

This should have been clear during the meeting that Santos do not approve access to country and this will come up in future meetings if not managed properly.

[redacted]

## 5.1.3 Nurrdalinji Native Title Aboriginal Corporation

### 5.1.3.1 2023.08.17 – 2023.09.26 – Work Program: Concerns and Responses

On Thu, Aug 17, 2023 at 4:39 PM [redacted] wrote:

To [redacted]

Santos understands the importance of stakeholder engagement requirements and seeking to adequately inform and engage with stakeholders about its activities.

The purpose of exploration and appraisal activity to be undertaken in 2023 and beyond is to increase our understanding of the prospectivity or potential of the EP161 permit area.

Please find attached relevant information regarding the proposed work program for the end of 2023 onwards.

If you require any further information or clarification of the proposed works, please contact Haydn Kreicbergs on the details contained in the attached letter.

Kind regards

[redacted]

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**From:** [redacted]
**Sent:** Monday, 28 August 2023 2:00 PM
**To:** [redacted]
**Cc:**
**Subject:** ![EXT]: Re: EP 161 Proposed 2023+ Work Program

Thank you for sending this through. We will send some questions to Haydn this week.

**From:** [redacted]
**Sent:** Thursday, 31 August 2023 8:44 AM
**To:** [redacted]
**Cc:**
**Subject:** ![EXT]: Re: EP 161 Proposed 2023+ Work Program

Hello,

Thank you for the information. We appreciate you getting in touch with Nurrdalinji. We have the following questions based on the documentation you sent us.1. When is draft EMP due to be released for public consultation and who have you consulted with to date on these proposed works?
2. When are NLC and Santos consultations due to be held in relation to these new EP 161 works and will you notify Nurrdalinji?
3. Has work already commenced (you say scouting will begin in mid 23)?
4. How close will the work be to restricted work areas? For example, the camp seems to sit very close to sacred site areas - will you consider moving the camp.
5. Why do the maps show such very large borrow pit areas?
6. Do you intend to recover, use or sell any exploratory gas as part of the appraisal gas provisions?
7. What pipeline plans do you have?
8. With regard to fracking:
- how many fracks per well are proposed?
- what is the volume of the frack chemicals per frac?
- what is the volume of frac fluid per frac?
- how much proppant per frac?
9. How are you going to accommodate the seasonal bushfire outlook for Spring 2023. We note areas of the Barkly are at increased risk of fire because of increased grass as fuel and expected elevated temperatures. While most of the high risk area is south of Elliot, not all of it is. The bad conditions will extend into the summer and some experts are saying they expect 80 percent of the Territory to burn by March. Is any of the equipment likely to create sparks or other grassfire ignition hazards? Will you share your emergency plans with us?
10. How will you notify community about the start and cessation of activity - will you be alert us about your arrival and departure?

**From:** [redacted]
**Sent:** Tuesday, 26 September 2023 4:02 PM
**To:** [redacted]Contact
**Cc:** [redacted]
**Subject:** RE: ![EXT]: Re: EP 161 Proposed 2023+ Work Program

**Importance:** High

Good Afternoon,

Thank you for your email.

Please find below our highlighted responses for each of the queries.

Regards,

[redacted]




Santos acknowledges the Traditional Owners and Custodians of the lands on which we operate. We pay our respects to their Elders past, present and emerging.

*Our understanding is that the draft EMP will not be released for public consultation as it will not contain any regulated activities relating to drilling or fracture stimulation.*

*The release of the Draft EMP for public comment is controlled/regulated by DEPWS.*

*Engagement for consultation/information in regards to the acquisition of the proposed 2D seismic is ongoing, it includes but is not limited to:*

- *Pastoralists – Tanumbirini Station and Beetaloo station.*
- *Traditional Owners – coordinated through the NLC and executed via on-country meetings.*
- *Nurrdalinji Native Title Aboriginal Corporation.*
- *MRP Pipeline operator – PwC.*
- *Amplitel (Telstra Tower) – microwave repeater station.*
- *Department of Infrastructure, Planning and Logistics – Carpentaria Highway owner.*
- *Local Councils - Roper Gulf Regional Council & Barkley Regional Council.*
- *Parks and Wildlife (DEPAWS) – The property boarders Limmen National Park operated by P&W.*
- *Minister for Mining and Industry (Nicole Manison) – Portfolio relevant.*
- *Member for Barkly (Steven Edgington) – Local member for region.*

When are NLC and Santos consultations due to be held in relation to these new EP 161 works and will you notify Nurrdalinji?

- *Consultation in regard to the proposed 2D seismic acquisition has already taken place via NLC coordination.*
- *Meeting was held at the Mataranka Town Hall on 11 April 2023.*
- *Meeting covered the proposed acquisition of 2D Seismic with a lighter touch discussing the potential forward looking work program.*
- *50 Traditional Owner were registered in attendance. A number of the attendees at the Mataranka meeting are registered members of the Nurrdalinji Native Title Aboriginal Corporation.*

Has work already commenced (you say scouting will begin in mid 23)?

- *Civils scouting, anthropological, ecological and weed surveys have already been undertaken over the planned acquisition area.*

How close will the work be to restricted work areas? For example, the camp seems to sit very close to sacred site areas - will you consider moving the camp.

- *No work will be undertaken in the RWA's as per requirements of the AAPA certificates.*
- *Protection measures will be implemented to ensure identified sites are not damaged.*

Why do the maps show such very large borrow pit areas?

- *There will be no borrow pits constructed as part of the seismic program (proposed regulated activity)*
- *The areas identified in the maps are indicative and based on previous scouting as areas that are likely to have suitable material for civils activities and as such identify possible areas for borrow pits and not the full extent of the disturbance footprint.*
- *The size of the borrow pits will ultimately be dictated by the volume of material required during different phases future activities, this will be documented in future EMP's as required.*

Do you intend to recover, use or sell any exploratory gas as part of the appraisal gas provisions?

- *The planned regulated activities (seismic) associated with the proposed EMP will not result in any production of hydrocarbons from EP161.*

What pipeline plans do you have?

- *There are no pipelines associated with the proposed EMP.*

With regard to fracking:how many fracks per well are proposed?

- what is the volume of the frack chemicals per frac?
- what is the volume of frac fluid per frac?
- how much proppant per frac?
    - *There is no fracture stimulation associated with the regulated activity in the proposed EMP (2D seismic only).*

How are you going to accommodate the seasonal bushfire outlook for Spring 2023. We note areas of the Barkly are at increased risk of fire because of increased grass as fuel and expected elevated temperatures. While most of the high risk area is south of Elliot, not all of it is. The bad conditions will extend into the summer and some experts are saying they expect 80 percent of the Territory to burn by March. Is any of the equipment likely to create sparks or other grassfire ignition hazards? Will you share your emergency plans with us?

- *Santos will have an approved bushfire management plan as part of the 2D seismic EMP, this will be publicly available when the approved EMP is published by DEPWS.*

How will you notify community about the start and cessation of activity - will you be alert us about your arrival and departure?

- *A proposed schedule of activities will be included with the EMP. Notification of commencement and Cessation of activities is limited to the Regulators and the Pastoralist.*

### 5.1.3.2 2023.09.21 – 2023.10.03 – Zoom Meeting Invitation

**From:** [redacted]
**Sent:** Thursday, September 21, 2023 5:09 PM
**To:** [redacted]
**Subject:** ![EXT]: Invitation to Katherine Oct 7-8 Senior Leaders Meeting - Beetaloo Basin

Dear [redacted]

Please find an invitation attached to [redacted] from the Deputy Chair of Nurrdalinji Aboriginal Corporation. Could you please ensure it is forwarded on and considered by your team?

Thank you,

[redacted]

Contact Person

Nurrdalinji Native Title Aboriginal Corporation

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On Fri, Sep 29, 2023 at 8:29 AM [redacted] wrote:

Morning [redacted]

Thank you for the correspondence dated 21 September.

Santos can confirm it would welcome the opportunity to attend with the following attendees.

[redacted]

Can you please advise what time will be allocated to Santos on the agenda.

[redacted]

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**From:** [redacted]
**Sent:** Monday, October 2, 2023 11:48 AM
**To** [redacted]
**Subject:** Re: ![EXT]: Invitation to Katherine Oct 7-8 Senior Leaders Meeting - Beetaloo Basin

Thank you Haydn. Appreciated. We will get back to you shortly.

On Tue, Oct 3, 2023 at 10:28 AM [redacted] wrote:

Thanks – please note we have allocated time from 11am to 4pm on the Saturday.

[redacted]

**From:** [redacted]
**Sent:** Tuesday, October 3, 2023 9:53 AM
**To** [redacted]
**Subject:** Re: ![EXT]: Invitation to Katherine Oct 7-8 Senior Leaders Meeting - Beetaloo Basin

Thank you, [redacted] and team, for agreeing to present at our Senior Leaders Gathering in Katherine this coming weekend.

We appreciate your time and commitment shown by agreeing to do so.

We have allocated 30 minutes for your zoom session.

Details are as follows:

**Date**: Saturday 7 October 2023
**Time**: 4-4.30pm ACST
**Zoom link**: https://us02web.zoom.us/j/83837663790

We hope you can provide a short and clear overview of your current exploration and production plans, including:

- timeframes
- the scale envisaged
- sacred sites protection, water extraction and any pipeline arrangements
- your 2023/2024 schedule for meetings with Traditional Owners (15 mins).

This will leave 15 mins for questions from the audience.

If you have any further queries, please don't hesitate to ask.

Contact for any issues on the day: Alison Orme 0432 332 104. We would appreciate you providing your best mobile contact also.

We look forward to hearing from you then.

## 5.1.4 Mineral / Mining Title Holders

### 5.1.4.1 2023.10.10 – Notification of Intent

**From:** [redacted]
**Sent:** Tuesday, 10 October 2023 10:34 AM
**To:** [redacted]
**Cc:**
**Subject:** NT Exploration licenses EL31981, 32002, 32010, 32011, 32012, 32013, 32014 Pennant Resources: Intended Regulated Activity within EP161

Good morning,

Please be advised Santos intends to undertake regulated activity within Exploration Permit 161 during 2024/25. This activity includes acquiring a ~240km 2D seismic survey in the Tanumbirini Station area (see attached maps).

The planned regulated activity will include mulching and/or slashing of small growth (if required) to create a corridor for the acquisition of the seismic survey. This regulated activity has low environmental impact and will be conducted solely above ground. Rehabilitation will occur via natural re-growth once the regulated activity is completed, and the site will be monitored to ensure rehabilitation is in alignment with regulatory requirements.

This regulated activity will be conducted following submission and approval of an Environmental Management Plan (EMP) to the Department of Environment, Parks and Water Security (DEPWS).

Santos has a proud history of safe, responsible activity. This EMP will outline Santos's procedures and systems that are industry best practice, and consistent with relevant Northern Territory legislation and regulations.

Santos is a conscientious community partner and a recognised leader in exploration and development practices. As such, if you have any questions on this project, please contact me via details noted below.

[redacted]

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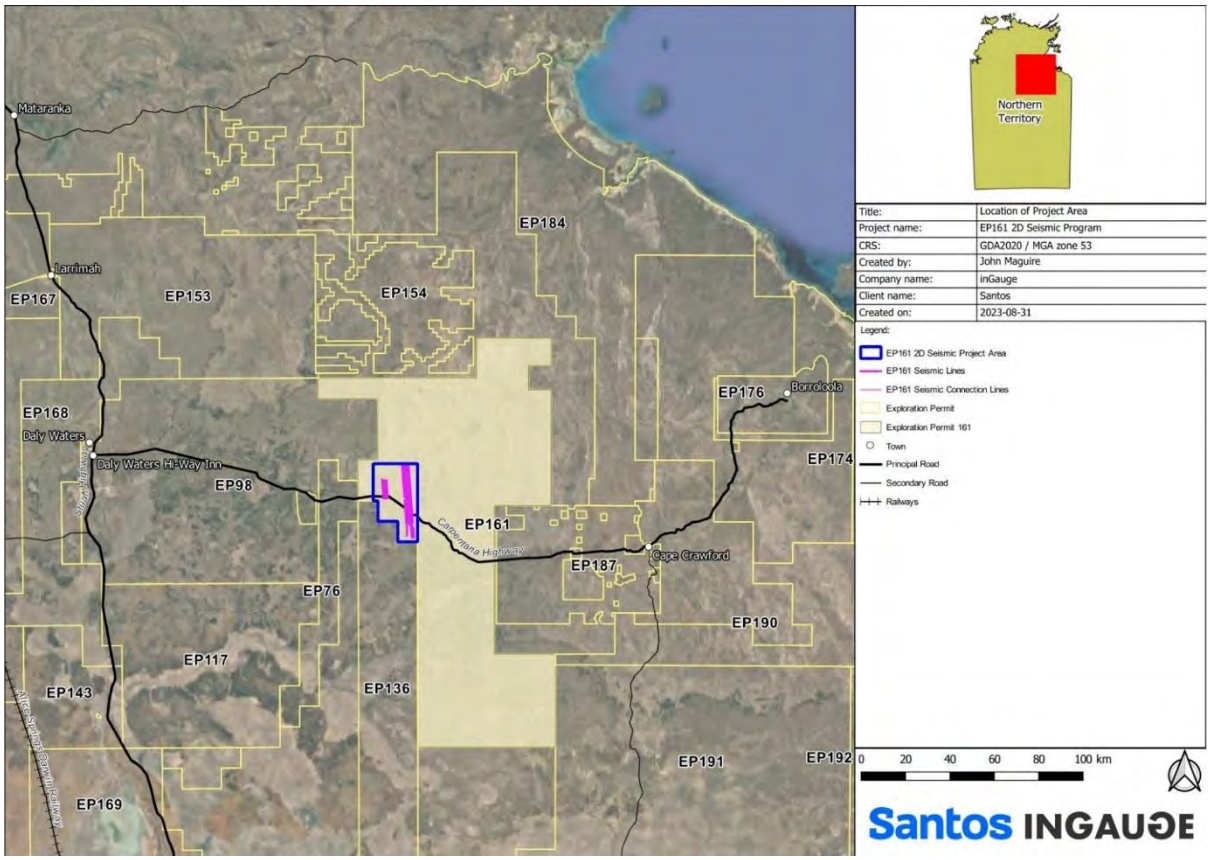


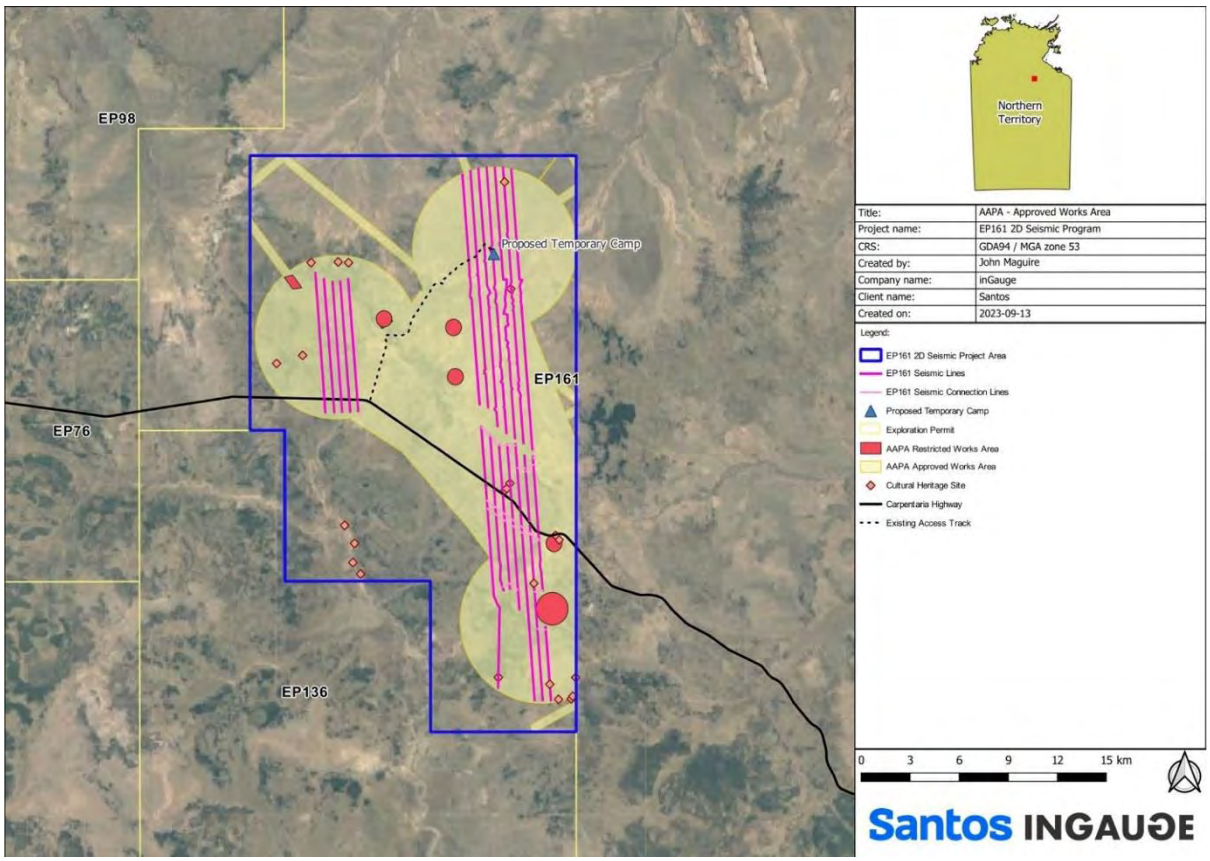

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Mataranka
Larrimah
EP167
EP153
EP154
EP184
EP168
Daly Waters
Daly Waters Hi Way Inn
EP98
EP161
Carpentaria Highway
EP176
Borroloola
EP174
Cape Crawford
EP187
EP76
EP190
EP117
EP143
EP136
EP191
EP192
EP169
Northern Territory
Title: Location of Project Area
Project name: EP161 2D Seismic Program
CRS: GDA2020 / MGA zone 53
Created by: John Maguire
Company name: inGauge
Client name: Santos
Created on: 2023-08-31
Legend:
EP161 2D Seismic Project Area
EP161 Seismic Lines
EP161 Seismic Connection Lines
Exploration Permit
Exploration Permit 161
Town
Principal Road
Secondary Road
Railways
0 20 40 60 80 100 km
Santos INGAUGE


EP98
Proposed Temporary Camp
EP161
EP76
EP136
Northern Territory
Title: AAPA - Approved Works Area
Project name: EP161 2D Seismic Program
CRS: GDA94 / MGA zone 53
Created by: John Maguire
Company name: inGauge
Client name: Santos
Created on: 2023-09-13
Legend:
EP161 2D Seismic Project Area
EP161 Seismic Lines
EP161 Seismic Connection Lines
Proposed Temporary Camp
Exploration Permit
AAPA Restricted Works Area
AAPA Approved Works Area
Cultural Heritage Site
Carpentaria Highway
Existing Access Track
0 3 6 9 12 15 km
Santos INGAUGE

## 5.1.5 Services

### 5.1.5.1 Telstra

#### 5.1.5.1.1 2023.08.02

**Santos engagement regarding Telstra tower 3354 Northern Territory**

[redacted]

Good afternoon,

I would like to enquire who to contact regarding Telstra Tower 3354 on Tanumbirini station in the Northern Territory.

Santos will be acquiring 2D seismic in this area, and as per the NT legislation, we are required to inform/engage with all relevant stakeholders in this area.

Could you please assist in providing me with the appropriate contact details?

Regards

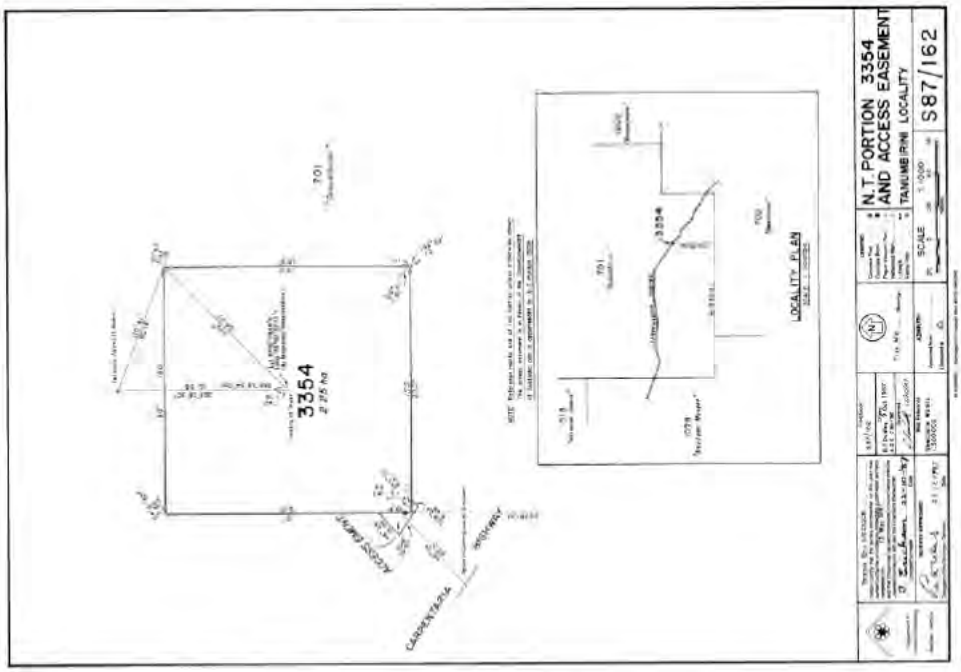
[redacted]

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Survey Plan S 87/162




Viewed at 12:14:15 on 02/08/2023

Page 1 of 1.

5.1.5.1.2 2023.09.06 – 2023.10.09

**General**

**From:** [redacted]
**Sent:** Wednesday, September 6, 2023 10:57 AM
**To** [redacted]
**Cc:** [redacted]
**Subject:** Re: Tower Maintenance Enquiry

[External Email] This email was sent from outside the organisation – be cautious, particularly with links and attachments.

Hi [redacted]

Thanks for the discussion this morning.
I have previously been speaking with Andrew at [redacted] who has contacted Ampitel regarding this matter. So this contact may be in the system somewhere.

As discussed, Santos will be acquiring 2D seismic in the area of the Tanumbirini Station in the NT, and as per the NT legislation, we are required to inform/engage with all relevant stakeholders in this area.

We believe the communications tower is identified as Telstra Tower 3354 which is located on the Carpentaria Highway.
Please find attached a GIS map with Lats and Longs of the location and the survey plan of the site.

I hope this is sufficient to identify the tower.

Look forward to hearing from you.

[redacted]

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**From:** [redacted]
**Sent:** Wednesday, 6 September 2023 2:58 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** ![EXT]: RE: Tower Maintenance Enquiry

[redacted]

Hi, thanks for the email & information.

I've checked with Engineering & we do not have any issues with the below being completed.

For reference, the Amplitel site information is below.

| | | | |
|---|---|---|---|
| Site Ref | NT000756 | Site Owner | Amplitel |
| Site Name | TRUSCOTT R/T | Site Type | Main RT |

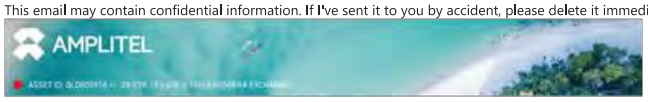
It has the below notes:

SITE MOTHBALLED. SITE IS INACTIVE

Cheers

[redacted]
Tower Asset Manager
M [redacted]

This email may contain confidential information. If I've sent it to you by accident, please delete it immediately.




Amplitel recognises and acknowledges the existing, original, and ancient connection Aboriginal and Torres Strait Islander peoples have to the lands and waterways across the Australian continent. We pay our respects to their Elders past, present and emerging.

Tower Maintenance Enquiry NT000756

[redacted]

Mon 9/10/2023 4:21 PM

To: [redacted]

Cc:

Bcc: [redacted]

[redacted] 2 attachments (2 MB)

EP161 - Location Map - project area.jpg; EP161 - Location Map - Regional.jpg;

Hi [redacted]

Thanks for all your assistance with this.
Whilst I realise this issue is closed (Case AMP0003174 has been closed), and I have received the email saying that there are no issues, I am sending the following as a formal communication of the work we will be conducting:

Please be advised Santos intends to undertake regulated activity within Exploration Permit 161 during 2024/25. This activity includes acquiring a ~240km 2D seismic survey in the Tanumbirini Station area (see attached maps).

The planned regulated activity will include mulching and/or slashing of small growth (if required) to create a corridor for the acquisition of the seismic survey. This regulated activity has low environmental impact and will be conducted solely above ground. Rehabilitation will occur via natural re-growth once the regulated activity is completed, and the site will be monitored to ensure rehabilitation is in alignment with regulatory requirements.

This regulated activity will be conducted following submission and approval of an Environmental Management Plan (EMP) to the Department of Environment, Parks and Water Security (DEPWS).

Santos has a proud history of safe, responsible activity. This EMP will outline Santos's procedures and systems that are industry best practice, and consistent with relevant Northern Territory legislation and regulations.

Santos is a conscientious community partner and a recognised leader in exploration and development practices. As such, if you have any questions on this project, please contact me via details noted below.

Thank you again

[redacted]

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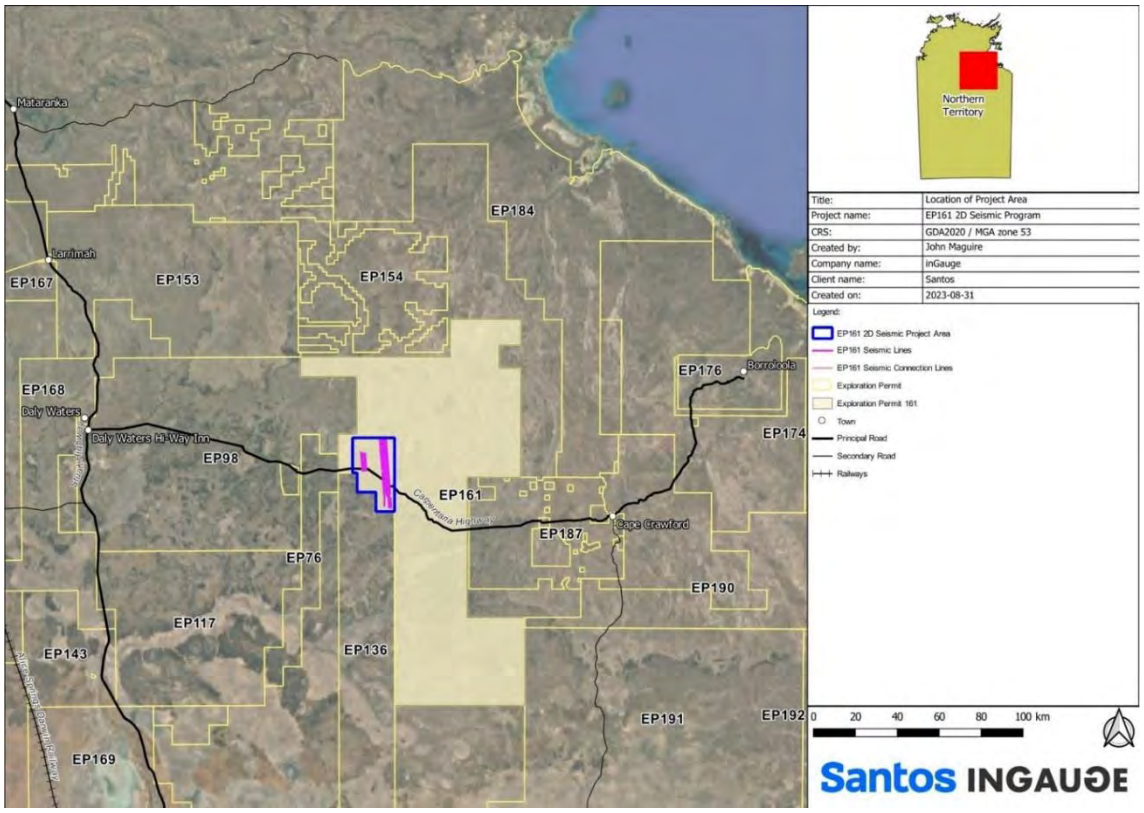



**Figure 5—1 Attachment: EP 161 Location Map – Regional**

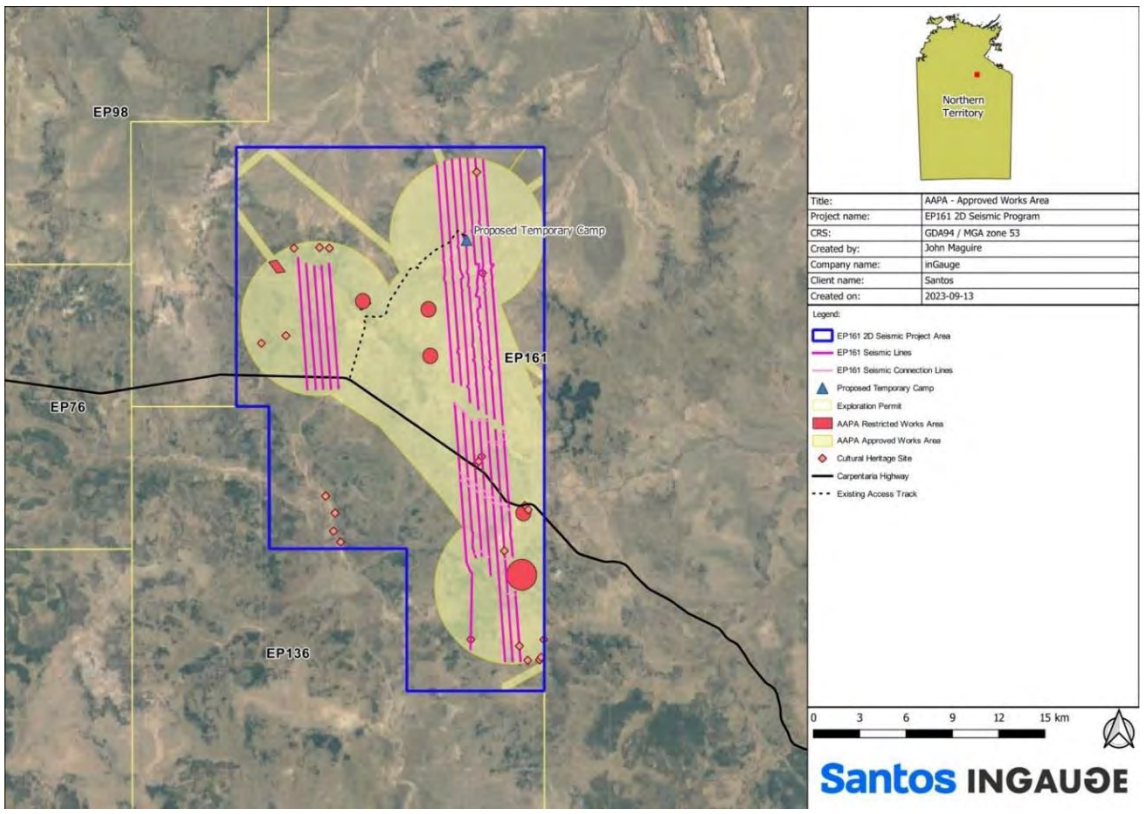



**Figure 5—2 Attachment: EP 161 Location Map – Project Area**

### 5.1.5.2 Power & Water

**From** [redacted]
**Sent:** Tuesday, 3 October 2023 3:06 PM
**Subject:** Intended Regulated Activity within EP161

**CAUTION:** This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Good afternoon,

Please be advised Santos intends to undertake regulated activity within Exploration Permit 161 during 2024/25. This activity includes acquiring a ~240km 2D seismic survey in the Tanumbirini Station area (see attached maps).

The planned regulated activity will include mulching and/or slashing of small growth (if required) to create a corridor for the acquisition of the seismic survey. This regulated activity has low environmental impact and will be conducted solely above ground. Rehabilitation will occur via natural re-growth once the regulated activity is completed, and the site will be monitored to ensure rehabilitation is in alignment with regulatory requirements.

This regulated activity will be conducted following submission and approval of an Environmental Management Plan (EMP) to the Department of Environment, Parks and Water Security (DEPWS).

Santos has a proud history of safe, responsible activity. This EMP will outline Santos's procedures and systems that are industry best practice, and consistent with relevant Northern Territory legislation and regulations.

Santos is a conscientious community partner and a recognised leader in exploration and development practices. As such, if you have any questions on this project, please contact me via details noted below.

[redacted]

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**From** [redacted]
**Sent:** Friday, October 6, 2023 10:02 AM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** ![EXT]: FW: Intended Regulated Activity within EP161

[redacted]

I would like to introduce you to [redacted] who is our operations and maintenance manager.

[redacted] will provide the PWC representation on our easement and guide you through the process of slashing and running seismic lines over the McArthur River Pipeline. Seismic investigations are a regulated activity under the Energy Pipelines Act and you can notify us formally using the Before You Dig service [redacted] Your submission will be received by [redacted] will ensure you get the support you need.

We have done this before and can readily assist.

Also, could you put me in touch with the person coordinating the slashing program. We are preparing for a similar campaign on Tanumbirini.

Good luck with the survey.

[redacted]

Regards,

---

[redacted]

**Power and Water Corporation**
Level 2, Mitchell Centre,
55 Mitchell Street, Darwin, Larrakia Country
GPO Box 1921 Darwin NT 0801

[../../../../../mhug/Downloads/powerwater.com.au]

PowerWater

[../../../../../mhug/Downloads/powerwater.com.au]**powerwater.com.au**

***I acknowledge the Traditional Owners and Custodians of the lands on which I live and work and pay my respect to Elders past, present and future.***

**From:** [redacted]
**Sent:** Wednesday, October 25, 2023 3:46 PM
**To** [redacted]
**Cc** [redacted]
**Subject:** Fw: Intended Regulated Activity within EP161

You don't often get email from lisa.dallow@santos.com. Learn why this is important

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Hi [redacted]

As noted below, I have submitted a byd form on line for this project. Please see attached.
We are looking forward to working with you on this project.
Please contact myself or [redacted] with any requirements or queries.

Regarding the slashing for the seismic program, the best contact for this is [redacted] who is the seismic acquisition coordinator.
I'm sure he will be happy to assist.

Kind Regards

[redacted]

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**![EXT]: RE: Intended Regulated Activity within EP161**

[redacted]
Wed 2023-10-25 20:16
To [redacted]
Cc [redacted]

Thanks for sending this through, I have passed this onto our Third Party works coordinator who will pull together the required information etc.

He will be in touch if he needs anything further.

Cheers

[redacted]

## ![EXT]: RE: Intended Regulated Activity within EP161

[redacted]

Thu 2023-10-26 14:38

To: [redacted]
Cc: [redacted]

Thank you for your time over the phone.

As discussed, could you please send me any previously sent attachments/maps for the proposed seismic lines as I have only received BYDA emails in the attachments.

If you are only using Vibroseis trucks as the seismic source and heavy vehicles to clear the seismic lines, we will have to confirm the locations where the vehicles will be crossing the pipeline. If any heavy equipment over 10T are to cross the pipeline at a non-designated crossing location, they will be subjected to an engineering assessment to ensure the safety of the pipeline. Here are some basic guidelines for use of Vibroseis trucks over the pipeline:

- Seismic methods must be arranged to limit ground vibrations so that the peak particle velocity (PPV) does not exceed a value of 10 mm/sec at any point on a gas transmission pipeline.
- Vibrating equipment is not to be used within 15m of the pipeline.

If you have further questions, please do not hesitate to contact me.

Kind regards,

[redacted]

Re: Intended Regulated Activity within EP161

[redacted]

[redacted] 2 attachments (4 MB)
Outlook-boycbss0; EP 161 2D Seismic - Stakeholder Engagement Pack.docx;

H[redacted]

Please find attached a Stakeholder information pack with maps and further information.

As noted in the pack, the Vibroseis trucks will be 30m clear of the pipeline during the seismic acquisition.
Prior to approaching the pipeline, the plan is to conduct some PPV testing onsite to verify that we will be below the 10 mm/sec threshold.
Both available contractors, Terrex and Velseis, have their own measurement equipment and can undertake the verification measurements.

The pack also outlines the route along the pipeline between seismic lines.

I look forward to discussing further with you.
Please contact me with any questions

Kind Regards

[redacted]

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Santos acknowledges the Traditional Owners and Custodians of the lands on which we operate. We pay our respects to their Elders past, present and emerging.

### 5.1.5.3 Department of Infrastructure, Planning and Logistics (DIPL)

**From:** [redacted]
**To:** [redacted]
[redacted]
**Sent:** Tuesday, October 3, 2023 3:06 PM
**Subject:** Intended Regulated Activity within EP161

Good afternoon,

Please be advised Santos intends to undertake regulated activity within Exploration Permit 161 during 2024/25. This activity includes acquiring a ~240km 2D seismic survey in the Tanumbirini Station area (see attached maps).

The planned regulated activity will include mulching and/or slashing of small growth (if required) to create a corridor for the acquisition of the seismic survey. This regulated activity has low environmental impact and will be conducted solely above ground. Rehabilitation will occur via natural re-growth once the regulated activity is completed, and the site will be monitored to ensure rehabilitation is in alignment with regulatory requirements.

This regulated activity will be conducted following submission and approval of an Environmental Management Plan (EMP) to the Department of Environment, Parks and Water Security (DEPWS).

Santos has a proud history of safe, responsible activity. This EMP will outline Santos's procedures and systems that are industry best practice, and consistent with relevant Northern Territory legislation and regulations.

Santos is a conscientious community partner and a recognised leader in exploration and development practices. As such, if you have any questions on this project, please contact me via details noted below.

[redacted]
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Santos Ltd A.B.N. 80 007 550 923
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## 5.1.6 Additional Parties

### 5.1.6.1 2023.10.10 – Beetaloo Station

**From:** [redacted]
**Sent:** Tuesday, 10 October 2023 11:43 AM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** Intended Regulated Activity within EP161
**Attachments:** EP161 - Location Map - Regional.jpg; EP161 - Location Map - project area.jpg

Hi [redacted]

Please be advised Santos intends to undertake regulated activity within Exploration Permit 161 during 2024/25. This activity includes acquiring a ~240km 2D seismic survey in the Tanumbirini Station area (see attached maps).

The planned regulated activity will include mulching and/or slashing of small growth (if required) to create a corridor for the acquisition of the seismic survey. This regulated activity has low environmental impact and will be conducted solely above ground. Rehabilitation will occur via natural re-growth once the regulated activity is completed, and the site will be monitored to ensure rehabilitation is in alignment with regulatory requirements.

This regulated activity will be conducted following submission and approval of an Environmental Management Plan (EMP) to the Department of Environment, Parks and Water Security (DEPWS).

Santos has a proud history of safe, responsible activity. This EMP will outline Santos's procedures and systems that are industry best practice, and consistent with relevant Northern Territory legislation and regulations.

Santos is a conscientious community partner and a recognised leader in exploration and development practices. As such, if you have any questions on this project, please contact me via details noted below.

Kind regards,

Santos

[redacted]

https://www.santos.com/

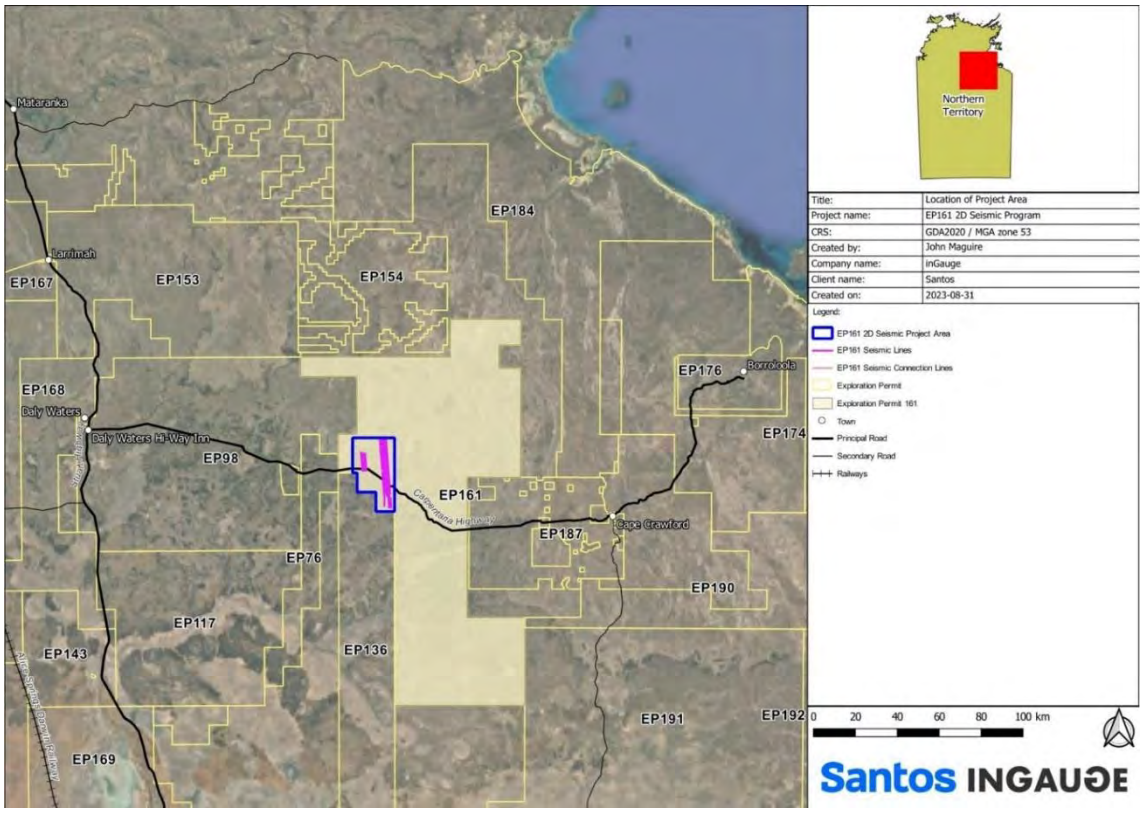



**Figure 5—3 Attachment: EP 161 Location Map – Regional**

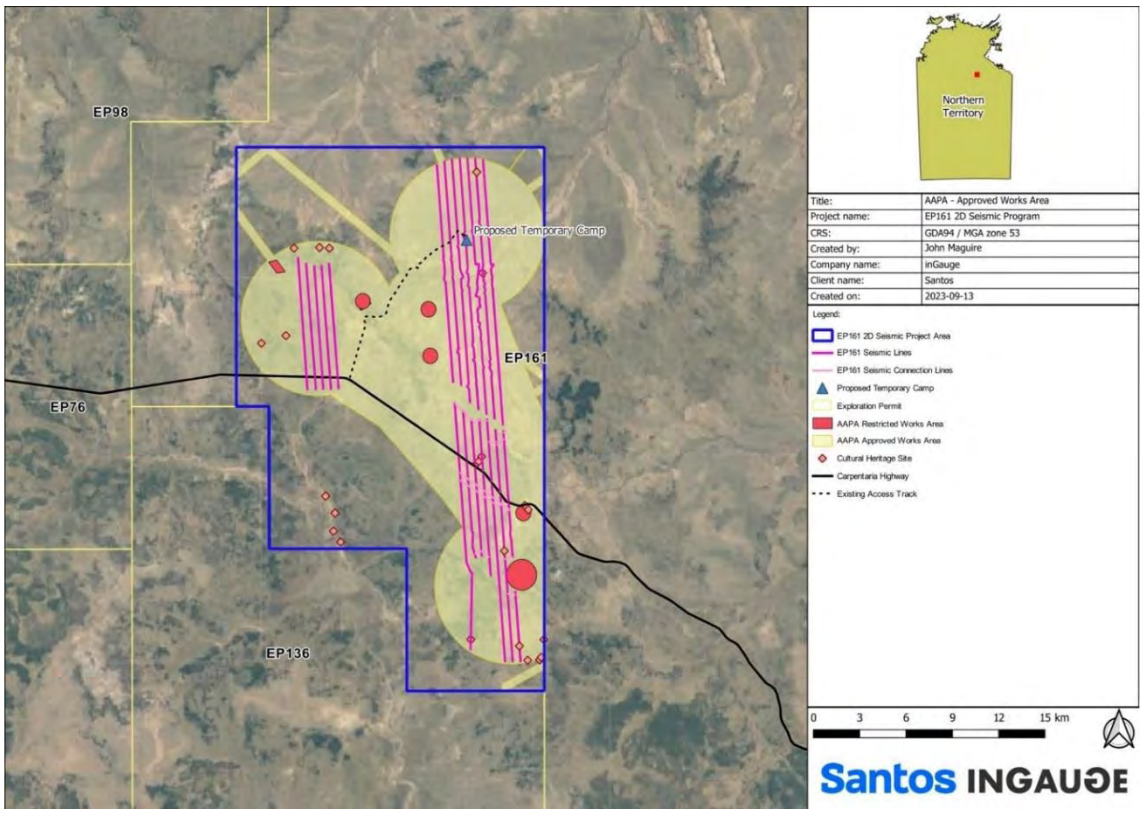



**Figure 5—4 Attachment: EP 161 Location Map – Project Area**

## 5.2 NLC Work Programme Submission

### 5.2.1 Email

**From:** [redacted]
**To:**
**Cc:**
**Subject:** EP 161 - 2023 Work Program Submission
**Date:** Monday, 26 September 2022 9:05:06 AM
**Attachments:** Santos_WP-210094-001_EP 161_Work Program Cover Letter.pdf
Santos_WP-210094-0001_EP 161__Attachment 1_Work Program.pdf
Santos_WP-210094-001_EP 161_Attachment 2_Annexures.pdf
EP161_Attachment 3 - 2023 Work Program_Spatial Files.zip

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Dea [redacted]

In accordance with clause 5.1(c) of the EP 161 Co-operation and Exploration Agreement Santos provides this Work Program and supporting spatial files with respect to areas within EP 161 where it proposes to undertake activities.

Attached is the following:

- Cover Letter
- Attachment 1 - Work Program
- Attachment 2 – Annexures
- Spatial files (shp.) with attributes for cross referencing

Please advise any specific queries or additional requirements.

We look forward to progressing the work program and associated community consultation arrangements as per the terms of the EP 161 Co-operation and Exploration Agreement.

Please advise a suitable time to meet regarding logistics and planning for the community consultation scheduled for 26 October.

Kind Regards

[redacted]

[redacted]

[redacted]

[redacted] santos.com

## 5.2.2 Cover Letter

Santos QNT Pty Ltd
ABN 33 083 077 196
Ground Floor Santos Centre
60 Flinders Street
Adelaide SA 5000
GPO Box 2455 Adelaide SA 5001
Telephone: 08 8116 5111

WP-210094-0001

23 September 2022

**CONFIDENTIAL – Commercial in Confidence**

[redacted] [redacted]

Dear [redacted]

**EP 161: Proposed 2023 Work Program**

Santos QNT Pty Ltd (Santos), in accordance with clause 5.1(b) of the Co-operation and Exploration Agreement, EP 161, provides this Proposed 2023 Work Program with respect to areas within EP 161 in which it proposes to undertake activities. The areas identified for the proposed activities in this submission (2D seismic, water bores and future exploration wells) have received sacred site certifications in 2013 (Authority Certificate C2013/142), in 2018 (Authority Certificate C2018/105), in 2019 (Authority Certificate C2019/043) in 2020 (Authority Certificate C2020/011).

This submission includes activities as outlined in the summary below and in detail in the attached annexures. We request the opportunity to inform the host Traditional Owners via a community consultation to be scheduled as soon as possible noting scheduling requirements

**Scope**

In summary, the key activities proposed for 2023 comprise:

1) Water monitoring bore program:
   - Initial scouting of water bore locations and access tracks,
   - Drilling of water monitoring bores, for baseline environmental water quality monitoring ahead of potential 2024+ exploration drilling activities,
   - Installation of water monitoring equipment subsurface and water bore headworks,
   - Environmental baseline monitoring,
   - Groundwater extraction.

2) Seismic: approximately 200-240 linear kms of 2D seismic to be scouted and acquired. This activity will inform follow up actions, which could include (in 2024+):

3) Exploration drilling: vertical and/or horizontal drilling (notionally Jibera South, Newcastle and October Creek locations) with associated Completion, Fracture stimulation and flow testing for up to 300 days.

The following scope of work is required to complete these key activities:

- ground scouting of proposed seismic lines and future exploration well locations
- line preparation for seismic survey; Santos proposes to use minimum clearing techniques to reduce surface impact where possible
- Water monitoring bore construction at the October Creek North and Newcastle
- Civil engineering activity – upgrading and creation of new access tracks, construction of a new lease pad at (Jibera South & October Creek), upgrade and maintenance of existing lease pads, and water extraction as required
- Exploration drilling – both vertical and horizontal drilling (where horizontal wells will be contained entirely within the certified area)
- Well evaluation – including wireline logging, formation testing, core acquisition, fluid sampling, open-hole formation integrity testing (i.e. DFITs) and other standard evaluation techniques as deemed appropriate
- Hydraulic fracture stimulation
- Flow-back and production testing
- Well suspension and/or well decommissioning
- Ongoing site and well maintenance and monitoring, work-over and re-entry, and evaluation as required
- Groundwater sampling from existing nominal water bores (if present) and the installed bores subject to the proposed work program

Details of the proposed project work activities are included in the attached tables and annexures.

**Purpose**

The purpose of exploration and appraisal activity undertaken in 2023 and beyond is to increase our understanding of the prospectivity or potential of the EP161 permit area. Our objective whenever undertaking such activity is to minimise our impact on the environment along with ensuring Traditional Owners are engaged and informed for each phase of the activities.

The purpose of the water monitoring bores is to obtain subsurface environmental baseline water quality assessment to build on the regional baseline environmental water monitoring Santos has acquired within the permit. The Northern Territory Government has stipulated that control monitoring bores must be installed up-gradient within 100m of future well pads to be used for drilling of exploration wells, and water monitoring bores must be in place six (6) months prior to the drilling activities commencing adjacent to exploration wells.

**AAPA Authority Certificate**

Santos has already obtained Authority Certificates from Aboriginal Areas Protection Authority (AAPA) in respect of the Proposed 2023 Work Program (Authority Certificates C2014/053, C2018/105, C2019/043 and C2020/011).

**Work Program Meeting**

Santos is available to attend work program meetings on country or, in the absence of a work program meeting, resource the NLC accordingly to meet any community requirements. Santos is willing to fund and resource interpreters or any other specific requirements to meet community requirements.

**Seismic and water bore and Coordinates**

Refer to the attached spatial data files for the coordinates of the proposed project works.

**Attachments**

Please refer to the attachments which contain descriptions of the activities proposed at each location with approximate coordinates of the proposed appraisal flowlines and compression facilities locations under application:

1. Attachment 1: Summary table of proposed work activities
2. Attachment 2: Annexure describing industry work activities
3. Attachment 3: GIS data and supporting imagery

Santos is seeking your approval to proceed on this basis and look forward to meeting at an agreed date to discuss in detail and progress this work program.

Santos also notes the importance of the community consultation requirements to ensure the host traditional owners are adequately consulted and informed of project activities. We look forward to working with the NLC to ensure the community consultations fully inform the host Traditional Owners.

Please contact Haydn Kreicbergs on the details below if you require any further information or clarification of the proposed works.

Kind regards,



## 5.2.3 Attachment 1 – Work Program

**Attachment 1 – EP 161**

### 1. Summary of proposed activities

All of the activities included in Table 1 and annexures are subject to extensive regulatory approvals or review by the Department of Industry, Tourism and Trade (DITT), the Department of Environment, Parks and Water Security (DEPWS), the Environmental Protection Authority (EPA), and other regulatory agencies. Moreover, substantial baseline data acquisition (including water monitoring bores installed at least six months prior to drilling hydraulic fracture stimulation activity) is required under the Petroleum Act and associated Petroleum Environment Regulations. Further details regarding these approvals and or approval submissions can be provided on request.

**Table 1. Summary of the Proposed Work Program**

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| (A) The nature, scope and objectives of proposed activities; | Please refer to Annexures for detailed descriptions of the exploration activities summarised in this table, which include scouting, seismic acquisition, water bore drilling, exploration drilling, hydraulic fracture stimulation, flow-back and production testing, well monitoring and site maintenance, and associated civils works.<br>The annexures detail the following activities that could potentially be proposed within the permit area (seismic acquisition and water bore drilling) and potential exploration drilling at the Jibera South, Newcastle, and October Creek North locations:<br><br>• 2D seismic acquisition (Annexure 1)<br>• Drilling of aquifer monitoring bores and installation of logging equipment (Annexure 2)<br>• Wellsite civils works, access and camps (Annexure 2)<br>• Drilling, Stimulation and Completion of exploration/appraisal wells including suspension and/or well decommissioning (Annexure 3)<br>• Ongoing well and site monitoring, maintenance, work-over and evaluation<br><br>Refer to the provided maps and spatial data for proposed locations, access, and approximate areas of disturbance. All proposed work activities will be located within the boundaries of the AAPA Authority Certificates C2014/053, C2018/105, C2019/043 and C2020/011. |
| (B) The estimated time and period for the performance of such activities; | It is proposed that initial scouting activities could commence in Q1 2023 and that seismic activities could commence in Q2 2023, assuming approvals are in place. Multiple seismic survey phases are expected to take place over the exploration permit term depending on the success of the ensuing exploration campaigns. These potential seismic programs will remain within the proposed boundary area pending appropriate notification and discussion by Traditional Owners through On Country Work Program meetings. All activities will observe and respect all sacred sites and designated areas of cultural significance identified on certificates of authority.<br><br>Future exploration drilling at the Jibera South, Newcastle, |

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| | and October Creek locations will likely commence in Q2 2024, assuming all approvals are in place.<br><br>**The following summarises typical timeframes for discrete work packages or activities and reflects the planned 2023+ work program plans. In future years, timings could vary and campaigns may have a smaller or larger footprint depending on survey requirements e.g. 2D seismic versus 3D seismic.**<br><br>**Seismic Acquisition**<br>**2-4 weeks – Scouting:**<br>Scouting of proposed seismic lines to map out acquisition tracks to ensure minimal disturbance of land by vibrator trucks. Lines will be GPS tracked and photos taken to allow optimal pre-job planning.<br><br>**4-12 weeks – Lease and Access Track Preparations:**<br>Access track preparation, well pad construction and associated works will be undertaken in preparation for drilling operations. Where possible existing access tracks will be upgraded; however, new access tracks will be created (within the surveyed areas only) if it achieves the objective to minimise the overall impact of the operations. Temporary camps will be used to support these activities.<br><br>**6-12 weeks – Seismic Acquisition:**<br>Depending on the extent of the survey:<br>• Line preparation and surveying typically takes 2-4 weeks.<br>• seismic recording crews typically commence 2-4 weeks after line preparation<br>• surveying crews will typically take a further 2-4 weeks to complete the seismic survey.<br>• The extent of any surveying that could be considered under this clearance request will always remain within the bounds of the areas that have approved certificates of authority in place.<br><br>**Waterbore drilling**<br>**2-6 weeks – Scouting & Drilling:**<br>Scouting of proposed well pads and access tracks to ensure minimal disturbance of land. Drilling of multiple waterbores (control and impact) at the proposed 2024+ exploration well locations.<br><br>**Exploration Drilling**<br>**4-12 weeks – Lease and Access Track Preparations:**<br>Access track preparation, well pad construction and associated works will be undertaken in preparation for drilling operations. Where possible existing access tracks will be upgraded; however, new access tracks will be created (within the surveyed areas only) if it achieves the objective to minimise the overall impact of the operations. Temporary camps will be used to support these activities. |

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| | **60-90 days (per well) – Drilling Phase:**<br>Following completion of lease and access track preparations, the drilling phase is anticipated to take approximately 60-90 days per well.<br><br>**5-40 days (per well) – Fracture Stimulation Phase:**<br>Following completion of drilling and well completion, the fracture stimulation phase is anticipated to take approximately 5-40 days per well.<br><br>**3-5 days (per well) – Completion Phase:**<br>Pending the initial gas flow rates, wells may be completed with a tubing string that is run in the well to improve productivity. The tubing will be installed with a workover rig and is anticipated to take approximately 3-5 days per well.<br><br>**Flow Testing Phase and Well Suspension:**<br>Subject to a successful reservoir outcome, the well will be put on extended flow test for an initial period of up to 300 days, dependant on approvals. Further approvals may be sought to extend the flow testing period from the Northern Territory regulator for early exploration wells to allow key data to be gathered. Flaring will be used to ensure hydrocarbon gases are safely and efficiently handled. Such approvals will be subject to rigorous environmental management plan approvals. Subsequent to any flow testing the well will be suspended. A build-up test may be incorporated into the well suspension to aid in the evaluation of the well results. Following the build-up test a successful test well will likely be suspended until a development project is sanctioned or a well is decommissioned at the end of the project life.<br><br>Further on-going well integrity monitoring, well-head maintenance, site maintenance, in-hole evaluation and work-over will be performed as required.<br><br>Further technical details will be presented to the relevant Traditional Owners at each On Country Work Program meeting prior to any proposed activities. |
| (C) The techniques, infrastructure and major items of equipment to be used; | **Civils Surveying:**<br>Surveying of proposed access tracks, leases, gravel/borrow pits, camp sites and associated facilities will be carried out using 4WD vehicles and GPS units utilising existing roads and station tracks where possible.<br><br>**Road Construction:**<br>Existing access roads and tracks will be upgraded and widened (within approved subject land area only) to accommodate larger vehicles and increased traffic. New access roads or tracks will be created where necessary to access any lines or minimise our overall environmental impact or impact on pastoral lessee infrastructure or activities. Junctions of access roads with the Carpentaria |

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| | Highway may be upgraded in line with regulatory requirements.<br><br>**Water bores:**<br>Drilling of new water bores and use of existing water monitoring bores are the preferred water supply sources; followed by use of existing station water bores. Water bores have been previously constructed by Santos at the Jibera South location, and further monitoring bores will be required to satisfy regulatory requirements. However, further water bores may be installed if needed and will always be located within the subject land. New water monitoring bores are planned for installation at the October Creek North and Newcastle locations. The water taken from water bores is limited by the conditions of the NT Government Water Act provisions and/or appropriate water extraction licence(s).<br><br>In addition, earthen water holding pond(s) and loadout facilities may be constructed and fenced as required. Water will be used for civil construction purposes and road maintenance as required.<br><br>**Waterbore Evaluation Activities:**<br>Open-hole wireline logs will be acquired over the open-hole sections as per Santos and Northern Territory Government requirements. If the wellbore is deemed unstable, the well may be logged after casing has been installed.<br><br>**Well Pad / Lease Construction:**<br>Well lease construction will include clearing and stockpiling, grading and capping with clay/suitable material if deemed required based on ground condition. Construction of turkey's nests and above ground storage tanks will occur if required.<br><br>Stockpiled vegetation and topsoil will be respread as part of the rehabilitation process, following well decommissioning (which may be some or many years in the future depending on exploration and appraisal activities and project success).<br><br>**Drilling Activities:**<br>Exploration wells will be drilled using either drilling mud or air hammer as required to suit formation properties. Wells will be either vertical only (i.e. a vertical well), or initially vertical with a subsequent inclined section leading to a lateral or horizontal section (i.e. a deviated or horizontal well). Vertical well sections could vary between approximately 1000m and 4500m and horizontal sections could vary from less than approximately 250m to in excess of 3000m (where the absolute limit of any horizontal well would be the area surveyed and cleared for sacred sites (i.e. the clearance area)).<br><br>Where possible, drill core and/or cutting samples and/or fluid samples will be obtained for geological assessment |

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| | and analyses as per Santos and regulatory requirements.<br><br>**Evaluation Activities:**<br>Open-hole wireline, or logging while drilling (LWD), logs will be acquired over the open-hole sections as per Santos and Northern Territory Government requirements. In addition to wireline/LWD logging Santos may undertake formation testing, open-hole formation integrity testing (i.e. DFITs) and other standard oilfield evaluation techniques as deemed appropriate. Vertical seismic profiling may also be completed, this activity combines surface seismic activities (Annexure 1) with down-hole wireline evaluation tools (geophones).<br><br>**Diagnostic Fracture Injection Test (DFIT):**<br>A DFIT refers to the act of injecting small volumes (e.g. 10-20 barrels) of a clear fluid, typically water (usually with a small percentage of Potassium Chloride e.g. 2 to 3% KCl) at low pumping rates to create a fracture before the wellhead is shut-in and the pressure allowed to fall-off naturally. The fluid contains no proppant so that the fracture can relax and close naturally when pressure is released. The pressure changes are measured with high-accuracy gauges that are either placed deep in the wellbore or at surface on the wellhead. The analyses of fracturing pressure, during injection and after shut-in, provide information data for understanding and improving the fracturing process. The DFIT process differs from fracture stimulation in a number of key ways, primarily it is of a much smaller scale, does not involve pumping proppant, and is not intended to induce hydrocarbon production.<br><br>**Well Completion Activities:**<br>The wells will have casing set in the well to meet the design objectives of the well and the meet the standards from the NT Well Operations Code of Practice and the Santos Drilling and Completions Management Process (DCMP). Casing will be set in order to isolate shallow aquifers present, isolate any geohazards that may present like significant formation losses or tight hole, as well as being designed to withstand the expected forces during hydraulic fracturing. Each casing string will be cemented in place to ensure aquifer isolation and overall wellbore integrity is maintained. Once each casing is cemented in place, it is pressure tested to ensure the cement and casing meet and/or exceed their design specifications. The final casing string, the production string, is tested to above the maximum anticipated pressure to stimulate and confirm the integrity of the designed well envelope.<br><br>**Hydraulic Fracture Stimulation Activities:**<br>Prior to the hydraulic fracture stimulation (or frac) “spread” (the term used to describe the various trucks and equipment needed to frac) arriving on location, the well will be logged to confirm the cement bond and ensure isolation between the fracture stimulation target |

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| | intervals and shallow aquifers. A number of valves are installed on the wellhead known as the "Christmas Tree" which are rated to above the maximum designed surface pressure, and allow for the transfer of fluid and proppant/sand into the wellbore. The complete system is then pressure tested again to simulate hydraulic fracturing conditions.<br>Intervals to be fracture stimulated will be perforated using a shaped charge which creates small holes in the casing providing a conduit between the wellbore and the formation. The combination of water, proppant and chemicals (generally <2% of total mix) known as the slurry are mixed together at surface using a "blender" – see Annexure 4 for summaries of the chemical composition of potential frac fluids and solids that could be included, and note that they are typically used at low concentrations (the final fluid composition must be provided to the NT Government as part of the environmental approval process).<br>The slurry is transferred to pumps that convert it from low pressure to high pressure, and allow it to be injected through the wellhead into the well, and ultimately into the formation that is being hydraulically fracture stimulated. After each frac stage, a plug is pumped down on wireline and the next frac stage is perforated, and the process starts again.<br>At the completion of hydraulic fracturing, Coiled Tubing is used, which is run in hole with a motor and mill on the end to remove the isolation plugs in place. After reaching the bottom of the well with the coiled tubing and establishing a flow path to the surface for all frac stages, the well flowback commences in order to recover the frac fluids pumped into the well.<br>Fracture Diagnostics are often used to determine the fracture effectiveness and allow for future optimisation. Chemicals Tracers may be pumped with the slurry at a known concentration. Their concentration during flowback can be measured to determine the relative contribution from each stage. Microseismic geophones may be used either at surface or in a neighbouring well, to listen for the very small seismic events that are created during fracture stimulation. Triangulation is used from the geophone array to determine the location of the event and hence gain a picture for fracture dimension (height and length) and direction. Tiltmeters may be used to gain an understanding of the micro deformation that takes place during a frac. These small changes can be used to determine the verticality of the frac and also indicate the direction in which the fracture has propagated. The installation of either surface geophones or tiltmeters is low-impact, and down-hole geophones have no impact on the environment. Further monitoring using high-resolution accelerometers to detect ground motion may also be implemented for real-time monitoring of the fracture stimulation process.<br><br>**Flow-back and Well Testing Activities:**<br>Some flow testing may be conducted with the drilling rig |

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| | on location prior or post open hole logging activities. Subject to a successful reservoir outcome, the well will be put on extended flow test for an initial period of up to 300 days. Further approvals may be sought to extend the flow testing period from the Northern Territory regulator for early exploration wells to allow key data to be gathered. Flaring will be used to ensure hydrocarbon gases are safely and efficiently handled. Such approvals will be subject to rigorous environmental management plan approvals.<br><br>**Well Status:**<br>Exploration wells in the McArthur/Beetaloo area generally are expected to have a relatively high uncertainty on reservoir outcome. The following activities may occur post logging evaluation:<br><br>1. The well will be suspended with steel casing cemented in place for future re-entry; or<br>2. The well will be decommissioned.<br><br>As part of the well suspension process, wellbore barriers will be put in place as per Santos and Northern Territory regulatory requirements. A well integrity monitoring plan will be put in place for any suspended well for monitoring of wellbore barriers.<br><br>As part of well decommissioning process, cement plugs will be permanently placed in the well as per Northern Territory regulatory requirements. The wellhead will be removed; leases and roads rehabilitated and signed properly as per Northern Territory regulatory requirements.<br><br>**Site Rehabilitation Activities:**<br>For any decommissioned well, the well pad and associated camp sites, etc. will be rehabilitated to ensure minimal disturbance.<br><br>For any suspended well, the wellhead area will be fenced off and the well pad site rehabilitated as much as practical to ensure re-entry for well integrity monitoring and intervention activities can be maintained.<br><br>**Camps**<br>Camps may be constructed within the approved subject lands to support the above activities. These camps may be capped with suitable clay material if required based on ground conditions. Preference will be given to utilising previously disturbed areas.<br><br>All camps will be covered by a valid Environmental Management Plan and comply with all conditions of that plan to minimise environmental impacts. |
| (D) The likely Environmental Impact of such activities and proposals to minimise the | Minimal disturbance methods will be used during seismic line preparation. This will include “blade up”, slashing, and |

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| Environmental Impact, in particular, the disturbance to Native Title Parties; | weaving around significant trees where possible. Post acquisition line rehabilitation will be conducted to return the acquisition live back to a natural state.<br><br>Where possible, access roads, borrow/gravel pits, leases, camp sites and associated works will be planned so as to use existing station roads and/or access roads or resources to minimise any new disturbance. Access tracks planned to be utilised have been identified from initial scouting activities. Where it is not possible to use existing tracks and access roads, due to the requirements of heavy vehicle access (where upgrading of the existing track is not feasible), some new access tracks will need to be constructed. New access tracks will not exceed the approved subject lands in the authority certificates referenced above.<br><br>Roads/access tracks could extend up to 10m either side of centre line (i.e. up to 20m in width). Where possible and practical new access tracks will be oriented to minimise or avoid disturbance to land systems and native flora.<br><br>Santos will construct stock proof fencing around specific work areas to minimise potential impacts on native fauna and livestock.<br><br>For any decommissioned well, the well pad and associated camp sites, etc. will be rehabilitated to ensure minimal disturbance.<br><br>For any suspended well, the wellhead area will be fenced off and well pad site rehabilitated as much as practical to ensure that re-entry for well integrity monitoring and intervention activities can be maintained. |
| (E) The proposed means of access and access routes for personnel and equipment, both into and within the Permit Area, including particulars of the amount of vehicular and airborne access and any proposals to construct or upgrade roads, landing strips, or other access facilities; | The amount of vehicular access will be variable during the scope of proposed activities, but Santos will aim to design proposed infrastructure that does not adversely impact Traditional Owners, pastoral lessees, nearby industry or the general public.<br><br>**Initial Access Roads**<br>Planned earthworks are required to provide a safe and practical work area and access to waterbores, campsites, airstrips and for other operational needs. The access road for the Jibera South location utilises part of the existing access constructed for the Tanumbirini location; further construction will be required to gain access to Jibera South. Regular watering may occur to reduce dust and additional capping may be added to the surface to reduce maintenance or closure following periods of rain. Access roads will be constructed for the installation of water monitoring bores at October Creek North and Newcastle locations within the approved area.<br><br>**Landing Strip**<br>Airstrips and Helipads are commonly used to bring the workforce from a main centre closer to worksites with the |

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| | aim of reducing fatigue and exposure to land transportation risks. Existing landowner airstrips will be utilised and upgraded under agreement to a condition where charter operator (for crew change), or RFDS or Careflight Air Ambulance (emergency evacuation) aircraft can be accommodated. Helipads may be constructed at each wellsite to provide additional direct access to remote wellsites.<br><br>**Well Integrity Monitoring**<br>Scheduled visits for well integrity monitoring one or two personnel as required. |
| (F) Any fly-camps or other camp sites of less than five days duration proposed to be used; | When and where feasible, temporary local accommodation (i.e. Tanumbirini Station) will be considered to minimise environmental impact.<br><br>Camps may be constructed within the subject areas. These camps may be capped with suitable clay material if required based on ground conditions. Preference will be given to utilising previously disturbed areas. |
| (G) Any water, timber or other resources proposed to be obtained from within the Permit Area and surrounding areas; | **Water bores:**<br>As described in section (C), the proposed drilling of new water bores and use of existing water monitoring bores are the preferred water supply sources; followed by use of existing station water bores. The water taken from water bores is limited by the conditions of the NT Government Water Act provisions and/or appropriate water extraction licence(s).<br><br>In addition, earthen water holding pond(s) and loadout facilities may be constructed and fenced as required. Water will be used for civil construction purposes and road maintenance as required.<br><br>**Construction materials (soils and gravels):**<br>Where in-situ materials are unsuitable, additional fill/clay/rubble for capping of roads, flood-ways, landowner pipeline crossings and leases will be sourced from approved areas; wherever possible this will be done by extending existing quarries or borrow pits.<br><br>**Borrow/gravel pits:**<br>Borrow pits may be required as a source for extraction of construction materials. The presence of suitable borrow/gravel pits within the subject land approved areas has been confirmed through initial scouting.<br><br>Management practices include stockpiling cleared vegetation and topsoil in separate piles for respreading over progressively reclaimed areas, and areas to be restored will have battered edges. Maximum excavation depth will be based on the available soil types and volume; however, excavations will not typically extend beyond 3m depth.<br><br>Where possible, materials stockpiled for construction will be stored within the cleared area and transferred to site |

| | |
|---|---|
| | as required.<br><br>Mixing of water with materials to create a cohesive mix may be undertaken at the pit or at the construction site – e.g. lease pad or roadway. |
| (H) The estimated costs of implementing such activities; | Approximately $4-6m to execute the proposed 2023 base scope including approximately 200-240km of 2D seismic and activities at the Jibera South and October Creek North locations.<br>Future activities beyond 2023 will be budgeted separately, however are expected to be in the order of $8-35m per well (depending on ultimate design/scope). |
| (I) Any proposals concerning employment, training and business opportunities; | To be determined.<br><br>Santos will provide further details as logistical and program requirements are finalised. Refer to section J below. |
| (J) If known, the identity of any proposed contractors and sub-contractors engaged or likely to be engaged and the minimum and maximum number of personnel likely to be on the Permit Area from time to time and their roles in undertaking such activities; | **Civil Works Wellsite & Access Road Construction** *(Includes Water Bore Construction)*<br>At this point in time the procurement process is ongoing. Santos has been in discussion with several contractors who have good indigenous engagement and local experience. It is expected that the following companies will be invited to tender for the 2023 scopes of work.<br>• MS Contracting<br>• Arnhem Earthmoving & Mechanical Pty Ltd<br>• Alderbrand<br>• City Earthmoving<br>• Waanyi Shamrock United Pty Ltd (WSU)<br>• Remote Civil<br>• Silver City Drilling<br><br>At any one time, the civil works crew may consist of approximately 20 personnel, including:<br>▪ Site management (3 personnel);<br>▪ Water Bore Drillers (4)<br>▪ Earthmoving Construction Crew (9) and<br>▪ Support Crew (4)<br><br>The crew will consist of plant operators, water bore specialists, truck drivers, camp support, and field management personnel. |
| (K) The chemical composition of any fluids and solids proposed for use in Hydraulic Fracturing of potential Hydrocarbon producing formations; | Refer to Annexure 4 for a list of chemicals used by Halliburton, Schlumberger and Condor in Fracture Stimulation operations. If chemicals other than those listed are proposed for use, these will be provided to the NLC and disclosed to Traditional Owners at On Country Work Program meetings. |
| (L) The area, or where appropriate, line distance the subject of such activities (in square or, where appropriate (for example, seismic lines and roads), line kilometres); and | Activity in conjunction with the 2023 Work Program is proposed at the Jibera South, October Creek North and Newcastle locations (exploration well preparation and waterbores), and seismic lines spanning from October Creek North to Tanumbirini and around the Jibera South |

| | |
|---|---|
| | location. These areas are entirely within the previously surveyed area of Authority Certificates C2014/053, C2018/105, C2019/043 and C2020/011.<br><br>Please refer to the maps below and the spatial data provided. |
| (M) Any other aspect of such activities that is likely to have any Environmental Impact, or in particular, any impact upon Native Title Parties. | Santos has procedures and extensive experience in operating in arid environments. Santos will ensure that any risk of long-term impact is minimised and that there is no risk or impact to sacred sites and cultural heritage as a result of the work.<br><br>To ensure there is no risk or impact to sacred sites and cultural heritage as a result of the proposed work, it is suggested that representative/s of the Traditional Owner group/s accompany the team where possible for any sampling, survey, or construction activities. Santos also welcomes the involvement of local Traditional Owner groups to provide cultural awareness training, welcome to country, and to visit the operations during our activities. |

## 2. Areas of proposed work activities

The proposed work activity falls within previously approved NLC reviewed & AAPA authorised areas approved under AAPA Authority Certificates C2014/053, C2018/105, C2019/043 and C2020/011 that were granted in April 2014, December 2018, May 2019 and February 2020 respectively (Figure 2.1). This application provides a refreshed work program detailing proposed activities within the approved areas and ensuring that no activity will occur within the identified restricted work areas (RWAs). Whilst the proposed lines currently do show some incursion into restricted work areas it is planned that at the scouting stage that alternative line orientations will be investigated. If no suitable alternative can be identified to mitigate incursion then the proposed line will be shortened to ensure that RWA are not entered.

Pending approvals Santos proposes to commence scouting, seismic line preparation, seismic acquisition, civil and wellbore-associated activities in late Q1 2023, depending on weather and surface conditions.

Access track preparation, well pad construction and associated works will likely be undertaken in early 2024 in preparation for future drilling operations. Where possible existing access tracks will be upgraded; however, new access tracks will be created (within the surveyed areas only) if it achieves the objective to minimise the overall impact of the operations. Temporary camps will be used to support these activities and will remain with the current cultural heritage authorised areas.

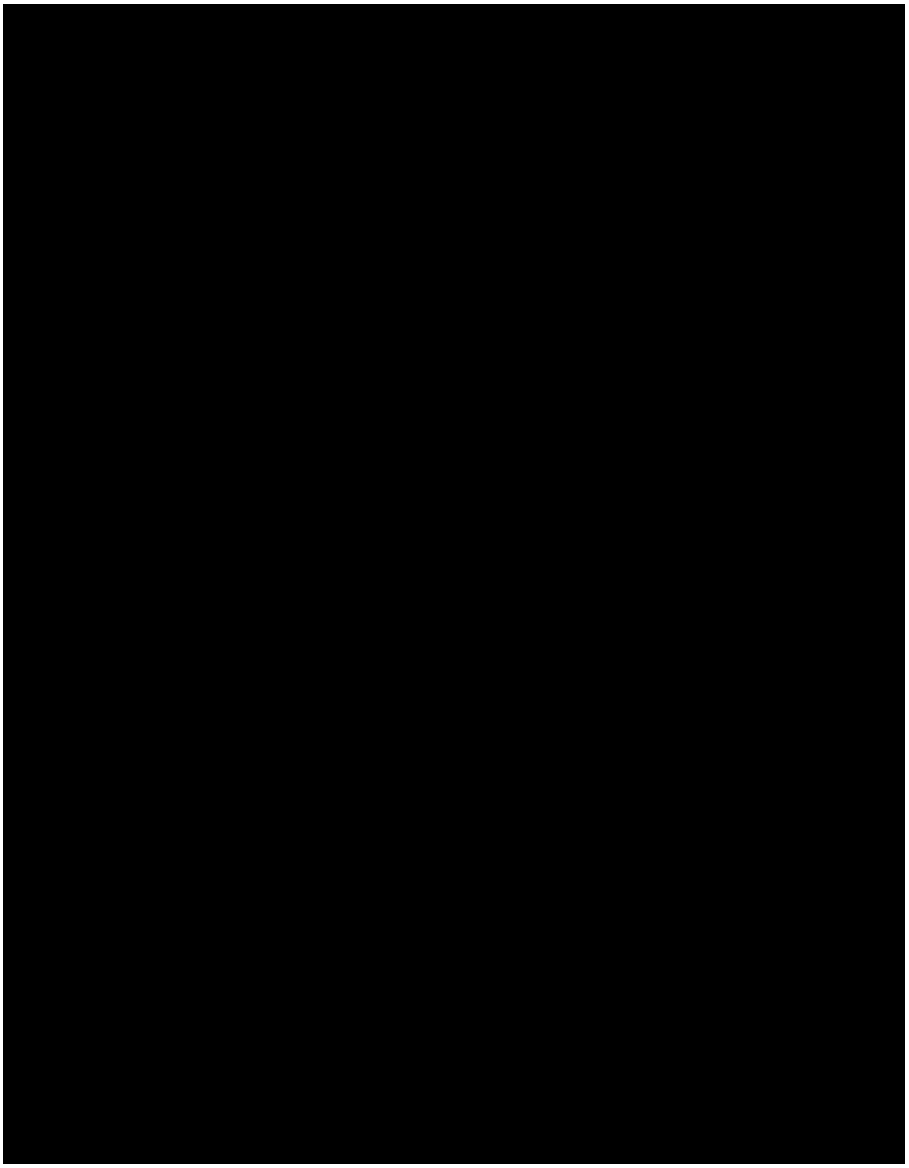


*Figure 2-1: Overview of the area showing the proposed work program areas.*

### 2.1 Jibera South Wellsite Infrastructure and Access

Civils work at Jibera South is proposed to access and prepare the area for the exploration and appraisal of the Jibera South wells. Approximate coordinates of the proposed Jibera South exploration location(s) are presented in Table 2.1 and monitoring bores in Table 2.2, with GIS files attached to this application that complement the work-scope. Images have been provided in Figure 2.1 and Figure 2.2 as a guide of the approximate location of each zone proposed in the lease pad area and access to the lease.

Final locations subject to on-ground scouting, surveying and regulatory approvals.

| | **Projection** | **GDA94 Zone 53 CM 135°** |
|---|---|---|
| **Exploration Location** | **Latitude** | **Longitude** |
| Proposed Jibera South-A vertical and/or horizontal well | 16° 26' 52.18" S | 134° 36' 55.30" E |
| | | |
| Proposed Jibera South-B horizontal well | 16° 26' 52.19" S | 134° 36' 56.33" E |

*Table 2.1: Approximate wellhead coordinates of proposed Jibera South wells*

| | **Projection** | **GDA94 Zone 53 CM 135°** |
|---|---|---|
| **Waterbore Locations** | **Latitude** | **Longitude** |
| Jibera South IMB#1 | 16° 26' 51.80" S | 134° 36'55.01" E |
| | | |
| Jibera South IMB#2 | 16° 26' 51.64" S | 134° 36' 55.32" E |

*Table 2.2: Wellhead coordinates of Jibera South monitoring bores*

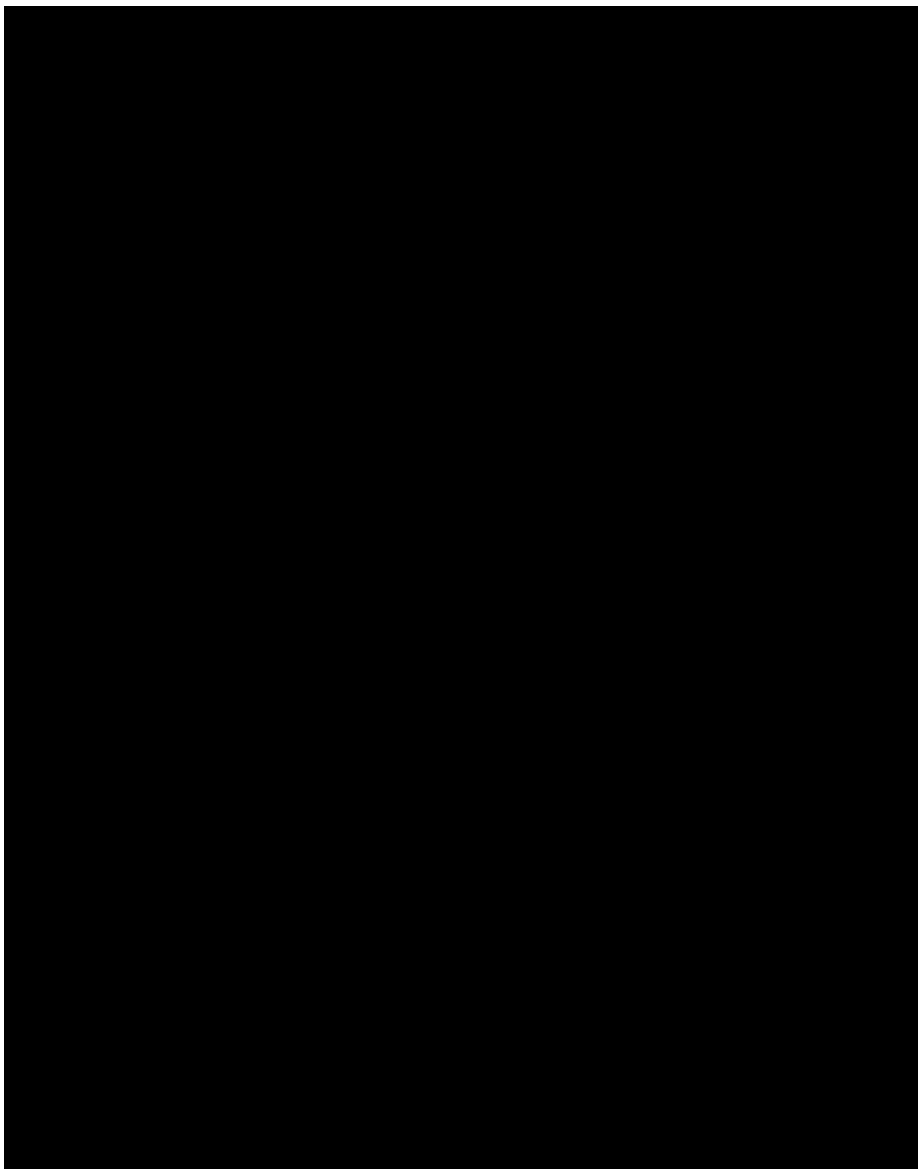


*Figure 2-2: Jibera South location*

### 2.2 October Creek North Wellsite Infrastructure and Access

Civils work at October Creek North is proposed to facilitate access and prepare the area for the exploration of the October Creek well(s). The approximate coordinates of the proposed exploration location(s) are presented in Table 2.5, and the proposed control and impact monitoring waterbores are presented in Table 2.3 and Table 2.4. Importantly, the control monitoring bores must be installed at least six (6) months prior to well construction activities. It is proposed to install the control monitoring bores (Table 2.3) in 2023, enabling well construction to occur 2024+. GIS files are attached to this application that complement proposed coordinates. Figure 2.1 and Figure 2.3 are location maps showing the October Creek location.

Final locations subject to on-ground scouting, surveying and regulatory approvals.

| | **Projection** | **GDA94 Zone 53, CM 135°** |
|---|---|---|
| **Waterbore Locations** | **Latitude** | **Longitude** |
| Proposed October Creek North CMB#1 | 16° 35' 14.38" S | 134° 43' 07.57" E |
| | | |
| Proposed October Creek North CMB#2 | 16° 35' 14.05" S | 134° 43' 07.97" E |

*Table 2.3: Approximate wellhead coordinates of proposed 2023 October Creek monitoring bores*

| | **Projection** | **GDA94 Zone 53, CM 135°** |
|---|---|---|
| **Waterbore Locations** | **Latitude** | **Longitude** |
| Proposed October Creek North IMB#1 | 16° 35' 12.10" S | 134° 43' 05.78" E |
| | | |
| Proposed October Creek North IMB#2 | 16° 35' 12.32" S | 134° 43' 05.58" E |

*Table 2.4: Approximate wellhead coordinates of proposed 2024+ October Creek monitoring bores*

| | **Projection** | **GDA94 Zone 53, CM 135°** |
|---|---|---|
| **Exploration Location** | **Latitude** | **Longitude** |
| Proposed October Creek North -A vertical and/or horizontal well | 16° 35' 12.45" S | 134° 43' 05.95" E |
| | | |
| Proposed October Creek North -B horizontal well | 16° 35' 12.36" S | 134° 43' 06.39" E |

*Table 2.5: Approximate wellhead coordinates of proposed 2024+ October Creek wells*

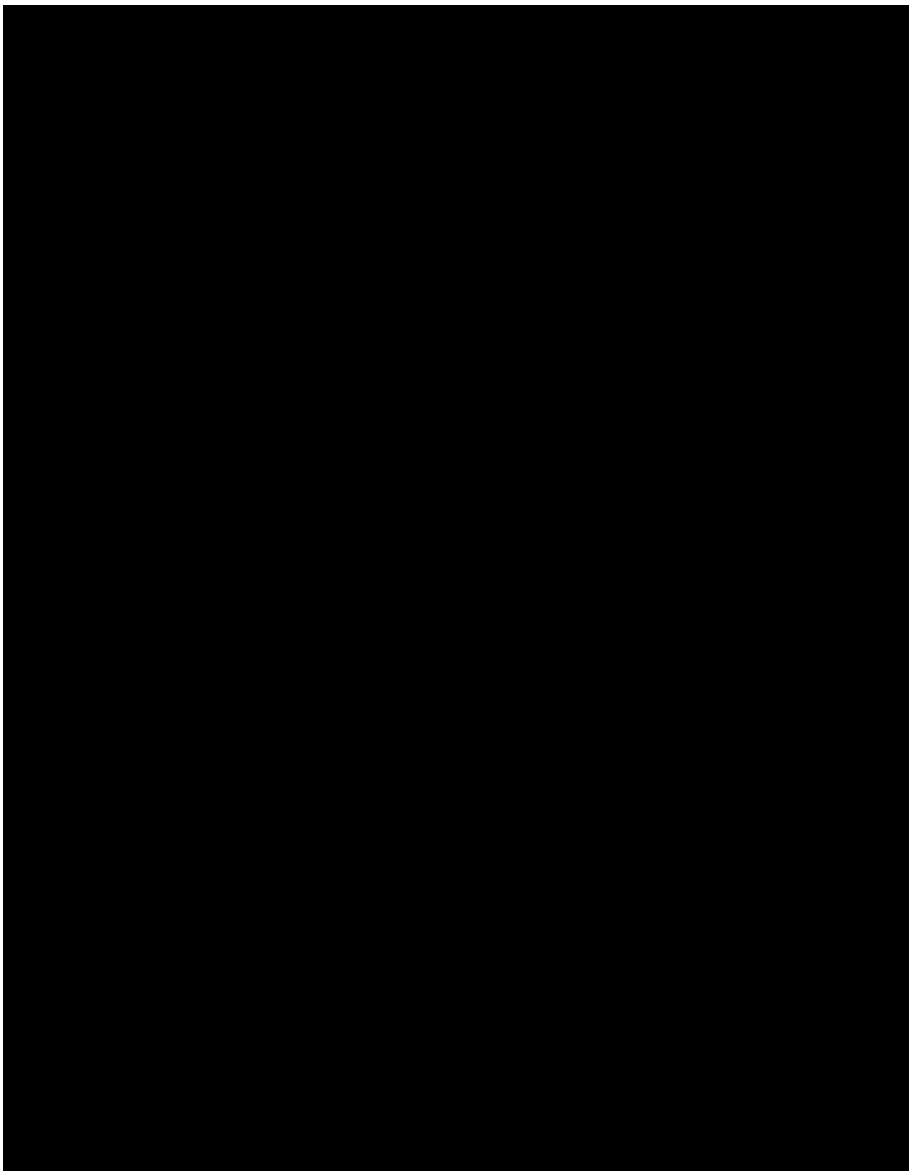


*Figure 2-3: October Creek North location*

### 2.3 Newcastle Wellsite Infrastructure and Access

Control monitoring waterbores are required to be drilled and equipped with monitoring equipment at least six (6) months in advance of an exploration drilling campaign. The baseline data collected typically includes monitoring water quality and water level/pressure. The approximate coordinates of the proposed locations are presented in Table 2.6 and Table 2.7. GIS files are attached to this application that complement the scope of work.

| | Projection | GDA94 Zone 53, CM 135° |
|---|---|---|
| **Exploration Location** | **Latitude** | **Longitude** |
| Proposed Newcastle A | 16° 31' 59.90" S | 134° 40' 37.31" E |

*Table 2.6: Approximate coordinates of proposed Newcastle exploration well*

| | Projection | GDA94 Zone 53, CM 135° |
|---|---|---|
| **Waterbore Locations** | **Latitude** | **Longitude** |
| Proposed Newcastle CMB#1 | 16° 32' 02.47" S | 134° 40' 38.15" E |
| | | |
| Proposed Newcastle CMB#2 | 16° 32' 02.16" S | 134° 40' 38.84" E |

*Table 2.7: Approximate wellhead coordinates of proposed Newcastle monitoring bores*

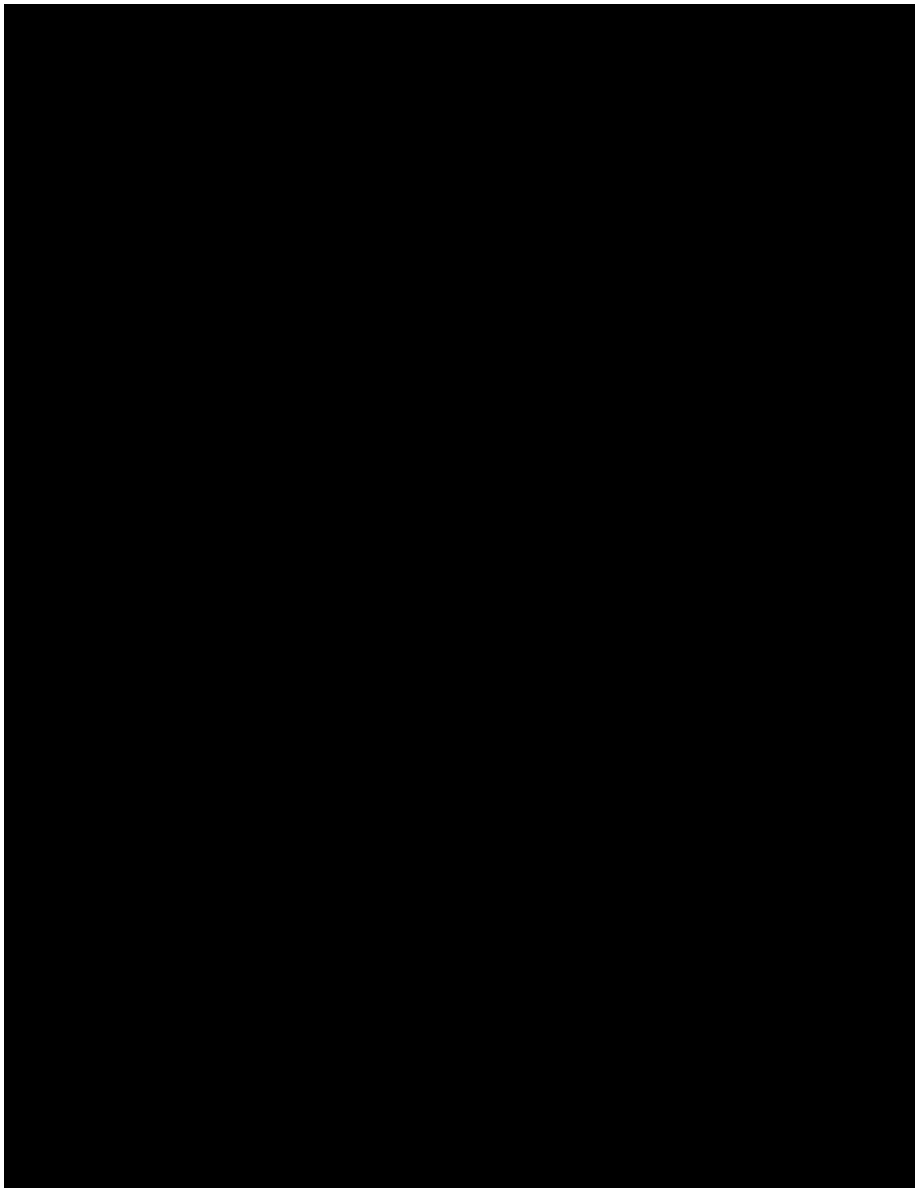


*Figure 2-4: Newcastle location*

## 2.4 Central Camp Location

Depending on the level of field activity, a central camp may assist workers to reduce travel time and improve living conditions. The area proposed would be central to most future activities.

| | Projection | GDA94 Zone 53, CM 135° |
|---|---|---|
| **Camp location** | **Latitude** | **Longitude** |
| Proposed central camp location | 16° 31' 34.73" S | 134° 42' 35.35" E |

*Table 2.8: Approximate coordinates of proposed central camp*

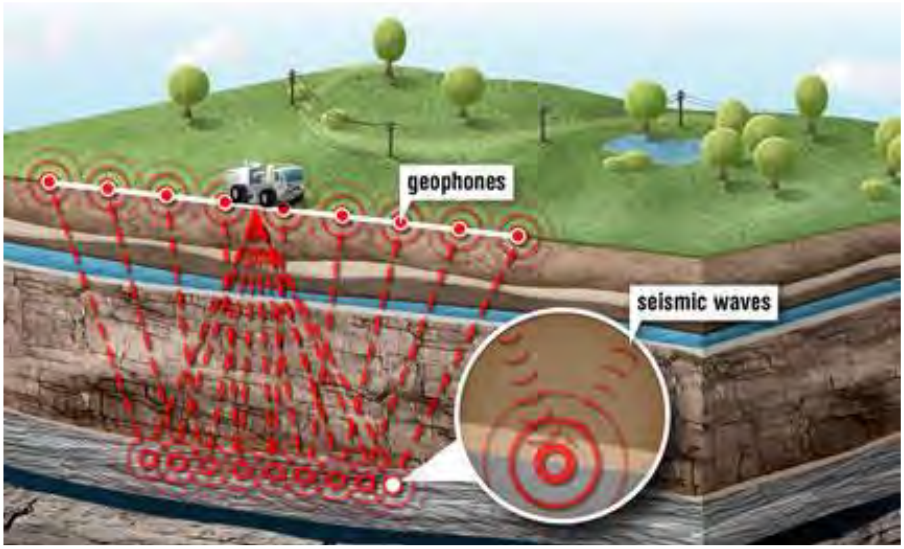
## 5.2.4 Attachment 2 – Annexures

**Attachment 2 – ANNEXURES**

### Annexure 1

# 1 Description of Seismic Operations

Seismic acquisition allows the explorer to 'image' below the surface and identifies areas where oil and gas may have accumulated. The seismic method utilises vibrator trucks as the energy source. The energy source causes sound waves, which travel into the earth and are then reflected from subsurface geological structures. The returning reflections are recorded in a digital format and sent to a seismic data processing centre to produce a 'cross-section' of the layers of the earth's crust. The following sections explain the field procedures for recording seismic data.




## 1.1 Line and Access track preparation

Once the line positions for an entire project have been cleared by both the environment and cultural heritage groups, the line preparation crew can commence work. All line preparation is undertaken within the requirements of the relevant Environment Authority or other applicable legislation, with any required additional internal constraints.

The line preparation crew usually operate simultaneously on different lines, characteristically using a slasher and loader fitted with a stick rake and possibly a grader in rougher terrain. In the main, the slasher will be used to slash grasses to allow clear and safe access for the subsequent operations. If ground conditions require, a bulldozer or wheeled loader will be utilised to simply walk with the blade up in easily traversable terrain, with the marks of the tracks/wheels being sufficient for the surveyors to follow.

The line position, including tolerances for weaving the line around vegetation etc, are pre-programmed into the real time GPS units housed in the line preparation equipment. The line preparation equipment weaves around vegetation stands within predetermined corridors to reduce visual impact.

All machine operators are given detailed inductions at the start of each project. In sensitive environments such as remnant vegetation or wetlands, lines are prepared without the use of heavy machinery wherever possible.



Seismic line after line preparation in open terrain

## 1.2 Line Surveying

Surveying commences shortly after line preparation. The field surveyors use real time kinematic GPS receivers to position the receiver points. Surveyors insert numbered wooden pegs to indicate the points. Markers protrude about 30cm above ground level. All of these markers are removed on completion of the recording phase. Line detours are often marked with biodegradable flagging which is also removed. Each survey team (one surveyor in a light 4WD vehicle) generally makes only one pass over any given section of line. Back tracking possibly occurs in areas where vehicle access routes have deviated from the true line position and markers have to be inserted on foot.

During the surveying phase, maps are prepared for subsequent operations that indicate any areas of restricted access such as exclusions for cultural heritage sites or infrastructure.

## 1.3 Recording

Normally commencing 5-7 days after the start of line preparation. This operation is the largest part of the seismic operation in terms of personnel and vehicles. A recording crew's strength would normally be in the order of up to 30 personnel and 20 vehicles.

In recent years, cable-less nodal recording systems have become more common, replacing the more traditional cable-based systems. The cable-less systems consist of individual nodes that are basically a geophone and internal HDD recorder, allowing the data to be stored internally. This negates the need to

have interconnecting cables that run between the geophones and the recording truck. One of the benefits of the cable-less nodal system is that the number of vehicles required are greatly reduced as there are no cables to transport, deploy and pick up. This results in less vehicle passes over any given section of seismic line and less personnel on the crew, giving a reduced environmental footprint in a number of areas

.



Different types of Available Recording Nodes

Work commences with the laying of nodes from 4WD vehicles. Line crew walk along the line placing the node in the ground (about 100mm deep) every 5-10 metres and programming its internal electronics. Once sufficient nodes are deployed and activated on the seismic line the recording operations can commence.

This layout is termed “the spread” and a preselected “live” section of it picks up the acoustic energy reflected from subsurface layers, converts it to electrical energy and stores it internally in the nodes HDD recorders.

The acoustic energy source is normally an array of two or three truck mounted vibrator units electronically synchronised to vibrate in phase with each other. They line up along the seismic line, a few metres apart, centred on a source point. On command from the instrument truck, the vibrators all input one or more frequency sweeps into the ground at each source point. Generally, 4 -12 seconds of reflected data is recorded at each source point. The source points are typically 10-20 metres apart. On completion of one source point the set of vibrators quickly move to the next source point.

The “live” section of spread is typically about 6km in length. The live spread is moved as the vibrators move up. As nodes become redundant behind the live spread, they are picked up and transported to the front end of the line and redeployed. This cycle continues until the line is completed.



Univibes parked alongside a Toyota Landcruiser line vehicle




"Univibe" Vibroseis units on a seismic line through a wheat field.

## 1.4 Line/Access Track Restoration

The majority of seismic lines & access tracks do not require restoration work as one of the main objectives is to prepare and utilise them in a way that will facilitate rapid natural recovery. However, instances that can give rise to restoration are:

- Wheel ruts caused after wet periods
- Windrows not fully removed by grader
- Windrows removed at intersection of lines and public tracks
- Public access tracks to be reshouldered where necessary
- Access tracks that have sustained damage due to extensive seismic traffic.

Normally a single dozer or grader or one of each is all that is required to carry out the restoration work. Methods used for rehabilitation include;

- Ripping of compacted areas with bulldozer rear tynes
- Windrow material pushed onto line and smoothed.
- Public road windrows reinstated.
- Wheel rut material used to infill affected areas.
- Affected water course channels and creek banks reinstated to pre-survey profile.



Seismic line following completion of operations. No restoration required.

**Environmental Monitoring**

During the above activities the maintenance of environmental standards are monitored closely by the Santos field representatives and Contractor section heads. All crew personnel are environmentally inducted prior to start up. Environmental monitoring points (EMP's) are set up close to easy vehicle access and the natural rehabilitation is monitored photographically over a period of years until rehabilitation is complete.

## Annexure 2

## 2 Wellsite civils works and access

Various earthworks are required to provide a safe and practical work area and access to drill exploration wells, water wells, campsites, airstrips and other operational needs. The construction designs will be determined by a framework that supports users, landowner and regulatory needs.

All civil work activities will be fit for purpose and will be undertaken to minimise impacts on Traditional Owners, pastoral lessees, nearby industry or the general public. Design and construction will be appropriate for:

1. The types of vehicles that need to use the road.
2. The type of road planned and the surface material – e.g., high clay (Black Soil), or fine bulldust soils require differing construction and maintenance requirements.
3. Expected weather conditions – i.e., all weather access and mobility can be improved by formation design, adequate drainage, plus capping with rock, rubble, or "Durabase Matting".
4. The conditions of the approved Environmental management plan, which requires a civil solution to manage erosion, wildlife impact, bushfire, and flood risks.

Optimally designed, planning and execution of civil works are critical to ensure that:

### 2.1 Well sites:

Well sites are constructed to create safe, fit for purpose work areas that include several distinct zones:

1. Drill hardstand is level and compacted using selected fill that supports the loads and pressures of drilling rig equipment operations.
2. Drill pad work area is level and surrounds the drill hardstand – this area needs to be compacted and support ancillary equipment like generators, fluid treatment systems, pipe racks and forklifts.
3. Wellsite work areas that surround the drill hardstand and cuttings pits have a level tolerance of <2% and must be compacted to support the movement of trucks and forklifts and bunded areas created for the storage of chemicals, racks and shelving supporting casings and other consumables.
4. Cuttings pits should be located in an area accessible directly from the fluid treatment systems (Mud Tanks) or loaders (in the case of "sumpless drilling"), usually on multi well pad sites. Pits can be unlined, lined with a suitable clay mix to create an impermeable layer, or lined with a synthetic membrane to retain drilling fluids during drilling and subsequent dehydration process prior to backfill.
5. As per the Code: A flare pit or the end of a flare line shall not be located within 45 metres of a well, separator, below-ground pipeline, storage tank or temporary production facility, and should be located in a position down-wind from the prevailing wind direction.
6. Mini camps, crib/first aid rooms and site management offices, are located outside the wellsite work/hardstand areas; offices will have a clear view of the rig floor. This area will be level, compacted and accessible to supplies and emergency vehicles, and usually include emergency muster points and vehicle parking.

### 2.2 Access Roads:

Access roads are designed and constructed so that road trains can deliver equipment and supplies to the sites, and personnel can be safely moved around or delivered to site. Roads may be watered to reduce dust, and/or capped to reduce maintenance and/or closed following rain.

## 2.3 Laydown areas

Laydown areas are constructed so that materials can be offloaded and stored for use as and when required. Materials include casings, tools and mud chemicals. Laydown yards must provide enough room for the safe movement of trucks and forklifts.

## 2.4 Campsites

Campsites for workers' accommodation, and refuge during severe weather, illness or injury, are located in positions that provide isolation from fire and flood dangers. Campsites must be reliably resupplied and provide workers with good comfort and recreation facilities. The location of campsites should reduce travel and fatigue exposure to acceptable levels.

## 2.5 Water Bores

Includes water observation bores and water supply bores. The drilling of observation or monitoring bores is a regulatory requirement, and drilled in proximity to proposed or existing exploration wells. These bores will be equipped with logging equipment and the data acquired reported to the NT Government. For the supply of water to aid compaction and reduce dust; support drilling, completion and hydraulic fracture stimulation operations; and supply water to the campsite for amenity needs. It is preferable to have a low salinity water supply close to site.

## 2.6 Water Storage Pads

Water storage pads are required so that water tanks can be erected, providing sufficient volume and delivery of water at a rate required to support the works. Typically, larger storage is required where water bore flow to surface is low. Water storage tanks will also store any fluid produced back to surface and then safely evaporated or disposed at a licensed facility.

## 2.7 Airstrips and Helipads

Airstrips are used to transport the workforce from a main centre to the worksite. Air transport reduces fatigue and exposure to land transportation risks. Existing landowner airstrips will be utilised and upgraded under agreement to a condition where charter operators (for crew change), or RFDS or Careflight Air Ambulance (emergency evacuation) aircraft can be used.

## Annexure 3

# 3 Drilling and evaluation

## 3.1 Drilling

Oil and gas wells are typically drilled by rotating a drill bit on the end of drill pipe while exerting downward force on the drill pipe. During drilling, fluid is pumped through the inside of the drill pipe or "string" to the drill bit and back up the outside of the drill string to lift drill cuttings out of the hole. The drilling fluid / drill cuttings are then channelled into tanks or suitable clay lined pits and the drill cuttings are separated from the drilling fluid; drilling fluid is then recycled down hole in a continuous process. The well is drilled deeper by adding a length of drill pipe to the drill string; this is repeated until the well, or a section of well, reaches the target depth. Once the target depth is reached, casing composed of concentric steel pipe is installed into the well and cemented in place to provide the structural integrity and well integrity barriers for the designed life of the well.

The figure below illustrates the drilling rig layout and lease and access roads required for a Cooper Basin drilling operation. The drilling rig along with specialised wellsite support services and camp are mobilised to the well location, comprising 100-150 truckloads. The drilling rig camp is either located adjacent to the wellsite or in a location central to multiple wellsites. It is designed to accommodate the crew working at the wellsite and will expand and contract as required to meet personnel requirements.



Drilling rig EWE 106 at Tanumbirini in 2021

Wells are drilled to reach the formation targets through a series of hole sections. While drilling, mud logging samples are captured in order to characterise the formations that are being drilled through and to calibrate the geological model. It is expected that 2-3 ML of water will be required to drill each well, with the water being supplied from water bores installed at or near the drill location. Each hole section serves a specific purpose for well construction and well integrity as outlined below:

- The Conductor Hole Section is drilled and cased to stabilise the surface sediments from the drilling of subsequent drilling phases (i.e., it prevents loose soils from caving into the borehole) and is cemented into place to ensure an appropriately robust seal (up to ground level). The conductor casing also serves to isolate aquifers near surface, if

present.

- The Surface Hole Section is drilled and cased to isolate shallow aquifer systems and to stabilise the well for subsequent hole sections. The hole section will be drilled with drilling fluid that exerts a higher hydrostatic pressure on the rock face than is present naturally in the rock pore space, ensuring formation fluids do not enter the wellbore. Other techniques such as underbalanced or managed pressure drilling may be applied dependant on the downhole environment. The surface casing is cemented in place from bottom to top to ensure effective pressure isolation of shallow aquifers from deeper hydrocarbon bearing zones encountered in subsequent hole sections. Finally, the casing is pressure tested to simulate well life design specifications.

- After the surface casing is installed, a Blowout Preventer (BOP) is installed onto the well at surface to provide a second barrier along with the drilling fluid. At the commencement of drilling the next hole section (i.e., only 2-3m of new hole drilled), a Leak Off Test (LOT) or Formation Integrity Test (FIT) is conducted to determine the rock strength. This will ensure the well is drilled without risk of the rock failing due to exerted pressure and will ensure the fluid used for drilling the well has the appropriate kick tolerance.

- The Intermediate Hole Section(s) may be drilled and cased to isolate deeper aquifer systems (if present), to contain pressure that may occur during the subsequent hole section, or to isolate a geohazard, like a salt formation prior to drilling deeper. The hole section is drilled with drilling fluid that exerts a higher hydrostatic pressure on the rock face than is present naturally in the rock pore space, ensuring formation fluids do not enter the wellbore. Other techniques such as underbalanced or managed pressure drilling may be applied dependant on the downhole environment. As with the surface casing, the intermediate casing is cemented in place to ensure appropriate well integrity. Finally, it is pressure tested to simulate well life design specifications

- The Production Hole Section is drilled to intersect formation targets containing gas and is drilled to a depth below the lowest hydrocarbon bearing target for evaluation or if the well is horizontal, the lateral section will remain in the target zone. The hole section is typically drilled with drilling fluid that exerts a higher hydrostatic pressure on the rock face than is present naturally in the rock pore space, ensuring formation fluids do not enter the wellbore. Other techniques such as underbalanced or managed pressure drilling may be applied dependent on the downhole environment. Logging while Drilling (LWD) can be used to gather data in real time to gain an understanding of the petrophysical environment. LWD will also be utilized when well bore trajectory does not allow for conventional open-hole wireline logging.

## 3.2 Evaluation

If well trajectory allows (near vertical), open hole wireline logging is generally performed after the production hole section has been drilled and prior to the production casing being run. Wireline operations for Santos are undertaken by a number of different industry recognised specialist service companies. The information acquired is used to ascertain whether the well warrants further evaluation and a decision can be made to run production casing for future testing.

- The logging evaluation program may include a vertical seismic profile (VSP) or check-shot survey, or a 'walk-away' VSP. These geophysical techniques are similar to surface seismic exploration, except the detectors (geophones) are located in the well bore, rather than at the surface, and the surface source is stationed at specific locations around the well. The geophone array comprises one to several geophones on wireline. The surface seismic energy source is either an airgun (in a water filled drum and pit) or a small vibrator truck located as close as is safe and practical to the well bore. The geophone array is run to the bottom of the hole on the wireline and is then moved up the hole at regular intervals (e.g., 15m) and the stationary surface source is triggered. The geophones record the time it takes for the seismic energy from the surface source to arrive downhole at the geophone. The data recorded provides accurate velocity information and is processed to produce a seismic wavelet well-tie, such that the well can be "tied" to the seismic line on which it is located.

After the production hole is drilled and logged, production casing is installed to the total depth of the wellbore and cemented in place. It is pressure tested to simulate well life design specifications. The purpose of the production casing is to provide isolation between the hydrocarbon reservoirs and all other overlying formations, to contain the pressurised fluid used to hydraulically stimulate the target zones, and to provide effective wellbore integrity for well production. High quality steel casing is designed specifically for each well. If the well does not require hydraulic stimulation, a lower grade of steel casing may be used that meets the design requirements for the life of the well. Casing design scenarios are modelled using well-established and reviewed techniques to simulate the design loads for collapse, burst and tensile failures that could conceivably be observed during the operational and production phases. The results of these analyses direct the selection of casing grade and weight. All casing is tested by Santos and the contractor using specific Quality Assessment and Quality Control (QA / QC) procedures prior to installation to ensure compliance with the Santos engineering and regulatory specifications.

After each hole section is drilled, the steel casing is cemented in place. The correct composition, volume and placement of cement is critical for well integrity. The cement serves two purposes – it provides protection and structural support to the casing while also providing zonal isolation between different formations, including groundwater and aquifers. The cement and required additives are high quality materials produced specifically for oil and gas operations with the materials selected designed to address the specific conditions of a particular well.

Santos and the cementing contractor ensure the cementing material and equipment is adequate to achieve the well design objectives and ensure effective isolation. Prior to pumping the cement, it will be laboratory tested against the engineering design and actual downhole conditions such as temperature. The cement is tested using specific QA / QC procedures and includes the following:

- slurry density
- thickening time
- fluid loss control
- free fluid
- compressive strength development
- fluid compatibility (cement, mix fluid, mud)
- sedimentation control
- expansion or shrinkage characteristics of the set cement
- static gel strength development

- mechanical properties (e.g., Young's Modulus, Poisson's Ratio, elastic / compressibility characteristics)

Cased hole logs can be run inside the cemented casing to validate the quality and integrity of the cement sheath bond to the casing and to the formation. Typically, these logs include:

- gamma ray - measures naturally occurring gamma radiation to characterise the rock or sediment in a borehole
- casing collar locator - a magnetic device that detects the casing collars
- cement bond log - an acoustic device used to measure the properties of the cement sheath and the quality of the cement bond between the casing and the formation

The cement bond log is an acoustic device that can detect cemented or non-cemented casing. It works by transmitting a sound or vibration signal through the casing, and then recording the amplitude of the arrival signal. Casing that has no or poor-quality cement surrounding it (i.e., free pipe) will have large amplitude acoustic signal because the energy remains in the pipe/annulus and isn't transmitted to the formation. Casing that has a good cement sheath (fills the annular space between the casing and the formation and effectively couples the two) will have a much smaller acoustic amplitude signal as the energy is absorbed by the formation due to effective acoustic coupling. Santos uses experienced contractors to identify the key features of the cement quality to ensure the integrity of the cement seal for each casing pipe sheath.

## 3.3 DFIT

A Diagnostic Fracture Injection Test (DFIT) goes by many names: mini-frac, mini fall-off, datafrac, etc.; but all refer to the act of injecting small volumes of a clear fluid (usually with a small percentage of Potassium Chloride e.g., 2 to 3% KCl) at low pumping rates to create a fracture before the wellhead is shut-in and the pressure allowed to fall-off naturally. The fluid contains no proppant so that the fracture can relax and close naturally when pressure is released. The pressure changes are measured with high-accuracy gauges that are either placed deep in the wellbore or at surface on the wellhead. The analyses of fracturing pressure, during injection and after shut-in, provide powerful tools for understanding and improving the fracturing process. DFIT data helps operators recognise fracture behaviours and design fracture stimulation programs accordingly to ensure that the targeted reservoirs are stimulated optimally.

## 3.4 Perforating

To perform a DFIT the casing needs to be perforated to provide communication between the wellbore and the formation target zone. The type of charge used depends on the type of hole, size and penetration depth required. The three primary types of perforating used are:

- Wireline Conveyed Perforating (WCP) – the most widely used perforating technique in the Cooper Basin. As the name suggests, WCP uses wireline to deploy the perforating charge.
- Tubing Conveyed Perforating (TCP) – uses the same technology as conventional wireline perforating but is run using a coiled tubing unit or jointed tubing (not wireline).
- Hydro-jetting – uses sand and water jetted through small holes in the bottom hole assembly to create holes in the casing across the target formation – there is no perforating charge.

## 3.5 Fracture Stimulation Evaluation

**Pressure Monitoring**

During a fracture stimulation treatment, computer assisted live monitoring allows for potential problems (surface or down-hole) to be identified and corrected quickly. An example of live monitoring applied to downhole conditions is if pressure communication between the annulus of the well and inside of the well is identified. Where communication is identified, it may be an indication that the first barrier control (as part of the well's integrity management) has been compromised and the treatment will be stopped immediately.

The figure below depicts information presented during real time stimulation operation monitoring. Key parameters such as surface, bottom-hole and annular treatment pressures, proppant concentrations, volume of injected fluid and fluid additives are monitored. The modelled pressures are compared with the actual pressures and can provide useful information in evaluating the overall fracture growth and fracture geometry achieved. This calibration process is used to refine and improve subsequent designs as part of the design optimisation process.

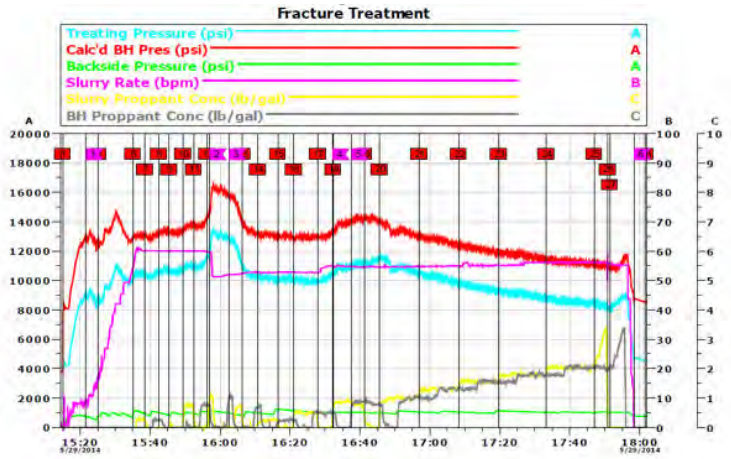



*Figure: Real time monitoring of hydraulic fracture parameters (pressure, rate etc.) on a shale gas frac in the Cooper Basin (Santos 2014)*

**Tracers**

Chemical tracers are used to determine the relative contribution from each fracture stimulation stage. The low dosage chemical are designed to be unique in composition and able to be absorbed into the water or gas phase. This enables the operator to determine the performance of each frac stage and incorporate optimisation learnings into future campaigns.

**Microseismic**

Advanced stimulation monitoring techniques such as microseismic monitoring, may be used to evaluate fracture azimuth, fracture height and fracture half length. This information can be further used to calibrate the hydraulic stimulation model predictions. Microseismic monitoring involves the use of sensitive receivers ("geophones") at the surface or within one or more nearby wells to detect and locate in 3D space the releases of energy associated with the propagation of the stimulated fractures. The figure below shows an example of a side-view of the locatable microseismic events that were detected during the multi-stage hydraulic stimulation of a Cooper Basin horizontal shale well, with the positions of the events colour-coded by stimulation stage. The modelling and field results show good agreement.

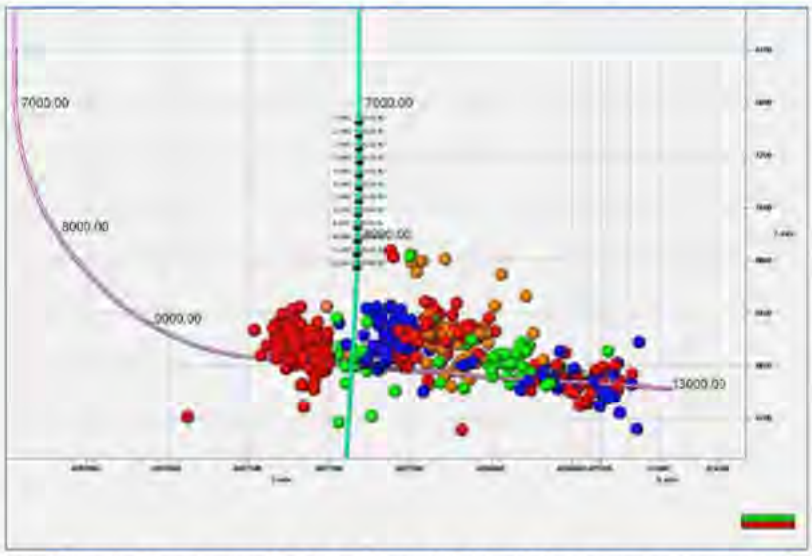



*Figure: Microseismic events mapped during the 10 stage shale hydraulic fracture treatments pumped in the Cooper Basin. The different colours represent the different frac stages (Santos 2014).*

The microseismic results are supported by detailed studies such as by Fisher and Warpinski (2012) which have reviewed height growth data from unconventional (shale) plays in the US including the Barnett, Marcellus and Woodford shales. These studies have indicated that maximum height growth is typically far less than 300m when contained within a relatively homogeneous layer.

**Tiltmeter installation**

Tiltmeters are very sensitive surface tools for measuring very minor displacement or movement in the subsurface. They are used in hydraulic fracture stimulation operations to provide insight into the spatial extent and orientation of induced fractures.

Tiltmeters are typically installed into pre-drilled and cased holes drilled with an 8" or 10" diameter bit to a depth of around 12 metres.

Once the drilling is completed a 4" PVC pipe is then cemented in place within the hole. The cement secures the 4" PVC pipe to the ground around it to ensure good coupling for the tiltmeter. The cement ends around 1.2m below ground. To further minimize unwanted noise a larger 8 – 10" pipe around 1.8m in length is then placed around the smaller pipe to a depth of about 1.2m below the surface. The tiltmeter tools are then lowered into the inner 4" string of PVC. A small amount of sand is poured around the tools to give positive coupling to the surrounding ground. An end cap is then placed over the 8" PVC pipe to make the entire setup weatherproof.

Drilling of the tiltmeter holes will be performed by a small truck mounted rig as pictured below. There will also be an additional vehicle and trailer for transporting extra equipment and consumables such as concrete and sand. As the vehicles are light vehicles only minimal (if any) line preparation will be needed for access. It is expected that most hole / tiltmeter sites will be accessible with no access track preparation at all.

Drill cuttings will be stacked adjacent the hole to be re-used to backfill the holes upon completion of the project.

Installation would typically be completed in a 2 week period.

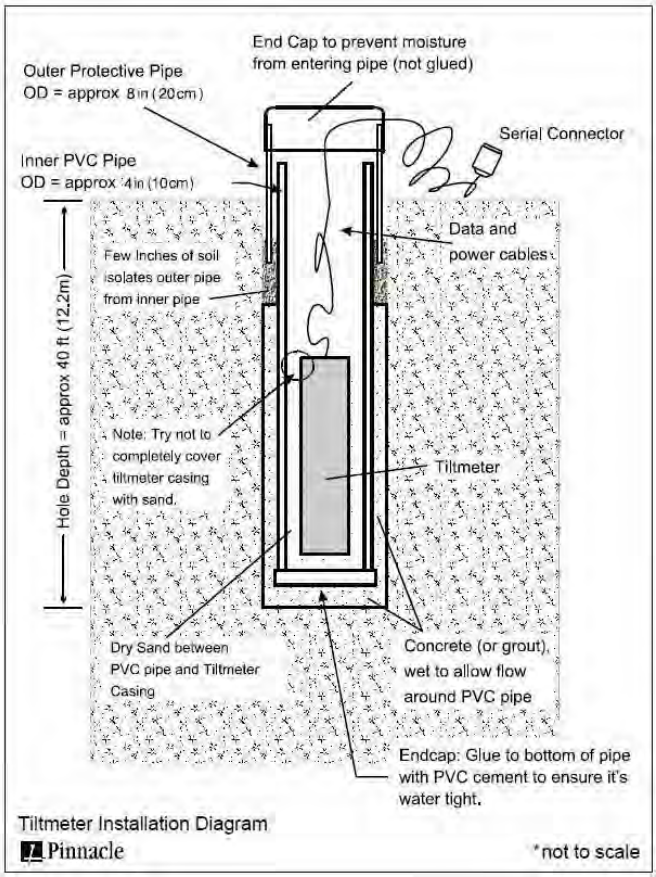



*Figure: Schematic of typical tiltmeter installation*



*Figure: Truck mounted rig preparing shallow hole to install tiltmeter.*

**Access track preparation**

The proposed locations have not yet been finalised but, wherever possible, they will be located close to existing roads or tracks for ease of access. These should all be accessible with no access track preparation. A small number of holes may be required that are remote to existing roads and will need longer cross country travel to reach.

Each hole is likely to only have 2 or 3 light vehicles access it during the installation process.

Should access line preparation be required, the lines will be prepared to the standard of seismic lines and access line preparation will be a conventional approach using a dozer and possibly a grader.

**Tiltmeter recording**

Once the tiltmeter installation is complete, the meters themselves are basically maintenance free and do not require any revisits until the project is complete and the meters are removed. The tiltmeters are expected to remain in-situ for 2 – 3 months.

**Tiltmeter recovery and restoration**

Once the tiltmeter survey is complete, the tiltmeters are removed and the location restored. To do this, each site is once again visited by a couple of light vehicles and the meter is manually removed. The outer 8" PVC casing is also removed. The remaining 4" PVC casing is then broken off around 1.2m below ground and the resultant hole is backfilled to ground level using the drill cuttings form the initial drilling if possible.

If any access tracks were prepared, they will be inspected at the time of tiltmeter removal and if required a grader will be brought in to restore the access tracks.

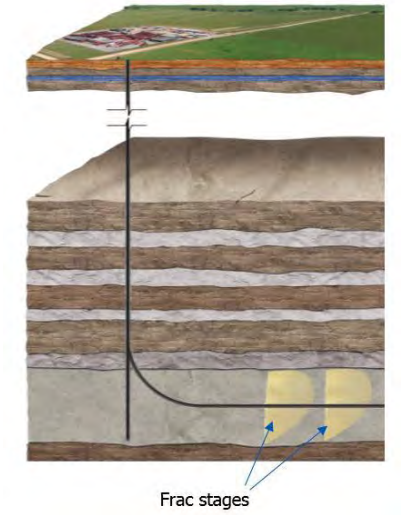
## 3.6 Fracture Stimulation process

**Objective**

After determining that a well has the required design and well integrity to undergo stimulation and completions, the well is handed over to 'complete' the well and set it up for production. Hydraulic fracture stimulation is not part of the drilling process but is a completion technique applied after the well is drilled. The intent of hydraulic stimulation is to place a highly conductive channel into the reservoir to increase the flow capacity of the well. Typically used in low permeability reservoirs that cannot sustain economic production such as shale. It is a process that has been used in the oil and gas industry since 1947. The Society of Petroleum Engineers (SPE) estimates that over 2.5 million hydraulic stimulation treatments have been undertaken in oil and gas wells worldwide. It has been successfully used on wells in the Cooper Basin for nearly 50 years without a primary barrier breach and is currently performed in many basins around Australia, including the Amadeus Basin in the Northern Territory.




*Figure: Fracture Stimulation spread rigged up on a 3-well pad in the Cooper Basin. (Source: Santos 2016)*




Vertical depth to proppant placement in hydraulically opened fractures will likely range between 1500m and 4000m below surface.

*Figure: Multi stage fracture stimulation operations in a horizontal well.*

The stimulation process involves pumping water, a specific blend of chemical additives and a propping agent such as sand or ceramic beads down the well at sufficient pressure to create a fracture in the target formation. Proppant keeps the fractures open once the pump pressure is released which thereby improves the productive potential of the well. A fracture created in deep shale reservoirs, will propagate laterally from the well in a vertical plane. Common dimensional terminology for the created fracture includes fracture half length (xf), fracture height (hf) and propped width (wf), as depicted in the figure below. An unconventional shale gas well typically takes 10 to 15 days to complete hydraulic stimulation operations, with a hydraulic stimulation fluid flowback period of 3 to 90 days, depending on the reservoir and clean up profile, which is typically followed by ongoing flaring and production testing. Production tests may be short if it is possible to put hydrocarbons into existing infrastructure (e.g. Cooper Basin, Surat Basin); however, for exploration wells in frontier basins extended periods (>1 year) of flaring and production testing will be required to establish whether a well or field has the potential to be developed economically

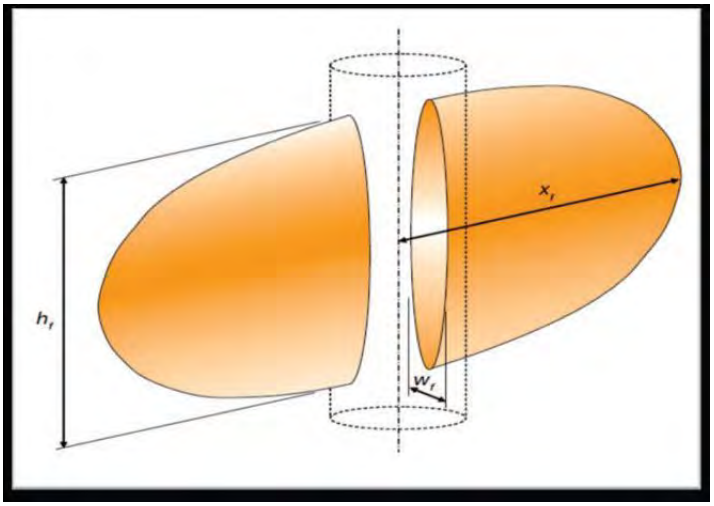



*Figure: Conceptualised Shape of Hydraulic Stimulation Zone of Influence. (Source: Economides and Martin, 2007)*

Santos has a long history of demonstrated well integrity during hydraulic fracturing operations. In nearly 50 years of hydraulic fracturing operations on over 1,150 wells, there has never been a loss of the primary barrier during the fracture treatment. The primary barrier during the stimulation phase is generally the production casing, with the secondary barrier being the surface well pressure control. Should the primary barrier fail, a pressure relief valve (PRV) installed to monitor pressure between the primary barrier and surface casing, is triggered to open at a pressure well below the failure point of the surface casing. This ensures that the surface casing is not exposed to pressure above its design specification, and as a result prevents the risk of failure. Also, programmable pressure triggers (kickouts) on each of the high pressure pumps will physically shutdown each pump (and associated pressure) if a certain trigger pressure is reached. This trigger is below the design of the well. If the primary barrier did fail during hydraulic fracturing operations, operations would cease and it would be repaired to meet the design requirements before going forward with completing the well again.

**Engineering Design**

Open hole and cased hole logging provides information required for the hydraulic stimulation design process, including rock stress and lithological parameters. This data is processed using

industry-accredited stimulation software to develop an optimal design. The basis of well specific hydraulic fracture design is to create a fracture within the target formation that will produce hydrocarbon through the number of required fractures. This is achieved by modelling fracture length, fracture conductivity, and fracture height for each created fracture as depicted in the figure below. A number of considerations influence the final design for each treatment, including:

- depth and thickness of the formation target
- lithology of formation target and bounding layers
- minimum and maximum horizontal stress across all layers (target and bounding)
- thickness of the seals above and below the target reservoir formation
- porosity and permeability of the formation
- pore fluid saturations (percentage of formation pore volume occupied by oil, gas or water)
- pore fluid properties (e.g. density, water salinity)
- well performance data, including flow rates, formation pressure and produced fluid properties
- formation boundaries (as identified from offset wells, log data, cuttings data, and/or seismic data)
- bulk rock density, elastic properties and compressibility
- natural fracture networks
- stress field analysis to determine the maximum principle stress direction and the minimum principle stress direction

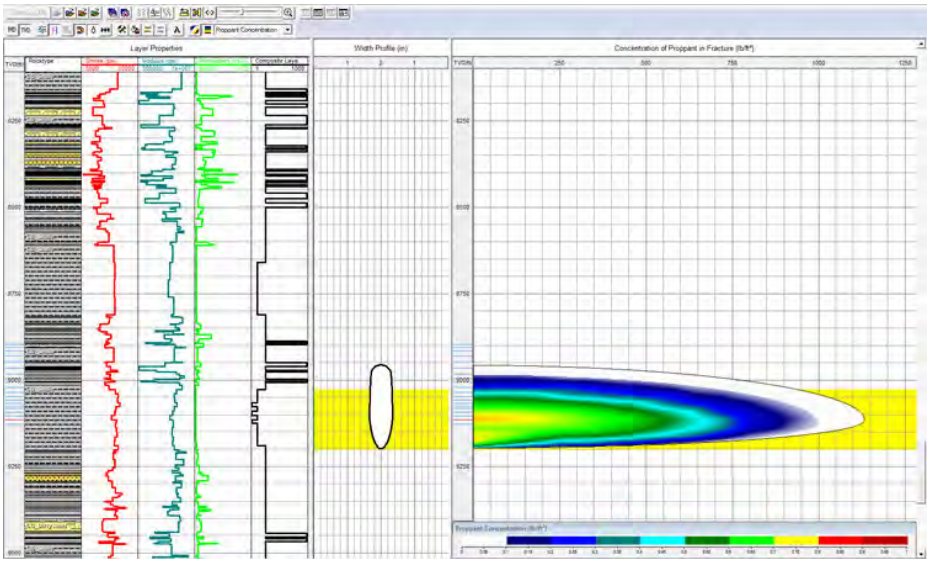


*Figure: Modelled side view output from industry accredited stimulation software for a Cooper Basin horizontal well shale hydraulic fracture (Source: Santos 2014)*

**Proppant and Chemicals**

In shale hydraulic stimulation treatments, water accounts for more than 90% of the mixture and sand accounts for about 5-9%. Chemicals generally account for less than 1% of the mixture and assist in carrying and dispersing the sand in the low permeability rock, and ensuring the fluids and formation are compatible and will have the desired physical properties. In accordance with regulatory requirements, chemical additives are subject to full disclosure. The chemical additives are not specific to the hydraulic fracture stimulation process, having many common household uses such as in swimming pools, toothpaste, baked goods, ice cream, food additives, detergents, cosmetics and soap. The chemicals used provide the following functions:

- Viscosity – gelling agents (natural plant based) are added to the water to provide viscosity to enable the proppant material to be transported down the well and into the created fractures.
- Friction reduction – to reduce the force required to pump the fluid, making the fluid more slippery and easier to pump at high pressures and high rates required to create the fracture network.
- Biocide – added to ensure that there are no microbes or organisms present in the water that will affect the gelling agents and to ensure they will not enter and affect the reservoir.
- Scale and corrosion – scale and corrosion inhibitors are added to prevent deposition of mineral scales and to prevent corrosion of the primary wellbore barrier (i.e. the steel casing).
- Surface tension – surfactants or surface tension modifiers are added to assist the flowback of fluids from the formation.

The process is initiated by pumping a pre-designed volume of the stimulation fluid without proppant, referred to as the "pad volume". The purpose of the pad volume is to create the fracture geometry required to receive the designed proppant volume. Prior to and during pumping the pad into the well, the base gel is prepared and tested using specific QA/QC procedures. Programmed and automated control systems are used to maintain the fluid properties during the pumping of the treatment process. The viscosity of the fluid is typically in the region of 10 to 40 centipoise (cp), depending on the specific fluid design. This may require the use of a base gel or cross-linked gel, both made from guar. In shale fracture stimulation, it is generally possible to use only Friction Reduced (FR) water (instead of a base or cross linked gel), by the addition of a friction reducing agent. This fluid system has the effect of making the fluid slippery to minimise friction pressure lost to the casing.



*Figure: Example of a typical slurry gum constituent, guar gum – illustrating its native form, seed form, splits and powder.*
*** Note: Guar gum is a vegetable product which is ground into a powder and used to create a viscous liquid for hydraulic fracturing. (Source: Economides and Martin, 2007)*

Once the pad volume has been pumped, the injection of the "slurry stages" begins. Proppant is added to the blender and proportioned into the stimulation fluid. The concentration of proppant generally increases through the slurry stages as designed within the fracture treatment simulator. Previously mentioned chemical additives are incorporated to provide a suitable fluid for transporting proppant into the already created fracture.

In a cross-linked gel fluid system, breaker compounds are added at progressively increasing concentrations throughout the pad and slurry stages. The breaker comprises an oxidizing compound or enzyme that breaks the crosslink sites, as well as the long chain polymers. The end

result is a fluid with significantly lower viscosity that can be easily flowed back from the formation to assist with fracture clean-up. The “break time” is designed to coincide with the known pump time at reservoir conditions plus some additional time to ensure the treatment is pumped to completion. This enables the fluid to be more easily recovered from the formation.

Proppant addition begins at low concentrations and is staged up to the final designed concentration which is specific to the formation being hydraulically stimulated. Typical proppant concentrations will range from 0.5 lb/gal (60 kg/m$^3$) to 8 lb/gal (1000 kg/m$^3$) for conventional reservoir stimulation, and typically range from 0.5 lb/gal (60 kg/m$^3$) to 2.0 lb/gal (240 kg/m$^3$) for shale reservoir stimulation. Proppant used in hydraulic stimulation range from graded quartz sand to higher strength ceramic proppants. The strength of this inert material varies, with ceramic proppant being much stronger than quartz sand. Ceramic proppant is used in formations with higher effective stresses, to prevent it from crushing and losing the created fractures conductive properties.




*Figure: Typical sand - guar gum fluid mix.* (Source Economides and Martin, 2007)

Once the final slurry stage is pumped on surface, the flush stage is pumped. The flush stage is a friction reduced fluid (non cross-linked) that is used simply to displace the last stage of slurry down to the perforations. This leaves the wellbore volume free of proppant and ensures that the proppant is placed within the fracture. Once this flush volume has been pumped, the high pressure pumps are shut down and the fracture treatment is considered complete. The duration of the treatment is dependent on the specified volumes to be pumped and the rate at which the treatment is pumped, but is typically around 2 hours for a single shale stage treatment.

**Perforating**

When the formations requiring hydraulic stimulation are identified, the casing needs to be perforated to provide communication between the wellbore and the formation target zone. The type of charge used depends on the type of hole, size and penetration depth required. The three primary types of perforating used are:

- Wireline Conveyed Perforating (WCP) – the most widely used perforating technique in the Cooper Basin. As the name suggests, WCP uses wireline to deploy the perforating charge.
- Tubing Conveyed Perforating (TCP) – uses the same technology as conventional wireline perforating but is run using a coiled tubing unit or jointed tubing (not wireline). TCP is the preferred perforating method when operating in underbalance or overbalanced conditions.
- Hydro-jetting – uses sand and water jetted through small holes in the bottom hole assembly to create holes in the casing across the target formation – there is no perforating charge. Hydro-jetting allows for targeted or pinpoint perforating, creating between 3 and 4 holes per event.

**Process**

A number of steps are involved in the hydraulic stimulation process to pump the designed fracture treatment:

1. Diagnostic Fracture Injection Test (DFIT) to validate and update the proposed stimulation design. This involves injecting a small volume of water, shutting down the surface pumps and monitoring pressure decline to evaluate near wellbore entry friction, fracture gradient, fluid leak off, and minimum horizontal stress. This stage is optional and typically only performed in the exploratory or appraisal stages of development, or until localised fracture characteristics are defined.
2. Main stimulation treatment consisting of pad volume, slurry stages with increasing proppant concentrations, and flush stage to displace last slurry stage through the perforations and into the fracture.
3. Isolation of the completed fracture stimulation stage using a mechanical plug installed at a pre-designed depth.
4. Perforation of the next stage to be hydraulically stimulated and repetition of the process in steps 2 to 4 above until the final fracture stimulation stage is completed.
5. Removal of all mechanical isolation devices by milling out the mechanical isolations.
6. Flowback well to clean up fracture stimulation fluids and monitor hydrocarbon production. This step may also be combined with an Extended Production Test (EPT) to help define the field reserves and expected production life. The flowback of stimulation fluid is conducted through a separator, which separates and captures liquids, and flares produced gas through a vertical 'flare stack'.

The above method describes the "plug and perf" technique for fracture stimulation. Another technique is to use coiled tubing assisted annular stimulation which is used to provide a conduit for "pin-point fracturing". Coiled tubing is run into the well to the deepest target. The bottom-hole assembly run on the end of the coiled tubing incorporates a jetting assembly that allows low concentration sand slurry to cut holes or slots into the casing and cement. The hydraulic stimulation treatment is then pumped into the coiled tubing / casing annulus to initiate and propagate the fracture.

**Equipment**

The equipment and machinery required to carry out a hydraulic stimulation operation is highly mobile and able to be installed and removed relatively quickly (generally within a couple days). The equipment is designed to comply with state and federal regulations for road transport, and are fitted with safeguards such as an in-vehicle monitoring system (IVMS) to ensure compliance of the individual contractors.

**The Wellhead –** is used to inject into and control the well, during hydraulic stimulation operations. The stimulation fluids, which are injected from the surface via the wellhead, are injected through the perforations in the well casing under high pressures in order to physically fracture the reservoir rock. The wellhead provides the primary surface barriers for well control.

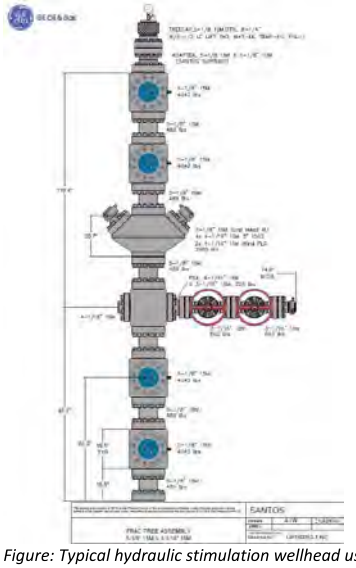


*Figure: Typical hydraulic stimulation wellhead used for shale stimulation operations*

**Above ground storage tanks** – on site, above ground water storage tanks provide temporary water storage for use in the hydraulic stimulation process. Source water can either be trucked from a nearby water source or piped along a temporary network. Small dosages of biocide are added to control algal growth particularly under warm and stagnant conditions. Following completion of works, temporary water storage infrastructure is removed from site.



*Figure: Above ground storage ponds used for frac make up water storage and frac flowback water storage in the Cooper Basin, (Santos 2013)*

**Sand Trailer Unit** – a large, multi-compartment trailer that holds proppant (sand or ceramic material) required for the treatment. When proppant is required, a conveyor system distributes proppant from the compartments to the blender unit.



*Figure: Sand trailer unit. (Halliburton 2012)*

**Blender Units** – In general, two different blending units are used: A pre-gel blender; and a down-hole blender. The pre-gel blender combines the source water with additives required for the base stimulation fluid and proportions of required additives to provide the final hydraulic stimulation fluid. The down-hole blender unit then proportions proppant to the stimulation fluid to provide the proppant concentrations specified in the treatment design. The final hydraulic stimulation fluid, without proppant, is referred to as the "clean fluid". The final hydraulic stimulation fluid, with proppant added, is referred to as "slurry". Chemical additives are precisely measured, controlled and recorded by the blender throughout the stimulation treatment process.



*Figure: Blender unit. (Halliburton 2012)*

**High Pressure Pumps** – Reciprocating triplex or quintaplex pumps that receive low pressure hydraulic stimulation fluid from the down-hole blender and inject these fluids at the required higher pressure into the well during the hydraulic stimulation process. 6-20 units are typically used on shale hydraulic fracture stimulation treatments. The pumps contain programmable pressure triggers (kick outs) to prevent pressure from exceeding the wellbore design limits. High pressure treating iron (pipes, manifolds, connectors, etc.) connecting the stimulation pumps and the wellhead also contain pressure safety valves (PSVs) that are set to open at a pre-set pressure to ensure the well components are protected.



*Figure: High pressure pump. (Halliburton 2012)*

**Control or Data Acquisition Unit** – telemetry from all units connects to a central control room during hydraulic stimulation treatments. Treatment parameter data, including surface and bottom-hole pressure, pumping rate, chemical rate and fluid density, are monitored, recorded and plotted. Treatment supervisors monitor and control the treatment to ensure that the treatment is pumped according to design. Satellite communication facilities allow further 'remote' oversight by technical experts.



*Figure: Control unit. (Halliburton 2012)*

**Coiled Tubing Unit** – a Coiled Tubing Unit (CTU) has many uses within oil and gas operations but is not always required as part of hydraulic stimulation operations. On some occasions the stimulation treatments are placed using coiled tubing assisted annular fracturing, as opposed to "perf and plug" completions (as described above). Coiled tubing can be used in place of wireline jet perforating by jetting holes through the casing and cement using abrasive jetting. Once perforations are jetted, the coiled tubing is left inside the well and the hydraulic stimulation treatment is pumped down the coiled tubing / casing annulus.

In Plug and Perf operations, the Coiled Tubing Unit is generally used at the completion of hydraulic fracturing operations and prior to flowing back into the well, in order to remove or "mill out" the bridge plugs set in the well to hydraulically isolate each stage.



*Figure 3.19: Coiled tubing unit. (Halliburton 2012)*

**Flowback Ponds and/or Tanks** – are used to receive fluids produced during stimulation operations and during the initial clean-up phase (following stimulation activities), and potentially during the early weeks and/or months (or possibly longer) of production testing operations. Typically the returning fluid decreases over time until it ceases and a hydrocarbon stream is solely produced. Ponds are typically double lined with UV stabilised synthetic liners to prevent leaks. Typically, after the initial clean-up phase, the produced fluids are allowed to evaporate or treated for disposal or re-use.

## 3.7 Completion

At the end of the clean-up phase, a workover rig may be used to install production tubing and associated completion equipment such as packers, nipple profiles, tubing hanger, and the production tree. Production tubing which has a smaller internal diameter than casing, is generally required to ensure the well can continue to 'clean up' and there is sufficient vertical lift performance to enable fluid to be removed from the well under natural lift from the well. After the well has been "completed" it is ready for longer term production via an inline production network.

## 3.8 Flow Testing

Once the injection process is complete, the internal pressure of the rock formation causes fluid to return or "flowback" to the surface through the shale gas well. This fluid, often referred to as flowback, contains the dissociation or breakdown products of the injected fluids plus naturally occurring geogenic compounds (i.e. material or substances that are mobilised through the process that must also be considered for any potential health or environmental impact).

A considerable volume of the injected fluids are recovered as flowback. Studies performed by the US EPA (US Environment Protection Agency (EPA), 2004) indicated that approximately 60% of the fluids are recovered in the first three weeks, and total recovery back to surface was estimated to be from 68–82%; however, this is variable across different fields and can be less than 20% in some instances. The flowback water is typically temporarily stored tanks or lined pits before treatment for reuse or disposal.

Initial flowback is typically performed with a mobile separator on location during exploration and appraisal when there are no or limited surface processing facilities. The separator is normally located on the well-pad and connected via relatively short flowlines that include debris catchers and choke manifolds to the wellhead in order to optimise the flowing conditions and frac clean-up. Separators are generally 3-phase which have the ability to effectively segregate gas, oil and water. The gas is sent through to a flare stack where it is flared on location (unless a gas network

is already in place), while the liquid hydrocarbon (oil/condensate) is stored in onsite storage tanks, and the water or flowback is stored as described above



*Figure 3.20: Flow testing separator rig up on a pad location. (Farley Riggs 2014)*

The recovered fluids produced during the initial clean-up phase (following stimulation activities), are stored in Flowback Ponds or Tanks, which are double lined with UV stabilised synthetic liners to prevent leaks. The fluid is allowed to evaporate or it is treated for disposal or reuse in the next hydraulic fracturing event. Waste treatment and management facilities are modular, factory fabricated and transported to site for assembly and connected to piping, electrical controls and instrumentation. By-products from wastewater treatment are contained in fully engineered, purpose built structures for further treatment and disposal. Strategic opportunities for further treatment and beneficial use will be reassessed once composition and technology is assessed. The NT Government will mandate a number of conditions through a Code of Practice that Santos will be required to comply with as a condition of its authorisation to undertake exploration activity.

Fluid samples are taken during the flowback period. The analysed samples are used to determine flow contribution from each of the fracture stimulation stages. Gas sampling is also performed in order to determine the composition of the gas (methane, ethane, butane, carbon dioxide, hydrogen sulphide [not expected], etc.). This will define the value of the product as well as optimising the casing and wellhead material specifications for future campaigns.

## Annexure 4 – List of Chemicals Proposed for use in Hydraulic Fracturing of Potential Hydrocarbon Producing Formations

Below is a list of chemicals used by Halliburton, Schlumberger and Condor in Fracture Stimulation operations. If chemicals other than those listed are proposed for use, these will be provided to the NLC and disclosed to Traditional Owners at On Country Work Program meetings.

| Chemical Name |
|---|
| 1,6-Hexanediol |
| 2-Ethoxy-naphthalene |
| 2-hydroxy-N,N,N-trimethylethanaminium chloride |
| 2-Mercaptoethyl Alcohol |
| 2-methyl-2h-isothiazol-3-one |
| 2-Propenamid (impurity) |
| 2-Propenoic acid, homopolymer, ammonium salt |
| 5-chloro-2-methyl-2h-isothiazolol-3-one |
| Acetic acid |
| Acrylamide acrylate copolymer |
| "Acrylamide, 2-acrylamido-2-methylpropanesulfonic acid, sodium |
| salt polymer" |
| Acrylamide, sodium acrylate polymer |
| Acrylonitrile |
| Alcohols, C10-16, ethoxylated propoxylated |
| Alcohols, C11-14-iso-, C13-rich, ethoxylated |
| Alcohols, C12-15, ethoxylated |
| Alcohols, C12-16, ethoxylated |
| Alcohols, C6-12, ethoxylated propoxylated |
| Alcohols, C9-11, ethoxylated |
| Alkyl Alcohol |
| Amides, tall-oil fatty, N,N-bis(hydroxyethyl) |
| Amine oxides, cocoalkyldimethyl |
| Ammonium Chloride |
| Ammonium Persulphate |
| Ammonium Sulphate |
| Amylase, Alpha |
| Benzaldehyde |
| but-2-enedioic acid |
| Butyl alcohol |
| Calcium magnesium sodium phosphate frit |
| Carbolite (proppant) |
| Castor Oil |
| Ceramic (proppant) |
| Chlorous acid, sodium salt |
| Choline Chloride |
| Cinnamaldehyde |
| Citric acid |
| Copper(II) sulfate |
| Cristobalite |
| Crystalline silica, quartz |
| Decamethyl cyclopentasiloxane |
| D-Gluconic acid, monosodium salt |
| Diammonium peroxodisulphate |
| Diatomaceous earth, calcined |
| Dicoco dimethyl quaternary ammonium chloride |
| Diethanolamine |
| Diethylene glycol |

| |
|---|
| Diethylene Glycol |
| Dimethyl siloxanes and silicones |
| Disodium octaborate tetrahydrate |
| Distillates, Hydrotreated Light |
| Diutan |
| Diutan gum |
| Dodecamethylcyclohexasiloxane |
| EGMBE |
| Ethanol |
| Ethoxylated branched C13 alcohol |
| Ethoxylated C11 Alcohol |
| Ethylene Glycol |
| Fatty acids, tall-oil, ethoxylated |
| Formic Acid |
| Glutaraldehyde |
| Guar Gum |
| Hemicellulase |
| Hydrochloric acid |
| Hydrotreated light petroleum distillate |
| Inorganic Salt |
| Isopropanol |
| ISP (proppant) |
| Magnesium chloride |
| Magnesium nitrate |
| Magnesium silicate hydrate (talc) |
| Methanol |
| N-Benzyl-Alkylpyridinium Chloride |
| Non-crystalline silica (impurity) |
| Octamethylcyclotetrasiloxane |
| Partially neutralized polycarboxylic acid polymer |
| Pine Oil |
| Poly(oxy-1,2-ethanediyl), alphahexyl-omega-hydroxy- |
| poly(tetrafluoroethylene) |
| Polyacrylamide |
| Polyethylene glycol |
| "Polymer of 2-acrylamido-2-methylpropanesulfonic acid sodium |
| salt and methyl acrylate" |
| Polyoxyethylene nonylphenol ether |
| Polyoxyethylene-polyoxypropylene Block Copolymer |
| Potassium Chloride |
| Potassium Hydroxide |
| Potassium persulfate |
| Potassium Sorbate |
| Propan-2-ol |
| Quartz, Crystalline silica |
| Quaternary ammonium compounds, bis(hydrogenated tallow alkyl) dimethyl, salts with bentonite |
| Sand (proppant) |
| Siloxanes and silicones, dimethyl, reaction products with silica |
| Sobitan, mono-9-octadecenoate, (Z) |
| Sodium acrylate, polymer with acrylamide and sodium AMPS |
| Sodium Benzoate |
| Sodium bisulfite |
| Sodium Bromate |
| Sodium calcium pentaborate octahydrate |
| Sodium Chloride |
| Sodium diacetate |
| Sodium erythorbate |

| |
|---|
| Sodium hydroxide |
| Sodium iodide |
| Sodium perborate tetrahydrate |
| Sodium persulfate |
| Sodium polyacrylate |
| Sodium Sulfate |
| sodium sulphite |
| Sodium Tetraborate Decahydrate |
| sodium thiosulphate |
| Sorbitan monooleate polyoxyethylene derivative |
| Sorbitan, mono-(9Z)-9-octadecenoate |
| Sorbitan, monooleate, polyoxyethylene derivs. |
| Tar Bases, Quinoline Derivatives, Benzyl Chloride-Quat |
| Tetrasodium ethylenediaminetetraacetate |
| Tributyl tetradecyl phosphonium chloride |
| Triethanol amine |
| Ulexite |
| Urea |

## 5.3 NLC On-Country Meeting Presentation Material

# EP 161 Work Program

## 2023+ Proposal

Santos

# Santos History

Santos

## Founded in 1954, Santos has been active in the energy business for more than 60 years.

**Its name was an acronym for South Australia Northern Territory Oil Search.**

Santos made its first significant discovery of natural gas in the Cooper Basin with the Gidgealpa 2 well in 1963. The Moomba 1 discovery in 1966 confirmed this region as a major petroleum province.

As a result of these discoveries, Santos had a commercially viable quantity of gas and entered into gas sales agreements with the South Australian Gas Company, the Electricity Trust of South Australia and the Australian Gas Light Company. Gas supplies commenced in 1969.




2

# Exploration Agreement – Summary Clause 5

Santos

| Clause | Details |
|---|---|
| Sacred Site Clearances | The Grantee Party shall only undertake:<br>(i) Exploration activities that have been approved by the NTP Representative<br>(ii) shall only undertake the proposed activities on areas of the Permit Area that have been cleared by the NTP Representative |
| Work Progam | A work program provided under Clause 5.1(b) shall include specific written particulars of each activity proposed to be undertaken on specified areas within the Permit Area by the Grantee Party. Without limiting the generality of the preceding sentence the Work Program shall include:<br>(i) two suitable scale topographic maps and, if available, aerial or satellite images showing the location of such activities (including without limitation the specific location of proposed drill sites)<br>(ii) (A) the nature, scope and objectives of such activities<br>(B) the estimated time and period for the performance of such activities<br>the techniques, infrastructure and major items of equipment to be used;<br>the likely environmental impact of such activities and proposals to minimise the environmental impact , in particular, the disturbance to Native Title Parties<br>the proposed means of access and access routes for personnel and equipment, both into and within the Permit Area, including particulars of the amount of vehicular and airborne access and any proposal to construct or upgrade roads, land strip, or other access facilities;<br>any fly-camps or other camp sites of less than five days duration proposed to be used;<br>any water, timber or other resources proposed to be obtained from within the Permit Area and surrounding areas.<br>the estimated costs of implementing such activities;<br>any proposals concerning the implementation of Clause 8 (Employment, Training Business Opportunities)<br>if known, the identity of any proposed contractors and subcontractors engaged<br>the chemical composition of any fluids and solids proposed for use in hydraulic fracturing of potential hydrocarbon bearing formations<br>the area or, where appropriate, line distance the subject of such activities (in square or appropriate (for example seismic line and roads), line kilometres<br>any other aspect of such activities that is likely to have any environmental impact, or in particular, any impact upon Native Title Parties. |
| Notification of Approval of Work Program | Subject to the proviso in Clause 5.2 and Clause 5.7, on or prior to 1 May of the same year that the items outlined in Clause 5.2 (a) and (b) are completed, the NTP Representative shall notify the Grantee Party<br>(a) that the work program has been approved (which approval may be subject to certain conditions); or<br>(b) whether such work program require amendment in accordance with Clause 5.2 (a) |

# EP161: Work Program History/Future plans

Santos

## EP 161 Exploration Timeline: Past Present Future

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017/18 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025+ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Farm-in | 497km 2D Seismic and Gravity Surveys | Drilled Tanumbirini-1 well | Studies | Drilled Marmbulligan -1 well | Studies | 10km 2D Seismic and 4-stage fracture stimulation on Tanumbirini 1 | Flowtest (EPT) and monitoring | Tanumbirini location. Drill 2 x horizontal wells, fracture stimulate and flowtest. Evaluate flow and monitor. | Tanumbirini horizontal wells flowtest. Evaluate flow and monitor. | Land scouting. 240km Seismic. (Waterbores) | Drill 2 vertical exploration wells, fracture stimulate and flowtest. | Development Program could potentially span for decades if exploration is successful |

Northern Territory Government moratorium on hydraulic fracturing



Seismic acquisition
2013



Tanumbirini 1
2014 Drill



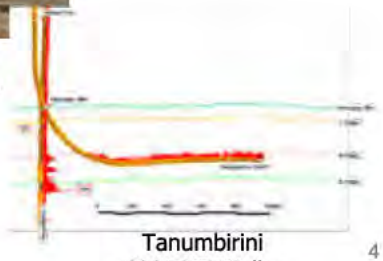
Marmbulligan 1 (Core)
2016



Tanumbirini 1
2019 Fracture Stimulate



Tanumbirini 1
2020 Flowtest



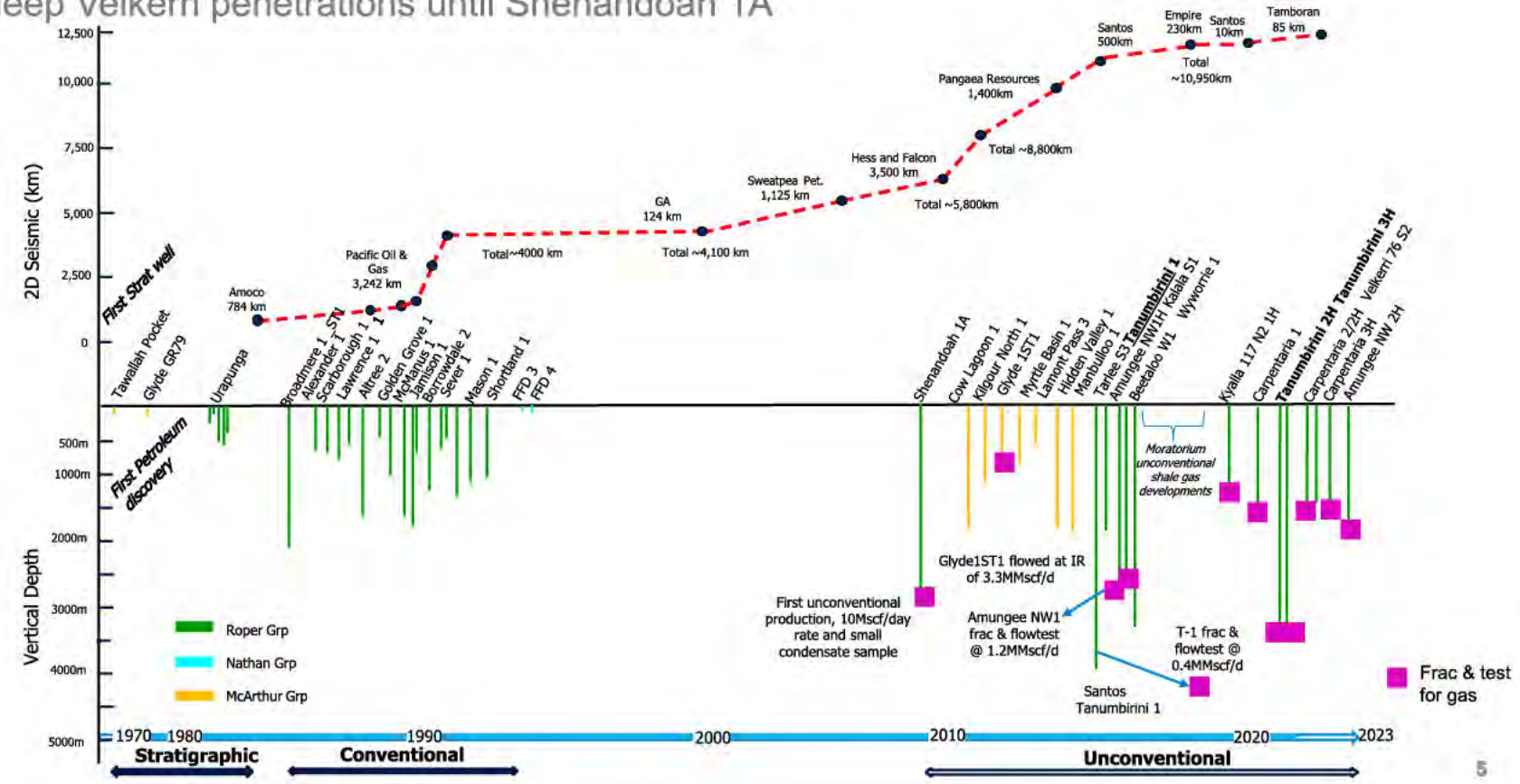
Tanumbirini
2021 HZ Wells

4

# McArthur Basin/Beetaloo Sub-basin exploration history

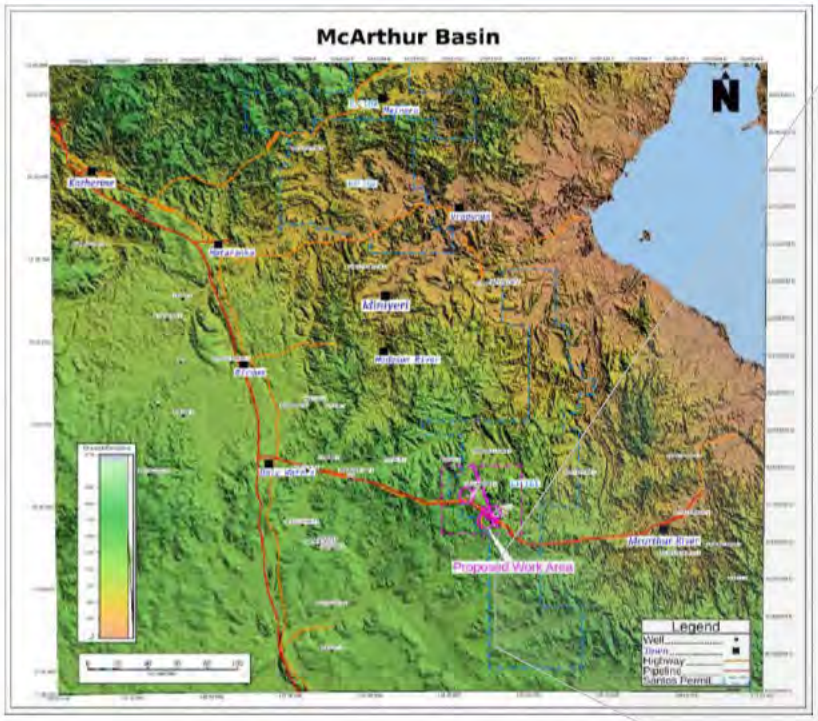
Santos

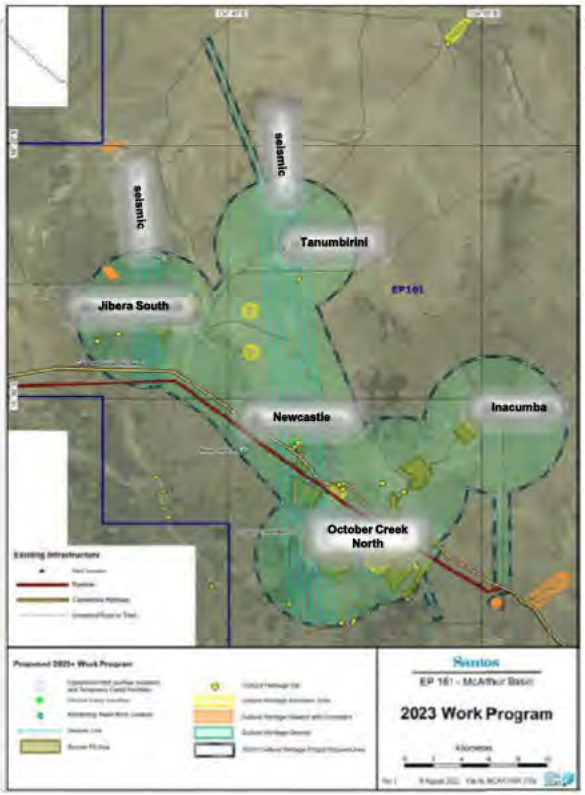
## No deep Velkerri penetrations until Shenandoah 1A



# 2021/22 Work Program

Santos




**2022 activities**

Tanumbirini

- Flow test (Dec 2021 onwards)
- Expected completion of test Dec 2022

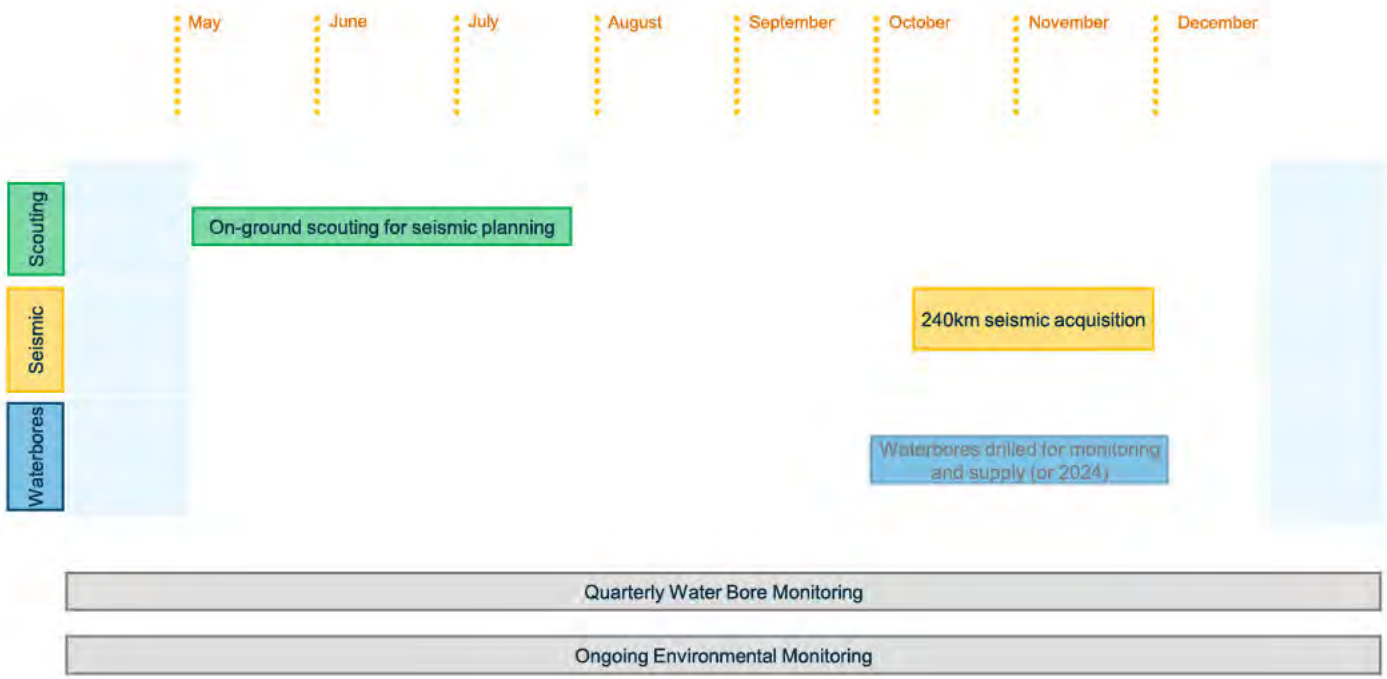
**2023 proposed activities**

- Land scouting
  - Seismic
  - Locating existing waterbores
  - Locating new waterbore sites
- 240km of seismic
- Potential Waterbore drilling
  - October Creek North
  - Possibly Newcastle
- Ongoing monitoring
  - Jibera South
  - Tanumbirini
  - Inacumba

6

# NT 2023 activity scope / timeline

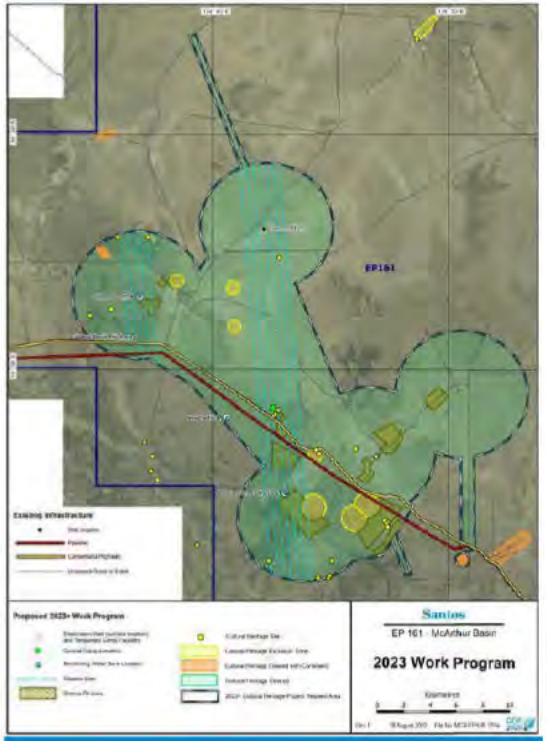
Santos



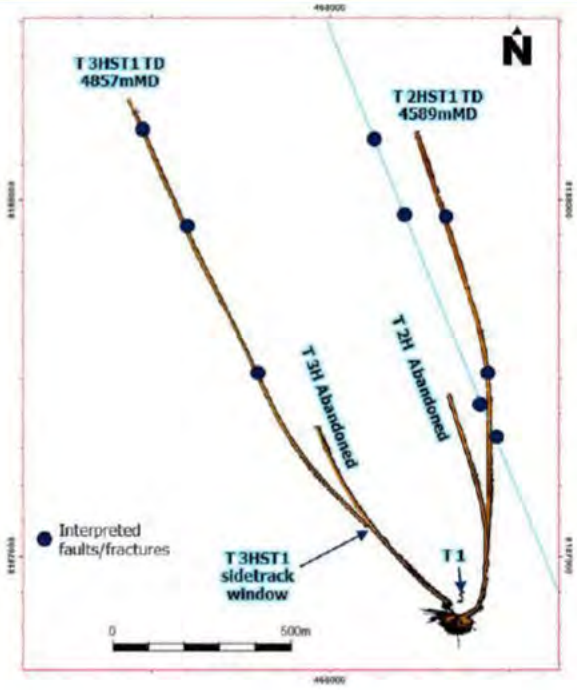

7

# Seismic overview

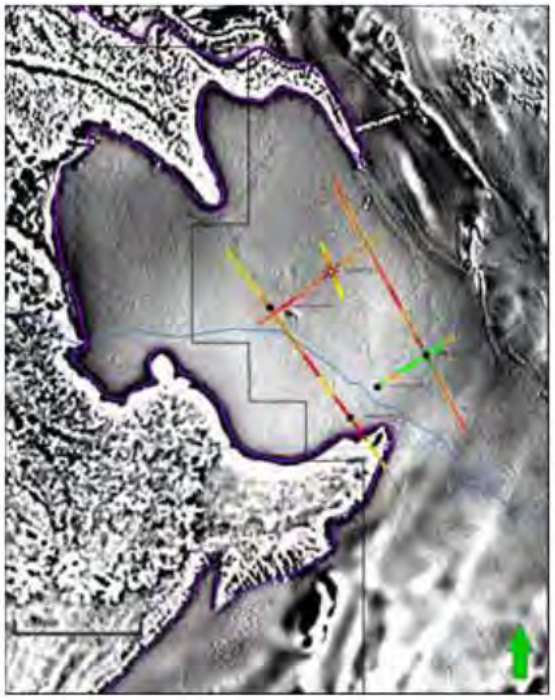
Santos




Proposal




Objectives

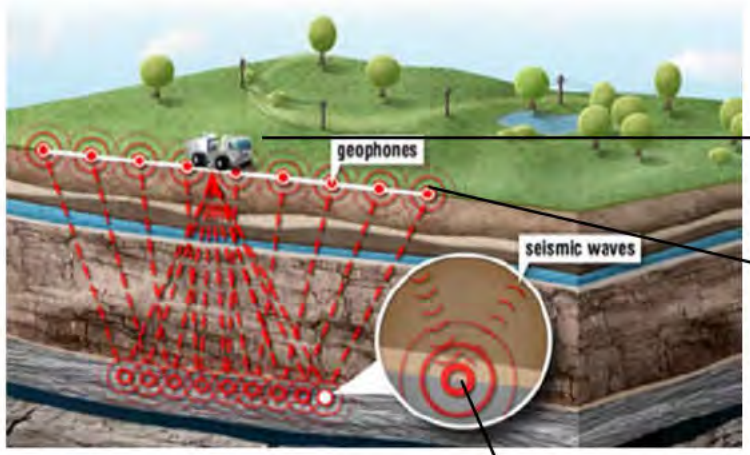


Examples

8

# 2023 Work Program – Seismic

Santos

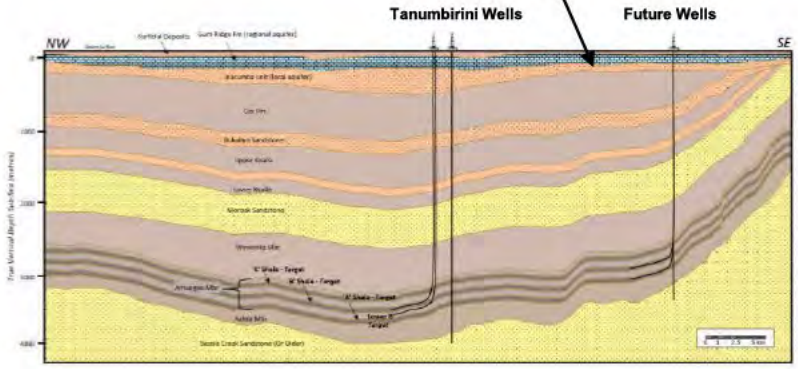





Vibrator trucks (source) and Landcruiser support vehicle



Geophones (receivers)




Seismic acquisition assists with:

1. Planning of well locations
2. Horizontal well placement
3. Understanding geology below ground

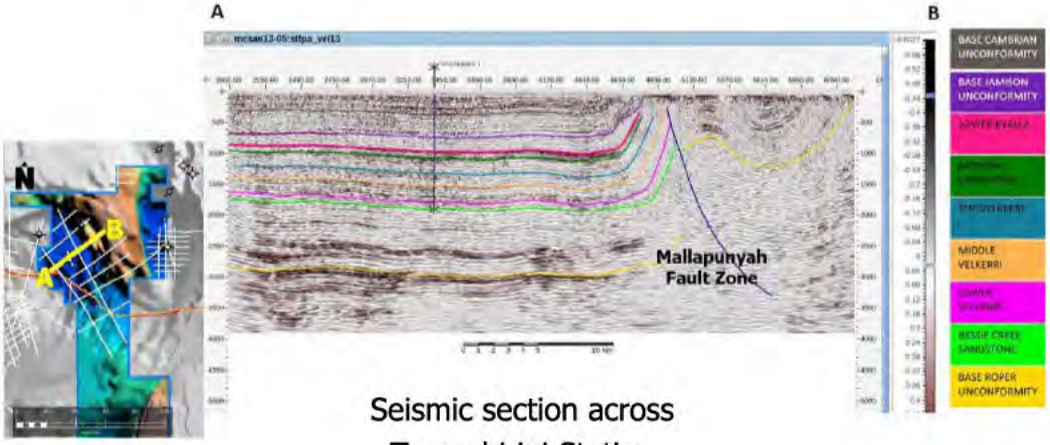
9

# Seismic Data

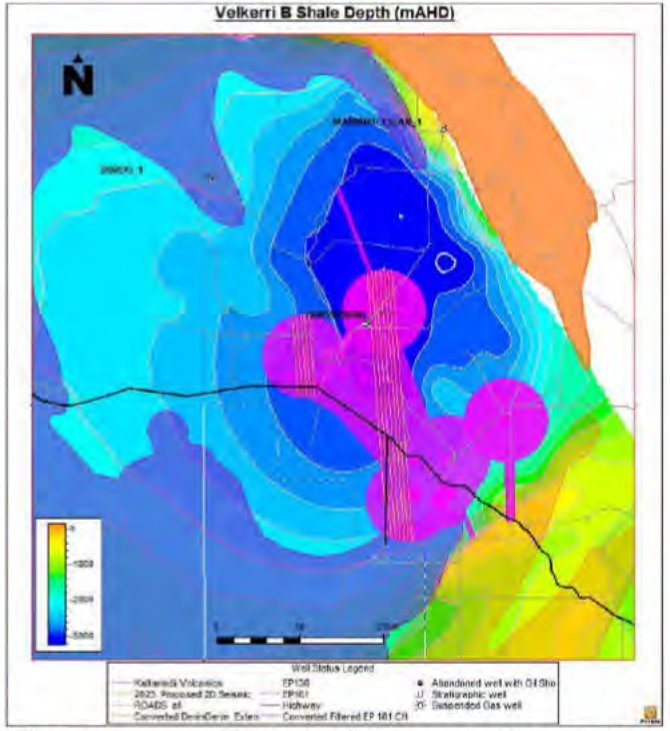
Santos

Santos acquired data from ~500km of seismic lines in 2013 to help drill Tanumbirini-1 and Marmbulligan-1. This data will also help drill future exploration wells.

In 2019 Santos acquired 2D seismic data over a 10km line within the approved clearance radius around Tanumbirini 1 to help plan Tanumbirini-2H and Tanumbirini 3H.




Seismic section across Tanumbirini Station



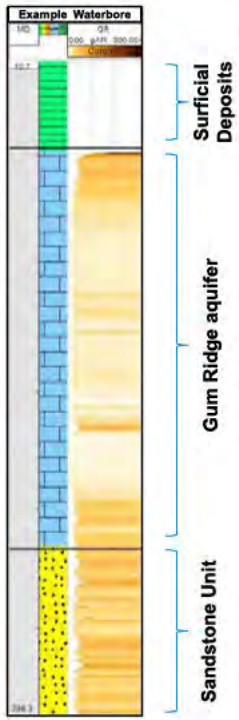

The map above illustrates the proposal to acquire approximately 240km of 2D seismic data.
This data will help ensure the further wells are planned properly.

# 2023 Work Program – Waterbores (possible delay to 2024)

Santos



**Silver City Waterbore Drilling Rig at Inacumba RN040939**




14 waterbores drilled to date at 4 locations

- Tanumbirini
- Inacumba
- Inacumba South
- Jibera South

Proposing further bores at

- October Creek North
- Newcastle (contingent)

Waterbores monitor the quality of the water in the aquifer and provides supply

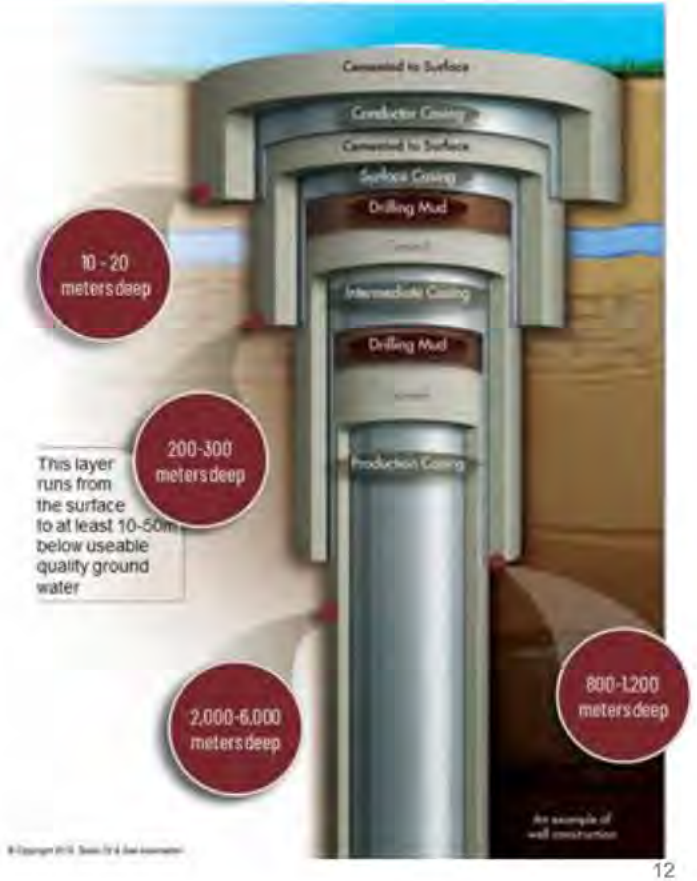
11

Commercial in confidence
Santos

# Protection of Groundwater Resources

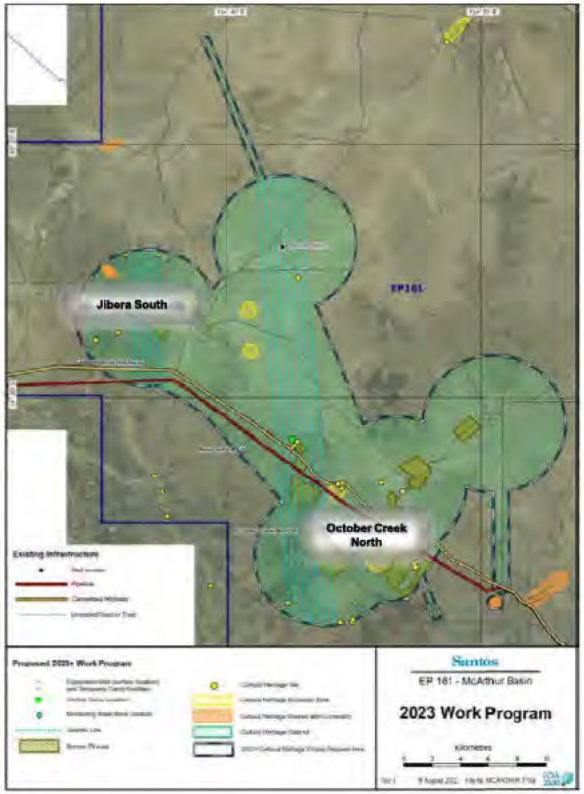
## Aquifer Isolation

- Drilling stopped at regular intervals so that purpose-built steel pipes or casing can be installed.
- Multiple layers of cement and steel casing separating the producing well from surrounding formations and aquifers.
- Specially formulated cement mixtures used.
- Casing is tested above operating pressures to ensure well integrity
- Wellbore design, construction and operations closely monitored and regulated.
- Regulators are kept fully informed on well bore integrity.
- Integrity of each casing and cement stage is verified prior to moving to next operation.



# 2024 Work Program – Exploration Wells

Santos




14 waterbores drilled to date at 4 locations

1. Tanumbirini
2. Inacumba
3. Inacumba South
4. Jibera South

Proposing further bores at

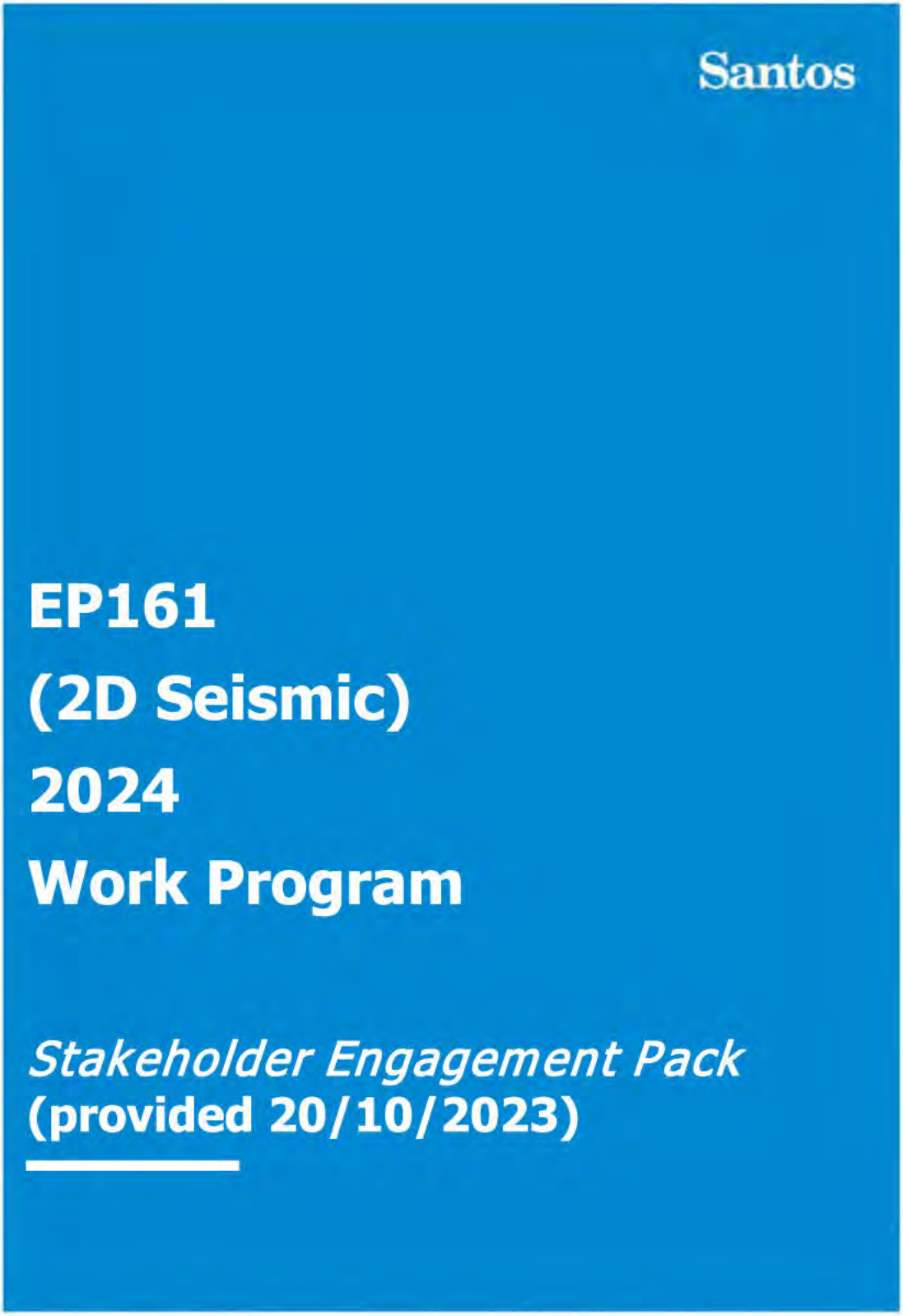
1. October Creek North
2. Newcastle (contingent)

Waterbores monitor the quality of the water in the aquifer and provides supply

13

## 5.4 Engagement Packs

### 5.4.1 Landholder



Santos

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Santos

# 1 Purpose

Santos Ltd (**Santos**) is proposing to submit an Environmental Management Plan (**EMP**) in support of the proposed 2024 activities on Tanumbirini Station in Exploration Permit (**EP**) 161. This Engagement Pack has been compiled to provide information regarding the proposed regulated Activity as described within the EMP.

Santos presents this document to the operators and interest holders of the McArthur River Pipeline to provide an understanding of:

a) The regulated activity the interest holder proposes to carry out,

b) The locations where it is proposed to carry out the activity,

c) The timeline of the proposed activity,

d) The potential environment impacts, risks, controls, and environmental outcomes of the activity, and

e) A proposed plan for ongoing engagement.

Any questions for feedback to the information provided in this pack will be reviewed and feedback provided and if applicable, incorporated in the submitted EMP. Santos also offers a face-to-face, or remote VC style, meeting with the stakeholder where subject matter experts can present the information in this pack and answer any questions. It should also be noted that Santos is committed to ongoing stakeholder engagement and discussion throughout the life of the activities.

## 1.1 Background

Santos QNT Pty Ltd, a subsidiary of Santos, is Operator of the EP 161 Joint Venture in the McArthur Basin and is actively exploring the permits with co-venturers Tamboran Resources (Figure 1). The acreage was originally granted by the NT Minister for Primary Industry, Fisheries and Resources under section 20(5) of the *Petroleum Act* on 21 May 2012.

Since becoming Operator of EP 161 in Dec 2012, Santos has acquired and processed 510 kilometres of 2D seismic within EP 161, followed by the drilling of Tanumbirini 1 (2014), Marmbulligan 1 (2016), Tanumbirini 2HST1 (2021) and Tanumbirini 3HST1 (2021) and the associated fracture stimulation and flow testing of Tanumbirini 1, Tanumbirini 2HST1 and Tanumbirini 3HST1 during 2019-2022.

This Stakeholder Engagement Pack provides information in relation to the proposed activities planned to occur on Tanumbirini Station in 2024. This pack provides a description of Santos' activities and how Santos proposes to manage the environmental impacts and risks associated with its activities, including how it will address its regulatory obligations and relevant Inquiry Recommendations that have underpinned the Code of Practice: Onshore Petroleum Activities in the Northern Territory (**the Code**).

Santos

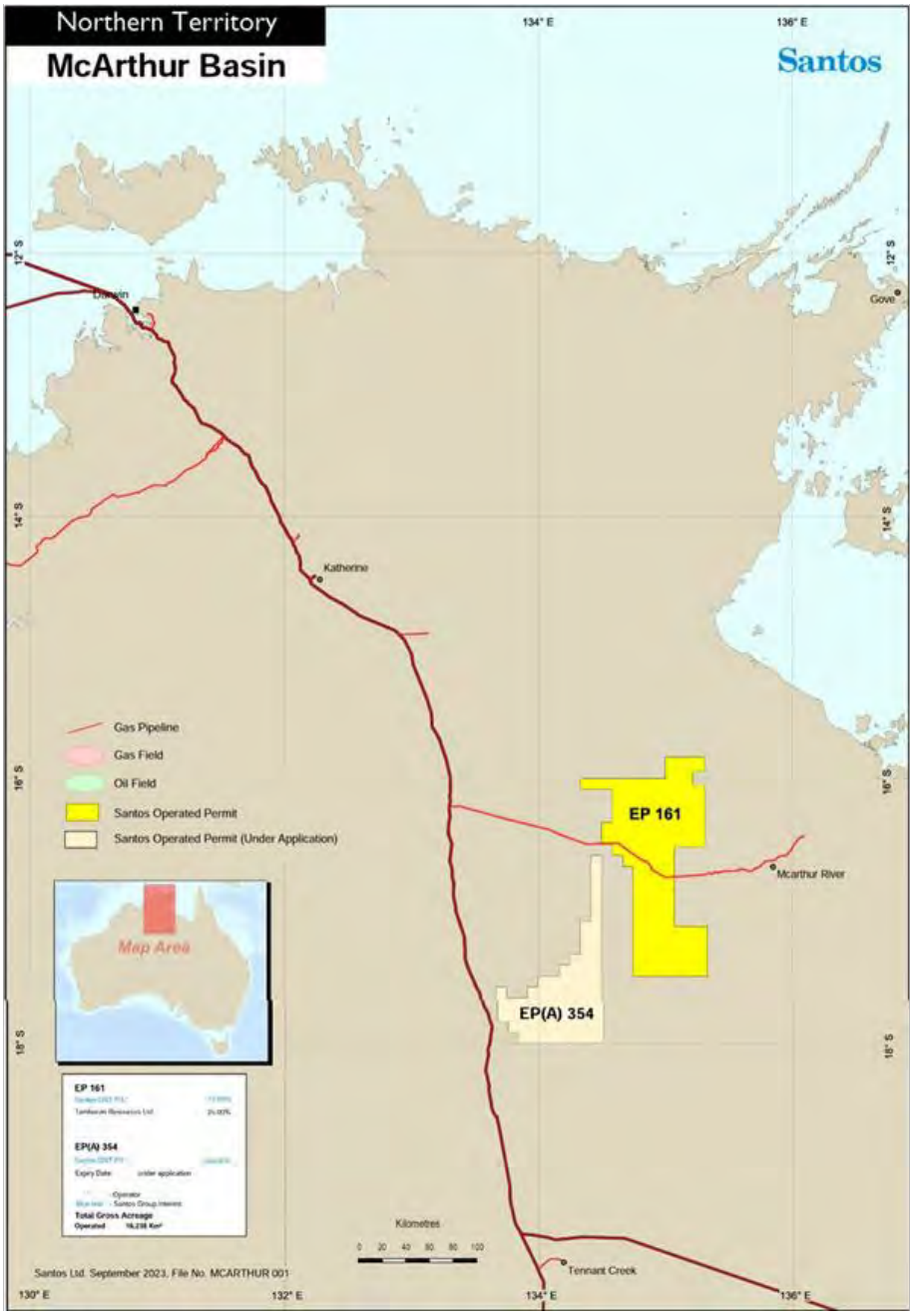



*Figure 1: Location of related Santos Permit Area*

Santos

## 2 Description and Location of the Regulated Activities

The regulated Activity covered in the proposed EMP is:

a. Acquisition of 2D Seismic (Figure 2), with ~ 249km of disturbance (239km associated with line preparation for acquisition source lines and a further 10km of "connection "paths).

b. Acquisition of a Gravity survey along the prepared lines.

c. Rehabilitation of disturbance and monitoring

*Table 1:* **Summary of project activity**

| Component | Details |
|---|---|
| **Operating Hours** | • Daylight restricted (12-hr day shifts where possible). |
| **Civil Works** | • Maintenance of the previously cleared Tanumbirini well pad and existing access tracks if necessary.<br>• Establishment of a temporary campsite at the Tanumbirini well pad for use during the Activity and for vehicle parking and fuelling. |
| **Seismic Acquisition Program** | • 2D seismic and ground gravity survey<br>• Line preparation of twelve seismic lines, one set of five, approximately 7.5 - 8.5 km long and another set of seven, approximately 24 – 33 km long. The total seismic line length is approximately 239 km.<br>• Preparation of approximately 10 km of connection lines between the seismic lines for access of mulchers and survey vehicles |
| **Equipment and Machinery** | • Light and heavy vehicles like mulchers, slashers, seismic vibroseis source and survey trucks, ground gravity survey vehicles. |
| **Access** | • Existing access to the Tanumbirini well pad and the seismic lines will be used wherever possible.<br>• LAA in place with the Tanumbirini Station. |
| **Diesel Use** | • Campsite, generators, light and heavy vehicle diesel usage. |
| **Water Source** | • Water required to maintain existing track(s) dust suppression and firefighting. Water will be trucked in from existing licenced bores.<br>• Potable water for the campsite will be trucked in. |
| **Rehabilitation Methods Proposed** | • Mulchers cut vegetation above ground and mulch and spread the cut material for minimal impact and to promote rapid rehabilitation. The soil is not disturbed, and vegetation rootstock is left intact.<br>• Rehabilitation of the seismic lines post-acquisition (as needed) |

Santos

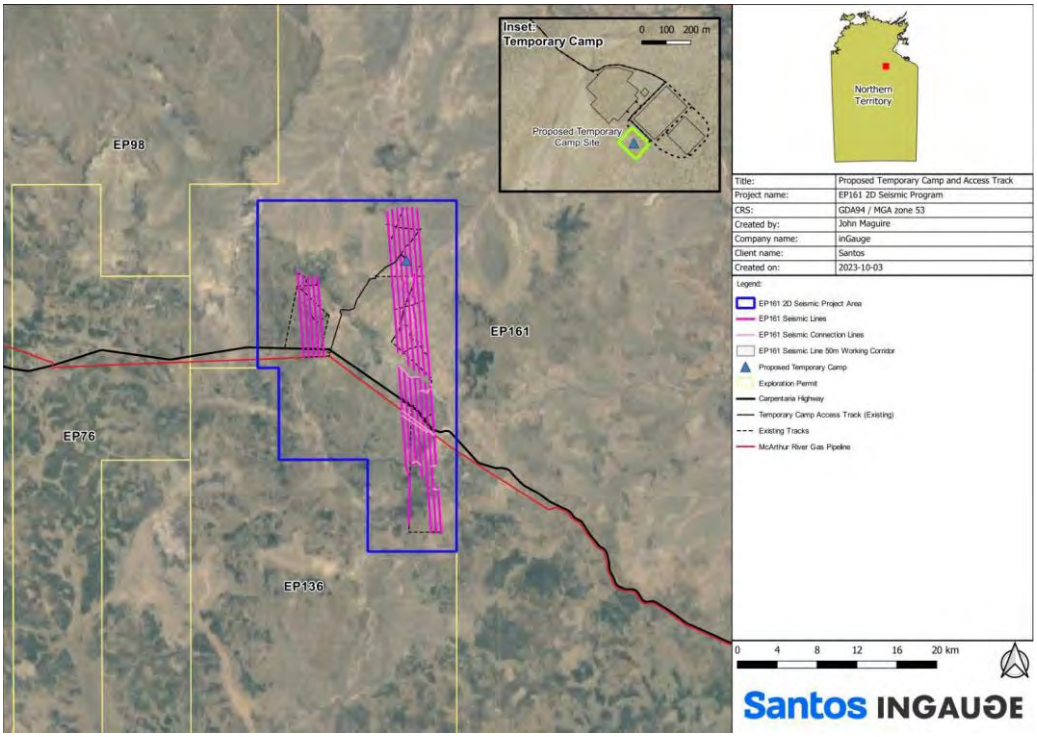



Figure 2: Location of proposed 2D seismic acquisition

Santos

## Seismic Acquisition Program

### Operational Background

***Technology***

Seismic acquisition allows an 'image' of the geological structures below the surface to be created. This method uses a seismic energy source. The energy source generates elastic waves, which travel into the earth and are then reflected from subsurface geological structures. The returning reflections are recorded in a digital format and, upon completion of the survey, sent to a seismic data processing centre to produce a 'cross-section' of the layers of the earth's crust.

Seismic lines are strategically selected and placed in close proximity to one another to capture this cross-sectional view of the subsurface structures, ensuring a clear 2D image of these structures. Connection lines provide access between seismic lines; and seismic acquisition will not occur along these lines.

***Site Selection***

The seismic and connection lines have been selected based on third-party desktop surveys as well as civil, ecological, archaeological, and field surveys. These seismic lines comply with the AAPA Authority Certificates C2020/011, C2019/043 (variation to C2014/053), and C2013/142, ensuring they avoid the Restricted Work Areas (RWA) outlined. A working corridor of 50 m has been established for the seismic and connection lines (25 m either side of the line) to allow deviations to avoid, where possible:

- Mulching, as opposed to traversing.
- Areas of greater erosion concern (e.g., significant slope).
- Key environmental sensitivities (e.g., large trees, trees with hollows or nests).
- Obstacles (e.g., termite mounds).
- Cultural heritage sites (e.g., archaeological sites, AAPA restricted work areas).

Figure 3 provides an overview of the seismic and connection lines, including an inset illustrating the working corridor applied to all lines. Detailed views of the seismic lines, associated connection lines, access tracks, and the campsite can be found in Figures 4, 5 and Figure 6

Figure 7 provides detailed views of the central area in the eastern group of seismic lines, highlighting all connection lines, and presenting two options for connection lines near the McArthur River gas pipeline.

***Line Preparation***

On-site assessments have identified that vegetation within the Project Area is predominantly sparse woodland (up to 85%) and traversing without line preparation will be feasible for much of the seismic and connection line length. Ground truthing will occur along the seismic and connection line routes to identify significant trees and riparian vegetation.

Mature trees, trees with hollows or nests selected for preservation, will be recorded and flagged to ensure their protection. The nominal 50 m seismic line working corridors allow deviation around potential obstacles and key environmental sensitivities (e.g., large trees, trees with hollows or nests) where practicable.

Small handheld portable nodal geophones may also be used in riparian areas for data acquisition where access is limited.

***Disturbance Areas***

Maximum disturbance estimates have been calculated on the assumption that vegetation will be mulched (5 m width) rather than traversed, for the total 249 km of proposed seismic (239km) and connection lines (10km), with 124 ha of maximum estimated disturbance.

This is a maximum disturbance estimate reflecting a worst-case scenario, as in practice, it is estimated 85% of the area of potential disturbance is made up of low-density woodland (74.6%), is already disturbed (4.4%) or is riparian (6.2%), which would require minimal line preparation. Thus, the actual disturbance area is expected to be much less than 124 ha.

In addition to the new disturbances, it is proposed to utilise existing tracks within the acquisition area to minimise impact to the environment along the acquisition lines. The tracks that will be utilised are identified in Figures 2-6.

***Seismic Connection Lines and McArthur River Pipeline***

Seismic connection lines that are determined to be easily traversable and should not require significant mulching have been scouted. Connection lines enable crews to traverse between adjacent lines, reducing traffic impact and fuel use.

In total, 10 km of connection lines are planned for utilisation to move between seismic lines. Along the route of the McArthur River pipeline, two potential seismic connection lines have been proposed (Option A & B in Figure 6), noting that only one of these options will be utilised during the activity.

Seismic vehicles will traverse the pipeline; however, no vibroseis energy source will be used within 30 m of the pipeline.

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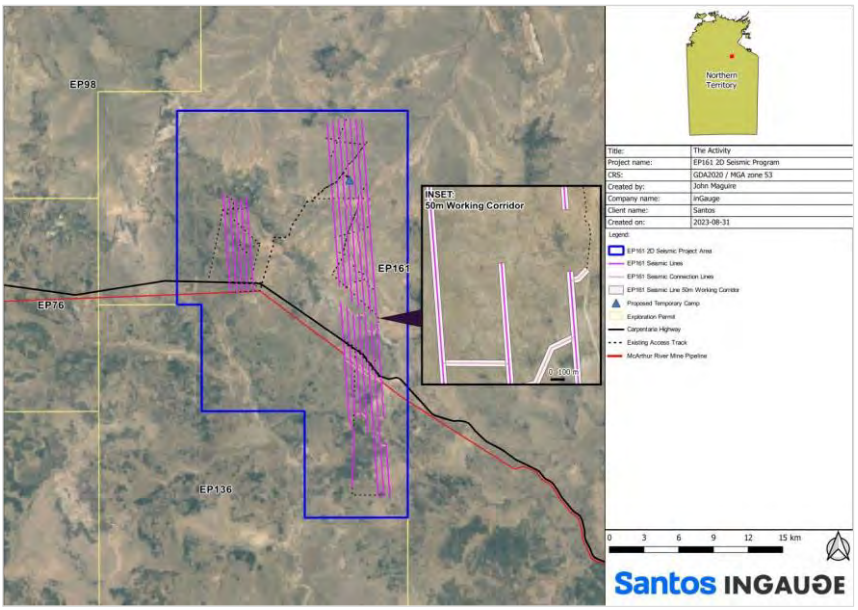



Figure 3: **Overview of Seismic Lines and Connection Lines with Inset Showing Close-up of Working Corridors**



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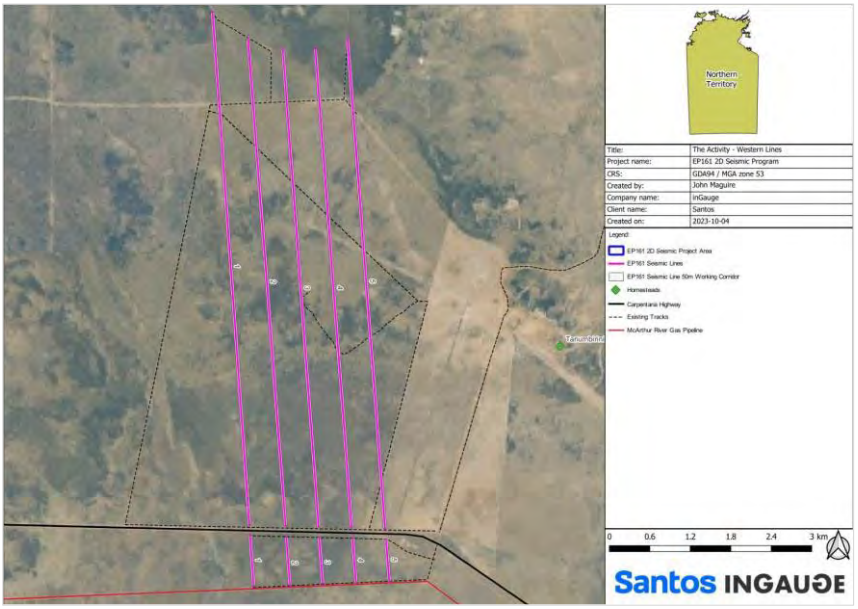



Figure 4: **Western Seismic Lines**

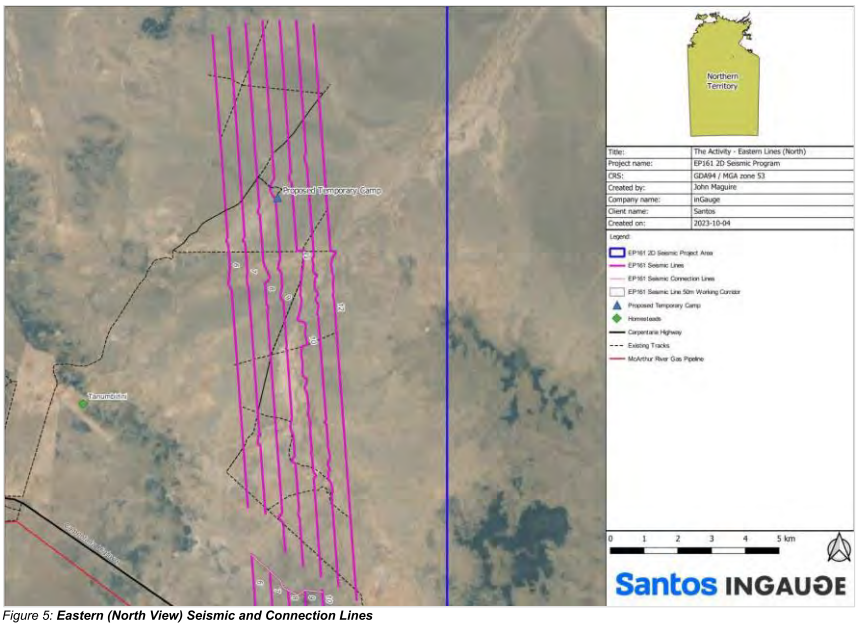



*Figure 5:* ***Eastern (North View) Seismic and Connection Lines***



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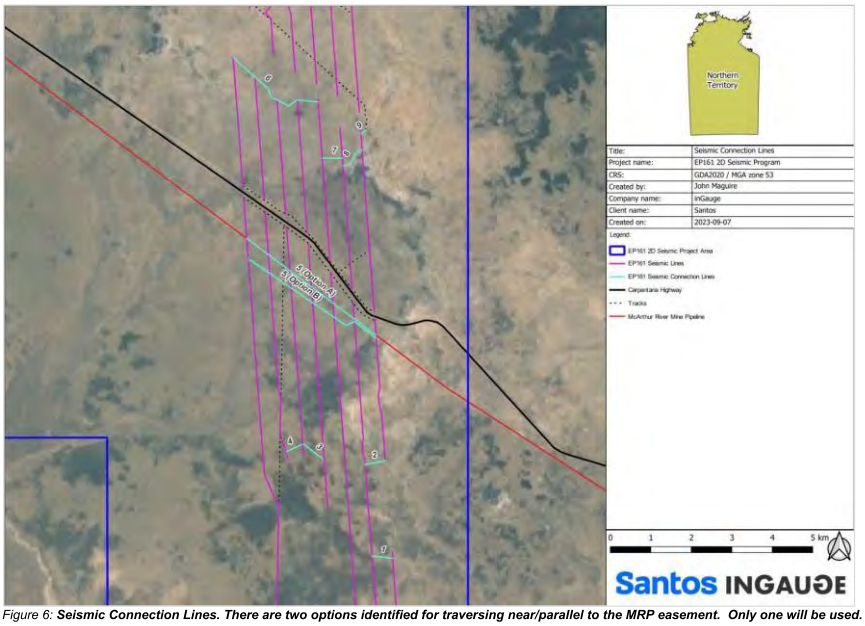



*Figure 6:* ***Seismic Connection Lines. There are two options identified for traversing near/parallel to the MRP easement. Only one will be used.***

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## Seismic Line Preparation

On-site assessments have identified that vegetation within the Project Area is predominantly sparse woodland, is already disturbed or is riparian. Traversing without line preparation will be feasible for much of the seismic line length. A mulcher will be necessary in some areas for preparing the seismic lines for the survey to provide safe access and enable sufficient ground contact for the seismic vibro-source and the geophone nodes.



*Figure 7:* ***Example Seismic Line Mulcher (indicative unit only) [ADMULCH, 2023]***

Where mulching is necessary, the mulcher simultaneously cuts, mulches, and spreads the mulch on the seismic line for minimal impact and rapid rehabilitation. The mulcher cut width is 5 m, the soil is not disturbed, and vegetation root stock is left intact. The nominal 50 m seismic line corridors allow deviation around potential obstacles and key environmental sensitivities (e.g., large trees, trees with hollows or nests) where practicable and cultural sites will be avoided. The mulcher will operate with the mulcher up within the working corridor when mulching is not required. To assist in safe passage of personnel, and reduce fire risk, some grass slashing may be necessary. Where suitable watercourse crossing points for seismic vehicles are not possible, existing access tracks will be used.

In the final ground truthing and recording of significant trees along the seismic line routes, the presence of any riparian vegetation would also be recorded. The final routes selected within the 50 m seismic line working corridors would avoid these areas as much as practicable.

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## Seismic Surveying

Seismic surveys commence after line preparation. The field surveyors use GPS receivers to position receiver points for the 2D surveys. Surveyors mark the ground with biodegradable paint, with selected points marked by wooden stakes. Line detours may also be marked with temporary biodegradable flagging.

Each survey team consists of one surveyor in a light 4WD vehicle and generally makes only one pass over any given section of line. Backtracking may occur in areas where vehicle access routes have deviated from the true line position, and markers must be inserted by personnel on foot.

## 2D Seismic Acquisition Operations

Work commences with the deployment of nodal geophones. The nodal geophones are autonomous units containing the actual geophone as well as battery and data storage units of size approximately 10x10x10 cm with a spike on the underside so that they can be easily pushed into the ground.

These nodes are deployed at regular intervals of approximately every 5 m to 10 m. Each node weighs approximately 1 kg each, so they can be hand carried. This allows for their placement in areas without mulching or vehicle access. Additionally, they can be deployed through sensitive environmental areas, ensuring continuous data acquisition across the Project Area.

Once a sufficient length of the seismic line has been laid out on the ground, the acquisition can begin. This layout is termed 'the spread' and picks up the acoustic energy reflected from subsurface layers, converts it to electrical energy and stores the data on the nodal unit until it is retrieved from the field and the data downloaded to the recording system.

## Ground Gravity Survey

A ground gravity survey is proposed to be undertaken after line preparation. The survey would be undertaken at regular intervals along the prepared seismic lines.

The survey method is a non-invasive geophysical approach that accurately measures the Earth's gravitational field at designated surface points using a gravity meter. Like the geophones, the gravity meter can be hand-carried. Processing the gravity data allows for the detection of slight shifts in gravity caused by differences in the density beneath the surface.

The gravity survey would be carried out by one surveyor using a suitably equipped light vehicle; an example is shown in Figure 9.




*Figure 8:* ***Example of a 4WD Vehicle Conducting a Gravity Survey (grey box gravity meter)***

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## Campsite

A temporary camp for the seismic crew will be placed on the previously cleared Tanumbirini well pad. The campsite will have an area for parking equipment and vehicles. A diesel storage tank and refuelling point will also be provided, and a small storage area for lubricants and hydraulic fluids, as well as segregated wastes.

The campsite will include a kitchen, showers, and port-a-loo type toilets. Sewage and greywater may be transported offsite by a waste management contractor or treated in a portable sewage treatment plant (STP).

Treated effluent from the STP would either be removed from site for disposal at an approved location or be irrigated in a designated irrigation area 50-100 m away from the camp location, well away from any place from which it is reasonably likely to enter any waters, and to minimise spray drift and ponding.
Fencing will be installed around the irrigation area as required. The STP would meet the NT's Code of Practice for Wastewater Management [P. Rogers, 2020].

## Water Use

Potable water at the campsite will be sourced off-site. It is anticipated that 200 L per person per day will be required. Groundwater will be extracted only in accordance with, and if authorised by, groundwater extraction licences held by Santos. Currently they are GRF10280 and U10335, which are licences due to expire on 31 Dec 2023. New extraction licences are being sought by Santos.
It should be noted that a seismic and ground gravity program does not inherently demand water. Thus, any water required for the Activity primarily supports secondary operational needs. These secondary operational needs include:

- Access track maintenance and dust suppression
- Firefighting.

The quantity of groundwater required is heavily influenced by on-ground conditions and prevailing weather patterns. For example, during prolonged dry periods, there could be an increased need for water for dust suppression, whereas during wetter periods, the demand might decrease. Thus, the need for groundwater extraction is highly variable and circumstantial.

## Post-survey Closure

On completion of the 2D seismic and ground gravity surveys, all pegs will be removed from the seismic lines. All temporary infrastructure at the campsite (the Tanumbirini well pad) will be removed.
As the seismic line mulcher simultaneously cuts, mulches, and spreads the mulch on the seismic line, leaving the soil undisturbed and root stock intact, no further rehabilitation of the seismic lines is required following the completion of survey work. However, the success of regrowth will be monitored to ensure suitable rehabilitation is achieved.

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## 3 Activity Timeline

Activity is expected to commence in mid-2024 (Table 2), with final acquisition timing to be confirmed based on post wet season review and availability of acquisition contractors. Final rehabilitation timing is difficult to predict, however ongoing evaluation of the disturbance rehabilitation will be continued until an appropriate level of rehabilitation is reached.

The current LAA is in place and contemplates the proposed activities.

*Table 2:* **Indicative Activity schedule (dependant on weather/access/availability of contractors)**

| Activity | Estimated Commencement / Completion |
|---|---|
| **Seismic Line Mobilisation** | 1st March 2024 |
| **Seismic Line Preparation** | 6th March-10th April 2024 |
| **Seismic and Ground Gravity Surveys** | 20th March – 29th April 2024 |
| **Survey Demobilisation** | 30th April - 5th May 2024 |

## 4 Environmental Risk Summary

The risks and potential impacts associated with the Activity are covered in the current EMP. The risks and controls have been summarised in Table 3.

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*Table 3* ***Environmental risks, impacts and controls of proposed activity (extract from draft EMP)***

| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| **Physical Disturbance** | Loss or disturbance to native vegetation. Loss of habitat impacts on flora and fauna. | Clearing and vehicle and plant movements. | 1. The temporary camp site will be in a previously cleared area.<br>2. Where possible, existing tracks, roads or seismic lines will be used for access.<br>3. Back tracking in prepared seismic line to reach existing access tracks rather than clear new connecting lines.<br>4. Mature trees, trees with hollows or nests selected for preservation are to be flagged to ensure their protection.<br>5. Line preparation will be done using mulcher, which simultaneously cuts, mulches, and spreads the mulch on the seismic line, leaving the root stock intact. Mulch is spread to reduce erosion and facilitate rehabilitation.<br>6. The mulcher only prepares a 5 m width within a notional 50 m seismic line corridor, allowing for deviation around potential obstacles, and key sensitivities where practicable.<br>7. The mulcher will be used "mulcher up" to avoid disturbance when not required.<br>8. Tree mulching decision tree to be used to protect mature and nesting trees. |
| **Physical Disturbance** | Disruption of natural drainage lines. Water quality and erosion. | Clearing and vehicle and plant movements. | 1. Environmental field advisor to pre-scout and identify riparian areas. Riparian area start and stop points to be input into navigation system.<br>2. Riparian vegetation decision tree to be used before traversing riparian vegetation.<br>3. All-terrain vehicles used do not require formed drainage line crossings and do not cause major disturbance.<br>4. The number of times a drainage line will be crossed will be limited with little disturbance expected.<br>5. The Activity will not commence if there has been rainfall in the past 24 hours within the Project Area until ground conditions have been assessed. |
| **Physical Disturbance** | Disturbance to soil. Compaction of soils. Erosion of soil due to loss of vegetative cover. | Clearing and vehicle and plant movements. | 1. The temporary campsite will be in a previously cleared area.<br>2. Existing, landholder access tracks will be utilised where possible.<br>3. Line preparation will be conducted using a mulcher, which prepares a 5 m width within an indicative 50 m corridor, so seismic vehicles can deviate around dense vegetation, landforms.<br>4. The mulcher leaves root stock intact and mulch is spread to reduce erosion and facilitate rehabilitation.<br>5. The mulcher will be used "mulcher up" to avoid disturbance in easily traversable terrain.<br>6. Weather checked daily to determine if the Activity will commence.<br>7. Environmental field advisor to pre-scout and identify riparian areas. Riparian area start and stop points to be input into navigation system.<br>8. Riparian Vegetation decision tree to be used before traversing riparian vegetation.<br>9. Immediately protect soil surface after mulching with mulch.<br>10. The Activity will not commence if there has been rainfall in the past 24 hours within the Project Area until ground conditions have been assessed. |



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| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| **Physical Disturbance** | Damage to culturally sensitive sites. Removal of vegetation exposing culturally sensitive site. | Clearing and vehicle and plant movements. | 1. Disturbance restricted to subject land and will avoid the restricted work areas in the AAPA Authority Certificate.<br>2. Known sites of sacred or cultural significance have been identified and will be avoided.<br>3. Any new sites identified during the Activity will be reported to the NT Heritage Branch.<br>4. Maintain GIS database of Project Area and cultural heritage sites including details of any works conditions. |
| **Groundwater Extraction** | Reduction in groundwater quantity. | Use of groundwater for the Activity. | 1. Groundwater for maintenance and dust suppression, if required, will be extracted from existing licenced bores.<br>2. The water use for the Activity is small. |
| **Groundwater Extraction** | Reduction in groundwater available for other users. | Use of groundwater for the Activity. | 1. Groundwater for maintenance and dust suppression, if required, will be extracted from existing licenced bores.<br>2. The quantity of water required is not expected to have any significant impact on the aquifer. |
| **Creation of Dust** | Smothering of flora. | Clearing and vehicle and plant movements. | 1. Line preparation will be done using a mulcher.<br>2. Mulching of seismic lines will reduce their potential to create dust.<br>3. Driving only permitted on designated access roads and seismic lines.<br>4. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines.<br>5. Seismic activities to be completed within a short timeframe.<br>6. Water trucks used to suppress dust on access tracks if required. |
| **Creation of Dust** | Loss of amenity. | Clearing and vehicle and plant movements. | 1. Line preparation will be done using a mulcher.<br>2. Mulching of seismic lines will reduce their potential to create dust.<br>3. Driving is only permitted on designated access roads and seismic lines.<br>4. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines.<br>5. Seismic activities to be completed within a short timeframe.<br>6. Water trucks used to suppress dust on access tracks, if required. |
| **Creation of Dust** | People inhaling dust | Clearing and vehicle and plant movements | 1. Line preparation will be undertaken using a mulcher.<br>2. Mulching of seismic lines will reduce the potential to create dust.<br>3. Driving is only permitted on designated access roads and seismic lines.<br>4. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines. |

| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| | | | 5. Duration of activities limited to approximately 20 weeks.<br>6. Access tracks clearly signed alerting people to the Activity.<br>7. Water trucks used to suppress dust on access tracks, if required. |
| **Creation of Vehicle and Plant Emissions** | Reduction in air quality | Vehicle and plant movements creating air emissions | 1. Vehicles and fixed plant maintained to OEM maintenance schedule.<br>2. Vehicles compliant with Northern Territory Motor Vehicle registration requirements and Work Health and Safety Regulations. |
| **Noise and Vibration from the Activity** | Disturbance to native fauna | Vehicle movements and seismic equipment generating noise and vibration | 1. Vehicles and fixed plant maintained to OEM maintenance schedule.<br>2. The Activity timeframe is short-lived and occurs away from sensitive receptors. |
| **Noise and Vibration from the Activity** | Disturbance to landholders | Vehicle movements and seismic equipment generating noise and vibration | 1. Vehicles and fixed plant maintained to OEM maintenance schedule.<br>2. Engines/machinery will have exhaust noise suppression devices.<br>3. The Activity will be restricted to daylight hours.<br>4. Land access agreement in place. |
| **Light from the Activity** | Disturbance to native fauna | Vehicles and seismic equipment operating at night. Lighting from camp | 1. The Activity will be restricted to daylight hours.<br>2. All boundary lighting for the camp will face inwards to provide adequate lighting for safe operations, without excessive overspill. |
| **Light from the Activity** | Disturbance to landholders | Vehicles and seismic equipment operating at night. Lighting from camp | 1. The Activity will be restricted to daylight hours.<br>2. All boundary lighting will face inwards to provide adequate lighting for safe operations, without excessive overspill. |
| **Fauna Interaction with Mobile Plant and Vehicles** | Disturbance, injury, or death to terrestrial fauna | Vehicles and seismic equipment | 1. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines.<br>2. Driving is only permitted on designated access roads and seismic lines.<br>3. Fauna spotter/catcher/fire tender during line preparation.<br>4. Night driving prohibited except in cases of emergency or unforeseen circumstances such as vehicle breakdown. |
| **Livestock Interaction with Mobile** | Disturbance, injury to, or | Vehicles and seismic equipment | 1. Relevant landowners and occupiers notified prior to commencement of the Activity.<br>2. All gates are left in the condition they were found (i.e., open/closed).<br>3. All fences restored to satisfaction of landowner/managers. |





| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| **Plant and Vehicles** | death of livestock | | 4. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines.<br>5. Fauna spotter/catcher/fire tender during clearing activity. |
| **Introduction and Spread of Weeds** | Loss of native vegetation through competition for resources | Plant and vehicles carrying weeds from outside the Project Area<br><br>Spread of weeds in Project Area through clearing and vehicle movements | 1. Comply with approved Weed Management Plan.<br>2. Dedicated Weed Officer.<br>3. Vehicle inspections and clearance certificates. |
| **Introduction and Spread of Weeds** | Loss of pasture and native species through competition for resources | Plant and vehicles carrying weeds from outside the Project Area<br>Spread of weeds in Project Area through clearing and vehicle movements | 1. Comply with approved Weed Management Plan.<br>2. Dedicated Weed Officer.<br>3. Vehicle inspections and clearance certificates. |
| **Fire** | Disturbance to or death of terrestrial fauna | Ignition sources from plant and machinery<br><br>Smoking | 1. All vehicles will be equipped with portable fire extinguishers.<br>2. Machinery and vehicles should be parked in areas of low fire risk.<br>3. Any petrol motor vehicles or petrol-powered pumps will be fitted with spark arresters.<br>4. All vehicles will be equipped with operational VHF and/or UHF radio transceivers.<br>5. Smoking will only be permitted in designated areas, all butts disposed in specially designed receptacles.<br>6. Monitor North Australian Fire Management (NAFI) annual fire mapping<br>7. Fauna spotter/catcher/fire tender during line preparation activity. All personnel will receive an induction prior to the commencement of the Activity relating to:<br>o The Emergency Response Plan.<br>o The operation of portable fire extinguishers and communications equipment.<br>o Smoking restrictions.<br>o Compliance with the Fire Management Plan.<br>8. Daily toolbox meetings will be conducted to:<br>o Alert the workforce of the fire risk level for the day. |

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| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| | | | ○ Discuss any fire incidents and near misses and remedial actions.<br>○ Reinforce compliance with the Fire Management Plan. |
| **Fire** | Injury to or death of livestock, loss of pasture, dwellings, and infrastructure | Ignition sources from plant and machinery<br><br>Smoking | 1. All vehicles will be equipped with portable fire extinguishers.<br>2. Machinery and vehicles parked in low fire risk areas.<br>3. All petrol motor vehicles or petrol-powered pumps will be fitted with spark arresters.<br>4. All vehicles will be equipped with operational VHF and / or UHF radio transceivers.<br>Smoking will only be permitted in designated areas, all butts disposed in specially designed receptacles.<br>5. Monitor North Australian Fire Management (NAFI) annual fire mapping<br>6. Fauna spotter/catcher/fire tender during line preparation activity<br>7. All personnel will receive an induction prior to the commencement of the Activity relating to:<br>○ The Emergency Response Plan.<br>○ The operation of portable fire extinguishers and communications equipment.<br>○ Smoking restrictions.<br>○ Compliance with the Fire Management Plan.<br>8. Daily toolbox meetings will be conducted to:<br>○ Alert the workforce of the fire risk level for the day.<br>○ Discuss any fire incidents and near misses and remedial actions.<br>○ Reinforce compliance with the Fire Management Plan. |
| **Disturbance to Landholder / Public** | Disturbance to landholders' activities | Vehicle and plant movements | 1. Relevant landowners and occupiers are notified prior to commencement of the Activity.<br>2. Inductions for all employees and contractors covers pastoral, conservation, legislation, and infrastructure issues.<br>3. System is in place for logging public/landholder complaints to ensure that issues are addressed.<br>4. Any damage to station tracks and fences is reported and restored to satisfaction of landowner / managers.<br>5. All gates are left in the condition they were found (i.e., open/closed).<br>6. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines.<br>7. Seismic sources are not to operate within the distance defined by the Interest Holder's standards, of any pipeline, utility, installation, or building. |
| **Chemical Leaks and Spills** | Impact to soil quality | Inappropriate storage or handling of hazardous substances<br><br>Poor refuelling or fuel transfer practices | 1. Spill kits available to treat spills in-situ.<br>2. Minimise fuel transfer where possible.<br>3. Site inductions include details of controls in the Spill Management Plan<br>4. No refuelling near riparian buffers<br>5. Use of drip trays for transfers.<br>6. Any spills contained and remediated.<br>7. Fuel and lubricants will be stored and managed, in accordance with AS1940.<br>8. Compliance with the Spill Management Plan. |



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| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| | | | 9. All contaminated materials / waste stored at the temporary campsite is in appropriate containers or bunds to prevent off-site release.<br>10. Secondary containment will have sufficient capacity to hold 100% of the volume of the largest container stored in the area (plus 10%) unless the container is equipped with individual secondary containment.<br>11. Daily inspections of chemical storage area and secondary containment (Table 7—2 Monitoring Program of the EMP).<br>12. Inspection reports and maintenance records (if any) of secondary containment shall be kept and available for review upon request.<br>13. Spill-specific contingency/emergency response drills to be conducted in line with the Emergency Response Plan (Appendix 5).<br>14. Comply with **Section 7.7.7.2** *Contingency Plan for Bogged Vehicles Transporting Chemicals* of Spill Management Plan |
| **Chemical Leaks and Spills** | Reduction in surface water and groundwater quality | Inappropriate storage or handling of hazardous substances<br><br>Poor refuelling or fuel transfer practices | 1. Spill kits available to treat spills in-situ.<br>2. Minimise fuel transfer where possible.<br>3. Site inductions include details of controls in the Spill Management Plan<br>4. No refuelling near water ways<br>5. Use of drip trays for transfers.<br>6. Any spills contained and remediated.<br>7. Fuel and lubricants will be stored and managed, in accordance with AS1940.<br>8. Compliance with the Spill Management Plan.<br>9. All contaminated materials / waste stored at the temporary campsite is in appropriate containers or bunds to prevent off-site release.<br>10. Secondary containment will have sufficient capacity to hold 100% of the volume of the largest container stored in the area (plus 10%) unless the container is equipped with individual secondary containment.<br>11. Daily inspections of chemical storage area and secondary containment (Table 7—2 Monitoring Program of the EMP).<br>12. Inspection reports and maintenance records (if any) of secondary containment shall be kept and available for review upon request.<br>13. Spill-specific contingency/emergency response drills to be conducted in line with the Emergency Response Plan (Appendix 5).<br>14. Comply with **Section 7.7.7.1** *Contingency Plan for Bogged Vehicles Transporting Chemicals* of Spill Management Plan |
| **Irrigation of Treated Effluent (if needed)** | Reduction in surface water quality | Irrigation of treated effluent in area where it can enter waterways | 1. Treated effluent sprayed in an irrigation area 50-100 m away from the camp in a place where it is reasonably unlikely to enter any waterways.<br>2. Personnel will be advised to minimise water usage when using showers, in the kitchen etc, to reduce volumes of greywater generated. |

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| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| | | | 3. Irrigation will be done in a manner to minimise spray drift and ponding.<br>4. Daily inspections to confirm controls complied with, records kept.<br>5. Fencing will be installed around the irrigation area.<br>6. The STP will be designed to comply with and all wastewater will be disposed of in accordance with the *Public and Environmental Health Regulation* 2014 and the NT's *Code of Practice for Wastewater Management* [DoH, 2014] |
| **Fauna Interaction** | Fauna attracted to waste | Waste stored inappropriately | 1. Waste will be segregated and stored on site and all putrescible waste material will be held in fauna proof containers.<br>2. Other than waste from approved wastewater systems and grey water there will be no disposal of waste to the natural environment.<br>3. Licenced waste contractor will be used for any offsite transfer or disposal. Tracking or other records to be kept.<br>4. Compliance with the Wastewater Management Plan.<br>5. During operations, daily inspections of the designated waste disposal area and the effluent hoses and irrigation area to ensure no visible leaks or pooling.<br>6. Daily inspection reports will be created and maintained. |

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# 5 Consequences for Stakeholder Rights and Activities

## 5.1 Stakeholder Rights

Santos respects the rights of all Stakeholders and seeks a sustainable relationship. Santos proposes to achieve this via the following key principles:

- Formal engagement aligned with the requirements of Regulation 7.2 (a) of the *NT Petroleum (Environment) Regulations*
- Structured and timely process for the execution of notices
- Mutually agreed ongoing engagement and communication

## 5.2 Stakeholder Activities

The proposed activities detailed in this document are in areas related to the McArthur River Pipeline. All efforts will be made to minimise impacts to the operation of the pipeline during the proposed regulated activities.

Figures 2 – Figure 6 display the location of the proposed seismic acquisition relative to nearby infrastructure.

Table 3 summarises the identified risks, potential impacts and proposed mitigations associated with the Regulated activities.

Key considerations when understanding the consequences to pipeline operations:

- The proposed regulated activities are part of the exploration phase and are therefore temporary in nature. At the completion of the activities, Santos will rehabilitate any disturbance.

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## 5.3 Stakeholder Engagement Plan Feedback

Santos proposes frequent discussions with nominated representatives of the McArthur River Pipeline to ensure a clear understanding of the activities and ongoing program.

All feedback on the proposed activities and their potential impacts, risks and proposed controls should be provided to Santos as soon as practicable.

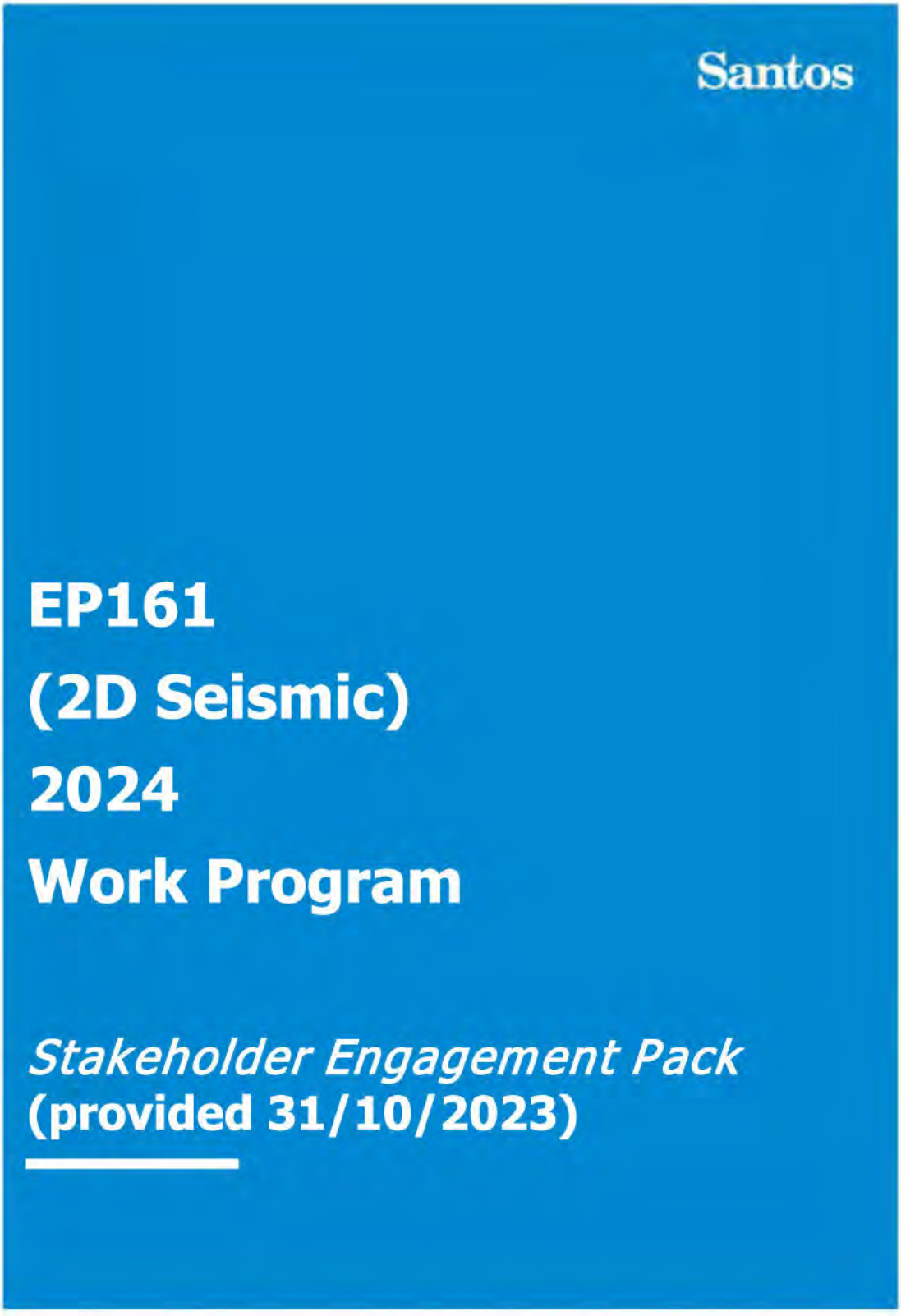
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## 6 Acronyms and Abbreviations

| Acronym | Meaning |
|---|---|
| AAPA | Aboriginal Areas Protection Authority |
| DEPWS | (Northern Territory Government) Department of Environment, Parks and Water Security |
| DITT | (Northern Territory Government) Department of Industry, Tourism and Trade |
| EMP | Environmental Management Plan |
| EP | Exploration Permit |
| LAA | Land Access Agreement |
| NLC | Northern Land Council |
| NT | Northern Territory |
| NTG | Northern Territory Government |

## 5.4.2 Services

### 5.4.2.1 Power & Water



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# 1 Purpose

Santos Ltd (**Santos**) is proposing to submit an Environmental Management Plan (**EMP**) in support of the proposed 2024 activities on Tanumbirini Station in Exploration Permit (**EP**) 161. This Engagement Pack has been compiled to provide information regarding the proposed regulated Activity as described within the EMP.

Santos presents this document to the operators and interest holders of the McArthur River Pipeline to provide an understanding of:

a) The regulated activity the interest holder proposes to carry out,

b) The locations where it is proposed to carry out the activity,

c) The timeline of the proposed activity,

d) The potential environment impacts, risks, controls, and environmental outcomes of the activity, and

e) A proposed plan for ongoing engagement.

Any questions for feedback to the information provided in this pack will be reviewed and feedback provided and if applicable, incorporated in the submitted EMP. Santos also offers a face-to-face, or remote VC style, meeting with the stakeholder where subject matter experts can present the information in this pack and answer any questions. It should also be noted that Santos is committed to ongoing stakeholder engagement and discussion throughout the life of the activities.

## 1.1 Background

Santos QNT Pty Ltd, a subsidiary of Santos, is Operator of the EP 161 Joint Venture in the McArthur Basin and is actively exploring the permits with co-venturers Tamboran Resources (Figure 1). The acreage was originally granted by the NT Minister for Primary Industry, Fisheries and Resources under section 20(5) of the *Petroleum Act* on 21 May 2012.

Since becoming Operator of EP 161 in Dec 2012, Santos has acquired and processed 510 kilometres of 2D seismic within EP 161, followed by the drilling of Tanumbirini 1 (2014), Marmbulligan 1 (2016), Tanumbirini 2HST1 (2021) and Tanumbirini 3HST1 (2021) and the associated fracture stimulation and flow testing of Tanumbirini 1, Tanumbirini 2HST1 and Tanumbirini 3HST1 during 2019-2022.

This Stakeholder Engagement Pack provides information in relation to the proposed activities planned to occur on Tanumbirini Station in 2024. This pack provides a description of Santos' activities and how Santos proposes to manage the environmental impacts and risks associated with its activities, including how it will address its regulatory obligations and relevant Inquiry Recommendations that have underpinned the Code of Practice: Onshore Petroleum Activities in the Northern Territory (**the Code**).

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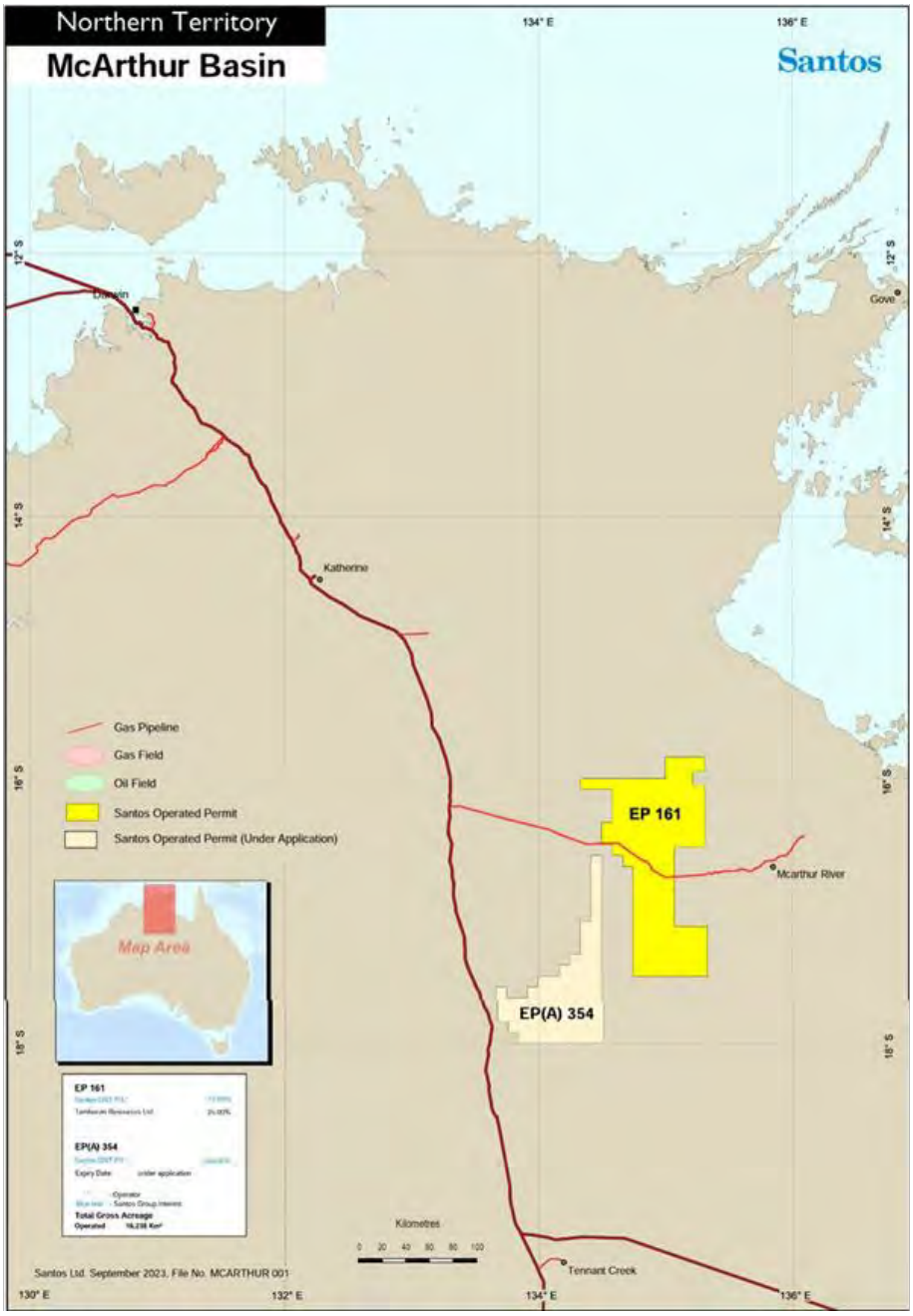



*Figure 1: Location of related Santos Permit Area*

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## 2 Description and Location of the Regulated Activities

The regulated Activity covered in the proposed EMP is:

a. Acquisition of 2D Seismic (Figure 2), with ~ 249km of disturbance (239km associated with line preparation for acquisition source lines and a further 10km of "connection "paths).

b. Acquisition of a Gravity survey along the prepared lines.

c. Rehabilitation of disturbance and monitoring

*Table 1:* **Summary of project activity**

| Component | Details |
|---|---|
| **Operating Hours** | • Daylight restricted (12-hr day shifts where possible). |
| **Civil Works** | • Maintenance of the previously cleared Tanumbirini well pad and existing access tracks if necessary.<br>• Establishment of a temporary campsite at the Tanumbirini well pad for use during the Activity and for vehicle parking and fuelling. |
| **Seismic Acquisition Program** | • 2D seismic and ground gravity survey<br>• Line preparation of twelve seismic lines, one set of five, approximately 7.5 - 8.5 km long and another set of seven, approximately 24 – 33 km long. The total seismic line length is approximately 239 km.<br>• Preparation of approximately 10 km of connection lines between the seismic lines for access of mulchers and survey vehicles |
| **Equipment and Machinery** | • Light and heavy vehicles like mulchers, slashers, seismic vibroseis source and survey trucks, ground gravity survey vehicles. |
| **Access** | • Existing access to the Tanumbirini well pad and the seismic lines will be used wherever possible.<br>• LAA in place with the Tanumbirini Station. |
| **Diesel Use** | • Campsite, generators, light and heavy vehicle diesel usage. |
| **Water Source** | • Water required to maintain existing track(s) dust suppression and firefighting. Water will be trucked in from existing licenced bores.<br>• Potable water for the campsite will be trucked in. |
| **Rehabilitation Methods Proposed** | • Mulchers cut vegetation above ground and mulch and spread the cut material for minimal impact and to promote rapid rehabilitation. The soil is not disturbed, and vegetation rootstock is left intact.<br>• Rehabilitation of the seismic lines post-acquisition (as needed) |

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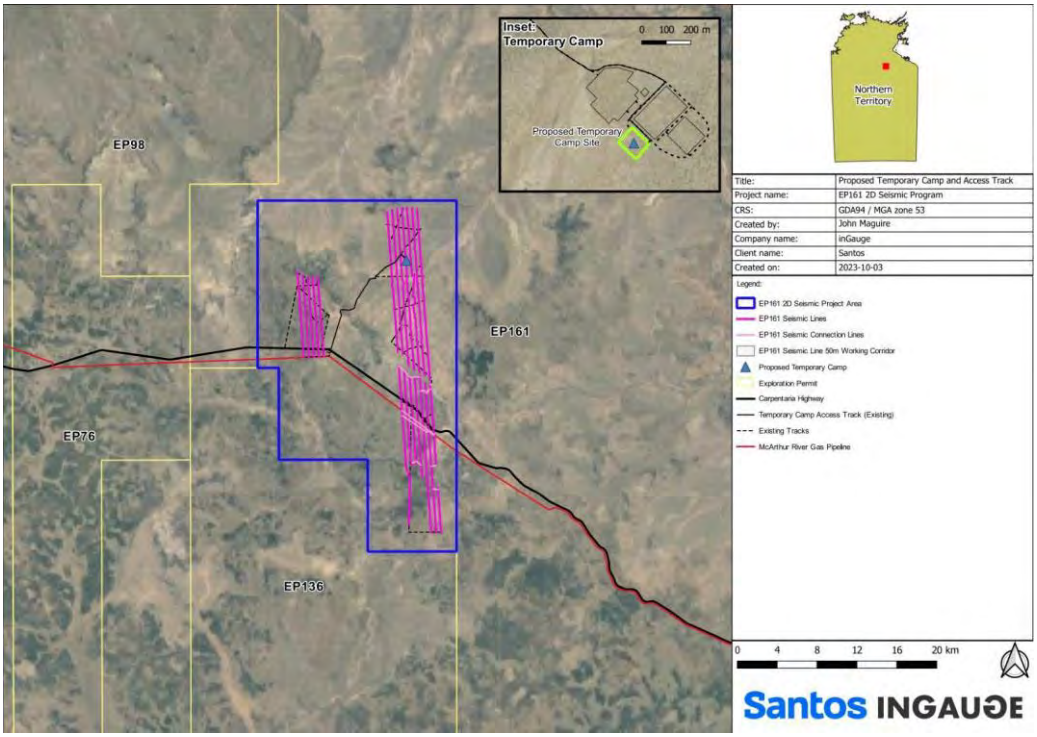



Figure 2: Location of proposed 2D seismic acquisition

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## Seismic Acquisition Program

### Operational Background

***Technology***

Seismic acquisition allows an 'image' of the geological structures below the surface to be created. This method uses a seismic energy source. The energy source generates elastic waves, which travel into the earth and are then reflected from subsurface geological structures. The returning reflections are recorded in a digital format and, upon completion of the survey, sent to a seismic data processing centre to produce a 'cross-section' of the layers of the earth's crust.

Seismic lines are strategically selected and placed in close proximity to one another to capture this cross-sectional view of the subsurface structures, ensuring a clear 2D image of these structures. Connection lines provide access between seismic lines; and seismic acquisition will not occur along these lines.

***Site Selection***

The seismic and connection lines have been selected based on third-party desktop surveys as well as civil, ecological, archaeological, and field surveys. These seismic lines comply with the AAPA Authority Certificates C2020/011, C2019/043 (variation to C2014/053), and C2013/142, ensuring they avoid the Restricted Work Areas (RWA) outlined. A working corridor of 50 m has been established for the seismic and connection lines (25 m either side of the line) to allow deviations to avoid, where possible:

- Mulching, as opposed to traversing.
- Areas of greater erosion concern (e.g., significant slope).
- Key environmental sensitivities (e.g., large trees, trees with hollows or nests).
- Obstacles (e.g., termite mounds).
- Cultural heritage sites (e.g., archaeological sites, AAPA restricted work areas).

Figure 3 provides an overview of the seismic and connection lines, including an inset illustrating the working corridor applied to all lines. Detailed views of the seismic lines, associated connection lines, access tracks, and the campsite can be found in Figures 4, 5 and Figure 6

Figure 7 provides detailed views of the central area in the eastern group of seismic lines, highlighting all connection lines, and presenting two options for connection lines near the McArthur River gas pipeline.

***Line Preparation***

On-site assessments have identified that vegetation within the Project Area is predominantly sparse woodland (up to 85%) and traversing without line preparation will be feasible for much of the seismic and connection line length. Ground truthing will occur along the seismic and connection line routes to identify significant trees and riparian vegetation.

Mature trees, trees with hollows or nests selected for preservation, will be recorded and flagged to ensure their protection. The nominal 50 m seismic line working corridors allow deviation around potential obstacles and key environmental sensitivities (e.g., large trees, trees with hollows or nests) where practicable.

Small handheld portable nodal geophones may also be used in riparian areas for data acquisition where access is limited.

***Disturbance Areas***

Maximum disturbance estimates have been calculated on the assumption that vegetation will be mulched (5 m width) rather than traversed, for the total 249 km of proposed seismic (239km) and connection lines (10km), with 124 ha of maximum estimated disturbance.

This is a maximum disturbance estimate reflecting a worst-case scenario, as in practice, it is estimated 85% of the area of potential disturbance is made up of low-density woodland (74.6%), is already disturbed (4.4%) or is riparian (6.2%), which would require minimal line preparation. Thus, the actual disturbance area is expected to be much less than 124 ha.

In addition to the new disturbances, it is proposed to utilise existing tracks within the acquisition area to minimise impact to the environment along the acquisition lines. The tracks that will be utilised are identified in Figures 2-6.

***Seismic Connection Lines and McArthur River Pipeline***

Seismic connection lines that are determined to be easily traversable and should not require significant mulching have been scouted. Connection lines enable crews to traverse between adjacent lines, reducing traffic impact and fuel use.

In total, 10 km of connection lines are planned for utilisation to move between seismic lines. Along the route of the McArthur River pipeline, two potential seismic connection lines have been proposed (Option A & B in Figure 6), noting that only one of these options will be utilised during the activity.

Seismic vehicles will traverse the pipeline; however, no vibroseis energy source will be used within 30 m of the pipeline.

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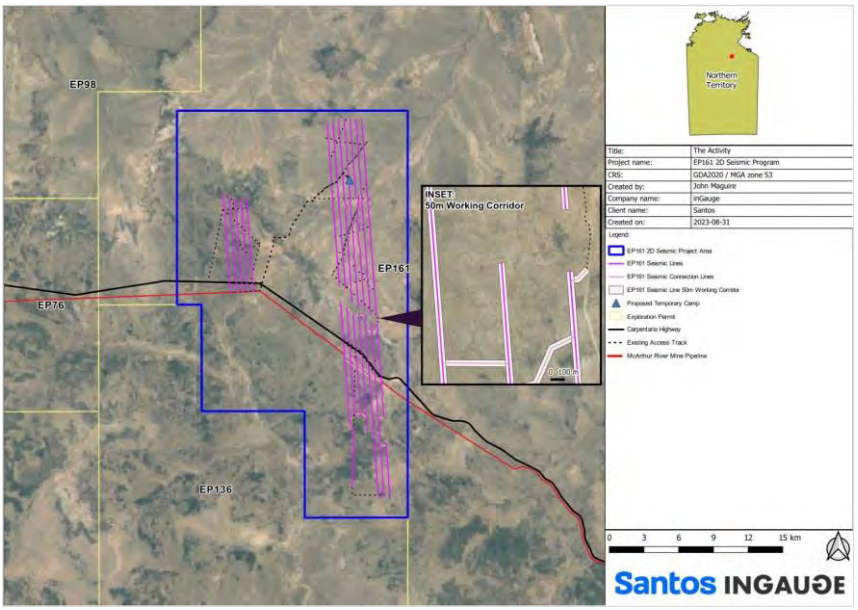



Figure 3: **Overview of Seismic Lines and Connection Lines with Inset Showing Close-up of Working Corridors**



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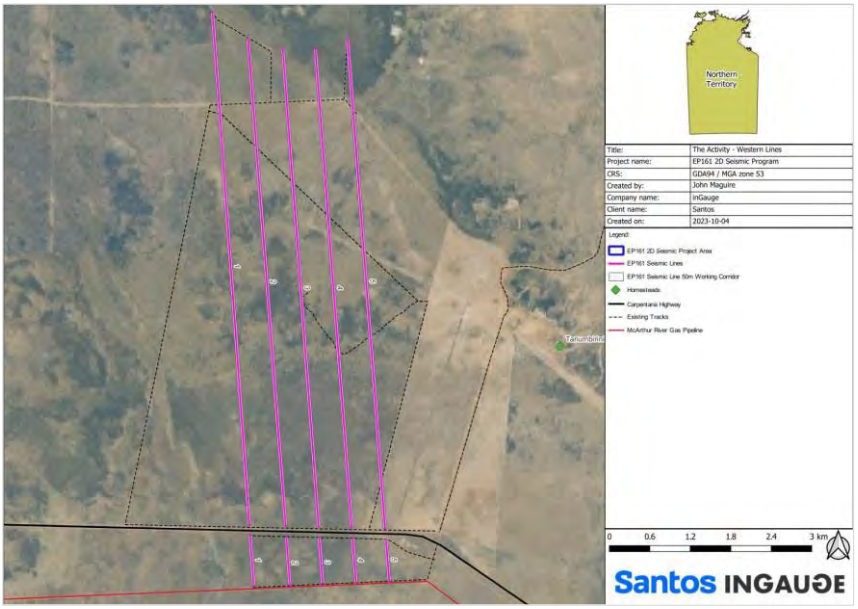



Figure 4: **Western Seismic Lines**

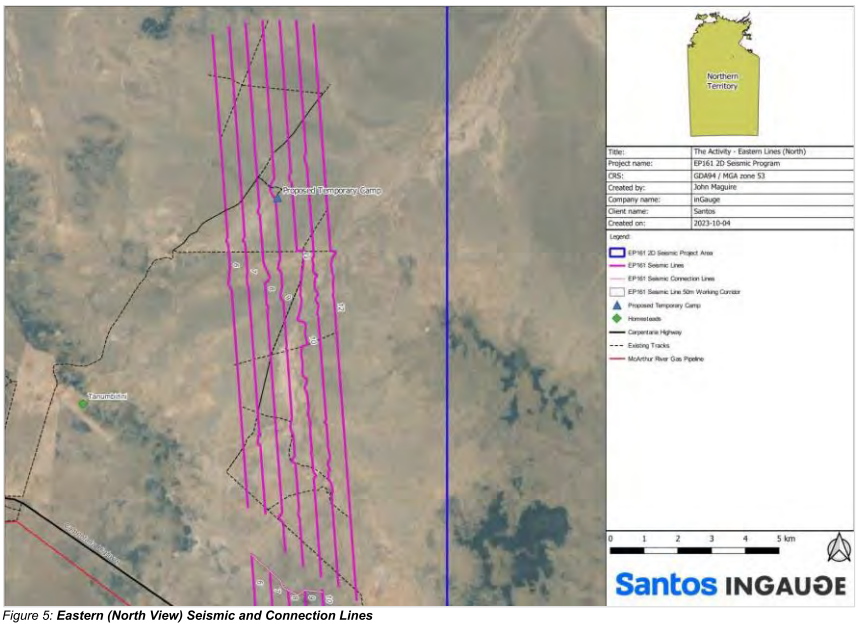



*Figure 5:* ***Eastern (North View) Seismic and Connection Lines***



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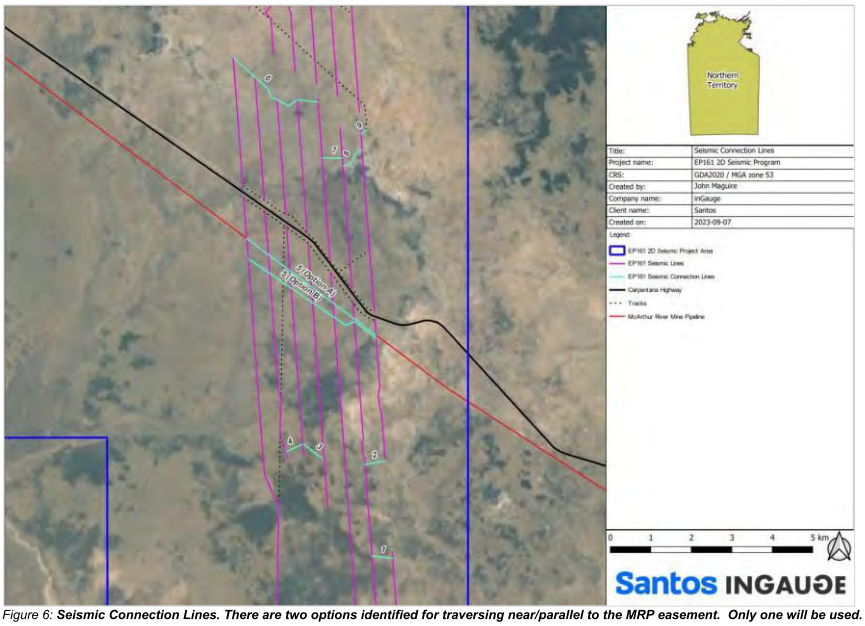



*Figure 6:* ***Seismic Connection Lines. There are two options identified for traversing near/parallel to the MRP easement. Only one will be used.***

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## Seismic Line Preparation

On-site assessments have identified that vegetation within the Project Area is predominantly sparse woodland, is already disturbed or is riparian. Traversing without line preparation will be feasible for much of the seismic line length. A mulcher will be necessary in some areas for preparing the seismic lines for the survey to provide safe access and enable sufficient ground contact for the seismic vibro-source and the geophone nodes.



*Figure 7:* ***Example Seismic Line Mulcher (indicative unit only) [ADMULCH, 2023]***

Where mulching is necessary, the mulcher simultaneously cuts, mulches, and spreads the mulch on the seismic line for minimal impact and rapid rehabilitation. The mulcher cut width is 5 m, the soil is not disturbed, and vegetation root stock is left intact. The nominal 50 m seismic line corridors allow deviation around potential obstacles and key environmental sensitivities (e.g., large trees, trees with hollows or nests) where practicable and cultural sites will be avoided. The mulcher will operate with the mulcher up within the working corridor when mulching is not required. To assist in safe passage of personnel, and reduce fire risk, some grass slashing may be necessary. Where suitable watercourse crossing points for seismic vehicles are not possible, existing access tracks will be used.

In the final ground truthing and recording of significant trees along the seismic line routes, the presence of any riparian vegetation would also be recorded. The final routes selected within the 50 m seismic line working corridors would avoid these areas as much as practicable.

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## Seismic Surveying

Seismic surveys commence after line preparation. The field surveyors use GPS receivers to position receiver points for the 2D surveys. Surveyors mark the ground with biodegradable paint, with selected points marked by wooden stakes. Line detours may also be marked with temporary biodegradable flagging.

Each survey team consists of one surveyor in a light 4WD vehicle and generally makes only one pass over any given section of line. Backtracking may occur in areas where vehicle access routes have deviated from the true line position, and markers must be inserted by personnel on foot.

## 2D Seismic Acquisition Operations

Work commences with the deployment of nodal geophones. The nodal geophones are autonomous units containing the actual geophone as well as battery and data storage units of size approximately 10x10x10 cm with a spike on the underside so that they can be easily pushed into the ground.

These nodes are deployed at regular intervals of approximately every 5 m to 10 m. Each node weighs approximately 1 kg each, so they can be hand carried. This allows for their placement in areas without mulching or vehicle access. Additionally, they can be deployed through sensitive environmental areas, ensuring continuous data acquisition across the Project Area.

Once a sufficient length of the seismic line has been laid out on the ground, the acquisition can begin. This layout is termed 'the spread' and picks up the acoustic energy reflected from subsurface layers, converts it to electrical energy and stores the data on the nodal unit until it is retrieved from the field and the data downloaded to the recording system.

## Ground Gravity Survey

A ground gravity survey is proposed to be undertaken after line preparation. The survey would be undertaken at regular intervals along the prepared seismic lines.

The survey method is a non-invasive geophysical approach that accurately measures the Earth's gravitational field at designated surface points using a gravity meter. Like the geophones, the gravity meter can be hand-carried. Processing the gravity data allows for the detection of slight shifts in gravity caused by differences in the density beneath the surface.

The gravity survey would be carried out by one surveyor using a suitably equipped light vehicle; an example is shown in Figure 9.




*Figure 8:* ***Example of a 4WD Vehicle Conducting a Gravity Survey (grey box gravity meter)***

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## Campsite

A temporary camp for the seismic crew will be placed on the previously cleared Tanumbirini well pad. The campsite will have an area for parking equipment and vehicles. A diesel storage tank and refuelling point will also be provided, and a small storage area for lubricants and hydraulic fluids, as well as segregated wastes.

The campsite will include a kitchen, showers, and port-a-loo type toilets. Sewage and greywater may be transported offsite by a waste management contractor or treated in a portable sewage treatment plant (STP).

Treated effluent from the STP would either be removed from site for disposal at an approved location or be irrigated in a designated irrigation area 50-100 m away from the camp location, well away from any place from which it is reasonably likely to enter any waters, and to minimise spray drift and ponding.
Fencing will be installed around the irrigation area as required. The STP would meet the NT's Code of Practice for Wastewater Management [P. Rogers, 2020].

## Water Use

Potable water at the campsite will be sourced off-site. It is anticipated that 200 L per person per day will be required. Groundwater will be extracted only in accordance with, and if authorised by, groundwater extraction licences held by Santos. Currently they are GRF10280 and U10335, which are licences due to expire on 31 Dec 2023. New extraction licences are being sought by Santos.
It should be noted that a seismic and ground gravity program does not inherently demand water. Thus, any water required for the Activity primarily supports secondary operational needs. These secondary operational needs include:

- Access track maintenance and dust suppression
- Firefighting.

The quantity of groundwater required is heavily influenced by on-ground conditions and prevailing weather patterns. For example, during prolonged dry periods, there could be an increased need for water for dust suppression, whereas during wetter periods, the demand might decrease. Thus, the need for groundwater extraction is highly variable and circumstantial.

## Post-survey Closure

On completion of the 2D seismic and ground gravity surveys, all pegs will be removed from the seismic lines. All temporary infrastructure at the campsite (the Tanumbirini well pad) will be removed.
As the seismic line mulcher simultaneously cuts, mulches, and spreads the mulch on the seismic line, leaving the soil undisturbed and root stock intact, no further rehabilitation of the seismic lines is required following the completion of survey work. However, the success of regrowth will be monitored to ensure suitable rehabilitation is achieved.

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## 3 Activity Timeline

Activity is expected to commence in mid-2024 (Table 2), with final acquisition timing to be confirmed based on post wet season review and availability of acquisition contractors. Final rehabilitation timing is difficult to predict, however ongoing evaluation of the disturbance rehabilitation will be continued until an appropriate level of rehabilitation is reached.

The current LAA is in place and contemplates the proposed activities.

*Table 2:* **Indicative Activity schedule (dependant on weather/access/availability of contractors)**

| Activity | Estimated Commencement / Completion |
|---|---|
| **Seismic Line Mobilisation** | 1st March 2024 |
| **Seismic Line Preparation** | 6th March-10th April 2024 |
| **Seismic and Ground Gravity Surveys** | 20th March – 29th April 2024 |
| **Survey Demobilisation** | 30th April - 5th May 2024 |

## 4 Environmental Risk Summary

The risks and potential impacts associated with the Activity are covered in the current EMP. The risks and controls have been summarised in Table 3.

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*Table 3* ***Environmental risks, impacts and controls of proposed activity (extract from draft EMP)***

| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| **Physical Disturbance** | Loss or disturbance to native vegetation. Loss of habitat impacts on flora and fauna. | Clearing and vehicle and plant movements. | 1. The temporary camp site will be in a previously cleared area.<br>2. Where possible, existing tracks, roads or seismic lines will be used for access.<br>3. Back tracking in prepared seismic line to reach existing access tracks rather than clear new connecting lines.<br>4. Mature trees, trees with hollows or nests selected for preservation are to be flagged to ensure their protection.<br>5. Line preparation will be done using mulcher, which simultaneously cuts, mulches, and spreads the mulch on the seismic line, leaving the root stock intact. Mulch is spread to reduce erosion and facilitate rehabilitation.<br>6. The mulcher only prepares a 5 m width within a notional 50 m seismic line corridor, allowing for deviation around potential obstacles, and key sensitivities where practicable.<br>7. The mulcher will be used "mulcher up" to avoid disturbance when not required.<br>8. Tree mulching decision tree to be used to protect mature and nesting trees. |
| **Physical Disturbance** | Disruption of natural drainage lines. Water quality and erosion. | Clearing and vehicle and plant movements. | 1. Environmental field advisor to pre-scout and identify riparian areas. Riparian area start and stop points to be input into navigation system.<br>2. Riparian vegetation decision tree to be used before traversing riparian vegetation.<br>3. All-terrain vehicles used do not require formed drainage line crossings and do not cause major disturbance.<br>4. The number of times a drainage line will be crossed will be limited with little disturbance expected.<br>5. The Activity will not commence if there has been rainfall in the past 24 hours within the Project Area until ground conditions have been assessed. |
| **Physical Disturbance** | Disturbance to soil. Compaction of soils. Erosion of soil due to loss of vegetative cover. | Clearing and vehicle and plant movements. | 1. The temporary campsite will be in a previously cleared area.<br>2. Existing, landholder access tracks will be utilised where possible.<br>3. Line preparation will be conducted using a mulcher, which prepares a 5 m width within an indicative 50 m corridor, so seismic vehicles can deviate around dense vegetation, landforms.<br>4. The mulcher leaves root stock intact and mulch is spread to reduce erosion and facilitate rehabilitation.<br>5. The mulcher will be used "mulcher up" to avoid disturbance in easily traversable terrain.<br>6. Weather checked daily to determine if the Activity will commence.<br>7. Environmental field advisor to pre-scout and identify riparian areas. Riparian area start and stop points to be input into navigation system.<br>8. Riparian Vegetation decision tree to be used before traversing riparian vegetation.<br>9. Immediately protect soil surface after mulching with mulch.<br>10. The Activity will not commence if there has been rainfall in the past 24 hours within the Project Area until ground conditions have been assessed. |



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| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| **Physical Disturbance** | Damage to culturally sensitive sites. Removal of vegetation exposing culturally sensitive site. | Clearing and vehicle and plant movements. | 1. Disturbance restricted to subject land and will avoid the restricted work areas in the AAPA Authority Certificate.<br>2. Known sites of sacred or cultural significance have been identified and will be avoided.<br>3. Any new sites identified during the Activity will be reported to the NT Heritage Branch.<br>4. Maintain GIS database of Project Area and cultural heritage sites including details of any works conditions. |
| **Groundwater Extraction** | Reduction in groundwater quantity. | Use of groundwater for the Activity. | 1. Groundwater for maintenance and dust suppression, if required, will be extracted from existing licenced bores.<br>2. The water use for the Activity is small. |
| **Groundwater Extraction** | Reduction in groundwater available for other users. | Use of groundwater for the Activity. | 1. Groundwater for maintenance and dust suppression, if required, will be extracted from existing licenced bores.<br>2. The quantity of water required is not expected to have any significant impact on the aquifer. |
| **Creation of Dust** | Smothering of flora. | Clearing and vehicle and plant movements. | 1. Line preparation will be done using a mulcher.<br>2. Mulching of seismic lines will reduce their potential to create dust.<br>3. Driving only permitted on designated access roads and seismic lines.<br>4. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines.<br>5. Seismic activities to be completed within a short timeframe.<br>6. Water trucks used to suppress dust on access tracks if required. |
| **Creation of Dust** | Loss of amenity. | Clearing and vehicle and plant movements. | 1. Line preparation will be done using a mulcher.<br>2. Mulching of seismic lines will reduce their potential to create dust.<br>3. Driving is only permitted on designated access roads and seismic lines.<br>4. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines.<br>5. Seismic activities to be completed within a short timeframe.<br>6. Water trucks used to suppress dust on access tracks, if required. |
| **Creation of Dust** | People inhaling dust | Clearing and vehicle and plant movements | 1. Line preparation will be undertaken using a mulcher.<br>2. Mulching of seismic lines will reduce the potential to create dust.<br>3. Driving is only permitted on designated access roads and seismic lines.<br>4. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines. |

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| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| | | | 5. Duration of activities limited to approximately 20 weeks.<br>6. Access tracks clearly signed alerting people to the Activity.<br>7. Water trucks used to suppress dust on access tracks, if required. |
| **Creation of Vehicle and Plant Emissions** | Reduction in air quality | Vehicle and plant movements creating air emissions | 1. Vehicles and fixed plant maintained to OEM maintenance schedule.<br>2. Vehicles compliant with Northern Territory Motor Vehicle registration requirements and Work Health and Safety Regulations. |
| **Noise and Vibration from the Activity** | Disturbance to native fauna | Vehicle movements and seismic equipment generating noise and vibration | 1. Vehicles and fixed plant maintained to OEM maintenance schedule.<br>2. The Activity timeframe is short-lived and occurs away from sensitive receptors. |
| **Noise and Vibration from the Activity** | Disturbance to landholders | Vehicle movements and seismic equipment generating noise and vibration | 1. Vehicles and fixed plant maintained to OEM maintenance schedule.<br>2. Engines/machinery will have exhaust noise suppression devices.<br>3. The Activity will be restricted to daylight hours.<br>4. Land access agreement in place. |
| **Light from the Activity** | Disturbance to native fauna | Vehicles and seismic equipment operating at night. Lighting from camp | 1. The Activity will be restricted to daylight hours.<br>2. All boundary lighting for the camp will face inwards to provide adequate lighting for safe operations, without excessive overspill. |
| **Light from the Activity** | Disturbance to landholders | Vehicles and seismic equipment operating at night. Lighting from camp | 1. The Activity will be restricted to daylight hours.<br>2. All boundary lighting will face inwards to provide adequate lighting for safe operations, without excessive overspill. |
| **Fauna Interaction with Mobile Plant and Vehicles** | Disturbance, injury, or death to terrestrial fauna | Vehicles and seismic equipment | 1. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines.<br>2. Driving is only permitted on designated access roads and seismic lines.<br>3. Fauna spotter/catcher/fire tender during line preparation.<br>4. Night driving prohibited except in cases of emergency or unforeseen circumstances such as vehicle breakdown. |
| **Livestock Interaction with Mobile** | Disturbance, injury to, or | Vehicles and seismic equipment | 1. Relevant landowners and occupiers notified prior to commencement of the Activity.<br>2. All gates are left in the condition they were found (i.e., open/closed).<br>3. All fences restored to satisfaction of landowner/managers. |



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| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| **Plant and Vehicles** | death of livestock | | 4. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines.<br>5. Fauna spotter/catcher/fire tender during clearing activity. |
| **Introduction and Spread of Weeds** | Loss of native vegetation through competition for resources | Plant and vehicles carrying weeds from outside the Project Area<br><br>Spread of weeds in Project Area through clearing and vehicle movements | 1. Comply with approved Weed Management Plan.<br>2. Dedicated Weed Officer.<br>3. Vehicle inspections and clearance certificates. |
| **Introduction and Spread of Weeds** | Loss of pasture and native species through competition for resources | Plant and vehicles carrying weeds from outside the Project Area<br>Spread of weeds in Project Area through clearing and vehicle movements | 1. Comply with approved Weed Management Plan.<br>2. Dedicated Weed Officer.<br>3. Vehicle inspections and clearance certificates. |
| **Fire** | Disturbance to or death of terrestrial fauna | Ignition sources from plant and machinery<br><br>Smoking | 1. All vehicles will be equipped with portable fire extinguishers.<br>2. Machinery and vehicles should be parked in areas of low fire risk.<br>3. Any petrol motor vehicles or petrol-powered pumps will be fitted with spark arresters.<br>4. All vehicles will be equipped with operational VHF and/or UHF radio transceivers.<br>5. Smoking will only be permitted in designated areas, all butts disposed in specially designed receptacles.<br>6. Monitor North Australian Fire Management (NAFI) annual fire mapping<br>7. Fauna spotter/catcher/fire tender during line preparation activity. All personnel will receive an induction prior to the commencement of the Activity relating to:<br>o The Emergency Response Plan.<br>o The operation of portable fire extinguishers and communications equipment.<br>o Smoking restrictions.<br>o Compliance with the Fire Management Plan.<br>8. Daily toolbox meetings will be conducted to:<br>o Alert the workforce of the fire risk level for the day. |

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| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| | | | ○ Discuss any fire incidents and near misses and remedial actions.<br>○ Reinforce compliance with the Fire Management Plan. |
| **Fire** | Injury to or death of livestock, loss of pasture, dwellings, and infrastructure | Ignition sources from plant and machinery<br><br>Smoking | 1. All vehicles will be equipped with portable fire extinguishers.<br>2. Machinery and vehicles parked in low fire risk areas.<br>3. All petrol motor vehicles or petrol-powered pumps will be fitted with spark arresters.<br>4. All vehicles will be equipped with operational VHF and / or UHF radio transceivers.<br>Smoking will only be permitted in designated areas, all butts disposed in specially designed receptacles.<br>5. Monitor North Australian Fire Management (NAFI) annual fire mapping<br>6. Fauna spotter/catcher/fire tender during line preparation activity<br>7. All personnel will receive an induction prior to the commencement of the Activity relating to:<br>○ The Emergency Response Plan.<br>○ The operation of portable fire extinguishers and communications equipment.<br>○ Smoking restrictions.<br>○ Compliance with the Fire Management Plan.<br>8. Daily toolbox meetings will be conducted to:<br>○ Alert the workforce of the fire risk level for the day.<br>○ Discuss any fire incidents and near misses and remedial actions.<br>○ Reinforce compliance with the Fire Management Plan. |
| **Disturbance to Landholder / Public** | Disturbance to landholders' activities | Vehicle and plant movements | 1. Relevant landowners and occupiers are notified prior to commencement of the Activity.<br>2. Inductions for all employees and contractors covers pastoral, conservation, legislation, and infrastructure issues.<br>3. System is in place for logging public/landholder complaints to ensure that issues are addressed.<br>4. Any damage to station tracks and fences is reported and restored to satisfaction of landowner / managers.<br>5. All gates are left in the condition they were found (i.e., open/closed).<br>6. Speeds on unsealed roads will be limited – maximum 60 km/hr on unsealed roads, 40 km/hr on seismic lines.<br>7. Seismic sources are not to operate within the distance defined by the Interest Holder's standards, of any pipeline, utility, installation, or building. |
| **Chemical Leaks and Spills** | Impact to soil quality | Inappropriate storage or handling of hazardous substances<br><br>Poor refuelling or fuel transfer practices | 1. Spill kits available to treat spills in-situ.<br>2. Minimise fuel transfer where possible.<br>3. Site inductions include details of controls in the Spill Management Plan<br>4. No refuelling near riparian buffers<br>5. Use of drip trays for transfers.<br>6. Any spills contained and remediated.<br>7. Fuel and lubricants will be stored and managed, in accordance with AS1940.<br>8. Compliance with the Spill Management Plan. |



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| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| | | | 9. All contaminated materials / waste stored at the temporary campsite is in appropriate containers or bunds to prevent off-site release.<br>10. Secondary containment will have sufficient capacity to hold 100% of the volume of the largest container stored in the area (plus 10%) unless the container is equipped with individual secondary containment.<br>11. Daily inspections of chemical storage area and secondary containment (Table 7—2 Monitoring Program of the EMP).<br>12. Inspection reports and maintenance records (if any) of secondary containment shall be kept and available for review upon request.<br>13. Spill-specific contingency/emergency response drills to be conducted in line with the Emergency Response Plan (Appendix 5).<br>14. Comply with **Section 7.7.7.2** *Contingency Plan for Bogged Vehicles Transporting Chemicals* of Spill Management Plan |
| **Chemical Leaks and Spills** | Reduction in surface water and groundwater quality | Inappropriate storage or handling of hazardous substances<br><br>Poor refuelling or fuel transfer practices | 1. Spill kits available to treat spills in-situ.<br>2. Minimise fuel transfer where possible.<br>3. Site inductions include details of controls in the Spill Management Plan<br>4. No refuelling near water ways<br>5. Use of drip trays for transfers.<br>6. Any spills contained and remediated.<br>7. Fuel and lubricants will be stored and managed, in accordance with AS1940.<br>8. Compliance with the Spill Management Plan.<br>9. All contaminated materials / waste stored at the temporary campsite is in appropriate containers or bunds to prevent off-site release.<br>10. Secondary containment will have sufficient capacity to hold 100% of the volume of the largest container stored in the area (plus 10%) unless the container is equipped with individual secondary containment.<br>11. Daily inspections of chemical storage area and secondary containment (Table 7—2 Monitoring Program of the EMP).<br>12. Inspection reports and maintenance records (if any) of secondary containment shall be kept and available for review upon request.<br>13. Spill-specific contingency/emergency response drills to be conducted in line with the Emergency Response Plan (Appendix 5).<br>14. Comply with **Section 7.7.7.1** *Contingency Plan for Bogged Vehicles Transporting Chemicals* of Spill Management Plan |
| **Irrigation of Treated Effluent (if needed)** | Reduction in surface water quality | Irrigation of treated effluent in area where it can enter waterways | 1. Treated effluent sprayed in an irrigation area 50-100 m away from the camp in a place where it is reasonably unlikely to enter any waterways.<br>2. Personnel will be advised to minimise water usage when using showers, in the kitchen etc, to reduce volumes of greywater generated. |

Santos

| Risk Type | Potential Impact | Risk Source | Mitigation and Management Measures |
|---|---|---|---|
| | | | EMP Commitments |
| | | | 3. Irrigation will be done in a manner to minimise spray drift and ponding.<br>4. Daily inspections to confirm controls complied with, records kept.<br>5. Fencing will be installed around the irrigation area.<br>6. The STP will be designed to comply with and all wastewater will be disposed of in accordance with the *Public and Environmental Health Regulation* 2014 and the NT's *Code of Practice for Wastewater Management* [DoH, 2014] |
| **Fauna Interaction** | Fauna attracted to waste | Waste stored inappropriately | 1. Waste will be segregated and stored on site and all putrescible waste material will be held in fauna proof containers.<br>2. Other than waste from approved wastewater systems and grey water there will be no disposal of waste to the natural environment.<br>3. Licenced waste contractor will be used for any offsite transfer or disposal. Tracking or other records to be kept.<br>4. Compliance with the Wastewater Management Plan.<br>5. During operations, daily inspections of the designated waste disposal area and the effluent hoses and irrigation area to ensure no visible leaks or pooling.<br>6. Daily inspection reports will be created and maintained. |

Santos

# 5 Consequences for Stakeholder Rights and Activities

## 5.1 Stakeholder Rights

Santos respects the rights of all Stakeholders and seeks a sustainable relationship. Santos proposes to achieve this via the following key principles:

- Formal engagement aligned with the requirements of Regulation 7.2 (a) of the *NT Petroleum (Environment) Regulations*
- Structured and timely process for the execution of notices
- Mutually agreed ongoing engagement and communication

## 5.2 Stakeholder Activities

The proposed activities detailed in this document are in areas related to the McArthur River Pipeline. All efforts will be made to minimise impacts to the operation of the pipeline during the proposed regulated activities.

Figures 2 – Figure 6 display the location of the proposed seismic acquisition relative to nearby infrastructure.

Table 3 summarises the identified risks, potential impacts and proposed mitigations associated with the Regulated activities.

Key considerations when understanding the consequences to pipeline operations:

- The proposed regulated activities are part of the exploration phase and are therefore temporary in nature. At the completion of the activities, Santos will rehabilitate any disturbance.

Santos

## 5.3 Stakeholder Engagement Plan Feedback

Santos proposes frequent discussions with nominated representatives of the McArthur River Pipeline to ensure a clear understanding of the activities and ongoing program.

All feedback on the proposed activities and their potential impacts, risks and proposed controls should be provided to Santos as soon as practicable.

Santos

## 6 Acronyms and Abbreviations

| Acronym | Meaning |
|---|---|
| AAPA | Aboriginal Areas Protection Authority |
| DEPWS | (Northern Territory Government) Department of Environment, Parks and Water Security |
| DITT | (Northern Territory Government) Department of Industry, Tourism and Trade |
| EMP | Environmental Management Plan |
| EP | Exploration Permit |
| LAA | Land Access Agreement |
| NLC | Northern Land Council |
| NT | Northern Territory |
| NTG | Northern Territory Government |

# Emergency Response Plan

# Appendix 05

# Environmental Management Plan: EP161 2D Seismic and Ground Gravity Survey Program

# STO7-4

# NT Exploration Permit 161

# Santos QNT PTY Ltd

# Upstream Onshore

## 0007-210-ERP-0008 Emergency Response Plan

## Purpose

This Plan outlines Santos' emergency response arrangements for Upstream Onshore.

## Scope

+ This Plan covers all activities conducted within the Upstream Onshore environment:
  - Exploration.
  - Drilling and Completions.
  - Development.
  - Production.
  - Support activities such as camps, roads, offices, and airports.

+ This Plan is the overarching Upstream Onshore Emergency Response Plan and provides the generic information for all of the Upstream Onshore Division.

+ Site or activity specific information is captured within the Plan appendices:
  - Onshore CSG locations across: Arcadia, Fairview, Narrabri, Scotia and Roma
  - Onshore Cooper locations across: Ballera, Central Fields, Cook, Cross Boarder, Jackson, Northern Fields, Tarbat, Watson.
  - Onshore Northern Territory locations: McArther / Beetaloo Sub-basin, Amadeus, South Nicholson
  - Cooper Basin Operations Support facilities and amenities located at Moomba and Ballera in the Cooper Basin including camps and airports.
  - Well Control.

+ Out of scope:
  - Cyber Security which is managed by Santos Information Systems.
  - Downstream LNG Facilities

## Document Control

| | | | |
|---|---|---|---|
| Document Owner: | Onshore HSER | | |
| Approved by: | EVP Onshore Upstream | | |
| Date approved: | 31/10/2022 | Version Number: | 7 (under review) |
| Version Changes: | + Update to new template and consolidate emergency response plans: Cooper Basin Operations, GLNG Upstream Operations Rev 6, Cooper D7C Emergency and Well Control Response Plan,<br>+ Update to align with SMS-HSS-OS05-PD01 – Crisis, Incident Management & Emergency Response Procedure and 0007-670-PLA-001 Upstream Onshore Incident Management Plan | | |

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# 1. Emergency Actions

## 1.1 Immediate Actions

**Process safety emergencies**

For process safety emergencies (e.g., loss of containment/fire):

+ Evacuate the area.
+ Activate emergency shutdown devices.
+ Raise the alarm.

**All Other Emergencies**

For all other emergencies:

+ Make the area safe (if safe to do so).
+ Raise the alarm and alert others in the area if able and without putting self at risk.

## 1.2 Raising the Alarm

**Prefix Emergency Call**

Prefix emergency call with “emergency emergency”.

**Cooper Basin**

To raise the alarm in the Cooper Basin:

| Method | Description |
|---|---|
| RADIO | + Digital Mobile Radio (DMR) Channel “All Cooper”.<br>+ [redacted]).<br>+ Long pressing the Emergency Duress radio button. |
| PHONE | + 222 / [redacted]<br>+ Direct to Santos Supervisor. |
| FIXED ALARM | + Fixed fire or ESD.<br>+ Facility muster alarms.<br>+ Camp alarms. |

**CSG**

To raise the alarm in CSG:

| Method | Description |
|---|---|
| RADIO | + Santos Talk Group Upstream Operations ([redacted]<br>+ Local site radio. |
| PHONE | + Direct to Santos Supervisor.<br>+ [redacted] |
| FIXED ALARM | + Fixed fire or ESD.<br>+ Facility muster alarms.<br>+ Camp alarms. |
| OTHER | + Long pressing the IVMS duress alarm in vehicles. |

Northern Territory

To raise the alarm in NT:

| Method | Description |
|---|---|
| RADIO | + Local site radio. |
| PHONE | + Direct to Santos Supervisor.<br>+ [redacted] |
| FIXED ALARM | + ESD.<br>+ Camp alarms. |
| OTHER | + Long pressing the IVMS duress alarm in vehicles. |

## 1.3 Emergency Information

### Relay Information

Relay the following information when raising the alarm:

| Information | Detail |
|---|---|
| Emergency description (type of incident examples): | + Loss of containment: gas, oil, water, chemical or other.<br>+ Fire.<br>+ Vehicle.<br>+ Medical.<br>+ Activism, theft. |
| Emergency location: | + The facility, equipment, vessel, road and crossroad etc. (or nearest).<br>+ Distance from landmark or identifiable equipment. |
| Injuries and how many injured: | + Who is injured (names of personnel, Santos or Contractor.)?<br>+ How many people are injured?<br>+ What are the injuries?<br>+ What first aid is being provided?<br>+ What emergency services have been called?<br>+ What further medical assistance is required?<br>**NOTE:** Avoid detailing names or injured personnel via radio. This information should only be provided by secure means such as phone, text or where available, secure radio channel. |
| Emergency size and potential: | + Area.<br>+ Height.<br>+ Volume. |

| | |
|---|---|
| | + How could this impact personnel, public, environment, assets? |
| Current status: | + Has the source been stopped or contained?<br>+ Is it under control?<br>+ Is it spreading? If yes, what direction? N/S/E/W?<br>+ Are personnel evacuating to muster location? |
| Emergency call made by and time: | + Name, company name and contact details?<br>+ Time emergency detected and time of call? |

## 1.4 Emergency Support Services

### Cooper Basin

Emergency Support in the Cooper Basin will be coordinated by the Operations Support Team Leaders or their delegates.

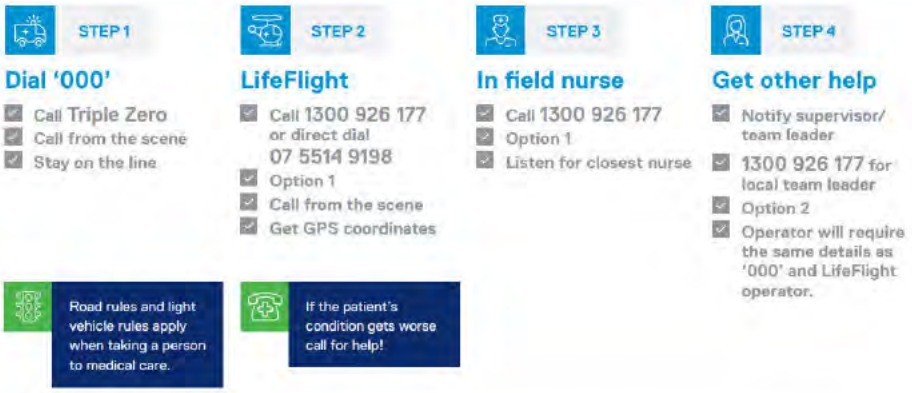
| Service | Description |
|---|---|
| Medical emergencies | + Medics located at Moomba and Ballera.<br>+ HEMS (aeromedical evacuation) based at Moomba.<br>+ Royal Flying Doctors Service (RFDS). |
| Entrapment extraction | + Emergency Services Officers based at Moomba. |
| Rescue from height | + Emergency Services Officers based at Moomba. |
| Confined space entry | + Where circumstances exceed the capability of the confined space team and their confined space rescue plan, Emergency Services Officers based at Moomba.<br>**NOTE:** Confined space entry and mechanical excavations require their own emergency plan as per their Procedure. These must be specific to the work task. |
| Flood | + Emergency Services Officers based at Moomba. |
| Response to fire and explosion | + Emergency Services Officers based at Moomba for:<br>o Recovery post event.<br>o Preventative measures such as wetting down areas, removing fuel loads etc outside of the emergency location. |
| Chemical spill | + Emergency Services Officers based at Moomba.<br>+ State Fire Services as the Hazard Management Agency.<br>+ Specialist contractor engaged to manage clean-up of hazardous materials and site recovery. |

**NOTE:** Due to location, external emergency services such as police, police rescue, fire and hazmat services will take > 6hrs to mobilise.

### CSG - Queensland

For medical emergencies in CSG – Queensland:

+ 000
+ 1300 926 177:
    - Prompt 1 – LifeFlight.
    - Prompt 2 – Roma Nurse
    - Prompt 3 – Fairview Nurse
    - Prompt 4 – Bottle Tree Nurse
    - Prompt 5 – Cattle Creek Nurse
    - Prompt 6 – Scotia Nurse




**NOTE:** Where possible, i.e., more than one person at the scene, escalate to both 000 and LifeFlight simultaneously. If not possible, contact 000 and then LifeFlight (ore delegate mobilisation to LifeFlight to another resource).

**NOTE:** The field nurse locations may change over time. 1300 926 177 will always have the correct and up to date directory for field nurses.

For Police, Fire and other external services – dial 000.

### CSG - NSW

Emergency services support in CSG – NSW - dial 000.

### CSG – External Call Centre

CSG also uses the services of an external call centre. The call centre provides the following services:

+ Receives emergency and general inquiry calls from both external and internal callers and directs to the relevant Santos Team Leader.
+ Logs, monitors and escalates (as required) Journey Management and Lone Worker Calls to the relevant supervisor or Santos Team Leader.
+ Receives and escalates IVMS Duress Alerts to the relevant Supervisor or Santos Team Leader.

**NOTE:** When raising the alarm, direct call to relevant Supervisor and Santos Team Leader is preferred.

### Northern territory

For medical emergencies in the Northern Territory:

| Service | Description |
|---|---|
| Medical emergencies | + Careflight (aeromedical evacuation) ph: 1300 655 855<br>+ Royal Flying Doctors Service (RFDS) ph:1800 167 222 |
| Emergency services | + Emergency Services (fire, ambulance and police) ph: 000 |

### Emergency Response by Road

Where emergency services (Emergency Services Officers based at Moomba, Ambulance, Police Fire etc.) are responding via road, a Santos employee or contractor will meet Emergency Services at an agreed location.

The agreed location may be:

+ Crossroad.
+ Landmark.
+ Santos Emergency Point.

## Emergency Response by Helicopter

Medical emergency response by air may be required via helicopter:

+ HEMS – Cooper Basin.
+ Lifeflight – CSG Queensland.
+ Careflight – Northern Territory

Injured personnel must not be transported via a standard helicopter. A standard helicopter may be used to mobilise medical assistance to the emergency location.

Provide the following when mobilising HEMS or LifeFlight:

+ Site name (i.e., Compressor Site 1, Well Site FV82, Dullingari) and exact location of the emergency.
+ Latitude / longitude, degrees / decimal.
+ Communication available at the location (i.e., radio including channel, mobile phone).
+ Type of terrain and hazards (i.e., trees or power lines).
+ Weather conditions in the area.
+ Obvious landmarks or potential landing locations.
+ Passenger weight / build.

Cooper Basin and CSG have identified designated landing zones. These zones are typically located next to facilities or camps and have been assessed as suitable for landing.

**NOTE:** Depending on the location of the emergency, the responding helicopter may be required to land closer to the scene and not at a designated landing zone. This will be at the discretion of the Pilot. Refer to Section 4.1 for information on Helicopter Landing and Take Off.

## Designated Landing Zones – Cooper Basin

Designated landing zones – Cooper Basin:

| Nearest Santos Facility | Coordinates DMS | Coordinates Decimal |
|---|---|---|
| Bookabourdie | Latitude: 27°32'02.41"<br>Longitude: 140°27'58.64" | Latitude: -27.534<br>Longitude: 140.4663 |
| Central Parker | Latitude: 28°11'42"<br>Longitude: 140°11'0.7" | Latitude: -28.195<br>Longitude: 140.1835 |
| Cook | Latitude: 26°41'40.9"<br>Longitude: 141°17'22.8" | Latitude: -26.6947<br>Longitude: 141.2897 |
| Della | Latitude: 28°05'04.86"<br>Longitude: 140°37'29.37" | Latitude: -28.0847<br>Longitude: 140.6248 |
| Dullingari | Latitude: 28°08'49.4"<br>Longitude: 140°52'04.9 | Latitude: -28.1471<br>Longitude: 140.868 |
| Gidgealpa | Latitude: 27°57'28.8" | Latitude: -27.958 |

| | | |
|---|---|---|
| | Longitude: 40°02'03.156" | Longitude: 140.0342 |
| Innamincka | Latitude: 27°44'33.3"<br>Longitude: 140°44'42.4" | Latitude: -27.7426<br>Longitude: 140.7451 |
| Jackson | Latitude: 27°38'17.57"<br>Longitude: 142°24'11.29" | Latitude: -27.6382<br>Longitude: 142.4031 |
| Limestone Creek | Latitude: 28°31'17.2"<br>Longitude: 140°23'39.7" | Latitude: -28.5214<br>Longitude: 140.3944 |
| Mat Parker MP | Latitude: 28°10'51"<br>Longitude: 140°16'07" | Latitude: -28.1808<br>Longitude: 140.2686 |
| Tarbat Camp | Latitude: 26°54'12.88"<br>Longitude: 143°17'46.27 | Latitude: -26.9036<br>Longitude: 143.2962 |
| Tarbat Mt Margaret | Latitude: 26°54'27.97"<br>Longitude: 143°19'18.69" | Latitude: -26.9078<br>Longitude: 143.3219 |
| Tirrawarra | Latitude: 27°41'30.7"<br>Longitude: 140°06'15.9" | Latitude: -27.6919<br>Longitude: 140.1044 |
| Toolachie | Latitude: 28°24'38.0"<br>Longitude: 140°48'19.1" | Latitude: -28.4106<br>Longitude: 140.8053 |
| Watson | Latitude: 28°04'35.98"<br>Longitude: 140°07'46.27" | Latitude: -28.0767<br>Longitude: 140.1295 |

## Designated Landing Zones - Queensland

Designated landing zones – Queensland:

| Nearest Santos Facility | Coordinates DMS | Coordinates Decimal |
|---|---|---|
| **Arcadia** | | |
| Arcadia Reverse Osmosis Plant (ROP) | Latitude: 25⁰19'55.396875"S<br>Longitude:48⁰51'12.232056"E | Latitude: 25.332055⁰S<br>Longitude: 148.853398⁰S |
| Arcadia Nuga Nuga Camp | Latitude: 25⁰13'8.489790"S<br>Longitude:148⁰48'5.341096"E | Latitude: 25.219025⁰S<br>Longitude: 148.801484⁰E |
| ACS02 | Latitude: 25020'47.758536"S<br>Longitude:148⁰52'56.47289⁰"E | Latitude: 25.346600⁰S<br>Longitude: 148.882354⁰E |
| **Fairview** | | |
| The old Springwater Camp | Latitude: 25⁰43'55.056195"S<br>Longitude: 48⁰59'51.490697"E | Latitude: 25.731960⁰S<br>Longitude: 148.997636⁰E |
| Nunda Warren Camp | Latitude: 25⁰36'54.190335"S<br>Longitude:148⁰54'53.910156"E | Latitude: 25.615053⁰S<br>Longitude: 148.914975⁰E |
| Wugoon Umo Camp | Latitude: 25⁰43'55.163056"S<br>Longitude:148⁰59'51.608393"E | Latitude:25·731990"S<br>Longitude: 148.997669⁰E |
| **Scotia** | | |
| Scotia Camp | Latitude: 25⁰56'4.181202"S<br>Longitude:150⁰2'44.932915"E | Latitude: 25.934495⁰S<br>Longitude:150.045815⁰E |
| **Roma Region** | | |
| Roma Hub 2 | Latitude: 26°26'58.874040"S<br>Longitude: 149⁰1 6.452433"E | Latitude: 26.449687⁰S<br>Longitude: 149.018459⁰E |
| Roma East Compressor Station | Latitude: 26°27' 37.264940"S<br>Longitude: 49°17'9.831332"E | Latitude: 26.460351⁰S<br>Longitude: 149.286064⁰E |
| Unburri Camp | Latitude: 26⁰27'33.859024"S<br>Longitude149⁰1'59.371576"E | Latitude: 26.459405⁰S<br>Longitude: 149.033159⁰E |

## Potential Landing Zones - Narrabri

Currently there are no designated landing zones in Narrabri. If a helicopter is required to land, the following sites may be suitable, subject to Pilot final decision:

| Nearest Santos Facility | Coordinates DMS | Coordinates Decimal |
|---|---|---|
| Wilga Park Power Station | Latitude: 30°20'39.894108"S<br>Longitude:149°39'12.124634"E | Latitude: 30.344415°S<br>Longitude:149.653368°E |
| Bibblewindi Facilities | Latitude: 30°37'58.763437"S<br>Longitude:149°38'54.329694"E | Latitude: 30.632990°S<br>Longitude:149.68425°E |
| Leewood Ponds | Latitude: 30°29'40.417763"S<br>Longitude:149°37'25.357816"E | Latitude: 30.494560°s<br>Longitude:149.623711°E |
| Narrabri Operations Centre | Latitude: 30°20'9.601576"S<br>Longitude:149°43'46.171771"E | Latitude: 30.336000°S<br>Longitude:149.729492°E |

## Potential Landing Zones – Northern Territory

| Nearest Santos Facility | Coordinates DMS | Coordinates Decimal |
|---|---|---|
| Tanumbirini Station Airstrip | Latitude: 16°27'30.8"S<br>Longitude:134°38'58.4"E | Latitude: 16.458553°S<br>Longitude:135.649543°E |
| Tanumbirini Wellpad | Latitude: 16°23'58.73"S<br>Longitude:134°42'13.05"E | Latitude: 16.3996472°S<br>Longitude: 134.703624°E |

# 2. Emergency Response Arrangements

## 2.1 Approach

### Santos Approach

Santos approach to emergencies is focused on the safety of personnel and removing personnel from an emergency situation.

An example of this approach is in relation to fires. Personnel can attempt to extinguish a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers or small hose systems. Anything greater than this, we do not attempt to extinguish.

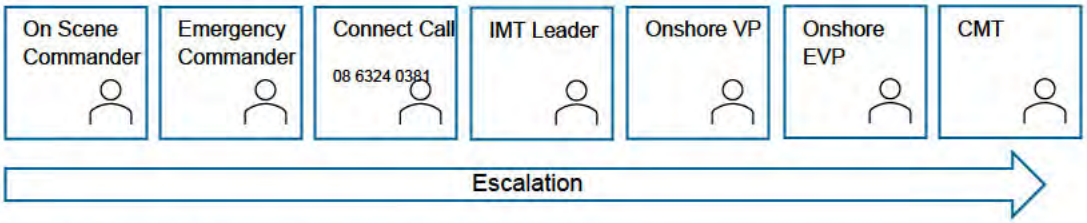
We will:

+ Utilise fixed systems where they exist.
+ Implement preventative measures such as wetting down areas, removing fuel loads etc outside of the emergency location and with the approval of the relevant Santos Line Leader or On Scene Commander.

### Principles and Philosophy

Upstream Onshore applies the following principles:

+ All emergencies are escalated to the relevant level of response i.e.:



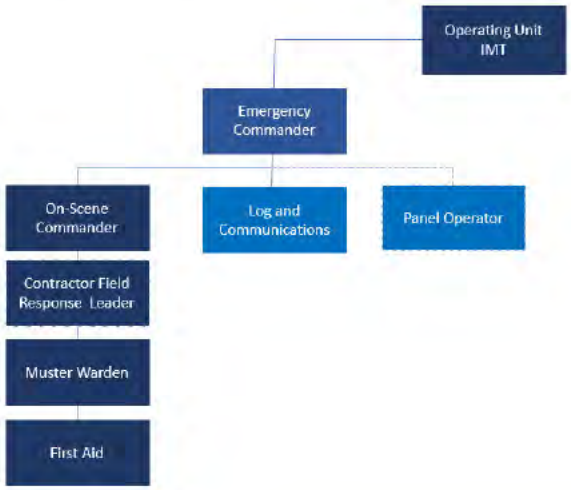

+ All emergencies are managed:
  - ESD, evacuate, activate fixed systems.
  - Provide first aid and request additional medical support as appropriate.
  - Muster and account for personnel in the affected area.
  - Mobilise emergency services.
  - To PEAR:

| Element | Impact on… |
|---|---|
| **P** – People | Safety and welfare of personnel, internally and within the community |
| **E** – Environment | Environmental values at risk |
| **A** – Assets | Production and / or business function assets |
| **R** – Recovery | Recovery of production and business operations |

**NOTE:** All Santos employees and Contractors have the authority to shut down or cease processing and production in order to follow the Santos emergency principles and philosophy.

## Emergency Response Team

The Onshore Emergency Response Team (ERT) structure consists of:




**NOTE:** The Emergency Commander will call on additional resources to support the emergency situation.

# 3. Emergency Response Roles, Responsibilities and Operations Centre

## 3.1 Roles

### Upstream Onshore IMT

Upstream Onshore IMT will support an Upstream Onshore emergency:

+ The rostered IMT Lead will be available 24/7 via the Santos Emergency Call Centre [redacted]
+ The Emergency Commander and IMT Lead will determine the need to convene the IMT to:
  - Develop objectives and actions to manage and support the consequences of the emergency event.
  - Plan for longer-term response.
  - Provide support for Media/Communications, HR/People, Safety, Environment, Resource/Logistics etc.
  - Develop recovery plans.



**NOTE:** Our emergency response strategy is to escalate early. Improves response time and can always be de-escalated.



**NOTE:** The IMT Lead on roster may initially stand up the IMT and then hand over to another IMT Lead. This handover may be due to more experience generally or to an IMT Lead that has the relevant site knowledge to better support the emergency situation.

### Emergency Commander

The Emergency Commanders within Upstream Onshore are:

| Team | Who |
|---|---|
| Operations - CSG | Area Managers (Brisbane) |
| Operations - Cooper | TL Operations Support (Moomba) |
| Development - CSG | Construction Managers (Brisbane) |
| Development - Cooper | TL Operations Support (Moomba) |
| D&C - CSG | Managers D&C Operations (Brisbane) |
| D&C - Cooper | TL Operations Support (Moomba) |
| Cooper (common infrastructure/camps, roads) | TL operations Support (Moomba) |
| Operations - NT | Area Managers (Brisbane) |

Emergency Commander:

+ Directs emergency response activities, considering:
  - Onshore common emergency scenarios.

- Incident Action Plans.

+ Provides support and direction to the On-Scene Commander and establishes regular situational report updates.
+ Notifies the Onshore IMT Lead:
  - Emergency situation.
  - ERT has been established, where required.
  - What external support services have been contacted and their expected time of arrival.
  - Emergency escalation is or is not likely.
  - Request for support from the IMT.
  - Establishes regular situational report updates.
+ Establishes regular "Time Outs" with Log and Communication role (and Panel Operator where established).
+ Develops a local recovery plan post emergency to recover operations.
+ Implements recovery actions identified by IMT.
+ Participates in after action reviews, post incident debriefs, and incident investigations as required.

### Log and Communications Officer

Log and Communications Officer:

+ Maintain a log of event as a record of response activities.
+ Upload log to EHS Toolbox Emergency Response Record.
+ On behalf of the Emergency Commander affect and receive notifications, as required.

> **NOTE:** Ongoing situational reports with IMT may be delegated to this role.

### Panel Operator

Panel Operators will form part of the Emergency Response Team when the emergency involves process plant and equipment:

+ Engaged by the Emergency Commander and assist in the response.
+ Manage production plant operations as directed by the Emergency Commander.
+ Communicate process equipment status to the Emergency Commander.

### On Scene Commander

On Scene Commander is fulfilled by the relevant Team Leader, Construction Supervisor, Operating Company Representative (OCR), Operations Support or their delegate:

+ Undertakes command and leads field response reporting to the Emergency Commander.
+ Maintains responder safety in accordance with the Santos response philosophy.
+ Ensures all field and affected area personnel are accounted for (evacuation and muster).
+ Ensures first aid is provided.
+ Considers tactical response in accordance with Emergency Checklists and Incident Action Plans.
+ Where warranted, mobilises emergency services to assist with the emergency.
+ Establishes and secures exclusion zone and forward command post.
+ Establishes a staging area when required.
+ Continuously monitors emergency for potential to escalate.
+ Scene preservation.

+ Acknowledgement of handover of scene to regulatory authority where required.

**Contractor Field Response Leader**

Contractor Field Response Leader is normally the Contractors:

+ Rig Manager/Tool Pusher (or equivalent Senior site Contractor Representative) located at the affected wellsite for Drilling and Completions.
+ Construction/Development Supervisor for the construction activity.

The Contractor Field Response Leader will ensure there are personnel to fulfil the following roles:

+ Muster warden.
+ First Aid.

**Muster Warden**

Muster Warden:

+ Appointed by and reports to the On Scene Commander.
+ Accounts for all personnel on-site during the emergency response.
+ Reports muster status to the On Scene Commander.
+ Coordinates movement of mustered personnel to safe locations during the emergency.
+ Account for Operations personnel and emergency services accessing the emergency scene, when safe to do so.

**First Aid Officer**

First Aid Officer:

+ Appointed by and reports to the On Scene Commander.
+ Ensures first aid is provided to injured personnel.
+ Ensures additional medical emergency services (internal and external) are mobilised to support the injured personnel.

## 3.2 Responsibilities

**Responsibilities**

Responsibilities under this plan:

| Person | Responsibility |
|---|---|
| Production Operations Managers | + Endorse annual emergency response exercise plan.<br>+ Ensure continuous On Scene Commander field capability. |
| Field Team Leaders | + Lead and participate in emergency exercises as per the annual emergency response exercise plan.<br>+ Fulfil the role of the On Scene Commander.<br>+ Ensure team are familiar with the emergency response plan.<br>+ Ensure hard copy of Plan is available. |
| All personnel | + Understand:<br>– Santos emergency response principles and philosophy.<br>– How to raise the alarm. |

| | |
|---|---|
| Emergency Response Adviser | + Develop annual emergency response exercise plan in conjunction with Operations, Drilling and Completions, Development and Operations Support.<br>+ Schedule emergency response exercises.<br>+ Ensure this Plan is reviewed every three years.<br>+ Distribute Plan to external agencies. |
| Emergency Commanders | + Understand and fulfil role in accordance with this Plan.<br>+ Establish the Emergency Operations Centre. |

**ERP Locations**

The Upstream Operations ERP will be available via Discover and in hard copy at main office / work locations such as compressor stations/satellites, OCR shack etc.

**ERP Distribution**

A copy of this Plan will be forwarded to external agencies where applicable.

## 3.3 Operations Centre

**Emergency Operations Centre**

The Emergency Operations Centre is a designated room used by the Emergency Commander and Log and Situation Officer. Located:

+ Brisbane Operations Centre – Level 17, Room 17.03.
+ Moomba – Operations Support Office.

Where practical, Emergency Commander and Log and Communication Officer will meet at the Emergency Operations Centre.

Depending on the emergency situation, the Emergency Commander and Log and Communication Officer may meet virtually via MS Teams and utilise Santos systems such as:

+ MyPlant.
+ WebGIS.
+ SuccessFactors.

# 4. Emergency Scene, Conclusion and Debrief

## 4.1 Emergency Scene

| | |
|---|---|
| Emergency Scene | The emergency scene will be controlled by the On Scene Commander. The On Scene Commander will make the following considerations:<br>+ Conduct an initial scene assessment.<br>+ Ensure means of communication with the Emergency Commander.<br>+ Muster personnel as required by the emergency.<br>+ Select location for forward command post as required.<br>+ Establish a hot zone and an isolation perimeter for the emergency.<br>+ Establish an injury clearing area as required.<br>+ Identify a staging area.<br>+ Identify and communicate, internal / external services meeting location and send team member to the location to escort to scene.<br>+ Designate ingress and egress routs from site (traffic management).<br>+ Establish entry control.<br>+ Ensure scene preservation post emergency. |
| Emergency Scene Control | Scene control may be handed over to the Police or other regulatory bodies. Where this occurs, the On Scene Commander should document name, position and regulatory body that is assuming control of the scene. |
| Emergency Scene Preservation | Post emergency, the emergency scene must be preserved for the purpose of an incident investigation. The following should be implemented:<br>+ Establish and secure a perimeter that prevents unauthorised access.<br>+ Consider protecting the scene from weather.<br>+ Do not move anything unless absolutely necessary.<br>+ Record any evidence located or moved (i.e., what, where, when and by whom).<br>+ Photograph or video the scene as soon as possible and prior to, during and post where items have been moved. |
| Emergency Conclusion | The emergency will be considered concluded:<br>+ When there is no longer a potential for an unwanted event as a result of the emergency or its response.<br>+ After consultation and agreement between the Emergency Commander and IMT Lead. |
| Debrief | Emergency Commander will ensure a debrief is conducted for all Emergency Response Team Members. This will include:<br>+ Overview of emergency.<br>+ What went well with the response.<br>+ Opportunities for improvement for the response, process or plans.<br><br>Debrief to be captured within the EHS Toolbox Emergency Response Record for the emergency. |
| Investigation | The incident resulting in the emergency situation, will be investigated as per the Santos Incident Investigation Procedure. |

# 5. Emergency Response Common Scenarios

## 5.1 Common Scenarios

### Reference guides

The following reference guides are common to all sites. Site specific information is located in the relevant emergency response plan Appendix.

### Adverse Weather

Adverse weather includes.

+ Storms.
+ Lightning.
+ High winds.
+ Poor visibility.

Work must cease and personnel take refuge within buildings or where not available, within vehicles where there is potential for lighting strike and during storms and high winds.

### Aircraft Accident

+ Raise the alarm.
+ Refer to the relevant emergency response plan appendix for Aviation Emergencies.

### Bomb or Other Harm Threat

Where you receive a bomb or other harm threat call, remain calm and obtain as much information as possible to assist with identifying the nature, location and likely support resources required for this emergency.

| Step | Information |
|---|---|
| 1. | + Write down:<br>+ Exact wording of the threat.<br>+ Date and time of call.<br>+ Duration of call.<br>+ Number call received on.<br>+ What number appeared on your phone. |
| 2. | + Ask questions, such as:<br>– Where is the bomb/other threat now?<br>– When will it explode/impact?<br>– What does it look like?<br>– What will set it off/cause the impact?<br>– Did you place the bomb/other threat?<br>– Why?<br>– What is your name?<br>– Where are you calling from?<br>– When will you call again?<br>– Why call this number?<br>– What group do you represent? |

| | |
|---|---|
| 3. | + Consider the following:<br>– Is the voice familiar? Who does it sound like?<br>– Describe the caller's voice: Calm / Angry / Excited / Slow / Fast / Slurred / Rapid / Stutter / Clearing throat / Disguised / Soft / Loud / Laughter / Crying / Normal / Deep Breathing / Cracking Voice / Yelling / Threatening.<br>– Did the caller appear familiar with Santos Operations?<br>– Was the caller female or male?<br>– Did the caller have an accent? What type?<br>– Describe the background sounds: Clear / Music / Moto / Animals / Children / Voices / Crockery / Factory / PA System / Static / Booth / Office / Train / Local / Aircraft / Street Noise / House Noise.<br>– How was the threat delivered: Foul / Well Spoken / Irrational / Nervous / Taped/ Message Read. |

Bomb or other harm threats may also be made in person, on paper, via email or identification of a suspect item. The following should be considered:

| Step | Information |
|---|---|
| 1. | + Notify your supervisor immediately. |
| 2. | + For a written threat, keep all paper and envelops as evidence. |
| 3. | + For an email threat, keep a copy of the email and do not close down the computer. |
| 4. | + For a suspect item:<br>– Do not touch the suspect object / package.<br>– Evacuate the immediate area.<br>– Raise the alarm. |

### Bushfire

Refer to Fire below.

For Bushfires, refer to the Bushfire Appendix to this Plan.

### Chemical Exposure

For exposure to chemicals, immediately refer to and follow the Safety Data Sheet (SDS) for the chemical. See decontamination for early, generic guidance.

### Confined Space Entry

All Confined Space Entries must have their own rescue plan which will be used in an emergency.

The following applies to all Confined Space Entry emergencies:

+ Raise the alarm.
+ Do NOT enter the confined space and prevent others from entering.
+ Implement task specific confined space rescue plan.

Considerations by On Scene Commander:

| Step | Information |
|---|---|
| 1. | + Determine details of the confined space activity and any related hazards (e.g., contaminated/flammable atmosphere, electricity, gravity etc.) and review confined space entry rescue plan. |
| 2. | + Coordinate scene activities and ensure site safety and security. |
| 3. | + Determine the need for additional emergency services. |
| 4. | + Provide situation report to Emergency Commander. |
| 5. | + Site Muster, where required. |

## Contact with High Voltage Equipment / Power Lines

Where vehicle, vehicle load or mobile equipment comes into contact with high voltage equipment, including fallen power lines, remain in vehicle and raise the alarm.



**Warning:** If you are the occupant and only as a last resort due to impending threat such as fire, should the occupant attempt to evacuate the vehicle prior to the power being deenergised:

+ Critical you jump well clear to avoid contact with the vehicle/equipment and land with your feet together at the same time.
+ Shuffle your feet to move away from the energised ground and vehicle/equipment. While shuffling, keep your feet touching the ground at all times to maintain the same voltage in both feet.
+ Continue to shuffle until you are at least 10 metres from the energised area.

Personnel arriving at the scene:

+ Do not approach the vehicle/equipment.
+ Raise the alarm.
+ Establish and exclusion zone of approximately 100 meters and block road access.
+ Remain at the scene.

## Decontamination

General decontamination steps:

+ Remove clothing (if possible, avoid lifting clothing over head).
+ Wash yourself off with water and if available, lots of soap. Do not scald, scrub or scratch your skin.
+ Put on clean clothes.
+ Follow SDS.



**Warning:** Your clothing is also contaminated and needs to be handled and disposed of in accordance with the SDS.

## Electric Shock

Person involved, observes, or comes across a person who has sustained an electric shock:

| Step | Information |
|---|---|
| 1. | + Do not place yourself in danger. Where possible, isolate the source of the electricity. |
| 2. | + Raise the alarm. |
| 3. | + Do NOT touch any injured person until they are no longer in contact with the source of the electricity. |
| 4. | + Provide first aid when safe to do so. |

Considerations by On Scene Commander:

| Step | Information |
|---|---|
| 1. | + Ensure medical assistance and any other services have been notified and enroute to scene. |

**NOTE:** Where person is still in contact with live source, wait for LV Rescue trained personnel, Emergency Services Officers, or external emergency services to respond.

## Evacuation

On hearing an alarm or receiving verbal instruction:

| Step | Information |
|---|---|
| 1. | + Evacuate area on foot. |
| 2. | + Go to Muster Point and remain at Muster Point until directed by On Scene Commander or Muster Warden. |

**NOTE:** If the Primary Muster Point is unsuitable relocate to secondary Muster Point as nominated by the On Scene Commander or Muster Warden.

**NOTE:** When evacuating, avoid going downwind of the emergency scene to avoid potential exposure. Do not enter smoke filled buildings and avoid passing through smoke plumes enroute to Muster Point.

Considerations by On Scene Commander:

| Step | Information |
|---|---|
| 1. | + Determine level of evacuation necessary in response to the emergency. Initiate muster alarms if not already activated. |
| 2. | + Consider the safe shutdown of equipment/plant at the emergency location. Where possible this should be carried out remotely and never at the risk of personnel safety. |
| 3. | + Appoint a Muster Warden and review suitability of Muster Point. Identify secondary Muster Point. |
| 4. | + Receive ongoing Muster Point update from Muster Warden.<br>+ Advise Emergency Commander of Muster Status and any unaccounted-for personnel, including:<br>– Names.<br>– Company.<br>– Expected work location.<br>– What attempts have been made to communicate with them. |
| 5. | + For unaccounted personnel, develop a search plan and seek approval from the Emergency Commander. Search can only be carried out:<br>– In areas outside of the emergency scene.<br>– Without any specialist equipment such as breathing apparatus, rope etc. |
| 6. | + At the conclusion of the emergency give the Muster Warden the "All Clear" for mustered personnel to leave the Muster Point and advise them of any restriction on their movements.<br><br>**NOTE:** The On Scene Commander and Muster Warden may determine that personnel can be released from the Muster Point to another work location or back to camp prior to the conclusion of the emergency. |

Considerations by Muster Point Warden:

| Step | Information |
|---|---|
| 1. | + Don Muster Warden vest (for easy identification). |
| 2. | + For plant location, Muster Warden to use access board to account for personnel at the Muster Point.<br>+ For other locations, use Work Permit, JHA or other means to identify personnel working at the location and account for personnel at Muster Point. |
| 3. | + Advise On Scene Commander of Muster Point status. |

| | |
|---|---|
| 4. | + Do not allow personnel to leave the Muster Point without permission from the On Scene Commander. |
| 5. | + Maintain log of events including movement in and out of Muster Point. |

**NOTE:** Camp evacuations will be managed by the Camp Manager or their delegate. All residents must comply with Camp Evacuation requirements.

## Environmental Considerations

Environmental monitoring will be conducted in response to an environmental emergency. The specific aspects of the environmental monitoring activities, including suitable monitoring locations, will vary depending on the nature of the incident and will be determined at the time of the incident. Typical monitoring that will be required may include:

| Step | Information |
|---|---|
| 1. | + Visual and olfactory inspections to determine the nature and extent of impacts and ongoing response actions. |
| 2. | + Vapour monitoring associated with the release of gases and petroleum hydrocarbon and / or chemical vapours to atmosphere; |
| 3. | + Field measurements of pH and conductivity in released waters, waters contained within temporary containment structures or tanks and receiving waters; and / or |
| 4. | + Laboratory measurements to identify constituents of concern in affected media where required (e.g., waters, soils). |

Further sampling and analysis may be conducted during the post-incident investigative process, assessment and, if required, remediation activities. This will include the implementation of environment monitoring programs where contaminants have been released to land or water, so as to determine the extent of any environmental impact. Programs will include upstream, downstream and impact site monitoring for releases to waters and a detailed soil monitoring program for releases to land.

## Explosives

For explosives:

+ Evacuate and prevent use of vehicles and radios in the area.
+ Refer to contractor's emergency procedure for dealing with explosives.

## Fatality

The following actions are to be carried out immediately upon identification of a fatality:

| Step | Information |
|---|---|
| 1. | + Raise the alarm. |
| 2. | + On Scene or Emergency Commander to: |

| | |
|---|---|
| | – Request attendance by Medic.<br>– Notify Police and follow directions.<br>– Restrict access to location.<br>– Notify Emergency Commander. |
| 3. | + Emergency Commander to notify IMT Lead. |
| 4. | + IMT Lead to stand up the Incident Management Team. |

## Fire

If you start a fire that can be put out with a beater or portable fire extinguisher, do so.

If the fire is larger than a few square meters, flame height greater than 0.3meters, or the fire is gaining on your attempt to extinguish it:

+ Stop.
+ Move to a safe location.
+ Raise the alarm.

If you observe a fire or smoke:

+ Raise the alarm.

In both instances, provide the following information when raising the alarm:

| Step | Information |
|---|---|
| 1. | + Time and location of fire and any distinguishing features or landmarks.<br>+ What could be impacted.<br>+ What is the vegetation and terrain. |
| 2. | + Approximate size of the fire and height of the flames.<br>+ Speed and direction the fire is moving. |
| 3. | + Is the fire contained or spreading.<br>+ What is the wind direction and approximate speed. |

If unsafe to remain at your location due to fire heading your way, go to the nearest Major Refuge Point.

If you are unable to get to a Major Refuge Point, prepare your vehicle for a potential burn over.

Considerations by On Scene Commander and Emergency Commander:

| Step | Information |
|---|---|
| 1. | + Potential human threat, any injuries/fatalities including to landholders and general public?<br>+ Potential environmental impact or under threat?<br>+ Equipment infrastructure impacted or under threat?<br>– Anything venting in fires path? |

| | |
|---|---|
| | – What needs to be isolated?<br>+ Available resources?<br>+ Emergency services required? Estimated time of arrival?<br>+ Suspected cause of fire?<br>+ Whose responsibility is the fire?<br>+ What actions have been taken or currently being taken at the scene? |
| 2. | + Ensure ongoing safety of personnel.<br>+ Stop and control entry to the location. |

## Fire and Explosion

For fires and explosions:

| Step | Information |
|---|---|
| 1. | + Remove yourself and others from danger. Stopping all work and shutting down any possible ignition sources.<br>+ Evacuate area on foot to Muster Point. |
| 2. | + Raise the alarm. |

Considerations by On Scene Commander:

| Step | Information |
|---|---|
| 1. | + Consider the safe shutdown of equipment/plant at the emergency location. Where possible this should be carried out remotely and never at the risk of personnel safety |
| 2. | + Consider potential for escalation, Including:<br>– What combustible materials are on site (flammable stores, toxic fumes/ gas, vehicles, buildings etc.).<br>– Structures that could be impacted. |
| 3. | + Ensure first aid is being provided to injured personnel and request additional medical assistance as required. |
| 4. | + Notify emergency services. |

## Flooding

Assess location and seek higher ground if suspect location will flood.

If safe to do so, move equipment, supplies, waste to higher ground and secure those items that may float and cause damage.

If personnel are required to drive, assess routes and follow Land Transport Procedure for Water Crossings and only consider driving through water if:

+ There are no practical alternatives.
+ The driver has confidence that:

- Road surface is intact.
- The water depth and speed are safe as per below:

**NOTE:** Drivers must never enter water on foot or in their vehicle to try to determine depth. Depth can be judged from depth markers if the road is intact, visual assessment if road surface is visible through the water, observing other vehicles crossing etc.".

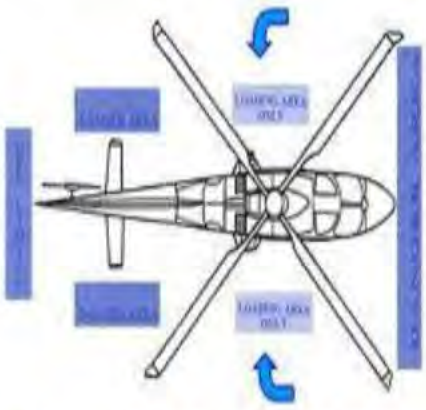
| Water speed | Maximum depth |
|---|---|
| Fast-flowing (above normal walking pace). | Bottom rim of the wheel. |
| Slow flowing or still (below normal walking pace). | Wheel hub |




## Helicopter Approach

Only approach a helicopter upon the direction of the Pilot and in the following manner:

+ Before approaching helicopter, extend right arm sideways with thumb extended upwards.
+ When the Pilot is ready for you to approach, he will in turn give the thumbs up signal.
+ Always approach the helicopter from the side and remain outside of the rotor path.
+ Never approach the helicopter from the front or the rear.
+ Do not proceed past rear locker on fuselage.



*Approaching & Departing from helicopter*

## Helicopter Landing / Take Off

When preparing to receive a helicopter ensure:

+ Landing location is clear of moveable debris and scrub in close proximity is not taller than 0.5 meters (as tail could sustain damage).

+ The site does not have a slope greater than 71/2 degrees. It should be reasonably flat ground.
+ Consider watering down the landing site if dust will be a problem.
+ Ensure flight path for take-off and landing does not require helicopter to pass over power or phone lines, trees, buildings or vehicles.
+ Where possible, do not use a road as a landing zone, particularly if the road has poor visibility, bends or T-Junctions.
+ Where a windsock is not available, stand with back to wind and arms outstretched at ten to two positions. Situate other personnel, 5 meters behind you crouching, kneeling or sitting.
+ Do not wear a hat/hard hat when approaching the helicopter or when indicating wind direction.

### Helicopter SAR

Santos Cooper Basin has the ability to utilise the HEMS and operational helicopters to conduct search and rescue (SAR) activities for Santos personnel and upon request from the Queensland and South Australian Police.

### Loss of Containment - Gas

For loss of containment emergencies:

+ ESD and get away.
+ Raise the alarm.
+ Muster personnel.

### Medical Emergency

A medical emergency includes but is not restricted to:

+ Compromised airway (e.g., neck trauma, throat injury).
+ Respiratory arrest (i.e., stopped breathing).
+ Cardiac arrest.
+ Hemodynamically unstable (poor circulation and / or bleeding).
+ Unresponsive to voice and touch.
+ Anaphylactic reaction (severe allergic reaction).
+ Prolonged or repeated seizures.
+ Broken large bones or pelvis or multiple broken bones.
+ Significant arterial or venous bleeding.
+ Respiratory rate less than 8/min.
+ Respiratory rate greater than 35/min.
+ Oxygen saturations less than 90%. Pulse less than 40 bpm.
+ Pulse rate greater than 140 bpm.
+ Systolic less than 90.
+ Chest pain or tightness.
+ Burns to greater than or equal to 10% of the body.
+ Elicit or narcotic drug overdose.
+ Heat-related illness where symptoms last more than 1 hour.
+ Snake or spider bite.
+ Paramedic, nurse or first aider has serious clinical concern about the patient and / or medical intervention is required urgently to prevent further deterioration of patient.

When raising the alarm and requesting medical assistance:

| Step | Information |
|---|---|
| 1. | + Provide your:<br>– Name. |

| | |
|---|---|
| | – Company.<br>– Phone Number.<br>– Location – including GPS coordinates.<br>+ Provide:<br>– Number of injured persons.<br>– Types of injuries.<br>– Priority of injuries:<br>▪ Urgent (example loss of life or limb <2 hours).<br>▪ Priority (example loss of life or limb <4 hours).<br>▪ Routine (example evacuate <24 hours).<br>+ Requirement of specialist equipment (e.g., oxygen, ventilator, IV).<br>+ First aid actions performed.<br>+ Approximate weight / build of injured persons.<br>+ Site terrain / hazards:<br>– Are there power lines / height obstacles close by?<br>– Is dust suppression available at the helicopter landing site?<br>– Foreign object debris (ground-based hazards)?<br>+ Weather conditions including wind direction and approximate speed.<br>+ Request estimated time of arrival of medical assistance.<br>+ If person raising the alarm is not remaining on the call, agree best means of follow up communication. |
| 2. | + Provide first aid to injured persons.<br>**NOTE:** Do not attempt to move injured persons unless other dangers are present, which may endanger life if they were not moved. |
| 3. | + Cordon off the area. |
| 4. | + Arrange for safe shutdown of equipment / plant in the affected area if it is presenting a hazard to the injured person or response personnel. |

## Missing Person/Vehicle

The following should be carried out when a person/vehicle is considered missing:

| Step | Information |
|---|---|
| 1. | + Moomba Comms or Team Leader attempts to locate vehicle via DMR, Securatrak or WebGIS.<br>+ Moomba Comms or Team Leader attempts to contact missing person via:<br>– Phone/radio.<br>– DMR system where fitted. |

| | |
|---|---|
| 2. | + Moomba Comms or Team Leader to contact the Drivers Supervisor and request that they:<br>– Attempt to contact missing person.<br>– Check camp room.<br>– Call other work team members to try and locate missing person. |
| 3. | + Moomba Comms or Team Leader identifies other vehicles in the location:<br>– Contact drivers and request support to contact missing person. |

**NOTE:** For missing persons that are not driving vehicles with DMR or Santos IVMS, Step 2 and a context specific search plan is to be developed.

## Pipeline Integrity Compromised

There are numerous pipelines across Upstream Operations. A failure of integrity will result in a leak of hazardous substances.

The below information is general in nature. For oil leaks, refer to the relevant emergency response plan Appendix.

+ ESD and evacuate. See Note.
+ If safe to do so, when evacuating, shutdown equipment in the vicinity.
+ Position personnel approximately 100 upwind of leak – on foot. This maybe considered the muster point location.
+ Confirm type of pipeline emergency.
+ Advise relevant operations Team Leader or raise the alarm via other means outlined in this Plan.

Restrict access to the location i.e., position personnel along main access points to restrict access.

**NOTE:** On high pressure pipelines, pressure control is a key factor in minimising risk of release and future damage to a pipeline. Pressure reduction should eb considered under the following circumstances:

+ To reduce potential for further damage.
+ To improve safety of operator evaluation or preparing the damaged pipe for repair.
+ To reduce inventory loss.
+ To facilitate repairs.

A positive gauge pressure should be maintained if possible. Care should be taken if lowering to zero- or lower-gauge pressures as they can result in air ingress that could lead to explosive air / gas mixture.

## Radiation

For potential exposure to radiation:

+ Evacuate, establish an exclusion zone and prevent access.
+ Remove contaminated clothing and shower.
+ Isolate clothing.
+ Refer to SDS and seek medical assistance.

## Rescue from Height

A complex rescue from height will require external assistance through Emergency Services such as Fire Services or in the Cooper Basin, the Emergency Services Officers.

Work in free fall arrest equipment must have a Fall Arrest Plan which includes how a rescue will be carried out and the rescue plan must be rehearsed as per Falls and Falling Objects Procedure.

Where a person requires rescue from height:

+ Raise the alarm and wait for Emergency Services.
+ Assess the location for hazards and implement controls.

For rescue from an elevated work platform and if safe to do so, standby person to switch the controls to ground control and lower the elevated work platform.

## Vehicle Accident

Person involved, observes or comes across a vehicle accident:

| Step | Information |
|---|---|
| 1. | + Raise the alarm and report vehicle accident advising of:<br>– Exact location of accident and distance / direction from nearest major site or landmark?<br>– Provide GPS coordinates?<br>– Number of vehicles involved?<br>– Number of people injured and nature of injuries?<br>– Number of people possibly trapped in vehicle?<br>– Vehicle positions (upright /on side / on roof)?<br>– Any hazardous materials or dangerous goods involved.<br>– Any signs of smoke or fire?<br>– Any concerns with oncoming traffic impacting the scene?<br>– Are vehicles in contact with electrical services or oil and gas infrastructure?<br>  **NOTE:** If vehicle is in contact with power lines stay clear of vehicle and tell vehicle occupants to stay in vehicle. |
| 2. | + Provide first aid where possible to do so.<br>  **NOTE:** If providing first aid to personnel in vehicle. Be aware of un-activated air bags. |
| 3. | + Do not attempt to remove causalities from vehicles unless other dangers are present which may endanger life if they were not removed. |
| 4. | + Make vehicle safe where possible to do so:<br>– Switch off vehicle ignition/isolate power.<br>– Lower hydraulic equipment (e.g., raised buckets/lifting platforms etc.).<br>– Cover any spilt petrol/diesel with sand. |

Considerations by On Scene Commander:

| Step | Information |
|---|---|
| 1. | + Proceed to scene, assess the situation, and render assistance to vehicle occupants (hazard assessment/response options) including consideration of:<br>– Establish traffic management to protect from oncoming traffic.<br>– Ensure vehicle is stable.<br>– Dangerous goods carried by the vehicle (e.g., fuel, explosives).<br>– Location hazards.<br>– Damage to buildings/equipment from accident (structural damage). |
| 2. | + Establish forward command post.<br>+ Establish staging area for the receipt of emergency response equipment and personnel.<br>+ Potentially establish a helicopter landing zone.<br><br>**NOTE:** In the Cooper Basin, emergency support will be provided by Emergency Services Officers with specialist extraction equipment. Depending on location of vehicle accident, this equipment and Emergency Services Officers may need to access the location by Helicopter.<br><br>**NOTE:** In CSG, emergency support will be provided by State Emergency Services including Police and Fire Services. |

## Well Control

Refer to the emergency response plan Appendix for Drilling and Completions which covers Well Control.

+ All personnel, upon identification of a well control issue, immediately:
  – Evacuate to a safe location.
  – Raise the alarm.

# 6. Santos Emergency Points – CSG Queensland

## 6.1 Santos Emergency points

### Santos Emergency Points

Santos Emergency Points, predetermined meeting locations in CSG Queensland. These points have been communicated to Queensland Emergency Services and may be used when requesting emergency assistance.

**NOTE:** Always know the nearest major crossroad when contacting emergency services. There have been instances where emergency services have not understood or been able to locate the Santos Emergency Points.

Not all Santos Emergency Points are signed within CSG.

Refer to the site-specific appendix or ERN for localised Santos Emergency Points.

### WebGIS

WebGIS contains the most up-to-date list of Santos Emergency Points.

### Number and GPS Coordinates

| SEP Number and GPS Coordinates | Closest Emergency Services |
|---|---|
| Santos Emergency Point 1<br>25 ° 37 ' 23.79" S<br>148 ° 52 ' 23.71" E | • Police – Roma / Injune<br>• Ambulance – Roma / Injune<br>• QFRS – Roma / Injune |
| Santos Emergency Point 2<br>25 ° 45 ' 53.25" S<br>148 ° 55 ' 49.34" E | • Police – Roma / Injune<br>• Ambulance – Roma / Injune<br>• QFRS – Roma / Injune |
| Santos Emergency Point 3<br>25 ° 48 ' 55.66" S<br>148 ° 55 ' 12.31" E | • Police - Roma<br>• Ambulance - Roma<br>• QFRS - Roma |
| Santos Emergency Point 4<br>25 ° 39 ' 24.45" S<br>148 ° 41 ' 6.91" E | • Police - Roma<br>• Ambulance - Roma<br>• QFRS - Roma |
| Santos Emergency Point 5<br>25 ° 32 ' 45.4" S<br>148 ° 41 ' 45.97" E | • Police - Roma<br>• Ambulance - Roma<br>• QFRS - Roma |
| Santos Emergency Point 6<br>25 ° 46 ' 48.3" S<br>149 ° 7 ' 25.62" E | • Police - Roma<br>• Ambulance - Roma<br>• QFRS - Roma |
| Santos Emergency Point 7<br>25 ° 17 ' 9.39" S<br>148 ° 39 ' 47.92" E | • Police - Roma<br>• Ambulance - Roma<br>• QFRS - Roma |
| Santos Emergency Point 8<br>25 ° 56 ' 38.12" S<br>150 ° 4 ' 19.41" E | • Police - Wandoan<br>• Ambulance - Wandoan<br>• QFRS - Wandoan |
| Santos Emergency Point 9<br>26 ° 41 ' 9.87" S<br>149 ° 11 ' 14.49" E | • Police – Roma / Wallumbilla<br>• Ambulance - Roma<br>• QFRS – Roma / Wallumbilla |
| Santos Emergency Point 10<br>25 ° 15 ' 16.7" S<br>148 ° 49 ' 18.35" E | • Police - Injune<br>• Ambulance - Injune<br>• QFRS - Injune |
| Santos Emergency Point 11<br>25 ° 4 ' 24.45" S<br>148 ° 58 ' 57.54" E | • Police - Injune<br>• Ambulance - Injune<br>• QFRS - Injune |
| Santos Emergency Point 12<br>26 ° 32 ' 39.89" S<br>148 ° 53 ' 17.35" E | • Police - Roma<br>• Ambulance - Roma<br>• QFRS - Roma |
| Santos Emergency Point 13<br>26 ° 26 ' 8.52" S<br>148 ° 59 ' 56.76" E | • Police – Roma / Wallumbilla<br>• Ambulance – Roma / Wallumbilla<br>• QFRS – Roma / Wallumbilla |