Appendices

Appendix 1 Flood Modelling

SURFACE WATER ASSESSMENT – CP 2020 GAS WELL EXPLORATION PROJECT

Flood Impact Assessment

Prepared for:

Enviro-Value Pty Ltd
110 Camp Street
TOOWONG QLD 4066

SLR Ref: 620.13770-R01
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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Enviro-Value Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

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1 Introduction

Central Petroleum has requested a Flood Impact Assessment (FIA) to be carried out for 7 sites in the 2020 well exploration project. The sites assessed were Dingo 5, Orange 1, Palm Valley 12, Mereenie West 27 & 28, the Mereenie West camp site and Mamlambo 1. The site locations are shown in **Figure 1**.

A flood impact assessment is required to determine the suitability of the site to minimise interference with wet season water flow paths and areas of inundation. Due to the variance in data available for each site, a range of methodologies have been used to determine the extent of flooding due to major overland flow paths and/or floodplain flooding from creeks, rivers or broad floodplain areas.

The FIA was prepared by SLR consulting Pty Ltd on behalf of EnviroValue Pty Ltd and Central Petroleum to support an Environmental Management Plan (EMP) for the proposed 2020 exploration drill program to meet the requirements of the *Code of Practice: Onshore Petroleum Activities in the Northern Territory.*

1.1 Report limitations

This Flood Impact Assessment has relied upon information which was received from the client and other sources and has been assumed to be accurate. Except where noted, no verification of accuracy of the information has been carried out. In the event that some of the information which was relied upon for this assessment is found to be inaccurate, then some or all of the findings may change.

Although this report has been undertaken with the usual care and professionalism, it shall only be used for the purposes intended. This report has been prepared for the assessment of site suitability for the proposed well pad infrastructure.

The source of terrain data for these assessments has varied for each site. For those sites where SRTM data has been relied upon, it is important to note that the data has a vertical accuracy of +/-7m and furthermore, the definition of small waterways and flow paths is not represented in the SRTM data nor the associated hydraulic modelling. Where this is the case, engineering judgement and 1D calculations have been carried out to supplement and further assess the accuracy of the hydraulic modelling. This has been noted at relevant points throughout the report.

This report should be read in full and no excerpts are to be taken as representative of the findings. This report has been prepared on behalf of EnviroValue Pty Ltd and Central Petroleum and SLR accept no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

-1800000
-1700000
-1600000
-1500000
7300000
7200000
7100000
Elkhi Creek
Waite Creek
Alice Springs
Orange 3
87
Palm Valley 12
Dingo 5
Mamlambo 1
West Mereenie 27
West Mereenie 28
Hugh Creek
Finke River
Lake Neale

CENTRAL PETROLEUM
2020 EXPLORATION PROJECT

Flood Impact Assessment
Site Locations

FIGURE 1

Indicative Well Pad Location

0 25 50 km

Coordinate System:	GDA 1994 MGA Zone 56
Scale:	1:1,250,000 at A4
Project Number:	620.13770
Date:	5/05/2020
Drawn by:	PM

SLR

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2 Site Description

2.1 Orange 1

Orange 1site is located 40km south west of Alice Springs, located between the Stuart Highway and Maryvale Road. The project site has a direct upper catchment of 2.1km^2, however due to breakouts during large rainfall areas, the contributing catchment can increase to a total area of 14.7km^2. Overland flow originating from the site discharges to the east to a major tributary of the Hugh River. The catchment is sparsely vegetated with native acacia and spinifex and has an average slope of 0.75%. Catchment delineation is shown in **Figure 2**.

2.2 Dingo 5

Dingo 5 site is located 58km south of Alice Springs. The project site and associated upper catchment has a total area of 11.7km^2. Overland flow originating from the site discharges westwards to a major tributary of the Hugh River. The catchment is sparsely vegetated with native acacia and spinifex and has an average slope of 1%. Typical landform and catchment delineation are shown respectively in **Photo 1** and **Figure 3**.

Photo 1 Typical landform at Dingo 5 site.

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Orange 1
Subcatchments

FIGURE 2

- Indicative Well Pad
- Ecology Clearance Area
- SRTM 5m Contour
- Sub-catchments (km2)

SRTM Terrain

Value

High : 638.764

Low : 546.428

47.5
1.6
0.8
2.1
1.2
9.0

0 100 200 400 600 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:45,000 at A4
Project Number:	620.13770
Date:	21-Aug-2020
Drawn by:	PM

SLR

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

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385000 386000 387000 388000 389000 390000

7322000 7321000 7320000 7319000

219 212 214 228 223 226 233 243 237 441 398 249 447 250 253 254 550 257 260 545 265 258 451 378 665 581 585 456 500 270 267 532 475 272 505 318 282 489 319 286 287 329 312 302 304 305 309 315 316 321 334

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

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Dingo 5
Sub-catchments

FIGURE 3

- Indicative Well Pad
- Ecology Clearance Areas
- Subcatchments (km2)
- 2m Contours (SRTM)

Value
High : 571
Low : 528

0 200 400 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:16,000 at A4
Project Number:	620.13770
Date:	21-Aug-2020
Drawn by:	PM

SLR

2.3 Palm Valley 12

Palm Valley 12 project site is located 6.5km southwest of Hermannsburg. The site is located along a rock sandstone outcrop north of the Finke Gorge National Park. The project site has a limited upstream catchment due to the project being located along a ridge line. Overland flow originating from the site discharges to the north into a series of channels which connect to the Finke River. The catchment is vegetated with native acacia and spinifex and has an average slope of 4%. Typical landform and catchment delineation are shown respectively in **Photo 1** and **Figure 4**.

Photo 2 Typical landform at Palm Valley 12 site.

CENTRAL PETROLEUM
2020 EXPLORATION PROJECT

Flood Impact Assessment
Palm Valley 12
Sub-catchments

FIGURE 4

- Indicative Well Pad
- Ecology Clearance Area
- Subcatchment
- 1m Contours (SRTM)

Elevation (mAHD)
- High : 859.794
- Low : 759.73

0 25 50 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:2,500 at A4
Project Number:	620.13770
Date:	21-Aug-2020
Drawn by:	PM

SLR

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2.4 Mereenie West 27

Mereenie West 27 site is located 250km south west of Alice Springs and 15km west of Mereenie Airport. The project site and associated upper catchment has a limited total area of 0.35km^2, as the project is located along a small ridgeline with sand dunes to the east. Typical landform and catchment delineation are shown respectively in **Photo 3** and **Figure 5**.

The well pad is located at the top of the catchment along a ridgeline. Direct rainfall discharges to the south-west boundary.

Photo 3 Typical landform at Mereenie West 27 site.

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Mereenie West 27
Subcatchments

FIGURE 5

- Indicative Well Pad
- Proposed Clearance Areas
- Subcatchments (km2)

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:4,000 at A4
Project Number:	620.13770
Date:	14-Oct-2020
Drawn by:	NB

0 25 50 100 m

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

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2.5 Mereenie West 28

Mereenie West 28 site is located 240km south west of Alice Springs and 2.5km south west of Mereenie West Airport. The project site and associated upper catchment has a limited total area of 0.2km^2, as the project is located north of a ridgeline. Overland flow originating from the site and surrounding catchments discharges north towards the flat wetland area which discharges into the upper reaches of Walker Creek. The catchment is sparsely vegetated with native acacia and spinifex and has an average slope of 1.3%. Catchment delineation is shown in **Figure 6**.

2.6 Mamlambo 1

Mamlambo 1 site is located 395km west of Alice Springs and 100km east of Lake Macdonald. The project site and associated upper catchment has a total area of 1km^2, as the project is located north on a steep outcrop. The site is also located on an expansive floodplain with a total catchment area of 12,500 km^2. The catchment originates 200km east of the site and is approximately 40km wide, however this reduces to less than 20km in width in the vicinity of the Mamlambo 1 project site, indicating a potential flood risk from this catchment. The catchment is predominately spinifex grassland. The floodplain has a slope of 0.05% and the upper catchment of the project site has an average slope of 1.8%. Catchment delineation is shown in **Figure 7**.

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Mereenie West 28
Sub-catchments

FIGURE 6

- Indicative Well Pad
- Ecology Clearance Area
- Subcatchments (km2)
- 1m Contours (LiDAR)
- 1m Contours (SRTM)

Elevation (mAHD)
804
766

0 50 100 150 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:5,500 at A4
Project Number:	620.13770
Date:	21-Aug-2020
Drawn by:	PM

SLR

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

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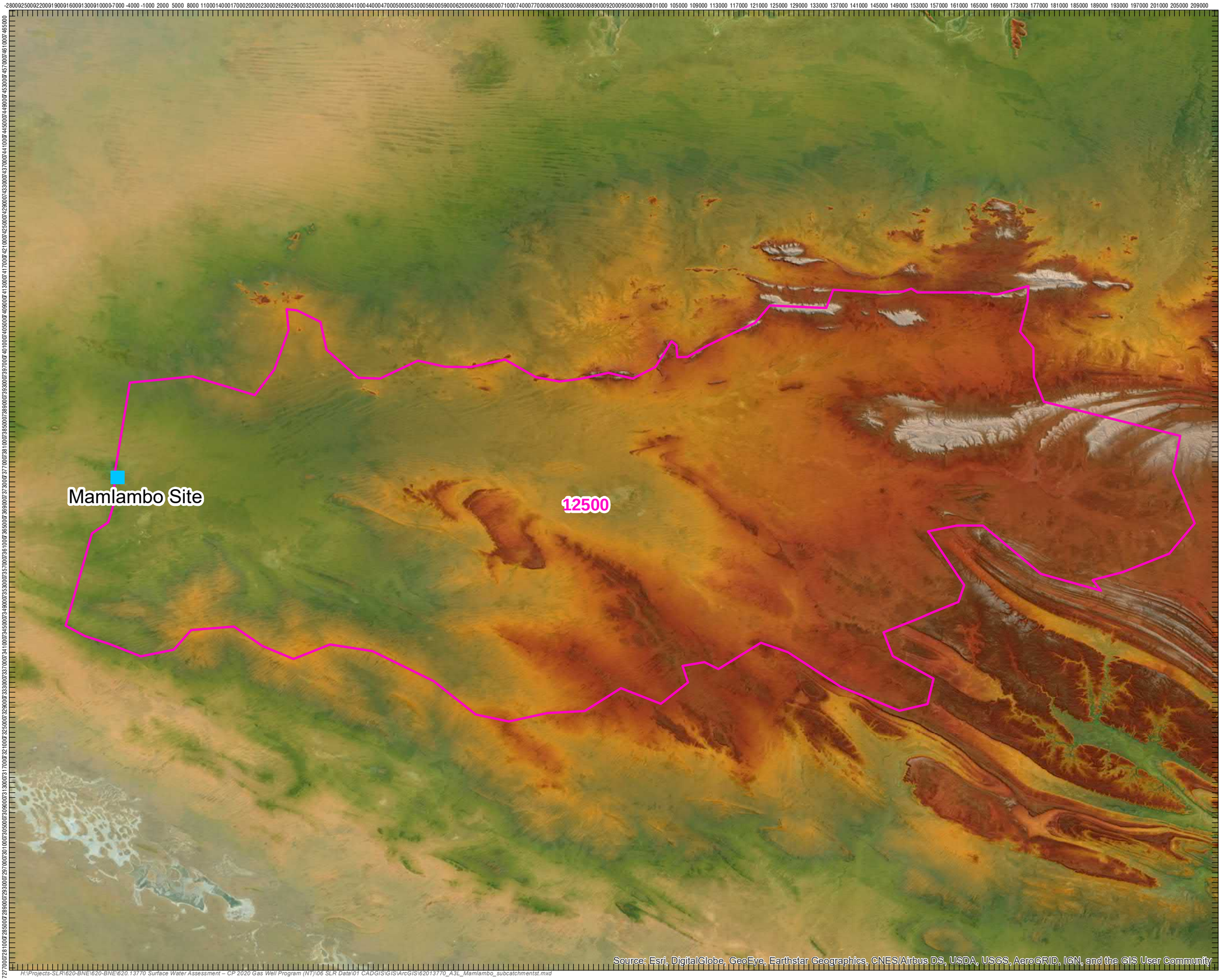

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Mamlambo
Catchment

FIGURE NUMBER

Catchment (km2)

Elevation (mAHD)
High : 1387.48
Low : 438.76

DISCLAIMER: All information within this document may be based on external sources.
SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.

200 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:682,000 at A4
Project Number:	620.13770
Date:	5/05/2020
Drawn by:	PM

SLR

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3 Hydrology

3.1 Methodology

A high-level hydrologic assessment was undertaken in order to estimate design discharges for a range of design storm events for the catchments in the vicinity of each site. All sites are located within an arid/semi-arid zone which prevented the application of Australian Rainfall and Runoff 2019 generated design storm losses to be applied to all sites. Furthermore, in line with best practice approaches, any hydrologic model development should be calibrated to available streamflow gauges to determine the appropriate rainfall losses due to infiltration. No flood gauges exist within the catchments containing the sites, which prevented the development of a hydrologic model which was reflective of the rainfall runoff behaviour at each site.

Therefore, a flood frequency analysis (FFA) was conducted on the suitable nearby gauged waterways with similar catchment characteristics to those of the catchments contributing to the sites. Peak flows for a range of design storm events for the site catchments were then estimated based on the ratio of discharge to catchment area of the FFA catchments. It is considered that this approach provides a more appropriate estimation of the peak runoff rate.

Details of the inputs, methodology and results of the assessment are provided below.

3.2 Data

3.2.1 Flood Gauge Data

Locations and data for stream flow gauges were accessed via the Department of Environment and Natural Resources (DENR) Water Data Web Portal and Natural Resource Maps.

No stream flow gauges exist within the catchments containing the project sites. Several gauges with historical recorded flow data are located on various watercourses in the vicinity of the Orange 1and Dingo 5 sites, with headwaters originating from the MacDonnell Ranges. The catchments of these gauges are, to a varying degree, characteristically consistent with those of the project sites with respect to key hydrologic factors including design rainfall Intensity-Frequency-Duration (IFD), imperviousness, slope and rainfall losses. The gauges were assessed as potential subjects of an FFA, as detailed in **Table 1.**

Table 1 DENR Stream Flow Gauge Information

Gauge ID	Gauge Name	Period of Record	Comments	FFA Status
G0050115	**Hugh River - S Road Xng**	**1972-2020**	**Adequate data record including numerous large flood events and extremely large recorded flows.**	**Adopted for FFA**
G0050116	Finke River - S Road Xng	2004-2020	Insufficient record period.	not used
G0050117	Palmer River - S Road Xng	2002-2020	Insufficient record period.	not used
G0050140	Finke River - Railway Bridge	2009-2020	Insufficient record period.	not used

Gauge ID	Gauge Name	Period of Record	Comments	FFA Status
G0060005	**Trephina Creek - Trephina Gorge**	**1973-2020**	**Lengthy data record and representative catchment conditions. 75 km from Orange 1project site catchment.**	**Adopted for FFA**
G0060008	Roe Creek - S Road Xng	1967-2020	Lengthy data record however data is missing records.	not used - better options exist
G0060009	Todd River - Anzac Oval	1972-2020	Lengthy data record with good quality however catchment includes urban area of Alice Springs.	not used - better options exist
G0060015	Station Creek - Bond Springs 2	1978-2015	Poor data quality.	not used
G0060017	Emily Creek - US Undoolya Road	1981-2019	Poor data quality.	not used
G0060040	Todd River - Amoonguna	1986-2020	Poor data quality.	not used
G0060041	Todd River - Rocky Hill	1978-2020	Poor data quality.	not used
G0060046	**Todd River - Wigley Gorge**	**1962-2020**	**Longest and high quality data record, with representative catchment conditions. Located 35 km from Orange 1project site catchment.**	**Adopted for FFA**
G0060047	Charles River - Big Dipper	1972-2020	Poor data quality	not used
G0060126	Todd River - Heavitree Gap	1973-2020	Adequate data record and quality, however includes all of Alice Spring urban area therefore not representative of project site catchments.	not used
G0280004	Allungra Creek - Allungra W Hole	1996-2020	Insufficient record period.	not used
G0280010	Woodforde River - Arden Soak	1974-2020	Data record and quality adequate, however, located 185 km from nearest project site catchment and drains to north of MacDonnell ranges.	not used - better options exist

3.2.2 Topographic Data

Limited topographic data was available for the catchments encompassing the study areas. 1 second SRTM Derived Hydrological Digital Elevation Model data was sourced from Geoscience Australia as the best available topographic data for catchment delineation. SRTM data provides an elevation data point at approximately 30 metre spacing and provides vertical accuracy of +/- 7 metres.

1m LiDAR (2012) was available from Central Petroleum for the Mereenie West 27, Mereenie West 28 and the associated camp sites. This data has a significantly higher resolution than the SRTM data. Metadata including horizontal and vertical accuracy of the data was not provided.

3.2.3 Aerial Photography

Aerial photography was provided by Central Petroleum for the Mereenie West sites. For all other sites, aerials were viewed using ArcGIS Base Maps. This information was used to determine likely Manning's n values and any visible drainage paths which may not have been represented by SRTM data.

3.2.4 Catchment Delineation

The sub-area catchments were delineated based on the ground levels of the LiDAR supplied by Central Petroleum and SRTM extracted from Geoscience Australia Elevation and Depth – Foundation Spatial Data website.

Catchment areas were delineated based on the clearance areas and well locations being the focal point of the assessment. Catchment delineation for each site is shown in **Figure 2** to **Figure 7**.

3.3 Flood Frequency Analysis (FFA)

A FFA was carried out for the selected gauges in **Table 1** using FLIKE software. A Log-Pearson Distribution III was fitted to data in order to extrapolate an expected peak discharge from the catchment for a range of annual exceedance probabilities.

The results of the gauge analysis are presented below in **Figure 8** to **Figure 10**.

Figure 8 Todd River FFA

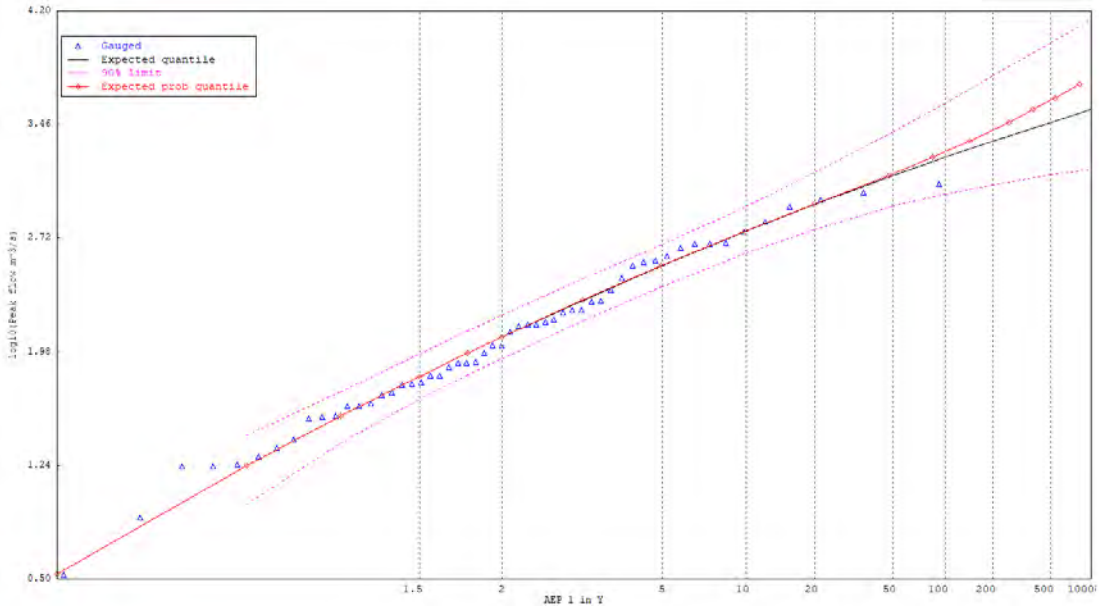


Figure 9 Hugh River FFA

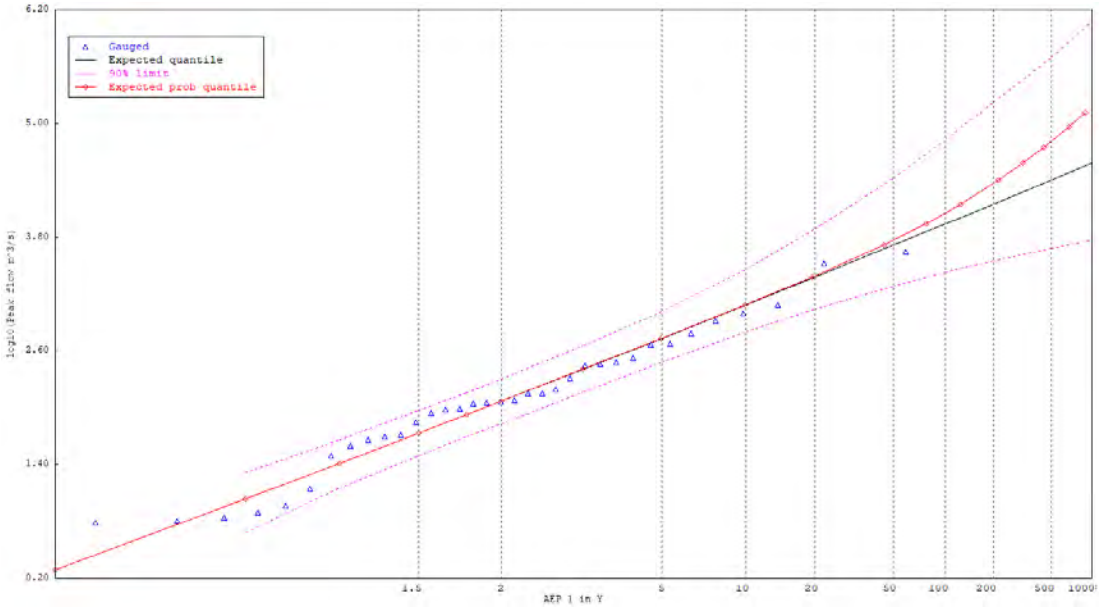
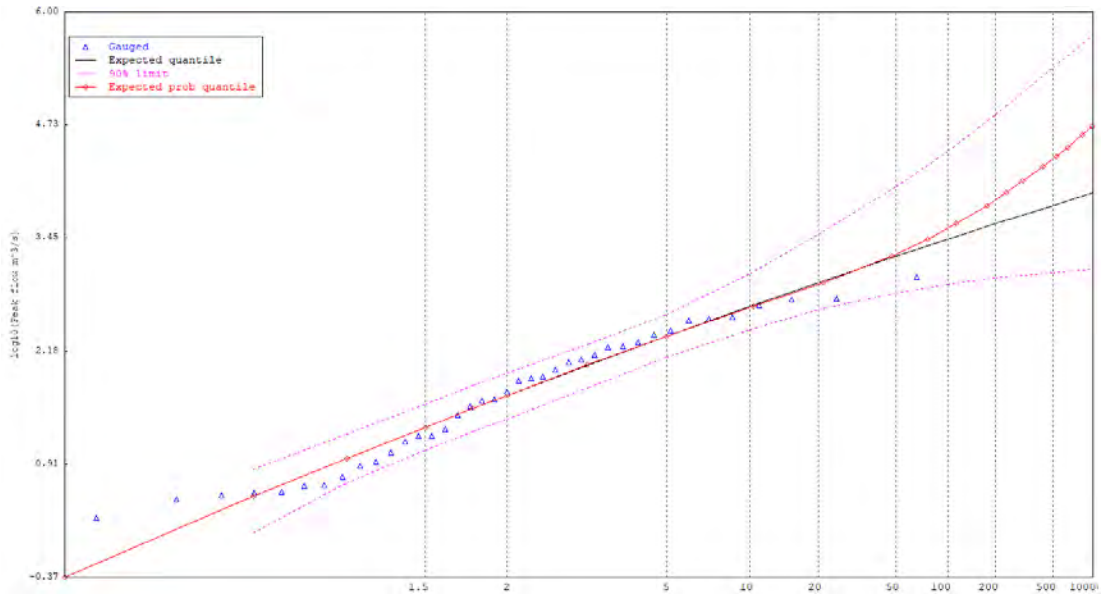


Figure 10 Trephina Creek FFA



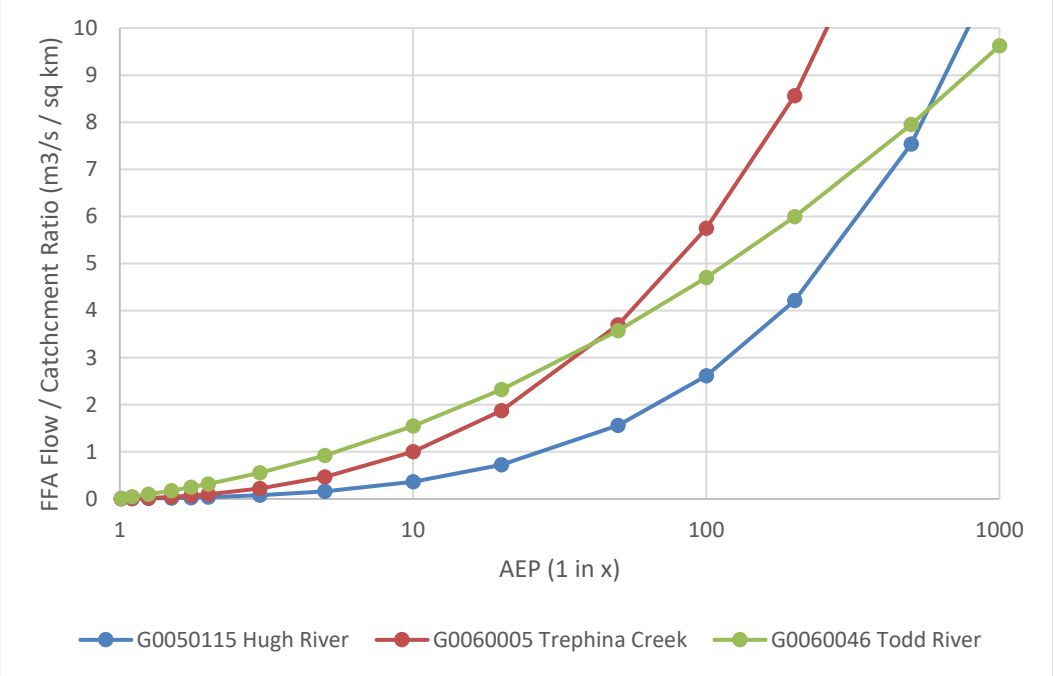
Both the Todd River and Hugh River gauge provided gauge recording for two rare events. The Todd River gauge was selected as the gauge to determine scaled inflows for all sites except Mamlambo 1 as it:

- provided the better data fit between the expected peak quantile regression curve and the recorded data;
- had recorded the rarest event;
- provided a more consistent increase in flows as AEP increased; and
- had a catchment size more aligned with the catchment areas in this study.

The Hugh River FFA was selected as being more appropriate for Mamlambo 1 due to the size of the gauged catchment. The Todd River has a catchment size in the order of 300km^2, however the Hugh River has an upstream catchment of 3300km^2. It is considered more appropriate to scale the inflows from the larger catchment which is more reflective of the infiltration losses which occur over a large catchment.

To apply the peak estimated discharges from the FFA to each site, the estimated flows required scaling to the respective catchment's areas. To do this, the peak flow (m^3/s) was divided by the catchment area to obtain a flow per square kilometre for each AEP. **Figure 11** shows the respective peak flows per km^2.

Figure 11 FFA to Flow Catchment Area Ration Comparison



Using the FFA flow to catchment area ratios, the peak flow estimates for all AEPs were derived for each sub-catchment for each site. These are presented in **Appendix A**.

The derived 1% AEP and 0.1% AEP flows for each sub catchment were used as inflows in the hydraulic modelling carried out for Dingo 5, Orange, Mereenie West 27 and 28 and for the manual 1D calculations carried out for Mamlambo 1.

4 Hydraulics

4.1 Software

A 1D-2D hydrodynamic model was developed for this project using the software package TUFLOW (Build 2020-01-AA). The TUFLOW Heavily Parallelised Compute (HPC) version was adopted in this assessment to achieve acceptable run times.

4.2 Data

4.2.1 Topography and Survey

The topography used in the hydraulic model was from either 2012 1m LiDAR supplied by the Central Petroleum or SRTM data available from Geoscience Australia.

4.2.2 Hydraulic Roughness

The hydraulic roughness adopted in the hydraulic model was defined using Google's aerial photography. The Manning's n value was calculated using the Modified Cowan method for channel and floodplain roughness. A roughness value of between 0.025 and 0.04 was used in the hydraulic models as the land type throughout was uniform.

4.2.3 Structures and landform alterations

No hydraulic structures or manual changes to landform occurred in any of the hydraulic models.

4.2.4 Boundaries

Inflows to the hydraulic model were schematised as local Source Area inflow polygons, placed at appropriate locations within the sub-catchments of the study area. Steady state peak discharge flows derived from the FFA analysis was applied as the inflow for the Source Area polygon corresponding to each sub-catchment.

The model's downstream boundaries were set as HQ (level flow) relationships, based on slope. It was determined that tailwater effects were unlikely to impact on the area of interest for each hydraulic model.

4.3 Hydraulic Model Results

4.3.1 Orange

4.3.1.1 Existing Flood Behaviour

The hydraulic model results (**Figure 12**) show that the well infrastructure areas are affected by flood depths of up to 100mm for the 1% AEP flood event. Although these depths are not substantial, the flood depths are generated by channels becoming less defined in the upper reaches and allowing flows to "sheet flow" and inundate the well infrastructure from the east and west.

The accuracy of the SRTM terrain data may have resulted in the capacity of the overland flow channels being under-estimated in the hydraulic model, resulting in sheet flow affecting the well pad area. From the available survey data, the site is located within an area of depressed terrain, resulting in any flow which cannot be contained within the adjacent overland flow paths being directed towards the infrastructure area.

One-dimensional calculations of the overland flow channels showed that assuming a waterway channel with a 5m wide base and 1 in 4 side slopes, the estimated catchment discharge for the 1% AEP event would result in a flow depth of 0.3m. This is reflective of the flood depth shown in the hydraulic model.

4.3.1.2 Orange 1 Flood Mitigation

Due to the risk that overland flow path channels may not be uniform and defined, as well as the infrastructure site being located in a depressed landform, it is considered appropriate that a 300mm water diversion bund be constructed on the north, east and western site boundaries to prevent inundation of the site. The proposed bunds are shown in **Figure 13**.

up to 300mm bund required to divert flows around pad.

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

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Orange 1
Hydraulic Results

FIGURE 12

- Indicative Well Pad
- Ecology Clearance Area
- Flood Bund
- Model Boundary
- SRTM 5m Contours

100y ARI Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

0 100 200 400 600 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:18,000 at A4
Project Number:	620.13770
Date:	21-Aug-2020
Drawn by:	PM

SLR

376000 376100 376200 376300 376400 376500 376600 376700 376800

7340200 7340100 7340000 7339900 7339800 7339700 7339600

580 580 579 578 577 576 575 574 573 572 571

Bund Max. Height = 300mm

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

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Orange 1
Hydraulic Model Results

FIGURE 13

- Indicative Well Pad
- Ecology Clearance Area
- 1m Contour (SRTM)
- Flood Bund
- Model Boundary

100y ARI Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

0 50 100 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:2,500 at A4
Project Number:	620.13770
Date:	21-Aug-2020
Drawn by:	PM

SLR

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4.3.2 Dingo 5

4.3.2.1 Existing Flood Behaviour

The hydraulic model results (**Figure 14** and **Figure 15**) show that the well infrastructure areas are not affected by the 1% AEP flood event. Overland flow from the upper catchment is directed to the north and south of the site due to a ridge located to the east of the well pad infrastructure.

4.3.2.2 Flood Mitigation

No flood mitigation is required. Some runoff from the ridge to the east may affect the well infrastructure, this will be managed through appropriate erosion and sediment control measures.

4.3.3 Palm Valley 12

4.3.3.1 Existing Flood Behaviour

The Palm Valley 12 site is located along a ridge line. As all overland flow paths are directed away from the site, as well as there being no impact from adjacent river flows, the site is considered to be unaffected by flooding.

4.3.3.2 Flood Mitigation

No Flood mitigation is required. Some runoff from the ridge to the west may affect the well infrastructure area and this will be managed through appropriate erosion and sediment control measures.

4.3.4 Mereenie West 27

4.3.4.1 Existing Flood Behaviour

The Mereenie 27 sites are located along a ridge line. As all overland flow paths are directed away from the site, as well as there being no impact from adjacent river flows, the site is considered to be unaffected by flooding.

4.3.4.2 Flood Mitigation

No Flood mitigation is required. Some runoff from the ridge to the west may affect the well infrastructure area and this will be managed through appropriate erosion and sediment control measures.

385000 386000 387000 388000 389000 390000

7322000 7321000 7320000 7319000

219 212 214 228 226 233 243 237 250 398 249 441 253 550 270 254 260 257 258 665 265 581 451 585 545 378 500 447 267 456 532 272 318 505 475 282 319 286 287 489 329 312 304 302 307 309 315 316 321 327 334 340

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

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Dingo 5
Hydraulic Model Results

FIGURE 1

- Indicative Well Pad
- Ecology Clearance Area
- 2m Contours (SRTM)
- Model Boundary

100y ARI Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

0 200 400 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:15,000 at A4
Project Number:	620.13770
Date:	21-Aug-2020
Drawn by:	PM

SLR

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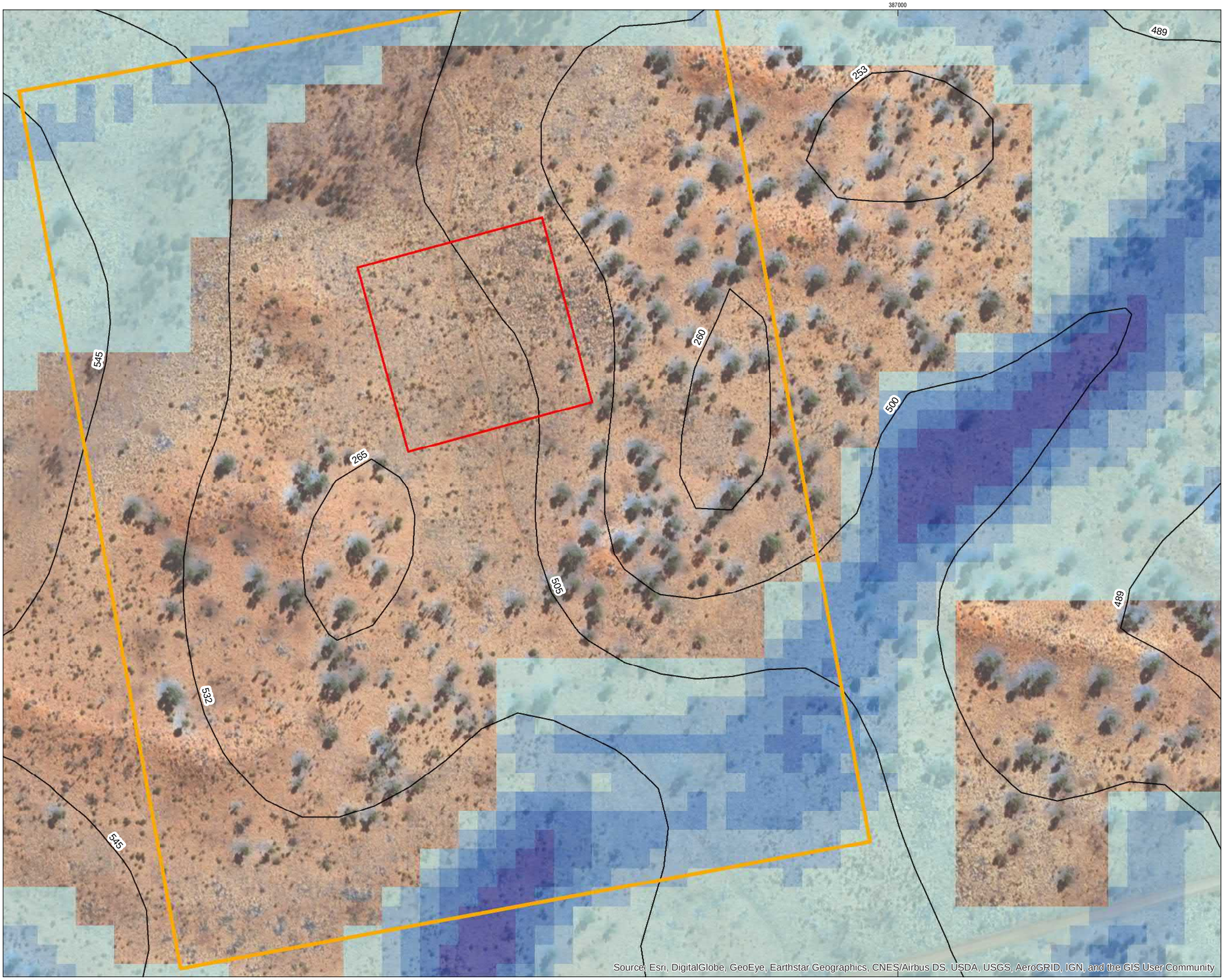

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Dingo 5
Hydraulic Model Results

FIGURE 15

- Indicative Well Pad
- Ecology Clearance Area
- 2m Contours (SRTM)
- Model Boundary

100y ARI Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

0 25 50 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:2,700 at A4
Project Number:	620.13770
Date:	21-Aug-2020
Drawn by:	PM

SLR

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4.3.5 Mereenie West 28

4.3.5.1 Existing Flood Behaviour

The Mereenie West 28 well pad is located at the confluence of two overland flow paths, as shown on **Figure 16** and **Figure 17**. The flow path which enters the well pad from the south is a result of a ridge deflecting flows towards the site. The flow path from the west has a broad base, resulting in low depth (less than 100mm in the 1% AEP event) inundation of the site.

A large storage area is located to the east of the well pad, with depths increasing to over 500mm before flowing north towards the upper tributaries of Walker Creek.

4.3.5.2 Flood Mitigation

To prevent inundation of the well pad, the following works are required.

- diversion of the overland flow path which enters the site from the south; and
- A diversion bund around the north western corner.

Confirmation of the extent of the bunding will be required as part of the civil design of the well pad earthworks.

4.3.6 Mamlambo 1

4.3.6.1 Existing Flood Behaviour

The Mamlambo 1 site is located within an expansive floodplain which convey flows to the Macdonald Lake during very rare flood events. Due to the significant 12,500km^2 catchment, a conservative approach of using the Hugh River FFA to develop a scaled catchment flow of 32,000m^3/s for the 1% AEP was considered for this site. Furthermore, based on the SRTM terrain, there is a flow path adjacent to the site which travels east-west as well as a flow path that travels north-south. Not taking into account any interaction or possible splitting of flows between the two paths, the total flow was used to carry out one-dimensional calculations to determine a likely flood depth for each flow path in the vicinity of the site.

The two channel locations and cross sections are shown below in **Figure 18** and **Figure 19**. A full breakdown of the one-dimensional calculations are shown in Appendix B.

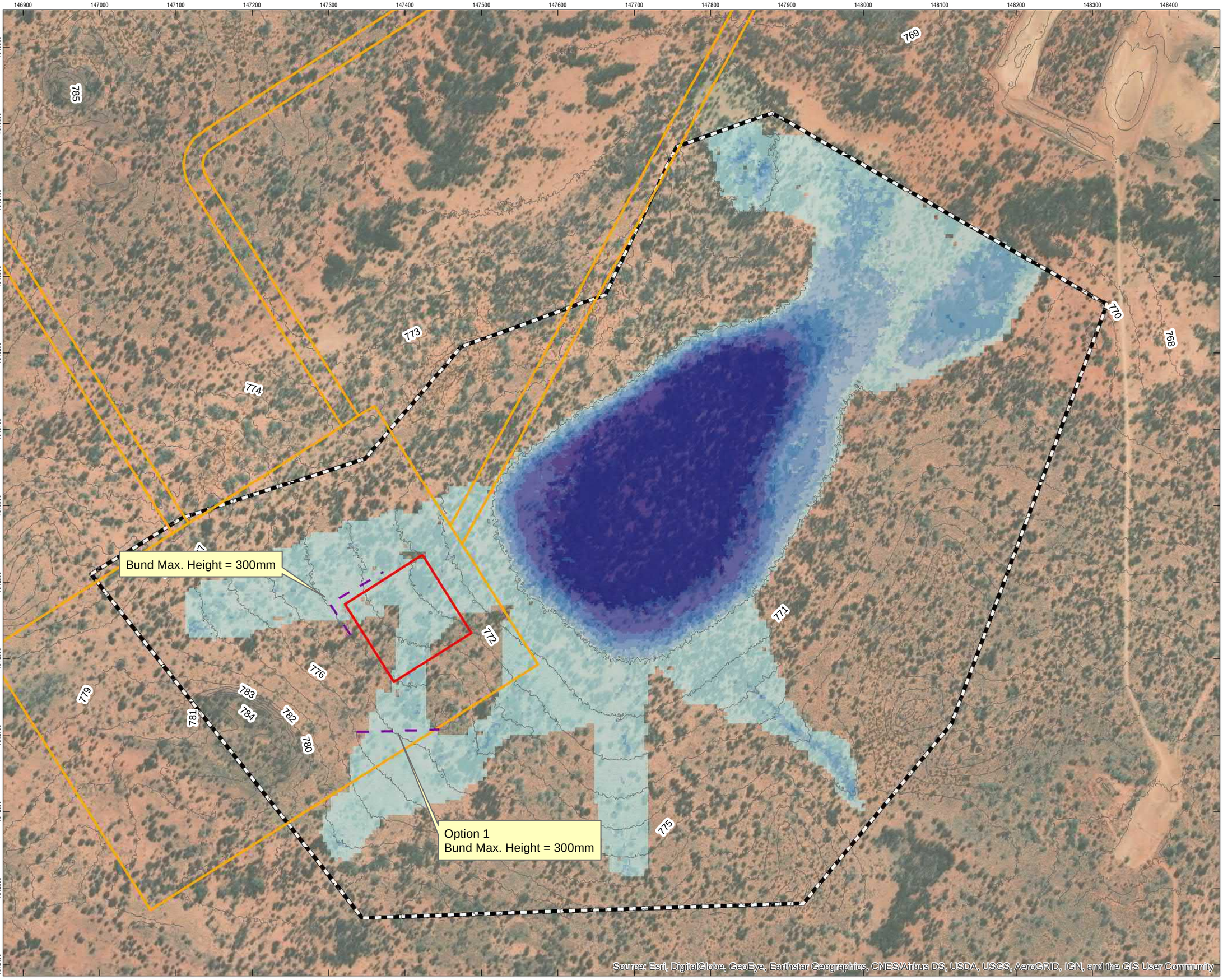
The calculations for the north-south flow path produces the greatest flood level as it is more confined. The 1% AEP flood produces a depth of 2.54m across the floodplain to an estimated level of 553.32m AHD (based on STRM terrain). The well pad is proposed at 557m AHD.

Furthermore, as a sensitivity, the roughness of the channel was doubled which resulted in an increased flood level of 553.32 mAHD. As there is a significant and ever-increasing floodplain volume available for each incremental increase in flood depth, it is considered unlikely that the well pad would be affected in rare flood events such as the 1% AEP event.

The estimated flood extent is shown in **Figure 20**.

4.3.6.2 Flood Mitigation

No Flood mitigation is required. Some runoff from the ridge to the west may affect the well infrastructure area and this will be managed through appropriate erosion and sediment control measures.



CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Mereenie West 28
Hydraulic Model Results

FIGURE 18

- Indicative Well Pad
- Ecology Clearance Area
- 1m Contours (LiDAR)
- Flood Bunds
- Model Boundary

100y ARI Flood Depth (m)

- < 0.1
- 0.1 - 0.2
- 0.2 - 0.3
- 0.3 - 0.4
- 0.4 - 0.5
- > 0.5

0 50 100 150 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:4,500 at A4
Project Number:	620.13770
Date:	21-Aug-2020
Drawn by:	PM

SLR

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Figure 18 East-West Channel

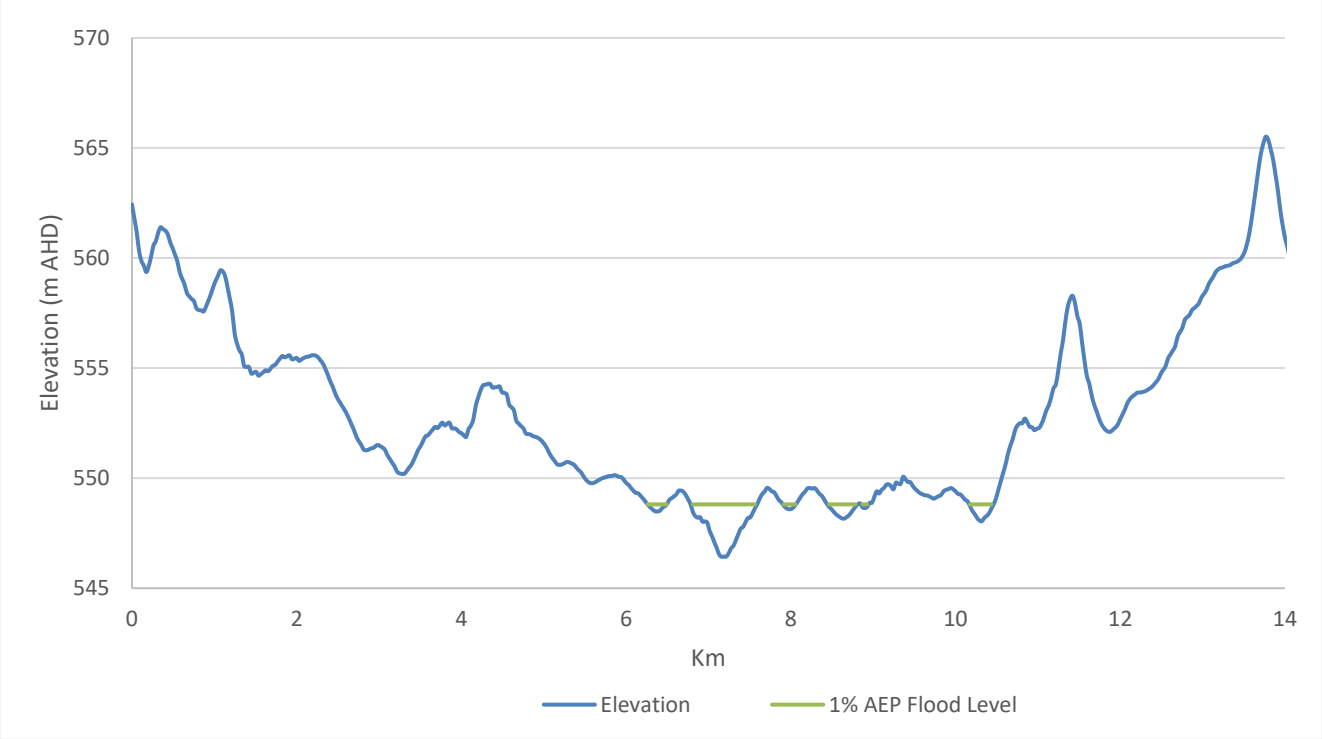
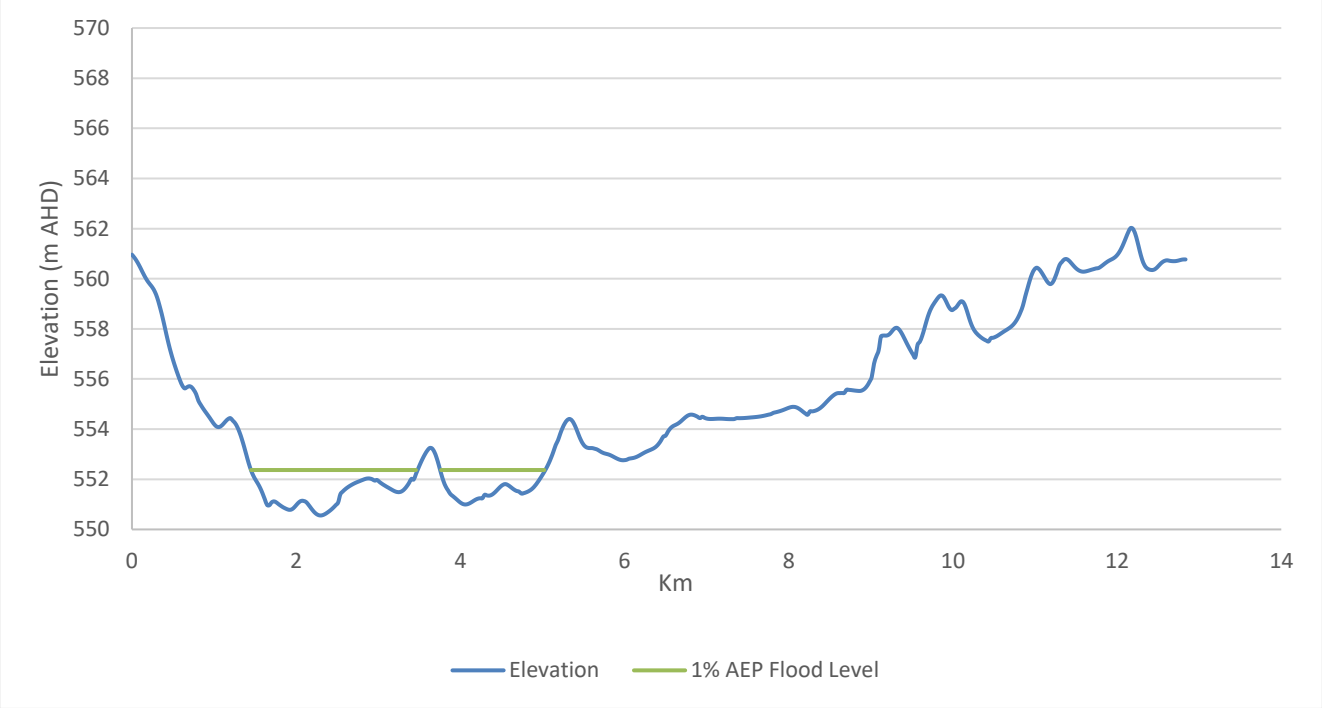


Figure 19 North-South Channel with estimated 1% AEP flood level.



-7000

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7375000

7374000

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Flood Impact Assessment
Mamlambo 1
Estimated Flood Extent- Well Pad

FIGURE 22

- Indicative well pad
- Ecology Clearance Area
- 100yr ARI Estimated Flood Extent
- Contour (SRTM)

0 100 200 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:7,669 at A4
Project Number:	620.13770
Date:	21-Aug-2020
Drawn by:	PM

SLR

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5 Conclusion

A hydraulic analysis was carried out for the proposed well sites. The estimated catchment runoff was determined by a flood frequency analysis and then scaled to each sub-catchment area.

A hydraulic model was used to estimate the flood extents for the 1% AEP flood event. Where there was limited survey data, one-dimensional calculations have been carried out to further understand the flood behaviour and likelihood of inundation to affect the well pad area.

For all sites the flood impact (with respect to depths) was minimal, however mitigation works have been identified where needed to prevent inundation of the well pad. Furthermore, impacts should be re-assessed post civil design of the well pads for sites where earthworks encroach on the modelled flood extent.

6 Compliance Summary

The following summary is provided in regard to the compliance of the proposed gas wells with the *Code of Practice: Onshore Petroleum Activities in the Northern Territory*. It is required that flood impact assessment be undertaken to determine the suitability of the site to minimise interference with wet season water flow paths and areas of inundation.

The majority of sites are unaffected by flooding. Sites such as Orange, Mereenie West 27 and Mereenie West 28 are affected by small inundation depths for the 1% AEP event. It is considered that these sites are not interfering with flow paths, rather sheet flow from localised catchments are extending into the well pad areas. Small flood diversion bunds which are required for erosion and sediment control management are proposed to prevent inundation of infrastructure areas as well as reduce the risk of sediment being transported downstream.

A summary of the flood impact assessment is provided below in **Table 2**.

Table 2 Compliance Summary

Site	Flood Risk – 1% AEP event	Mitigation
Orange	Modelled flood depth of up to 100mm possible.	Appropriate bunding to prevent inundation.
Dingo 5	Not affected	Localised runoff to be managed through erosion and sediment controls.
Palm Valley 12	Not affected	Localised runoff to be managed through erosion and sediment controls.
Mereenie West 27	Not affected	Localised runoff to be managed through erosion and sediment controls.
Mereenie West 28	Partly affected in the 1% AEP event.	Diversion of the southern flow path and bunding of a portion of the well pad to be designed in conjunction with the well pad civil design.
Mamlambo 1	Not affected	Localised runoff to be managed through erosion and sediment controls.

APPENDIX A

Flow Estimates

Orange 1 Catchment						
Catchment name	**Orange01**	**Orange21**	**Orange 131**	**Orange32**	**Orange33**	**Orange34**
Area (sq km)	**47.56**	**9.07**	**1.55**	**0.78**	**1.23**	**2.14**
AEP 1 in x	**Flow (m3/s)**					
1.01	0.43	0.08	0.01	0.01	0.01	0.02
1.1	2.20	0.42	0.07	0.04	0.06	0.10
1.25	4.63	0.88	0.15	0.08	0.12	0.21
1.5	8.36	1.59	0.27	0.14	0.22	0.38
1.75	11.83	2.26	0.39	0.19	0.31	0.53
2	15.08	2.88	0.49	0.25	0.39	0.68
3	26.43	5.04	0.86	0.43	0.68	1.19
5	43.93	8.38	1.43	0.72	1.14	1.98
10	73.60	14.04	2.40	1.21	1.90	3.31
20	110.28	21.03	3.59	1.81	2.85	4.96
50	169.92	32.40	5.54	2.79	4.39	7.65
100	223.71	42.66	7.29	3.67	5.79	10.07
200	285.14	54.38	9.29	4.68	7.37	12.83
500	378.25	72.13	12.33	6.20	9.78	17.02
1000	457.80	87.30	14.92	7.51	11.84	20.60
2000	545.24	103.98	17.77	8.94	14.10	24.53
5000	672.96	128.34	21.93	11.04	17.40	30.28
10000	778.72	148.51	25.38	12.77	20.14	35.04
20000	892.31	170.17	29.08	14.63	23.08	40.15
50000	1054.34	201.07	34.36	17.29	27.27	47.44
100000	1185.76	226.13	38.64	19.45	30.67	53.35

Dingo 5 Catchment											
Catchment name	**Dingo 501**	**Dingo 502**	**Dingo 503**	**Dingo 504**	**Dingo 505**	**Dingo 506**	**Dingo 507**	**Dingo 508**	**Dingo 509**	**Dingo 510**	**Dingo 511**
Area (sq km)	**0.97**	**1.376**	**1.295**	**0.397**	**1.087**	**0.522**	**0.451**	**0.728**	**2.038**	**1.701**	**1.15**
AEP 1 in x	**Flow (m3/s)**										
1.01	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.02	0.02	0.01
1.1	0.04	0.06	0.06	0.02	0.05	0.02	0.02	0.03	0.09	0.08	0.05
1.25	0.09	0.13	0.13	0.04	0.11	0.05	0.04	0.07	0.20	0.17	0.11
1.5	0.17	0.24	0.23	0.07	0.19	0.09	0.08	0.13	0.36	0.30	0.20
1.75	0.24	0.34	0.32	0.10	0.27	0.13	0.11	0.18	0.51	0.42	0.29
2	0.31	0.44	0.41	0.13	0.34	0.17	0.14	0.23	0.65	0.54	0.36
3	0.54	0.76	0.72	0.22	0.60	0.29	0.25	0.40	1.13	0.95	0.64
5	0.90	1.27	1.20	0.37	1.00	0.48	0.42	0.67	1.88	1.57	1.06
10	1.50	2.13	2.00	0.61	1.68	0.81	0.70	1.13	3.15	2.63	1.78
20	2.25	3.19	3.00	0.92	2.52	1.21	1.05	1.69	4.73	3.94	2.67
50	3.47	4.92	4.63	1.42	3.88	1.86	1.61	2.60	7.28	6.08	4.11
100	4.56	6.47	6.09	1.87	5.11	2.46	2.12	3.42	9.59	8.00	5.41
200	5.82	8.25	7.76	2.38	6.52	3.13	2.70	4.36	12.22	10.20	6.89
500	7.71	10.94	10.30	3.16	8.65	4.15	3.59	5.79	16.21	13.53	9.15
1000	9.34	13.24	12.47	3.82	10.46	5.02	4.34	7.01	19.62	16.37	11.07
2000	11.12	15.77	14.85	4.55	12.46	5.98	5.17	8.35	23.36	19.50	13.18
5000	13.73	19.47	18.32	5.62	15.38	7.39	6.38	10.30	28.84	24.07	16.27
10000	15.88	22.53	21.20	6.50	17.80	8.55	7.38	11.92	33.37	27.85	18.83
20000	18.20	25.82	24.30	7.45	20.39	9.79	8.46	13.66	38.24	31.91	21.58
50000	21.50	30.50	28.71	8.80	24.10	11.57	10.00	16.14	45.18	37.71	25.49
100000	24.18	34.31	32.29	9.90	27.10	13.01	11.24	18.15	50.81	42.41	28.67

Mereenie West 27 Catchments				
Catchment name	**M27_1**	**M27_2**	**M27_3**	M27_4
Area (sq km)	**0.086**	**0.029**	**0.241**	0.199
AEP 1 in x	**Flow (m3/s)**			
1.01	0.00	0.00	0.00	0.00
1.1	0.00	0.00	0.01	0.01
1.25	0.01	0.00	0.02	0.02
1.5	0.02	0.01	0.04	0.03
1.75	0.02	0.01	0.06	0.05
2	0.03	0.01	0.08	0.06
3	0.05	0.02	0.13	0.11
5	0.08	0.03	0.22	0.18
10	0.13	0.04	0.37	0.31
20	0.20	0.07	0.56	0.46
50	0.31	0.10	0.86	0.71
100	0.40	0.14	1.13	0.94
200	0.52	0.17	1.44	1.19
500	0.68	0.23	1.92	1.58
1000	0.83	0.28	2.32	1.92
2000	0.99	0.33	2.76	2.28
5000	1.22	0.41	3.41	2.82
10000	1.41	0.47	3.95	3.26
20000	1.61	0.54	4.52	3.73
50000	1.91	0.64	5.34	4.41
100000	2.14	0.72	6.01	4.96

Mereenie West 28 Catchments				
Catchment name	**M28_1**	**M28_2**	**M28_3**	**M28_4**
Area (sq km)	0.274	0.362	0.426	0.342
AEP 1 in x	**Flow (m3/s)**			
1.01	0.00	0.00	0.00	0.00
1.1	0.01	0.02	0.02	0.02
1.25	0.03	0.04	0.04	0.03
1.5	0.05	0.06	0.07	0.06
1.75	0.07	0.09	0.11	0.09
2	0.09	0.11	0.14	0.11
3	0.15	0.20	0.24	0.19
5	0.25	0.33	0.39	0.32
10	0.42	0.56	0.66	0.53
20	0.64	0.84	0.99	0.79
50	0.98	1.29	1.52	1.22
100	1.29	1.70	2.00	1.61
200	1.64	2.17	2.55	2.05
500	2.18	2.88	3.39	2.72
1000	2.64	3.48	4.10	3.29
2000	3.14	4.15	4.88	3.92
5000	3.88	5.12	6.03	4.84
10000	4.49	5.93	6.98	5.60
20000	5.14	6.79	7.99	6.42
50000	6.07	8.03	9.44	7.58
100000	6.83	9.03	10.62	8.53

	Mereenie West Camp	
Catchment name	**MC_1**	**MC_2**
Area (sq km)	0.255	0.125
AEP 1 in x		
1.01	0.00	0.00
1.1	0.01	0.01
1.25	0.02	0.01
1.5	0.04	0.02
1.75	0.06	0.03
2	0.08	0.04
3	0.14	0.07
5	0.24	0.12
10	0.39	0.19
20	0.59	0.29
50	0.91	0.45
100	1.20	0.59
200	1.53	0.75
500	2.03	0.99
1000	2.45	1.20
2000	2.92	1.43
5000	3.61	1.77
10000	4.18	2.05
20000	4.78	2.35
50000	5.65	2.77
100000	6.36	3.12

	Mamlambo 1
Catchment name	
Area (sq km)	12500
AEP 1 in x	
1.01	7.36
1.1	40.99
1.25	97.46
1.5	202.06
1.75	316.46
2	437.48
3	954.91
5	2026.07
10	4571.24
20	9009.02
50	19469.79
100	32681.13
200	52653.97
500	94206.76
1000	142029.12
2000	209694.66
5000	341606.21
10000	485564.17
20000	681218.14
50000	1047124.81
100000	1432510.75

APPENDIX B

Mamlambo Flow Estimate

1-D Calculations

East – West Channel – full floodplain flow

Manning's n channel calculations		
Q = 1/n A R^(2/3) S^(1/2)		
1% Flow	33,000	m^3/s
Trapezoid channel		
Top Width	3200	m
Bottom Width	1000	m
Side Slope 1:	60	
n	0.04	
Slope	0.0005	m/m

Flow (m^3/s)	Depth	Area (m^2)	Hyd Radius (m)	Calculated Flow (m^3/s)
33,000	0.57	589.49	1004.70	33056.90

East – West Channel – Confined floodplain flow

Manning's n channel calculations		
Q = 1/n A R^(2/3) S^(1/2)		
1% Flow	33,000	m^3/s
Trapezoid channel		
Top Width	1000	m
Bottom Width	200	m
Side Slope 1:	150	
n	0.04	
Slope	0.0005	m/m

Flow (m^3/s)	Depth	Area (m^2)	Hyd Rad (m)	Calculated Flow (m^3/s)
33,000	2.68	1613.36	222.10	33,076.67

North-South Channel

Manning's n channel calculations		
Q = 1/n A R^(2/3) S^(1/2)		
1% Flow	33,000	m^3/s
Trapezoid channel		
Top Width	1280	m
Bottom Width	400	m
Side Slope 1:	170	
n	0.08	
Slope	0.0005	m/m

Flow (m^3/s)	Depth	Area (m^2)	Hyd Radius (m)	Calculated Flow (m^3/s)
33,000	2.54	2112.77	420.95	33,168.93

Appendix C contents here

ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
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Appendix 2 Baseline Ecological Assessment

ECOLOGICAL ASSESSMENT EXPLORATION PROGRAM 2020

CENTRAL PETROLEUM LIMITED

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ACRONYMS

AAPA	Aboriginal Areas Protection Authority
ALRA	*Aboriginal Land Rights Act*
BOM	Bureau of Meteorology
CR	Critically Endangered species (listed under the *TPWC Act* or *EPBC Act*)
DAWE	Department of Agriculture, Water and the Environment (Commonwealth)
DEPWS	Department of Environment, Parks and Water Security (Northern Territory) – formerly DENR
DPIR	Department of Primary Industry and Resources
DTSC	Department of Tourism, Sport and Culture (Northern Territory)
EA	Environmental Assessment Act
EcOz	EcOz Environmental Consultants
EMP	Environment Management Plan
EN	Endangered species (listed under the *TPWC Act* or *EPBC Act*)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
GDA94	Geocentric Datum of Australia 1994
GDE	Groundwater Dependent Ecosystems
GIS	Geographic Information System
GPS	Global Positioning System
LC	Least Concern species (listed under the *TPWC Act*)
MOGF	Mereenie Oil and Gas Field
NAFI	Northern Australian Fire Information
NE	Not Evaluated species (listed under the *TPWC* Act)
NT	Near Threatened species (listed under the *TPWC Act*)
NVIS	National Vegetation Information System
PMST	Protected Matters Search Tool
PPL	Pastoral Perpetual Lease
PV12	Palm Valley 12 (proposed gas well)
PVGF	Palm Valley Gas Field
SOBS	Site of Botanical Significance
SOCS	Site of Conservation Significance
TPWC Act	*Territory Parks and Wildlife Conservation Act* (Northern Territory)
VU	Vulnerable species (listed under the *TPWC Act* or *EPBC Act*)
WA	Western Australia
WM27	West Mereenie 27 (proposed gas well)
WM28	West Mereenie 28 (proposed gas well)
WONS	Weed of National Significance

EXECUTIVE SUMMARY

EcOz Environmental Consultants (EcOz) was commissioned by Central Petroleum to undertake an ecological assessment of the Central Petroleum 2020 Exploration Drilling Program, which comprises of seven well sites located in the southern region of the Northern Territory. The assessment has been undertaken to support the Environmental Management Plan for the drilling program.

The objective of this ecological assessment is to identify ecological constraints within (or in close proximity to) the exploration program operational area and, if found, recommend strategies in which potential impacts could be avoided or mitigated. Central Petroleum deliberately selected an ecological survey area that is larger than what is required for well pad establishment to allow for positioning of the pad in a location of lowest environmental impact.

Desktop research was undertaken to describe the regional environmental context and to identify ecological values that have potential to occur within the region of the well sites (mainly focused on threatened species, weeds, pests, sensitive vegetation etc.). Field surveys were then undertaken by local ecologists to describe habitat (by mapping land types), identify sensitive vegetation / important habitat, record existing weed infestations and determine the likelihood of occurrence of threatened species (and other species of importance that may occupy the survey areas).

The main conclusions from the assessment are summarised below:

- There are no ecological values of high significance within any of the well site survey areas (i.e. presence or likely occurrence of threatened species, significant/sensitive vegetation, GDE's and declared weed infestation). As such, it does not require assessment under the *Environment Assessment Act* (Northern Territory) or referral under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).
- There is a low likelihood of occurrence of five threatened species listed under the *TPWC Act* (Northern Territory). These species are discussed below:
    - Southern Marsupial Mole (*Notoryctes typhlops*) (Vulnerable). Based on available data, there is a low likelihood that the species could occupy sand dunes within Dingo 1-ST1, Dingo 5, WM27, WM28 and Mamlambo 1.
    - Grey Falcon (*Falco hypoleucos*) and Princess Parrot (*Polytelis alexandrae*) (both Vulnerable) may occur on occasion as nomadic visitors within all survey areas. Potential impact to these species is negligible because habitat present does not constitute important and / or breeding habitat for these species.
    - Greater Bilby (*Macrotis lagotis*) and Brush-tailed Mulgara (*Dasycercus blythi*) (both Vulnerable) may occasionally utilise sandplains at Mamlambo 1 when better conditions persist; however, this study did not record evidence of previous or current occupation. Potential impacts to regional populations is considered as negligible because habitat within the survey areas is not considered as 'core' or 'essential' to these species, and removal of such a small area of suitable habitat will not result in fragmentation impacts.
- Apart from the Princess Parrot, Greater Bilby and Brush-tailed Mulgara (listed under the *EPBC Act* as Vulnerable) – discussed above – there are no Matters of National Environmental Significance at risk of impact from the drilling program.
- Near Threatened flora species (*TWPC Act*) were recorded within PV12 survey area:
    - PV12 survey area: *Eucalyptus lucens* (plateau) *and Stenanthemum central* (plateau; gullies).
- WM28 supports a rocky hill (land type WM28-D) that is considered as locally important habitat.

- PV12 supports steep rocky drainage gullies and slopes (land types PV-C and PV-D) that are considered as locally important habitat (outcrops and cliff faces); the gullies support drainage lines (1st stream order) that are linked to downstream riparian vegetation that is assumed to be of high environmental significance.
- Drainage features are present in most survey areas (all ephemeral). With the exception of steep rocky gullies at PV12 (described above), surveys indicate that vegetation and habitat supported within these drainage features has no especial biodiversity value and are not linked to downstream sensitive riparian habitat. As such, they do not need to be buffered in accordance with the *Land Clearing Guidelines* (DEPWS 2020).
- No declared weeds (under the Northern Territory *Weeds Management Act*) or Weed of National Significance (WONS) were identified within, or adjacent to, any of the survey areas. Buffel Grass (*Cenchrus ciliaris*) is present at most sites (noting that this species is not declared under *Weed Management Act*, but is listed as a 'significant threat' species in the *Alice Springs Regional Weed Management Plan 2013 – 2018*, DLRM 2013).

Although there are no ecological values of high significance at risk from the proposed drilling program, there is opportunity to further mitigate risks to ecological values to very low levels by implementing the following recommendations (also refer to maps in Section 6):

1. Avoid disturbance of sand dune habitat (relevant to Dingo 1-ST1, Dingo 5, Orange 3, WM27, WM28 and Mamlambo 1 survey areas) where possible to reduce potential impacts; to Southern Marsupial Mole (which is only considered to have a low likelihood of occurrence).
2. Avoid disturbance within the "Vegetation Buffer" proposed within the PV12 survey area where possible; to reduce potential impact to *Eucalyptus lucens* and *Stenanthemum centrale* (both Near Threatened plants) and *Acacia aneura var. Holey trunk* (noted as old growth trees).
3. Avoid disturbance of land type WM28-D (isolated sandstone hill; locally important habitat) located with the WM28 survey area.
4. Avoid disturbance of land types PV-C and PV-D (steep gullies and slopes) within PV12 survey area, and apply an additional 25m riparian buffer area around the edge of mapped land type boundaries (this complies with recommended buffers in the *Land Clearing Guidelines*, DEPWS 2020). It is also important that drilling operations on the plateau minimise the chance of downstream contamination (i.e. indirect impacts) of ecological communities by implementing best practice in fluid control, erosion controls, well construction and weed management.
5. Avoid disturbance of drainage feature land types where possible.
6. Develop and implement a Weed Management Plan to minimise the introduction and/or proliferation of weeds from land clearing, construction and operation of the exploration program. This plan should focus on weed hygiene of vehicles and machinery travelling to site (as there are currently low levels of weed infestation, none of which are declared species). Minimising the spread of Buffel Grass should also be integrated into the plan, as it is considered a significant threat to biodiversity in high infestation scenarios.

If avoidance measures described above cannot be achieved (i.e. for logistical reasons or other project constraints), the EMP needs to justify why these areas cannot be avoided; and how potential impacts will be managed to minimise potential for environmental impact (i.e. erosion controls). This should include how the well pad has been been positioned to minimise ecological impacts in balance with other aspects (i.e. gas reserve targets, heritage sites, erosion risk, exiting infrastructure).

1 INTRODUCTION

EcOz Environmental Consultants (EcOz) was commissioned by Central Petroleum Limited (Central Petroleum) to undertake an ecological assessment for the Central Petroleum 2020 Exploration Drilling Program, located in the southern region of the Northern Territory. The assessment has been undertaken to support the Environmental Management Plan (EMP) for the drilling program.

The objective of this ecological assessment is to identify ecological constraints within (or in close proximity to) the exploration program operational area. Where constraints are found, this report recommends strategies to avoid potential impacts to ecological values. If avoidance is not possible, the EMP should propose appropriate impact mitigation measures.

1.1 Project description and ecological survey area

Central Petroleum propose to undertake gas exploration (using conventional drilling methods) at seven well sites – Dingo 1-ST1, Dingo 5, Orange 3, Palm Valley 12 (PV12), West Mereenie 27 (WM27), West Mereenie 28 (WM28) and Mamlambo 1 (locations are shown on Figure 1-1). Each well site will require a 150 x 150m drill pad and access / flow line corridors. Where possible, Central Petroleum will utilise areas that have been previously disturbed (for example, drilling camps will be located in previously cleared areas). Location and tenure information for well site is provided in Table 1-1.

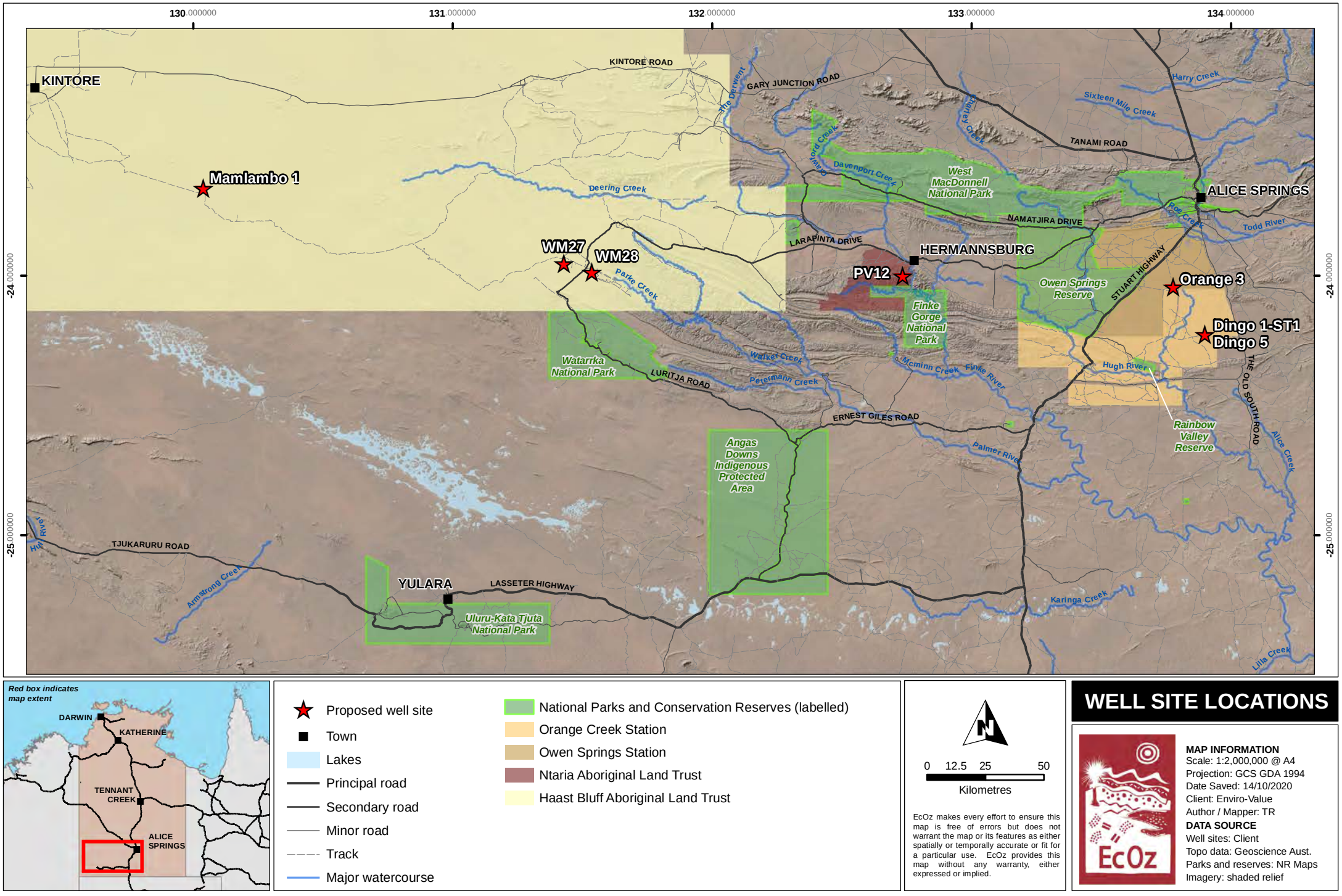
The ecological survey area for each well site is larger in size (at least 500 x 500m) than what is required for the proposed disturbance footprint. Results from the survey area can be used to position the disturbance footprint in a location that achieves the lowest level of potential ecological impact.

Table 1-1. Location and tenure information for proposed well sites

Proposed well site	Centre Point (approx.) (GDA94)	Lease	Portion	Tenure	Owner	Property name
Dingo 1-ST1	-24.224938° 133.897376°	L7	652	PPL[1]	Private	Orange Creek Station
Dingo 5	-24.223816° 133.883619°	L7	652	PPL[1]	Private	Orange Creek Station
Orange 3	-24.04796° 133.784765°	EP82	1406	PPL[1]	Northern Territory Government	Owen Springs Station (sub-leased to Deep Well Station)
PV12	-23.998291° 132.733624°	OL3	2079	Freehold	Aboriginal Land[2]	Ntaria Aboriginal Land Trust
WM27	-23.953091° 131.421368°	OL4	1635	Freehold	Aboriginal Land[2]	Haast Bluff Aboriginal Land Trust
WM28	-23.987203° 131.535127°	OL4	1635	Freehold	Aboriginal Land[2]	Haast Bluff Aboriginal Land Trust
Mamlambo 1	-23.661367° 130.036996°	L6 / EP115	NT Por 1635	Freehold	Aboriginal Land[2]	Haast Bluff Aboriginal Land Trust

[1] *Pastoral Perpetual Lease*

[2] *Aboriginal Land scheduled under Aboriginal Land Rights Act (ALRA)*



- Proposed well site
- Town
- Lakes
- Principal road
- Secondary road
- Minor road
- Track
- Major watercourse
- National Parks and Conservation Reserves (labelled)
- Orange Creek Station
- Owen Springs Station
- Ntaria Aboriginal Land Trust
- Haast Bluff Aboriginal Land Trust

N

0 12.5 25 50

Kilometres

EcOz makes every effort to ensure this map is free of errors but does not warrant the map or its features as either spatially or temporally accurate or fit for a particular use. EcOz provides this map without any warranty, either expressed or implied.

WELL SITE LOCATIONS

MAP INFORMATION
Scale: 1:2,000,000 @ A4
Projection: GCS GDA 1994
Date Saved: 14/10/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Well sites: Client
Topo data: Geoscience Aust.
Parks and reserves: NR Maps
Imagery: shaded relief

Path: D:\01. EcOz GIS Projects (TR)\EZ19243 (Tom) - Ecological Site Assessment Central Petroleum\01 Project Files\Location_AllSites_v2.mxd

Figure 1-1. Map of proposed well site locations, conservation areas and property names

1.2 Scope of assessment

The scope of the ecological assessment is to (for each survey area):

- Describe the ecological context of the region.
- Describe and map areas of similar landform, soils and vegetation (i.e. land types).
- Identify ecological matters (i.e. threatened species or threatened ecological communities) protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and / or the *Territory Parks and Wildlife Conservation Act* (*TPWC Act*).
- Identify sensitive or significant vegetation, and drainage features, as defined by the Northern Territory *Land Clearing Guidelines* (DEPWS 2020).
- Identify habitat that is locally important because it supports relatively high biodiversity, refugia habitat and/or less common species (including Near Threatened species).
- Identify the existing level of weed infestation (docus on declared weed species).
- Recommend strategies to avoid or mitigate potential impacts to ecological values.
- Advise on whether the project needs to be assessed under the *Environment Assessment Act* (Northern Territory), and / or referred under the *EPBC Act* (Commonwealth).

1.3 Approach

To address the scope, this report presents the following main components:

- A **desktop review** of the environment associated with each survey area (i.e. climate, bioregions, land systems/units, fire history, vegetation communities, and available flora and fauna data).
- **Land type mapping** for each survey area (to a scale of 1:5,000) to delineate areas of similar landform, soils and vegetation. This includes a general habitat condition assessment (i.e. weeds, fire, feral animals, clearing, pastoralism, drought, erosion, etc.) and identifies the presence or absence of significant vegetation.
- A **threatened species assessment** was undertaken to determine which threatened species have the potential to occur within each survey area. This firstly involved a desk-based likelihood of occurrence assessment, which was followed by a field survey to ground-truth and validate likelihood ratings. Other significant or notable species (such as near threatened, data deficient or restricted range species etc.) were also identified during surveys.
- **Conclusion** that summarises key ecological values identified from the assessment, and provides recommendations or planning strategies to avoid or mitigate potential impacts.

1.4 Survey team

Field work was conducted by Tom Ewers-Reilly and Andrew Schubert. The field team was selected for their expertise in arid zone flora and fauna, and their ability to identify and assess the suitability of threatened species habitat within the region. Tom (Project Manager / Ecologist / Author) has worked as an ecological consultant in the NT since 2002, leading numerous flora and fauna surveys (both general biodiversity and targeted threatened species surveys) and vegetation / habitat mapping surveys. In this time, he has gained specific expertise of the arid zone habitats within Central Australia.

Andrew Schubert (Project Botanist) is a well-recognised arid zone botanist and ecologist within Central Australia. Andrew has over 20 years of ecological survey work within Central Australia from private consultancy work and Parks and Wildlife ranger work, including being the Senior Ranger (ranger-in-charge) at the Finke Gorge National Park (i.e. Palm Valley) between 2006 to 2012.

2 LEGISLATIVE FRAMEWORK

Key legislation relevant to ecological components of the project is described in this chapter.

2.1 Commonwealth

***Environment Protection and Biodiversity Conservation Act* (*EPBC Act*)**

Assessment under this Act is required for actions that are likely to have a significant impact on a prescribed Matter of National Environmental Significance.

The Department of Agriculture, Water and the Environment (DAWE) administers the Act and has established a formal referral and assessment process. If DAWE determines that a project will likely significantly impact a matter of national significance it is declared a 'controlled action' and is required to undergo assessment and approval under the *EPBC Act*. In the Northern Territory this will be through the bilateral agreement between the Northern Territory and Commonwealth governments. If the project is not a controlled action, assessment will proceed under the Northern Territory legislative approvals process.

2.2 Northern Territory

***Territory Parks and Wildlife Conservation Act* (*TPWC Act*) and TPWC Regulations**

The *TPWC Act* makes provision for and in relation to the establishment of Parks and the study, protection, conservation and sustainable utilisation of wildlife. All native wildlife cannot be removed, or interfered with without a permit. The Act also provides for additional protection for listed threatened species.

***Environment Protection Act* (EP Act)**

The *EP Act* establishes the framework for the assessment of potential or anticipated environmental impacts of a development. The object of the *EP Act* is to ensure that matters affecting the environment to a significant extent are fully examined and taken into account in decisions by the Northern Territory Government. The Northern Territory Minister for DEPWS is responsible for administering the Act, and determines the appropriate level of assessment for new developments or material changes to existing operations, based on the sensitivity of the local environment, the scale of the proposal and its potential impact upon the environment.

***Weeds Management Act* (and Weed Management Regulations)**

The *Weeds Management Act* is administered by the DEPWS. The Act provides for certain species of plant to be declared weeds. All declared weeds must be managed according to their classification and all attempts must be made to prevent the introduction of weeds on to and off site. Section 9 of the Act establishes the responsibilities of land owners and occupiers for managing 'declared weeds'.

Petroleum (Environment) Regulations

The Petroleum (Environment) Regulations require submission of an EMP prior to any petroleum exploration or production activity. This ecological assessment represents a component of the EMP for the Central Petroleum Exploration Drilling Program. The EMP must demonstrate how the requirements of the *Code of Practice: Onshore Petroleum Activities in the Northern Territory* will be met. The Code stipulates that the planning, design, location and construction of petroleum infrastructure must have regard to the considerations in the *Land Clearing Guidelines* (DEPWS 2020).

3 DESKTOP RESEARCH

3.1 Climate

The proposed well sites are located in an arid to semi-arid climate, which is characterised by hot dry summers and cool dry winters with a low average annual rainfall. Typically, more rainfall occurs in the summer months associated with monsoonal influences; however, the amount of rainfall in the arid zone has a history of being highly variable. Variable rainfall creates a typical boom and bust environment for many native (and introduced) flora and fauna species.

Rainfall data has been summarised from weather stations in close proximity to the proposed drilling targets and Table 3-1 shows long term annual average, lowest annual rainfall and highest annual rainfall (Bureau of Meteorology http://www.bom.gov.au/, February 2020). Refer to Figure 3-1 for annual rainfall data since 2011, which highlights the variability of annual rainfall between years and (in some cases) also between survey areas, noting that the lowest rainfall period occurred in 2019.

Generally, average maximum temperatures range across the regions from 19.9ºC in July to 39.6ºC in January, and average minimum temperatures range from 4.0ºC in July to 26.2ºC in January. The mean annual evaporation rate at Alice Springs is 3,066 mm.

Table 3-1. Long term rainfall statistics from closest weather stations

Drill target	Weather station	Annual rainfall statistics (mm)		
		Average	Lowest	Highest
Dingo and Orange	015590 (Alice Springs)	282.8	67.6	782.5
PV12	015633 (Palm Valley)	309.7	32.1	1083.8
WM27 and WM28	015652 (Watarrka)	303.6	30.6	824.4
Mamlambo 1	015664 (Walungurru / Kintore)	279.4	30.4	689.0

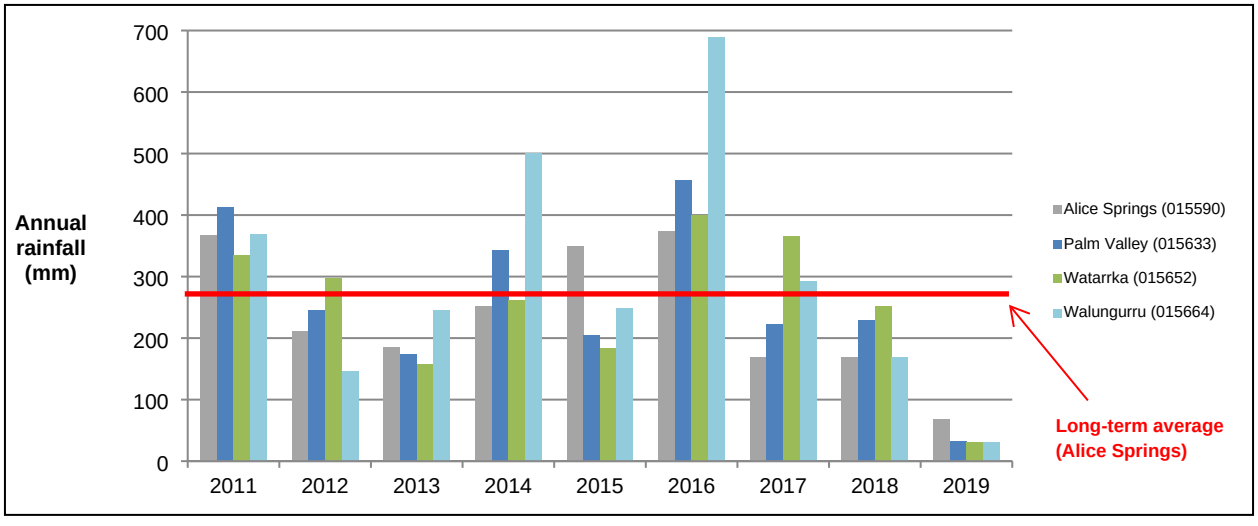


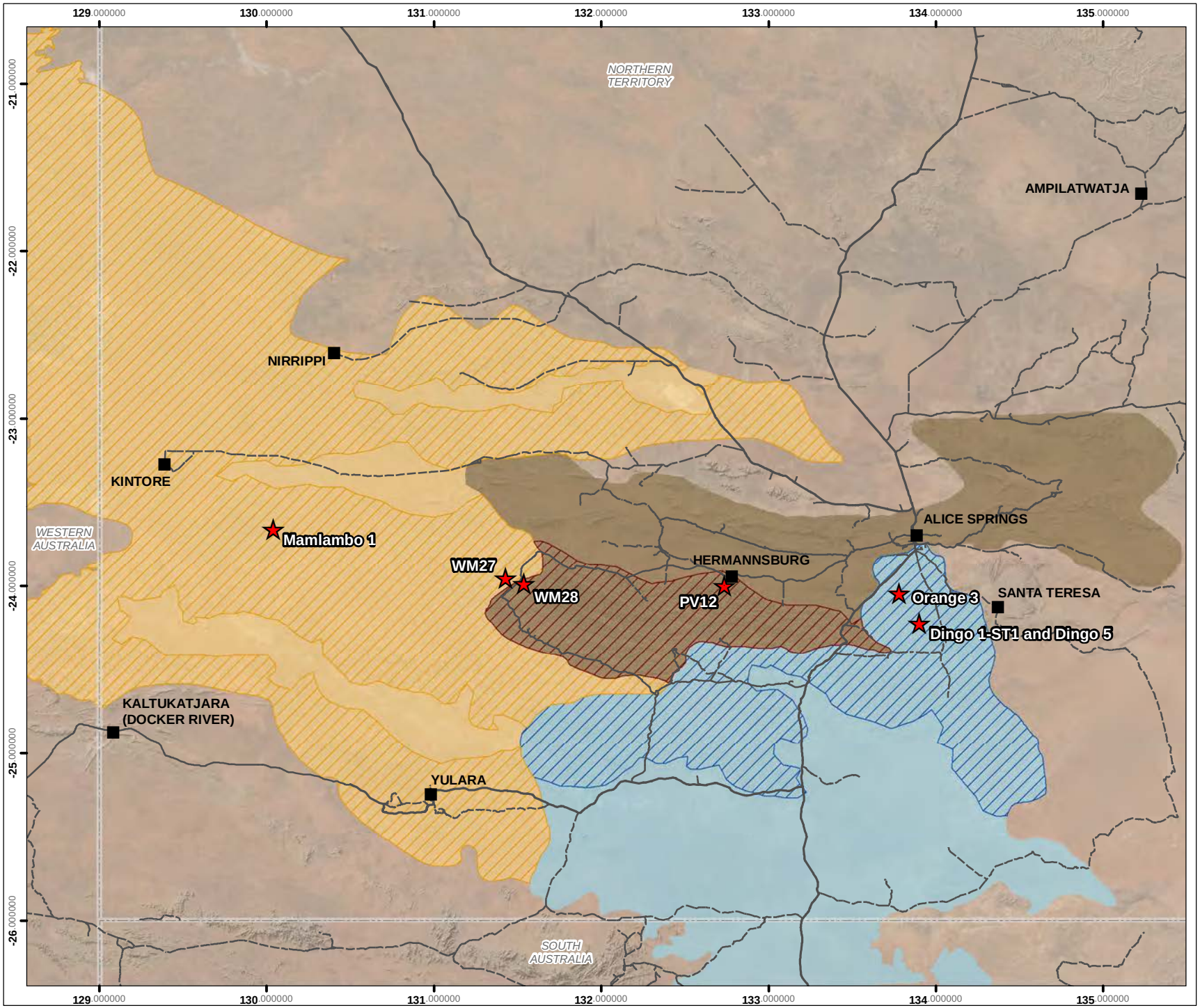
Figure 3-1. Graph of annual rainfall data for each survey area since 2011

3.2 Bioregions

A bioregion is a broad area of land with largely similar climate, geology, landform, native vegetation and species (Baker et al. 2005). For the purpose of this report, bioregions (and their associated sub-regions) are used to provide a general summary of ecological values and habitat types present in the region of each survey area that may need to be considered in the project risk assessment (i.e. threatened species, significant habitat etc.). Bioregions intersected by the drill site survey areas are described in Table 3-2, noting that sub-regions will be used as the basis for the threatened species 'likelihood of occurrence' assessment (described further in Section 5.2).

Table 3-2. Bioregions intersected by the survey areas

Bioregion	Drill site	**Description** (adapted from Baker et al. 2005)
Finke	• Orange 2 • Orange 3 • Dingo 1-ST1 • Dingo 5	Geomorphologically variable complex of low sandstone ranges, weathered tablelands and rounded metamorphic hills, giving rise to undulating plains and low hills with extensive sand plains and sand dunes and flood outs. It lies over the Amadeus Basin and small parts of the Pedirka and Eremonga Basins and contains sedimentary rocks of Devonian and Cambrian age. Soils are a mix of shallow and deep sands, massive earths, and red duplex saline affected soils. Dominant vegetation includes hummock grasslands, acacia shrublands and saltbush/bluebush open shrublands. It includes three subregions – of which survey areas occur within Henbury subregion (Finke P1).
MacDonnell Ranges	• PV12 • WM28 (edge)	High relief ranges and foothills, of diverse geology (mostly sedimentary rocks in the Amadeus Basin and crystalline metamorphic rocks in the Arunta Block). The ranges enclose some broad plains and watercourses. It is one of the most important refugial areas in arid Australia, supporting many endemic plant taxa and isolated occurrences of plants more typically associated with higher rainfall areas. Many ecosystems and species are highly localised, typically to the most fire-protected, topographically complex sites (such as gorges and escarpments), and/or to places with persistent moisture availability. It includes three subregions – of which the survey areas occur within Watarrka subregion (MacDonnell Ranges P2).
Great Sandy Desert	• WM27 • WM28 (edge) • Mamlambo	This is an extensive bioregion stretches from the south western Northern Territory to almost the Indian Ocean in WA through some of the remotest areas of Australia. The area is generally flat and arid with few watercourses, although there are several low ranges. Vegetation is dominated by hummock grassland with areas of tall-shrubland or low open woodland, Mulga tall open-shrubland and Samphire low open-shrubland fringing salt pans. Soils are predominantly shallow sands and are influenced by the presence of saline lakes, where mostly saline loams occur. The Northern Territory component is subdivided into six subregions where large saline lakes occur, the largest of these is Lake Mackay which straddles the WA border. The survey areas occur within Mackay subregion.



BIOREGIONS

- Proposed well site
- Town
- Principal road
- Secondary road
- Minor road
- State borders

Bioregion (IBRA 7)

- Finke bioregion
- Great Sandy Desert bioregion
- MacDonnell Ranges bioregion

Sub-bioregion

- Henbury subregion
- Mackay subregion
- Watarrka subregion

N

0 20 40 80
Kilometres

MAP INFORMATION
Scale: 1:3,500,000 @ A4
Projection: GCS GDA 1994
Date Saved: 14/10/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Well sites: Central Petroleum
Topo data: Geoscience Australia
Imagery: Shaded relief

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Path: D:\01. EcOz GIS Projects (TR)\EZ19243 (Tom) - Ecological Site Assessment Central Petroleum\01 Project Files\Bioregions_v2.mxd

Figure 3-2. Map of bioregion and sub-regions relevant to the survey areas

3.3 National Parks and conservation reserves

None of the proposed drill sites occur within a national park or conservation reserve (see Figure 1-1 for boundaries of national parks and reserves in relation to proposed drill sites).

PV12 occurs 4.5 km to the north of Finke Gorge National Park and WM27 / WM28 occur 16.5 km north of Watarrka (Kings Canyon) National Park. Avoiding indirect impacts to these areas will be required. All remaining well sites do not occur in close proximity to a conservation area.

3.4 Sites of Conservation Significance

Sites of Conservation Significance (SOCS) are areas defined by the Northern Territory Government as important sites for biodiversity conservation. A SOCS does not have specific legislation attached.

Although there is no specific legislative controls over a SOCS (compared to areas such as National Parks), they do highlight that the area is known to contain habitat that supports higher concentrations of species (and/or important breeding areas) that are protected under environmental legislation (such as the *TPWC Act* and the *EPBC Act*). The Northern Territory Government will often assess projects located within SOCS to ensure that specific values of the SOCS are not significantly impacted.

PV12 occurs within the Greater MacDonnell Ranges SOCS (Harrison et al. 2009). The SOCS is rated as Internationally Significant and has high ecological value based on the number of threatened and endemic species, particularly short-range endemics and the permanent water sources which act as habitat refuges. The presence of ecological values of this SOCS will be assessed as part of field studies. (https://www.territorystories.nt.gov.au/bitstream/handle/10070/254318/55_greatermacdonnell.pdf).

All remaining drill sites do not occur within a SOCS.

3.5 Sites of Botanical Significance

A Site of Botanical Significance (SOBS) is an area that has been defined (by White et al. 2000) to hold important and / or unique botanical assemblages. A SOBS does not have specific legislation attached.

Although there are no specific legislative controls over a SOBS, they do highlight a range of botanical values that could be present within an area, some of which may be protected under environmental legislation (such as the *TPWC Act* and the *EPBC Act*).

- PV12 occurs within the 'Palm Valley' SOBS. This is regarded as nationally important due to the number of species of conservation significance and endemic species in the area. The presence of these botanical values will be assessed as part of field studies.
- WM27 and WM28 occur on the edge of two SOBS – 'Lay Cock's Sandplain' and 'Mereenie'. These SOBS are regarded as having 'bioregional' significance due to the number of endemic and restricted range species in the area (i.e. area is not known to support high numbers of threatened species). The presence of these botanical values will be assessed as part of field studies.

All remaining drill sites do not occur within a SOBS.

3.6 Land systems

A land system is an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation (Christian and Stewart, 1968). Land system descriptions provide a general and consistent basis for determining potential habitat types present within the region of the survey areas. Land system mapping available for survey areas is at a scale of 1:1,000,000 (Perry et al. 1962).

Table 3-3. Land systems intersected by the survey areas

Land system	Landform class	Description	Drill sites
Ewaninga	Desert sandplains	Undulating sandy country with low sand dunes, sandplains and minor limestone hills. Quaternary aeolian sand and scattered outcrops of calcareous conglomerate and sandstone. Deep red sands and loamy limestone soils. *Acacia aneura* (mulga) and *Acacia kempeana* (witchetty bush) or minor sparse shrubs over spinifex.	• Orange 2 • Orange 3
Simpson	Desert dunefields	Spinifex-covered sand dunes. Dunefields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes. Variable relief. Associated swales in between dunes. Red sands on dunes and a variety of soil types in swales- such as red clayey sands, red earths and calcareous earths. Sparse shrubs and low trees (occasional *Allocasuarina decaisneana,* desert oak) over spinifex and tussock grasses. Dune crests can support *Zygochloa paradoxa* (desert cane grass). Swales can support *Acacia aneura* (mulga) and *Eucalyptus microtheca* (coolabah) or sparse low trees over samphire and old man saltbush.	• Dingo 1-ST1 • Dingo 5 • WM27 • WM28 • Mamlambo
Krichauff	Sandstone hills	Bold sandstone plateaux. Stony plateaux, tablelands & hills on sandstone, siltstone, quartzite & conglomerate (deeply weathered in places). Strongly superimposed drainages with narrow gorges and joint-controlled tributaries that can feed into riverine channels. Relief up to 200m. Outcrop with shallow stony soils. Sparse shrubs and low trees over spinifex. Riverine channels support Eucalyptus camaldulensis (red gum) and Acacia estrophiolata (ironwood) over tussock grasses.	• PV12

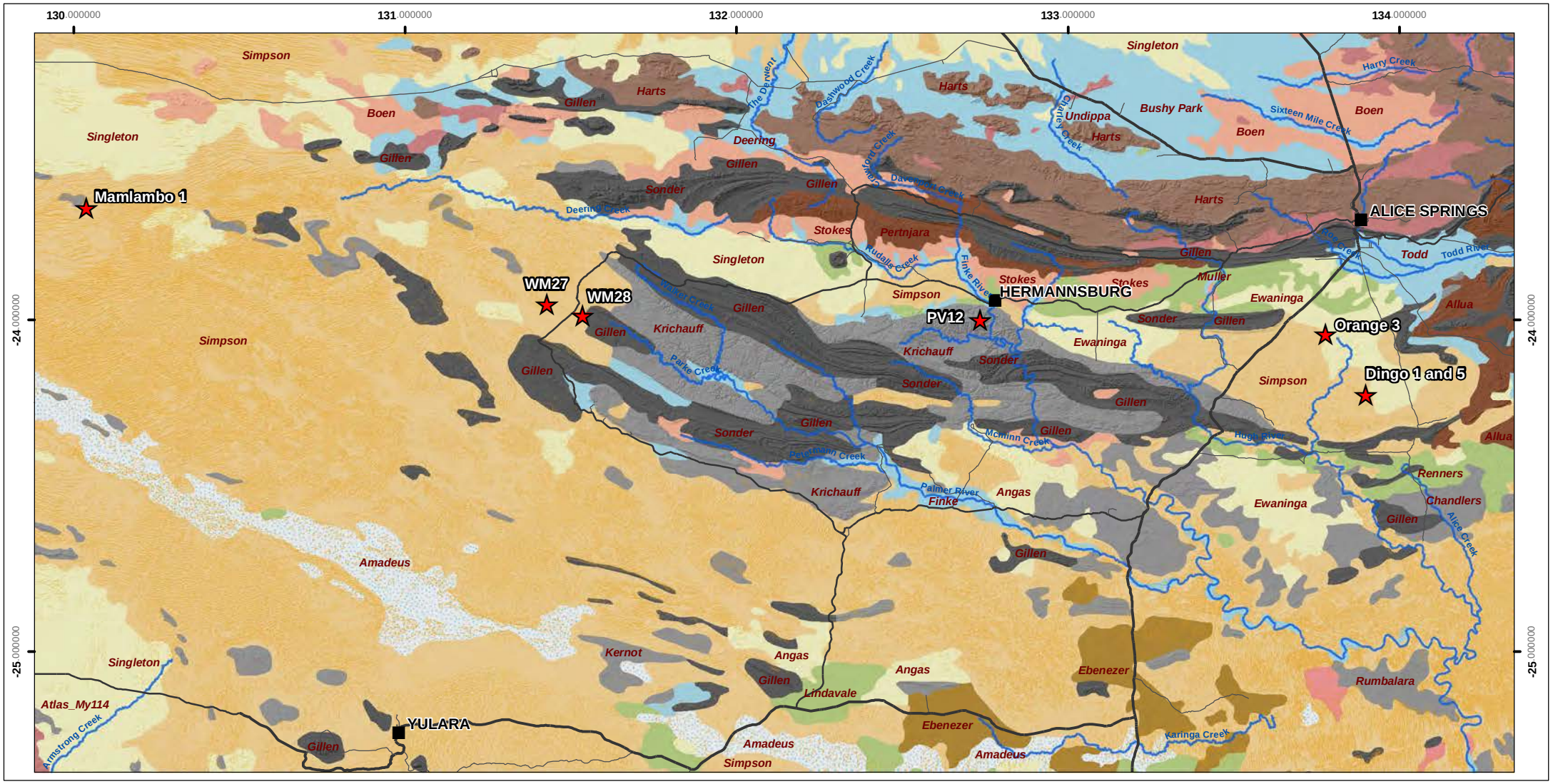
3.7 Land units

Within each land system, a set of component land units is defined. Land units are areas of comparatively similar landform, soils and vegetation; their smaller scale make them useful for identifying finer scale habitat features, particularly those supporting threatened species and sensitive vegetation types. Whilst land system mapping is available for all of the Northern Territory, land unit mapping has only been completed for selected parts (generally related to land resource assessments for pastoral properties / conservation areas).

Land unit mapping is available for the following well sites:

- Orange 3 (at a scale of 1:50,000) (Owspr_50) (Torlach 1983)
- Dingo 1-ST1 and Dingo 5 (at a scale of 1:100,000) (Orang_100) (Lennartz and Whitehouse 2002)
- PV12 (approximate scale of 1:50,000) (Low Ecological Services 2007)

Available land unit mapping will be used to inform land type surveys described in Chapter 4.



Proposed well site
Town
Principal road
Secondary road
Minor road
Major watercourse
Sand ridges

Land systems (major landform classes are shown and land systems are labelled)

- Alluvial floodplains
- Desert dunefields
- Desert sandplains
- Granite plains and rises
- Lateritic plains and rises
- Limestone plains and rises
- Sandstone plains and rises
- Granite hills
- Limestone hills
- Sandstone hills
- Granite ranges
- Sandstone ranges
- Salt pans

0 12.5 25 50
Kilometres

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LAND SYSTEMS

MAP INFORMATION
Scale: 1:1,811,531 @ A4
Projection: GCS GDA 1994
Date Saved: 27/04/2020
Client: Enviro-Value
Author / Mapper: TR
DATA SOURCE
Well sites: Central Petroleum
Land Systems: NT Government
Topo data: Geoscience Australia
Imagery: shaded relief

Path: C:\01. EcOz GIS Projects (TR)\EZ19243 (Tom) - Ecological Site Assessment Central Petroleum\01 Project Files\LandSystems_AllSites.mxd

Figure 3-3. Map of land systems within the region of the survey areas

3.8 Fire history

Fire history and fire scar mapping available from 2000 using the Northern Australian Fire Information (NAFI) website (https://www.firenorth.org.au/nafi3/) is summarised for each survey area in Table 3-4.

Table 3-4. Fire history description for each survey area (using NAFI, using data since 2000)

Drill site	Fire history description
Dingo 1-ST1	• Low fire frequency • Burnt once in the last 20 years. • Last fire was in 2011, which burnt entire survey area (part of large-scale fire).
Dingo 5	• Low fire frequency • Burnt once in the last 20 years. • Last fire was in 2011, which burnt entire survey area (part of large-scale fire).
Orange 3	• Low fire frequency • Burnt once in the last 20 years. • Last fire was in 2011, which burnt the western half of survey area (part of large-scale fire).
PV12	• Low fire frequency • Burnt once in the last 20 years. • The last fire occurred on the northern side of the existing access road in 2002, which was a controlled burn organised and undertaken by rangers from Finke Gorge National Park in conjunction with Palm Valley Gas Field (VGF). • The majority of vegetation to the south was most likely burnt last in the 1970s
WM27	• Low fire frequency • Burnt once in the last 20 years. • Last fire was in 2011, which burnt entire survey area (part of large-scale fire).
WM28	• Low fire frequency • No fire scars in the last 20 years.
Mamlambo 1	• Low fire frequency • Some areas burnt twice in last 20 years (large scale fires). • Survey area was burnt in 2011 as part of wide-scale fires throughout the region (edge of fire scar only so impacts may only be minor). • Access track area was recently burnt in 2019 as part of wide-scale fires throughout the region.

3.9 Vegetation

Broad-scale vegetation communities

The National Vegetation Information System 2007 (NVIS) (https://www.environment.gov.au/land/native-vegetation/national-vegetation-information-system) was used to determine broad-scale vegetation communities within the each survey area (i.e. to provide a regional perspective; not site-specific). This is a broad-scale data set (i.e. it is mapped at a scale of 1:1,000,000) and vegetation and landform data will be more accurately described for each survey areas as part of land type surveys (see Chapter 4).

Significant vegetation and landform

A review of available data and aerial imagery does not indicate that significant vegetation type and landforms – as defined by the Northern Territory *Land Clearing Guidelines* (DEPWS 2020) – are present within the survey areas (to be validated in the field).

Table 3-5. NVIS 2007 vegetation communities within each survey area

NVIS unit	Vegetation community description	Well site
422	Triodia low hummock grassland on gently undulating sandplains, scattered dunes, red earthy sands and red siliceous sands. UPPER LAYER – *Eucalyptus gamophylla, Acacia aneura*, *Acacia kempeana* MID LAYER – *Acacia aneura, Acacia ligulata, Senna artemisioides subsp. filifolia* GROUND LAYER – *Triodia basedowii, Triodia pungens, Eragrostis eriopoda*	• Dingo 1-ST1 • Dingo 5 • Orange 2 • Orange 3
426	Triodia low hummock grassland on rocky hills, sandstone and quartzite ranges, shallow, gravelly sands, extensive area of bare rock UPPER LAYER – *Acacia aneura, Eucalyptus gamophylla, Corymbia bella* MID LAYER – *Eucalyptus tetragonophylla, Eremophila sturtii +/- Hakea lorea* GROUND LAYER – *Triodia brizoides, Eriachne mucronata, Enneapogon oblongus*	• PV12
577	Triodia low hummock grassland on extensive dune fields and sandplains, infertile red siliceous and clayey sands UPPER LAYER – *Allocasuarina decaisneana, Acacia aneura +/- Acacia estrophiolata* MID LAYER – *Acacia ligulata, Acacia dictyophleba, Acacia murrayana* GROUND LAYER – *Triodia basedowii, Triodia pungens +/- Triodia schinzii*	• WM-27 • WM-28 • Mamlambo 1

Groundwater Dependent Ecosystems (GDEs)

The GDE Atlas (http://www.bom.gov.au/water/groundwater/gde/map.shtml) was checked to determine potential GDEs within each survey area. No aquatic GDEs were identified to occur within or in close proximity to any of the survey areas. There is no data for any of the survey areas for terrestrial or subterranean GDEs on the GDE Atlas.

Based on the location and landform types present, it is considered highly unlikely that terrestrial or subterranean GDEs are present within, or in close proximity to, the survey areas (to be validated in the field).

EPBC-listed ecological communities

The EPBC Protected Matters Search Tool (PMST) did not identify any ecological communities listed under the *EPBC Act* within, or in close proximity to, the survey areas.

3.10 Flora and fauna

Available data

The Northern Territory Flora and Fauna Atlas (maintained by the Department of Environment and Natural Resources) and Northern Territory herbarium records (Holtze Database) were used to identify existing records within and surrounding the survey areas. These datasets were primarily used as part of the desktop threatened species 'likelihood of occurrence' assessment (undertaken in Section 5.2), and presence of other significant species (such as near threatened and endemic species listed under the *TPWC Act*) previously recorded in the vicinity of the survey areas.

Data from a site-specific ecological survey was available for PV12 (Low Ecological Services 2015). This included detailed fauna surveys (including a three night trapping program) of the proposed PV12 survey area. No other site-specific survey data were identified during desktop review.

Introduced fauna (i.e. pests)

A 50 km radius clip using recent data from the Northern Territory Fauna Atlas (February 2020) was undertaken for each survey area to identify which species have been locally recorded (see Table 3-6). Of these, the following pest species are listed as a key threatening process under the *EPBC Act* as they can have a significant detrimental impact on native fauna (including threatened species) – Rabbit, Fox, Camel, Cat and Horse.

Table 3-6. Introduced fauna known to occur within 50 km of each survey area

Class	Common name	Scientific name	DG	OR	PV	WM	MAM
Reptile	Flower-pot Blind Snake	*Indotyphlops braminus*		✓			
Bird	Barbary Dove	*Streptopelia roseogrisea*	✓	✓			
Bird	Common Starling	*Sturnus vulgaris*		✓			
Bird	House Sparrow	*Passer domesticus*	✓	✓	✓		
Bird	Long-billed Corella	*Cacatua tenuirostris*	✓	✓	✓		
Bird	Rock Dove	*Columba livia*	✓	✓	✓		
Bird	Spotted Turtle-dove	*Spilopelia chinensis*	✓	✓			
Mammal	Black Rat	*Rattus rattus*		✓			
Mammal	Brown Rat	*Rattus norvegicus*		✓			
Mammal	Camel	*Camelus dromedarius*	✓	✓	✓	✓	✓
Mammal	Cat	*Felis catus*	✓	✓	✓	✓	✓
Mammal	Cattle	*Bos taurus*	✓	✓	✓	✓	
Mammal	Donkey	*Equus asinus*			✓	✓	
Mammal	Fox	*Vulpes vulpes*	✓	✓	✓	✓	✓
Mammal	Horse	*Equus caballus*	✓	✓	✓	✓	✓
Mammal	House Mouse	*Mus musculus*	✓	✓	✓	✓	✓
Mammal	Pig	*Sus scrofa*	✓	✓	✓		
Mammal	Rabbit	*Oryctolagus cuniculus*	✓	✓	✓	✓	✓
Fish	Eastern Gambusia	*Gambusia holbrooki*		✓			
Fish	Swordtail	*Xiphophorus hellerii*	✓	✓			
Invertebrate	Monarch	*Danaus plexippus*			✓		

***Key:* DG** = *Dingo 1-ST1 & Dingo 5;* **OR** = *Orange 3;* **PV** = *PV12;* **WM** = *WM27 & WM28;* **MAM** = *Mamlambo 1*

Weeds

The survey areas all fall within the Alice Springs Weed Management Zone, which is covered by the *Alice Springs Regional Weed Management Plan 2013 – 2018*. This plan identifies priority weeds for the region that need to be targeted / considered by land managers or proponents such as Central Petroleum. Priority weeds are species that require priority management attention and listed in Table 3-7.

A 50 km radius weed clip using current data from the Northern Territory Weeds Branch (February 2020) was undertaken around each survey area to identify which species have been locally recorded. Species that declared under the Northern Territory *Weed Management Act* and / or Weed of National Significance are listed in Table 3-8.

Weed surveys were conducted by local ecologists (as part of land type and habitat condition surveys) within each survey area to determine current level of infestation (refer to Chapter 4).

Table 3-7. Priority weeds for the region (as per *Alice Springs Regional Weed Management Plan)*

Scientific name	Common name	Listing
Calotropis procera	Rubber Bush	Class B
Cenchrus ciliaris	Buffel Grass	Significant threat species
Opuntia and *Cylindropuntia spp.*	Cacti	Class A/C, WONS
Parkinsonia aculeata	Parkinsonia	Class B/C, WONS
Tamarix aphylla	Athel pine	Class A/C, WONS

Table 3-8. Declared weed records within 50 km of survey areas (using Weeds Branch / Atlas data)

Scientific name	Common name	Listing	DG	OR	PV	WM	MAM
Andropogon gayanus	Gamba grass	A / WONS	✓	✓			
Alternanthera pungens	Khaki weed	B			✓	✓	
Argemone ochroleuca	Mexican poppy	B	✓		✓		
Asphodelus fistulosus	Onion weed	A				✓	
Calotropis procera	Rubber bush	B	✓	✓			
Carthamus lanatus	Saffron thistle	B	✓	✓			
Cenchrus echinatus	Mossman river grass	B	✓	✓	✓	✓	✓
Cenchrus setaceus	Fountain grass	B	✓	✓		✓	
Cylindropuntia fulgida	Rope cactus - fulgida	A / WONS	✓	✓			
Cylindropuntia imbricata	Rope cactus - Devils rope	A / WONS	✓	✓			
Datura ferox	Thornapple - Longspine	A		✓			
Datura inoxia	Thornapple - inoxia	C		✓			
Datura wrightii	Thornapple - wrightii	C		✓			
Echium plantagineum	Patterson's curse	A	✓	✓			
Emex australis	Spiny emex	B		✓		✓	
Jatropha gossypiifolia	Bellyache bush	A		✓			
Lantana camara	Lantana - common	B		✓			
Lycium ferocissimum	African boxthorn	A		✓			
Opuntia elatior	Prickly pears - elatior	A / WONS		✓	✓		
Opuntia puberula	Prickly pears - puberula	A / WONS					
Opuntia stricta	Prickly pears - stricta	A / WONS	✓	✓	✓		
Parkinsonia aculeata	Parkinsonia	B / WONS	✓	✓	✓		
Prosopis pallida	Mesquite	A / WONS	✓	✓	✓		
Prosopis velutina	Mesquite - velutina	A / WONS		✓			
Ricinus communis	Castor oil plant	B	✓	✓	✓		
Senna obtusifolia	Senna - Sicklepod	B		✓			
Senna occidentalis	Senna - Coffee	B	✓	✓			
Sida acuta	Sida - Spiny head	B	✓	✓		✓	
Sida cordifolia	Sida - Flannel weed	B			✓		
Sida rhombifolia	Sida - Paddys lucerne	B		✓		✓	
Tamarix aphylla	Athel pine	A / WONS		✓	✓		
Tribulus cistoides	Caltrop - cistoides	B					✓
Tribulus terrestris	Caltrop - terrestris	B	✓	✓	✓	✓	✓
Xanthium spinosum	Burr - Bathurst	B	✓	✓	✓		
Xanthium strumarium	Burr - Noogoora	B	✓	✓			

***Key:* DG** = *Dingo 1-ST1 & Dingo 5;* **OR** = *Orange 3;* **PV** = *PV12;* **WM** = *WM27 & WM28;* **MAM** = *Mamlambo 1*

4 LAND TYPE AND WEED SURVEY

Land types are a mapping unit that delineate areas of similar landform, soils and vegetation to a reasonable level of detail and accuracy. The purpose of the survey is to map land types, describe current level of weed infestation, describe habitat condition, and to identify the presence or absence of GDEs, sensitive/significant vegetation and drainage features.

4.1 Methodology

Land types were mapped at a scale of 1:5,000 within each survey area. This scale was selected to accurately delineate the landforms, vegetation types and vegetation structures for the purpose of assessing the environmental risk of the project.

Prior to field work, existing land resource data (see Chapter 3), aerial imagery (numerous sources) and contour data was used to delineate preliminary land type boundaries. The resultant polygons were uploaded into AVENZA Maps to locate and validate land type boundaries whilst in the field.

In the field, land type boundaries were ground-truthed by walking transects throughout each survey area and recording information on landform, soil and vegetation. GPS waypoints were taken as 'check-sites' to confirm unit boundaries. Numerous representative photographs were taken as part of the survey process. Descriptions were based on those used by Brocklehurst et al. (2007) and to align with *National Vegetation Information System (NVIS)*.

All flora species encountered along transects were recorded to provide a 'species list' for each survey area. General abundance and habitat information was recorded.

Drainage features are described as per definitions in the *Land Clearing Guidelines* (DEPWS 2020).

Vegetation condition is described or each survey area, based on current level of impacts from threatening processes such as weeds, introduced herbivores (Cattle, Horses and Rabbits) and fire. For weeds, particular focus occurred within high risk areas such as drainage features and previously disturbed locations.

Survey data, polygon revisions and other field observations were used to finalise land type descriptions and boundaries. All mapping and editing was performed using GIS software (ArcGIS 10.2).

4.2 Survey conditions

The landscape is currently very dry, with only 67 mm of rainfall occurring in 2019, which is well below long term average of 236 mm (based on data from Alice Springs Airport 015590) (Bureau of Meteorology http://www.bom.gov.au/, February 2020). Rainfall totals for 2017 and 2018 were also below long-term average (see Section 3.1).

The prolonged dry conditions have resulted in the absence or low diversity/abundance of annual or short-lived flora species (predominantly associated with the ground stratum). Nonetheless, conditions are suitable for identifying perennial dominant species, and the botanical expertise from surveyors enabled identification of numerous groundcover species despite dry conditions.

4.3 Results

Results for each survey area are summarised in the sub-sections below. Flora species lists for each survey area are provided in Appendix A.

4.3.1 Dingo 1-ST1

Six land types occur within the Dingo 1-ST1 survey area (refer to Table 4-1; mapped in Figure 4-2); none of which contain sensitive or significant vegetation communities, or are considered as a GDE.

The survey area consists of sandplains (land types DG-A and DG-E), sandy rises (land type DG-B), low relief sand dunes (land type DG-D), red earth plains / depressions (land type DG-C) and a minor drainage (land type DG-F).

Two land types are drainage features – DG-C (Mulga depressions) and DG-F (Mulga drainage); however they are of low ecological significance (i.e. both widespread in the region, they do not hold specific refugial habitat, surveys indicate they do not support species species of significance).

Vegetation within the survey area is predominately an open *Acacia spp.* or *Senna spp*. shrubland over spinifex (*Triodia basedowii*), with occasional stands of Desert Oak (*Allocasuarina decaisneana*). Common shrub and tree species include Mulga (*Acacia aneura*), Sandhill Wattle (*Acacia ligulata*), Witchetty Bush (*Acacia kempeana*), Desert Cassia (*Senna artemisioides subsp. filifolia*) and Ironwood (*Acacia estrophiolata*). The minor ephemeral drainage situated to the south of survey area supports Mulga (likely *Acacia aneura*).

An existing (historic) pad and well head is present (approximate size of 100 x 100 m) (see photographs in Figure 4-1). The access road is well established as it is the main access to the currently active Dingo-2 well site located 2 km to the east.

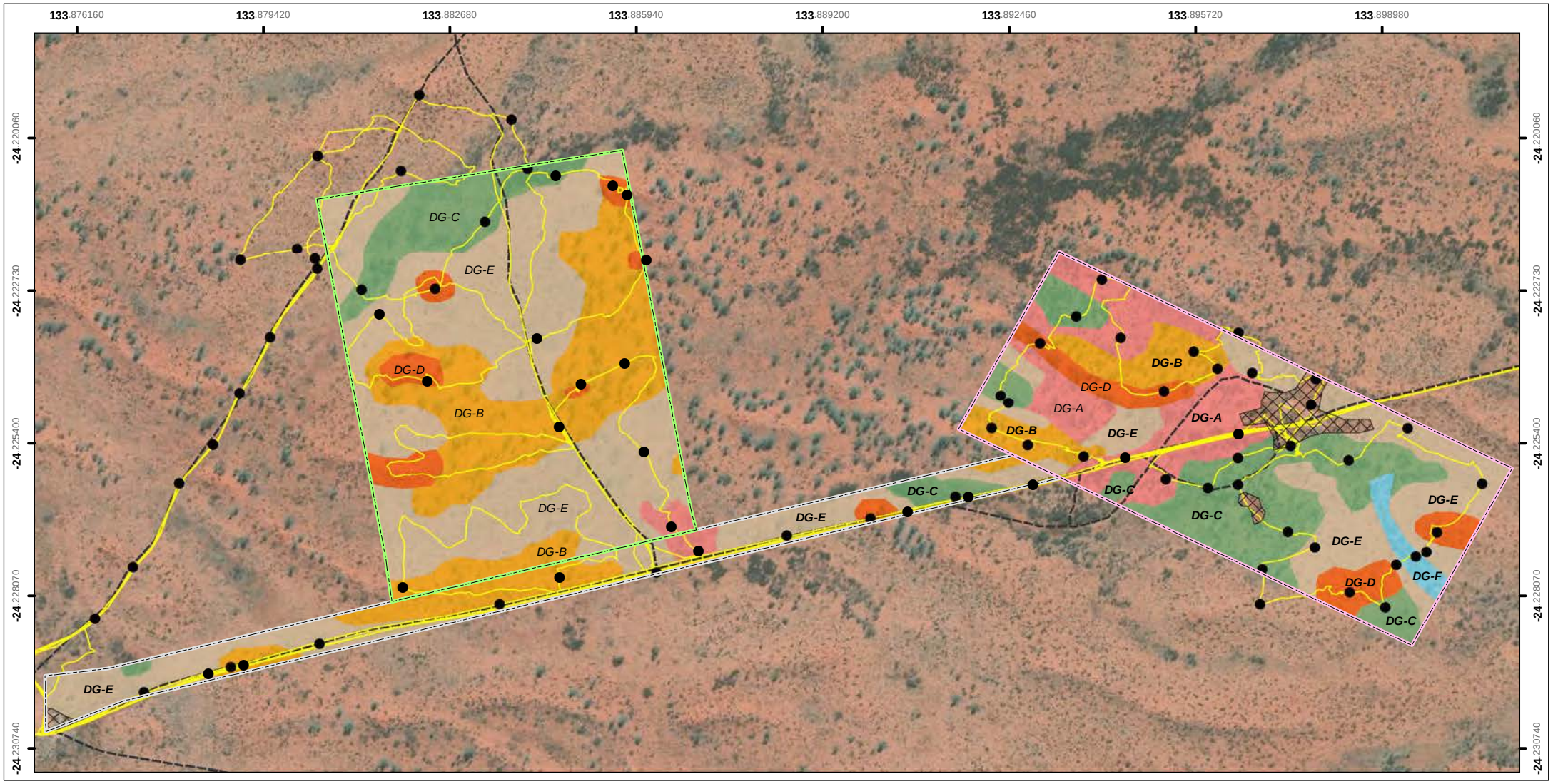
Weed impacts are low. No declared weed species under the *Weed Management Act* were recorded. Buffel Grass (*Cenchrus ciliaris*) is present at low densities across the survey area, and was generally only associated with areas of existing disturbance in the red earth plains land type (land type DG-C). Paddymelon (*Citrullus colocynthis*) (a naturalised environmental weed) had a scattered occurrence along roadside windrows, as is common in pastoral areas.

Vegetation condition was generally good, with some areas with minor gully erosion. Pastoral impact is present but considered low. The last fire occurred in 2011, which burnt most of the site with the exception of a portion of the Mulga in the red earth swales.

Figure 4-1. Photograph of existing pad and well head area at Dingo 1-ST1

Table 4-1. Land type descriptions and photographs – Dingo 1-ST1 survey area

Land type	Description	Representative photograph
DG-A	Flat to gently undulating sandplain. Sandy red earth soils, with areas of sub-surface heavier red earths, particularly in areas of higher Mulga densities. Low open woodland to open shrubland of *Acacia aneura* +/- *Acacia kempeana*, *Acacia estrophiolata* and *Senna artemisioides subsp. filifolia* over spinifex (*Triodia basedowii*).	
DG-B	Sandy rises and dune flanks. Sandy surface soils; unknown sub-surface. Open stands of Desert Oak (*Allocasuarina decaisneana*) with a sparse low shrubland of *Senna artemisioides subsp. filifolia* +/- *Acacia ligulata* over a sparse or patchy cover of spinifex (*Triodia basedowii*) and *Eragrostis eriopoda*.	
DG-C	Flat red earth plain; considered to be an ephemeral drainage depression. Drainage feature; low ecolofical significance. Sandy clay soils; typically occurs at low-points. Open tall shrubland of *Acacia aneura* (occasionally groved over sparse tussock grasses and occasional patch of spinifex and areas of sandier soils. Occasional *Acacia estrophiolata*.	
DG-D	Low sand dunes / sand hills. Red siliceous sands. Open to scattered Acacia shrubland (*Acacia ligulata, Acacia aneura, Acacia kempeana, Acacia estrophiolata*) over open spinifex grassland (*Triodia basedowii*). Occasional emergent *Allocasuarina decaisneana* mainly on dune flanks.	
DG-E	Gently sloping red earth sandplain, minor swales. Sandy loam / sandy red earths. Open shrubland of *Senna artemisioides subsp. filifolia* and *Acacia ligulata* (plus other mixed shrubs) over patchy spinifex (*Triodia basedowii*) and *Eragrostis eriopoda* (currently mostly senesced).	
DG-F	Minor ephemeral drainage (weakly defined channel <1m width, < 20cm depth); sandy loam soils. Drainage feature; low ecolofical significance. Shrubland of Mulga (*Acacia aneura*) over sparse tussock grasses (unknown species due to dry conditions).	



Survey information

- Dingo 1-ST1 survey area
- Dingo 5 survey area
- Access corridor survey area
- Check sites
- Survey transects
- Disturbed (previously cleared)
- Existing tracks or siesmic lines

Land types (1:5,000) (ground-truthed)

- DG-A: flat to gently undulating sandplain with low open woodland to open shrubland of Acacia aneura +/- Acacia kempeana, Acacia estrophiolata and Senna artemisioides subsp. filifolia over spinifex (Triodia basedowii)
- DG-B: sandy rises and dune flanks with open stands of Desert Oak (Allocasuarina decaisneana) with a sparse low shrubland of Senna artemisioides subsp. filifolia +/- Acacia ligulata over spinifex (Triodia basedowii) and native tussock grasses.
- DG-C: flat red earth plain with an open tall shrubland of Acacia aneura and possibly Acacia aptaneura (occasionally groved) over native tussock grasses (or spinifex in areas of sandier soils)
- DG-D: low sand dunes and sand hills with a sparse shrubland of Acacia ligulata, Grevillea juncifolia, Acacia murrayana and Senna artemisioides subsp. filifolia over spinifex (Triodia basedowii). Occasional patches of stunted Acacia estrophiolata.
- DG-E: gently sloping red earth sandplain with an open to sparse shrubland of Acacia ligulata, Acacia murrayana and Senna artemisioides subsp. filifolia over spinifex (Triodia basedowii) and native tussock grasses (Eragrostis eriopoda, Aristida holathera)
- DG-F: minor drainage (poorly defined channel) lined with Mulga (Acacia aneura) over native tussock grasses

N

0 50 100 200

Metres

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DINGO 1-ST1 & DINGO 5

MAP INFORMATION
Scale: 1:10,500 @ A4
Projection: GCS GDA 1994
Date Saved: 14/10/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Survey area: Client
Survey data: EcOz 2020
Imagery: Maxar (3/7/2017)

Path: D:\01. EcOz GIS Projects (TR)\EZ19243 (Tom) - Ecological Site Assessment Central Petroleum\01 Project Files\LandTypes_Dingo1_5_v2.mxd

Figure 4-2. Map of land types present within the Dingo 1-ST1 and Dingo 5 survey areas

4.3.2 Dingo 5

Five land types occur within the Dingo 5 survey area (refer to Table 4-2; mapped in Figure 4-2); none of which contain sensitive or significant vegetation communities, or are considered as a GDE.

The survey area predominantly consists of flat red earth sandplains with an open shrubland over spinifex (*Triodia basedowii*) (land type DG-E) and low sandy rises with Desert Oak (*Allocasuarina decaisneana*) over spinifex (*Triodia basedowii*). Five low sand dunes/hills (land type DG-D) are present. A red earth swale with Mulga (*Acacia aneura* and possibly *Acacia aptaneura*) over tussock grass (land type DG-C) is present in the northwest part of the survey area, which has occasional surface calcrete fragments indicating calcrete may be at shallow depth. A small area of sandy red earth plain with Mulga (*Acacia aneura*) and spinifex (*Triodia basedowii*) (land type DG-A) is present in the south-east corner.

One land type a drainage feature – DG-C (Mulga depressions); however it is of low ecological significance (i.e. widespread in the region, does not hold specific refugial habitat, surveys indicate it does not support species species of significance).

Weed impacts are low. No declared weed species under the *Weed Management Act* were recorded. Buffel Grass (*Cenchrus ciliaris*) is present at low densities across the survey area, and was generally only associated with areas of existing disturbance in the red earth plains land type (land type DG-C). Paddymelon (*Citrullus colocynthis*) (a naturalised environmental weed) had a scattered occurrence along roadside windrows (expected in pastoral areas).

There is a very low level of physical disturbance within the survey area, with the only clearing being a seismic line (unknown year of establishment), which has revegetated to a high standard (see Figure 4-3).

Vegetation was generally in good condition. No significant erosion impacts were observed. Pastoral impact is considered low, as the site is distant from a water source. The last fire occurred in 2011, which burnt most of the survey area.

Table 4-2. Land type descriptions and photographs – Dingo 5 survey area

Land type	Description	Photograph
DG-A	Flat to gently undulating sandplain. Sandy red earth soils, with areas of sub-surface heavier red earths, particularly in areas of higher Mulga densities. Low open woodland to open shrubland of *Acacia aneura* +/- *Acacia kempeana*, *Acacia estrophiolata* and *Senna artemisioides subsp. filifolia* over spinifex (*Triodia basedowii*).	
DG-B	Low sandy rise; sandy surface soils Open stand of *Allocasuarina decaisneana* with a sparse low shrubland of *Senna artemisioides subsp. filifolia* and *Acacia ligulata* over a sparse or patchy cover of spinifex (*Triodia basedowii*) and *Eragrostis eriopoda*.	

Land type	Description	Photograph
DG-C	Flat red earth plain / depression. Considered to be an ephemeral drainage feature. Occurs in low-points; red earths / sandy clay, occasional small calcrete fragments. Tall open shrubland (varying densities) of *Acacia aneura* (occasionally groved) and possibly *Acacia aptaneura* over sparse tussock grasses. Occasional *Acacia estrophiolata* emergent.	
DG-D	Low sand dunes and sand hills Red siliceous sands. Sparse shrubland of *Acacia ligulata*, *Grevillea juncifolia*, *Acacia murrayana* and *Senna artemisioides subsp. filifolia* over spinifex (*Triodia basedowii*). Occasional patches of stunted *Acacia estrophiolata*.	
DG-E	Flat to gently undulating sandplains. Red sandy soils. Open to sparse shrubland of *Acacia ligulata*, *Acacia murrayana* and *Senna artemisioides subsp. filifolia* over spinifex (*Triodia basedowii*) and scattered tussock grasses (*Eragrostis eriopoda* and *Aristida holathera*). Occasional emergent *Allocasuarina decaisneana* and *Acacia estrophiolata*.	

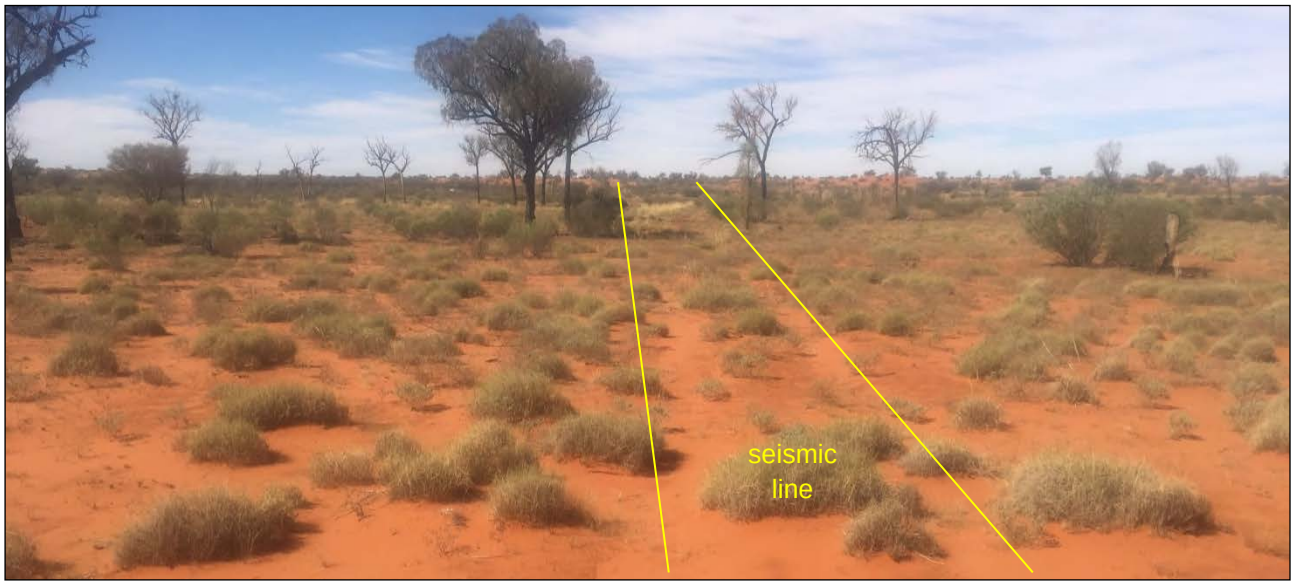


Figure 4-3. Photograph of vegetation establishment along old seismic line (yellow lines) at Dingo 5

4.3.3 Orange 3

Six land types occur within the Orange 3 survey area (refer to Table 4-3; mapped in Figure 4-4); none of which contain sensitive or significant vegetation communities, or are considered as a GDE.

The survey area mostly consists of flat to gently undulating calcareous tussock grass plains (land type O3-A) and sandy rises with spinifex (land type O3-B). There are a few sand dunes and sand hills (land type O3-E) present. There is one spinifex covered rocky calcrete rise (land type O3-C) located in the northern eastern part of the survey area. A weakly defined ephemeral drainage (patchily dominated by Mulga) (land type O3-D) is situated diagonally across the survey area, and several small clay depressions are also present (O3-F).

Two drainage feature land types are present within the survey area – O3-D (minor drainage, weakly defined channel) and O3-F (clay loam depressions); however they are of low ecological significance (i.e. both widespread in the region, they do not hold specific refugial habitat, surveys indicate they do not support species species of significance).

Weed impacts are low. No declared weed species under the *Weed Management Act* were recorded. Buffel Grass (*Cenchrus ciliaris*) is common within calcareous plains (land type O3-A) and uncommon to absent in other land types. Paddymelon (*Citrullus colocynthis*) (a naturalised environmental weed) is scattered throughout the area (small sprouts observed only).

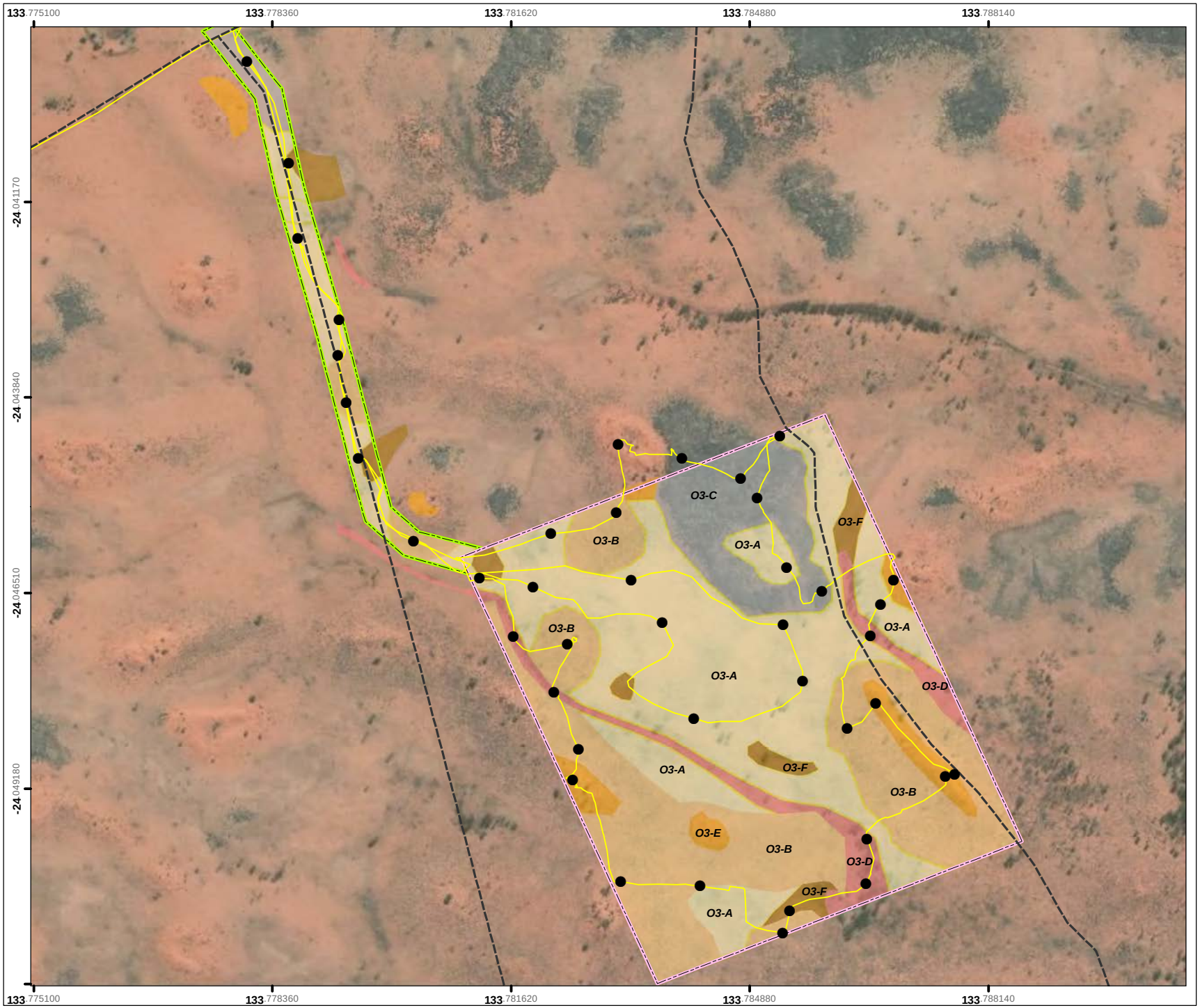
There is a very low level of physical disturbance within the survey area; the only clearing is associated with a historic single lane seismic line (unknown year of establishment) that is barely visible onground (i.e. no erosion and vegetation is similar to surrounding areas).

Pastoral impacts are considered to be high; likely due to the close vicinity of Railway Bore. There is very little fire impact, likely a result of heavy grazing keep fuel loads down between spinifex patches. Site condition was generally good within the calcrete rises and poor in other areas (because of grazing is the current dry conditions).

Table 4-3. Land type descriptions and photographs – Orange 3 survey area

Land type	Description	Photograph
O3-A	Gently undulating calcareous plain. Sandy loam soils. Scattered shrubs over Buffel Grass (*Cenchrus ciliaris*) and a variety of native ground cover species that are currently sparse due to dry conditions (species encountered included *Enneapogon avenaceus*, *Eragrostis eriopoda, Tribulus eichlerianus, Aristida arida* and *Triodia basedowii*). Occasional *Acacia aneura*, *Acacia murrayana* and *Acacia estrophiolata.*	
O3-B	Slightly elevated sandy areas. Red sands; aeolian. Sparse to absent shrubs over an open spinifex (*Triodia basedowii*) grassland.	

Land type	Description	Photograph
O3-C	Low calcrete rises Shallow / skeletal calcareous sandy loam soils; exposed outcrop, mostly calcareous, but also conglomerate and other rock types present; rapid run-off. High cover of spinifex (*Triodia brizoides*) and very low cover of other flora species (including *Eragrostis eriopoda*, *Tribulus eichlerianus*, *Sida fibulifera* and *Sida sp. limestone*). Scattered *Senna artemisioides subsp. artemisioides.*	
O3-D	Minor drainage Sandy loam soils; stream channel is weakly defined and absent in some sections. Ephemeral drainage feature; low ecological significance. An open to sparse shrubland of *Acacia aneura* over tussock grasses (unknown species due to dry conditions), including Buffel Grass.	
O3-E	Sandy hills and shortly aligned sand dunes. Red sands; aeolian. Sparse shrubs (*Grevillea stenobotrya, Acacia ligulata, Dodonaea viscosa subsp. mucronata, Acacia murrayana*) over spinifex (*Triodia basedowii*). Emergent and/or stunted *Acacia estrophiolata* occasionally present.	
O3-F	Clay loam (closed) depression. Clay loam soils; run-on area. Considered to be an ephemeral drainage feature, of low ecological significance. Although this land type is a clay-based closed depressions, they are not considered as a 'claypan' due to presence of clay-loam soil and higher level of permeability than what is expected on a typical claypan. Very sparse vegetation. Annual and short-lived flora species senesced and not present (or identifiable) at time of survey.	



ORANGE 3

Survey data

- Ecological survey area (drill pad)
- Ecological survey area (access)
- Existing tracks or siesmic lines
- Check sites
- Survey transect

Land types (1:5,000) (ground-truthed)

- O3-A: Gently undulating calcareous plain with sparse Acacia shrubs over tussock grasses (including Cenchrus ciliaris)
- O3-B: Slightly elevated sandy areas with sparse shrubs over spinifex (Triodia basedowii)
- O3-C: Low calcrete rises with spinifex (Triodia brizoides)
- O3-D: Minor drainages and red earth swales with patchy Mulga (Acacia aneura) over sparse tussock grasses
- O3-E: Sand hills / dunes with sparse shrubs (Grevillea stenobotrya, Acacia ligulata, Dodonaea viscosa subsp. mucronata, Acacia murrayana) over spinifex (Triodia basedowii)
- O3-F: Clay loam depressions with sparse ephemeral vegetation (grasses and forbs)

N

0 50 100 200
Metres

MAP INFORMATION
Scale: 1:8,000 @ A4
Projection: GCS GDA 1994
Date Saved: 17/08/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Survey area: Central Petroleum
Survey data: EcOz (Feb 2020)
Imagery: DigitalGlobe (5/11/2019)

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Figure 4-4. Map of land types within the Orange 3 survey area

4.3.4 Palm Valley 12 (PV12)

Four land types occur within the PV12 survey area (refer to Table 4-4; mapped in Figure 4-6); none of which contain sensitive or significant vegetation communities, or are considered as a GDE.

The survey area consists of sandstone plateaux with minor areas of siltstone, quartzite and conglomerate (deeply weathered in places) (land type PV-A), which supports a low shrubland of Witchetty Bush (*Acacia kempeana*) and Red bud mallee (*Eucalyptus sessilis*) over spinifex (*Triodia brizoides* and *T. melvillei*). This is the land type where the drill pad and other infrastructure are likely to occur within. The plateau area to the south of the access road (land type PV-B) has a similar landform but instead of an open shrubland, it supports an open woodland of Hill Mulga (*Acacia macdonnellensis subsp. macdonnellensis*) over spinifex (*Triodia brizoides*) with a patch of Holey Trunk Mulga (*Acacia aneura var. Holey trunk*) in the south-east corner of survey area that is estimated to be >100 years old (based on trunk diameter) which may constitute 'old growth trees' (patch is shown on Figure 4-6). North-facing gullies (land type PV-C) generally support mixed *Acacia spp*. over spinifex (*Triodia brizoides*) with occasional patches of Hill Mulga (*Acacia macdonnellensis subsp. macdonnellensis*). South-facing gullies (land type PV-D) generally support a higher cover of Hill Mulga and Red-Bud Mallee (*Eucalyptus sessilis*) over spinifex (*Triodia melvillei*) with scattered White Cypress Pine (*Callitris glaucophylla*). These gullies likely feed into tributaries that are linked to riverine channels lower in the landscape.

Two drainage feature land types are present (both steep gullies) – PV-C (steep north-facing gullies and slopes) and PV-D (steep south-facing gullies and slopes). They are considered to be locally important habitat for a range of native species, and are linked to more significant 'down-stream' riparian vegetation.

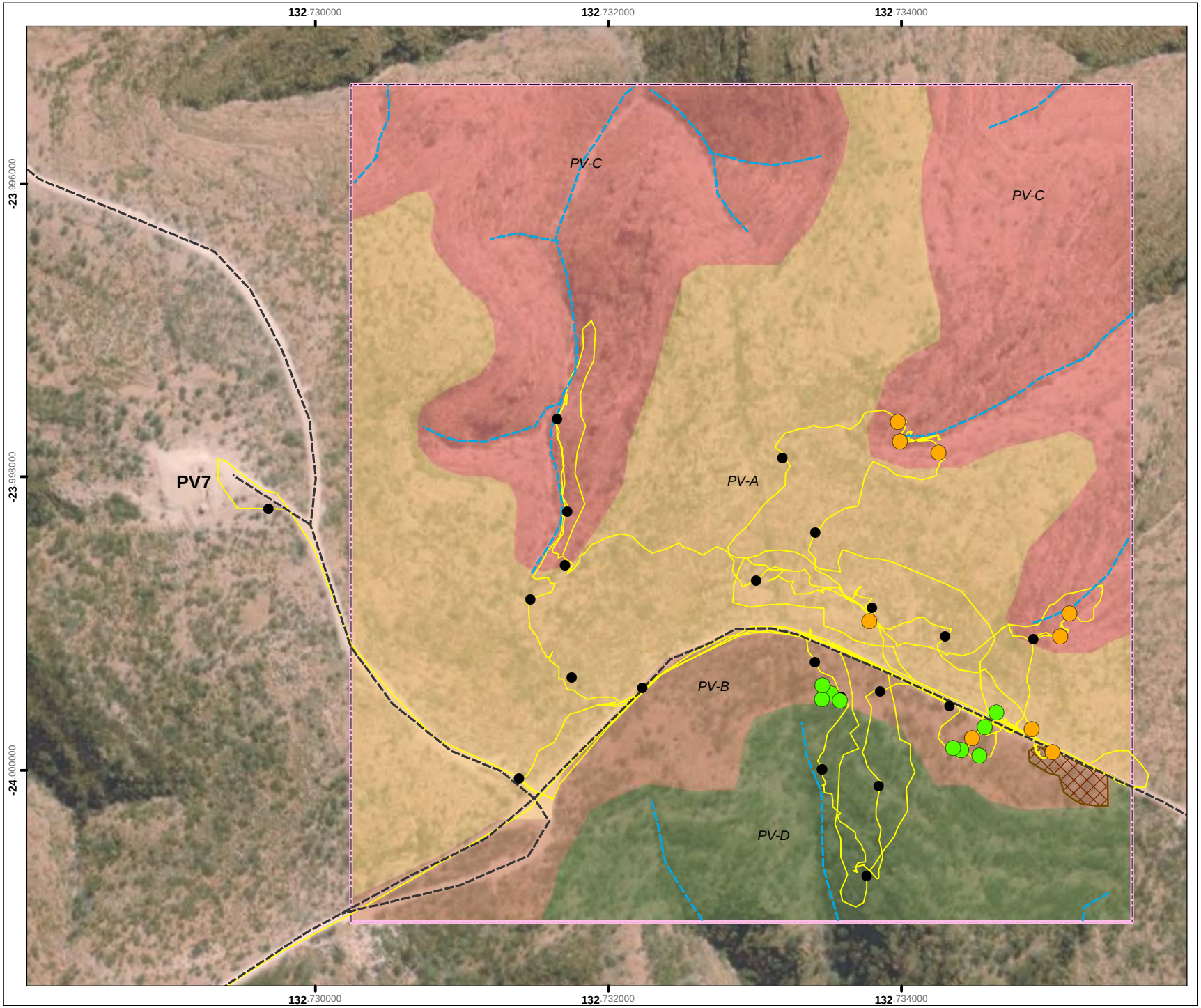
Weed impacts are very low. No declared weed species under the *Weed Management Act* were recorded. Buffel Grass (*Cenchrus ciliaris*) was only observed at very low densities at one location (four plants observed in the north-western gully). Buffel Grass was scattered throughout disturbed areas in other parts of the PVGF.

Vegetation is in relatively good condition, and is regenerating well after previous fire impacts. Apart from the existing PVGF access road (see photograph in Figure 4-5), the survey area has a very low level of physical disturbance. No recent fires have occurred within the survey area. The last fire occurred on the northern side of the existing access road in 2002, which was a controlled burn organised and undertaken by rangers from Finke Gorge National Park (in conjunction with PVGF). The majority of vegetation to the south was most likely burnt last in the 1970s (estimate based on trunk size of *Acacia macdonnellensis subsp. macdonnellensis*).

Figure 4-5. Photograph of existing access road to PV12 (view to west)

Table 4-4. Land type descriptions and photographs – PV12 survey area

Land type	Description	Photograph
PV-A	Undulating rocky plateau; north of access road. Shallow pale brown sandy loam soils; with accumulation in minor deposition areas. Soil cover is low (estimated at 10 to 15%). Low shrubland of *Acacia kempeana* and *Eucalyptus sessilis* over spinifex (*Triodia brizoides* and *Triodia melvillei*). No upper stratum present. Other common shrub layer species include *Scaevola spinescens* and *Senna artemisioides subsp. artemisioides*. Majority of area was burnt in 2002.	
PV-B	Undulating rocky plateau; south of access road Very shallow pale brown sandy loam soils. Low open woodland of *Acacia macdonnellensis subsp. macdonnellensis* and *Eucalyptus sessilis* over spinifex (*Triodia melvillei* and *Triodia brizoides*). Occasional *Acacia aneura var. Holey trunk* – including one patch to south east corner of survey area that is estimated to be >100 years old. No recent fires, last fire approximately in the 1970s (based on small size of Hill Mulga).	
PV-C	Steep rocky north-facing gullies. Ephemeral drainage feature; locally important habitat; linked to significant habitat. Skeletal soils; shallow pale brown sandy loams. Low open shrubland (common species included *Acacia macdonnellensis subsp. macdonnellensis*, *A. melleodora*, *A. kempeana*, *Stenanthemum centrale, Olearia ferresii, Ozothamnus kempei*) over spinifex (*Triodia brizoides* and *Triodia melvillei*) and to a lesser extent *Eriachne mucronata* and *Cymbopogon ambiguus*. Occasional emergent trees *Corymbia aparrerinja* and *Callitris glaucophylla*. Majority of area was burnt in 2002.	
PV-D	Steep rocky south-facing gullies. Ephemeral drainage feature; locally important habitat; linked to significant habitat. Skeletal soils; shallow pale brown sandy loams. Low open woodland of *Acacia macdonnellensis subsp. macdonnellensis +/- Eucalyptus sessilis* over spinifex (*Triodia melvillei*). Other common species include *Psydrax latifolia, Corymbia eremaea, Callitris glaucophylla, Eriachne mucronata and Triodia brizoides*. No recent fires, last fire approximately in the 1970s (based on small size of Hill Mulga).	



PALM VALLEY 12

Survey data

- Ecological survey area
- Check sites
- Existing roads
- Drainage gullies
- Survey transects
- Eucalyptus lucens records (Near Threatened species)
- Stenanthemum centrale records (Near Threatened species)
- Holey Trunk Mulga Patch

Land types (1:5,000) (ground-truthed)

- PV-A: undulating rocky plateau (north of access road) with low shrubland of Acacia kempeana and Eucalyptus sessilis over spinifex (Triodia brizoides and Triodia melvillei)
- PV-B: undulating rocky plateau (south of access road) with low open woodland of of Acacia macdonnellensis and Eucalyptus sessilis over spinifex (Triodia melvillei and Triodia brizoides)
- PV-C: steep rocky north facing gullies and slope with low open shrubland (common species - Acacia macdonnellensis, A. melleodora, A. kempeana, Stenanthemum centrale, Olearia ferresii, Ozothamnus kempei) over spinifex (Triodia brizoides and Triodia melvillei)
- PV-D: steep rocky south facing gullies and slopes with low open woodland of Acacia macdonnellensis +/- Eucalyptus sessilis over spinifex (Triodia melvillei)

N

0 25 50 100
Metres

MAP INFORMATION
Scale: 1:4,000 @ A4
Projection: GCS GDA 1994
Date Saved: 17/08/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Clearance area: Central Petroleum
Survey data: EcOz (Feb 2020)
Imagery: Maxar (7/6/2019)

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Figure 4-6. Map of land types present within the PV12 survey area

4.3.5 West Mereenie 27 (WM27)

Three land types occur within the WM27 survey area (refer to Table 4-5; mapped in Figure 4-7); none of which contain sensitive or significant vegetation communities, or are considered as a GDE.

The majority of the survey area consists of a gently sloping red sandplain and minor sandy rises (land type WM27-A) – the dominant landform in the north-western half of the survey area. This sandplain also has localised occurrences of low sandstone outcrop. Mulga and Senna shrubs (and tussock grasses) tended to dominated the outcrop areas.

Small dunes (land type WM27-B) are the dominant landform in the south-eastern half of the survey area, and have a fairly irregular morphology. There are some distinct dune swales within the survey area that are equivent to the surrounding sandplains (land type WM27-A). Some dune crests support minor 'bowling'.

There is one small patch of Mulga (*Acacia aneura* and *Acacia ayersiana*) that has established on sandstone outcrop (non-quartzite) and laterised gravel and sandy red earth soils (land type WM27-C).

There are no drainage features within the survey area. General drainage direction is to the south-west.

No weed species were recorded within the survey area; however, Buffel Grass (*Cenchrus ciliaris*) is known to occur in surrounding areas at low densities (determined via general observations).

Vegetation is generally in good condition. Grazing and trampling impacts from wild Horses, Camel and Donkeys is present. The southern part of the site has been recently burnt (last two years); and the entire site was burnt in 2011 (with the exception of a few small areas such as the Mulga patch). There is a very low level of previous vegetation clearing within the survey area, with the only clearing associated with historic seismic lines (which are now well revegetated).

Table 4-5. Land type descriptions and photographs – WM27 survey area

Land type	Description	Photograph
WM27-A	Flat to undulating sandplain and dune swales with small and localised areas of sandstone outcrop. Aeolian red siliceous sands and red earths. Dominant vegetation is an open shrubland of *Acacia melleodora* and *Eremophila latrobei subsp. latrobei* over spinifex (*Triodia schinzii*) with occasional emergent trees (*Corymbia chippendalei*, *Allocasuarina decaisneana, Brachychiton gregorii*). Localised outcrop areas tend to support tussock grasses (including *Aristida holathera var. holathera*, *Eriachne helmsii*, *and Eragrostis eriopoda)* with an open to sparse low shrubland of *Senna artemisioides subsp. artemisioides* and *Acacia ayersiana*. *Acacia aneura* is also present. *Triodia schinzii* is yet to regenerate after recently burnt areas (low rainfall), and other small forbs (including *Scaevola basedowii* and *Leptosema chambersii*) were more common in these areas. Sandplains in close proximity to dune often also included reasonable numbers of dune specialist species. An extensive fire burnt most parts of the sandplain in 2011; and a more recent fire (<2 years) burnt the swales in the south-eastern part of survey area.	

Land type	Description	Photograph
WM27-B	Sand dune and dune flanks (<10m relief). Aeolian red siliceous sands. Open shrubland of *Acacia melleodora* and *Grevillea stenobotrya* over spinifex (*Triodia schinzii*). Other common species are *Chrysocephalum eremaeum, Dampiera cinerea* and *Calotis erinacea*. Patches of *Aluta maisonneuvei subsp. maisonneuvei* were also present on dune flanks. Sporadic emergent trees (*Corymbia chippendalei* and *Allocasuarina decaisneana*). Spinifex was absent or regenerating after recent fire (with last 2 years), and often small sub-shrubs/forbs were dominant in burnt areas (such as *Scaevola basedowii* and *Leptosema chambersii*). An extensive fire burnt most parts of the dunes in 2011; and a more recent fire (<2 years) burnt the south-eastern part of survey area.	
WM27-C	Mulga on localised areas sandstone outcrop and laterised gravel. Sandy red earth soils; likely shallow. Patchy low woodland to low open woodland of *Acacia aneura* and *Acacia ayersiana*. Common shrubs include *Eremophila latrobei subsp. glabra* and *Senna artemisioides subsp. artemisioides*. Ground layer is sparse in the red earth areas with *Eriachne helmsii* and *Eragrostis eriopoda* being most common species. This small patch has avoided recent fires (over the past 10 to 20 years). Evidence of old burnt mulga stumps around the edge of the patch indicate that it may have been a large patch prior to burning (edges are more exposed to spinifex fuel loads and therefore more at risk of fire impact). Very little mulga regeneration was observed.	

WEST MEREENIE 27

Survey information

- Survey area (well pad)
- Survey area (access and pipelines)
- Check sites
- Survey transects
- Exisitng underground pipeline
- Existing tracks or siesmic lines

Land types (1:5,000) (ground-truthed)

WM27-A: undulating sandplain with an open shrubland of Acacia melleodora and Eremophila latrobei subsp. latrobei over spinifex (Triodia schinzii) with occasional emergent trees. Scattered areas of localised sandstone outcrop.

WM27-B: sand dunes (<10m height) with open to sparse shrubland of Acacia melleodora and Grevillea stenobotrya over spinifex (Triodia schinzii). Scattered emergent Allocasuarina decaisneana and Corymbia chippendalei.

WM27-C: Low outcrop and laterised gravel with patchy low woodland of Acacia aneura and Acacia ayersiana over tussock grasses.

N

0 37.5 75 150

Metres

MAP INFORMATION
Scale: 1:5,500 @ A4
Projection: GCS GDA 1994
Date Saved: 15/10/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Survey area: EcOz (based on client)
Survey data: EcOz (Feb 2020)
Imagery: Maxar (24/8/2018)

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Figure 4-7. Map of land types present within the WM27 survey area

4.3.6 West Mereenie 28 (WM28)

Seven land types occur within the WM28 survey area (refer to Table 4-6; Figure 4-9); none of which contain sensitive or significant vegetation communities, or are considered as a GDE. The eastern access survey area was not ground-surveyed (land types were inferred from aerial imagery and adjacent field data).

The majority of the survey area supports sandy red earth plains and rises with Blue Mallee (*Eucalyptus gamophylla*) and Acacia (*Acacia aneura, A. aptaneura and A. ayersiana*) that are dominated by either tussock grasses (mainly *Eragrostis eriopoda subsp. Red earth*) (land type WM28-A) or spinifex (*Triodia schinzii*) (land type WM28-B). Red earth depressions dominated by Mulga (*Acacia aneura, Acacia aptaneura and Acacia ayersiana*) (land type WM28-C) occur in the low-points (run-ons). A sandstone hill (approximate 10m relief) is located in central western region of the survey area which supports Hill Mulga (*Acacia macdonnellensis subsp. macdonnellensis*) over spinifex (*Triodia melvillei*) (land type WM28-D). This area transitions into a relatively flat gravelly (laterised) plain (land type WM28-E). A low dune is present along the eastern access corridor (land type WM28-G).

The sandstone hill (land type WM28-D) located within the central part of the survey area contains a rocky breakaway that is considered to be locally important refugia for native species (relatively isolated rocky habitat) (see photograph in Figure 4-8); no significant species were recorded during the survey.

One ephemeral drainage feature is present within the survey area – land type WM28-C (red earth Mulga depression). This has a low level of ecological significance (as it is common in the region and is not known to support a significance species).

Weed impacts are very low. No declared weed species under the *Weed Management Act* were recorded. Buffel Grass (*Cenchrus ciliaris*) was only observed at one location (single plant).

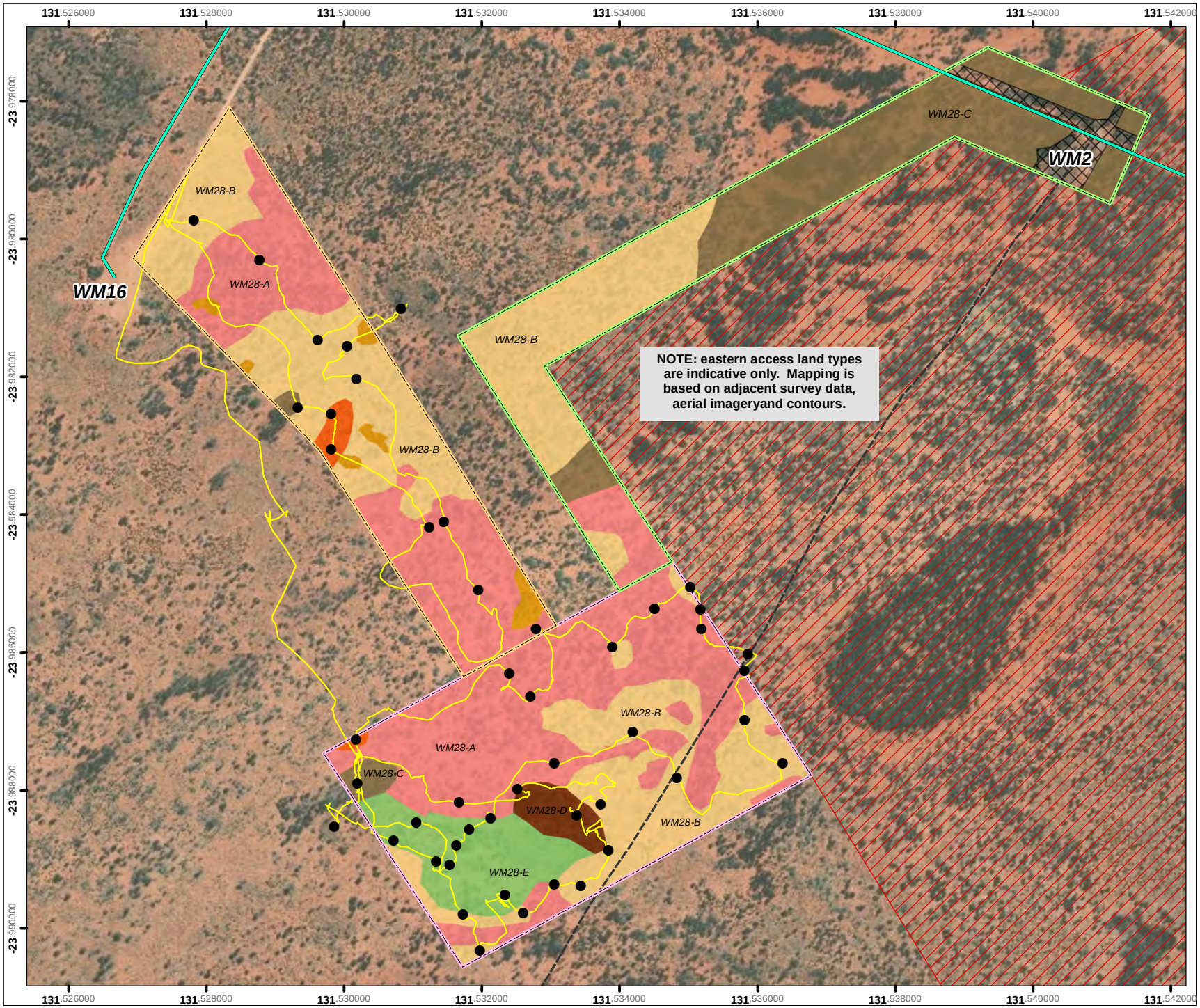
Vegetation is in relatively good condition. There is a very low level of physical disturbance within the survey area, with the only clearing associated with an historic single lane seismic line (unknown year of establishment) which is barely visible onground. Impacts by Horse and Camel were at low levels. There was very little fire impact (partially burnt in 2011 and the last widespread fire occurring at least 20 years ago).

Figure 4-8. Photograph of isolated rocky hill at WM28 (considered to be locally important habitat)

Table 4-6. Land type descriptions and photographs – WM28 survey area

Land type	Description	Photograph
WM28-A	Tussock grass sandy red earth plains and rises. Sandy red earth soils. Patchy tall shrubland of *Acacia aneura, Acacia ayersiana* and *Eucalyptus gamophylla* over scattered low shrubs (mainly *Eremophila latrobei subsp. latrobei, Psydrax latifolia* and *Acacia ramulosa var. ramulosa*) with a tussock grass dominant ground layer (mainly *Eragrostis eriopoda subsp. Red earth*). Occasional *Eucalyptus intertexta*.	
WM28-B	Spinifex red earth sandplains and sandy rises. Soils vary from sandy red earth to aeolian red siliceous sands. Open to sparse shrubland of *Eucalyptus gamophylla +/- Acacia kempeana* and *A. aneura* over spinifex (*Triodia schinzii*). Other common shrubs include *Grevillea juncifolia subsp. juncifolia*, *Psydrax latifolia, Acacia maitlandii, Senna artemisioides subsp. artemisioides, Aluta maisonneuvei subsp. maisonneuvei, Eremophila willsii subsp. Kata Pata, Jasminum calcareum)*. Uncommon emergent *Allocasuarina decaisneana* (mostly only young trees present) Last fire estimated at 20 years.	
WM28-C	Red earth depression. Ephemeral drainage feature (i.e. depression); considered to have low ecological significance. Clayey red earth; localised run-on areas. Low woodland of *Acacia aneura, Acacia aptaneura and Acacia ayersiana* with sparse shrubs (*Eremophila latrobei subsp. latrobei, Psydrax latifolia* and *Psydrax ammophila*) over a scattered cover of tussock grasses (common species include *Aristida inaequiglumis, Eragrostis eriopoda subsp. Red earth* and *Digitaria brownii*). Long-time unburnt.	
WM28-D	Sandstone hill (~ 10m relief) with a rocky breakaway area on the eastern side; transitions into a gravel plain to the west. Considered to support locally important habitat. Skeletal soils; shallow pale brown sandy loam. Open shrubland of Acacia macdonnellensis subsp. macdonnellensis over spinifex (*Triodia melvillei*). Shrub layer is relatively sparse with commonly encountered species *Psydrax latifolia* and *Eremophila latrobei subsp. latrobei*. Emergent trees (isolated) *Corymbia eremaea.* Last fire estimated at 20 years.	

Land type	Description	Photograph
WM28-E	Gravelly (laterised) sandstone rise (flat). Sandy loam (likely shallow) with fine to pebbly laterised gravel. Open to sparse shrubland of Mulga hybrid *Acacia aneura x Acacia minyura* over sparse tussock grasses (mainly *Eragrostis eriopoda* and *Eriachne mucronata*). Other less common species include *Senna artemisioides subsp. artemisioides, Psydrax suaveolens, Psydrax latifolia, Ptilotus obovatus var. obovatus*). An unknown form of *Acacia aneura* (likely hybridised) was encountered in this land type. Last fire estimated at 20 years.	
WM28-G	Spinifex sand dunes; low relief. Red siliceous sands Patchy shrubland of *Aluta maisonneuvei subsp. maisonneuvei, Eucalyptus gamophylla* over spinifex (*Triodia schinzii*) and *Chrysocephalum eremaeum*. Other common species include *Acacia ligulata*, *Acacia melleodora, Grevillea juncifolia subsp. juncifolia, Goodenia mueckeana, Eremophila willsii subsp. Kata Pata, Leucochrysum stipitatum and Eremophila latrobei subsp. latrobei*). Sporadic emergents *Allocasuarina decaisneana* and *Corymbia chippendalei.* Last fire estimated at 20 years.	
WM28-H	Sandy rise. Red siliceous sands and sandy red earths. Low shrubland of *Aluta maisonneuvei subsp. maisonneuvei* over scattered spinifex (*Triodia schinzii*). Only generally present in small isolated patches, or at the base of sand dunes.	



WEST MEREENIE 28

Survey information

- Well site survey area (field)
- Western access option (field)
- Eastern access option (desktop)
- Underground pipelines (existing)
- CLC Restricted Works Area
- Existing tracks or siesmic lines

Land types (1:5,000) (ground-truthed)

- WM28-A: undulating sandy red earths with a patchy tall shrubland of Acacia aneura, Acacia ayersiana and Eucalyptus gamophylla over tussock grass
- WM28-B: sandy red earth plains / rises with open to sparse shrubland of Eucalyptus gamophylla +/- Acacia kempeana and Acacia aneura over spinifex (Triodia schinzii)
- WM28-C: red earth depression / swale with Acacia aneura, Acacia aptaneura and Acacia ayersiana over scattered tussock grasses
- WM28-D: sandstone hill (with breakaway) with an open shrubland of Acacia macdonnellensis over spinifex (Triodia melvillei)
- WM28-E: gravel plain with an open to sparse shrubland of Mulga hybrid Acacia aneura x Acacia minyura over sparse tussock grasses
- WM28-G: sand dunes with a patchy shrubland of Aluta maisonneuvei subsp. maisonneuvei, Eucalyptus gamophylla over spinifex (Triodia schinzii) and Chrysocephalum eremaeum
- WM28-H: sandy rises with an open shrubland of Aluta maisonneuvei subsp. maisonneuvei
- Disturbed
- Survey transect

0 50 100 200
Metres

MAP INFORMATION
Scale: 1:8,500 @ A4
Projection: GCS GDA 1994
Date Saved: 17/08/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Survey area: Central Petroleum
Survey data: EcOz (Feb 2020)
Imagery: Maxar (18/8/2018)

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Figure 4-9. Map of land types present within the WM28 survey area

4.3.7 Mamlambo 1

Six land types occur within the Mamlambo 1 survey area (refer to Table 4-7; Figure 4-11); none of which are sensitive or significant vegetation communities, or are considered as a GDE.

The drill site survey area mostly comprises of spinifex-covered sandplains (land type M1-A) support Blue Mallee (*Eucalyptus gamophylla*) and other mixed Acacia shrubs (common species including *Acacia abrupta, Acacia ligulata* and *Acacia melleodora*) over spinifex (*Triodia epactia* and *T. schinzii*). There are also occasional patches of sandy red earth (land type M1-B) that support open stands of mature Ironwood (*Acacia estrophiolata*) and Mulga (mostly *Acacia ayersiana*). One low dune (land type M1-C) is present on the northern boundary of the survey area, as well as a small stand of mature Desert Oak (land type (M1-D).

The access corridor follows a seismic line and was burnt in late 2019 and vegetation is yet to recover (fire scar within survey area is shown on Figure 4-11). It mainly supports spinifex-covered sandplains (land type M1-A) with two dune crossings in the southern section of the corridor (land type M1-C). Low calcrete rises (land type M1-E) and calcareous earths (land type M1-F) are present in the central part of the corridor, which occur in close association with lower lying Mulga dominated red earth depressions (land type M1-B). These depressions form part of a weakly defined drainage network that flows to clay pan 1 km to the east.

One ephemeral drainage feature is present within the survey area – land type M1-B (red earth depression with Ironwood and Mulga). This has a low level of ecological significance (as it is common in the region and is not known to support a significance species).

No weed species were recorded within the survey area, and access tracks and roads into site also had low to no weed presence. Buffel Grass (*Cenchrus ciliaris*) was only observed at one small patch at the Surprise 1 well site (latitude -23.714076; longitude 129.994292; GDA94), which is currently confined to a gravel stockpile (see photograph in Figure 4-10). Survey within the fenced areas of Surprise 1 was not possible due to locked gates; however, inspection from outside the fence did not indicate any obvious infestations of Buffel Grass or any other weed species.

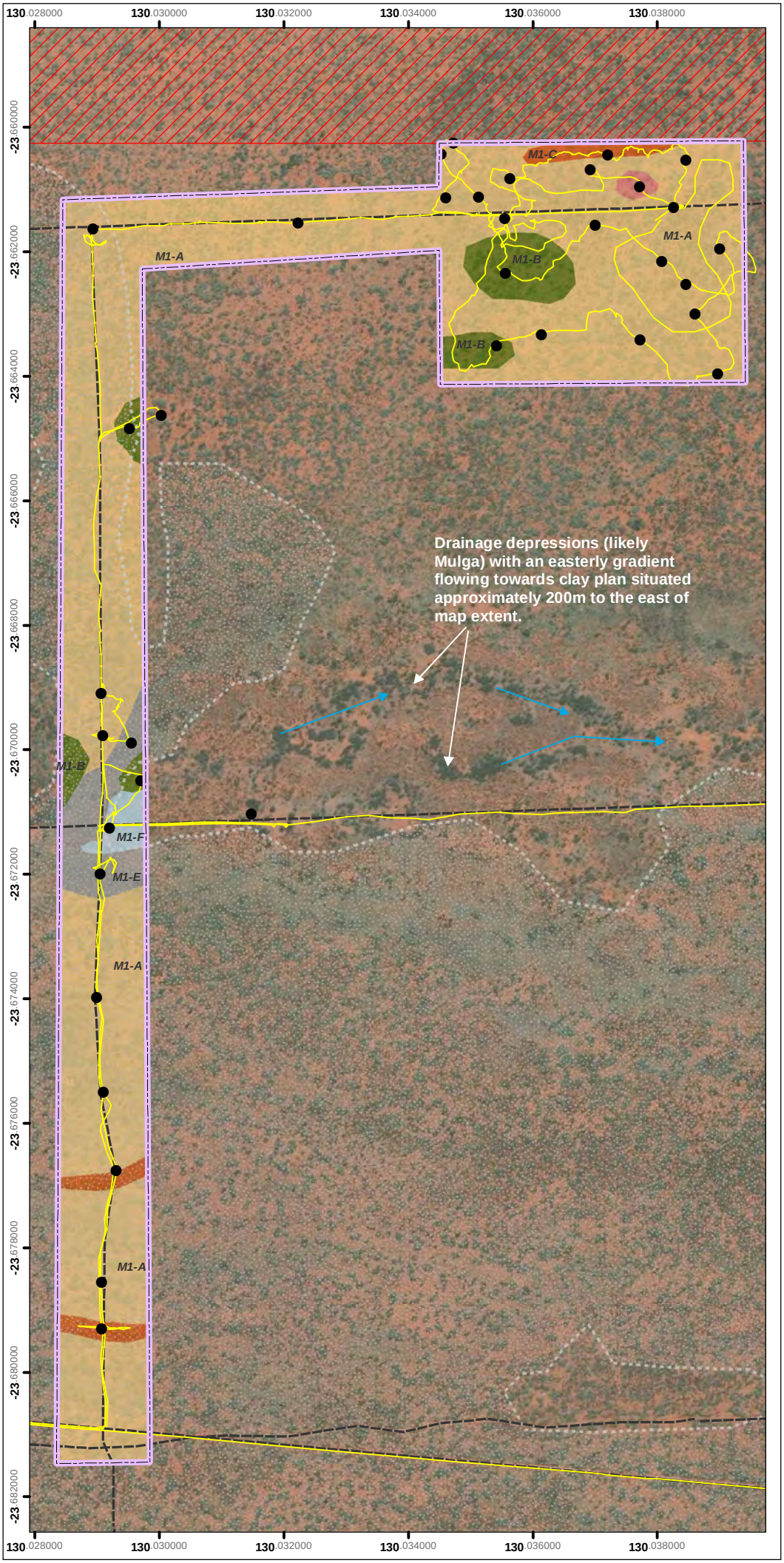
Vegetation within the drill site survey area is in good condition, as well as unburnt areas within the access corridor. There is a very low level of physical disturbance within the survey area, with the only clearing associated with a single lane seismic line (unknown year of establishment) that is still trafficable. The proposed access road follows this seismic line to minimise area of vegetation disturbance. Most of the access track survey area was recently burnt 2019; the drill site area has not been burnt in the last 20 years.

Figure 4-10. Photograph of Buffel Grass established on gravel stockpile at Surprise 1

Table 4-7. Land type descriptions and photographs – Mamlambo 1 survey area

Land type	Description	Photograph
M1-A	Flat to gently undulating sandplain. Red siliceous sands; occasional spots of exposed calcrete outcrop and calcareous fragments. Open shrubland dominated by *Eucalyptus gamophylla, Acacia ligulata, Acacia abrupta* and *Acacia melleodora* over spinifex (*Triodia epactia* and to a lesser extent *Triodia schinzii*). *Templetonia egena* and *Ptilotus obovatus* were also scattered across this unit. The eastern and southern parts of the drill site area supported notably higher densities of *Acacia abrupta*. *Eucalyptus gamophylla* and *Acacia melleodora* also 'thickened up' in some areas (mainly in the western portion). Recently burnt areas (present along the access track) supported early recruit grass species including *Aristida holathera, Paspalidium reflexum* and *Yakirra australiensis var. australiensis*. Very little other recovery was noted due to low rainfall.	
M1-B	Sandy red earth depressions; flat; localised. Ephemeral drainage features (i.e. depression); considered to have low ecological significance. Sandy red earth; earthy clays. Open woodland of *Acacia ayersiana* and *Acacia estrophiolata* over open spinifex (*Triodia epactia*), tussock grasses (mainly *Eragrostis eriopoda / laniflora*) and *Ptilotus obovatus*. Likely higher cover of tussock grasses in better conditions. Other scattered trees and shrubs (likely associated with bird dispersal) include *Senna artemisioides subsp. petiolaris, Acacia pruinocarpa, Psydrax ammophila, Eremophila latrobei subsp. latrobei, Anthobolus leptomerioides, Stylobasium spathulatum*).	

Land type	Description	Photograph
M1-C	Low linear sand dunes (relief approx. to 5m). Red siliceous sands. Open shrubland of *Eucalyptus gamophylla* and *Acacia ligulata* with scattered *Grevillea stenobotrya, Dodonaea viscosa subsp. angustissima* and *Acacia melleodora* over spinifex (*Triodia schinzii* and *Triodia epactia*). Other less common dune species included *Chrysocephalum eremaeum, Eriachne helmsii* and *Calytrix carinata.* Recently burnt areas (only encountered along access track) supported some early recruitment / germination of *Paractaenum refractum, Eriachne aristidea, Crotalaria cunninghamii* and *Tribulopis angustifolia*; however, very little recovery of other dominant species (such as spinifex and shrubs) had occurred due to low rainfall.	
M1-D	Stand of Desert Oak within sandplain. Sandy red earth soils. Open woodland of *Allocasuarina decaisneana* over scattered spinifex (*Triodia epactia*) and *Ptilotus obovatus*. Very low groundcover under canopy. Sparse low shrubland of *Eremophila latrobei subsp. latrobei, Eremophila platythamnos subsp. exotrachys* and *Acacia ligulata*. Desert Oak are scattered throughout other land types but rarely present as mature stands.	
M1-E	Low calcrete rise. Calcareous earths; calcrete outcrop / fragments. Only present along access track. Low open shrubland of *Acacia kempeana* and *Senna artemisioides subsp. petiolaris* over *Aristida holathera*. Spinifex is the dominant groundcover; but was absent due to recent fire (could see remnants of burnt spinifex rings). Entirely burnt from recent fire in 2019. Therefore vegetation difficult to confidently describe.	
M1-F	Calcareous earth. Run-on area associated with calcrete rises. Only present along access track; avoided fire. Low open shrubland of *Senna artemisioides subsp. petiolaris* over a sparse ground later of *Ptilotus obovatus* and spinifex (*Triodia epactia*). Other less common species included *Templetonia egena, Ptilotus sessilifolius, Sclerolaena diacantha, Eremophea spinosa, Eragrostis sp. Limestone, Eremophila sturtii, Eragrostis eriopoda.*	



MAMLAMBO 1

Survey information

- Ecological survey area
- Check sites
- Survey transects
- Existing tracks or siesmic lines
- Recent fire scar (Nov 2019)
- CLC Restricted Works Area

Land types (1:5,000) (ground-truthed)

M1-A: Sandplain with an open shrubland dominated by Eucalyptus gamophylla, Acacia ligulata, Acacia abrupta and Acacia melleodora over spinifex (Triodia epactia and to a lesser extent Triodia schinzii).

M1-B: Sandy red earth depression with an open woodland of Acacia ayersiana and Acacia estrophiolata over open spinifex (Triodia epactia), tussock grasses (mainly Eragrostis eriopoda / laniflora) and Ptilotus obovatus.

M1-C: Sand dune with an open shrubland of Eucalyptus gamophylla and Acacia ligulata with scattered Grevillea stenobotrya, Dodonaea viscosa subsp. angustissima and Acacia melleodora over spinifex (Triodia schinzii and Triodia epactia)

M1-D: Sandy red earth with Open woodland of Desert Oak (Allocasuarina decaisneana) over spinifex (Triodia epactia) and Ptilotus obovatus. Sparse shrubs.

M1-E: Low calcrete rise (recently burnt) with a low open shrubland of Acacia kempeana and Senna artemisioides subsp. petiolaris over spinifex.

M1-F: Calcareous plain with a low open shrubland of Senna artemisioides subsp. petiolaris over a sparse ground later of Ptilotus obovatus and spinifex (Triodia epactia).

N

0 50 100 200
Metres

MAP INFORMATION
Scale: 1:10,000 @ A4
Projection: GCS GDA 1994
Date Saved: 17/08/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Survey area: Central Petroleum
Survey data: EcOz (Mar 2020)
Fire scar 2019: EcOz 2020
Imagery: Maxar (Aug 2018)

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Path: C:\01. EcOz GIS Projects (TR)\EZ19243 (Tom) - Ecological Site Assessment Central Petroleum\01 Project Files\LandTypes_MAM-1 v3.mxd

Figure 4-11. Map of land types present within the Mamlambo 1 survey area

5 THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT

This chapter focuses on determining which threatened species have the potential to occur within the survey area. This includes a desk-based likelihood of occurrence assessment, followed by a field validation survey for each threatened species considered to possibly occur in the survey area. Data from previous surveys was also incorporated into the assessment (if available).

5.1 Threatened species categories

The International Union for the Conservation of Nature nominates a set of criteria used to identify species at risk of extinction. These criteria are used to define categories of risk which are used by the Northern Territory Government to determine which threatened species are listed under the *Territory Parks and Wildlife Conservation Act* (*TPWC Act*), and by the Commonwealth Government to determine which threatened species are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). This report focusses on species that are listed as Vulnerable, Endangered or Critically Endangered under either Act. The *EPBC Act* also protects important habitat for, and significant occurrences of, migratory species. Northern Territory Flora and Fauna Atlas records and land type mapping indicate that the study area contains neither – and, as such, migratory species do not require further assessment.

Species listed as Near Threatened under the *TPWC Act*, or known to have a restricted range, were also noted if observed during field surveys – because avoiding / minimising impacts to these species is also recommended in terms of minimising impacts to local or regional biodiversity values. However, these species are not included in the likelihood of occurrence assessment. Instead, a list for the sub-bioregion was generated from Flora and Fauna Atlas data and surveyors searched for the presence / potential presence of these species during field studies.

5.2 Desktop 'likelihood of occurrence' assessment

The purpose of the desktop 'likelihood of occurrence' assessment is to identify which threatened species have potential to occur within the survey areas. The assessment uses sub-bioregional flora and fauna records, land system information, aerial imagery, species ecological knowledge, expert knowledge and any previous biological surveys in close proximity to the survey area. This is a broad-scale approach to ensure that all relevant species are properly interrogated. Species identified to have the potential to occur within the survey areas were further investigated during field studies to validate the occurrence assessment.

For this assessment, survey areas that occur in close proximity, and occur within the same sub-bioregion and land system, have been evaluated together (as per Table 5-1). For each species identified by sub-bioregion Flora and Fauna Atlas clips, the likelihood of occurrence within the survey area was made based on habitat requirements, distribution, the number and dates of proximate records, existing survey data and expert knowledge. The procedure for the assessment is described below.

Table 5-1. Bioregions used for the desktop threatened species assessment

Well site	Bioregion	Sub region	Land system	Assessment
Dingo 1ST1 & 5	Finke	Henbury	Simpson (desert dunefields / sandplains)	Appendix B
Orange 3	Finke	Henbury	Ewaninga (desert sandplains / calcrete rises)	Appendix C
PV12	MacDonnell Ranges	Watarrka	Krichauff (sandstone hills / ranges)	Appendix D
WM27 & 28	Great Sandy Desert	Mackay	Simpson (desert dunefields / sandplains)	Appendix E
Mamlambo	Great Sandy Desert	Mackay	Simpson (desert dunefields / sandplains)	Appendix F

5.2.1 Procedure

The following procedure was used to undertake the likelihood of occurrence assessment for each relevant threatened species:

1) Identify which sub-bioregions intersect each well site (as per Table 5-1).
2) Correlate threatened flora and fauna records with the sub-bioregions using the latest Northern Territory Flora and Fauna Atlas database (last updated in February 2020).
3) Use the EPBC Protected Matters Search Tool to determine species listed as threatened under the *EPBC Act* (undertaken February 2020 – see Appendix H). A buffer of 50 km around each survey area was used.
4) Combine the results of steps 2 and 3 to generate a list of threatened species that may occur within the sub-bioregion intersected by the survey area.
5) Review details for each of those species – conservation status (Northern Territory and Commonwealth), habitat requirements, distribution, number of records (from the Northern Territory Fauna and Flora Atlas dataset), and presence inferences from the EPBC PMST report.
6) Analyse the likelihood that each species will occur in the survey area by applying likelihood ratings defined in Table 5-2 (this assessment uses the existing environment information described in Section 2 to estimate/infer habitat suitability of the survey area):

Table 5-2. Threatened species 'likelihood of occurrence' criteria definitions

Likelihood rating	Likelihood of occurrence definition
HIGH	It is expected that this species lives within the study area because there is core habitat and recent (post-2000) proximate Atlas records or knowledge that the species occurs in the local area.
MEDIUM	Species may live within the study area because there is suitable habitat; however, there is evidence that lowers its likelihood of occurrence (known range contraction of the species in the region, no recent records with the search area, substantial loss of habitat within the study area since previous records, species is naturally-rare or occurs at a low density etc.).
LOW	Species may occur, as a vagrant, within the study area; only marginally-suitable habitat is expected.
NONE	There is strong evidence that this species will not occur within the study area.

5.2.2 Desktop results

The results from the desktop threatened species 'likelihood of occurrence' assessment are summarised in Table 5-3. Full details of each assessment are provided in Appendix B (Dingo 1-ST1 & 5), Appendix C (Orange 3), Appendix D (PV12), Appendix E (WM27 & WM28) and Appendix F (Mamlambo 1).

Species considered to potentially occur within the survey areas (i.e. they have a likelihood rating of High, Medium or Low) will be investigated during field studies to ground-truth their likelihood of occurrence, with a higher degree of assessment species given 'High' or 'Medium' likelihood ratings.

No further investigation is required for species given a 'None' likelihood rating, as they are not expected to occur within the survey area.

Table 5-3. Desktop threatened species 'likelihood of occurrence' summary

Likelihood	Species	Status	
		TPWC	EPBC
DINGO 1-ST1 and DINGO 5			
HIGH	Rainbow Valley Fuchsia Bush (*Eremophila prostrata*)	NT	VU
MEDIUM	Desert Quandong (*Santalum acuminatum*)	VU	-
	Slater's Skink (*Liopholis slateri*)	VU	EN
LOW	Grey Falcon (*Falco hypoleucos*)	VU	-
	Princess Parrot (*Polytelis alexandrae*)	VU	VU
	Greater Bilby(*Macrotis lagotis*)	VU	VU
	Southern Marsupial Mole (*Notoryctes typhlops*)	VU	-
NONE	19 species (refer to Appendix B)	n/a	n/a
ORANGE 3			
MEDIUM	Rainbow Valley Fuchsia Bush (*Eremophila prostrata*)	NT	VU
	Slater's Skink (*Liopholis slateri*)	VU	EN
LOW	Tjilpi Wattle (*Acacia latzii*)	VU	VU
	Grey Falcon (*Falco hypoleucos*)	VU	-
NONE	25 species (refer to Appendix C)	n/a	n/a
PV12			
HIGH	Slater's Skink (*Liopholis slateri*)	VU	EN
MEDIUM	Black-footed Rock-wallaby (*Petrogale lateralis*)	NT	VU
LOW	MacDonnell Ranges Cycad (*Macrozamia macdonnellii*)	NT	VU
	Minnie Daisy (*Minuria tridens*)	VU	VU
	Palm Valley Myrtle (*Thryptomene hexandra*)	NT	VU
	Olearia (*Olearia macdonnellensis*)	EN	VU
	Grey Falcon (*Falco hypoleucos*)	VU	-
	a land snail *(Granulomelon squamulosum*)	VU	-
	a land snail (*Divellomelon hillieri*)	VU	-
NONE	35 species (refer to Appendix D)	n/a	n/a
WM27 and WM28			
MEDIUM	Desert Quandong (*Santalum acuminatum*)	VU	-
	Princess Parrot (*Polytelis alexandrae*)	VU	VU
	Brush-tailed Mulgara (*Dasycercus blythi*)	VU	VU
	Greater Bilby(*Macrotis lagotis*)	VU	VU
	Southern Marsupial Mole (*Notoryctes typhlops*)	-	VU
	Great Desert Skink (*Liopholis kintorei*)	VU	VU
LOW	Night Parrot (*Pezoporus occidentalis*)	CR	EN
	Grey Falcon (*Falco hypoleucos*)	VU	-
	Slater's Skink (*Liopholis slateri*)	VU	EN
NONE	18 species (refer to Appendix E)	n/a	n/a
MAMLAMBO			
HIGH	Brush-tailed Mulgara (*Dasycercus blythi*)	VU	VU
	Greater Bilby(*Macrotis lagotis*)	VU	VU
MEDIUM	Desert Quandong (*Santalum acuminatum*)	VU	-
	Princess Parrot (*Polytelis alexandrae*)	VU	VU
	Great Desert Skink (*Liopholis kintorei*)	VU	VU
LOW	Night Parrot (*Pezoporus occidentalis*)	CR	EN
	Grey Falcon (*Falco hypoleucos*)	VU	-
	Southern Marsupial Mole (*Notoryctes typhlops*)	VU	-
NONE	16 species (refer to Appendix F)	n/a	n/a

5.3 Field survey and assessment

Threatened species identified by the desktop assessment (see Section 5.2) to have a 'High' or 'Medium' likelihood rating were subject to targeted surveys to confirm presence or absence within the survey area(s) to a reasonable level of certainty. Species searches and habitat suitability checks were also undertaken for species given a 'Low' likelihood rating; however, a lower level of survey 'rigor' was considered necessary because a significant impact to these species is not expected to occur as a result of proposed clearing.

Threatened fauna species were surveyed using track-based survey techniques and habitat suitability checks based on Commonwealth survey guideline documents (DSEWPaC 2010a & b; DSEWPaC 2011) and arid zone track-plot techniques described by Moseby et al. (2012). Methods and survey effort used in this survey are consistent with those previously accepted by DEPWS Flora Fauna Division for a range of other projects within the southern Northern Territory for determining presence or absence of these species within a survey area – such as Ammaroo EIS (Verdant Resources), Northern Gas Pipeline EIS (Jemena) and Yulara Hybrid Power Station Development Application (Territory Generation).

Threatened flora species were surveyed by Andrew Schubert (well known arid zone botanist), who searched for each species by walking transects throughout each survey area. All target flora species are perennial and are expected to be detectable at the time of survey, if present. Habitat suitability checks were also undertaken. All flora species encountered along transects were recorded to provide a 'species list' for each survey area. General abundance and habitat information was recorded.

Surveys were conducted by Tom Ewers-Reilly (ecologist) and Andrew Schubert (botanist / ecologist) in December 2019 (Dingo 1-ST1, Dingo 5, PV12, WM27 and WM28), February 2020 (Orange 3), March 2020 (Mamlambo) and October 2020 (WM27 new survey area). Tom and Andrew are suitably qualified to survey and assess the target species related to this program – refer to Section 1.4 for surveyor experience.

5.3.1 Methodology

As the survey areas are relatively small (i.e. maximum of 550 x 700m) and easily accessible on foot, walked-transect searches were employed as they provided the most efficient means of surveying species detectability over the entire survey area (rather than 'survey sites' or 'quadrats'). Transects were walked by two ecologists and representative areas of each land type were surveyed – targeting habitat of interest where relevant. Refer to land type maps in Section 4.3 for transect locations (transect distance based on GPS tracklog data is provided in results section). This level of survey effort aims to provide a sufficient degree of certainty for determining presence or absence of each target species.

Survey techniques for each target species are described in Table 5-4. Active searches involved recording all species encountered (flora and fauna), with a focus on target species, and also other species of regional conservation significance (such as Near Threatened species listed under the *TPWC Act*). Fauna tracking (i.e. tracks, burrows, diggings, sightings, scats, nests) were recorded for all species, and assigned general 'age' (i.e. fresh, recent, old) and 'abundance' (i.e. abundant, common, uncommon). Habitat suitability was undertaken by comparing species habitat requirements with onsite conditions (i.e. landform type, vegetation type and condition, availability of food sources, fire history, weed infestation, feral animal presence / impacts, existing disturbances, and presence or absence of any critical habitat features).

5.3.2 Permits

- Animal Welfare Authority (DPIR) Licence No 038. Expires 22/01/21.
- Animal Research Permit: A20009 'Fauna Studies in the Northern Territory' (CDU Ethics Committee) Expires 5/02/2024.
- Permit to Interfere with Protected Wildlife Northern Territory: 66511 (Parks and Wildlife Commission). Expires 15/4/2022.
- No permits are required for flora surveys in the Northern Territory.

Table 5-4. Threatened species survey techniques

Species	Survey area	Species information	Survey techniques
Rainbow Valley Fuchsia Bush (*Eremophila prostrata*)	• Dingo 1-ST1 (high likelihood) • Dingo 5 (high likelihood) • Orange 3 (medium likelihood)	• Small perennial spreading shrub to 50cm high • Sandplains and lower dune slopes that characteristically support hummock grasses (Triodia basedowii), and a variety of shrubs and trees including Grevillea, Hakea, Acacia, and Desert Oaks (Kerrigan et al. 2012). • Threats are unknown.	• Transect searches for direct observation of species. Focusing on sandplains and lower dune slopes. • Habitat suitability check.
Desert Quandong (*Santalum acuminatum*)	• Dingo 1-ST1 (medium likelihood) • Dingo 5 (medium likelihood) • WM27 (medium likelihood) • WM28 (medium likelihood)	• Perennial shrub or small tree up to 3 to 4m • Known to occur in dune swales, creeks, plains and low rises with sandy or sandy or loam soils – sometimes with shallow limestone or sandstone. • Threats are camel grazing, wildfire, wood harvesting, and grazing on germination / regrowth by rabbits and horses after fire.	• Transect searches for direct observation of species within entire survey area. • Habitat suitability check.
Tjilpi Wattle (*Acacia latzii*)	• Orange 3 (low likelihood)	• Perennial shrub or small tree up to 4 m (Nano et al. 2012a). • Known to occur on silcrete-capped mesas and low stony hills derived from mainly shale and siltstone – often concentrated along minor drainages and on low hill slopes (Nano et al. 2012a). • Threats are increase fire hazard associated with Buffel Grass. Recruitment impacted by grazing from introduced herbivores (Nano et al. 2012a).	• Transect searches for direct observation of species within entire survey area. • Habitat suitability check.
MacDonnell Ranges Cycad (*Macrozamia macdonnellii*)	• PV12 (low likelihood)	• Distinctive cycad, often to 2 m (Kerrigan et al. 2006). • Known to occur on rocky sites, predominantly in gorges and on steep sheltered slopes but also occasionally on exposed hills / mountain tops – prefers shady locations with relatively high soil moisture (Kerrigan et al. 2006). • Threats include seed collection and increasing aridity due to climate change (Kerrigan et al. 2006).	• Transect searches for direct observation of species within entire survey area. • Habitat suitability check.
Minnie Daisy (*Minuria tridens*)	• PV12 (low likelihood)	• Perennial sub-shrub to 30cm high (Nano et al. 2012b). • Known to occur on dolomite, limestone and calcrete impregnated sandstone hills, rises and ranges. Typically southerly aspect – in low Acacia shrublands and spinifex is often absent (DoE 2016). • Main threat is increase fire hazard, mainly cause by Buffel Grass (Nano et al. 2012b).	• Transect searches for direct observation of species within entire survey area, but more focused searches within rocky gullies. • Habitat suitability check.

Species	Survey area	Species information	Survey techniques
Palm Valley Myrtle (*Thryptomene hexandra*)	• PV12 (low likelihood)	• Perennial shrub to 2.5 m with a spreading habit. • Known to occur on rocky gullies and steep rocky slopes, generally with a southerly aspect and with a degree of natural fire protection (pers. comm Andrew Schubert 2020).	• Transect searches for direct observation of species within entire survey area. • Habitat suitability check.
Olearia (*Olearia macdonnellensis*)	• PV12 (low likelihood)	• Viscid aromatic shrub to 1.2 m high (Nano et al. 2012c). • Known to occur in a variety of rocky habitat and aspects, often with some degree of natural fire protection (Nano et al. 2012c). • Main threat is fire (Nano et al. 2012c).	• Transect searches for direct observation of species within entire survey area. • Habitat suitability check.
Grey Falcon (*Falco hypoleucos*)	• All sites (low likelihood)	• Medium sized pale falcon. • A generally solitary desert falcon that occurs in areas of lightly-timbered lowland plains, typically on inland drainage systems, where the average annual rainfall is less than 500 mm (Ward 2012). • Sparsely distributed through much of the arid and semi-arid regions. • Breeding records mostly occur south of Daly Waters (Schoenjahn 2013), with nests positioned in trees along major watercourses.	• Check for potential nests and / or suitable nesting habitat by walking transects within entire survey area. • Incidental sightings also recorded.
Princess Parrot (*Polytelis alexandrae*)	• Dingo 1-ST1 (low likelihood) • Dingo 5 (low likelihood) • WM27 (medium likelihood) • WM28 (medium likelihood) • Mamlambo (medium likelihood)	• Distinctive (colourful) medium sized parrot. • Usually occupies dune swales, and occasionally slopes and crests of dunes (Pavey 2006). • Breeding occurs in hollows in large Eucalypts (River Ged Gum and Marble Gum) and Desert Oaks (Pavey 2006). • Threats are not well known; likely associated with habitat homogenization since European settlement. Grazing by rabbits and introduced herbivores (particularly camels) and changes to fire regimes are likely also factors (Pavey 2006a).	• Check for potential nests and / or suitable nesting habitat by walking transects within entire survey area. • Incidental sightings also recorded.
Greater Bilby (*Macrotis lagotis*)	• Dingo 1-ST1 (low likelihood) • Dingo 5 (low likelihood) • WM27 (medium likelihood) • WM28 (medium likelihood) • Mamlambo (high likelihood)	• A large distinctive bandicoot with grey fur and large ears; nocturnal (Pavey 2006b). • Typical habitat consists of sandy soils dominated by hummock grasslands covered predominantly by three species of spinifex – *Triodia basedowii, T. pungens* and *T. schinzii* (Pavey 2006b). But have been observed in a wide range of habitats including stony uplands, lateritic areas, spinifex sand-plains, mulga scrub / woodlands, drainage depressions and palaeodrainage systems (Southgate 1990). • Greater Bilby move over a wide area according to available food and vegetation cover conditions (associated with seasons and fires) (Southgate &	• Track-based surveys specifically looking for burrows, scratchings, diggings, scats and tracks by walking numerous transects within the entire survey area. • Habitat suitability assessment included checking potential areas of habitat for key food plants and reviewing threatening processes currently present at the site (such as

Species	Survey area	Species information	Survey techniques
		Carthew 2006; Southgate & Carthew 2007). • Feed on plant material (seeds and bulbs) and invertebrates such as beetles, termites and root-dwelling larvae (Pavey 2006b). • Plants that are known to be targeted for root-dwelling larvae (in the NT) include *Acacia hilliana, A. lysiphloia, A. monticola, A. acradenia, A. melleodora, A. bivenosa, Senna notabilis* and *Indigofera georgei* (Southgate 2017, in prep.). • Common seed and bulb food sources are *Yakirra australiense* (seed) and the *Cyperus bulbosus* (bulb). Others include *Scaevola parviflora, Calandrinia spp., Dactyloctenium radulans* and *Wurmbea deserticola* (Southgate 2017, in prep.). • Threats include predation by foxes, and to a lesser extent cats and dingoes. Competition with rabbits, cattle grazing and unsuitable fire regimes may restrict breeding / impede dispersal and reduce food options and availability.	foxes and cats).
Brush-tailed Mulgara (*Dasycercus blythi*)	• WM27 (medium likelihood) • WM28 (medium likelihood) • Mamlambo (high likelihood)	• A large carnivorous marsupial, head-body length of 15 cm; primarily nocturnal (Pavey et al. 2006). • Shelters during the day in burrows that are about 0.5 m deep. Digs burrows between sand dunes (Woolley 2008). • Occurs in a range of vegetation types; however, the principal habitat is sand-plains and drainage depressions that support mature hummock grasslands of spinifex, especially *Triodia basedowii* and *T. pungens* (Pavey et al. 2006; Woinarski 2006; Masters et al. 2003). • Threats are not well understood, but it is likely that changes in fire regimes, grazing by introduced herbivores including cattle and rabbits, and predation by introduced predators are all likely threatening processes (Pavey et al. 2006)..	• Track-based surveys specifically looking for burrows, scats, and tracks by walking numerous transects in sandplains and dune swales within the survey area. • Habitat suitability assessment included checking potential areas of habitat for key spinifex species, fire history, and degree of other threatening processes.
Great Desert Skink (*Liopholis kintorei*)	• WM27 (medium likelihood) • WM28 (medium likelihood) • Mamlambo (medium likelihood)	• A large burrowing lizard (up to 44 cm long); predominantly nocturnal also emerges dawn and dusk (Pavey et al. 2012). • Occurs in sandplains and adjacent swales (and also palaeodrainage) that support hummock grassland and scattered shrubs, and a low fire impacted vegetation community. They prefer a mosaic landscape of different aged vegetation (i.e. fire ages) (Pavey et al. 2012). • Construct burrow systems (also referred to as warrens) that can have 5 to 10 entrances and support up to 10 individuals. Burrow systems have at least one latrine located at the surface (Pavey et al. 2012). • Omnivorous, eating a range of invertebrates (particularly termites), small	• Track-based surveys specifically looking for burrow systems (i.e. multiple entrances burrows with a distinct latrine) by walking numerous transects through sandplains and dune swales within the survey area. • Check any located burrows for signs of activity (i.e. active latrine site, recently dug soil at entrances, fresh tracks at burrow entrance) and for the emergence of animals at dawn

Species	Survey area	Species information	Survey techniques
		vertebrates and plants, and forage relatively close to their burrows at dusk and at night. Crepuscular to nocturnal species (Wilson and Swan 2013). • Habitat suitability is degraded by large scale intense wildfires that can devastate and fragment populations. Predation by cats and fox. Rabbits can dig up and destroy burrows (Pavey et al. 2012).	or dusk. • Habitat suitability was assessed by describing land form, vegetation, fire history, predator sign and soil type.
Southern Marsupial Mole (*Notoryctes typhlops*)	• Dingo 1-ST1 (low likelihood) • Dingo 5 (low likelihood) • WM27 (medium likelihood) • WM28 (medium likelihood) • Mamlambo (low likelihood)	• A small mole (up to 140 mm in length) (Pavey 2015). • Inhabits sand dunes and adjacent swales where there is suitable deep, loose sand. They spend almost their entire life underground, only very occasionally coming to the surface, and only remaining on the surface for a short time. Its distribution follows that of the sand dune habitat it prefers (Pavey 2015). • Threats are not well understood. It is speculated that predation by feral cats, foxes and dingoes occur above ground. Soil compaction by cattle or vehicles, and changes in abundance of food by altered fire regimes and grazing (Pavey 2015). • Seems to be confined to the southern and western sections of the NT (Benshemesh & Schultz 2008).	• Check dunes for any surface evidence of the species (i.e. exit and entry points, and also for any locomotion on the soil surface such as zig-zag tail drags, and soil 'uplifts' formed by shallow tunnels). • NOTE: targeted trench observation surveys were not justified based on available evidence because habitat is considered as marginal (few dunes) and there are very few existing records in the region. Furthermore, Central Petroleum agreed that disturbance of dunes will be avoided or limited to road crossings (suitably minimises risk).
Slater's Skink (*Liopholis slateri*)	• Dingo 1-ST1 (med. likelihood) • Dingo 5 (medium likelihood) • Orange 3 (med. likelihood) • PV12 (high likelihood) • WM27 (low likelihood) • WM28 (low likelihood)	• A medium sized smooth bodies skink up to 97 mm (McDonald 2012). • Occurs in depositional alluvial areas containing Eremophila shrubs with low soil pedestals for burrowing (McKinney et al. 2014) and are likely to be found in close association with depositional land systems rather than erosional land types. • Mostly found in floodplain type habitats, but there are also populations in minor drainages among stony hills as well as depositional areas on rocky plateau (McDonald 2012). • Habitat suitability is degraded by Buffel Grass (*Cenchrus ciliaris*) and may have resulted in the expiration of several populations in the region (McDonald 2012). It is thought that Buffel Grass reduces ant abundance/diversity (primary prey) and impacts ability to forage by increase ground cover and subsequently reducing ground visibility from burrow entrances (where the species waits to ambush prey) (McKinney et al. 2014). • Other threats include trampling by feral herbivores and cattle and changed fire regimes Chapple et al 2019).	• Track-based surveys looking for burrows by walking numerous transects through entire survey area, particularly in alluvial or depositional areas with evidence of soil mounding at base of shrubs. • Check burrows for signs of activity (i.e. scats at entrance, recently dug soil at entrances, fresh tracks). • Habitat suitability was assessed by checking depositional areas for suitable burrowing substrate and presence of shrubs with soil pedestals at base. • Check other locations on the PVGF plateau where the species has been previously recorded to check current

Species	Survey area	Species information	Survey techniques
			presence and activity.
Night Parrot (*Pezoporus occidentalis*)	• WM27 (low likelihood) • WM28 (low likelihood) • Mamlambo (low likelihood)	• A medium sized green and yellow bird with a stocky build and short tail; highly elusive and nocturnal (Pavey 2006c). • Roosting and nesting sites are in clumps of dense vegetation, primarily old and large spinifex (Triodia) clumps (but sometimes other vegetation types) that are well protected from fire. • Little is known about foraging sites, but favoured sites are likely to vary across the range of the species. • Little is known about the threats to this species; however, habitat suitability is thought to be degraded by frequent and/or widespread fires, grazing and predation by feral cats; and probably a combination of other factors – such as climate change (Pavey 2006c).	• Habitat suitability was assessed by finding areas of old (long unburnt) spinifex that may be potential roost sites, and looking for sign of other potential threatening processes. • Reviewing fire history as large widespread fires will likely reduce suitability.
Black-footed Rock-wallaby (*Petrogale lateralis*)	• PV12 (medium likelihood)	• A moderately sized macropod about 50cm high; mostly nocturnal but usually emerge late afternoon to early evening to feed (on grass, leaves, herbs, fruit) (Pavey et al. 2006b). • Occurs in rocky outcrops and associated steep rocky slopes. They shelter in caves and under boulders (Pavey et al. 2006b). • Habitat suitability is degraded by presence of predators (foxes and cats) and heavy grazing (cattle) (Pavey et al. 2006b).	• Scat searches throughout entire survey area. • Incidental observation / sighting (daytime searches only). • Check for potential shelter habitat. • Check for evidence of predators and other types of habitat degradation.
a land snail (*Granulomelon squamulosum*)	• PV12 (low likelihood)	• A small land snail • Occurs under leaf litter under fig trees in or under rocks (Wilson et al. 2006b). • Threats are not known, but likely associated with increase fire frequency / intensities fuelled by the introduced grass Buffel Grass (*Cenchrus ciliaris*) (Wilson et al. 2006a).	• Check under figs and in leaf litter. • Walk transects throughout survey area and check for snails under rocks.
a land snail (*Divellomelon hillieri*)	• PV12 (low likelihood)	• A small land snail • Occurs within rock rubble and litter at the bottom of deep vertical rock fissures; and also under fig trees (Wilson et al. 2006b). • Threats are not known, but likely associated with increase fire frequency / intensities fuelled by the introduced grass Buffel Grass (*Cenchrus ciliaris*) (Wilson et al. 2006b).	• Check under figs and in leaf litter. • Walk transects throughout survey area and check for snails under rocks.

5.3.3 Dingo 1-ST1

A total of 6,086 m were traversed as part of the Dingo 1-ST1 field assessment on 9 December 2019, which included inspections of all key habitat features within the survey area – namely spinifex sandplains, sandy red earth plains, low sand dunes, dune swales / red earth depressions and a minor drainage (refer to Section 4.3.1 for land type descriptions, habitat condition and representative photographs).

Survey conditions were dry and hot (22.4ºC to 43.6ºC), with a very low relative humidity (4 to 6%). Tracking conditions were excellent due to no rain in the week leading up to the survey (at least), lack of cloud cover (good for detecting track shadow), and presence of red earth soils (excellent tracking surface).

Survey results indicate that the survey area is not likely to support threatened species as explained in Table 5-5. Three threatened species – all listed as Vulnerable – have a low likelihood of occurring:

- Southern Marsupial Mole may inhabit sand dunes.
- Grey Falcon and Princess Parrot would only occur as nomadic visitors.

Fauna data

- Fauna diversity and activity was low at the time of survey.
- All species are common throughout the region and listed as Least Concern under the *TPWC Act*:

BIRD	
Corvus bennetti (Little Crow)	sighted; uncommon
Oreoica gutturalis (Crested Bellbird)	call heard; uncommon
Rhipidura leucophrys (Willie Wagtail)	single sighting; Mulga
Taeniopygia guttata (Zebra Finch)	small flock sighted at the old Dingo 1 well head.
REPTILE	
Varanus gouldii (Sand Goanna)	tracks, diggings, burrows; scattered; old and recent
MAMMAL	
Canis familiaris dingo (Dingo)	scats, old; uncommon
INTRODUCED SPECIES	
Camelus dromedarius (Camel)	few old tracks and scats in the sandplain
Bos taurus (Cattle)	tracks, scats; old; located within pastoral station.

Flora data

- Twenty-one species were recorded (refer to Appendix A for species list):
  - None are threatened under the *TPWC Act* or the *EPBC Act*
  - None are Near Threatened under the *TPWC Act*.
  - Two (non-declared) weed species were recorded – Buffel Grass (*Cenchrus ciliaris*) and Paddymelon (*Citrullus colocynthis*) (weeds described in Section 4.3.1).
  - The remaining species are listed as Least Concern under the *TPWC Act*.

Table 5-5. Threatened species survey results summary – Dingo 1-ST1

Target species	Desktop likelihood	Survey results	Survey likelihood
Rainbow Valley Fuchsia Bush (*Eremophila prostrata*)	**HIGH**	The species was not observed during the survey (targeted searches occurred in suitable habitat - sandplains and lower dune slopes). It is a perennial shrub; however, the dry conditions may have resulted in senescence making identification difficult. However, no prostrate (ground creeping) *Eremophila* shrubs were found during searches and it is unlikely that it currently persists within the survey area.	**NONE**
Desert Quandong (*Santalum acuminatum*)	**MEDIUM**	The species was not observed during the survey (targeted searches occurred in dune swales, sandplains and low sandy rises). This is a highly conspicuous tree species and would have been located if currently present.	**NONE**
Grey Falcon (*Falco hypoleucos*)	**LOW**	The species was not observed during the survey. Nest searches found a small raptor nest in a Desert Oak; however, no sign of activity (i.e. sighting, fresh scats or carcass under nest). Not considered to be used by Grey Falcon. Habitat within the survey area is not considered as preferred nesting habitat.	**LOW** (rare flyover or foraging individual only)
Princess Parrot (*Polytelis alexandrae*)	**LOW**	The species was not observed during the survey. Desert Oaks were inspected for hollows and none were observed. The survey area, or surrounds, is highly unlikely support suitable nesting opportunities. Princess Parrots are rarely observed in the region and there are no confirmed regional breeding sites.	**LOW** (nomadic visitor only)
Greater Bilby (*Macrotis lagotis*)	**LOW**	The species was not observed during the survey. Tracking surveys did not locate any evidence (i.e. burrows, diggings, tracks or scats) that bilbies have recently inhabited the survey area. Long term pastoral impacts within the survey area have also potentially reduced habitat suitability. Bilbies are not currently known to occur in the region.	**NONE**
Southern Marsupial Mole (*Notoryctes typhlops*)	**LOW**	Tracking searches did find any surface evidence of the species (noting that sign is scarce due to the subterranean habit of species). The low dunes and sand hills within the survey area could be suitable habitat; however, they occur as small, isolated patches, and therefore are considered as marginally-suitable. There are few regional records (because of the paucity of large dune systems), which further indicates a very low likelihood of a local population.	**LOW** (within dune habitat only)
Slater's Skink (*Liopholis slateri*)	**MEDIUM**	The species was not observed during the survey. No suspected burrows were found within potentially suitable habitat (i.e. dune swales and minor drainages lined with Mulga). Inspection of these habitat types indicated that they are marginal at best (for this species) as the species typically occurs in alluvial (depositional) habitat types. Based on survey data and known recent species records, it is unlikely that a population persists within or adjacent to the survey area.	**NONE**

5.3.4 Dingo 5

A total of 8,974 m were traversed as part of the Dingo 5 field assessment on 7 May 2020, which included inspections of all key habitat features within the survey area – spinifex sandplains, sandy red earth plains, low sand dunes and dune swales / red earth depressions (refer to Section 4.3.2 for land type descriptions, habitat condition and representative photographs).

Survey conditions were dry and warm (11.2ºC to 30.9ºC), with a low relative humidity (10 to 24%). Tracking conditions were good due to no significant rain in the week leading up to the survey (however a small shower did occur which may reduce visibility of smaller sign), lack of cloud cover (good for detecting track shadow), and presence of red earth soils (excellent tracking surface).

Survey results indicate that the survey area is not likely to support threatened species as explained in Table 5-6. Three threatened species – all listed as Vulnerable – have a low likelihood of occurring:

- Southern Marsupial Mole may inhabit sand dunes.
- Grey Falcon and Princess Parrot would only occur as nomadic visitors.

Fauna data

- Fauna diversity and activity was low at the time of survey.
- All species are common throughout the region and listed as Least Concern under the *TPWC Act*:

BIRD	
Corvus bennetti (Little Crow)	sighted; uncommon
Oreoica gutturalis (Crested Bellbird)	call heard; uncommon
Rhipidura leucophrys (Willie Wagtail)	single sighting; in Mulga
Barnardius zonarius (Australian Ringneck)	sighting (pair); in Mulga
Taeniopygia guttata (Zebra Finch)	small flock; uncommon within Mulga
REPTILE	
Lerista sp. (a legless lizard)	recent tracks on sand dunes; uncommon
Varanus gouldii (Sand Goanna)	tracks, diggings, burrows; scattered; old, recent
MAMMAL	
Canis familiaris dingo (Dingo)	scats, old; uncommon
Notomys alexis (Spinifex Hopping Mouse)	tracks; suspected ID only; uncommon on dunes
Osphranter rufus (Red Kangaroo)	scats; uncommon and relatively old
Pseudomys hermannsburgensis (Sandy Inland Mouse)	tracks; suspected ID only; uncommon on dunes
INTRODUCED SPECIES	
Camelus dromedarius (Camel)	old tracks and scat; sandplain; old
Felis catus (Cat)	single track; recent; sandplain
Bos taurus (Cattle)	tracks; scats; old; pastoral station

Flora data

- Sixty-four flora species were recorded (refer to Appendix A for species list).
    - None are threatened under the *TPWC Act* or the *EPBC Act*
    - None are Near Threatened under the *TPWC Act*.
    - Two (non-declared) weed species were recorded – Buffel Grass (*Cenchrus ciliaris*) and Paddymelon (*Citrullus colocynthis*) (weeds described in Section 4.3.2).
    - The remaining species are listed as Least Concern under the *TPWC Act*.

Table 5-6. Threatened species survey results summary – Dingo 5

Target species	Desktop likelihood	Survey results	Survey likelihood
Rainbow Valley Fuchsia Bush (*Eremophila prostrata*)	**HIGH**	The species was not observed during the survey (targeted searches occurred in suitable habitat - sandplains and lower dune slopes). It is a perennial shrub; however, the dry conditions may have resulted in senescence making identification difficult. However, no prostrate (ground creeping) *Eremophila* shrubs were found during searches and it is unlikely that it currently persists within the survey area.	**NONE**
Desert Quandong (*Santalum acuminatum*)	**MEDIUM**	The species was not observed during the survey (targeted searches occurred in dune swales, sandplains and low sandy rises with the survey area). This is a highly conspicuous tree species and would have been located if currently present.	**NONE**
Grey Falcon (*Falco hypoleucos*)	**LOW**	The species was not observed during the survey. Nest searches found a small raptor nest in a Desert Oak; however, no sign of activity (i.e. sighting, fresh scats or carcass under nest). Not considered to be used by Grey Falcon. Habitat within the survey area is not considered as preferred nesting habitat.	**LOW** (rare flyover or foraging individual only)
Princess Parrot (*Polytelis alexandrae*)	**LOW**	The species was not observed during the survey. Desert Oaks were inspected for hollows and none were observed. The survey area, or surrounds, is highly unlikely support suitable nesting opportunities. Princess Parrots are rarely observed in the region and there are no confirmed regional breeding sites.	**LOW** (nomadic visitor only)
Greater Bilby (*Macrotis lagotis*)	**LOW**	The species was not observed during the survey. Tracking surveys did not locate any evidence (i.e. burrows, diggings, tracks or scats) that bilbies have recently inhabited the survey area. Long term pastoral impacts within the survey area have also potentially reduced habitat suitability. Bilbies are not currently known to occur in the region.	**NONE**
Southern Marsupial Mole (*Notoryctes typhlops*)	**LOW**	Tracking searches did find any surface evidence of the species (noting that these features are often scarce due to the subterranean habit of species). The low dunes and sand hills within the survey area could be suitable habitat; however, they occur as small, isolated patches, and therefore are only marginally-suitable. There are few regional records (because of the paucity of large dune systems), which further indicates a very low likelihood of a local population.	**LOW** (within dune habitat only)
Slater's Skink (*Liopholis slateri*)	**MEDIUM**	The species was not observed during the survey. No suspected burrows were found within potentially suitable habitat (i.e. dune swales and minor drainages lined with Mulga). Inspection of these habitat types indicated that they are marginal at best (for this species) as the species typically occurs in alluvial (depositional) habitat types. Based on survey data and known recent species records, it is unlikely that a population persists within or adjacent to the survey area.	**NONE**

5.3.5 Orange 3

A total of 5,251 m were traversed as part of the Orange 3 field assessment on 28 February 2020, which included inspections of all key habitat features within the survey area – namely undulating calcareous plains, calcrete rises, low sand dunes / sand hills and a minor poorly-defined drainage (refer to Section 4.3.3 for land type descriptions, habitat condition and representative photographs).

Survey conditions were dry and hot (24.3ºC to 37.6ºC), with a low relative humidity (17 to 28%). Tracking conditions were excellent due to no rain in the week leading up to the survey (at least), lack of cloud cover (good for detecting track shadow), and presence of loamy soils (reasonable tracking surface).

Survey results indicate that the survey area is not likely to support threatened species as explained in Table 5-6. One threatened species – Grey Falcon (Vulnerable) – has a low likelihood of occurring as a nomadic visitor.

Fauna data

- Fauna diversity and activity was low at the time of survey.
- All species are common throughout the region and listed as Least Concern under the *TPWC Act*:

BIRD	
Rhipidura leucophrys (Willie Wagtail)	single sighting; Mulga
REPTILE	
Varanus gouldii (Sand Goanna)	tracks, diggings, burrows; scattered; old and recent
Varanus giganteus (Perentie)	scat; scarce; relatively recent; on calcrete rise
Small lizards (unknown species)	scattered; very low levels of recent activity
MAMMAL	
Canis familiaris dingo (Dingo)	scats, old; uncommon
INTRODUCED SPECIES	
Oryctolagus cuniculus (Rabbit)	old scats; scarce
Bos taurus (Cattle)	tracks; scats

- There was a large raptor nest on a dead Ironwood (see photograph in Figure 5-1). No signs that it is currently active (no fresh scats or carcass at the base of nest).
- Old warrens from Burrowing Bettong (*Bettongia lesueur*) (extinct in the Northern Territory) occur in the local area (see photograph in Figure 5-2). These warrens are often used by a range of other species such as Rabbits, Perentie and Sand Goannas. Warrens in the area are typically located on the calcrete rises; however, none were found within the Orange 3 survey area.

Flora data

- Thirty flora species were recorded (refer to Appendix A for species list), of these:
  - None are threatened under the *TPWC Act* or the *EPBC Act*
  - None are Near Threatened under the *TPWC Act*.
  - Two (non-declared) weed species were recorded – Buffel Grass (*Cenchrus ciliaris*) and Paddymelon (*Citrullus colocynthis*) (weeds described in Section 4.3.3).
  - The remaining species are listed as Least Concern under the *TPWC Act*.

Table 5-7. Threatened species survey results summary – Orange 3

Target species	Desktop likelihood	Survey results	Survey likelihood
Rainbow Valley Fuchsia Bush (*Eremophila prostrata*)	**MEDIUM**	The species was not observed during the survey (including targeted searches occurred in sandy loams and lower dune slopes). It is a perennial shrub; however, the dry conditions may have resulted in senescence making identification difficult. However, no prostrate (ground creeping) *Eremophila* shrubs were found during searches and it is unlikely that it currently persists within the survey area. Habitat present within survey area is not considered suitable.	**NONE**
Tjilpi Wattle (*Acacia latzii*)	**LOW**	The species was not observed during the survey. This is a highly conspicuous tree species and would have been located if currently present within the survey area.	**NONE**
Grey Falcon (*Falco hypoleucos*)	**LOW**	The species was not observed during the survey. A large (1 x 1m^2) currently unused raptor nest was observed on a dead Ironwood established on a dune flank (see Figure 5-1). The nest likely belongs to a Wedge-tailed Eagle or Black Breasted Buzzard. Habitat within the survey area is not considered as preferred nesting habitat.	**LOW** (rare flyover or foraging individual only)
Slater's Skink (*Liopholis slateri*)	**MEDIUM**	The species was not observed during the survey. No suspected burrows were found within potentially suitable habitat (i.e. dune swales and minor drainages lined with Mulga). Inspection of these habitat types indicated that they are marginal at best (for this species) as the species typically occurs in alluvial (depositional) habitat types. Based on survey data and known recent species records, it is unlikely that a population persists within or adjacent to the survey area.	**NONE**

Figure 5-1. Photograph of large raptor nest at Orange 3

Figure 5-2. Photograph of Burrow Bettong warren (extinct species) near Orange 3 survey area

5.3.6 PV12

A total of 4,342 m were traversed as part of the PV12 field assessment on 10 December 2019, which included inspections of all key habitat features within the survey area – namely sandstone plateaux and the 'head' of steep rocky sandstone gullies (refer to Section 4.3.4 for land type descriptions, habitat condition and representative photographs).

Survey conditions were dry and hot (23.0ºC to 42.9ºC), with a low relative humidity (8 to 16%). Tracking conditions were suitable for detecting target species (i.e. scat searches for Black-footed Rock-wallaby and burrow searches for Slaters Skink).

Survey results indicate that the survey area is not likely to support threatened species as explained in Table 5-8. One threatened species – Grey Falcon (Vulnerable) – has a low likelihood of occurring as a nomadic visitor.

Fauna data

- Fauna diversity and activity was very low at the time of survey.
- All species are common throughout the region and listed as Least Concern under the *TPWC Act*.

REPTILE	
Ctenophorus caudicinctus (Ring-tailed Dragon)	tracks; scattered confined to roadside
MAMMAL	
Osphranter robustus (Common Wallaroo)	scats; common; old to relatively recent.
INTRODUCED SPECIES	
Oryctolagus cuniculus (Rabbit)	scats; old; not currently active in the area

- Fauna surveys at PV12 in March 2015 (by Low Ecological Services 2015) resulted in a low trap success rate with only three captures, plus several other incidental or track-based records:
    - Sandy Inland Mouse (*Pseudomys hermannsburgensis*) (two Elliott trap captures); suspected identification only as it cannot be reliably differentiated in the field from Central Pebble-mound Mouse (*Pseudomys johnsoni*).
    - Leopard Skink (*Ctenotus pantherinus*) (1 funnel trap capture)
    - Ring-tailed Dragon (*Ctenophorus caudicinctus*) (numerous sightings)
    - Goanna (*Varanus sp*.) (track in sandy part of road)
    - Dingo (*Canis familiaris dingo*) (tracks and scats on road)
    - Rabbit (*Oryctolagus cuniculus*) (scats)
    - Several bird species – Spiny-cheeked Honeyeater, Australian Raven (likely), Mistletoebird, Variegated Fairy Wren, Grey-headed Honeyeater, Singing Honeyeater and Crested Bellbird.

Flora data

- Forty-seven flora species (refer to Appendix A for species list), of these:
    - None are threatened under the *TPWC Act* or the *EPBC Act*
    - Two species are listed as Near Threatened (under the *TPWC Act*):
        - Shiny-leaved Mallee (*Eucalyptus lucens*). A mallee to 3 to 4 m high. Approximately 10 individuals were recorded (locations shown on Figure 4-6), all but one located to the south of the access road in land type PV-B. Photograph shown in Figure 5-3. This species is relatively common within the surrounding Krichauff and James Ranges (pers. Comm. Andrew Schubert 2020).

- *Stenanthemum centrale*. A small shrub to 1 m high (photograph shown in Figure 5-4). Scattered within land type PV12-A (plateau), and patchily common to co-dominant in north-facing gullies (land type PV12-C). This species is relatively common within the surrounding Krichauff and James Ranges (pers. Comm. Andrew Schubert 2020).

o One species is listed as Data Deficient (under the *TPWC Act*):

- *Senna artemisioides subsp. James Range* (P.K. Latz 18528). A small shrub. Recorded along a north-facing gully where uncommon. This taxon is much more common in gullies further south through the Krichauff and James Ranges (pers. Comm. Andrew Schubert 2020).

o One (non-declared) weed species was recorded – Buffel Grass (*Cenchrus ciliaris*) (weed survey described in Section 4.3.4).

o The remaining species are listed as Least Concern under the *TPWC Act*.

Figure 5-3. Photograph of *Eucalyptus lucens* (Near Threatened species, *TPWC Act*) at PV12

Figure 5-4. Photograph of *Stenanthemum centrale* (Near Threatened species, *TPWC Act*) at PV12

Table 5-8. Threatened species survey results summary – PV12

Target species	Desktop likelihood	Survey results	Survey likelihood
Slater's Skink (*Liopholis slateri*)	**HIGH**	Searches occurred in potentially suitable habitat within the survey area in localised clay depressions (run-on areas) and in sandy soils associated with roadside drains and windrows; but the entire survey area was generally checked for the species. The species was not observed during the survey; and no suspected burrows were found. Upon inspection, the localised clay loam depressions are not considered suitable for the species (see image below), as soil pedestals (i.e. mounding) at the base of shrubs is not present (these areas are often used for burrowing purposes by this species); and soils are likely to be too heavy in clay for burrow construction. The sandy roadside drains and windrows may be suitable, but there is no evidence of previous or current occupation (similar observations in March 2015, Low Ecological Services 2015). The remaining areas were rocky and not suitable for Slater Skink. *Note: Although there is no evidence that Slater's Skink persists within the survey area, they are known to occur within other areas on the plateau, including near PV2, near PVGF headquarters and drains associated with the main PVGF access road.*	**NONE** (but known to occur in local area; including spoon drains with alluvial soils)
Black-footed Rock-wallaby (*Petrogale lateralis*)	**MEDIUM**	Searches for scats and incidental sightings occurred throughout the entire survey area, and also further down gullies where habitat is considered to be more suitable due to presence of overhangs and crevices that may provide den sites for the species. No scats or other evidence of the species was found. There are no known occurrences of the species within the local area. Based on survey data and existing records, it is unlikely that the species currently occurs within or adjacent to the survey area.	**NONE**
MacDonnell Ranges Cycad (*Macrozamia macdonnellii*)	**LOW**	Searches occurred throughout the entire survey area, and also further down gullies where habitat is considered as more suitable for the species. The species was not found during the surveys. There are no known records within the PVGF lease area despite numerous environmental surveys. Based on survey data and existing records, the species does not currently occurs within or adjacent to the survey area.	**NONE**

Target species	Desktop likelihood	Survey results	Survey likelihood
Minnie Daisy (*Minuria tridens*)	**LOW**	Targeted searches occurred throughout the entire survey area, and also further down gullies where habitat is considered as more suitable for the species. The species was not found during the surveys. Species habitat does not occur within the survey area (i.e. dolomite, limestone and calcrete impregnated sandstone hills, rises and ranges). It is more likely present in areas at lower altitudes.	**NONE**
Palm Valley Myrtle (*Thryptomene hexandra*)	**LOW**	Targeted searches occurred throughout the entire survey area, with particular focus on rocky gullies and steep rocky slopes with a southerly aspect and with a degree of natural fire protection (as this is the habitat preference for the species). The species was not found during the surveys.	**NONE**
Olearia (*Olearia macdonnellensis*)	**LOW**	Targeted searches occurred throughout the entire survey area; with more focus in the southern extent of the survey area which has not been burnt for approximately 50 years. The species was not found during surveys. There are no records from PVGF or in the adjacent Finke Gorge National Park.	**NONE**
Grey Falcon (*Falco hypoleucos*)	**LOW**	The species was not observed during the surveys. The survey area does not support potential nesting habitat; if present, nesting would more likely occur along major watercourses at the base of the sandstone hills. And the Plateau area could be occasionally visited by raptors such as Grey Falcon when prey numbers are 'booming'. Currently, prey numbers are very low due to prolonged dry period. There are no existing records within the PVGF.	**LOW** (rare flyover or foraging individual only)
land snails (*Granulomelon squamulosum & Divellomelon hillieri*)	**LOW**	Searches occurred throughout the entire survey area; particularly in gullies and crevices. No snails were found within the survey area. Very dry conditions may have caused species to retreat to lower areas in ranges.	**NONE**

5.3.7 WM27

A total of 4,482 m were traversed as part of the WM27 field assessment on 11 December 2019, which included inspections of all key habitat features within the survey area – namely gently sloping red sandplain, low linear dune, Mulga-dominated red earth depressions and sandy red earth areas (refer to Section 4.3.5 for land type descriptions, habitat condition and representative photographs).

Survey conditions were dry and hot (23.0ºC to 42.3ºC), with a low relative humidity (9%). Tracking conditions were good due to no rain in the week leading up to the survey (at least), lack of cloud cover (good for detecting track shadow), and presence of red earth soils over the majority of the survey area (excellent tracking surface).

Survey results indicate that the survey area is not likely to support threatened species as explained in Table 5-8. Three threatened species – all listed as Vulnerable – have a low likelihood of occurring:

- Southern Marsupial Mole may inhabit sand dunes.
- Grey Falcon and Princess Parrot would only occur as nomadic visitors.

Fauna data

- Fauna diversity and activity was low at the time of survey.
- All species are common throughout the region and listed as Least Concern under the *TPWC Act*:

BIRD	
Corvus bennetti (Little Crow)	sighting; uncommon
Oreoica gutturalis (Crested Bellbird)	call heard; uncommon
Rhipidura leucophrys (Willie Wagtail)	sighting, call; uncommon
Malurus splendens (Splendid Fairy-wren)	sighting, call; uncommon
Pachycephala rufiventris (Rufous Whistler)	call; uncommon
REPTILE	
Varanus gouldii (Sand Goanna)	tracks, digs, burrows; common; recent and old
Ctenotus pantherinus (Leopard Ctenotus)	sighting; uncommon
Numerous other small lizards (various species)	tracks, burrows; sign not able to be identified.
MAMMAL	
Canis familiaris dingo (Dingo)	tracks, scats; relatively recent; uncommon
INTRODUCED SPECIES	
Equus caballus (Horse)	relatively high impact via trampling and grazing.

Flora data

- Sixty-four flora species were recorded (refer to Appendix A for species list), including:
  - None are threatened under the *TPWC Act* or the *EPBC Act*
  - None are Near Threatened under the *TPWC Act*.
  - One species is listed as Not Evaluated (under the *TPWC Act*):
    - *Sida sp. Excedentifolia.* Widespread species; formerly within *S. filifolia* group.
  - No weed species were recorded.
  - The remaining species are listed as Least Concern under the *TPWC Act*.

Table 5-9. Threatened species survey results summary – WM27

Target species	Desktop likelihood	Survey results	Survey likelihood
Desert Quandong (*Santalum acuminatum*)	**MEDIUM**	Searches occurred throughout the entire survey area. The species was not found during the survey. This is a highly conspicuous tree species and would have been located if currently present within the survey area.	**NONE**
Princess Parrot (*Polytelis alexandrae*)	**MEDIUM**	Searches occurred throughout the entire survey area, specially looking for nesting opportunities in tree hollows of key species. The species was not observed during the survey. Desert Oaks are present within the survey area (low numbers in the northern part) and were checked for hollows as they may provide nesting opportunities – however, no hollows were observed. As such, the survey area is unlikely to support suitable nesting habitat for the species. Princess Parrots are known to occur in the region and may be occasionally observed foraging / flyover within the survey area.	**LOW** (nomadic visitor only, especially as they are known to occur in the region)
Brush-tailed Mulgara (*Dasycercus blythi*)	**MEDIUM**	Tracking surveys were conducted within sandplains to check for potential sign and current activity – namely burrows, tracks and/or scats. No evidence was observed during the survey; it is unlikely that mulgara have recently inhabited the survey area. Sandplains constitute potentially-suitable habitat; however fire frequency and habitat impact from horses lowers its suitability for mulgara. Population numbers of the species are also expected to be very low across the landscape due to prolonged dry conditions (i.e. mulgara are a 'boom' and 'bust' species).	**NONE**
Greater Bilby (*Macrotis lagotis*)	**MEDIUM**	Tracking surveys were conducted within sandplains to check for potential bilby sign and current activity (i.e. burrows, diggings, tracks or scats). Surveys did not locate any evidence that bilbies have inhabited the survey area. Only one potential food plant species was observed at the time of survey: • *Acacia melleodora*. Species has been known to be foraged by bilbies in search of root dwelling larvae. Species is scattered throughout the sandplains; however there was no evidence of basal diggings by bilbies on any plants. Habitat degradation from horses is also likely to lower habitat suitability for bilbies. Bilbies are not currently known to occur in the vicinity of the survey area. Therefore, based on existing records and survey data, it is unlikely that bilbies occur within, or will move into, the survey area in the near future.	**NONE**
Southern Marsupial Mole	**MEDIUM**	Searches for tracks and entry/exit points occurred within the sand dune, and the surrounding sandplains.	**LOW** (within dune

Target species	Desktop likelihood	Survey results	Survey likelihood
(*Notoryctes typhlops*)		No evidence of the species was observed; however, tracking surface evidence from this species is often scarce due to the subterranean habit of species. The low dunes and sand hills within the survey area could be suitable habitat; however, they occur as small, isolated patches, and therefore are only marginally-suitable. There are few regional records (because of the paucity of large dune systems), which further indicates a very low likelihood of a local population.	habitat only)
Great Desert Skink (*Liopholis kintorei*)	**MEDIUM**	Searches were conducted within sandplains, and included checking for burrow systems, latrines, scats and tracks – incidental sightings were not likely due to searches occurring in daylight. No evidence of the species was observed. Numerous burrows were inspected but all were attributed to goanna (*Varanus spp*.) based on burrow dimensions, tracks, scats, sightings and the absence of a latrine. There are no known populations in the local region. Based on existing records and survey data, it is unlikely that individuals occur, or will move into, the survey area in the near future.	**NONE**
Night Parrot (*Pezoporus occidentalis*)	**LOW**	The species was not observed during the survey. There is no old growth spinifex within the survey area that is considered to possibly support this species. Widespread horse trampling impacts have also likely lowered habitat suitability for the species. Passive sound recording survey techniques used to detect species presence were not undertaken as suitable habitat was not present.	**NONE**
Grey Falcon (*Falco hypoleucos*)	**LOW**	The species was not observed during the survey. The survey area does not support preferred nesting habitat for the species.	**LOW** (rare flyover or foraging individual only)
Slater's Skink (*Liopholis slateri*)	**LOW**	Tracking surveys were conducted within sandplains to check for potential sign and current activity – namely looking for burrows, tracks and/or scats. No evidence was observed during the survey. Preferred habitat is not present (i.e. depositional alluvial areas with shrubs that have soil mounding at the base). Additionally, high level of horse impacts at the site may also further reduce habitat suitability. There are no known populations in the local region. Based on survey data and existing records, it is unlikely that the species persists within, or adjacent to, the survey area.	**NONE**

5.3.8 WM28

A total of 7,401 m were traversed as part of the WM28 field assessment on 12 December 2019, which included inspections of all key habitat features within the survey area and western access corridor – namely sandy red earth plains and rises, a low sandstone hill (approximate 10m relief), a flat gravelly (laterised) plain, and a low dune (refer to Section 4.3.6 for land type descriptions, habitat condition and representative photographs). The eastern access survey area was not surveyed.

Survey conditions were dry and hot (28.8ºC to 40.5ºC), with a low relative humidity (9 to 13%). Tracking conditions were good due to no rain in the week leading up to the survey (at least), lack of cloud cover (good for detecting track shadow), and presence of red earth soils over the majority of the survey area (excellent tracking surface).

Survey results indicate that the survey area is not likely to support threatened species as explained in Table 5-8. Three threatened species – all listed as Vulnerable – have a low likelihood of occurring:

- Southern Marsupial Mole may inhabit sand dunes.
- Grey Falcon and Princess Parrot would only occur as nomadic visitors.

Fauna data

- Fauna diversity and activity was relatively low at the time of survey.
- All species are common throughout the region and listed as Least Concern under the *TPWC Act*:

BIRD	
Acanthagenys rufogularis (Spiny-cheeked Honeyeater)	sighting, call; uncommon
Corvus bennetti (Little Crow)	sighting, call; uncommon
Eurostopodus argus (Spotted Nightjar)	sighting; uncommon (single record)
Melanodryas cucullata (Hooded Robin)	sighting, call; uncommon; in mulga
Nymphicus hollandicus (Cockatiel)	sighting, uncommon; small flock
Oreoica gutturalis (Crested Bellbird)	sighting, call; common
Psophodes occidentalis (Chiming Wedgebill)	sighting, call; uncommon
Rhipidura albiscapa (Grey Fantail)	sighting; uncommon; in mulga
Rhipidura leucophrys (Willie Wagtail)	sighting, call; common
REPTILE	
Ctenophorus caudicinctus (Rock Ringtail Dragon)	sighting; uncommon; sandstone hill
Ctenotus pantherinus (Leopard Ctenotus)	sighting; relatively common; sandplain
Ctenotus quattuordecimlineatus (Fourteen-lined Ctenotus)	sighting; uncommon; sandplain
Varanus acanthurus (Ridge-tailed Monitor)	sighting; uncommon; sandplain
Varanus gouldii (Sand Goanna)	sighting; single record; sandstone hill
MAMMAL	
Canis familiaris dingo (Dingo)	tracks; uncommon; sandplain
INTRODUCED SPECIES	
Bos taurus (Cattle)	low impact; only old scats observed.
Equus caballus (Horse)	fairly low level of presence and impact
Oryctolagus cuniculus (Rabbit)	only one pile of old scats observed

Flora data

- Seventy-six flora species were recorded (refer to Appendix A for species list):
  - None are threatened under the *TPWC Act* or the *EPBC Act*
  - None are Near Threatened under the *TPWC Act*.

- One species is listed as Not Evaluated under the *TPWC Act*:
  - *Sida sp. Excedentifolia.* A small perennial sub-shrub. Very common and widespread species formerly included within *Sida filifolia*.
- An unknown form of *Acacia aneura* (likely hybridised) was encountered in gravel plain (land type WM28-E) (latitude -23.989027; longitude 131.53134; GDA94). Seed pods and flowers are required to properly identify (which were not present) therefore a voucher specimen was not collected. This is of taxonomic interest, but is not considered as a significant species.
- One (non-declared) weed species was recorded – Buffel Grass (*Cenchrus ciliaris*) (weed survey described in Section 4.3.6).
- The remaining species are listed as Least Concern under the *TPWC Act*.

Table 5-10. Threatened species survey results summary – WM28

Target species	Desktop likelihood	Survey results	Survey likelihood
Desert Quandong (*Santalum acuminatum*)	**MEDIUM**	Searches occurred throughout the entire survey area. The species was not found during the survey. This is a highly conspicuous tree species and would have been located if currently present.	**NONE**
Princess Parrot (*Polytelis alexandrae*)	**MEDIUM**	Searches occurred throughout the entire survey area, specially looking for nesting opportunities in tree hollows of key species. The species was not observed during the survey. Desert Oaks are present within the survey area (low numbers in the northern part) and were checked for hollows as they may provide nesting opportunities – however, no hollows were observed. The survey area is unlikely to support suitable nesting habitat for the species. Princess Parrots are known to occur in the region (89 records) and may be occasionally observed foraging / flying over within the survey area.	**LOW** (nomadic visitor only, especially as they are known to occur in the region)
Brush-tailed Mulgara (*Dasycercus blythi*)	**MEDIUM**	Tracking surveys were conducted within sandplains to check for potential sign and current activity – namely burrows, tracks and/or scats. No evidence was observed during the survey; it is unlikely that mulgara have recently inhabited the survey area. Sandplains constitute potentially suitable habitat; however fire frequency and habitat impact from horses lowers its suitability for mulgara. Population numbers of the species are also expected to be very low across the landscape due to prolonged dry conditions (i.e. mulgara are a 'boom and bust' species).	**NONE**
Greater Bilby (*Macrotis lagotis*)	**MEDIUM**	Tracking surveys were conducted within sandplains to check for potential bilby sign and current activity (i.e. burrows, diggings, tracks or scats). Surveys did not locate any evidence that bilbies have inhabited the survey area. Only one potential food plant species was observed at the time of survey: • *Acacia melleodora*. Species has been known to be foraged by bilbies in search of root dwelling larvae. Species is scattered	**NONE**

Target species	Desktop likelihood	Survey results	Survey likelihood
		throughout the sandplains; however there was no evidence of basal diggings by bilbies on any plants. Bilbies are not currently known to occur in the vicinity of the survey area. Therefore, based on existing records and survey data, it is unlikely that bilbies occur within, or will move into, the survey area in the near future.	
Southern Marsupial Mole (*Notoryctes typhlops*)	**MEDIUM**	Searches for tracks and entry/exit points occurred within the sand dune, and the surrounding sandplains. No evidence of the species was observed; however, tracking surface evidence from this species is often scarce due to the subterranean habit of species. The low dunes and sand hills within the survey area could be suitable habitat; however, they occur as small, isolated patches, and therefore are only marginally-suitable. There are few regional records (because of the paucity of large dune systems), which further indicates a very low likelihood of a local population.	**LOW** (within dune habitat only)
Great Desert Skink (*Liopholis kintorei*)	**MEDIUM**	Searches were conducted within sandplains, and included checking for burrow systems, latrines, scats and tracks – incidental sightings were not likely due to searches occurring in daylight. No evidence of the species was observed. Numerous burrows were inspected but all were attributed to goanna (*Varanus spp*.) based on burrow dimensions, tracks, scats, sightings and the absence of a latrine. There are no known populations in the local region. Based on existing records and survey data, it is unlikely that individuals occur, or will move into, the survey area in the near future.	**NONE**
Night Parrot (*Pezoporus occidentalis*)	**LOW**	The species was not observed during the survey. There is no old growth spinifex within the survey area that is considered to possibly support this species. Widespread horse trampling impacts have also likely lowered habitat suitability for the species. Passive sound recording survey techniques used to detect species presence were not undertaken as suitable habitat was not present.	**NONE**
Grey Falcon (*Falco hypoleucos*)	**LOW**	The species was not observed during the survey. The survey area does not support preferred nesting habitat for the species.	**LOW** (rare flyover or foraging individual only)
Slater's Skink (*Liopholis slateri*)	**LOW**	Tracking surveys were conducted within sandplains to check for potential sign and current activity – namely looking for burrows, tracks and/or scats. No evidence was observed during the survey. Preferred habitat is not present (i.e. depositional alluvial areas with shrubs that have soil mounding at the base). There are no known populations in the local region. Based on survey data and existing records, it is unlikely that the species persists within, or adjacent to, the survey area.	**NONE**

5.3.9 Mamlambo 1

A total of 9,070 m were traversed as part of the Mamlambo 1 field assessment on 18 March 2020, which included inspections of all key habitat features within the survey area – namely sandy red earth plains and rises, a low sandstone hill (approximate 10m relief), a flat gravelly (laterised) plain, and a low dune (refer to Section 4.3.7 for land type descriptions, habitat condition and representative photographs).

Survey conditions were dry and hot (26.4ºC to 40.0ºC), with a low relative humidity (11 to 22%). Tracking conditions were excellent due to no rain in the week leading up to the survey (at least), lack of cloud cover (good for detecting track shadow), and presence of red earth soils (excellent tracking surface).

Survey results indicate that the survey area is not likely to support threatened species as explained in Table 5-8. Five threatened species – all listed as Vulnerable – have a low likelihood of occurring:

- Southern Marsupial Mole may inhabit sand dunes.
- Greater Bilby and Brush-tailed Mulgara may occasionally occur within sandplains (no evidence of previous or current occupation was observed during tracking surveys). .
- Grey Falcon and Princess Parrot would only occur as nomadic visitors.

Fauna data

- Fauna diversity and activity was relatively moderate, most records occurred within unburnt areas.
- All species are common throughout the region and listed as Least Concern under the *TPWC Act*:

BIRD	
Acanthagenys rufogularis (Spiny-cheeked Honeyeater)	sighting, call; uncommon
Artamus cinereus (Black-faced Woodswallow)	sighting, call; uncommon
Corvus bennetti (Little Crow)	sighting, call; common
Gavicalis virescens (Singing Honeyeater)	sighting, call; uncommon
Geopelia cuneata (Diamond Dove)	sighting, call; uncommon
Oreoica gutturalis (Crested Bellbird)	call; common
Pachycephala rufiventris (Rufous Whistler)	call; uncommon
Pomatostomus superciliosus (White-browed Babbler)	sighting, call; uncommon; small family group
Rhipidura leucophrys (Willie Wagtail)	sighting, call; common
Taeniopygia guttata (Zebra Finch)	sighting, call; uncommon
REPTILE	
Ctenotus dux (Chief Ctenotus)	sighting; uncommon
Ctenotus greeri (Greer's Ctenotus)	sighting; uncommon
Ctenotus leae (Lea's Ctenotus)	sighting; uncommon
Ctenotus pantherinus (Leopard Ctenotus)	sighting; relatively common
Gehyra variegata (Tree Dtella)	sighting (spotlight); uncommon
Lerista sp.	tracks; recent; common on dunes
Snake tracks	tracks; recent; uncommon on sandplain
Varanus brevicauda / eremius (Pygmy Monitors)	tracks, diggings, burrows; recent; common
Varanus giganteus (Perentie)	tracks; recent; uncommon on sandplain
Varanus gouldii (Sand Goanna)	tracks, digs, burrows; recent; common
MAMMAL	
Canis familiaris dingo (Dingo)	tracks, scats; recent; uncommon on sandplain
Notomys alexis (Spinifex Hopping Mouse)	tracks; suspected ID only; uncommon on dunes
Pseudomys hermannsburgensis (Sandy Inland Mouse)	tracks; suspected ID only; uncommon on dunes
Sminthopsis sp. (a dunnart)	tracks; recent; uncommon on dunes
INTRODUCED SPECIES	
Camelus dromedarius (Camel)	fairly low level of presence and impact

Flora data

- Ninety-six species flora were recorded (refer to Appendix A for species list):
  - None are threatened under the *TPWC Act* or the *EPBC Act*.
  - None are listed as Near Threatened under the *TPWC Act*.
  - One species is listed as Data Deficient under the *TPWC Act*:
    - *Acacia incurvaneura*. A single juvenile on sandplain near dune north in northern part of drill site survey area. Species was incidentally observed in several other locations outside of the survey area, and likely has a scattered occurrence throughout the region.
  - One species is listed as Not Evaluated under the *TPWC Act*:
    - *Evolvulus alsinoides var. alsinoides*. A widespread and common species, listed as Not Evaluated due to recent taxonomic changes not yet been subject to *TPWC Act* criteria.
  - The remaining species are listed as Least Concern under the *TPWC Act*.

Table 5-11. Threatened species survey results summary – Mamlambo 1

Target species	Desktop likelihood	Survey results	Survey likelihood
Brush-tailed Mulgara (*Dasycercus blythi*)	**HIGH**	Tracking was conducted throughout the sandplains within the survey area, to check for potential sign and current activity – namely burrows, tracks and/or scats. No evidence of the species was observed. Spinifex sandplains may be suitable habitat for the species; however, large regional fires in 2011 and 2019 may have reduced suitability for the species or limited populations to unburnt pockets. Population numbers are also expected to be currently regionally low due to prolonged dry conditions (i.e. mulgara are a 'boom and bust' species) and detection rates would be low. Tracking results indicate that the survey area does not currently support mulgara; however, the survey area may become utilised when better conditions eventuate and the regional population increases.	**LOW** (within sandplains)
Greater Bilby (*Macrotis lagotis*)	**HIGH**	Tracking surveys were conducted within sandplains to check for potential bilby sign and current activity (i.e. burrows, diggings, tracks or scats). Surveys did not locate any evidence that bilbies have inhabited the survey area. Potential food plants for the species were in low numbers and diversity at the time of survey: • *Yakirra australiensis var. australiensis* (known to be a key seed source plant). Only observed along access track area which was recently burnt (2019). • *Acacia melleodora* (can support Root Dwelling Larvae, RDL). Common throughout the sandplains – no evidence of basal diggings for RDL. There are very few recent records of bilbies in the area (NT Atlas data). Therefore, based on regional records and survey data, there is a low likelihood of individuals occurring within, or moving in and utilising, the survey area.	**LOW** (due to suitable habitat and known presence within wider region; not currently present within survey area)

Target species	Desktop likelihood	Survey results	Survey likelihood
Desert Quandong (*Santalum acuminatum*)	**MEDIUM**	Searches occurred throughout the entire survey area. The species was not found during the survey. This is a highly conspicuous tree species and would have been located if currently present.	**NONE**
Princess Parrot (*Polytelis alexandrae*)	**MEDIUM**	Searches occurred throughout the entire survey area, specially looking for nesting opportunities in tree hollows of key species. The species was not observed during the survey. Desert Oaks are present within the survey area (low numbers in the northern part) and were checked for hollows as they may provide nesting opportunities – however, no hollows were observed. The survey area is unlikely to support suitable nesting habitat for the species. Princess Parrots are known to occur in the region and are highly mobile and unpredictable in terms of occurrence. They may be occasionally observed foraging / flying over within the survey area.	**LOW** (nomadic visitor only, especially as they are known to occur in the region)
Great Desert Skink (*Liopholis kintorei*)	**MEDIUM**	Searches were conducted within sandplains, and included checking for burrow systems, latrines, scats and tracks – incidental sightings were not likely due to searches occurring in daylight. No evidence of the species was observed. Numerous burrows were inspected but all were attributed to goanna (*Varanus spp*.) based on burrow dimensions, tracks, scats, sightings and the absence of a latrine. The sandplains are potentially suitable habitat; however, broad-scale fire in the region has likely reduced suitability for the species (as it is known to be fire sensitive and preferred smaller scale fires). There are no known populations in the vicinity of the survey area. It is unlikely that individuals occur, or will move into, the survey area in the near future.	**NONE**
Night Parrot (*Pezoporus occidentalis*)	**LOW**	The species was not observed during the survey. There is no old growth spinifex within the survey area that is considered to possibly support this species. Widespread horse trampling impacts have also likely lowered habitat suitability for the species. Passive sound recording survey techniques used to detect species presence were not undertaken as suitable habitat was not present.	**NONE**
Grey Falcon (*Falco hypoleucos*)	**LOW**	The species was not observed during the survey. The survey area does not support preferred nesting habitat for the species.	**LOW** (flyover or foraging individual only)
Southern Marsupial Mole (*Notoryctes typhlops*)	**LOW**	Searches for tracks and entry/exit points occurred within the sand dune, and the surrounding sandplains. No evidence of the species was observed; however, tracking surface evidence from this species is often scarce due to the subterranean habit of species. The low dunes and sand hills within the survey area could be suitable habitat; however, they occur as small, isolated patches, and therefore are only marginally-suitable. There are few regional records (because of the paucity of large dune systems), which further indicates a very low likelihood of a local population.	**LOW** (within dune habitat only)

6 CONCLUSION

The ecological assessment of the proposed Central Petroleum 2020 exploration drilling program did not identify any ecological values of high significance (i.e. presence or likely occurrence of threatened species, significant/sensitive vegetation, GDE's and declared weed infestation). As such, it does not require assessment under the *Environment Assessment Act* (Northern Territory) or referral under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth).

The surveys did, however, identify several ecological values of lower significance that should be considered when selecting the final location of drill pad footprint to minimise the overall ecological impact from the drilling operation. These are described below (with proposed recommendations in bold):

- There is a low likelihood of occurrence of five threatened species listed under the *TPWC Act* (Northern Territory), and as such – significant impact assessments are not necessary. These species are discussed below:
    - Southern Marsupial Mole (*Notoryctes typhlops*) (Vulnerable). Based on available data, there is a low likelihood that the species could occupy sand dunes within Dingo 1-ST1, Dingo 5, WM27, WM28 and Mamlambo 1.

      To minimise potential impact to Southern Marsupial Mole, avoid or minimise disturbance of sand dune habitat in these areas.
    - Grey Falcon (*Falco hypoleucos*) and Princess Parrot (*Polytelis alexandrae*) (both Vulnerable) may occur on occasion as nomadic visitors within all survey areas. Potential impact to these species is negligible because habitat present does not constitute important and / or breeding habitat for these species.

      No specific mitigation measures are proposed for Grey Falcon or Princess Parrot.
    - Greater Bilby (*Macrotis lagotis*) and Brush-tailed Mulgara (*Dasycercus blythi*) (both Vulnerable) may occasionally utilise sandplains at Mamlambo 1 when better conditions persist; however, comprehensive tracking surveys conducted as part of this study did not record evidence of previous or current occupation of these species. Potential impacts to regional populations is considered as negligible because habitat within the survey areas is not considered as 'core' or 'essential' to these species, and removal of a small area of suitable habitat (i.e. 1 hectare) will not result in impacts.

      No specific mitigation measures are proposed for Greater Bilby or Brush-tailed Mulgara.
- Apart from the Princess Parrot, Greater Bilby and Brush-tailed Mulgara (listed under the *EPBC Act* as Vulnerable) – discussed above – there are no Matters of National Environmental Significance at risk of impact from the drilling program.
- Near Threatened flora species (as per the *TWPC Act*) were recorded within PV12 (two species).
    - *Eucalyptus lucens* (Shiny-leaved Mallee). Recorded within PV12 survey area. Approximately 10 individuals were recorded, all but one located to the south of the access road in land type PV-B.

      To minimise potential impact to *Eucalyptus lucens*, adhere to proposed vegetation buffer presented in Figure 6-3.

      The above recommendation would avoid all known occurrences within the survey area. In any case, *Eucalyptus lucens* is relatively common within the surrounding Krichauff and James Ranges and removal / disturbance of a few individuals within the PV12 survey area

would not constitute a significant impact to this species (pers. Comm. Andrew Schubert 2020, arid zone botanist and ex-Senior Ranger at the Finke Gorge National Park 2006 -12).

- *Stenanthemum centrale*. Recorded within PV12 survey area. Rare to scattered within land type PV12-A (plateau), and patchily common to co-dominant in north-facing gullies (land type PV12-C).

To minimise potential impact to *Stenanthemum centrale*, avoid disturbance of gully habitat, and adhere to proposed vegetation buffer presented in Figure 6-3.

In any case, *Stenanthemum centrale* is relatively common within the surrounding Krichauff and James Ranges and removal / disturbance of a few individuals within the PV12 survey area would not constitute a significant impact to this species (pers. Comm. Andrew Schubert 2020, arid zone botanist and ex-Senior Ranger at the Finke Gorge National Park 2006 -12).

- The sandstone hill at WM28 (land type WM28-D) is considered as locally important habitat (presence of isolated rock outcrop – its removal would displace rock dependant native species).

To minimise potential impacts, it is recommended that direct disturbance of land type WM28-D is avoided.

- Steep rocky gullies and slopes at PV12 (land types PV-C and PV-D) support important habitat (outcrops and cliff faces) and 1st stream order drainage lines that are linked to downstream riparian vegetation. As such, these areas need to be protected.

To minimise potential impacts, it is recommended that direct disturbance to these land types is avoided, and that 25m buffers are implemented.

This complies with buffer recommendations for 1st order streams as per the *Land Clearing Guidelines* (DEPWS 2020).

It is also important that drilling operations on the plateau minimise the chance of downstream contamination (i.e. indirect impacts) of ecological communities by implementing best practice in fluid control, erosion controls, well construction and weed management.

- Several other minor drainage features are also present (refer to Table 6-1) in the form of open depressions, closed depressions and minor drainage lines (all ephemeral drainage features). With the exception of steep rocky gullies at PV12 (described above), surveys indicate that vegetation in drainage features has no especial biodiversity value and are not linked to riparian habitat, but may have an ecological function in that it reduces erosion of the drainage lines during flows, or it becomes seasonally inundated (in the case of depressions). Subsequently, these drainage features do not need to be buffered in accordance with the *Land Clearing Guidelines* (DEPWS 2020).

It is recommended that drill pads are positioned to avoid disturbance of drainage feature land types. If avoidance is not practicable, the EMP needs to explain why these areas cannot be avoided, and how potential impacts will be managed to minimise potential for environmental impact (i.e. erosion controls).

- No declared weeds (under the Northern Territory *Weeds Management Act*) or Weed of National Significance (WONS) were identified within, or adjacent to, any of the survey areas. Buffel Grass (*Cenchrus ciliaris*) is present at most sites (noting that this species is not declared under *Weed Management Act*, but is listed as a 'significant threat' species in the *Alice Springs Regional Weed Management Plan 2013 – 2018*, DLRM 2013).

It is recommended that the project Weed Management Plan implement specific controls to limit the spread of Buffel Grass.

The main ecological findings and recommendations to minimise ecological impact for each survey area are provided in Table 6-1 and mapped in Figure 6-1 to Figure 6-6.

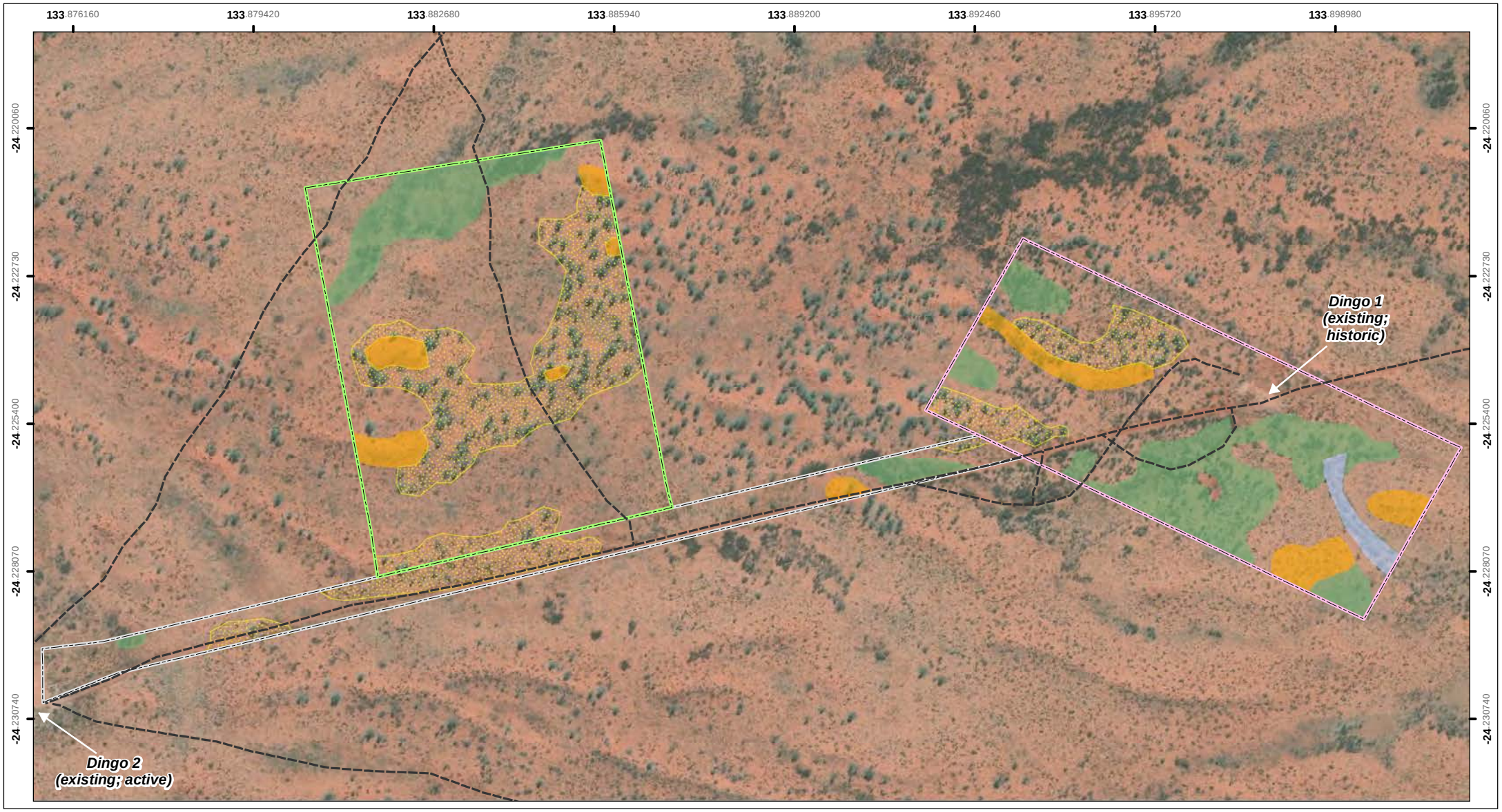
Table 6-1. Assessment summary and recommended management measures for each survey area

Well site	Main ecological findings	Management measures
DINGO 1-ST1	• No threatened species have a high or medium likelihood of occurring within the survey area. • Three threatened species – all listed as Vulnerable – have a low likelihood of occurring. ▪ Southern Marsupial Mole has low likelihood of occurrence within the sand dunes (land type DG-D) in the survey area. ▪ Grey Falcon and Princess Parrot would only occur as nomadic visitors. • No significant/sensitive vegetation communities or GDEs occur within, or are associated with, the survey area. • Two drainage feature land types are present (both considered to have low ecological significance): ▪ Land type DG-C (Mulga depressions) ▪ Land type DG-F (minor drainage, with Mulga). • No existing occurrences of declared weed species or WONS; however, a significant threat species, Buffel Grass (*Cenchrus ciliaris*), is present (currently in disturbed areas at relatively low densities).	• Avoid or minimise disturbance to sand dunes / sand hills (land type DG-D) due to low likelihood of supporting Southern Marsupial Mole. • Avoid or minimise disturbance within drainage features (land type DG-C and land type DG-F). As these areas have low ecological value, a buffer is not considered necessary. However, mitigation measures (i.e. standard erosion and sediment controls) will be required if avoidance cannot be achieved. • Consider minimising direct disturbance of mature Desert Oak trees where possible (mostly within land type DG-B); due to large old trees; not a legislative obligation. • Implement strict weed hygiene protocols (via a Weed Management Plan), noting that Buffel Grass is present at low densities and efforts to minimise spread of species should be included in management plan.
DINGO 5	• No threatened species have a high or medium likelihood of occurring within the survey area. • Three threatened species – all listed as Vulnerable – have a low likelihood of occurring. ▪ Southern Marsupial Mole has low likelihood of occurrence within the sand dunes (land type DG-D) in the survey area. ▪ Grey Falcon and Princess Parrot would only occur as nomadic visitors. • No significant/sensitive vegetation communities or GDEs occur within, or are associated with, the survey area. • One drainage feature land type is present (considered to have low ecological significance): ▪ Land type DG-C (Mulga depressions) • No existing occurrences of declared weed species or WONS; however, a significant threat species, Buffel Grass (*Cenchrus ciliaris*), is present (currently in disturbed areas at relatively low densities).	• Avoid or minimise disturbance to sand dunes / sand hills (land type DG-D) due to low likelihood of supporting Southern Marsupial Mole. • Avoid or minimise disturbance within drainage features (land type DG-C and land type DG-F). As these areas have low ecological value, a buffer is not considered necessary. However, mitigation measures (i.e. standard erosion and sediment controls) will be required if avoidance cannot be achieved. • Consider minimising direct disturbance of mature Desert Oak trees where possible (mostly within land type DG-B); due to large old trees; not a legislative obligation. • Implement strict weed hygiene protocols (via a Weed Management Plan), noting that Buffel Grass is present at low densities and efforts to minimise spread of species should be included in management plan.
ORANGE 3	• No threatened species have a high or medium likelihood of occurring within the survey area. • One threatened species – Grey Falcon (Vulnerable) – has a low likelihood of occurring as a nomadic visitor. • No significant/sensitive vegetation communities or	• Avoid or minimise disturbance within drainage features (land types O3-D and land type O3-F). As these areas have low ecological value, a buffer is not considered necessary. However, mitigation measures (i.e. standard erosion and sediment controls) will be required if avoidance

Well site	Main ecological findings	Management measures
	GDEs occur within, or are associated with, the area. • Two drainage feature land types are present (both considered to have low ecological significance): ▪ Land type O3-D (clay loam depressions) ▪ Land type O3-F (minor drainage, Mulga) • No existing occurrences of declared weed species or WONS; however, a significant threat species, Buffel Grass (*Cenchrus ciliaris*), is present (currently at relatively low densities).	cannot be achieved. • Avoid or minimise disturbance of the low rocky rise (land type O3-C) due to sloped terrain (i.e. increased erosion risk). • Avoid or minimise disturbance of low dunes and sand hills (land type O3-E) due to sloped terrain (i.e. increased erosion risk); also contains local habitat value. • Implement strict weed hygiene protocols (via a Weed Management Plan), noting that Buffel Grass is present at low densities and efforts to minimise spread of species should be included in management plan.
PV12	• No threatened species have a high or medium likelihood of occurring within the survey area. • One threatened species – Grey Falcon (Vulnerable) – has a low likelihood of occurring as a nomadic visitor. • The survey recorded two flora species listed as Near Threatened (records shown on Figure 6-3) : ▪ *Eucalyptus lucens* (Shiny-leafed Mallee). 10 plants observed, mostly in fire protected areas to south of existing access road. ▪ *Stenanthemum centrale*. Rare to scattered on the plateau (land type PV-A) and patchily common within north-facing gullies (land type PV-C). • No significant/sensitive vegetation communities or GDEs occur within, or are associated with, the area. • Rocky gullies (land types PV-C and PV-D) are considered as drainage features (1st order stream) and also support locally-important refugia habitat. Additionally, the south-facing gullies are linked to habitat that supports a range of threatened species (such as *Livistona mariae subsp. mariae* and snails). • A small patch of (long-unburnt) Holey Trunk Mulga is present in the south-eastern corner of the survey area. This species does not have special significance status; however, the 'old growth' does have some merit to minimise impacts if practicable. • No declared weed species were recorded within the survey area; however, Buffel Grass (*Cenchrus ciliaris*) is present at low densities and generally occurs in disturbed areas within the PVGF.	• Avoid direct disturbance of steep rocky gullies and slopes (land type PV-C and PV-D), and where possible, implement a 25m buffer from land types boundary (to comply with buffer recommendations for 1st stream order drainage lines in the *Land Clearing Guidelines*). Mitigation measures (i.e. standard erosion and sediment controls) will be required if avoidance cannot be achieved. • To minimise chance of downstream contamination (i.e. indirect impacts) of ecological communities, implement best practice in fluid control, erosion controls, well construction and weed management. • Additional to the gully buffer, implement a vegetation buffer as per Figure 6-3 to avoid disturbance to *Eucalyptus lucens* (Near Threatened plant), avoid disturbance of Holey Trunk Acacia (old growth patch), and further minimise disturbance of *Stenanthemum centrale* (Near Threatened species). • It is possible that some unmapped individuals from the two recorded Near Threatened species may be removed as part of drill pad establishment (as the survey did not systematically survey for these species due to their status). However, removal of a few individuals within the survey area will not significantly affect the overall population status of these species as both species are common within the surrounding Krichauff and James Ranges (pers. comm. Andrew Schubert 2020, arid zone botanist and ex-Senior Ranger at the Finke Gorge National Park 2006 -12). • Implement strict weed hygiene protocols (via a Weed Management Plan), and as Buffel Grass is present at low densities, efforts to minimise spread of species should be included in management plan.

Well site	Main ecological findings	Management measures
WM27	• No threatened species have a high or medium likelihood of occurring within the survey area. • Three threatened species – all listed as Vulnerable – have a low likelihood of occurring. ▪ Southern Marsupial Mole has low likelihood of occurrence within the sand dunes (land type WM27-B) in the survey area. ▪ Grey Falcon and Princess Parrot would only occur as nomadic visitors. • No near threatened species were recorded. • No significant/sensitive vegetation communities or GDEs occur within, or are associated with, the survey area. • No drainage feature land types are present. • No existing occurrences of declared weed species or WONS; however, Buffel Grass (*Cenchrus ciliaris*), is present at very low densities.	• Avoid or minimise disturbance to sand dunes (land type WM27-B) due to low likelihood of supporting Southern Marsupial Mole (threatened species). • Implement strict weed hygiene protocols (via a Weed Management Plan), and as Buffel Grass is present at low densities, efforts to minimise spread of species should be included in management plan.
WM28	• No threatened species have a high or medium likelihood of occurring within the survey area. • Three threatened species – all listed as Vulnerable – have a low likelihood of occurring. ▪ Southern Marsupial Mole has low likelihood of occurrence within the sand dunes (land type WM28-G) in the survey area. ▪ Grey Falcon and Princess Parrot would only occur as nomadic visitors. • No significant/sensitive vegetation communities or GDEs occur within, or are associated with, the survey area. • The rocky breakaway (land type WM28-D) is considered to support locally important biodiversity values and/or refugia habitat. • One drainage feature land type is present (considered to have low ecological significance): ▪ Land type WM28-C (red earth Mulga depression) • No existing occurrences of declared weed species or WONS; however, a significant threat species, Buffel Grass (*Cenchrus ciliaris*), is present (currently at very low densities).	• Avoid or minimise disturbance to sand dunes (land type WM28-G) due to low likelihood of supporting Southern Marsupial Mole (threatened species). • Avoid or minimise disturbance to rocky breakaway (land type WM28-D) as this area is considered to support locally important habitat. • Avoid or minimise disturbance within drainage features (land type WM28-C). As this land type has low ecological value, a buffer is not considered necessary. However, mitigation measures (i.e. standard erosion and sediment controls) will be required if avoidance cannot be achieved. • Implement strict weed hygiene protocols (via a Weed Management Plan), and as Buffel Grass is present at low densities, efforts to minimise spread of species should be included in management plan.
MAMLAMBO 1	• No threatened species have a high or medium likelihood of occurring within the survey area. • Five threatened species – all listed as Vulnerable – have a low likelihood of occurring. ▪ Southern Marsupial Mole has low likelihood of occurrence within the sand dunes (land type M1-C) in the survey area. ▪ Two of these would only occur as nomadic visitors (Grey Falcon and Princess Parrot). ▪ Greater Bilby and Brush-tailed Mulgara all have	• Avoid or minimise disturbance to sand dunes (land type M1-C) due to low likelihood of supporting Southern Marsupial Mole (threatened species). • Utilise existing sand dune crossing (from old seismic track) to minimise additional impact to dune habitat. • Avoid or minimise disturbance within drainage features (land types M1-B). As this land type has low ecological value, a buffer is not considered necessary.

Well site	Main ecological findings	Management measures
	a low likelihood of occurrence within sandplains in the survey area (M1-A). • No significant/sensitive vegetation communities or GDEs occur within, or are associated with, the survey area. • One drainage feature land type is present (considered to have low ecological significance): ▪ Land type M1-B (red earth Mulga depression) • No weed species were recorded within the survey area. Buffel Grass (Cenchrus ciliaris) was observed at low densities at Surprise 1.	However, mitigation measures (i.e. standard erosion and sediment controls) will be required if avoidance cannot be achieved. • Implement strict weed hygiene protocols (via a Weed Management Plan), and as Buffel Grass is present at low densities in the general area (i.e. Surprise 1), efforts to minimise spread of species should be included in management plan.



DINGO 1-ST1 & DINGO 5

General information

- Dingo 1-ST1 survey area
- Dingo 5 survey area
- Access corridor survey area
- Existing tracks or siesmic lines

Ecological values and recommended mitigation measures

- Mulga depressions (land type DG-C); drainage feature (low ecological significance, so no buffer proposed); avoid where possible or manage appropriately when avoidance cannot be achieved.
- Minor Mulga drainage (land type DG-F) is considered as a 1st order stream (low ecological significance, so no buffer proposed); avoid where possible or manage appropriately when avoidance cannot be achieved.
- Sand dunes (land type DG-D); suitable habitat for Southern Marsupial Mole (threatened species) (low likelihood of occurence); avoid disturbance where possible.
- Where possible, avoid clearing mature Desert Oak trees (mostly within land type DG-B); large old trees.

N

0 50 100 200

Metres

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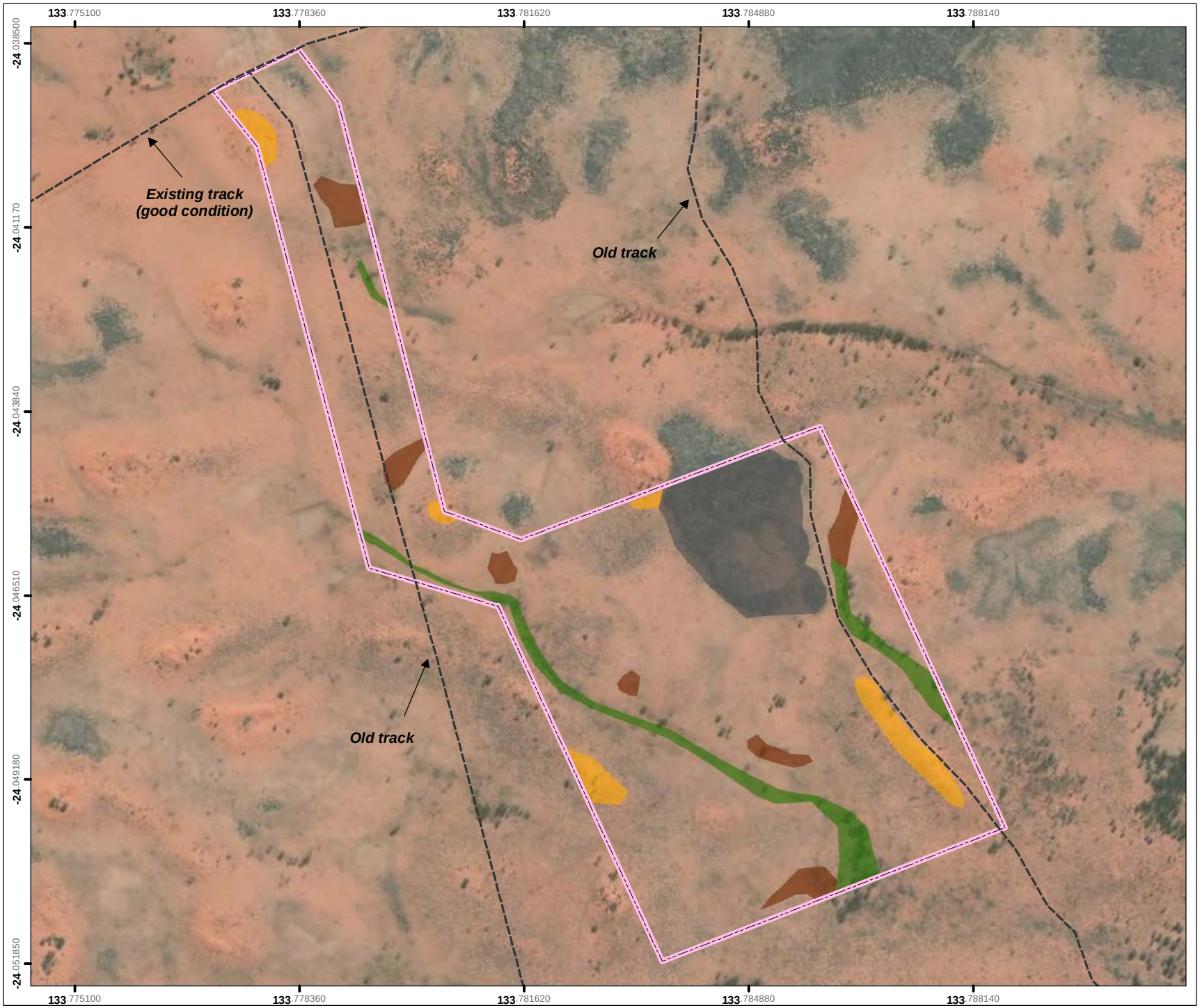
MAP INFORMATION
Scale: 1:10,500 @ A4
Projection: GCS GDA 1994
Date Saved: 14/10/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Well site and survey area; Client
All other data: EcOz 2020
Imagery: Maxar (3/7/2017)

Path: D:\01. EcOz GIS Projects (TR)\EZ19243 (Tom) - Ecological Site Assessment Central Petroleum\01 Project Files\EcologyBuffers_Dingo_Aug2020 v2.mxd

Figure 6-1. Map of ecological values and recommended mitigation measures within the Dingo 1-ST1 and Dingo 5 survey areas



ORANGE 3

General information

Ecological survey area

Existing tracks or siesmic lines

Ecological values and recommended mitigation measures

Clay loam depressions (land type O3-D) (not considered as claypan); drainage feature (low ecological significance so no buffer proposed); avoid where possible, or manage appropriately when avoidance cannot be achieved.

Mulga depressions and minor drainages (land type O3-F); drainage feature (low ecological significance so no buffer proposed); avoid where possible, or manage appropriately when avoidance cannot be achieved.

Low rocky rise (land type O3-C); steep terrain; avoid or minimise disturbance where possible, or manage appropriately when avoidance cannot be achieved.

Low sand dune (land type O3-E); steep terrain; avoid or minimise disturbance where possible, or manage appropriately when avoidance cannot be achieved.

N

0 50 100 200
Metres

MAP INFORMATION
Scale: 1:8,500 @ A4
Projection: GCS GDA 1994
Date Saved: 17/08/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Survey area: Central Petroleum
Survey data: EcOz (Feb 2020)
Imagery: DigitalGlobe (5/11/2019)

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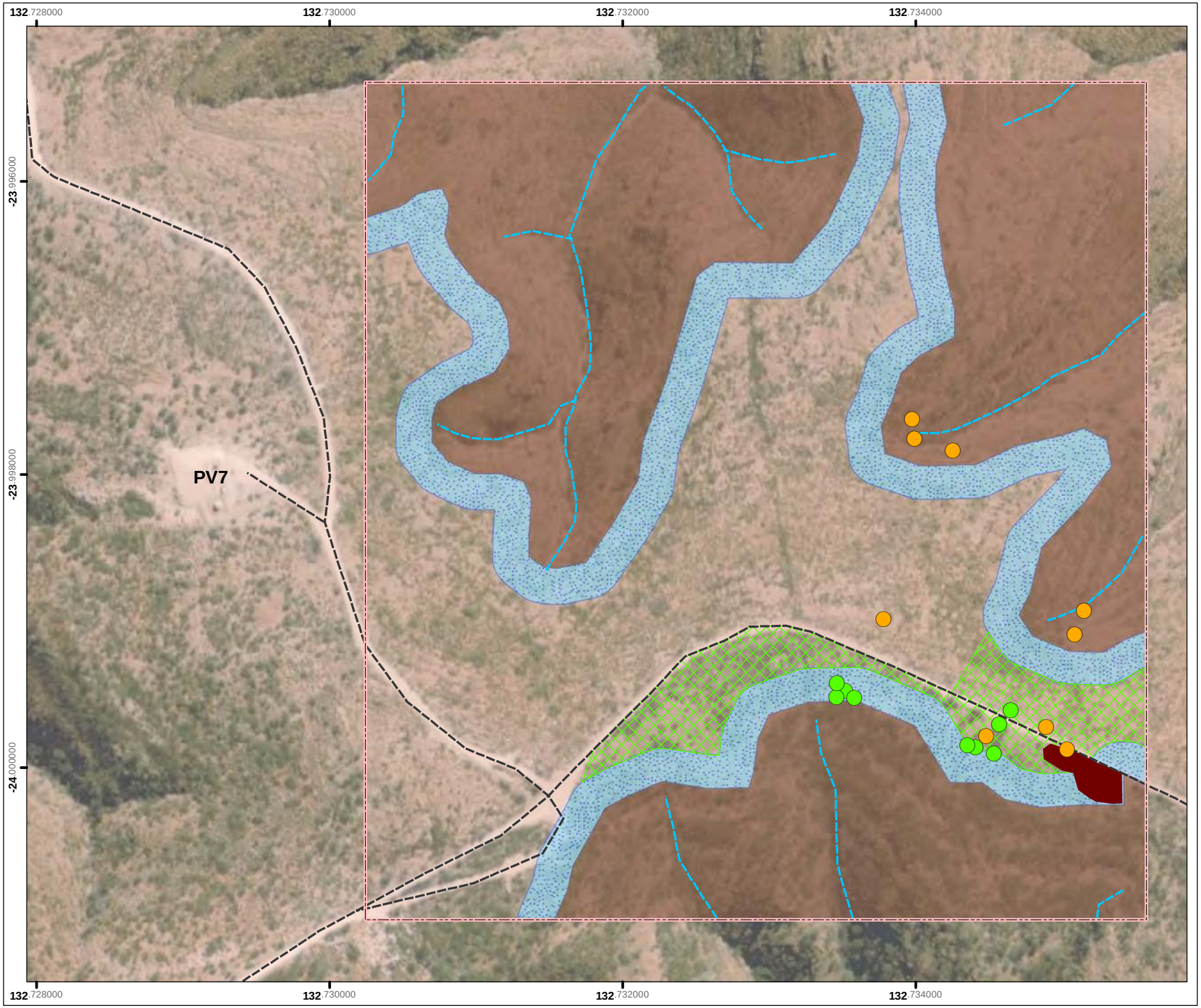
Figure 6-2. Map of ecological values and recommended mitigation measures within the Orange 3 survey area



PALM VALLEY 12

General information

- Ecological survey area
- Existing roads
- Upper gully drainage (1st order; linked to riparian habitat)

Ecological values and recommended mitigation measures

- Stenanthemum centrale records (Near Threatened plant); avoid disturbance where possible.
- Eucalyptus lucens records (Near Threatened plant); avoid disturbance where possible.
- Patch of old Holey Trunk Mulga (trees estimate to be >100 years old); avoid disturbance if possible.
- Steep rocky gullies and slopes (land type PV-C and PV-D); locally important habitat; drainage feature / 1st order stream linked to downstream riparian vegetation; avoid direct disturbance and manage indirect impacts (i.e. stormwater) appropriately.
- Drainage feature buffer (25m) as recommended by Land Clearing Guidelines 2019 for 1st order streams; also provides protection to locally important gully habitat.
- Consider applying this 'vegetation buffer' to minimise potential impact to Near Threatened species and old growth Holey Trunk Mulga patch.

N

0 25 50 100
Metres

MAP INFORMATION
Scale: 1:4,000 @ A4
Projection: GCS GDA 1994
Date Saved: 14/10/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Clearance area: Central Petroleum
Survey data: EcOz (Feb 2020)
Imagery: Maxar (7/6/2019)

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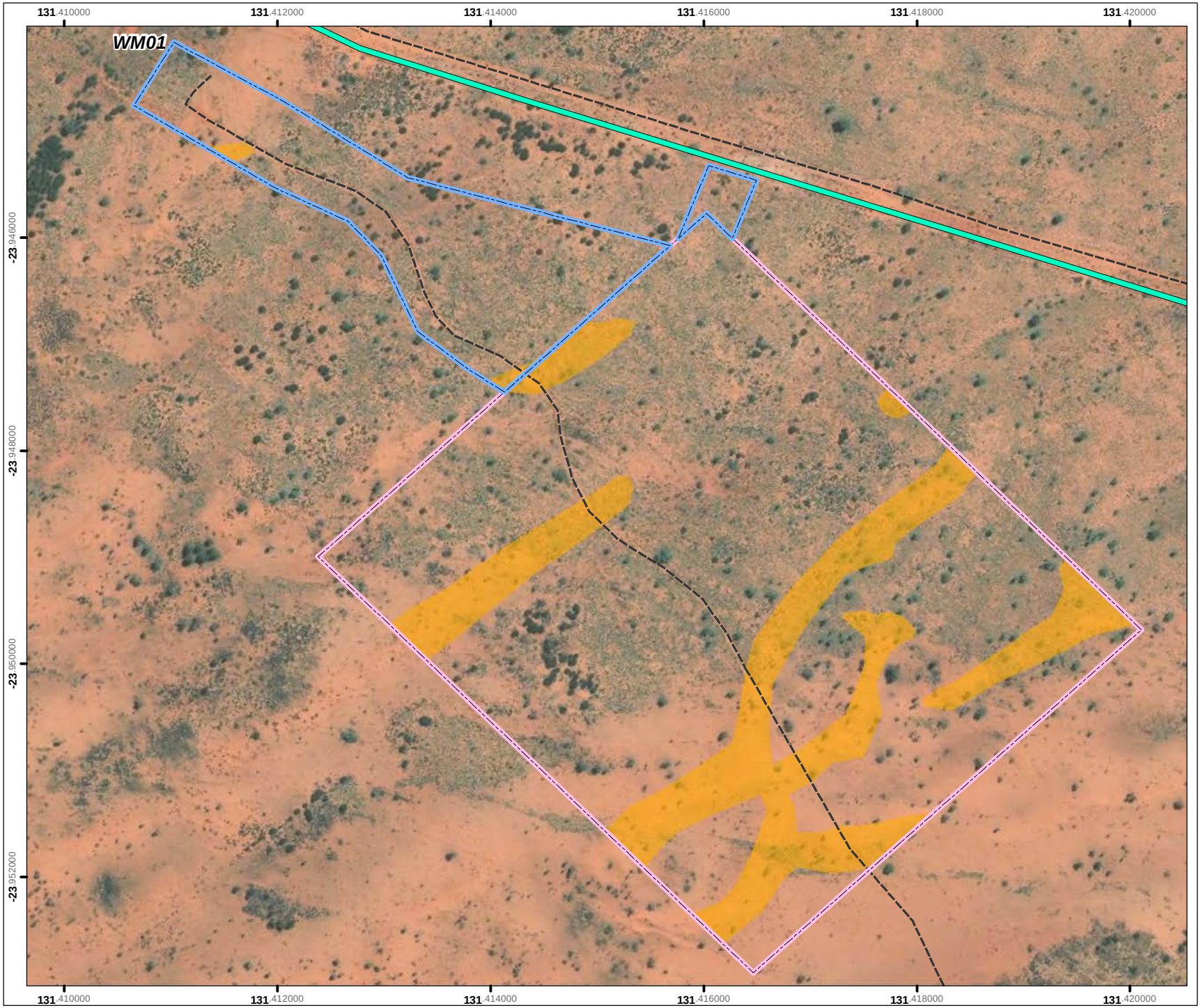
Figure 6-3. Map of ecological values and recommended mitigation measures within the PV12 survey area



WEST MEREENIE 27

Survey information

- Survey area (well pad)
- Survey area (access and pipeline)
- Exisitng underground pipeline
- Existing tracks or siesmic lines

Key ecological values and recommended mitigation measures

- Sand dunes (land type WM27-B); low likelihood of occurrence for Southern Marsupial Mole (threatened species); avoid or minimise disturbance where possible.

Note that a buffer has not been applied to sand dune habitat as the survey did not record presence (or likely presence) of any significant species; noting that the Southern Marsupial Mole is only considered to have a low likelihood of occurrence in the local region (therefore project inherently has a low risk of impact to the species).

There are no drainage feature land types within the survey area.

N

0 40 80 160
Metres

MAP INFORMATION
Scale: 1:5,500 @ A4
Projection: GCS GDA 1994
Date Saved: 15/10/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Survey area: EcOz (based on client)
Survey data: EcOz (Feb 2020)
Imagery: Maxar (24/8/2018)

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Figure 6-4. Map of ecological values and recommended mitigation measures within the WM27 survey area

WEST MEREENIE 28

General information

- Well site survey area (field)
- Western access option (field)
- Eastern access option (desktop)
- Underground pipelines (existing)
- Existing tracks or siesmic lines
- CLC Restricted Works Area

Ecological values and recommended mitigation measures

- Rocky breakaway (land type WM28-D); locally important habitat; steep terrain; avoid disturbance if possible.
- Sand dunes (land type WM28-G); suitable habitat for Southern Marsupial Mole (threatened species) (low likelihood of occurrence); avoid or minimise disturbance where possible.
- Mulga depression (land type WM28-C); drainage feature (low ecological significance so no buffer proposed); avoid where possible or manage appropriately if avoidance cannot be achieved.

N

0 50 100 200
Metres

MAP INFORMATION
Scale: 1:8,500 @ A4
Projection: GCS GDA 1994
Date Saved: 17/08/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Survey area: Central Petroleum
Survey data: EcOz (Feb 2020)
Imagery: Maxar (18/8/2018)

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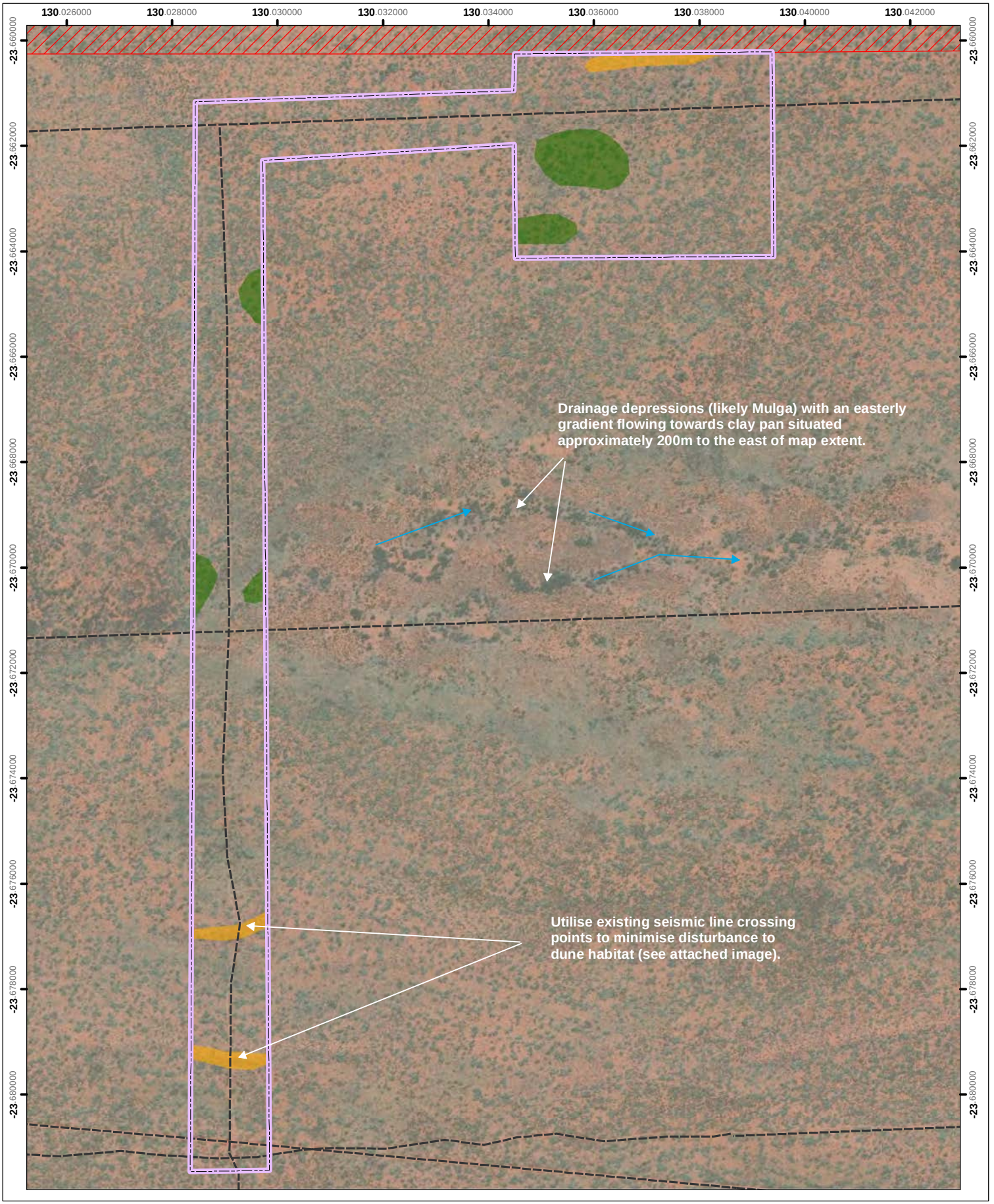
Path: C:\01. EcOz GIS Projects (TR)\EZ19243 (Tom) - Ecological Site Assessment Central Petroleum\01 Project Files\EcologyBuffers_WM28_Aug2020 v2.mxd

Figure 6-5. Map of ecological values and recommended mitigation measures within WM28 survey area



MAMLAMBO 1

General information

- Ecological survey area
- Existing tracks or seismic lines
- CLC Restricted Works Area

Ecological values and recommended mitigation measures

- Low sand dunes (land type M1-C); suitable habitat for Southern Marsupial Mole (threatened species) (low likelihood of occurrence); minimise disturbance; utilise existing seismic lines for access where possible
- Mulga and Ironwood depressions (land type M1-B); drainage feature (low ecological significance, so no buffer proposed); avoid where possible, manage appropriately when avoidance cannot be achieved.

N

0 50 100 200

Metres

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MAP INFORMATION
Scale: 1:10,500 @ A4
Projection: GCS GDA 1994
Date Saved: 17/08/2020
Client: Enviro-Value
Author / Mapper: TR

DATA SOURCE
Survey area: Central Petroleum
Survey data: EcOz (Mar 2020)
Imagery: Maxar (Aug 2018)

Path: C:\01. EcOz GIS Projects (TR)\EZ19243 (Tom) - Ecological Site Assessment Central Petroleum\01 Project Files\EcologyBuffers_MAM1_Aug2020 v2.mxd

Figure 6-6. Map of ecological values and recommended mitigation measures within the Mamlambo 1 survey area

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APPENDIX A FLORA SPECIES (PER SURVEY AREA)

Flora species lists are present for each survey area.

1) Dingo 1-ST1 (survey by Tom Ewers-Reilly, checked by Andrew Schubert)
2) Dingo 5 (survey by Andrew Schubert and Tom Ewers-Reilly)
3) Orange 3 (survey by Andrew Schubert and Tom Ewers-Reilly)
4) PV12 (survey by Andrew Schubert and Tom Ewers-Reilly)
5) WM27 (survey by Andrew Schubert and Tom Ewers-Reilly)
6) WM28 (survey by Andrew Schubert and Tom Ewers-Reilly)
7) Mamlambo 1 (survey by Andrew Schubert and Tom Ewers-Reilly)

Species are sorted by scientific name in alphabetical order.

TPWC status key

- **LC** = Least Concern species
- **DD** = Data Deficient species
- **NE** = Not Evaluated species
- **NT** = Near Threatened species
- *Blank results = identification could not be made to species level*

EPBC status key

- **INV** = listed as an invasive species on the EPBC PMST online report
- *Please note that no Commonwealth threatened species were recorded so status keys are not provided.*

Growth form code

- **tr** = tree
- **sh** = shrub
- **gr** = grass
- **vn** = vine
- **fo** = forb
- **pr** = parasite
- **fn** = fern
- **se** = sedge

Perennial / annual code:

- **p** = perennial species
- **a** = annual species

DINGO 1-ST1	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Acacia aneura	FABACEAE	LC	-	tr.sh	p	Common on red earth plains (DG-A; DG-C)
Acacia estrophiolata	FABACEAE	LC	-	tr	p	Common on red earth plains (DG-C), stunted on some low dunes (D1-D)
Acacia kempeana	FABACEAE	LC	-	tr.sh	p	Scattered to common (in general)
Acacia ligulata	FABACEAE	LC	-	tr.sh	p	Common on sandplains and dunes (DG-A; DG-D); scattered elsewhere
Acacia murrayana	FABACEAE	LC	-	tr.sh	p	Scattered on sandplains and dunes (DG-A; DG-D)
Acacia victoriae	FABACEAE	LC	-	tr.sh	p	Rare on plains (DG-E)
Allocasuarina decaisneana	CASUARINACEAE	LC	-	tr	p	Common on some dune flanks, sandy rises and sandy swales (DG-B)
Aristida holathera var. holathera	POACEAE	LC	-	gr	a.p	Uncommon in most areas (DG-C)
Cenchrus ciliaris	POACEAE	(int)	INV	gr	p	Uncommon in red earths (DG-C), and roadsides / disturbed areas
Citrullus colocynthis	CUCURBITACEAE	(int)		vn	r	Patchy on roadside windrows (sprouted since rainfall)
Eragrostis eriopoda	POACEAE	LC	-	gr	p	Uncommon on red earths (DG-C), scattered / scarce elsewhere
Eremophila latrobei subsp. latrobei	SCROPHULARIACEAE	LC	-	sh	p	Scattered in red earths (DG-C), occasional in sandplains (DG-A)
Eremophila longifolia	SCROPHULARIACEAE	LC	-	sh	p	Scattered in red earths (DG-C), occasional in sandplains (DG-A)
Grevillea juncifolia subsp. juncifolia	PROTEACEAE	LC	-	tr.sh	p	Rarely encountered on dunes (DG-D)
Ptilotus latifolius	AMARANTHACEAE	LC	-	sh.fo	a.r	Rarely encountered on dunes (DG-D)
Sclerolaena sp.	AMARANTHACEAE	-	-	fo	a.p	Rarely encountered
Senna artemisioides subsp. alicia	FABACEAE	LC	-	sh	p	Rarely encountered (DG-E)
Senna artemisioides subsp. filifolia	FABACEAE	LC	-	sh	p	Common to scattered across area
Sida platycalyx	MALVACEAE	LC	-	sh.fo	p.r	Fruiting bodies only scattered in most land types
Solanum centrale	SOLANACEAE	LC	-	sh	p	Rare on sandplains
Triodia basedowii	POACEAE	LC	-	gr	p	Common on sandplains (DG-A) and dunes (DG-D) and some sandy red earths

DINGO 5	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Abutilon otocarpum	MALVACEAE	LC		sh.fo	a	Uncommon on red earths in swale with mulga (DG-C)
Acacia aneura	FABACEAE	LC		tr.sh	p	Dominant mulga on red earth in swale (DG-C)
Acacia aptaneura	FABACEAE	LC		tr	p	Possibly a co-dominant mulga on red earth in swale (DG-C)
Acacia estrophiolata	FABACEAE	LC		tr	p	Emergent on sandplain and red earth soils in swale (DG-E, DG-C)
Acacia kempeana	FABACEAE	LC		tr.sh	p	Occasional on sandplain in swale (DG-E)
Acacia ligulata	FABACEAE	LC		tr.sh	p	Common on sandy soils (DG-E, DG-B, DG-D)
Acacia melleodora	POACEAE	LC		sh	p	Uncommon on dunes (DG-D)
Acacia murrayana	FABACEAE	LC		tr.sh	p	Scattered on sandplain (DG-E)
Allocasuarina decaisneana	CASUARINACEAE	LC		tr	p	Patchy on sandy rises, emergent on sandplain (DG-B, D5-D)
Aristida holathera var. holathera	POACEAE	LC		gr	a.p	Common on sandy soils (DG-E, DG-B, DG-D)
Boerhavia sp.	NYCTAGINACEAE			fo	r	Rare on red earth swale (DG-C)
Calandrinia balonensis	PORTULACACEAE	LC		fo	a	Scattered to uncommon in sandplains (DG-E)
Calandrinia ptychosperma	PORTULACACEAE	LC		fo	a	Common in Mulga red earth swale (DG-C); scattered in other sandplains
Cenchrus ciliaris	POACEAE	(int)		gr	p	Uncommon on red earth, mostly along minor drainage (DG-C)
Chrysocephalum apiculatum	ASTERACEAE	LC		sh.fo	p	Uncommon on sandplain (DG-E)
Citrullus colocynthis	CUCURBITACEAE	(int)		vn	r	Patchy on roadside windrows (sprouted since rainfall)
Corchorus sidoides	MALVACEAE	LC		fo	a	Scattered on dunes (DG-D) and surrounding sandplains (DG-E)
Crotalaria cunninghamii subsp. sturtii	FABACEAE	LC		sh	p	Scattered on dunes (DG-D); increasing after rain
Cullen sp. (mostly likely *pallidum*)	FABACEAE	LC		sh.fo	a	Rarely observed on sandyplains (DG-E) and sandy rises (DG-B)
Dicrastylis lewellinii	LAMIACEAE	LC		sh	a.p	Common clonal subshrub on sandplains (DG-A and DG-E)
Digitaria ammophila	POACEAE	LC		gr	a.p	Sporadic in association with mulga on red earth swale (DG-C)
Dodonaea viscosa subsp. mucronata	SAPINDACEAE	LC		sh	p	Scattered on sand hills (DG-D); rarely on sandplains
Dysphania cristata	AMARANTHACEAE	LC		fo	a	Sporadic in association with mulga on red earth swale (DG-C)
Einadia nutans subsp. eremaea	AMARANTHACEAE	LC		sh.fo	p	Sporadic in association with mulga on red earth swale (DG-C)
Enchylaena tomentosa var. tomentosa	AMARANTHACEAE	LC		sh	p	Uncommon in swale on sandy and red earth soils (DG-E, DG-C)
Enneapogon avenaceus	POACEAE	LC		gr	a	Uncommon on sandplains (DG-E) and dunes (DG-D)
Enneapogon polyphyllus	POACEAE	LC		gr	a.p	Uncommon in swale on sandy and red earth soils (DG-E, DG-C)
Eragrostis eriopoda	POACEAE	LC		gr	p	Common in swale on sandy and red earth soils (DG-E, DG-C)

DINGO 5	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Eremophila longifolia	SCROPHULARIACEAE	LC		sh	p	Scattered/uncommon on sandy soils (DG-E, DG-B, DG-D)
Eriachne aristidea	POACEAE	LC		gr	a.p	Uncommon on dunes (DG-D)
Eriochiton sclerolaenoides	AMARANTHACEAE	LC		sh	p	Uncommon on red earths in swale (DG-C)
Euphorbia tannensis subsp. tannensis	EUPHORBIACEAE	LC		sh.fo	p	Patchy occurrence on sandy and red earth soils (DG-E, DG-C)
Exocarpos sparteus	SANTALACEAE	LC		sh.pr	p	Rare on sandy rises (DG-B)
Fimbristylis dichotoma	CYPERACEAE	LC		se	p	Uncommon on red earths in swale (DG-C)
Grevillea juncifolia subsp. juncifolia	PROTEACEAE	LC		tr.sh	p	Sandy rises, dunes, occasional on sandplain, (DG-E, DG-B, DG-D)
Lepidium muelleriferdinandi	BRASSICACEAE	LC		fo	a	Uncommon on red earths in swale (DG-C)
Portulaca oleracea	PORTULACACEAE	LC		fo	a	Uncommon on red earths in swale (DG-C)
Ptilotus latifolius	AMARANTHACEAE	LC		sh.fo	a.r	Confined to dune crest, uncommon
Ptilotus polystachyus	AMARANTHACEAE	LC		fo	a.p	Uncommon on red earths in swale (DG-C)
Ptilotus sessilifolius	AMARANTHACEAE	LC		sh.fo	r	Uncommon on red earths in swale with mulga (DG-C)
Maireana villosa	AMARANTHACEAE	LC		sh	p	Uncommon on sandy rises (DG-B) and sandplains (DG-E)
Rhagodia eremaea	AMARANTHACEAE	LC		sh	p	Uncommon on red earths in swale with mulga (DG-C)
Rhodanthe floribunda	ASTERACEAE	LC		fo	a	Uncommon on red earths in swale with mulga (DG-C)
Salsola tragus subsp. tragus	AMARANTHACEAE	LC		sh.fo	a	Uncommon in swale on sandy and red earth soils (DG-E, DG-C)
Santalum lanceolatum	SANTALACEAE	LC		tr.sh.pr	p	Uncommon on sandy rises (DG-B)
Sclerolaena convexula	AMARANTHACEAE	LC		sh.fo	p	Uncommon on red earths in swale with mulga (DG-C)
Sclerolaena johnsonii	AMARANTHACEAE	LC		sh.fo	a.p	Occasional on sandy soils (DG-E, DG-B, DG-D)
Senna artemisioides subsp. alicia	FABACEAE	LC		sh	p	Uncommon on red earths in swale with mulga (DG-C)
Senna artemisioides subsp. filifolia	FABACEAE	LC		sh	p	Co-dominant on sandplain (DG-E)
Senna pleurocarpa var. pleurocarpa	FABACEAE	LC		sh	p	Rare on dunes and sandhills (DG-D)
Sida ammophila	MALVACEAE	LC		sh.fo	p.r	Sporadic on sandplains and rises (DG-E, DG-B)
Sida cunninghamii	MALVACEAE	LC		sh.fo	p.r	Uncommon on red earths in swale (DG-C)
Sida fibulifera	MALVACEAE	LC		sh.fo	p.r	Uncommon on red earths in swale (D5-C)
Sida platycalyx	MALVACEAE	LC		sh.fo	p.r	Common on red earths in swale (DG-C)
Solanum centrale	SOLANACEAE	LC		sh	p	Occasional on sandplain (DG-E)
Solanum lithophilum	SOLANACEAE	LC		sh	p	Uncommon on red earths in swale (DG-C)

DINGO 5	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Solanum quadriloculatum	SOLANACEAE	LC		sh	p	Uncommon in swale on sandy and red earth soils (DG-E, DG-C)
Swainsona affinis	FABACEAE	LC		fo	a.p	Occasional on sandplain (DG-E)
Tragus australianus	POACEAE	LC		gr	a.p	Uncommon on red earths in swale (DG-C)
Tribulus eichlerianus	ZYGOPHYLLACEAE	LC		fo	a	Uncommon on red earths in swale (DG-C)
Triodia basedowii	POACEAE	LC		gr	p	Dominant on sandy soils (DG-E, DG-B, DG-D)
Tripogon loliiformis	POACEAE	LC		gr	a	Uncommon on red earths in swale (DG-C)
Xerochrysum bracteatum	ASTERACEAE	LC		sh.fo	a.p	Uncommon on red earths in swale with mulga (DG-C)
Yakirra australiensis var. australiensis	POACEAE	LC		gr	a.p	Scattered on sandplain (DG-E) and dunes / sandhills (DG-D)

ORANGE 3	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Acacia aneura	FABACEAE	LC		tr.sh	p	Rare on alluvial loam soil (O3-A); patchily common along drainage (O3- D)
Acacia estrophiolata	FABACEAE	LC		tr	p	Common on dunes (O3-E); rare on alluvial loam soil (O3-A) (some large trees; mostly juveniles)
Acacia kempeana	FABACEAE	LC		tr.sh	p	Rare on alluvial loam soil with calcrete fragments (O3-A)
Acacia ligulata	FABACEAE	LC		tr.sh	p	Common on dunes (O3-E)
Acacia murrayana	FABACEAE	LC		tr.sh	p	Scattered and uncommon across the site
Acacia tetragonophylla	FABACEAE	LC		tr.sh	p	Rare on alluvial loam soil (O3-A)
Aristida arida	POACEAE	LC		gr	a.p	Rare on non-spinifex parts of site
Aristida holathera var. holathera	POACEAE	LC		gr	a.p	Rare on loam soil (O3-A)
Boerhavia sp.	NYCTAGINACEAE			fo	r	Rare on sandy rises (O3-B) and sand hills (O3-E)
Cenchrus ciliaris	POACEAE	(int)		gr	p	Common on alluvial loam soil, patchy on loam soil with calcrete fragments, rare with spinifex
Citrullus colocynthis	CUCURBITACEAE	(int)		vn	r	Sprouts emerging within sandy rises (O3-B) and sand hills (O3-E); no large vines present
Digitaria brownii	POACEAE	LC		gr	p	Rare on alluvial loam soil (O3-A)
Dodonaea viscosa subsp. mucronata	SAPINDACEAE	LC		sh	p	Scattered to common on sand hills (O3-E)
Enneapogon avenaceus	POACEAE	LC		gr	a.p	Dominant on loam soil with calcrete fragments (O3-A)
Enneapogon polyphyllus	POACEAE	LC		gr	a.p	Possibly occuring on alluvial loam soil (sterile material) (O3-A)
Eragrostis eriopoda	POACEAE	LC		gr	p	Uncommon on alluvial loam soil (O3-A); rare elsewhere
Eremophea spinosa	AMARANTHACEAE	LC		sh	p	Rare on loam soil (O3-A)
Fimbristylis dichotoma	CYPERACEAE	LC		se	p	Common in clay depressions (O3-F)
Grevillea stenobotrya	PROTEACEAE	LC		sh	p	Scattered to common on sand hills (O3-E)
Hakea leucoptera subsp. leucoptera	PROTEACEAE	LC		tr.sh	p	Rare on loam soil with calcrete fragments (O3-A)
Marsdenia australis	APOCYNACEAE	LC		vn	f	Sprouts emerging within sandy rises (O3-B) and sand hills (O3-E); no large vines present
Ptilotus sessilifolius	AMARANTHACEAE	LC		sh.fo	r	Rare on non-spinifex parts of site
Sclerolaena patenticuspis	AMARANTHACEAE	LC		fo	p	Rare on alluvial loam soil with calcrete fragments (O3-A)
Senna artemisioides subsp. artemisioides	FABACEAE	LC		sh	p	Scattered on calcrete rises (O3-C); rare on loam soil with calcrete fragments (O3-A)
Senna artemisioides subsp. filifolia	FABACEAE	LC		sh	p	Rare on loam soil with calcrete fragments (O3-A)
Sida platycalyx	MALVACEAE	LC		sh.fo	p.r	Rare on alluvial loam soil with calcrete fragments (only old fruits observed)

ORANGE 3	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
						(O3-A)
Solanum quadriloculatum	SOLANACEAE	LC		sh	p	Uncommon on non-spinifex parts of site
Tribulus eichlerianus	ZYGOPHYLLACEAE	LC		fo	a	Scattered on loam soil (O3-A)
Triodia basedowii	POACEAE	LC		gr	p	Confined to sandy rises (O3-B)
Triodia brizoides	POACEAE	LC		gr	p	Dominant on calcrete rises (O3-C)

PV12	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Acacia aneura var. Holey trunk	FABACEAE	LC		tr	p	Co-dominant in patches on plateau south of main access track (PV-B)
Acacia basedowii	FABACEAE	LC		sh	p	Rare on plateau north side of access track (PV-A)
Acacia bivenosa	FABACEAE	LC		sh	p	Common on north side of access track (PV-A)
Acacia kempeana	FABACEAE	LC		tr.sh	p	Co-dominant on north side of access track (PV-A)
Acacia macdonnellensis subsp. macdonnellensis	FABACEAE	LC		tr.sh	p	Common to co-dominant on all land types except northern plateau (PV-A)
Acacia melleodora	FABACEAE	LC		sh	p	Sporadic to common on plateau north side of access track (PV-A)
Aristida capillifolia	POACEAE	LC		gr	a.p	Rare, confined to gully in NW of site (PV-C)
Aristida nitidula	POACEAE	LC		gr	a.p	Sporadic in NE gully (PV-C)
Callitris glaucophylla	CUPRESSACEAE	LC		tr	p	Confined to gullies as emergents (PV-C, PV-D)
Capparis mitchellii	CAPPARACEAE	LC		tr.sh	p	Rare, only seen in NW gully (PV-C) as a juvenile
Cenchrus ciliaris	POACEAE	(int)		gr	p	Environmental weed; confined to 4 plants in NW gully (PV-C)
Cheilanthes lasiophylla	PTERIDACEAE	LC		fn	r	Mostly in gullies (PV-C, PV-D) and southern side of access track (PV-B)
Corymbia aparrerinja	MYRTACEAE	LC		tr	f	Few individuals in gully in NW of area (PV-C)
Corymbia eremaea	MYRTACEAE	LC		tr.sh	p	Scattered in southern gullies (PV-D), occasional across the remainder
Cymbopogon ambiguus	POACEAE	LC		gr	p	Sporadic in north-facing gullies (PV-C)
Digitaria brownii	POACEAE	LC		gr	p	Sporadic in gullies (PV-C, PV-D) and southern side of access track (PV-B)
Dodonaea lanceolata	SAPINDACEAE	LC		sh	p	Uncommon in north-facing gullies (PV-C) and plateau (PV-A)
Dodonaea viscosa subsp. mucronata	SAPINDACEAE	LC		sh	p	Sporadic in north-facing gullies (PV-C)
Eragrostis eriopoda subsp. Hill top	POACEAE	LC		gr	p	Sporadic on rocky plateau (PV-C, PV-D)
Eremophila latrobei var. glabra	SCROPHULARIACEAE	LC		sh	p	Sporadic across site
Eriachne mucronata	POACEAE	LC		gr	r	More common on southern plateau and gullies (PV-B, PV-C, PV-D)
Eucalyptus intertexta	MYRTACEAE	LC		tr	p	Uncommon on plateau, mostly close to access track (PV-A, PV-B)
Eucalyptus lucens	MYRTACEAE	NT		tr.sh	p	Confined to several individuals near main access track (PV-B)
Eucalyptus sessilis	MYRTACEAE	LC		tr.sh	p	Common to dominant across large parts of site
Eucalyptus trivalvis		LC		sh	p	Co-dominant in the western part of site (PV-A)
Gastrolobium brevipes	FABACEAE	LC		sh	p	Uncommon on plateau north side of access track (PV-A)
Grevillea wickhamii	PROTEACEAE	LC		sh	p	Uncommon, scattered on plateau north side of access track (PV-A)
Halgania cyanea var. Allambi Stn	BORAGINACEAE	LC		sh.fo	p	Uncommon on northern and gullies (PV-A, PV-C)

PV12	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Hybanthus aurantiacus		LC		sh.fo	p	Only seen in NE gully (PV-C), rare
Leiocarpa semicalva subsp. semicalva	ASTERACEAE	LC		sh.fo	p	Mostly occurring sporadically in gullies (PV-C, PV-D)
Olearia ferresii	ASTERACEAE	LC		sh	p	Sometimes common in north-facing gullies (PV-C), rare elsewhere
Ozothamnus kempei	ASTERACEAE	LC		sh	p	Sometimes common in rocky gullies (PV-C, PV-D)
Pandorea doratoxylon	BIGNONIACEAE	LC		sh.vn	p	Rare, confined to gullies (PV-C, PV-D)
Prostanthera sericea	LAMIACEAE	LC		sh	p	Confined to south-facing gullies (PV-C)
Psydrax latifolia	RUBIACEAE	LC		tr.sh	p	Sporadic in rocky gullies (PV-C, PV-D) and southern plateau (PV-B)
Ptilotus decipiens	AMARANTHACEAE	LC		fo	a	Occasional in north-facing gullies (PV-C)
Santalum lanceolatum	SANTALACEAE	LC		tr.sh.pr	p	Sporadic, mostly in north-facing gullies (PV-C)
Scaevola spinescens	GOODENIACEAE	LC		sh	p	Quite common in patches on plateau north side of access track (PV-A)
Senna artemisioides subsp. artemisioides	FABACEAE	LC		sh	p	Scattered, sometimes common across the plateau (PV-A, PV-B)
Senna artemisioides subsp. James Range	FABACEAE	DD		sh	p	Rare in north-facing gullies (PV-C)
Senna glutinosa subsp. glutinosa	FABACEAE	LC		sh	p	Uncommon on plateau north side of access track (PV-A)
Sida sp. Excedentifolia	MALVACEAE	NE		sh.fo	p.r	Uncommon across the site
Solanum orbiculatum subsp. macrophyllum	SOLANACEAE	LC		sh	p	Rare in rocky gullies (PV-C, PV-D)
Stenanthemum centrale	RHAMNACEAE	NT		sh	p	Patchy, sometimes common on plateau (PV-A, PV-B), extending to gullies
Triodia brizoides	POACEAE	LC		gr	p	Co-dominant across the site, less common in south-facing gullies (PV-D)
Triodia melvillei	POACEAE	LC		gr	p	Co-dominant, especially in the southern part of site (PV-B, PV-D)
Tripogon loliiformis	POACEAE	LC		gr	a	Patchy, uncommon but widespread on rocky plateau (PV-A)

WM27	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Acacia aneura	FABACEAE	LC		tr.sh	p	Co-dominant in WM27-C, extending to WM27-D where present often as burnt stumps
Acacia ayersiana	FABACEAE	LC		tr	p	Co-dominant in mulga (WM27-C)
Acacia ligulata	FABACEAE	LC		tr.sh	p	Mostly on dune slopes and crests (WM27B), extending to sandplains (WM27-A)
Acacia maitlandii	FABACEAE	LC		sh	p	Sporadic on sandy soils with spinifex (WM27-A, WM27-B)
Acacia melleodora	FABACEAE	LC		sh	p	Co-dominant shrub on dunes (WM27B), extending to spinifex sandplains (WM27A)
Acacia ramulosa var. ramulosa	FABACEAE	LC		sh	p	Uncommon on localised outcrop on sandy plains (WM27-A)
Acacia sericophylla	FABACEAE	LC		tr.sh	p	Rare spinifex sandplains (WM27-A)
Allocasuarina decaisneana	CASUARINACEAE	LC		tr	p	Emergent on dunes (WM27-B)
Aluta maisonneuvei subsp. maisonneuvei	MYRTACEAE	LC		sh	p	Uncommon to sporadic on dune flanks (WM27-B), just extending to sandy red earth plains
Amphipogon caricinus var. caricinus	POACEAE	LC		gr	p	Sporadic on spinifex sandplains (WM27-A)
Aristida holathera var. holathera	POACEAE	LC		gr	a.p	Common on sandy soils of sandplains and dunes (WM27-A, WM27-B)
Brachychiton gregorii	MALVACEAE	LC		tr	o	Occassional emergent on dune flanks (WM276-B), occassional in red earth swales (WM27-D)
Brunoniella australis	ACANTHACEAE	LC		fo	r	Uncommon on dune flanks and sandplains (WM27-A, WM27-B)
Calotis erinacea	ASTERACEAE	LC		fo	p	Common on dune crests (WM27-B)
Calytrix carinata	MYRTACEAE	LC		sh	p	Rare on dune crests (WM27-B)
Cheilanthes sieberi subsp. sieberi	PTERIDACEAE	LC		fn	r	Associated with mulga patches (WM27-C)
Chenopodium desertorum	AMARANTHACEAE	LC		fo	a.p	Uncommon on dune flanks and sandplains (WM27-A, WM27-B)
Chrysocephalum eremaeum	ASTERACEAE	LC		sh.fo	p	Common on dune crests (WM27-B)
Corymbia chippendalei	MYRTACEAE	LC		tr.sh	p	Emergent on dunes (WM27-B)
Corynotheca micrantha var. divaricata	HEMEROCALLIDACEAE	LC		sh.fo	p.r	Common on dune crests (WM27-B)
Crotalaria cunninghamii subsp. sturtii	FABACEAE	LC		sh	p	Uncommon on dune crests (WM27-B)
Cymbopogon sp.	POACEAE					Only observed on dunes (WM27-B)
Dampiera cinerea	GOODENIACEAE	LC		sh.fo	p	Common on dune crests (WM27-B)
Dicrastylis beveridgei	LAMIACEAE			sh	p	Present on dune crests (WM27-B)
Digitaria ammophila	POACEAE	LC		gr		Uncommon on sandplains (WM27-A) and lower dune slopes (WM27-B)
Digitaria brownii	POACEAE	LC		gr	p	Present in mulga including around sandstone outcrops (WM27-C)

WM27	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Duboisia hopwoodii	SOLANACEAE	LC		sh	p	Uncommon on dune crests (WM27-B)
Enchylaena tomentosa var. tomentosa	AMARANTHACEAE	LC		sh	p	Uncommon under trees in all habitats
Eragrostis eriopoda	POACEAE	LC				Uncommon on sandy plains (WM27-A)
Eremophila latrobei subsp. glabra	SCROPHULARIACEAE			sh	p	Common shrub within mulga (WM27-C), but extending to other areas except dune crests
Eremophila latrobei subsp. latrobei	SCROPHULARIACEAE			sh	p	Uncommon on sandplains (WM27-A), sandstone within mulga (WM27-C)
Eremophila longifolia	SCROPHULARIACEAE	LC		sh	p	Uncommon on sandy plains (WM27-A)
Eremophila willsii subsp. Kata Pata	SCROPHULARIACEAE			0	0	Common on sandy soils of sandplains and dunes (WM27-A, WM27-B)
Eriachne aristidea	POACEAE	LC		gr	a.p	Common on dune crests (WM27-B)
Eriachne helmsii	POACEAE	LC		gr		Quite common on dunes (WM27-B); patchy in sandplains (WM27-A)
Eucalyptus gamophylla	MYRTACEAE	LC		sh	p	Uncommon on dune flanks and sandplains (WM27-A, WM27-B)
Eucalyptus oxymitra	MYRTACEAE	LC		tr.sh	p	Patchy on dune slopes (WM27-B) and sandplains (WM27-A)
Exocarpos sparteus	SANTALACEAE	LC		sh.pr	p	Uncommon on sandplains (WM27-A)
Fimbristylis dichotoma	CYPERACEAE	LC		se	p	Patchy within mulga (WM27-C)
Grevillea juncifolia subsp. juncifolia	PROTEACEAE	LC		tr.sh	p	Scattered on sandplains and dune slopes (WM27-A, WM27-B)
Grevillea stenobotrya	PROTEACEAE	LC		sh	p	Scattered on dune crests (WM27-B)
Gyrostemon tepperi	GYROSTEMONACEAE	LC		sh	p	Rare on dune crests (WM27-B)
Hannafordia bissillii subsp. bissillii	MALVACEAE	LC		sh	p	Uncommon on sandplains (WM27-A)
Jasminum calcareum	OLEACEAE	LC		sh.vn	p	Uncommon on sandy plains with tussock grasses (WM27-A)
Leptosema chambersii	FABACEAE	LC		sh.fo	p	Common on dunes (WM27-B) and plains (WM27-A); more in burnt areas.
Leucochrysum stipitatum	ASTERACEAE	LC		fo	a	Common on dune lower slopes and sandplains (WM27-A, WM27-B)
Newcastelia spodiotricha	LAMIACEAE	LC		sh	p	Resticted to dune crests, sporadic (WM27-B)
Pimelea trichostachya	THYMELAEACEAE	LC		sh	p	Rare on dune lower slopes (WM27-B)
Pomax sp. Sand dunes	RUBIACEAE	LC		sh.fo	a.p	Uncommon on dune crests (WM27-B)
Psydrax suaveolens	RUBIACEAE	LC		tr.sh	p	Rare in mulga (WM27-C)
Ptilotus obovatus	AMARANTHACEAE	LC		sh.fo	p	Widespread but uncommon in all areas.
Scaevola basedowii	GOODENIACEAE	LC		sh.fo	p	Present on dunes (WM27-B)
Sclerolaena convexula	AMARANTHACEAE	LC		sh.fo	p	Uncommon in mulga (WM27-C)
Senna artemisioides subsp. artemisioides	FABACEAE	LC		sh	p	Common around sandstone outcrop with mulga (WM27-C)

WM27	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Senna pleurocarpa var. pleurocarpa	FABACEAE	LC		sh	p	Uncommon within sandplains (WM27-A)
Sida platycalyx	MALVACEAE	LC		sh.fo	p.r	Uncommon in mulga (WM27-C)
Sida sp. Excedentifolia	MALVACEAE	NE		sh.fo	p.r	Restricted to areas of sandstone outcrop within WM27-C
Solanum coactiliferum	SOLANACEAE	LC		sh	p	Uncommon on dune lower slopes (WM27-B) and sandplains (WM27-A)
Solanum quadriloculatum	SOLANACEAE	LC		sh	p	Uncommon in mulga (WM27-C)
Tragus australianus	POACEAE	LC		gr		Rare on sandplains (WM27-A)
Triodia pungens	POACEAE	LC		gr	p	Co-dominant around sandstone outcrop with hill mulga WM27-C
Triodia schinzii	POACEAE	LC		gr	p	Dominant in unburnt sandplain (WM27-A) and dunes (WM27-B)
Tripogon loliiformis	POACEAE	LC		gr	a	Minor occurrence in mulga (WM27-C)
Yakirra australiensis var. australiensis	POACEAE	LC		gr	a.p	Present in sandplains (WM27-A) & dunes (WM27-B); more in burnt areas

WM28	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Acacia aneura	FABACEAE	LC		tr.sh	p	Co-dominant in mulga swale (WM28-C) scattered to common elsewhere except dunes
Acacia aneura x Acacia minyura	FABACEAE	LC		tr.sh	p	Co-dominant on elevated gravel plains (WM28-E)
Acacia aptaneura	FABACEAE	LC		tr	p	Co-dominant in mulga groves (WM28-C)
Acacia ayersiana	FABACEAE	LC		tr	p	Co-dominant mulga on sandy red earth plains (WM28-A) and mulga groves (Wm28-C)
Acacia kempeana	FABACEAE	LC		tr.sh	p	Scattered to common on sandy red earth plains (WM28-A) & spinifex sandplains (WM28-B)
Acacia ligulata	FABACEAE	LC		tr.sh	p	Scattered on sandy red earth plains (WM28-A), common on dunes (WM28-G)
Acacia macdonnellensis subsp. macdonnellensis	FABACEAE	LC		tr.sh	p	Dominant small tree on sandstone breakaways (WM28-D)
Acacia maitlandii	FABACEAE	LC		sh	p	Common on spinifex sandplains (WM28-B)
Acacia melleodora	FABACEAE	LC		sh	p	Common on dunes (WM28-G)
Acacia minyura	FABACEAE	LC		sh	p	Occasional on sandy red earth plains (WM28-A)
Acacia ramulosa var. ramulosa	FABACEAE	LC		sh	p	Co-dominant on sandy red earth plains (WM28-A), extending to mulga groves (WM28-C) & sandplains (WM28-B)
Allocasuarina decaisneana	CASUARINACEAE	LC		tr	p	Scattered emergent on dunes (WM28-G), rare on spinifex sandplains (WM28-B)
Aluta maisonneuvei subsp. maisonneuvei	MYRTACEAE	LC		sh	p	Scattered on spinifex sandplains (WM28-B), patchy on dunes (WM28-G)
Amphipogon sp.	POACEAE			gr	p	Scattered on sandy red earth plains (WM28-A), common spinifex sandplains (WM28-B)
Aristida holathera var. holathera	POACEAE	LC		gr	a.p	Scattered on dunes (WM28-G)
Aristida inaequiglumis	POACEAE	LC		gr	p	Common in mulga groves (WM28-C)
Brachychiton gregorii	MALVACEAE	LC		tr	o	Emergent on sandy red earth plains (WM28-A) and spinifex sandplains (WM28-B)
Calandrinia reticulata	PORTULACACEAE	LC		fo	a	Uncommon on elevated gravel plains (WM28-E)
Calandrinia sp.	PORTULACACEAE			fo	a	Uncommon on sandstone breakaways (WM28-D)
Cenchrus ciliaris	POACEAE	(int)		gr	p	Rare on sandy red earth plains (WM28-A) & lower slopes of sandstone breakaways (WM28-D)
Cheilanthes sieberi subsp. sieberi	PTERIDACEAE	LC		fn	r	Uncommon in mulga groves (WM28-C) & on sandstone breakaway (WM28-D)
Chrysocephalum eremaeum	ASTERACEAE	LC		sh.fo	p	Abundant on dunes (WM28-G)
Codonocarpus cotinifolius	GYROSTEMONACEAE	LC		tr.sh	p	Scattered on sandy red earth plains (WM28-A)
Corymbia chippendalei	MYRTACEAE	LC		tr.sh	p	Scattered emergent on dunes (WM28-G)

WM28	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Corymbia eremaea	MYRTACEAE	LC		tr.sh	p	Scattered emergents on sandstone (WM28-D) and spinifex sandplains (MW28-B)
Digitaria brownii	POACEAE	LC		gr	p	Common in mulga groves (WM28-C), uncommon on sandy red earth plains (WM28-A) and sandstone (WM28-D)
Enchylaena tomentosa var. tomentosa	AMARANTHACEAE	LC		sh	p	Uncommon on sandy red earth plains (WM28-A), mulga groves (WM28-C) and sandplains (WM28-B)
Eragrostis eriopoda subsp. Red earth	POACEAE	LC		gr	p	Co-dominant in mulga groves (WM28-c), sandy red earth plains (WM28-A), elevated gravel plains (WM28-E), rare on sandplains (WM28-B)
Eremophila gilesii subsp. gilesii	SCROPHULARIACEAE	LC		sh	p	Common in mulga groves (WM28-C), uncommon on sandy red earth plains (WM28-A)
Eremophila latrobei subsp. glabra	SCROPHULARIACEAE	LC		sh	p	Common and widespread
Eremophila latrobei subsp. latrobei	SCROPHULARIACEAE	LC		sh	p	Dominant shrub in mulga groves (WM28-C) & sandstone (WM28-D), occasional on dunes (WM28-G)
Eremophila longifolia	SCROPHULARIACEAE	LC		sh	p	Scattered on sandy red earth plains (WM28-A) and in mulga groves (WM28-C)
Eremophila willsii subsp. Kata Pata	SCROPHULARIACEAE			sh	p	Common on spinifex sandplains (WM28-B) and dunes (WM28-G)
Eriachne helmsii	POACEAE	LC		gr		Co-dominant to scattered on sandy red earth plains (WM28-A), scattered elsewhere except on sandstone
Eriachne mucronata	POACEAE	LC		gr	r	Common on elevated gravel plains (WM28-G), scattered on sandstone (WM28-D)
Eriachne sp. Woolly culms	POACEAE	LC		gr		Scattered on sandstone breakaways (WM28-D)
Eucalyptus gamophylla	MYRTACEAE	LC		sh	p	Co-dominant on sandy red earth plains WM28-A, sandplains (WM28-B) & dunes (WM28-G)
Eucalyptus intertexta	MYRTACEAE	LC		tr	p	Occasional emergent on sandy red earth plains (WM28-A)
Eucalyptus oxymitra	MYRTACEAE	LC		tr.sh	p	Co-dominant on spinifex sandplains (WM28-B)
Fimbristylis dichotoma	CYPERACEAE	LC		se	p	Rare at the base of sandstone breakaways (WM28-D)
Goodenia mueckeana	GOODENIACEAE	LC		fo	p	Occasional on dunes (WM28-G)
Grevillea juncifolia subsp. juncifolia	PROTEACEAE	LC		tr.sh	p	Common on spinifex sandplains (WM28-B) and dunes (WM28-G)
Gyrostemon tepperi	GYROSTEMONACEAE	LC		sh	p	Rare on spinifex sandplains (WM28-B)
Hakea divaricata	PROTEACEAE	LC		tr.sh	p	Rare on sandy red earth plains (WM28-A) & elevated gravel plains (WM28-E)
Hannafordia bissillii subsp. bissillii	MALVACEAE	LC		sh	p	Uncommon on sandstone breakaways (WM28-D)
Indigofera cornuligera var. cornuligera	FABACEAE	LC		sh	a.p	Scattered on sandstone breakaways (WM28-D), spinifex sandplains (WM28-B)
Jasminum calcareum	OLEACEAE	LC		sh.vn	p	Scattered on spinifex sandplains (WM28-B)

WM28	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Jasminum didymum	OLEACEAE	LC		vn	p	Uncommon on sandy red earth plains (WM28-A)
Leptosema chambersii	FABACEAE	LC		sh.fo	p	Common on spinifex sandplains (WM28-B), extending to dunes (WM28-G)
Leucochrysum stipitatum	ASTERACEAE	LC		fo	a	Occasional on dunes (WM28-G) & spinifex sandplains (WM28-B)
Maireana villosa	AMARANTHACEAE	LC		sh	p	Occasional in mulga groves (WM28-C)
Micromyrtus flaviflora	MYRTACEAE	LC		sh	p	Rare on spinifex sandplains (WM28-B)
Monachather paradoxus	POACEAE	LC		gr		Common on sandy red earth plains (WM28-A), rare on spinifex sandplains (WM28-B)
Olearia subspicata	ASTERACEAE	LC		sh.fo	p	Common on spinifex sandplains (WM28-B)
Prostanthera althoferi subsp. longifolia	LAMIACEAE	LC		sh	p	Scattered on sandy red earth plains (WM28-A) and spinifex sandplains (WM28-B)
Prostanthera striatiflora	LAMIACEAE	LC		sh	p	Uncommon in mulga groves (WM28-C) & spinifex sandplains (Wm28-B)
Psydrax ammophila	RUBIACEAE	LC		tr.sh	p	Scattered to common on sandy red earth plains (WM28-A), & in mulga groves (WM28-C)
Psydrax latifolia	RUBIACEAE	LC		tr.sh	p	Common on sandy red earth plains (WM28-A) & sandplains (WM28-B), scattered elsewhere, absent on dunes
Psydrax suaveolens	RUBIACEAE	LC		tr.sh	p	Uncommon on sandy red earth plains (WM28-A), elevated gravel plains (WM28-E)
Ptilotus obovatus	AMARANTHACEAE	LC		sh.fo	p	Uncommon on sandy red earth plains (WM28-A), sandstone breakaways (WM28-D) and sandplains (WM28-B)
Rhyncharrhena linearis	APOCYNACEAE	LC		vn	p	Rare on sandy red earth plains (WM28-A)
Scaevola glabrata	GOODENIACEAE	LC		sh.fo	p	Rare on sandstone breakaways (WM28-D)
Sclerolaena johnsonii	AMARANTHACEAE	LC		sh.fo	a.p	Scattered on dunes (WM28-G)
Senna artemisioides subsp. artemisioides	FABACEAE	LC		sh	p	Common on sandy red earth plains (WM28-A) & sandplains (MW28-B), scattered elsewhere
Senna artemisioides subsp. filifolia	FABACEAE	LC		sh	p	Rare on spinifex sandplains (WM28-B)
Senna artemisioides subsp. petiolaris	FABACEAE	LC		sh	p	Common on spinifex sandplains (WM28-B)
Seringia sp. (formerly *Keraudrenia sp.)*	MALVACEAE			sh	p	Rare on spinifex sandplains (WM28-B)
Sida sp. Excedentifolia	MALVACEAE	NE		sh.fo	p.r	Common on sandstone breakaways (WM28-D)
Solanum coactiliferum	SOLANACEAE	LC		sh	p	Rare on spinifex sandplains (WM28-B)
Solanum orbiculatum subsp. orbiculatum	SOLANACEAE	LC		sh	p	Uncommon in mulga groves (WM28-C), on sandy red earth plains (WM28-A), elevated gravel plains (WM28-E)
Solanum quadriloculatum	SOLANACEAE	LC		sh	p	Uncommon on elevated gravel plains (WM28-E)

WM28	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Teucrium teucriiflora	LAMIACEAE	LC		sh.fo	p	Scattered in mulga groves (WM28-C), uncommon on sandy red earth plains (WM28-A) & sandstone breakaways (WM28-D)
Thyridolepis mitchelliana	POACEAE	LC		gr	a.p	Uncommon on elevated gravel plains (WM28-E), mulga groves (WM28-C) & sandstone (WM28-D)
Triodia melvillei	POACEAE	LC		gr	p	Dominant on sandstone breakaways (WM28-D), uncommon on elevated gravel plains (WM28-E)
Triodia schinzii	POACEAE	LC		gr	p	Dominant on sandplains (WM28-B) & dunes (WM28-G) but extending to other habitats
Tripogon loliiformis	POACEAE	LC		gr	a	Uncommon on elevated gravel plains (WM28-E) & sandstone breakaways (WM28-C)

MAMLAMBO 1	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Abutilon otocarpum	MALVACEAE	LC		sh.fo	a	Rarely observed on recently burnt sandplains (M1-A)
Acacia abrupta	FABACEAE	LC		sh	p	Common in patches on spinifex sandplains (M1-A)
Acacia adsurgens	FABACEAE	LC		tr.sh	p	Uncommon within sandplains (M1-A)
Acacia ayersiana	FABACEAE	LC		tr	p	Common within Ironwood sandy red earth (M1-B)
Acacia estrophiolata	FABACEAE	LC		tr	p	Common within Ironwood sandy red earth (M1-B)
Acacia inaequilatera	FABACEAE	LC		tr	p	Observed in low numbers along E-W access track
Acacia incurvaneura	FABACEAE	DD		tr.sh	p	Rare on sandplains (M1-A)
Acacia kempeana	FABACEAE	LC		tr.sh	p	Co-dominant on calcrete rises (M1-E), uncommon on sandplain (M1-A)
Acacia ligulata	FABACEAE	LC		tr.sh	p	Common in unburnt areas; likely common in burnt areas but unable to ID
Acacia maitlandii	FABACEAE	LC		sh	p	Rare on sandplains (M1-A)
Acacia melleodora	FABACEAE	LC		sh	p	Common on sandplains (M1-A) and dunes (M1-C)
Acacia pruinocarpa	FABACEAE	LC		tr.sh	p	Uncommon on sandy red earth (M1-B)
Acacia sericophylla	FABACEAE	LC		tr.sh	p	Uncommon on sandplains (M1-A)
Acacia sp. mulga group	FABACEAE	LC		tr.sh	p	Locally common on some calcrete rises (M1-E), possibly Acacia aneura
Acacia tetragonophylla	FABACEAE	LC		tr.sh	p	Rare with ironwood (M1-B)
Allocasuarina decaisneana	CASUARINACEAE	LC		tr	p	One stand of mature trees (M1-D), rare on sandplain (M1-A)
Alyogyne pinoniana	MALVACEAE	LC		sh	p.r	Rare on sandplain (M1-A)
Androcalva loxophylla	MALVACEAE	LC		sh	p	Rare on calcrete rises (M1-E)
Anthobolus leptomerioides	SANTALACEAE	LC		sh.pr	p	Common with ironwood on sandy red earth (M1-B), rare on sandplain (M1-A)
Aristida holathera	POACEAE	LC		gr	a.p	Rare on sandplains (M1-A); occasional on dunes (M1-C) and on calcrete rises (M1-E)
Aristida inaequiglumis	POACEAE	LC		gr	p	Rarely on sandplains (M1-A)
Atalaya hemiglauca	SAPINDACEAE	LC		tr	p	Rare with ironwood sandy red earth (M1-B)
Boerhavia coccinea	NYCTAGINACEAE	LC		fo	a.p	Only observed in low numbers along E-W access track from Sunrise turnoff (M1-A)
Bonamia erecta	CONVOLVULACEAE	LC		sh.fo	p	Rare on burnt sandplains (M1-A)
Calytrix carinata	MYRTACEAE	LC		sh	p	Confined to a single patch of a few plants on dune (M1-C)
Chrysocephalum eremaeum	ASTERACEAE	LC		sh.fo	p	Uncommon on dunes (M1-C)
Cleome viscosa	CLEOMACEAE	LC		fo	a	Uncommon on recently burnt sandplains (M1-A)

MAMLAMBO 1	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Corchorus sidoides	MALVACEAE	LC		fo	a	Rare on calcrete rises (M1-E)
Corymbia opaca	MYRTACEAE	LC		tr	p	Rare on spinifex sandplains (M1-A)
Crotalaria cunninghamii subsp. sturtii	FABACEAE	LC		fo	p	Scattered to common on dunes (M1-C); mostly observed in recently burnt areas
Digitaria brownii	POACEAE	LC		gr	p	Rare with ironwood on sandy red earth (M1-B), spinifex sandplains (M1-B)
Dodonaea viscosa subsp. angustissima	SAPINDACEAE	LC		sh	p	Uncommon to scattered, associated with dunes (M1-C)
Einadia nutans subsp. eremaea	AMARANTHACEAE	LC		sh.fo	p	Rarely observed with ironwood on sandy red earth (M1-B)
Enchylaena tomentosa	AMARANTHACEAE	LC		sh.fo	p	Uncommon on sandplains (M1-A), with ironwood on sandy red earth (M1-B)
Eragrostis eriopoda	POACEAE	LC		gr	p	Rarely observed in areas of calcareous earth (M1-E)
Eragrostis eriopoda subsp. Sandy fireweed	POACEAE	LC		gr	p	Uncommon on sandplains (M1-A)
Eragrostis eriopoda/laniflora	POACEAE	LC		gr	p	Rare on sandplains (M1A); relatively common in association with ironwood (M1-B); can't ID from sterile material
Eragrostis sp. Limestone	POACEAE	LC		gr	p	Rarely observed on calcareous earth (M1-F)
Eremophea spinosa	AMARANTHACEAE	LC		sh	p	Rarely observed on calcareous earth (M1-F)
Eremophila glabra subsp. glabra	SCROPHULARIACEAE	LC		sh	p	Uncommon, scattered across drill area on sandplains and sandy red earth (M1-A, M1-B)
Eremophila latrobei subsp. glabra	SCROPHULARIACEAE	LC		sh	p	Rare on sandplain (M1-A)
Eremophila latrobei subsp. latrobei	SCROPHULARIACEAE	LC		sh	p	Uncommon on sandplains (M1-A), more common on sandy red earth (M1-B)
Eremophila longifolia	SCROPHULARIACEAE	LC		sh	p	Uncommon, scattered across area
Eremophila platythamnos subsp. exotrachys	SCROPHULARIACEAE			sh	p	Rare, mostly associated with desert oak patch (M1-B)
Eremophila sturtii	SCROPHULARIACEAE	LC		sh	p	Scattered on calcareous earth (M1-F)
Eriachne aristidea	POACEAE	LC		gr	a.p	Common on burnt dunes (M1-C)
Eriachne helmsii	POACEAE	LC		gr	a.p	Only seen on dune slope (M1-C)
Eucalyptus gamophylla	MYRTACEAE	LC		sh	p	Dominant on sandplains (M1-A); also present on dunes (M1-C); rare on sandy red earth (M1-B)
Eucalyptus socialis subsp. eucentrica	MYRTACEAE	LC		tr.sh	p	Confined to several individuals in the far east of area (M1-A)
Euphobia australis	EUPHORBIACEAE	LC		fo	a.p	Observed along E-W access from Sunrise 1; only observed in burnt areas
Euphorbia tannensis subsp. eremophila	EUPHORBIACEAE	LC		sh.fo	p	Rare on recently burnt sandplains (M1-A)
Evolvulus alsinoides var. alsinoides	CONVOLVULACEAE	NE		fo	r	Observed along E-W access from Sunrise 1; only observed in burnt areas
Grevillea eriostachya	PROTEACEAE	LC		sh	p.r	Rare on sandplains (M1-A)

MAMLAMBO 1	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
Grevillea stenobotrya	PROTEACEAE	LC		sh	p	Scattered to common on dunes (M1-C)
Hakea divaricata	PROTEACEAE	LC		tr.sh	p	Rarely observed on sandplain (M1-A) small individuals only
Halgania erecta	BORAGINACEAE	LC		sh.fo	p	Rare, one patch of plants on sandplain (M1-A) near desert oak patch
Heliotropium glanduliferum	BORAGINACEAE	LC		sh.fo	p	Uncommon on calcrete rises (M1-E)
Hibiscus burtonii	MALVACEAE	LC		sh	a	Observed along E-W access from Sunrise 1; only observed in burnt areas
Indigofera georgei	FABACEAE	LC		sh.fo	r	Rare on calcrete rise (M1-E)
Leptosema chambersii	FABACEAE	LC		sh.fo	p	Rare on sandplain (M1-A); only seen on vehicle track through site
Paractaenum refractum	POACEAE	LC		gr	a	Common on burnt dunes (M1-C)
Paraneurachne muelleri	POACEAE	LC		gr	p	Rare on sandplains (M1-A)
Paspalidium basicladum	POACEAE	LC		gr		Rare on sandplains (M1-A)
Paspalidium reflexum	POACEAE	LC		gr		Common to co-dominant after fire on sandplains (M1-A)
Portulaca oleracea	PORTULACACEAE	LC		fo	a	Rare with ironwood on sandy red earth (M1-B)
Psydrax ammophila	RUBIACEAE	LC		tr.sh	p	Uncommon on sandplains (M1-A), more common in association with ironwood on sandy red earth (M1-B)
Ptilotus obovatus	AMARANTHACEAE	LC		sh.fo	p	Scattered to common on sandplains (M1-A) and calcareous earths (M1-F)
Ptilotus sessilifolius	AMARANTHACEAE	LC		sh.fo	r	Uncommon on sandplain (M1-A); scattered on calcrete rises (M1-E) and calcareous earth (M1-F)
Rhagodia eremaea	AMARANTHACEAE	LC		sh	p	Uncommon on sandplains (M1-A), more common in association with ironwood on sandy red earth (M1-B)
Rhyncharrhena linearis	APOCYNACEAE	LC		vn	p	Only seen in desert oak patch (M1-D)
Scaevola ambylanthera	GOODENIACEAE	LC		sh.fo	p	Rare on calcrete rises (M1-E)
Scaevola parvifolia subsp. parvifolia	GOODENIACEAE	LC		sh.fo	p	Rare on spinifex sandplains (M1-A)
Scaevola spinescens	GOODENIACEAE	LC		sh	p	Locally common in western part of drill area on spinifex sandplain (M1-A)
Sclerolaena cornishiana	AMARANTHACEAE	LC		fo	a.p	Rare on spinifex sandplains (M1-A)
Sclerolaena diacantha	AMARANTHACEAE	LC		fo	p	Uncommon on calcareous earth (M1-F)
Sclerolaena johnsonii	AMARANTHACEAE	LC		sh.fo	a.p	Rare on spinifex sandplains and dunes (M1-A, C)
Senna artemisioides subsp. artemisioides	FABACEAE	LC		sh	p	Rare on spinifex sandplains (M1-A)
Senna artemisioides subsp. helmsii	FABACEAE	LC		sh	p	Uncommon on calcareous earth (M1-F)
Senna artemisioides subsp. oligophylla	FABACEAE	LC		sh	p	Rare on calcrete rises (M1-E)
Senna artemisioides subsp. petiolaris	FABACEAE	LC		sh	p	Common on sandy red earth (M1-B), calcareous rises (M1-E) and calcareous

MAMLAMBO 1	FLORA SPECIES LIST					
Scientific name	**Family**	**TPWC**	**EPBC**	**Growth form**	**Perennial / annual**	**Survey area notes**
						earths (M1-F), scattered on sandplains (M1-A)
Senna pleurocarpa var. pleurocarpa	FABACEAE	LC		sh	p	Uncommon on sandplains (M1-A) and dunes (M1-C)
Seringia sp. (formerly *Keraudrenia sp.*)	MALVACEAE			sh	p	Uncommon on sandplains (M1-A)
Sida ammophila	MALVACEAE	LC		sh.fo	p.r	Uncommon on dunes (M1-C)
Sida sp. limestone	MALVACEAE	LC		sh.fo	p.r	Rare on calcrete rises (M1-E)
Solanum coactiliferum	SOLANACEAE	LC		sh	p	Scattered across the area
Solanum lithophilum	SOLANACEAE	LC		0	0	Rare with ironwood on sandy red earth (M1-B)
Stylobasium spathulatum	SURIANACEAE	LC		sh	p.r	Common on sandy red earth (M1-B), scattered on sandplains (M1-A)
Templetonia egena	FABACEAE	LC		sh	p	Scattered on sandplain (M1-A) and on calcareous earth (M1-F)
Tephrosia sp. deserts	FABACEAE			fo	a.r	Patchily common on calcrete rises (M1-E)
Tribulopis angustifolia	ZYGOPHYLLACEAE	LC		fo	a.r	Uncommon on unburnt sandplains and dunes (M1-A, C), more common where recently burnt
Tribulus eichlerianus	ZYGOPHYLLACEAE	LC		fo	a	Scattered on calcrete rises (M1-E)
Tribulus macrocarpus	ZYGOPHYLLACEAE	LC		fo	a	Uncommon on calcrete rises (M1-E), occasional on dunes (M1-C)
Triodia epactia	POACEAE	LC		gr	p	Dominant on sandplains (M1-A)
Triodia schinzii	POACEAE	LC		gr	p	Associated with dunes (M1-C), rare on sandplains (M1-A)
Triodia sp.	POACEAE			gr	p	Unknown species on calcrete rises (M1-E) due to recent fire
Yakirra australiensis var. australiensis	POACEAE	LC		gr	a.p	Rare to common on burnt sandplains (M1-A)

APPENDIX B DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE – DINGO 1-ST1 & DINGO 5

Table key

[1] EPBC PMST presence assessment based on a 50km search buffer from proposed well site.

[2] Northern Territory Flora and Fauna Atlas records within the applicable bioregion.

[3] Likelihood of occurrence assessment made by reviewing available desktop resources. Species considered to have a High, Medium or Low likelihood will require ground survey to confirm likelihood and inform project risk assessment.

TPWC status key

- **EX** = Extinct species
- **CR** = Critically Endangered species
- **EN** = Near Threatened species
- **VU** = Vulnerable species
- **NT** = Near Threatened species
- **DD** = Data Deficient species
- **LC** = Least Concern species

EPBC status key

- **EX** = Extinct species
- **CR** = Critically Endangered species
- **EN** = Near Threatened species
- **VU** = Vulnerable species
- **-** = no listing

DINGO 1-ST1 & DINGO 5	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Finke			**SUB-BIOREGION:** Henbury				**LAND SYSTEM:** Simpson (desert dunefields and sandplains)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence within proposed well site(s)[3]**
Plant	*Acacia latzii*	Tjilpi Wattle	VU	VU	-	4	**NONE** • No local records (closest is 95km to southwest). • Suitable habitat is unlikely to occur within survey area (i.e. minor drainages; on slopes on silcrete-capped mesas; or shale and siltstone low stony hills).
Plant	*Eleocharis papillosa*	Dwarf Desert Spike-rush	VU	VU	May occur	0	**NONE** • Essential habitat (i.e. wetlands) does not occur within or surrounding survey area. • No records within subregion.
Plant	*Eremophila prostrata*	Rainbow Valley Fuchsia Bush	NT	VU	Known to occur	18	**HIGH** • Suitable habitat is likely present within survey area (i.e. sandplains and lower dune slopes with spinifex and a variety of shrubs and trees including Grevillea, Hakea, Acacia, and Desert Oak). • Species has been previously recorded in Simpson land system and there are numerous records within 30km of survey area.
Plant	*Macrozamia macdonnellii*	MacDonnell Ranges Cycad	NT	VU	Likely to occur	0	**NONE** • Essential habitat (i.e. rocky gorges) does not occur within or surrounding survey area. • No records within subregion.
Plant	*Minuria tridens*	Minnie Daisy	VU	VU	Known to occur	0	**NONE** • Essential habitat (i.e. sandstone hills, rises, ridges) does not occur within or surrounding survey area. • No records within subregion.
Plant	*Santalum acuminatum*	Desert Quandong, Native Peach	VU	-	-	5	**MEDIUM** • Suitable habitat may be present within survey area (i.e. dune swales, creeks, sandplains and low sandy rises). • Species has been previously recorded in Simpson land system. The closest known record is 130 km to the west.
Bird	*Amytornis modesta modesta*	Thick-billed Grasswren	EX	VU	May occur	0	**NONE** • Species extinct in the Northern Territory.
Bird	*Calidris ferruginea*	Curlew Sandpiper	VU	CR	Likely to occur	4	**NONE** • Essential habitat does not occur within survey area (i.e. lakes, wetlands)

DINGO 1-ST1 & DINGO 5	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Finke			**SUB-BIOREGION:** Henbury				**LAND SYSTEM:** Simpson (desert dunefields and sandplains)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence within proposed well site(s)[3]**
Bird	*Erythrotriorchis radiatus*	Red Goshawk	VU	VU	May occur	0	**NONE** • No records within the Finke subregion; and no confirmed recent records in the larger region. • Required habitat does not occur (i.e. tall open eucalypt forest; riparian).
Bird	*Falco hypoleucos*	Grey Falcon	VU	-	-	22	**LOW** • Scattered records in the region; however the majority occur near ranges and main waterways. • The survey areas are only expected to provide opportunistic hunting / foraging / transiting habitat; as nest sites typically occur in large trees associated with major waterways which are not present.
Bird	*Limosa lapponica*	Bar-tailed Godwit	VU	-	-	6	**NONE** • Essential habitat does not occur within survey area (i.e. lakes, wetlands).
Bird	*Pezoporus occidentalis*	Night Parrot	CR	EN	May occur	0	**NONE** • No records within the Finke subregion; and no confirmed recent records in the larger region. • Additionally, suitable habitat is unlikely to occur within survey area (i.e. mature spinifex grassland).
Bird	*Polytelis alexandrae*	Princess Parrot	VU	VU	Known to occur	3	**LOW** • Suitable habitat may be present within proposed well sites (i.e. dune swales); however, the region is not known to support the species; or known to support suitable breeding habitat. • Very low number of records in subregion. • Occurrence of the species is likely opportunistic, and would only occur during good seasons (i.e. associated with high rainfall).
Bird	*Rostratula australis*	Australian Painted-snipe	VU	EN	May occur	1	**NONE** • Essential habitat does not occur within survey area (i.e. lakes, wetlands).
Reptile	*Liopholis slateri*	Slater's Skink	VU	EN	May occur	78	**MEDIUM** • NT records from bioregion are mostly historic (pre-1970). • Species has been recorded in Simpson land system • Preferred habitat may occur (i.e. alluvial areas; variety of landforms)
Mammal	*Isoodon auratus*	Golden Bandicoot	EN	VU	-	3	**NONE** • Species extinct on mainland the Northern Territory.

DINGO 1-ST1 & DINGO 5	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Finke		**SUB-BIOREGION:** Henbury				**LAND SYSTEM:** Simpson (desert dunefields and sandplains)	
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence within proposed well site(s)[3]**
Mammal	*Macrotis lagotis*	Greater Bilby	VU	VU	-	2	**LOW** • Not currently known to occur in the Finke bioregion (i.e. NT Atlas records are old or have no date of record). • Species is known to occur in the Simpson land system; however, records are generally confined to the Tanami Desert / Great Sandy Desert areas over 200 km to the west.
Mammal	*Notoryctes typhlops*	Itjaritjari, Southern Marsupial Mole	VU	-	-	6	**LOW** • Suitable habitat is present (i.e. dunes and sandplains) • Species is known to occur in the Simpson land system; however, there are no recent records of the species within 100 km of the site.
Mammal	*Petrogale lateralis*	Black-footed Rock-wallaby	NT	VU	Known to occur	3	**NONE** • Required habitat does not occur (i.e. rocky ranges).
Mammal	*Pseudomys australis*	Plains Mouse	EN	VU	-	1	**NONE** • Required habitat does not occur (i.e. gibber plains, cracking clay soil associated with minor drainage features).
Mammal	*Rattus tunneyi*	Pale Field-rat	VU	-	-	1	**NONE** • Now restricted to higher rainfall areas in Northern Australia.
Mammal	*Trichosurus vulpecula vulpecula*	Common Brushtail Possum (central)	EN	-	-	1	**NONE** • Required habitat does not occur (i.e. riverine habitat that is close to rocky outcrops and moist gullies within the ranges or rocky slopes).
Mammal	*Zyzomys pedunculatus*	Central Rock-rat	EN	CR	May occur	1	**NONE** • Required habitat does not occur (i.e. rocky ranges).
Fish	*Chlamydogobius japalpa*	Finke Goby	VU	-	-	5	**NONE** • Required habitat does not occur (i.e. waterway).
Invertebrate	*Semotrachia euzyga*	a land snail	EN	EN	-	1	**NONE** • Required habitat does not occur (i.e. rocky ranges under fig trees); species has a highly restricted population.
Invertebrate	*Sinumelon bednalli*	Bednall's Land Snail	NT	CR	May occur	6	**NONE** • Required habitat does not occur (i.e. rocky ranges under fig trees); species has a highly restricted population.

APPENDIX C DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE – ORANGE 3

Table key

[1] EPBC PMST presence assessment based on a 50km search buffer from proposed well site.

[2] Northern Territory Flora and Fauna records within the applicable bioregion.

[3] Likelihood of occurrence assessment made by reviewing available desktop resources. Species considered to have a High, Medium or Low will require ground survey to confirm likelihood and inform project risk assessment.

TPWC status key

- **EX** = Extinct species
- **CR** = Critically Endangered species
- **EN** = Near Threatened species
- **VU** = Vulnerable species
- **NT** = Near Threatened species
- **DD** = Data Deficient species
- **LC** = Least Concern species

EPBC status key

- **EX** = Extinct species
- **CR** = Critically Endangered species
- **EN** = Near Threatened species
- **VU** = Vulnerable species
- **-** = no listing

ORANGE 3	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Finke		**SUB-BIOREGION:** Henbury			**LAND SYSTEM:** Ewaninga (desert sandplains)		
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Plant	*Acacia latzii*	Tjilpi Wattle, Latz's Wattle	VU	VU	-	4	**LOW** • Species has not been previously recorded in Ewaninga land system. • 95 km to closest record.
Plant	*Actinotus schwarzii*	Desert Flannel-flower	VU	VU	Likely to occur	0	**NONE** • Required habitat (i.e. rocky gorges) does not occur. • Species not known from subregion.
Plant	*Eleocharis papillosa*	Dwarf Desert Spike-rush	VU	VU	Known to occur	0	**NONE** • Required habitat (i.e. wetlands) does not occur. • Species not known from subregion.
Plant	*Eremophila prostrata*	Rainbow Valley Fuchsia Bush	NT	VU	Known to occur	18	**MEDIUM** • Species has been previously recorded in Ewaninga land system. • Species has been recorded within 30 km of survey area.
Plant	*Macrozamia macdonnellii*	MacDonnell Ranges Cycad	NT	VU	Likely to occur	0	**NONE** • Required habitat (i.e. rocky gorges) does not occur. • Species not known from subregion.
Plant	*Minuria tridens*	Minnie Daisy	VU	VU	Known to occur	0	**NONE** • Required habitat (i.e. sandstone hills, rises, ridges) does not occur. • Species not known from subregion.
Plant	*Olearia macdonnellensis*	Olearia	EN	VU	Likely to occur	0	**NONE** • Required habitat (i.e. ranges and ridges) does not occur. • Species not known from subregion.
Plant	*Ricinocarpos gloria-medii*	Glory-of-the-Centre	NT	VU	Known to occur	0	**NONE** • Required habitat (i.e. deep rocky gullies) does not occur. • Species not known from subregion.
Plant	*Santalum acuminatum*	Desert Quandong, Native Peach	VU	-	-	5	**NONE** • Species has not been previously recorded in Ewaninga land system. • Over 100 km to closest record.
Bird	*Amytornis modesta*	Thick-billed Grasswren	EX	VU	May occur	0	**NONE** • Species extinct in the Northern Territory.

ORANGE 3	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Finke		**SUB-BIOREGION:** Henbury			**LAND SYSTEM:** Ewaninga (desert sandplains)		
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Bird	*Calidris ferruginea*	Curlew Sandpiper	VU	CR	Known to occur	4	**NONE** • Required habitat (i.e. wetlands) does not occur.
Bird	*Erythrotriorchis radiatus*	Red Goshawk	VU	VU	May occur	0	**NONE** • No records within the Finke subregion; and no confirmed recent records in the larger region. • Required habitat (i.e. tall open eucalypt forest and riparian areas) does not occur.
Bird	*Falco hypoleucos*	Grey Falcon	VU	-	-	22	**LOW** • There are numerous records in the region; however the majority occur near ranges and main waterways. • The survey area is only expected to provide marginal foraging habitat; as nest sites typically occur in large trees associated with major waterways.
Bird	*Limosa lapponica*	Bar-tailed Godwit	VU	-	May occur	6	**NONE** • Required habitat (i.e. wetlands) does not occur.
Bird	*Pezoporus occidentalis*	Night Parrot	CR	EN	May occur	0	**NONE** • No records within the Finke subregion; and no confirmed recent records in the larger region. • Marginal habitat may occur within survey area (i.e. spinifex) grassland but it is not considered to be high quality due to long-term grazing impacts.
Bird	*Polytelis alexandrae*	Princess Parrot	VU	VU	Known to occur	3	**NONE** • Very low number of records in area • Local area not known to support the species. • Suitable habitat does not occur (i.e. dune swales).
Bird	*Rostratula australis*	Australian Painted-snipe	VU	EN	May occur	1	**NONE** • Required habitat (i.e. wetlands) does not occur.
Reptile	*Liopholis slateri*	Slater's Skink	VU	EN	Known to occur	78	**MEDIUM** • NT records from bioregion are mostly historic (pre-1970). • Species has not been recorded in Ewaninga land system • Preferred habitat may occur (i.e. alluvial areas; drainages)
Mammal	*Isoodon auratus*	Golden Bandicoot	EN	VU	-	3	**NONE** • Species extinct on mainland the Northern Territory.

ORANGE 3	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Finke			**SUB-BIOREGION:** Henbury				**LAND SYSTEM:** Ewaninga (desert sandplains)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Mammal	*Trichosurus vulpecula vulpecula*	Common Brushtail Possum (central)	EN	-	-	1	**NONE** • Required habitat does not occur (i.e. riverine habitat that is close to rocky outcrops and moist gullies within the ranges or rocky slopes); species has a highly restricted population.
Mammal	*Zyzomys pedunculatus*	Central Rock-rat	EN	CR	Known to occur	1	**NONE** • Required habitat does not occur (i.e. rocky ranges).
Mammal	*Pseudomys australis*	Plains Mouse	EN	VU	-	1	**NONE** • Required habitat does not occur (i.e. gibber plains, cracking clay soil associated with minor drainage features).
Mammal	*Petrogale lateralis*	Black-footed Rock-wallaby	NT	VU	Known to occur	3	**NONE** • Required habitat does not occur (i.e. rocky ranges).
Mammal	*Rattus tunneyi*	Pale Field-rat	VU	-	-	1	**NONE** • Now restricted to higher rainfall areas in Northern Australia.
Mammal	*Macrotis lagotis*	Greater Bilby	VU	VU	-	2	**NONE** • Not currently known to occur in the Finke bioregion (i.e. NT Atlas records are old or have no date of record). • Habitat quality is likely to be low; species has not been previously recorded in Ewaninga land system.
Mammal	*Notoryctes typhlops*	Itjaritjari, Southern Marsupial Mole	VU	-	-	6	**NONE** • Habitat quality is likely to be low (shallow rock substrate and species requires dunes / deep sandplains); species has not been previously recorded in Ewaninga land system.
Fish	*Chlamydogobius japalpa*	Finke Goby	VU	-	-	5	**NONE** • Required habitat does not occur (i.e. waterway).
Invertebrate	*Semotrachia euzyga*	a land snail	EN	EN	Likely to occur	1	**NONE** • Required habitat (i.e. rocky ranges under fig trees) does not occur; species has a highly restricted population.
Invertebrate	*Sinumelon bednalli*	Bednall's Land Snail	NT	CR	Likely to occur	6	**NONE** • Required habitat (i.e. rocky ranges under fig trees) does not occur; species has a highly restricted population.

APPENDIX D DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE – PV12

Table key

[1] EPBC PMST presence assessment based on a 50km search buffer from proposed well site.

[2] Northern Territory Flora and Fauna Atlas records within the applicable bioregion.

[3] Likelihood of occurrence assessment made by reviewing available desktop resources. Species considered to have a High, Medium or Low will require ground survey to confirm likelihood and inform project risk assessment.

TPWC status key

- **EX** = Extinct species
- **CR** = Critically Endangered species
- **EN** = Near Threatened species
- **VU** = Vulnerable species
- **NT** = Near Threatened species
- **DD** = Data Deficient species
- **LC** = Least Concern species

EPBC status key

- **EX** = Extinct species
- **CR** = Critically Endangered species
- **EN** = Near Threatened species
- **VU** = Vulnerable species
- **-** = no listing

PV12	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: MacDonnell Ranges			**SUB-BIOREGION:** Watarrka				**LAND SYSTEM:** Krichauff (sandstone hills)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Plant	*Acacia latzii*	Tjilpi Wattle, Latz's Wattle	VU	VU	Likely to occur	0	**NONE** • No records within sub-bioregion or Krichauff land system • Suitable habitat does not occur (i.e. minor drainages and on slopes on silcrete-capped mesas or shale and siltstone low stony hills).
Plant	*Actinotus schwarzii*	Desert Flannel-flower	VU	VU	Likely to occur	0	**NONE** • No records within sub-bioregion or Krichauff land system. • All records occur within the West MacDonnell Ranges to the north. • Suitable habitat is unlikely to occur based on review of aerial imagery and previous survey (i.e. sheltered gorges & steep south-facing slopes)
Plant	*Amperea spicata*	George Gill Range Cliff-bush	VU	-	-	9	**NONE** • Species appears to be restricted to catchments of Stokes and Kathlene Creeks in Watarrka National Park.
Plant	*Baumea arthrophylla*	Baumea	EN	-	-	3	**NONE** • Only known from one location in the NT in Watarrka National Park approximately 50 km to the west. • Suitable habitat is unlikely present (i.e. seepage area in sandstone gorge).
Plant	*Bolboschoenus caldwellii*	Bolboschoenus	EN	-	-	5	**NONE** • Suitable habitat is unlikely present (i.e. damp soils adjacent to permanent or semi-permanent water). • Not known to occur on ridgetops or plateau
Plant	*Eremophila prostrata*	Rainbow Valley Fuchsia Bush	NT	VU	-	10	**NONE** • No suitable habitat (i.e. requires sandplains and lower dune slopes); nor are there any local records.
Plant	*Livistona mariae subsp. mariae*	Red Cabbage Palm	EN	EN	Known to occur	22	**NONE** • No suitable habitat present (i.e. gorge floors with permanent water). • There are numerous proximate records (5km to the south).
Plant	*Macrozamia macdonnellii*	MacDonnell Ranges Cycad	NT	VU	Known to occur	25	**LOW** • Suitable habitat is present (i.e. gorges and on steep sheltered slopes, occasionally on exposed hills or mountain tops); however there are no known records of the species within the Palm Valley Gas Field lease area despite numerous environmental surveys within the site.

PV12	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: MacDonnell Ranges			**SUB-BIOREGION:** Watarrka			**LAND SYSTEM:** Krichauff (sandstone hills)	
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Plant	*Minuria tridens*	Minnie Daisy	VU	VU	Known to occur	22	**LOW** • Species habitat is unlikely to occur (i.e. dolomite, limestone and calcrete impregnated sandstone hills, rises and ranges; typically found on southerly aspects). • There is a proximate record 2.5km to southeast, and several others within 5km; however these records are located in lower terrain where limestone / calcrete typically occurs.
Plant	*Olearia macdonnellensis*	Olearia	EN	VU	Likely to occur	0	**LOW** • Suitable habitat may be present (i.e. rocky ranges). • However, there are no records from PVGF or in the adjacent Finke Gorge National Park.
Plant	*Prostanthera schultzii*	Wrixonia	VU	VU	Likely to occur	0	**NONE** • Not known to occur within sub-bioregion. • Suitable habitat may be present (i.e. shady, upper slopes and tops of quartzite mountains and ranges, particularly on southerly aspects). • Appears to be restricted to West MacDonnell Ranges.
Plant	*Santalum acuminatum*	Desert Quandong, Native Peach	VU	-	-	32	**NONE** • Species habitat does not occur (i.e. dune swales, creeks, sandplains and low sandy rises).
Plant	*Thryptomene hexandra*	Palm Valley Myrtle	NT	VU	Likely to occur	20	**LOW** • Suitable habitat is potentially present (i.e. rocky gullies and steep rocky slopes, generally with a southerly aspect and with a degree of natural fire protection) • Numerous records within Finke Gorge National Park 4km to south; however there are no known occurrences within the Palm Valley Gas Field lease area.
Bird	*Amytornis modestus modestus*	Thick-billed Grasswren (Mac Range)	EX	VU	-	23	**NONE** • Species extinct in the Northern Territory.
Bird	*Calidris ferruginea*	Curlew Sandpiper	VU	CR	May occur	0	**NONE** • Critical habitat does not occur (i.e. wetlands).
Bird	*Erythrotriorchis radiatus*	Red Goshawk	VU	VU	May occur	1	**NONE** • A single record within the subregion; and no confirmed recent records in

PV12	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: MacDonnell Ranges			**SUB-BIOREGION:** Watarrka				**LAND SYSTEM:** Krichauff (sandstone hills)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
							the larger region. • Suitable habitat does not occur (i.e. tall open eucalypt forest; riparian)
Bird	*Falco hypoleucos*	Grey Falcon	VU	-	-	15	**LOW** • Several records in local area, including one record at the PVGF base camp (unknown date). • Species is naturally rare / scarce and is only expected to be an occasional visitor during period of high prey numbers. • Nesting habitat is not present (i.e. tall trees along major waterways).
Bird	*Leipoa ocellata*	Malleefowl	CR	VU	-	2	**NONE** • Species is regionally extinct; and suitable habitat is not present.
Bird	*Melanodryas cucullata melvillensis*	Hooded Robin (Tiwi)	CR	CR	-	2	**NONE** • Miss-identification; species is only known to occur on the Tiwi Islands
Bird	*Pezoporus occidentalis*	Night Parrot	CR	EN	May occur	0	**NONE** • No records within the sub-bioregion; and no confirmed recent records in the larger region. • Species not known to inhabit rocky ranges.
Bird	*Polytelis alexandrae*	Princess Parrot	VU	VU	Known to occur	2	**NONE** • Very low number of records in sub-bioregion. • Local area not known to support the species. • Suitable habitat does not occur (i.e. dune swales).
Bird	*Rostratula australis*	Australian Painted-snipe	VU	EN	May occur	1	**NONE** • Required habitat does not occur (i.e. wetlands).
Reptile	*Liopholis kintorei*	Great Desert Skink	VU	VU	-	5	**NONE** • Species does not inhabit rocky ranges.
Reptile	*Liopholis slateri*	Slater's Skink	VU	EN	Known to occur	88	**HIGH** • Numerous recent records within the PVGF. • At PVGF, the species occurs in alluvial areas on the rocky plateau.
Mammal	*Dasycercus blythi*	Brush-tailed Mulgara	VU	VU	-	7	**NONE** • Species does not inhabit rocky ranges.

PV12	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: MacDonnell Ranges			**SUB-BIOREGION:** Watarrka				**LAND SYSTEM:** Krichauff (sandstone hills)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Mammal	*Dasyurus geoffroii*	Western Quoll	ER	VU	-	3	**NONE** • Species is regionally extinct throughout Central Australia.
Mammal	*Lagorchestes hirsutus*	Mala	EW	CR	-	2	**NONE** • Species is extinct in the wild in the Northern Territory.
Mammal	*Macroderma gigas*	Ghost Bat	NT	VU	-	1	**NONE** • Species is regionally extinct throughout Central Australia.
Mammal	*Macrotis lagotis*	Greater Bilby	VU	VU	-	16	**NONE** • Species does not inhabit rocky ranges.
Mammal	*Notoryctes typhlops*	Itjaritjari, Southern Marsupial Mole	VU	-	-	60	**NONE** • Species does not inhabit rocky ranges.
Mammal	*Petrogale lateralis*	Black-footed Rock-wallaby	NT	VU	Known to occur	655	**MEDIUM** • Numerous records in Finke Gorge National Park to the south of the site; however, there are only scattered records within the PVGF area indicating population is more likely confined to habitat associated with Palm Creek where permanent water is available.
Mammal	*Trichosurus vulpecula vulpecula*	Common Brushtail Possum (central)	EN	-	-	2	**NONE** • Required habitat does not occur (i.e. riverine habitat that is close to rocky outcrops and moist gullies within the ranges or rocky slopes) • Species not known to occur in PVGF or adjacent Finke Gorge NP.
Mammal	*Zyzomys pedunculatus*	Central Rock-rat	EN	CR	Known to occur	0	**NONE** • Species has not been recorded in PVGF or Finke Gorge NP; despite numerous fauna surveys.
Fish	*Chlamydogobius japalpa*	Finke Goby	VU	-	-	24	**NONE** • Required habitat does not occur within site (i.e. waterway). • There are two records in close proximity to survey area; however, it is assumed that this is due to incorrect coordinates as riverine habitat is not present. Record likely from Finke River ~5 km to southeast.
Invertebrate	*Bothriembryon spenceri*	Spencer's Land Snail	VU	-	-	3	**NONE** • Very few records in the region. • Species is typically found in lower relief areas, under fig trees, which is unlikely to occur within the survey area.

PV12	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: MacDonnell Ranges			**SUB-BIOREGION:** Watarrka			**LAND SYSTEM:** Krichauff (sandstone hills)	
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Invertebrate	*Divellomelon hillieri*	a land snail	VU	-	-	28	**LOW** • It is unlikely that suitable habitat is present within survey area (i.e. rock rubble and litter at the bottom of deep vertical rock fissures; and also under fig trees) based on previous flora fauna surveys. • There are two recent NT Atlas records (Mar 2018 & Nov 2019) in close proximity to well site. It is likely that the records have incorrect coordinates and that they are located further south towards Palm Creek and Finke River where the majority of other records occur.
Invertebrate	*Granulomelon (formerly Basedowena) squamulosum*	a land snail	VU	-	-	64	**LOW** • There are numerous records within 10km of well site – all to the south in Finke Gorge National Park. • Suitable habitat is unlikely to occur within survey area (i.e. leaf litter under fig trees in or under rocks); species has not been previously recorded in plateau habitat like that which occurs at project site.
Invertebrate	*Granulomelon arcigerens*	West MacDonnell's Land Snail	VU	-	-	6	**NONE** • Very few records in the region. • Restricted range species with known populations 30km to the north. • Species has not been previously recorded in plateau habitat.
Invertebrate	*Semotrachia elleryi*	Ellery Gorge Land Snail	VU	-	-	34	**NONE** • Unlikely that suitable habitat is present on the plateau based on previous survey results (i.e. specimens have been collected under figs and in talus at a cliff base). • Species has been recorded within 10km of well site, but all records are proximate to Ellery Creek or Finke River.
Invertebrate	*Semotrachia esau*	a land snail	VU	-	-	186	**NONE** • Numerous records within 10km to the south in Finke Gorge NP; including 2 records from 1981 about 3.5km west along the PVGF access road. • Suitable habitat is unlikely to occur within survey area (i.e. under fig trees; has also been found under spinifex). Most occurrences are in lower relief areas with better access to water.
Invertebrate	*Semotrachia euzyga*	a land snail	EN	EN	-	3	**NONE** • Very few records in the region – all located in rocky habitat adjacent to Finke River. • Suitable habitat (i.e. rocky litter under the figs) is unlikely to occur

PV12	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: MacDonnell Ranges			**SUB-BIOREGION:** Watarrka				**LAND SYSTEM:** Krichauff (sandstone hills)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Invertebrate	*Semotrachia illarana*	a land snail	VU	-	-	13	**NONE** • Species has a highly restricted population near Illara Waterhole which is approximately 50 km from well site. • The species is also associated with fig trees, which do not occur at the site (based on previous PVGF survey data from 2015).
Invertebrate	*Sinumelon bednalli*	Bednall's Land Snail	NT	CR	-	8	**NONE** • Required habitat (i.e. rocky ranges under fig trees) does not occur; species has a highly restricted population.
Invertebrate	*Tateropa (formerly Pilomena) aemula*	a land snail	VU	-	-	9	**NONE** • Restricted range species with population 120 km to southwest within Watarrka National Park. Considered too far from population to have potential to occur within survey area. • Unknown population status. Species occurs in moist areas, under fig trees, cycads or scrub – which are unlikely to occur at the site.

APPENDIX E DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE – WM27 & WM28

Table key

[1] EPBC PMST presence assessment based on a 50km search buffer from proposed well site.

[2] Northern Territory Flora and Fauna Atlas records within the applicable bioregion.

[3] Likelihood of occurrence assessment made by reviewing available desktop resources. Species considered to have a High, Medium or Low likelihood will require ground survey to confirm likelihood and inform project risk assessment.

TPWC status key

- **EX** = Extinct species
- **CR** = Critically Endangered species
- **EN** = Near Threatened species
- **VU** = Vulnerable species
- **NT** = Near Threatened species
- **DD** = Data Deficient species
- **LC** = Least Concern species

EPBC status key

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- **CR** = Critically Endangered species
- **EN** = Near Threatened species
- **VU** = Vulnerable species
- **-** = no listing

WM27 & WM28	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Great Sandy Desert			**SUB-BIOREGION:** Mackay				**LAND SYSTEM:** Simpson (desert dunefields and sandplains)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Plant	*Eleocharis papillosa*	Dwarf Desert Spike-rush	VU	VU	-	2	**NONE** • Required habitat (i.e. wetlands) does not occur.
Plant	*Macrozamia macdonnellii*	MacDonnell Ranges Cycad	NT	VU	Known to occur	0	**NONE** • Species is not known to occur in sandplains
Plant	*Santalum acuminatum*	Desert Quandong, Native Peach	VU	-	-	7	**MEDIUM** • Several records in bioregion, including one record by Peter Latz in 2000 2.5km north of WM28. • Potentially suitable habitat is present (i.e. dune swales, creeks, sandplains and low rises – rarely on hills)
Bird	*Calidris ferruginea*	Curlew Sandpiper	VU	CR	May occur	1	**NONE** • Species habitat (i.e. wetlands) does not occur.
Bird	*Calidris tenuirostris*	Great Knot	VU	CR	-	1	**NONE** • Species habitat (i.e. wetlands) does not occur.
Bird	*Erythrotriorchis radiatus*	Red Goshawk	VU	VU	May occur	0	**NONE** • No records within the Mackay subregion; and no confirmed recent records in the larger region. • Required habitat (i.e. tall open eucalypt forest and riparian areas) does not occur. Species distribution is restricted to Northern Australia.
Bird	*Falco hypoleucos*	Grey Falcon	VU	-	-	52	**LOW** • Several records in local area, however, there are none within Mereenie Oil and Gas Field. • Species is naturally rare / scarce and is only expected to be an occasional visitor during period of high prey numbers. • Nesting habitat is not present (tall trees along major waterways).
Bird	*Leipoa ocellata*	Malleefowl	CR	VU	-	7	**NONE** • Species is regionally extinct; historic records within sub-bioregion only.
Bird	*Pezoporus occidentalis*	Night Parrot	CR	EN	May occur	2	**LOW** • Very few recent records of this species in the NT • Potentially suitable habitat is present; however, fire frequency is likely too high for species. If large areas of old growth spinifex are present; DEPWS will be contacted to determine survey effort requirements.

WM27 & WM28	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Great Sandy Desert			**SUB-BIOREGION:** Mackay				**LAND SYSTEM:** Simpson (desert dunefields and sandplains)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Bird	*Polytelis alexandrae*	Princess Parrot	VU	VU	Known to occur	89	**MEDIUM** • Suitable habitat is likely present (i.e. dunes and dune swales); suitable nesting habitat may also be present (i.e. large Desert Oaks; other nesting trees include River red Gum and Marble Gum which are not expected to be present based on aerial imagery). • There are numerous records of the species to the west of survey area.
Bird	*Rostratula australis*	Australian Painted-snipe	VU	EN	May occur	0	**NONE** • Species habitat (i.e. wetlands) does not occur.
Reptile	*Liopholis kintorei*	Great Desert Skink	VU	VU	May occur	81	**MEDIUM** • Suitable habitat (i.e. swales sandplains) is present and there are numerous records in the Mackay sub-bioregion and the Simpson land system. • No existing records at Mereenie Oil and Gas Field (noting paucity of records may be related to survey effort rather than species absence); however, the majority of records are concentrated 150km to south (Yulara / Uluru) and 160km to north (near Nyirripi / Newhaven).
Reptile	*Liopholis slateri*	Slater's Skink	VU	EN	May occur	1	**LOW** • Very few records of species in sub-bioregion. • Suitable habitat is not expected to occur (i.e. alluvial areas, floodplain depositional areas and minor drainages associated with rocky hills).
Mammal	*Dasycercus blythi*	Brush-tailed Mulgara	VU	VU	-	423	**MEDIUM** • Suitable habitat likely occurs (i.e. mature spinifex sandplains, often more prevalent near drainage lines and palaeochannels) • Numerous records within the sub-bioregion, including records within the Simpson land system; however, there are no proximate records as most are concentrated 100km to the north and south (noting paucity of records may be related to survey effort rather than species absence).
Mammal	*Dasycercus cristicauda*	Crest-tailed Mulgara	VU	EN	-	4	**NONE** • NT Atlas records are likely a misidentification; recent taxonomic evidence indicates that mulgara in this region are *D. blythi.*
Mammal	*Isoodon auratus*	Golden Bandicoot	EN	VU	-	16	**NONE** • Species extinct on mainland the Northern Territory.
Mammal	*Lagorchestes hirsutus*	Mala	EW	CR	Likely to occur	12	**NONE** • Species is extinct in the wild in the Northern Territory.

WM27 & WM28	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Great Sandy Desert			**SUB-BIOREGION:** Mackay				**LAND SYSTEM:** Simpson (desert dunefields and sandplains)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Mammal	*Macroderma gigas*	Ghost Bat	NT	VU	-	5	**NONE** • Species is regionally extinct throughout Central Australia.
Mammal	*Macrotis lagotis*	Greater Bilby	VU	VU	-	213	**MEDIUM** • Suitable habitat potentially occurs within survey area. • Numerous records within the sub-bioregion, including records within the Simpson land system. However, there is only one proximate record 15km northwest of WM27 (unknown date). Most records are concentrated over 100km to the north and northwest in the Tanami and Great Sandy Deserts (noting record paucity may be related to survey effort rather than absence).
Mammal	*Notoryctes typhlops*	Itjaritjari, Southern Marsupial Mole	VU	-	-	92	**MEDIUM** • Suitable habitat potentially occurs within survey area (i.e. sand dunes and sandplains). Most likely to occur in dunes, but may occur in swales. • No existing records at Mereenie Oil and Gas Field noting paucity of records may be related to survey effort rather than species absence), but there are numerous records in dune country (near Watarrka NP) 35km to the south.
Mammal	*Petrogale lateralis*	Black-footed Rock-wallaby	NT	VU	Known to occur	62	**NONE** • Species habitat (rocky ranges) does not occur.
Mammal	*Rattus tunneyi*	Pale Field-rat	VU	-	-	1	**NONE** • Species distribution is now restricted to northern Australia.
Mammal	*Sminthopsis longicaudata*	Long-tailed Dunnart	VU	-		2	**NONE** • Species habitat (rocky ranges) does not occur.
Mammal	*Trichosurus vulpecula vulpecula*	Common Brushtail Possum (central)	EN	-	-	34	**NONE** • Species habitat (rocky ranges) does not occur.
Mammal	*Zyzomys pedunculatus*	Central Rock-rat	EN	CR	Likely to occur	3	**NONE** • Species habitat (rocky ranges) does not occur.
Invertebrate	*Granulomelon squamulosum*	a land snail	VU	-	-	1	**NONE** • Only one record in subregion 160km northeast; not in Simpson land system. • Suitable habitat is unlikely to occur (i.e. leaf litter under fig; under rocks).
Invertebrate	*Semotrachia euzyga*	a land snail	EN	EN	-	2	**NONE** • Required habitat (i.e. rocky ranges under fig trees) does not occur.

APPENDIX F DESKTOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE – MAMLAMBO

Table key

[1] EPBC PMST presence assessment based on a 50km search buffer from proposed well site.

[2] Northern Territory Flora and Fauna Atlas records within the applicable bioregion.

[3] Likelihood of occurrence assessment made by reviewing available desktop resources. Species considered to have a High, Medium or Low likelihood will require ground survey to confirm likelihood and inform project risk assessment.

TPWC status key

- **EX** = Extinct species
- **CR** = Critically Endangered species
- **EN** = Near Threatened species
- **VU** = Vulnerable species
- **NT** = Near Threatened species
- **DD** = Data Deficient species
- **LC** = Least Concern species

EPBC status key

- **EX** = Extinct species
- **CR** = Critically Endangered species
- **EN** = Near Threatened species
- **VU** = Vulnerable species
- **-** = no listing

MAMLAMBO	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Great Sandy Desert			**SUB-BIOREGION:** Mackay				**LAND SYSTEM:** Simpson (desert dunefields and sandplains)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Plant	*Eleocharis papillosa*	Dwarf Desert Spike-rush	VU	VU	-	2	**NONE** • Required habitat (i.e. wetlands) does not occur.
Plant	*Santalum acuminatum*	Desert Quandong, Native Peach	VU	-	-	7	**MEDIUM** • Suitable habitat is likely present (i.e. dune swales, creeks, sandplains and low rises – rarely on hills) • No records within 100km of project site (noting paucity of records may be related to survey effort rather than species absence).
Bird	*Calidris ferruginea*	Curlew Sandpiper	VU	CR	-	1	**NONE** • Required habitat (i.e. wetlands) does not occur.
Bird	*Calidris tenuirostris*	Great Knot	VU	CR	-	1	**NONE** • Required habitat (i.e. wetlands) does not occur.
Bird	*Falco hypoleucos*	Grey Falcon	VU	-	-	52	**LOW** • Several records in local area. • Species is naturally rare / scarce and is only expected to be an occasional visitor for hunting / foraging / transiting purposes. • Preferred nesting habitat (i.e. tall trees along major waterways) is not likely present, based on review of aerial imagery.
Bird	*Leipoa ocellata*	Malleefowl	CR	VU	-	7	**NONE** • Species is regionally extinct; historic records of species within sub-bioregion only.
Bird	*Pezoporus occidentalis*	Night Parrot	CR	EN	May occur	2	**LOW** • Very few recent records of this species in the NT • Potentially suitable habitat is present; NAFI fire scar mapping indicates low fire frequency in area which may mean it supports old growth spinifex.
Bird	*Polytelis alexandrae*	Princess Parrot	VU	VU	Likely to occur	89	**MEDIUM** • No records within 50km; however there are numerous records in the Simpson land system within 100km of the project site. • Suitable habitat is potentially present (i.e. dunes and dune swales). • Suitable nesting habitat may also be present (i.e. large Desert Oaks; other nesting trees include River Red Gum and Marble Gum which are not expected to be present).

MAMLAMBO	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Great Sandy Desert			**SUB-BIOREGION:** Mackay				**LAND SYSTEM:** Simpson (desert dunefields and sandplains)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Reptile	*Liopholis kintorei*	Great Desert Skink	VU	VU	May occur	81	**MEDIUM** • Suitable habitat (i.e. swales / sandplains) is likely present. • Numerous records in the Mackay subregion and the Simpson land system • No existing records within 70km (noting paucity of records may be related to survey effort rather than species absence); with the majority of records are concentrated 180km to southeast (Yulara / Uluru) and 130km to north (near Nyirripi / Newhaven).
Reptile	*Liopholis slateri*	Slater's Skink	VU	EN	-	1	**NONE** • Survey area is very distant from nearest known occurrence. • Potentially suitable habitat is not expected in vast desert sandplains.
Mammal	*Dasycercus blythi*	Brush-tailed Mulgara	VU	VU	-	423	**HIGH** • Suitable habitat likely occurs (i.e. mature spinifex sandplains, often more prevalent near drainage lines and palaeochannels) • Numerous records 60k m to the north (noting that paucity of records may be related to survey effort rather than species absence). • NAFI fire scar mapping indicates low fire frequency in area which may mean it supports old growth spinifex that is preferred by this species.
Mammal	*Dasycercus cristicauda*	Crest-tailed Mulgara	VU	EN	-	4	**NONE** NT Atlas records are likely a misidentification; recent taxonomic evidence indicates that mulgara in this region are *D. blythi.*
Mammal	*Isoodon auratus*	Golden Bandicoot	EN	VU	-	16	**NONE** Species extinct on mainland the Northern Territory; now only known to occur on islands on the Top End.
Mammal	*Lagorchestes hirsutus*	Mala	EW	CR	Likely to occur	12	**NONE** • Species is extinct in the wild in the Northern Territory.
Mammal	*Macroderma gigas*	Ghost Bat	NT	VU	-	5	**NONE** • Species is regionally extinct throughout Central Australia.
Mammal	*Macrotis lagotis*	Greater Bilby	VU	VU	May occur	213	**HIGH** • Suitable habitat potentially occurs. • Numerous records 60km to the north, including records within the Simpson land system (noting that paucity of records may be related to survey effort rather than species absence).

MAMLAMBO	DESKOP THREATENED SPECIES LIKELIHOOD OF OCCURRENCE ASSESSMENT						
BIOREGION: Great Sandy Desert			**SUB-BIOREGION:** Mackay				**LAND SYSTEM:** Simpson (desert dunefields and sandplains)
Class	**Scientific name**	**Common name**	**TPWC Act**	**EPBC Act**	**EPBC PMST Presence[1]**	**NT Atlas records[2]**	**Likelihood of occurrence[3]**
Mammal	*Notoryctes typhlops*	Itjaritjari, Southern Marsupial Mole	VU	-	-	92	**LOW** • Records are scarce but widely distributed across the Simpson land system. The closest record is 80km to northwest (by J Benshemesh, unknown date), which indicates species may occur in the wider area in suitable habitat. • Review of aerial imagery indicates are only a few short-aligned small dunes present within the survey area (i.e. dunes are preferred habitat for the species).
Mammal	*Petrogale lateralis*	Black-footed Rock-wallaby	NT	VU	May occur	62	**NONE** Species habitat (rocky ranges) does not occur.
Mammal	*Rattus tunneyi*	Pale Field-rat	VU	-	-	1	**NONE** Species distribution is now restricted to northern Australia.
Mammal	*Sminthopsis longicaudata*	Long-tailed Dunnart	VU	-		2	**NONE** Species habitat (rocky ranges) does not occur.
Mammal	*Trichosurus vulpecula vulpecula*	Common Brushtail Possum (central)	EN	-	-	34	**NONE** Species habitat (rocky ranges) does not occur.
Mammal	*Zyzomys pedunculatus*	Central Rock-rat	EN	CR	-	3	**NONE** Species habitat (rocky ranges) does not occur.
Invertebrate	*Semotrachia euzyga*	a land snail	EN	EN	-	2	**NONE** • Essential habitat (i.e. rocky ranges under fig trees) does not occur.
Invertebrate	*Granulomelon squamulosum*	a land snail	VU	-	-	1	**NONE** • Essential habitat (i.e. rocky ranges / gorges with leaf litter under fig trees in or under rocks) does not occur.

APPENDIX G EPBC PROTECTED MATTERS SEARCH TOOL (PMST) REPORT

Five EPBC PMST reports were generated for this project, each including a 50 km buffer from a central location of the proposed drill site. EPBC reports are listed as follows:

- EPBC PMST Search 1 – Dingo 1-ST1 and Dingo 5
- EPBC PMST Search 2 – Orange 3
- EPBC PMST Search 3 – PV12
- EPBC PMST Search 4 – WM27 and WM28
- EPBC PMST Search 5 – Mamlambo 1

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.

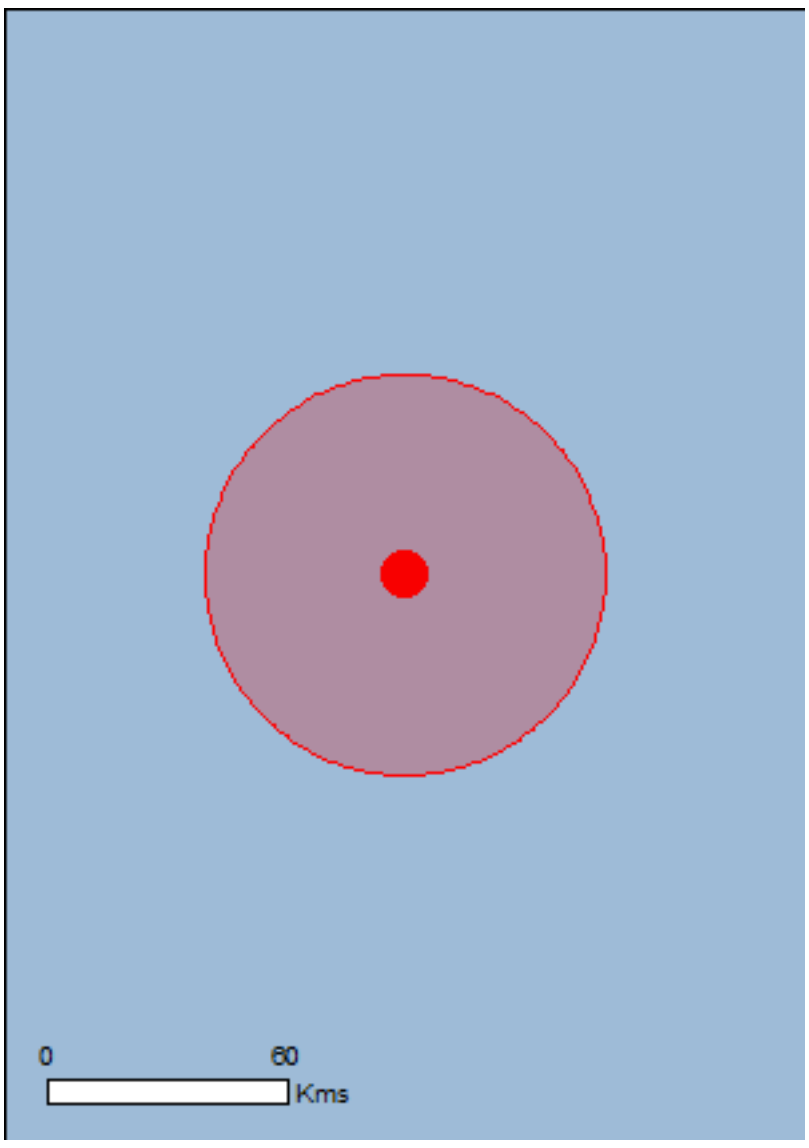
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 13/02/20 12:49:59

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

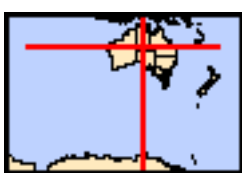
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 50.0Km



Summary

DINGO EPBC PMST

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	14
Listed Migratory Species:	11

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 http://www.environment.gov.au/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 Land:	3
Commonwealth Heritage Places:	None
Listed Marine Species:	16
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	4
Regional Forest Agreements:	None
Invasive Species:	21
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

DINGO EPBC PMST

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Amytornis modestus Thick-billed Grasswren [84121]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Petrogale lateralis MacDonnell Ranges race Warru, Black-footed Rock-wallaby (MacDonnell Ranges race) [66649]	Vulnerable	Species or species habitat known to occur within area
Zyzomys pedunculatus Central Rock-rat, Antina [68]	Critically Endangered	Species or species habitat may occur within area
Other		
Sinumelon bednalli Bednall's Land Snail [79113]	Endangered	Species or species habitat may occur within area
Plants		
Eleocharis papillosa Dwarf Desert Spike-rush [2519]	Vulnerable	Species or species habitat may occur within area
Eremophila prostrata Rainbow Valley Fuchsia Bush [56749]	Vulnerable	Species or species habitat known to occur within area
Macrozamia macdonnellii MacDonnell Ranges Cycad [11843]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence within area
[Minuria tridens](#) Minnie Daisy [13753]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
[Liopholis slateri slateri](#) Slater's Skink, Floodplain Skink [83163]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat known to occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat likely to occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may occur within area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat may occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Government Solicitor
Commonwealth Land - Department of Transport & Regional Development

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Kuyunba	NT
Napwerte / Ewaninga Rock Carvings	NT
Owen Springs Reserve	NT
Rainbow Valley	NT

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur

DINGO EPBC PMST

Name	Status	Type of Presence
		within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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 distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-24.22601 133.88266

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
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-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
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-Queensland Herbarium
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-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

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EPBC Act Protected Matters Report

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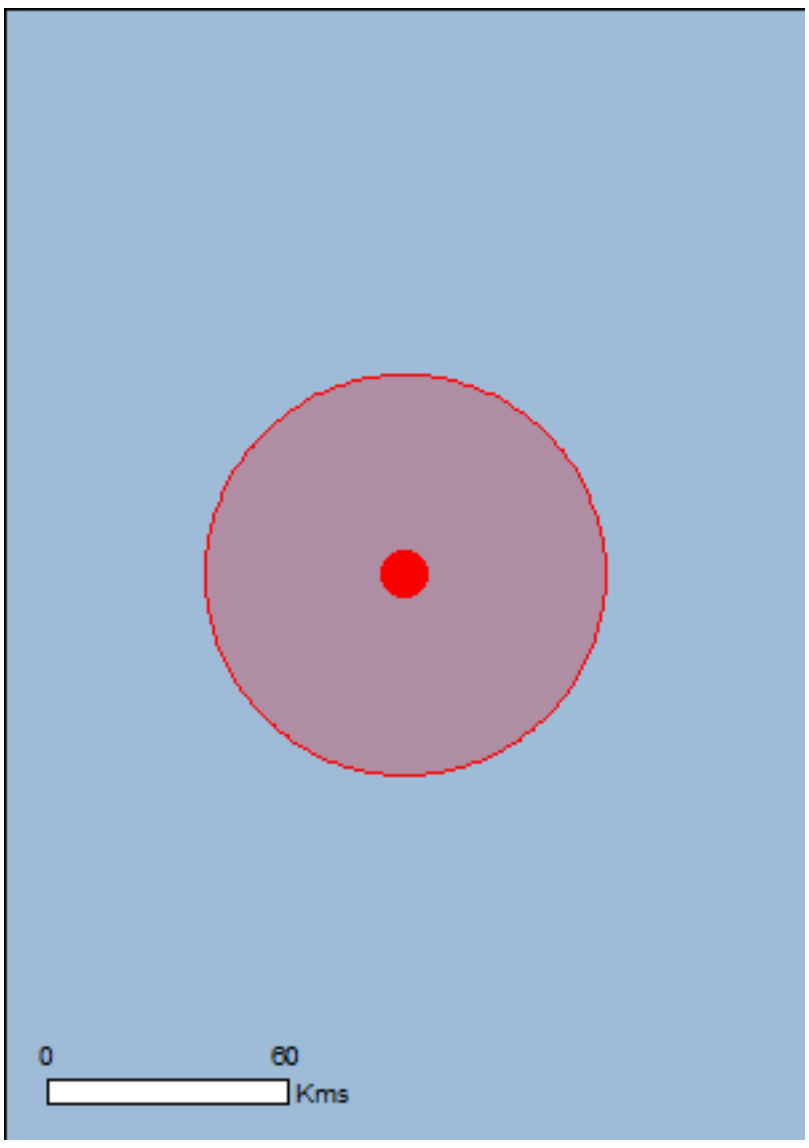
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 13/02/20 12:52:44

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

Caveat
Acknowledgements



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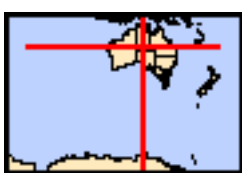
Coordinates

Buffer: 50.0Km



Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	20
Listed Migratory Species:	12

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 http://www.environment.gov.au/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 Land:	8
Commonwealth Heritage Places:	1
Listed Marine Species:	17
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	12
Regional Forest Agreements:	None
Invasive Species:	23
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

ORANGE EPBC PMST

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Amytornis modestus Thick-billed Grasswren [84121]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Petrogale lateralis MacDonnell Ranges race Warru, Black-footed Rock-wallaby (MacDonnell Ranges race) [66649]	Vulnerable	Species or species habitat known to occur within area
Zyzomys pedunculatus Central Rock-rat, Antina [68]	Critically Endangered	Species or species habitat known to occur within area
Other		
Semotrachia euzyga a land snail [79219]	Endangered	Species or species habitat likely to occur within area
Sinumelon bednalli Bednall's Land Snail [79113]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Plants		
Actinotus schwarzii Desert Flannel-flower [18659]	Vulnerable	Species or species habitat likely to occur within area
Eleocharis papillosa Dwarf Desert Spike-rush [2519]	Vulnerable	Species or species habitat known to occur within area
Eremophila prostrata Rainbow Valley Fuchsia Bush [56749]	Vulnerable	Species or species habitat known to occur within area
Macrozamia macdonnellii MacDonnell Ranges Cycad [11843]	Vulnerable	Species or species habitat known to occur within area
Minuria tridens Minnie Daisy [13753]	Vulnerable	Species or species habitat known to occur within area
Olearia macdonnellensis [14180]	Vulnerable	Species or species habitat likely to occur within area
Ricinocarpos gloria-medii Glory of the Centre [6525]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Liopholis slateri slateri Slater's Skink, Floodplain Skink [83163]	Endangered	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Government Solicitor
Commonwealth Land - Department of Administrative Services
Commonwealth Land - Department of Transport & Regional Development
Commonwealth Land - Joint Defence Facility Pine Gap
Defence - ALICE SPRINGS - SINGLE MBRS AC
Defence - INLAND FUEL DEPOT
Defence - NORFORCE DEPOT - ALICE SPRINGS

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Arid A Type Residence	NT	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Alice Springs Desert Park	NT
Alice Springs Telegraph Station	NT
Alice Springs Telegraph Station	NT
Heavitree Gap Police Station	NT
John Flynn's Grave	NT
Joint Geological / Geophysical Reserve	NT
Kuyunba	NT
Napwerte / Ewaninga Rock Carvings	NT
Owen Springs Reserve	NT
Rainbow Valley	NT
Tjoritja / West MacDonnell	NT
Yeperenye / Emily and Jessie Gaps	NT

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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 distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-24.03736 133.78207

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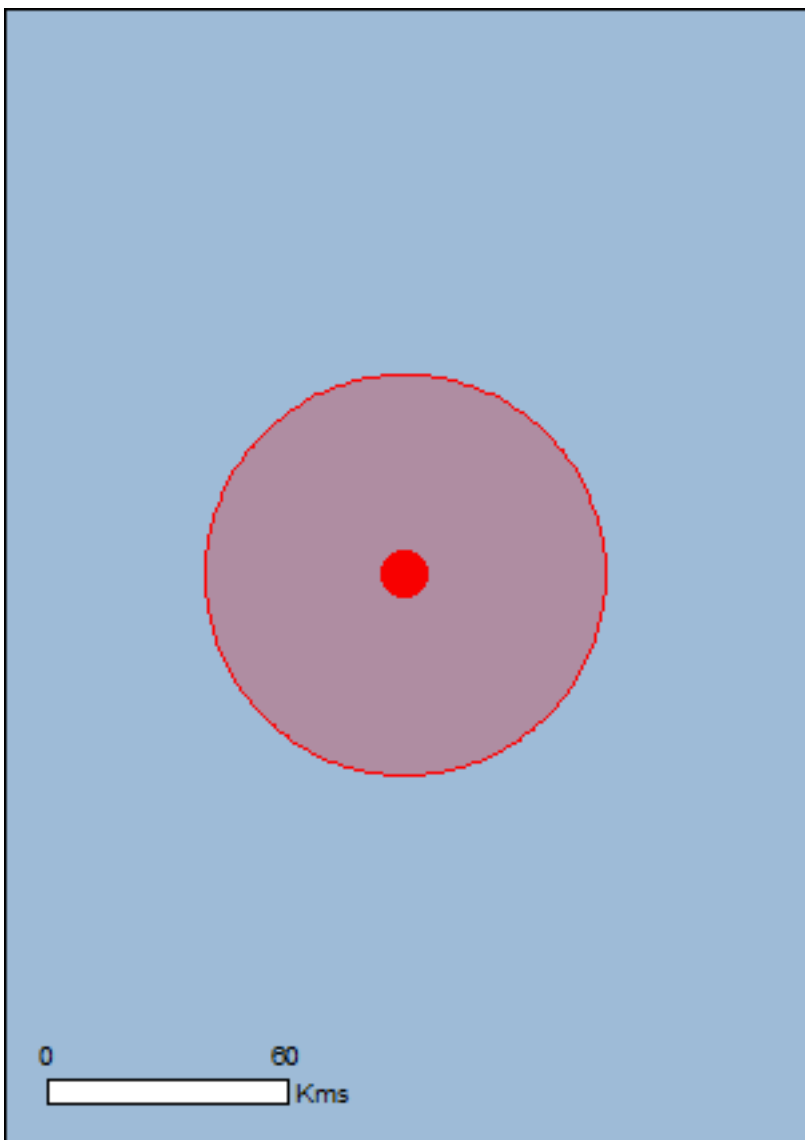

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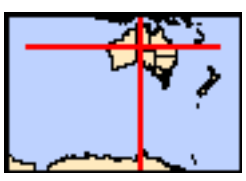

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World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	16
Listed Migratory Species:	10

Other Matters Protected by the EPBC Act

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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 Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	5
Regional Forest Agreements:	None
Invasive Species:	17
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

National Heritage Properties		[Resource Information]
Name	State	Status
Indigenous		
Hermannsburg Historic Precinct	NT	Listed place

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Petrogale lateralis MacDonnell Ranges race Warru, Black-footed Rock-wallaby (MacDonnell Ranges race) [66649]	Vulnerable	Species or species habitat known to occur within area
Zyzomys pedunculatus Central Rock-rat, Antina [68]	Critically Endangered	Species or species habitat known to occur within area
Plants		
Acacia latzii Latz's Wattle [14275]	Vulnerable	Species or species habitat likely to occur within area
Actinotus schwarzii Desert Flannel-flower [18659]	Vulnerable	Species or species habitat likely to occur within area
Livistona mariae subsp. mariae Central Australian Cabbage Palm, Red Cabbage Palm [64929]	Endangered	Species or species habitat known to occur within area
Macrozamia macdonnellii MacDonnell Ranges Cycad [11843]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
[Minuria tridens](#) Minnie Daisy [13753]	Vulnerable	Species or species habitat known to occur within area
[Olearia macdonnellensis](#) [14180]	Vulnerable	Species or species habitat known to occur within area
[Prostanthera schultzii](#) [52651]	Vulnerable	Species or species habitat likely to occur within area
[Thryptomene wittweri](#) Mountain Thryptomene [16645]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
[Liopholis slateri slateri](#) Slater's Skink, Floodplain Skink [83163]	Endangered	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
[Motacilla cinerea](#) Grey Wagtail [642]		Species or species habitat may occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat may occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may occur within area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
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Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Finke Gorge	NT
Illamurta Springs	NT
Owen Springs Reserve	NT
Tjoritja / West MacDonnell	NT
Tnorala (Gosse Bluff)	NT

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Finke River Headwater Gorges System	NT

Caveat

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Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-23.99896 132.7332

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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EPBC Act Protected Matters Report

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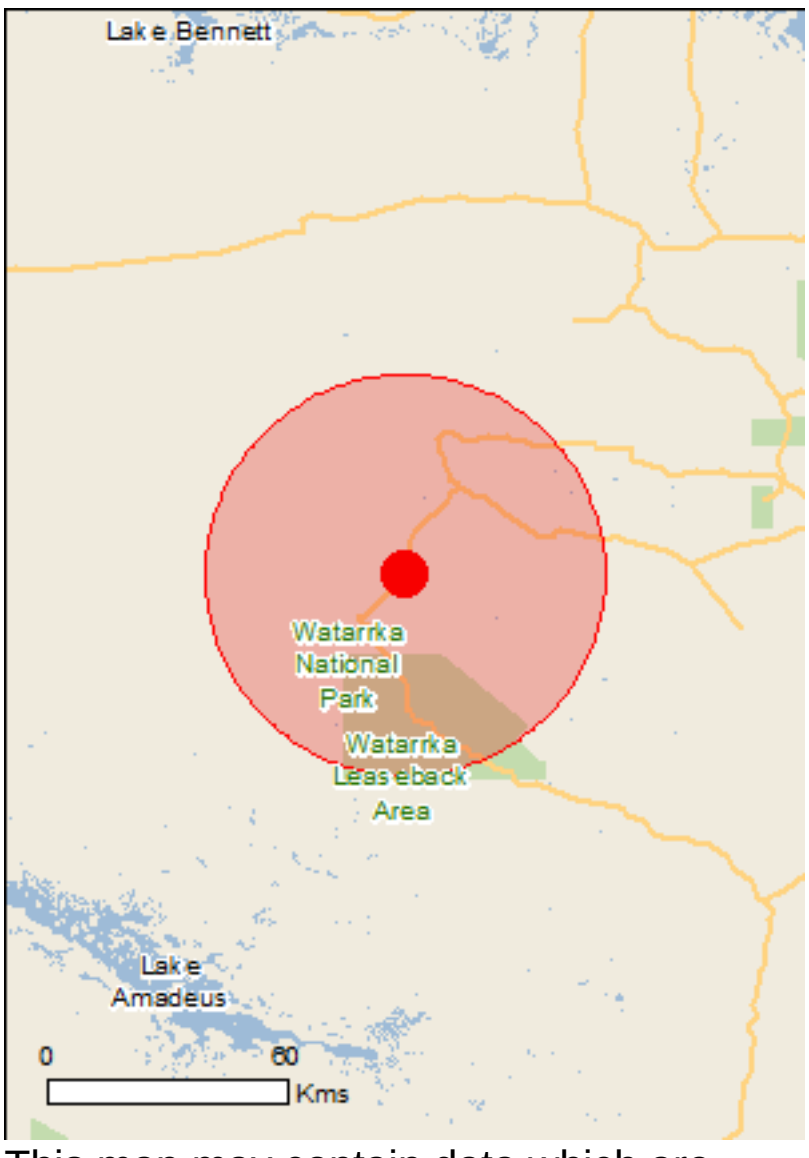
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 13/02/20 12:59:29

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

Caveat
Acknowledgements



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Coordinates

Buffer: 50.0Km

Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	11
Listed Migratory Species:	9

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 http://www.environment.gov.au/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 Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	14
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	9
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Lagorchestes hirsutus Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Species or species habitat likely to occur within area
Petrogale lateralis MacDonnell Ranges race Warru, Black-footed Rock-wallaby (MacDonnell Ranges race) [66649]	Vulnerable	Species or species habitat known to occur within area
Zyzomys pedunculatus Central Rock-rat, Antina [68]	Critically Endangered	Species or species habitat likely to occur within area
Plants		
Macrozamia macdonnellii MacDonnell Ranges Cycad [11843]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Liopholis kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area
Liopholis slateri slateri Slater's Skink, Floodplain Skink [83163]	Endangered	Species or species habitat may occur within area

Listed Migratory Species	[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.	

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis		
Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
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Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Katiti Petermann	NT
Watarrka	NT

Invasive Species	[Resource Information]

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Name	Status	Type of Presence
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

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Coordinates

-23.97238 131.50672

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-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
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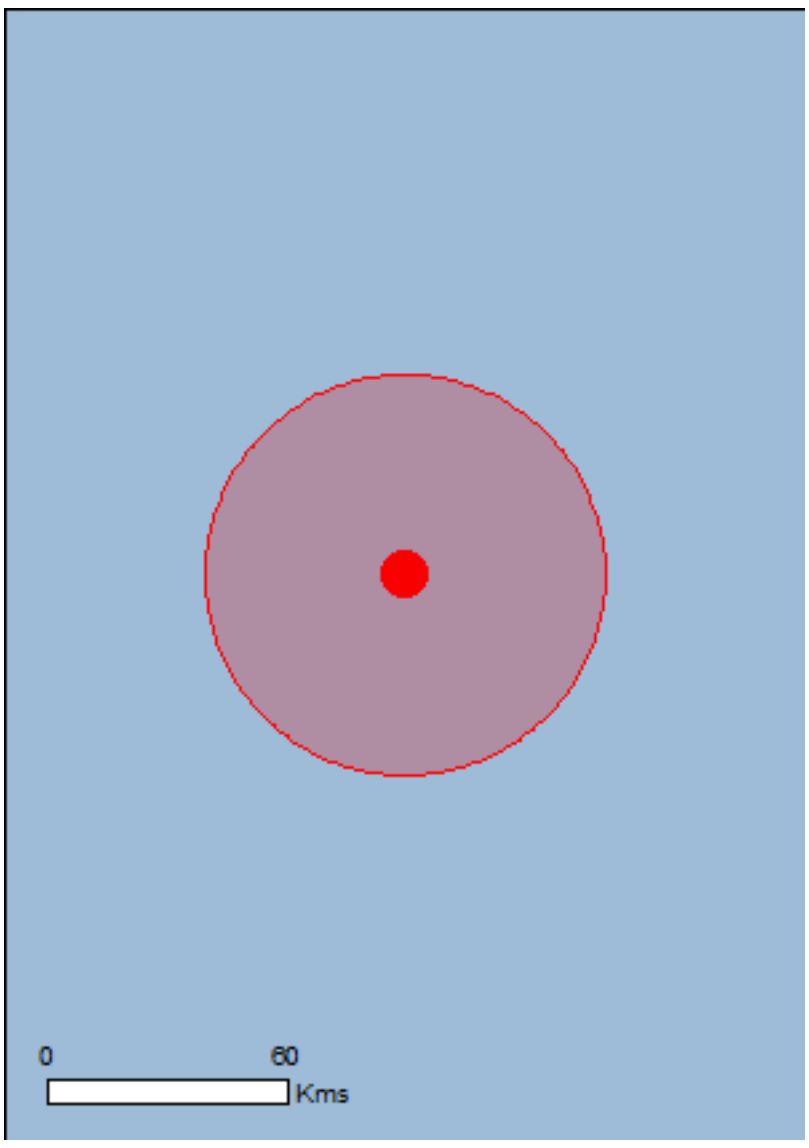
Report created: 13/02/20 13:03:14

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

Caveat
Acknowledgements



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Coordinates

Buffer: 50.0Km

Summary

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World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	5
Listed Migratory Species:	8

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Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	11
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	7
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Polytelis alexandrae Princess Parrot, Alexandra's Parrot [758]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat may occur within area
Petrogale lateralis MacDonnell Ranges race Warru, Black-footed Rock-wallaby (MacDonnell Ranges race) [66649]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Liopholis kintorei Great Desert Skink, Tjakura, Warrarna, Mulyamiji [83160]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species	[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.	
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba		
Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus		
Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans		
Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, 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 distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-23.66235 130.03539

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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Appendix 3 Heritage Assessment

EVERICK HERITAGE

Central Petroleum Drilling Program 2020, Northern Territory

Aboriginal Archaeological Assessment

Written for Central Petroleum Limited

Everick Heritage Pty Ltd

October 2020

Report Reference:

T. Hill, J. Wallace and R. Mazlin 2020. *Central Petroleum Drilling Program 2020: Aboriginal Archaeological Assessment.* Everick Heritage Pty Ltd unpublished report prepared for Central Petroleum Limited.

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11	T. Hill	Exec, 3,5,6,7	22.10.2020	T. Robins

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Executive Summary

Everick Heritage Pty Ltd (the 'Consultant') was commissioned by Central Petroleum (the 'Proponent') to undertake an Aboriginal Archaeological Assessment ('AAA') for the Central Petroleum 2020 exploration drilling program in the Northern Territory ('NT'). The assessment has been commissioned to support the Environmental Management Plan ('EMP') for the drill program. The objective of the investigation was to identify any archaeological constraints within the Survey Area, and if found, establish ways in which any impacts to the values of those sites could be avoided or mitigated.

The methods employed in this assessment included:

a) a search of relevant heritage registers;

b) a review of environmental resources for the region;

c) a review of relevant archaeological and ethnographic studies for the region;

d) an archaeological site inspection using meandering pedestrian transects;

e) assessments of archaeological and cultural heritage significance and impact; and

f) report on findings and recommended management strategies.

Results

As a result of the desktop study and the archaeological investigation it is possible to make the following statements regarding the potential of the Central Petroleum 2020 drill program to impact on Aboriginal objects.

- Works within the Dingo 1 ST Survey Area are not likely to impact on Aboriginal sites.
- Works within the Dingo 5 Survey Area are not likely to impact on Aboriginal sites.
- Works within the Orange 3 Survey Area have the potential to impact on the Orange 3_01 knapping site and quarry. However, works on the low sandy flat have a low potential to impact on Aboriginal archaeological sites.
- Works within the Palm Valley 12 Survey Area have the potential to impact on Aboriginal objects, however the conservation value of the objects is relatively low as the artefacts occur in low densities and the sites do not demonstrate a high degree of technological diversity or adaptation.
- Works within the West Mereenie 27 Survey Area have the potential to impact on the West Mereenie 27_01 quarry and stone artefact scatter site. However, works on the surrounding sand plain below the small localised rocky outcrops have a low potential to impact on Aboriginal archaeological sites. It is likely that the focus of Aboriginal use of the site is the small mallee outcrops and claypans tot eh south of the rocky outcrops.
- Works within the West Mereenie 28 Survey Area have the potential to impact on the West Mereenie_01 knapping site which appears to be associated with the small elevated rocky ridge to the east of the site. However, works on the surrounding sand plain below the rocky ridge have a low potential to impact on Aboriginal archaeological sites.
- Works within the Mamlambo Survey Area have the potential to impact on the Mamlambo 01 grind stone fragment. This artefact is locally rare and a relatively unique example of technological adaptation in

the western desert. Works in the surrounding sand plain have the potential to impact on isolated flakes or the other portion of the grindstone.

Recommendations

Having consideration for the outcomes of the survey it is reasonable to conclude that the Proposed Works have the potential to impact on Aboriginal objects. As such the following recommendations are provided.

Recommendation 1: Aboriginal Object Find/ Stop Work Procedure.

If suspected Aboriginal material has been uncovered because of development activities:

- work in the surrounding area is to stop immediately;
- a temporary fence or barrier is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;
- an appropriately qualified archaeological consultant is to be engaged to identify the material, either in person or remotely;
- if the material is found to be of Aboriginal origin and it has been determined that the objects has been disturbed or damaged the NT Heritage Branch should be notified;
- if the material is found to be of Aboriginal origin and it has been determined that the objects have not been disturbed or damaged the works program and EMP should be revised to avoid works in the vicinity of the site.

Recommendation 2: Aboriginal Human Remains

Although it is unlikely that Human Remains will be located at any stage during earthworks within the Survey Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The Survey Area should be cordoned off and the remains

themselves should be left untouched. The nearest police station and the NT Heritage Branch all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal community and the Heritage Branch should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

Recommendation 3: Heritage exclusion areas.

It is recommended that heritage exclusion areas are established around sites with conservation value. Strategies for the implementation of the exclusion areas include:

- Redesign of site layouts to ensure at least 10 metre buffers to all exclusion areas.
- Installation of fencing or bunting to delineate the exclusion area.
- Identification of exclusion areas on all plans which are included in work contracts.
- Identification of exclusion areas in all site establishment meetings and inductions for new staff.

Recommendation 4: Works Approval.

It is recommended Works Approval under the Heritage Act (2011) is obtained for the following sites;

- Orange 2_03 and Orange 2-04 including similar isolated artefacts and low-density artefact scatters.
- Palm Valley 12 (01-04) including all artefacts within the approved work area.

Application for the works approval should include the following conditions:

- Collection and analysis of artefacts by a suitably qualified person;
- Relocation of the artefacts in an area adjacent to the works area;

- Notification of the relocation area to the NT Heritage Branch including a detailed analysis of the artefacts; and
- Establishment of a heritage exclusion area (as outlined in Recommendation 3) around the artefact relocation area.

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DEFINITIONS

AAA means the Aboriginal Archaeological Assessment.

AAPA means Aboriginal Areas Protection Authority.

Aboriginal Object means the same as described in the *Heritage Act* (2011) (Northern Territory). Namely, that comprises a relic that relates to the past human occupation of the Territory by Aboriginal or Maccassan people.

EMP means Environmental Management Plan.

The Consultant means qualified archaeological staff of Everick Heritage Consultants Pty Ltd.

Heritage Branch means the Heritage Branch of the Department of Tourism, Sport and Culture.

NT means Northern Territory.

Survey Area means Petroleum leases held by Central Petroleum Limited in Central Australia subject to the 2020 exploration program identified in Section 1.2 of this report.

Survey Unit means the lands subject to archaeological survey.

Proponent means Central Petroleum Limited and all associated employees, contractors and subcontractors of the same.

Proposed works means the description of works identified in Section 1.2 of this report.

PV means Palm Valley.

WM means West Mereenie.

1. INTRODUCTION

1.1. Proponent, Project Brief & Methodology

Everick Heritage Pty Ltd (the 'Consultant') was commissioned by Central Petroleum (the 'Proponent') to undertake an Aboriginal Archaeological Assessment ('AAA') for the Central Petroleum 2020 exploration drilling program in the Northern Territory ('NT'). The assessment has been commissioned to support the Environmental Management Plan ('EMP') for the drill program. The objective of the investigation was to identify any archaeological constraints within the Survey Area, and if found, establish ways in which any impacts top the values of those sites could be avoided or mitigated.

The methods employed in this assessment included:

a) a search of relevant heritage registers;

b) a review of environmental resources for the region;

c) a review of relevant archaeological and ethnographic studies for the region;

d) an archaeological site inspection using meandering pedestrian transects;

e) assessments of archaeological and cultural heritage significance and impact; and

f) report on findings and recommended management strategies.

1.2. Defining the Survey Area and Proposed Works

The Survey Areas are situated within the Macdonell Shire and comprise the following locations (Table 1, Figure 1, Figure 2, Figure 3, Figure 4 and Figure 5).

Table 1: Survey Area descriptions

Survey Area	Survey Area Size	Lease
Dingo 1 ST	44 ha	L7
Dingo 5	39 ha	L7
Orange Creek 3	43 ha	EP82

Palm Valley 12	12 ha	OL3
West Mereenie 27	31 ha	OL4
West Mereenie 28	27 ha	OL4
Mamlambo	33 ha	L6/EP115

The Proponent is proposing to undertake a seven (7) well drilling program as part of its 2020 exploration program (noting that either Dingo 1 ST or Dingo 5 will be drilled, not both). The works to be undertaken for each of the wells can be broken into the below phases.

1.2.1. Construction

Construction of the following infrastructure:

- Access tracks:
  - Dingo 1 ST - utilize existing
  - Dingo 5 - 0.48 ha (120 m x 40 m)
  - Orange 3 – 4 ha (1 km x 40 m)
  - Palm Valley 12 – utilize existing
  - West Mereenie 27 – utilize existing
  - West Mereenie - 28 – 2.5 ha (1 km x 25m)
  - Mamlambo 1 - 10.8 ha (2.7 km x 40 m)
- Well lease up to 3 ha (200 m x 150 m)
- Vehicle turnarounds
- Accommodation camp and effluent irrigation area – 4 ha (200 m x 200 m)
  - Existing camp locations will be used for the Mamlambo 1, Palm Valley 12 and West Mereenie 27 / 28 wells)
- Topsoil and vegetation stockpiles
- Laydown areas as required
- Gravel / sand extraction.

To accommodate the disturbance associated with the above infrastructure it will be contained in the Survey Areas depicted in Figure 1 to Figure 5. This Survey Area for each well location is considerably larger than the actual disturbance areas required for the proposed infrastructure. This larger Survey Area will allow the Proponent flexibility in finalising its design and placement of the proposed works.

1.2.2. Drilling / Production Testing

Each well will be drilled using a combination of air and water-based mixtures to the designated target depth. This drilling process will take between 20 and 64 days dependent upon the well location.

At the completion of drilling the well will be assessed for the presence of natural gas (oil for Mamlambo). Where the recovery rate of the gas /oil is of a commercial quantity the well will be cased and suspended pending flowline construction and tie-in connections to enable the gas / oil to be transported to market. Where the resource recovery rate is not of a commercial quantity the well will be abandoned in accordance with the NT Government's Code of Practice: Onshore Petroleum Activities in the Northern Territory (2019)

1.2.3. Rehabilitation

At the completion of production testing, each disturbance area will be rehabilitated back to one of the following:

- Cased and suspended - the minimum area required to enable a production well and associated facilities
- Abandoned - all areas reinstated to its pre-disturbance environment.

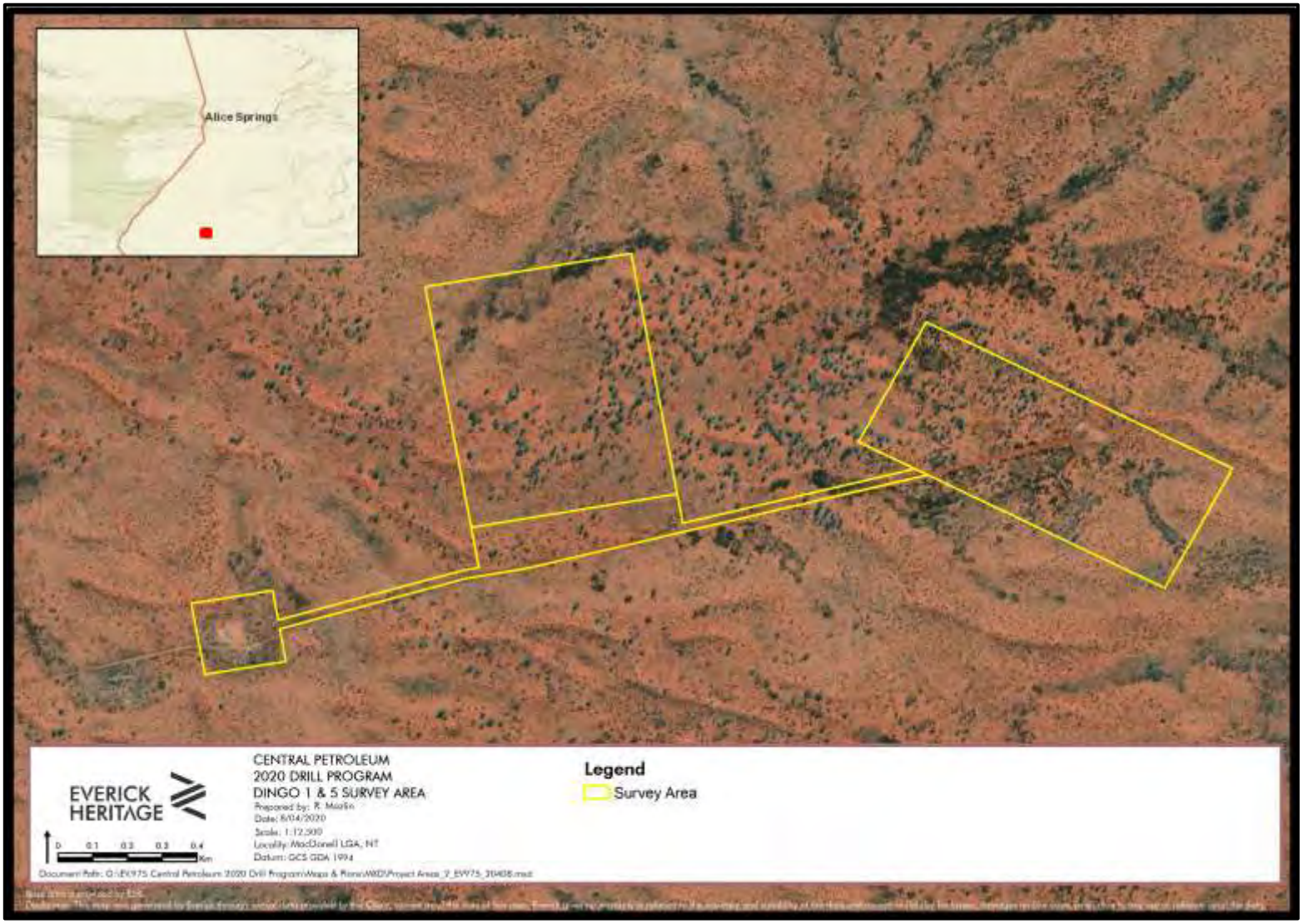

Figure 1: Survey Area Dingo 1 ST and Dingo 5.

Figure 2: Survey Area Orange 3

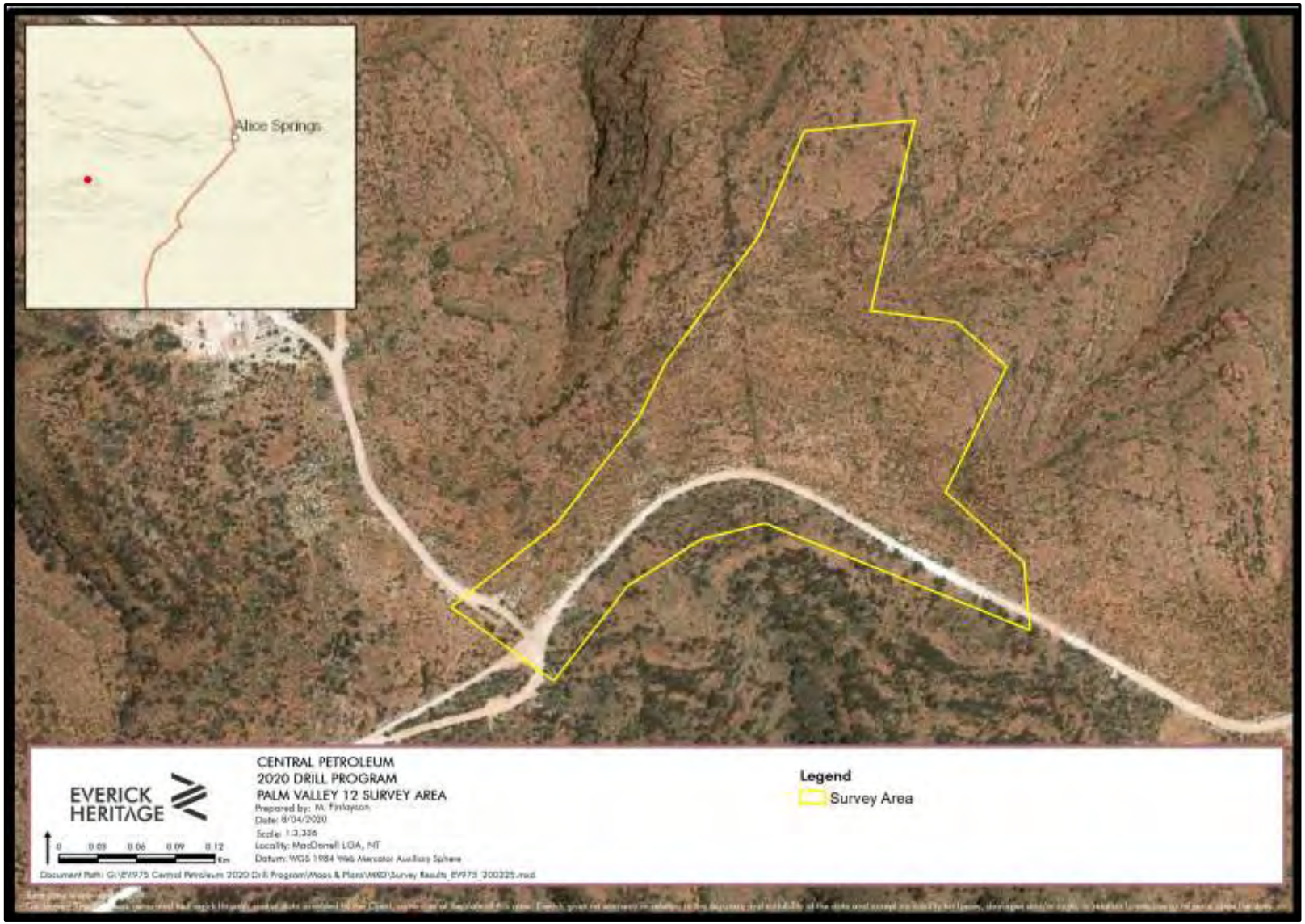

Figure 3: Survey Area Palm Valley 12.

Figure 4: Survey Area West Mereenie 27 and 28.

Figure 5: Survey Area Mamlambo.

1.3. Report Authorship

The AAA was prepared by Principal Consultant (Northern NSW and Northern Territory) Tim Hill and Dr. Jamie Wallace (Principal Queensland) Archaeologist Robbie Mazlin and Graduate Archaeologist Matt Finlayson. The Aboriginal community consultation was conducted by Tim Hill.

2. LEGISLATIVE AND PLANNING CONTEXT

2.1. The Heritage Act 2011 (NT)

The Heritage Act 2011 (NT) ('Heritage Act') is the primary piece of legislation for the management of physical cultural heritage within the Northern Territory. The Heritage Act provides protection for Archaeological (Heritage) Places (s.7) and Objects (s.8) of both historic and Aboriginal or Macassan significance. The definitions of archaeological place are quite broad. And archaeological place is a place that (s.6(1)):

a) *relates to the past human occupation of the Territory; and*

b) *has been modified by the activity of the occupiers.'*

Similarly, and Aboriginal or Macassan archaeological places is a place that related to Aboriginal or Macassan occupation and shows evidence of being modified by those people (s.6(2)).

In relation to Archaeological Objects, the Act uses the term 'relics', which is (s.9(1)):

a) *an artefact or thing given shape by a person:*

b) *human or animal skeletal remains; or*

c) *something else prescribed by regulation.'*

Examples are provided in s.9(2), which include a secret or ceremonial object, a log or bark coffin, human remain, rock or wood carvings or engravings and stone tools.

The thresholds for protection of historic and Indigenous / Macassan places vary considerably. Under the Heritage Act all Aboriginal or Macassan Objects or Places are given protection (ss. 17 and 18), whereby a permit is required in order to relocate or harm them (s.72).

In contrast, for historic sites, only places or objects that are of heritage significance (s.10), as defined by the heritage assessment criteria (s.11) are afforded protection. This is on the proviso that they are declared so by the Minister (Division 5) under recommendation from the Heritage Council (Chapter 6). The heritage assessment criteria are:

a) *whether it is important to the course, or pattern, of the Territory's cultural or natural history;*

b) *whether it possesses uncommon, rare or endangered aspects of the Territory's cultural or natural history;*

c) *whether it has potential to yield information that will contribute to an understanding of the Territory's cultural or natural history;*

d) *whether it is important in demonstrating the principal characteristics of a class of cultural or natural places or environments;*

e) *whether it is important in exhibiting particular aesthetic characteristics;*

f) *whether it is important in demonstrating a high degree of creative or technical achievement during a particular period;*

g) *whether it has a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons, including the significance of a place to Aboriginal people as part of their continuing and developing cultural traditions; or*

h) *whether it has a special association with the life or works of a person, or group of persons, of importance in the Territory's history.'*

The Heritage Act allows for the conservation of significant heritage items or places through Heritage Agreements (Part 3.1), Work Approvals (Part 3.2) or Exempt Work (Part 3.3). Where a heritage officer is satisfied that imminent works are a serious threat to the significance of a heritage place, Stop Work Orders may be issued (Part 3.4). Repair Orders may also be issued where works have proceeded on a heritage place without the requisite approvals (Part 3.5).

Part 5.5 of the Heritage Act covers the offence procedures. Persons whom knowingly damage (s.111) or remove (ss. 112 & 113) all or part of a heritage place are liable for fines of up to $59,600 (400 penalty units) or 2 years imprisonment. Persons who unintentionally damage a heritage place are liable for fines of up to $14,900 (100 penalty units). Importantly, a person who discovers an archaeological place or object must notify the DLPE in writing as soon as practicable. Failure to do so may result in a fine of $2,980 (20 penalty units)

2.2. The Northern Territory Aboriginal Sacred Sites Act 1989 (NT)

The following is provided for general information purposes only, as the scope of works for this project did not include providing advice over the management of sacred sites.

The *Northern Territory Aboriginal Sacred Sites Act 1989* (NT) ('NTASS Act') provides protection for places that are 'sacred sites' within the meaning of the *Aboriginal Land Rights (Northern Territory) Act 1976* (NT) being sites that are (s.3):

'*sacred to Aboriginals or is otherwise of significance according to Aboriginal tradition, and includes any land that, under a law of the Northern Territory, is declared to be sacred to Aboriginals or of significance according to Aboriginal tradition*.'

The provisions of the NTASS Act are administered by the Aboriginal Areas Protection Authority (AAPA). AAPA is the agency responsible for consulting with Traditional custodians, in conjunction with the relevant Aboriginal Land Councils, over the potential impacts of proposed development and land use may have on sacred sites (s.19F). Under Division 1A, AAPA has the power to issue Authority Certificates to persons who propose to carry out work on lands within the Northern Territory. The purpose of the certificate is to document whether a proposed action is likely to impact on sacred sites, and if so to set out any conditions that may need to be followed to ensure sacred sites are avoided.

3. SURVEY AREA ENVIRONMENT AND LANDSCAPE

3.1. Landforms and Hydrology

The following table broadly summarises the landform and hydrology within each Survey Area (Table 3)

Table 2: Landform and hydrology

Survey Area	Landform and hydrology
Dingo 1 ST	Undulating red sandplains with low sand dunes, dune swales and sandplains. Associated swales in between dunes. No watercourses or clay pan features present; minor ephemeral drainage (lined with Mulga) situated to the south of Survey Area.
Dingo 5	Undulating red sandplains with low sand dunes, dune swales and sandplains. Associated swales in between dunes. No watercourses or clay pan features present.
Orange 3	Undulating calcareous and alluvial sandplains with spinifex dominated low calcrete rises and low sand dunes. Weakly defined ephemeral drainage (patchily dominated by Mulga) situated diagonally across the Survey Area. No clay pans or watercourses present; however, there are some minor clay depressions.
Palm Valley 12	Sandstone plateaux with minor areas of siltstone, quartzite and conglomerate (deeply weathered in places). Survey Area includes the head of steep rocky sandstone gullies, some of which feed into tributaries and riverine channels lower in the landscape.
West Mereenie 27	Spinifex-covered sandplains and dunes. One dune is present across the central part of the Survey Area from east to west. Some areas of sandstone outcrop to the east and south of Survey Area. No clay pans or watercourses present.
West Mereenie 28	The majority of the Survey Area is sandplains with minor area of low sandy rises. There is one rocky breakaway feature within the central part of the Survey Area. No clay pans or watercourses present.

Survey Area	Landform and hydrology
Mamlambo	Spinifex-covered sandplains and low dunes. No clay pans or watercourses present; however, claypans and rocky hills are located in fairly close proximity to the Survey Area.

3.2. Soil Description

The following table broadly summarises the landform and soils within each Survey Area (Table 3)

Table 3: Soil summary.

Survey Area	Landform and soil description
Dingo 1 ST	Red sands on dunes and a variety of soil types in swales- such as red clayey sands and red earths.
Dingo 5	Red sands on dunes and a variety of soil types in swales- such as red clayey sands and red earths.
Orange 3	Calcareous alluvium and windblown sands within sandplains and shallow soils on calcrete rises. Red sands on low dunes / sand hills
Palm Valley 12	Outcrop with shallow stony soils – pale brown sandy loam.
West Mereenie 27	Red sands on dunes and sandplains and a variety of soil types in swales - such as red clayey sands and red earths.
West Mereenie 28	Red sands on dunes and sandplains and a variety of soil types in swales - such as red clayey sands and red earths.

Survey Area	Landform and soil description
Mamlambo	Red sands on dunes and sandplains; with sandy red earths in minor run-on areas (generally where large Mulga and Ironwood are present). Calcrete outcrop present in some areas indicating that sandplain may be shallow in some parts.

3.3. Vegetation

The following table broadly summarises the vegetation within each Survey Area (Table 4)

Table 4: Vegetation summary.

Survey Area	Vegetation description
Dingo 1 ST	Supports an open shrubland over spinifex (*Triodia basedowii*), with occasional stands of Desert Oak (*Allocasuarina decaisneana*). Common shrub and tree species include Mulga (*Acacia aneura*), Sandhill Wattle (*Acacia ligulata*), Witchetty Bush (*Acacia kempeana*) and Ironwood (*Acacia estrophiolata*).
Dingo 5	Supports an open shrubland over spinifex (*Triodia basedowii*), with occasional Desert Oak (*Allocasuarina decaisneana*). Common shrub and tree species include Mulga (*Acacia aneura*) and Sandhill Wattle (*Acacia ligulata*).
Orange 3	Lower lying sandy areas (alluvium) support tussock grass and sparse shrubs and trees. Low dunes and sand hills support spinifex (*Triodia basedowii*) +/- Sandhill Wattle (*Acacia ligulata*), Rattlepod Grevillea (*Grevillia stenobotrya*), Hopbush (*Dodonaea viscosa subsp. mucronata*) and Ironwood (*Acacia estrophiolata*). Minor drainage and red earths generally support patchy Mulga. Clay depressions have very low vegetation cover – mostly annual forbs and grasses.
Palm Valley 12	The rocky plateau supports a low shrubland of Witchetty Bush (*Acacia kempeana*) and Red bud mallee (*Eucalyptus sessilis*) over Spinifex (*Triodia brizoides* and *T. melvillei*). There is a small patch of *Acacia aneura var. Holey Trunk* located in the southeast corner of the Survey Area. North facing gullies generally support *Acacia spp.* over Hard Spinifex (*Triodia brizoides*) with occasional patches of Hill Mulga (*Acacia*

Survey Area	Vegetation description
	macdonnellensis subsp. macdonnellensis). South facing gullies generally support a higher cover of Hill Mulga and Red bud mallee (*Eucalyptus sessilis*) over Spinifex (*Triodia melvillei*) with scattered White Cypress Pine (*Callitris glaucophylla*).
West Mereenie 27	The sandplains support an open shrubland of Waxy Wattle (*Acacia melleodora*) and Crimson Turkey Bush (*Eremophila latrobei subsp. latrobei*) over Feathertop Spinifex (*Triodia schinzii*) with occasional emergent trees Sand Dune Bloodwood (*Corymbia chippendalei*) and Desert Oak (*Allocasuarina decaisneana*). The sand dune supports an open shrubland of Waxy Wattle over Rattlepod Grevillea (*Grevillea stenobotrya*) over Feathertop Spinifex and Everlasting (*Chrysocephalum eremaeum*). Mulga patches (*Acacia aneura* and *A. ayersiana*) occur in red earth swales and Hill Mulga (*Acacia macdonnellensis*) occur in areas where laterised sandstone outcrop persist.
West Mereenie 28	The majority of the Survey Area supports a spinifex sandplain with Blue Mallee (*Eucalyptus gamophylla*) and *Acacia spp*. Sandy red earth depressions support groves of Mulga (*Acacia aneura, A. aptaneura and A. ayersiana*) over mixed tussock grasses. The rocky breakaway supports Hill Mulga (*Acacia macdonnellensis*) over spinifex (*Triodia melvillei*). The eastern access track traverse sandplain habitat similar to above with the occasional spinifex covered low dune with Honey Grevillea (*Grevillea juncifolia*) and emergent Sand Dune Bloodwood (*Corymbia chippendalei*) and Desert Oak (*Allocasuarina decaisneana*).
Mamlambo	The Survey Area supports red sandplain with Blue Mallee (Eucalyptus gamophylla) and other mixed Acacia shrubs (common species including *Acacia ligulata, A. melleodora* and *A. abrupta*) over spinifex (*Triodia epactia* and *T. schinzii*) with one stand of Desert Oak (*Allocasuarina decaisneana*). Patches of sandy red earth support open stands of Ironwood (Acacia estrophiolata) and Mulga. The access track (old seismic line) intersects dune and sandplain habitat (as described above but has been recently burnt), as well as calcrete rises and calcareous earths which support a mix of Mulga and Senna shrublands.

3.4. Land Use and Disturbance History

The following table broadly summarises the land use and disturbance history within each Survey Area (Table 5)

Table 5: Land use and disturbance history.

Survey Area	Land use and disturbance history
Dingo 1 ST	Pastoralism, but currently low level of grazing activity at site. Well head and associated cleared pads are present in the central part of the Survey Area. Gully erosion present to the south of existing road as a result of previous clearing activities.
Dingo 5	Pastoralism, but currently low level of grazing activity at site. No cleared areas apart from seismic line.
Orange 3	Pastoralism, and appears to have a high level of grazing disturbance due to close proximity to Railway Bore (approx. 2 km to north east). No obvious signs of previous mining disturbance.
Palm Valley 12	Occurs within existing Palm Valley Gas Field. Gas field access road travels through the site from east to west. No obvious signs of other mining disturbance.
West Mereenie 27	Occurs within existing Mereenie Oil and Gas Field, and falls adjacent to active well site WM01. No obvious signs of other significant disturbance; apart from some historic seismic line disturbance that has since rehabilitated.
West Mereenie 28	Occurs within existing Mereenie Oil and Gas Field, and falls close to active well site WM16. No obvious signs of other mining disturbance; apart from some historic seismic line disturbance that has since rehabilitated. Low to moderate level of disturbance from introduced fauna – mainly horses and camels.
Mamlambo	Occurs within Haast Bluff Aboriginal Land Trust. No obvious signs of other mining disturbance; apart from some historic seismic line disturbance that has since rehabilitated.

4. SYNTHESIS OF PREVIOUS ARCHAEOLOGICAL INVESTIGATIONS AND ETHNOHISTORY

4.1. Heritage Register Searches

An email was sent to Diane Bensley at Heritage Branch requesting a search of the NT Heritage database. The following summarises the results of the data base search (Table 6). A screenshot of the Heritage database was provided to indicate the location of the known sites nearby to West Mereenie 28 however a geographic coordinate for this site was not provided (Figure 6 see also Appendix 1 for email from Dianne Bensley, NT Heritage Branch).

Table 6: Summary of heritage database search.

Survey Area	Previously recorded sites	Notes
Dingo 1 ST	NIL	
Dingo 5	NIL	
Orange Creek 3	NIL	
Palm Valley 12	NIL	
West Mereenie 27	NIL	
West Mereenie 28	Nearby	Previously recorded rock art and stone artefacts scatters approximately 3.5km east.
Mamlambo	NIL	

Figure 6: Location of Archaeological site near West Mereenie 28 (source HNT Heritage Branch).

4.2. Archaeology of Arid Australia.

Archaeological investigations of the Australian Arid zones have historically been conducted under two main agendas. The first occurred during the early 1900's with in depth ethnographic studies of desert dwelling Aboriginal populations for academic purposes. Currently, arid zone research is primarily conducted for developer and mining companies seeking to fulfil their legislative responsibilities to Cultural Heritage prior to conducting further works. The results of the different research schema employed are that there has been a general decrease in published literature on the archaeology of Australia's arid zone. Increasing amounts of grey literature and unpublished cultural heritage assessment reports are currently the norm. This does unfortunately limit the amount of peer reviewed research available to conduct in-depth desktop analysis.

Despite the desolate and resource poor landscape, what research that has been carried out in the arid interior suggests that the region was occupied extensively throughout the past 40 000 years (Hiscock 2008). Recent re-analysis of radiocarbon dates from Kulpi Mara by Thorely et al (2011) show the site has a median basal age of 34,178BP, further West at Puritjara, occupation dates to around 39,000BP, while the earliest phase of occupation at Serpents Glen dates to 23,500BP (O'Connor et al 1998).The occupation of these sites suggests that human groups were active within the desert regions of Australia

during the Pleistocene. However, no such sites have been located within the Simpson Desert itself. The reason for this is unclear.

Occupation of the arid regions of Australia would have been fundamentally and adversely impacted by the location and accessibility of resources, particularly permanent sources of fresh water. This idea has been the driving force behind models of arid occupation (Hiscock 2008; Veth). Veth's (1989) landmark refuge, corridor, barrier model posited that the resource and drainage poor sandridge deserts of Australia would have been barriers to human movement across the interior and the subsequent settlement patterns (Hiscock 2008). The lack of documented archaeological evidence within the Simpson appears to support this model, however this may be more of a construct of poor research than a reflection of the model's effectiveness. The inherent danger of Veth's (1989) model is that there is a base assumption that the prehistoric inhabitants of Australia shared the same adaptive strategies as their current desert dwelling Indigenous contemporaries (Hiscock 2008). Hiscock and Wallis (2005) proposed an alternative hypothesis in which human occupation of the arid interior occurred during favourable climatic conditions by highly mobile groups who employed non-specialist foraging strategies. The desert transformation model therefore posits that these people modified and changed their foraging strategies in response to the deteriorating climatic conditions throughout the late Pleistocene and Holocene.

There is a degree of consensus that the most lucrative period of arid occupation occurs from 13 000BP, with a decline suggested at 5000BP associated with deteriorating climatic conditions (Smith and Ross 2008; See also Smith et al 1991 and Veth et al 1990). Smith and Clarke (1993) date the first occupation of the Simpson Desert to 3000BP, however as noted by Smith (1993) data are too small and sparse to inform regional trends.

4.3. Archaeological and Cultural Heritage Assessments

4.3.1. Dingo

No previous archaeological investigations are documented for the Dingo well site. Previous surveys undertaken for the Waterhouse Range/ Ooramina Program are in a comparable geographic location (Hill 2006) identified the potential to Aboriginal archaeological sites to occur in close proximity to water and rocky ranges, however demonstrated a low potential for archaeological sites within the meandering sand dune country away from water.

4.3.2. Orange Creek

No previous archaeological investigations are documented for the Orange Creek exploration area.

4.3.3. West Mereenie

Previous site surveys of the Mereenie oilfields have been undertaken by a team led by Mike Smith in 1983 (Smith et al 1983) and by Peter Thorley for the Watarka/ Mereenie roadworks (Thorley 1993). Numerous place names and sacred sites were recorded however only three site recordings specifically identified archaeological material. Of note is that Puritjara site complex to the north west of West Mereenie. Based on information from the topographic map this site is geographically quite similar to the West Mereenie oil field- being on the edge of sand dune country and surrounded by localised drainage systems associated with smaller sedimentary ranges. The authors conclude;

> The results of this work suggest that most archaeological site cluster around the sandstone plateau (anticlinal core) or are located on the sand dunes and mounds associated with Red Waterhole. Archaeological remains were uncommon in most other areas as far as we could tell from this limited survey. The transects of the sand plains discovered no archaeological sites and we conclude that sites in this area are probably rare or highly localised. (Smith et. Al 1983:10)

A survey was undertaken by Hill (2009), for the expansion of the West Mereenie oilfield by SANTOS 2010 seismic program, did not identify any sites, however it is noted that this survey was in sand dune fields further west of West Mereenie 27 and 28.

4.3.4. Palm Valley

Studies completed nearby to Palm valley include the Injartnma to Wallace Rockhole powerline corridor (Hill 2008 which recorded four archaeological sites being two grindstones (Wallace Rockhole 1 and Injartnama 1) and two isolated quartzite flakes (Wallace Rockhole 2 and 3). This study was located approximately 30km east of Palm Valley in the Waterhouse Range.

The archaeological assessment for the Central Petroleum Waterhouse and Ooramina Range seismic program (Hill 2006A) to the south east of the Krichauff Range identified 12 stone artefact and quarry sites in the Waterhouse Range and 28 in the Ooramina Range indicating the potential density of sites in the rocky range environment. Sites were consistently associated with outcrops of stone materials suitable for knapping (quartzite, silcrete and cherts) and water sources- either in creeks of rock waterholes.

A survey of the Aneldika site complex on Tempe Downs Station/ James Range to the south of Palm Valley was undertaken in 2006 (Hill 2006B) to record archaeological sites in an analogous rocky range environment to Palm Valley. This survey identified a consistent pattern of occupation sites nearby to water sources and quarry sites at suitable outcrops of quartzite, silcrete and chert.

Peter Thorley undertook a major archaeological survey program around Tempe Downs Station to the south of Palm Valley and identified;

> …a pattern of many small sites and a few large ones, which were also the richest in terms of artefact types and components. …the variables most commonly associated with site location were access to water, proximity to rockshelters and availability of raw materials for artefact manufacture. …Sites with the largest surface area and most diverse assemblages of artefacts and art occur where there is a combination of these attributes- shelter, water and stone materials- in close proximity. (Thorley 1998:180,181).

The most common archaeological remains were stone artefacts, predominately produced from silcrete/quartzite with relatively smaller percentages of chert and chalcedony. The authors noted that artefacts produced on chert and chalcedony were more significantly reduced, i.e. they were smaller and contained no cortex, indicating that this material was sourced from a location some considerable distance away or from a small outcrop. Conversely, artefacts made from quartzite/silcrete were larger and showed fewer signs of rationing and re-use, indicating a much more local and available source (Smith et. Al 1983:14).

4.3.5. Mamlambo

Extensive archaeological surveys were undertaken in the Kintore area by Dick Kimber in 1997, however these focused on the rocky ranges closer to Kintore township and did not extend into the Mamlambo area. Archaeological investigations for the Johnstone Hill and Gypsum exploration areas were completed in 2007 (Hill 2007) which identified two archaeological sites;

> A total of 18.2 km with effective width visibility of 5 metres was surveyed. Two sites were recorded across all of the three identified environment types. Both sites were stone artefact scatters/open living areas with a range of raw material types. Johnstone Hill South 1 site was a spatially extensive open living area located on a fresh water lake/claypan and Johnstone Hill 1 site was a spatially discrete chert knapping area. (Hill 2007).

The Mamlambo drill site is located on a seismic line from the earlier seismic program, however based on the sampling strategy this area was not specifically surveyed as the results of the 2007 survey indicated a low likelihood that archaeological sites would be located in the open sand dune landforms.

4.4. Aboriginal land use model

The previous archaeological investigations for the Central Petroleum seismic survey provides the most comprehensive regional predictive model for archaeological sites. The following Aboriginal land use model is based on landforms and is provided below (from Hill 2010) and is based on the three main Central Australian landforms, Elevated ranges, Mulga/ Mallee woodlands and Spinifex/ Desert oak sand plains (see Table 7).

Table 7:Aboriginal land use model

Landform	Land use
Elevated ranges and jump-ups.	• Continuous living areas around rock formations and shelters and at semi-permanent and permanent waterholes. • Use while travelling as geographical reference points/for lookouts. • Extraction of local stone materials. • Restricted ceremonial activities.
Mulga/ Mallee woodlands	• Small family living areas in soakages and drainage lines used while traveling. • Collection of specific resources around creeks and soakages after periods of rain. • Hunting parties within isolated patches of mulga/ mallee forests. • Living areas around semi-permanent water sources.
Spinifex/Desert Oak sandplain	• Small family living areas while traveling. • Collection of specific resources around creeks and soakages after periods of rain. • Living areas around semi-permanent/ ephemeral water sources.

4.5. Predictive archaeological model

The previous archaeological investigations for the Central Petroleum seismic survey provides the most comprehensive regional predictive model for archaeological sites. The following archaeological site predictive model is based on landforms and is provided below (from Hill 2010) and is based on the three main Central Australian landforms, Elevated ranges, Mulga/ Mallee woodlands and Spinifex/ Desert oak sand plains (see Table 8).

Table 8: Archaeological site predictive model.

Landform	Land use
Elevated ranges and jump-ups.	• Low archaeological sensitivity on steep slopes, ridges and range tops. • High archaeological sensitivity areas immediately around outcrops of silcrete, chert or quartzite. • Moderate archaeological sensitivity on the lower margins of the range. • High archaeological sensitivity around semi-permanent and permanent water sources.
Mulga/ Mallee woodlands	• Low-Moderate archaeological sensitivity within sand plains, mallee and mulga forests. • Moderate archaeological sensitivity focused around semi-permanent water sources and stone resource areas.
Spinifex/Desert Oak sandplain	• Low archaeological sensitivity generally. • Moderate archaeological sensitivity focused around semi-permanent water sources and stone resource areas (gibber plains).

5. FIELD SURVEY: ABORIGINAL CULTURAL HERITAGE

5.1. Survey Strategy and Conditions

The archaeological or scientific aim of the cultural heritage survey was to locate physical evidence of Aboriginal occupation, the evidence of which is most commonly stone artefact scatters; individual (isolated) artefacts and in clear ground situations traces of bone (human and animal) and ash-stained earth that might represent fireplaces. The assessment methods aimed to inspect exposed ground surfaces as conditions would allow; to record any archaeological material found and assess its significance; and assess the potential for concealed Aboriginal archaeological sites. Survey was undertaken through targeted meandering pedestrian survey. Survey targeted areas of likely impact from the proposed exploration works as well as areas with increased likelihood to contain archaeological material. Photographs were taken as a record of general features and conditions and to document the degree of surface visibility. Notes were made of the degree of surface visibility, the area of visibility, ground cover, land uses and any other relevant features. A hand-held GPS (GDA 94 datum) is used to record locations of Aboriginal sites found, the extent of survey coverage except where fence lines, google and topographic mapping provided clear reference points.

An assessment of the constraints to site detection is made to assist in formulating a view as to the effectiveness of the field inspection to locate Aboriginal sites and cultural materials. It also assists in the forming of a view of the likelihood of concealed sites keeping in mind a site-specific knowledge of the impacts that European land uses and natural processes may have had on the 'survivability' of Aboriginal sites in an Assessment Area. The constraints to site detection are almost always most influenced by post European settlement land uses and in some areas by natural erosion processes. The effectiveness of a sampling strategy is based upon the extent (% sq. m.) and 'quality' (e.g.: 5%, 90%) of surface visibility. The area of surface exposure and the degree of surface visibility within exposed surfaces are usually the product of 'recent' land uses e.g. ploughing, road construction, natural erosion and accelerated (manmade) erosion (McDonald et al 1990:92).

The Palm Valley campsite and Mamlambo Campsites were not included within the survey as these activities will be restricted to areas of complete disturbance from previous operation. The following describes survey conditions at each of the Survey Areas (Table 9):

Table 9: Summary of survey conditions and constraints

Survey Area	Landform/ Vegetation type	Disturbance/ constraints to survey
Dingo 1 ST	Mulga/ Mallee woodlands and Spinifex/ Desert Oak	• Cattle Grazing. • Station/ Well site access track. • Some rubbish and evidence of small campsites
Dingo 5	Spinifex/ Desert Oak	• Cattle Grazing.
Orange Creek 3	Spinifex/ Desert Oak	• Cattle grazing
Palm Valley 12	Elevated ranges and jump-ups.	Nil
West Mereenie 27	Spinifex/ Desert Oak	• Former seismic line. • Existing infrastructure (WM01)
West Mereenie 28	Mulga/ Mallee woodlands and Spinifex/ Desert Oak	Nil
Mamlambo	Spinifex/ Desert Oak	Nil

5.2. Survey Coverage

Ground Surface Visibility ('GSV') is a measure of how much ground surface can be seen at the time of an archaeological survey. It is usually worked out as a percentage of the overall survey area, although it can also be worked out as a range when GSV changes dramatically. For this assessment, GSV was worked out by assessing a 1 m x 1 m area and inferring how much ground surface was visible within that. This gave a percentage of GSV within the square, which was extrapolated to a survey unit, so long as the ground conditions did not fundamentally change.

Table 10 presents information on the extent to which survey data provides sufficient evidence for an evaluation of the distribution of archaeological materials across the Survey Areas. The evaluation of survey coverage provides a measure of the potential for each of the landform elements to reveal archaeological evidence. The calculations do not provide an exact percentage of area but a reasonable estimate of ground available for sampling.

Table 10: Survey coverage calculation.

Survey Unit	Landform/ vegetation	Survey Unit Area (m^2)	Visibility/ cover (%)	Exposure / erosion (%)	Effective Coverage Area (m^2)	Effective Coverage (%)
Dingo 1 ST	Mulga/ Mallee woodlands and Spinifex/ Desert Oak	8000	50	50	2000	25
Dingo 5	Spinifex/ Desert Oak	13000	70	80	72800	56
Orange 3	Mulga/ Mallee woodlands and Spinifex/ Desert Oak	26000	80	80	16400	64
Palm Valley 12	elevated range and jump ups	4200	20	20	168	4
West Mereenie 27	Sand plain/ elevated range and jump ups	40857	50	50	10214	25
West Mereenie 28	Mulga/ Mallee woodlands and Spinifex/ Desert Oak	16000	60	30	2880	18
Mamlambo	Spinifex/ Desert Oak	11200	50	50	2800	25

5.3. Results

The most common 'type' of archaeological site located during the survey was low density stone artefact scatters comprising either small knapping areas or isolated artefacts. A localised knapping area and quarry was located immediately adjacent to Orange 3 (Orange 3_01 and Orange 3_02). An isolated grindstone fragment was located south of the access to Mamlambo which is considered unexpected, however grindstones are a common archaeological site feature in sandplain environments dominated by seeds. The most common raw material types were silcrete and quartzite, which is common across Central Australia, however some chert/ chalcedony artefacts were also located. The following describes the outcomes of the archaeological survey (Table 11).

Table 11: Archaeological survey results.

Survey Area	Site	Site type	Easting	Northing	Description
Dingo 1 ST	NIL				
Dingo 5	NIL				
Orange 3	Orange 3_01	Knapping site/ quarry	376329	70288	Moderately dense knapping area/ quarry using local gibber field.
	Orange 03_02	Artefact scatter	376285	7340311	Knapping area within sand depression adjacent to gibber quarry.
Palm Valley 12	Palm Valley 12-01	Silcrete artefact scatter	269380	7344137	Low density dispersed silcrete knapping area.
	Palm Valley 12_02	Silcrete isolated artefact	269380	7344137	Dark silcrete flake
	Palm Valley 12_03	Silcrete flake scatter	269462	7344037	Low density silcrete flake scatter (localised)
	Palm Valley 12_04	Silcrete isolated flake	269395	7344040	Light grey silcrete primary flake.
West Mereenie 27	West Meerenie 27 _01	Quartzite quarry	745762	7349454	Low density artefacts on the sand plain adjacent to a series of small quartzite outcrops that extend into the adjacent sand dune. The outcrops have higher artefact densities- consistent with small localised stone extraction sites.

Survey Area	Site	Site type	Easting	Northing	Description
West Mereenie 28	West Mereenie 28_01	Low density stone artefact scatter	757583	7344592	Scatter of approximately 4 quartzite flakes/ flake pieces and a single core
Mamlambo	Mamlambo_01	Grindstone fragment	605619	7382856	Sandstone/ Quartzite grindstone fragment (125mmx63mmx65mm). Grinding surface is oval and approximately 65mm x 110mm 10mm deep.

Figure 7: Orange 3 Survey Results

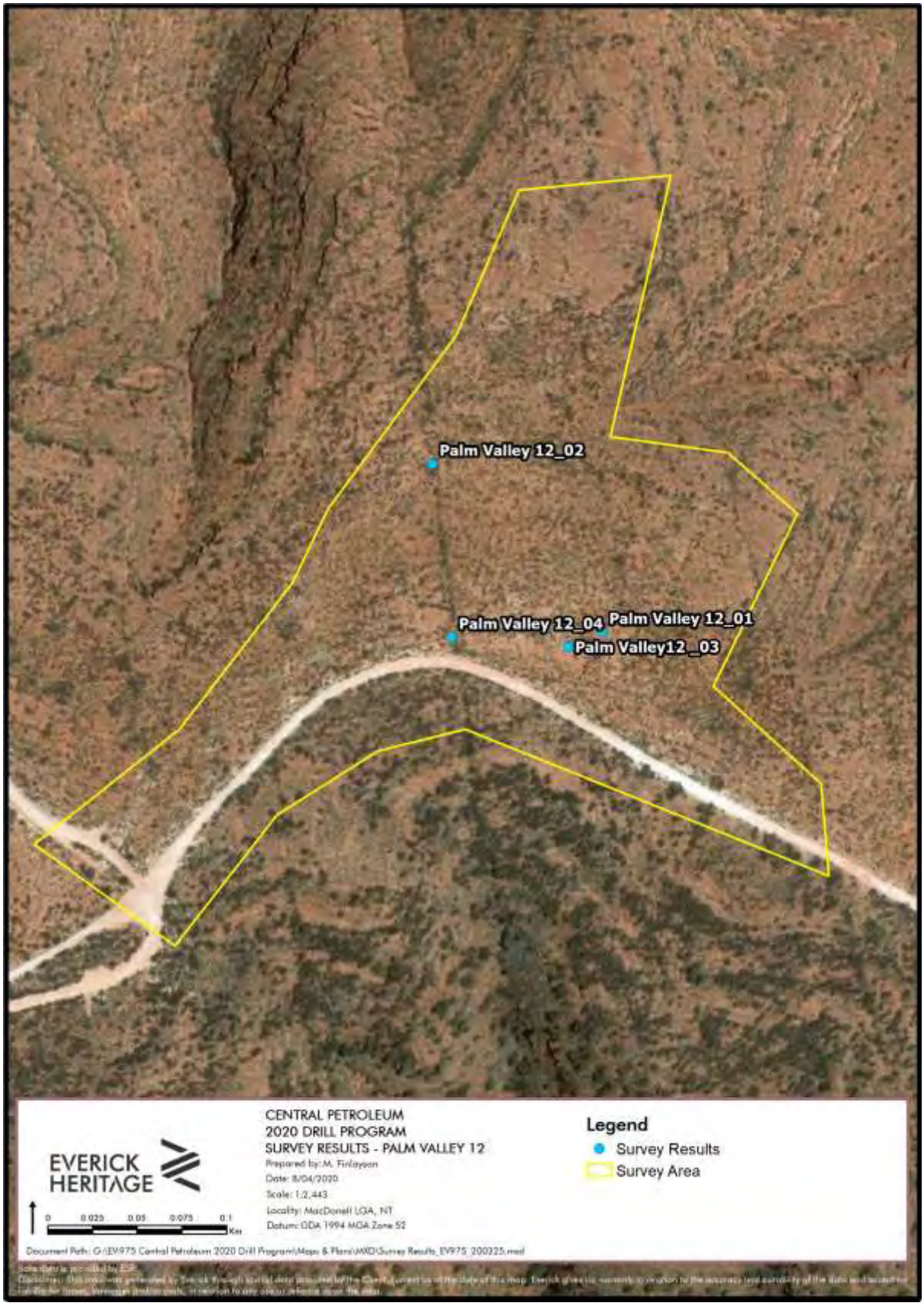

Figure 8: Palm Valley 12 Survey Results

Figure 9: West Meerenie 27 Survey Results

Figure 10: West Mereenie 28 Survey Results

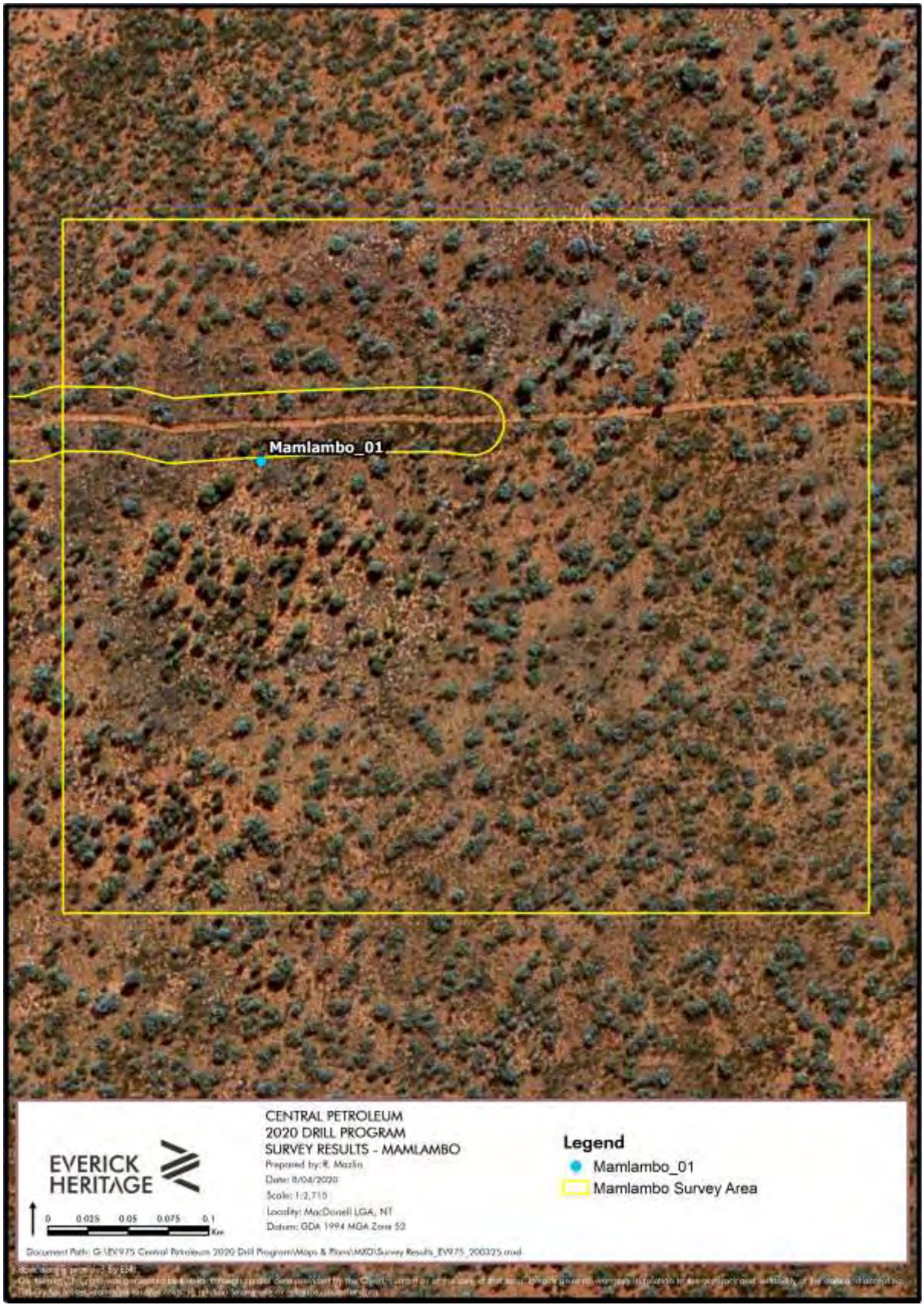

Figure 11: Mamlambo Survey Results

Figure 12: Orange 3_01 showing low calcrete/ gibber outcrop with spinifex

Figure 13: Orange 3_02 showing artefacts within sand dune depression

Figure 14: Palm Valley 12_01 showing elevated eroding rocky surface and spinifex

Figure 15: Palm Valley 12_02 showing typical dark silcrete primary flakes.

Figure 16: West Meerenie 27 (WM27) quarry site.

Figure 17: West Meerenie 27 (WM27) Artefact 1.

Figure 18: West Meerenie 27 proposed pipeline access route.

Figure 19: West Mereenie 28_01 showing surround mulga woodland.

Figure 20: West Mereenie 28_01 showing typical quartzite flakes.

Figure 21: Mamlambo_01: dorsal surface of grind stone fragment.

Figure 22: Mamlambo_01: profile of grindstone fragments showing ground surface (top).

6. DISCUSSION AND MANAGEMENT RESPONSE

As a result of the desktop study and the archaeological investigation it is possible to make the following statements regarding the potential of the Central Petroleum 2020 drill program to impact on Aboriginal objects.

- Works within the Dingo 1 ST Survey Area are not likely to impact on Aboriginal sites.
- Works within the Dingo 5 Survey Area are not likely to impact on Aboriginal sites.
- Works within the Orange 3 well site have the potential to impact on the Orange 3_01 knapping site and quarry. However, works on the low sandy flat have a low potential to impact on Aboriginal archaeological sites.
- Works within the Palm Valley 12 Survey Area have the potential to impact on Aboriginal objects, however the conservation value of the objects is relatively low as the artefacts occur in low densities and the sites do not demonstrate a high degree of diversity or technological adaptation.
- Works within the West Mereenie 27 Survey Area have the potential to impact on the West Mereenie 27_01 quarry and stone artefact scatter site. However, works on the surrounding sand plain below the small localised rocky outcrops have a low potential to impact on Aboriginal archaeological sites. It is likely that the focus of Aboriginal use of the site is the small mallee outcrops and claypans to the south of the rocky outcrops.
- Works within the West Mereenie 28 have the potential to impact on the West Mereenie_01 knapping site which appears to be associated with the small elevated rocky ridge to the east of the site. However, works on the surrounding sand plain below the rocky ridge have a low potential to impact on Aboriginal archaeological sites.
- Works within the Mamlambo Survey Area have the potential to impact on the Mamlambo 01 grindstone fragment. This artefact is locally rare and a relatively unique example of technological adaptation in the western desert. Works in the surrounding sand plain have the potential to impact on isolated flakes or the other portion of the grindstone.

Having consideration for the nature and extent of archaeological sites and the potential for those sites to be impacted by the Proposed Works, the following Table is provided as a framework for the management of Aboriginal archaeological sites (Table 12).

Table 12: Managment Response table

Survey Area	Site	Management Response
Dingo 1 ST	NIL	Implementation of an Aboriginal objects find/ Stop Work procedure.
Dingo 2	NIL	Implementation of an Aboriginal objects find/ Stop Work procedure.
Orange 3	Orange 3_01	Implementation of a heritage exclusion area (Figure 23). Implementation of an Aboriginal objects find/ Stop Work procedure.
Palm Valley 12	Palm Valley 12_01-04	Application for a Heritage Act Works Approval (s75)
West Mereenie 27	West Mereenie 27_01	Implementation of a heritage exclusion area (Figure 24). Implementation of an Aboriginal objects find/ Stop Work procedure.
West Mereenie 28	West Mereenie 28_01	Implementation of a heritage exclusion area (Figure 25). Implementation of an Aboriginal objects find/ Stop Work for residual area.
Mamlambo	Mamlambo_01	Implementation of a heritage exclusion area (Figure 26). Implementation of an Aboriginal objects find/ Stop Work procedure for residual area.

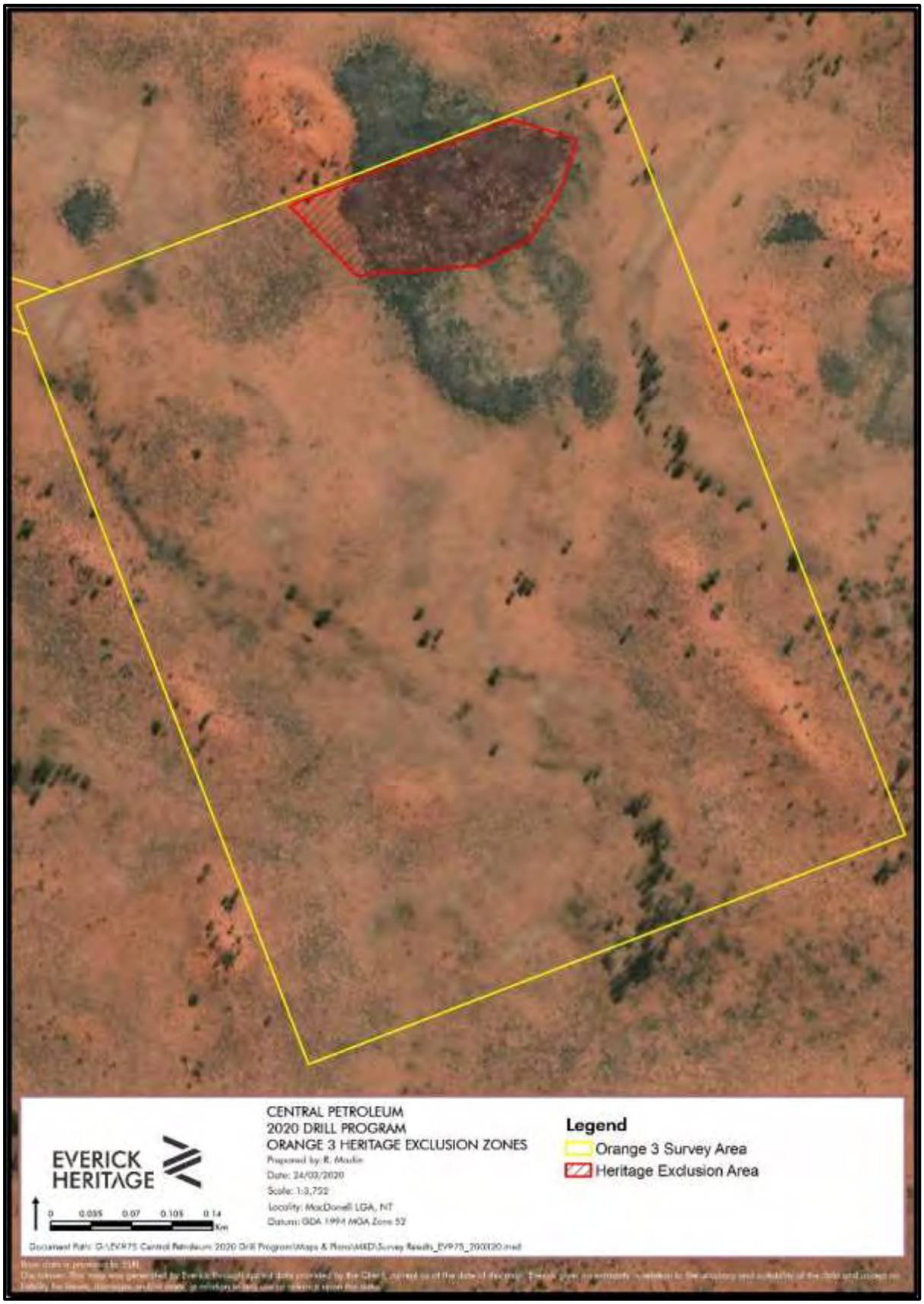

Figure 23: Orange 3 Heritage exclusion area.

Figure 24: West Mereenie 27 Heritage Exclusion Area

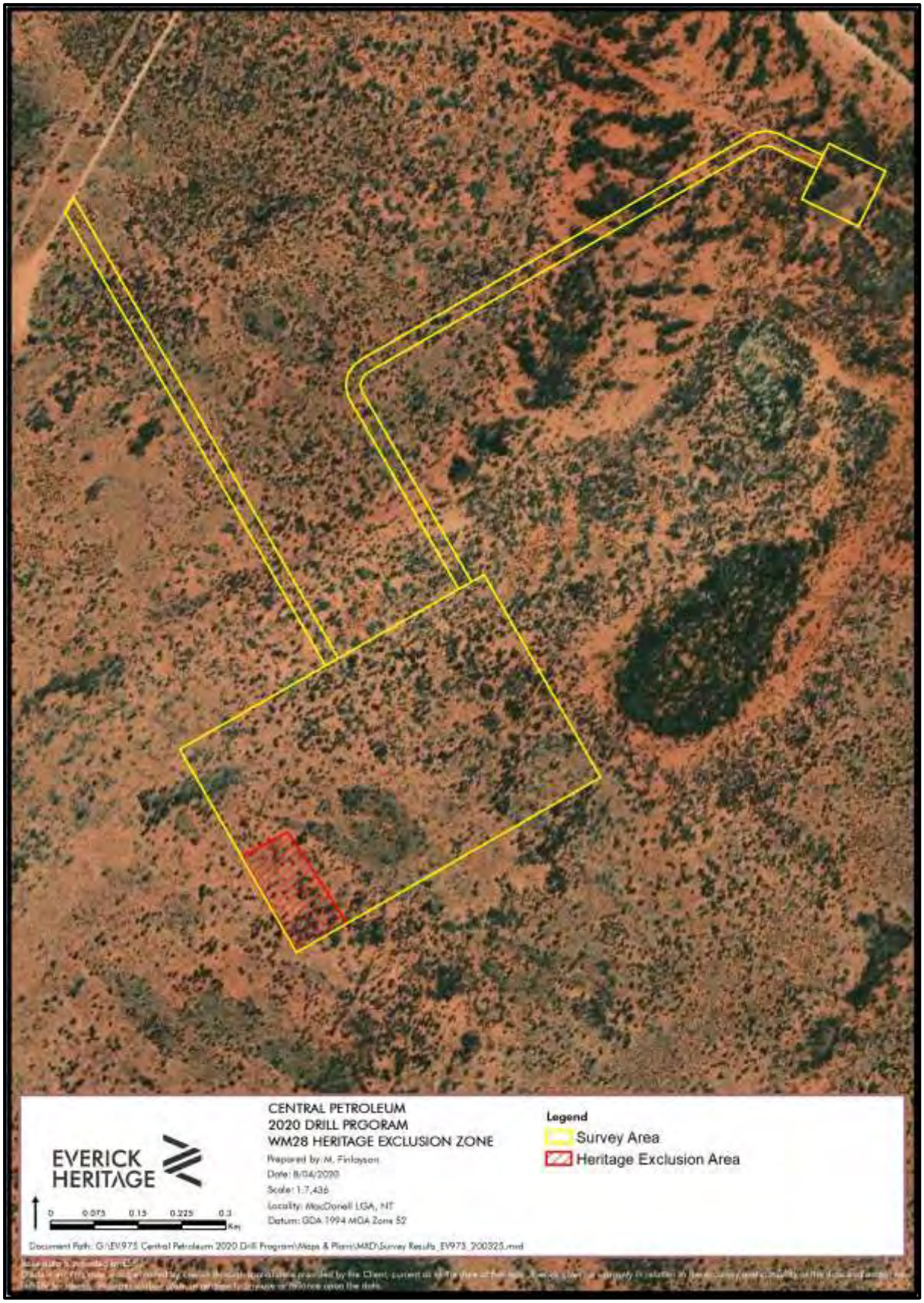

Figure 25: West Mereenie 28 Heritage Exclusion Area

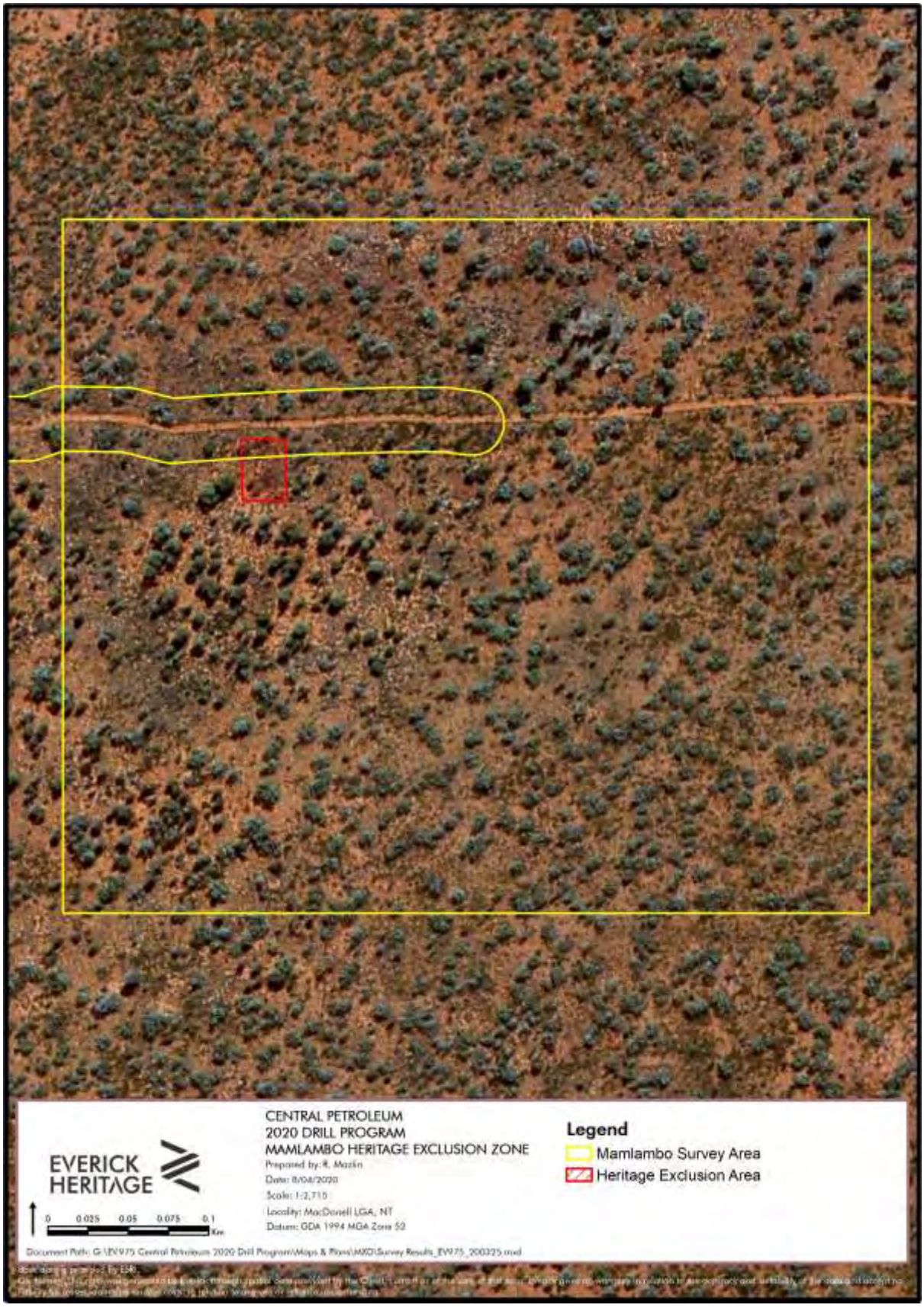

Figure 26: Mamlambo 01 Heritage Exclusion Area

7. RECOMMENDATIONS

Having consideration for the outcomes of the survey it is reasonable to conclude that the Proposed Works have the potential to impact on Aboriginal objects. As such the following recommendations are provided.

Recommendation 1: Aboriginal Object Find/ Stop Work Procedure.

If suspected Aboriginal material has been uncovered because of development activities within the Survey Areas:

- work in the surrounding area is to stop immediately;
- a temporary fence or barrier is to be erected around the site, with a buffer zone of at least 10 metres around the known edge of the site;
- an appropriately qualified archaeological consultant is to be engaged to identify the material, either in person or remotely;
- if the material is found to be of Aboriginal origin and it has been determined that the objects has been disturbed or damaged the NT Heritage Branch should be notified.
- if the material is found to be of Aboriginal origin and it has been determined that the objects have not been disturbed or damaged the works program and EMP should be revised to avoid works in the vicinity of the site.

Recommendation 2: Aboriginal Human Remains

Although it is unlikely that Human Remains will be located at any stage during earthworks within the Survey Area, should this event arise it is recommended that all works must halt in the immediate area to prevent any further impacts to the remains. The Site should be cordoned off and the remains themselves should be left untouched. The nearest police station and the NT Heritage Branch all to be notified as soon as possible. If the remains are found to be of Aboriginal origin and the police do not wish to investigate the Site for criminal activities, the Aboriginal community and the Heritage Branch should be consulted as to how the remains should be dealt with. Work may only resume after agreement is reached between all notified parties, provided it is in accordance with all parties' statutory obligations.

Recommendation 3: Heritage exclusion areas.

It is recommended that heritage exclusion areas are established around sites with conservation value. Strategies for the implementation of the exclusion areas include;

- Redesign of site layouts to ensure at least 10 metre buffers to all exclusion areas.
- Installation of fencing or bunting to delineate the exclusion area,
- Identification of exclusion areas on all plans which are included in work contracts.

- Identification of exclusion areas in all site establishment meetings and inductions for new staff.

Recommendation 4: Works Approval.

It is recommended Works Approval under the Heritage Act (2011) is obtained for the following sites;

- Orange 2_03 and Orange 2-04 including similar isolated artefacts and low-density artefact scatters.
- Palm Valley 12 (01-04) including all artefacts within the approved work area.

Application for the works approval should proposed the following conditions;

- Collection and analysis of artefacts by a suitably qualified person;
- Relocation of the artefacts in an area adjacent to the works area;
- Notification of the relocation area to the NT Heritage Branch including a detailed analysis of the artefacts; and
- Establishment of a heritage exclusion area (as outlined in Recommendation 3) around the artefact relocation area.

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9. APPENDIX 1: CORRESPONDENCE FROM HERITAGE NT

From: Dianne Bensley <Dianne.Bensley@nt.gov.au>

Sent: Thursday, 5 March 2020 2:49 PM

To: Tim Hill <t.hill@everick.net.au>

Subject: FW: Aboriginal Heritage Inquiry

Hi,

Apologies for forgetting to copy you in on the original reply! See below. Let me know if you need any further information.

Cheers,

Di

Dianne Bensley

Senior Heritage Officer

Heritage Branch

Parks, Wildlife and Heritage Division

Department of Tourism, Sport and Culture I

Northern Territory Government

Level 1 JHV2, Jape Homemaker Village,

356 Bagot Road, Millner, NT, 0810

PO Box 1448, Darwin, NT 0801

P: (08) 8999 5051 I

E: dianne.bensley@nt.gov.au

W: www.nt.gov.au

From: Dianne Bensley

Sent: Monday, 24 February 2020 4:28 PM

To: 'Robbie Mazlin' <r.mazlin@everick.net.au>

Subject: RE: Aboriginal Heritage Inquiry

Hi Robbie,

Apologies for the delay in getting back to you on this, but we are extremely short-staffed at the moment and it got away from me!

I have plotted your survey areas in my GIS program and it appears that there are no declared heritage places, nor any previously recorded Aboriginal archaeological sites located within close proximity to any of your proposed project areas.

The only area of concern was the Proposed WM28 clearance area and access, which had some rock art sites and stone artefact scatters located about 3.5km away to the east.

I have attached an aerial map extract. There may be other Aboriginal archaeological sites closer to your proposed project area so the fact that you are conducting cultural heritage surveys commencing this week is a good plan.

Let me know if you require any further information.

Regards,

Di

Dianne Bensley

Senior Heritage Officer

Heritage Branch

Parks, Wildlife and Heritage Division

Department of Tourism, Sport and Culture I

Northern Territory Government

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P: (08) 8999 5051 I

E: dianne.bensley@nt.gov.au

W: www.nt.gov.au

From: Robbie Mazlin <r.mazlin@everick.net.au>

Sent: Tuesday, 18 February 2020 12:03 PM

To: Heritage Branch <Heritage.Branch@nt.gov.au>

Cc: Tim Hill <t.hill@everick.net.au>

Subject: Aboriginal Heritage Inquiry

Good afternoon Di,

Thank you for your time on the phone earlier, as discussed we are preparing for upcoming cultural heritage surveys commencing next week.

The attached KML files indicate the requested survey areas.

If you could provide any information on Aboriginal heritage at these locations that would be much appreciated!

Kind regards,

Robbie Mazlin

Archaeologist

Ph: (07) 3211 4478

"redacted"

Everick Heritage Pty Ltd

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Appendix 4 Baseline Bore Results

Analyte	Unit	Limit of Reporting	Drinking Water Guideline[1]	Stock Water Guideline[2]	RN006503	RN018463	RN018955	RN017657	RN011831
Field Parameters									
Associated well					Palm Valley-12	Mamlambo-1	West Mereenie	West Mereenie	Orange-3
Groundwater level	mTOC	-	-	-	Artesian	10.01	No access	No access	No access
Electrical Conductivity	µS/cm	-	-	-	1045	5130	444	810	1525
pH	pH Unit	-	6.5 - 8.5^	-	7.25	8.8	7.0	7.0	7.15
Temperature	° C	-	-	-	29.7	28.3	28.7	28.5	28.6
General Laboratory Analytes									
pH	pH Unit	0.01	6.5 - 8.5^	-	8.13	9.05	7.62	7.56	8.01
Sodium Adsorption Ratio	-	0.01	-	-	2.67	55.6	2.12	2.54	2.85
Electrical Conductivity	µS/cm	1	-	-	1460	4560	406	722	1390
Total Dissolved Solids	mg/L	10	1200	4000	949	2960	264	469	904
Total Suspended Solids	mg/L	5	-	-	<5	39	<5	6	<5
Total Hardness	mg/L	1	200^	-	484	46	78	160	419
Alkalinity									
Hydroxide Alkalinity	mg/L	1	-	-	<1	<1	<1	<1	<1
Carbonate Alkalinity	mg/L	1	-	-	<1	18	<1	<1	<1
Bicarbonate Alkalinity	mg/L	1	-	-	264	15	55	64	298
Total Alkalinity	mg/L	1	-	-	264	33	55	64	298
Dissolved Cations and Anions									
Calcium	mg/L	1	-	1000	113	15	13	28	77
Magnesium	mg/L	1	-	-	49	2	11	22	55
Sodium	mg/L	1	180^	-	135	864	43	74	134
Potassium	mg/L	1	-	-	10	108	12	16	15
Chloride	mg/L	1	250^	-	193	1200	67	126	234
Sulfate	mg/L	1	250^	1000	262	350	34	101	122
Fluoride	mg/L	0.1	1.5	-	0.2	4.3	0.5	0.6	1.2
Ionic Balance									

Analyte	Unit	Limit of Reporting	Drinking Water Guideline[1]	Stock Water Guideline[2]	RN006503	RN018463	RN018955	RN017657	RN011831
Total Anions	meq/L	0.01	-	-	16.2	41.8	3.7	6.94	15.1
Total Cations	meq/L	0.01	-	-	15.8	41.2	3.73	6.84	14.6
Ionic Balance	%	0.01	-	-	1.17	0.65	0.46	0.72	1.73
Nutrients									
Nitrite as N	mg/L	0.01	3	30	<0.01	<0.01	<0.01	<0.01	<0.01
Nitrate as N	mg/L	0.01	50	400	0.01	<0.01	0.44	1.54	0.41
Nitrite + Nitrate as N	mg/L	0.01	-	-	0.01	<0.01	0.44	1.54	0.41
Dissolved Silica									
Silicon as Si02	mg/L	0.1	80^	-	19.6	0.3	12.8	14.4	15.8
Dissolved Metals									
Arsenic	mg/L	0.001	0.01	0.5	<0.001	<0.001	<0.001	<0.001	<0.001
Barium	mg/L	0.001	2	-	0.051	0.037	0.034	0.06	0.071
Cadmium	mg/L	0.0001	0.002	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	0.05	1	<0.001	<0.001	<0.001	0.001	<0.001
Copper	mg/L	0.001	2	1	<0.001	<0.001	<0.001	0.002	<0.001
Lead	mg/L	0.001	0.01	0.1	<0.001	<0.001	<0.001	<0.001	<0.001
Lithium	mg/L	0.001	-	-	0.046	0.015	<0.001	0.002	0.012
Manganese	mg/L	0.001	0.5	-	0.054	<0.001	0.082	0.003	0.008
Selenium	mg/L	0.01	0.01	1	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	mg/L	0.001	0.1	-	<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	mg/L	0.001	-	-	0.88	1.53	0.145	0.247	0.712
Zinc	mg/L	0.005	3^	20	<0.005	<0.005	<0.005	0.033	0.111
Boron	mg/L	0.05	4	5	<0.05	0.5	0.14	0.21	0.24
Iron	mg/L	0.05	0.3^	-	0.81	<0.05	0.1	<0.05	<0.05
Mercury	mg/L	0.0001	0.001	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Total Metals									
Arsenic	mg/L	0.001	0.01	0.5	0.001	0.002	<0.001	<0.001	<0.001
Barium	mg/L	0.001	2	-	0.055	0.042	0.035	0.065	0.074
Cadmium	mg/L	0.0001	0.002	0.01	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Chromium	mg/L	0.001	0.05	1	<0.001	<0.001	0.003	0.003	0.025

Analyte	Unit	Limit of Reporting	Drinking Water Guideline[1]	Stock Water Guideline[2]	RN006503	RN018463	RN018955	RN017657	RN011831
Copper	mg/L	0.001	2	1	0.002	<0.001	<0.001	0.004	<0.001
Lead	mg/L	0.001	0.01	0.1	<0.001	<0.001	<0.001	<0.001	0.005
Lithium	mg/L	0.001	-	-	0.046	0.015	<0.001	0.002	0.012
Manganese	mg/L	0.001	0.5	-	0.057	0.03	0.086	0.004	0.011
Selenium	mg/L	0.01	0.01	1	<0.01	<0.01	<0.01	<0.01	<0.01
Silver	mg/L	0.001	0.1	-	<0.001	<0.001	<0.001	<0.001	<0.001
Strontium	mg/L	0.001	-	-	0.937	1.66	0.153	0.259	0.765
Zinc	mg/L	0.005	3^	20	0.011	<0.005	<0.005	0.042	0.172
Boron	mg/L	0.05	4	5	<0.05	0.46	0.12	0.15	0.18
Iron	mg/L	0.05	0.3^	-	2.91	20.5	1.09	0.46	1.04
Mercury	mg/L	0.0001	0.001	0.002	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Total Petroleum Hydrocarbons									
C6 - C9 Fraction	µg/L	20	-	-	<20	<20	<20	<20	<20
C10 - C14 Fraction	µg/L	50	-	-	<50	<50	<50	<50	<50
C15 - C28 Fraction	µg/L	100	-	-	<100	270	<100	<100	<100
C29 - C36 Fraction	µg/L	50	-	-	<50	<50	<50	<50	<50
C10 - C36 Fraction (sum)	µg/L	50	-	-	<50	270	<50	<50	<50
Total Recoverable Hydrocarbons									
C6 - C10 Fraction									
C6 - C10 Fraction minus BTEX (F1)									
>C10 - C16 Fraction									
>C16 - C34 Fraction									
>C34 - C40 Fraction									
>C10 - C40 Fraction (sum)									
>C10 - C16 Fraction minus Naphthalene (F2)									

Appendix 5 Erosion and Sediment Control Plan

PRIMARY EROSION AND SEDIMENT CONTROL PLAN

CP 2020 Gas Wells

Prepared for:

Enviro-Value Pty Ltd
110 Camp Street
Toowong Qld 4066

SLR Ref: 620.13770-R01
Version No: 5.0
November 2020

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Enviro-Value Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
620.13770-R01-v5.0	9 November 2020	Nicole Bichel	Helen Doherty	
620.13770-R01-v4.0	16 October 2020	Nicole Bichel	Helen Doherty	
620.13770-R01-v3.0	20 August 2020	Nicole Bichel	Helen Doherty	
620.13770-R01-v2.0	6 May 2020	Nicole Bichel	Helen Doherty	Mark Caslin
620.13770-R01-v1.0DRAFT	23 April 2020	Nicole Bichel	Kim Walker	Mark Caslin
620.13770-R01-v0.4	2 March 2020	Nicole Bichel		

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1 Introduction

SLR have been engaged by Enviro-Value Pty Ltd to prepare a Primary Erosion and Sediment Control Plan (ESCP) for the 2020 exploration drilling program for Central Petroleum. The exploration program includes one well within the Dingo Field (re-entry at Dingo 1 or a new drill at Dingo 5), two wells at Mereenie (Mereenie 27 and 28), one well at Palm Valley (PV12), one well at Orange (Orange 3) and one well at Mamlambo (Mamlambo 1). These primary erosion and sediment control plans have been developed to assess the potential of erosion to each site and prevent impacts external to the site due to the discharge of sediment laden water to waterways.

1.1 Objectives

The aim of this ESCP is to:

- Prevent erosion and control sediment discharge, which may occur as a result of the Project activities;
- Manage stormwater and protect water quality downstream of the sites; and
- Provide adequate pollution and drainage control measures for areas disturbed as a result of the Project

The objective of this primary ESCP is to manage the proposed activities to minimise land and water impacts from activities which result in soil disturbance.

1.2 Legislation & Guidelines

This ESCP has been developed in accordance with, and taken guidance from, the following documents:

- Code of Practice: Onshore Petroleum Activities in the NT, 2019
- Best Practice Erosion and Sediment Control (IECA, 2008)
- NTEPA Erosion and Sediment Control Plan Content (formally NRETAS, 2006)
- Land Clearing Guidelines (DENR, 2019)
- Erosion and Sediment Control Guidelines for Rural Development Environment Fact Sheet (DLRM, 2018)
- Soil Conservation and Land Utilization Act (NT, Current Version)
- Waste Management and Pollution Control Act (NT, Current Version)
- Water Act (NT, Current Version)

This plan has been undertaken by Nicole Bichel who holds a Bachelor of Engineering (Environmental). Nicole has 5 years' experience in developing Erosion and Sediment Control plans for urban, mining and gas clients. This ESCP has been reviewed by Helen Doherty who has over 25 years' experience in civil engineering, surface water and erosion and sediment control plans. Nicole and Helen are both considered as suitably qualified personnel to develop a primary erosion and sediment control plan.

2 Assessment Methodology

It is understood that Section A.3.1 of the Code of Practice: Onshore Petroleum Activities in the Northern Territory (COP) states that the planning design and location of the infrastructure must have regard to the considerations in the Northern Territory Planning Scheme Land Clearing Guidelines (LCG).

Well pads have been located in consideration of all site constraints, including (but not limited to) slope, ecological significance, cultural heritage, flooding/overland flow and resource availability. The proposed constructed well pads will be flat (<1%), dependant on civil design of the cut/fill. All sites except for Orange and Mamlambo are constrained by the 2% slope mapping produced by NT Government. That being said, the mapping is not entirely reflective of the site characteristics due to the grid resolution of the data and use of SRTM terrain. LiDAR (where available) has been used to determine maximum slopes within the disturbance areas for this assessment.

The general approach in management of clearing on steeper lands includes:

- Detailed ESCP for the land clearing and construction phase of the works;
- Clean water diversions with spreaders to intercept overland flow;
- Appropriate treatment of construction batters with erosion and sediment control devices; and
- Treatment of sediment laden runoff from the well pad and downstream batters.

Each site has been assessed to determine whether relocation was possible to avoid areas of slope greater than 2%. A summary of findings has been provided below.

Table 1 Site location assessment

Lease Name	Site	Constraints
Orange	Orange 3	Disturbance area slope of 0.4%. Well pad has been located based on environmental, cultural and operational constraints as outlined in the EMP.
Palm Valley West	PV12	Disturbance area slope of 6%. To be managed through civil design and appropriate ESCP controls for high-risk clearing as outlined in the LCG. Well pad has been located based on environmental, cultural and operational constraints as outlined in the EMP.
Mereenie	Mereenie 27	Disturbance area has isolated areas of 4% slope. To be managed through civil design and appropriate ESCP controls for high-risk clearing as outlined in the LCG. Well pad has been located based on environmental, cultural and operational constraints as outlined in the EMP.
	Mereenie 28	Disturbance area has a slope of 1.6%. LiDAR shows slopes are less than 2% although triggered by NT Government 2% slope mapping. Well pad has been located based on environmental, cultural and operational constraints as outlined in the EMP.
Dingo	Dingo 1	Disturbance area has a slope of 1.5%. SRTM shows slopes are less than 2% although triggered by NT Government 2% slope mapping. Well pad is existing.

Lease Name	Site	Constraints
	Dingo 5	Slope of 1.3% based on SRTM data. Site is located west of steeper ridgeline. Well pad has been located based on environmental, cultural and operational constraints as outlined in the EMP.
Mamlambo	Mamlambo 1	Slope of 1.3% based on SRTM data. Site is located west of steeper ridgeline. Well pad has been located based on environmental, cultural and operational constraints as outlined in the EMP.

It is understood that for areas of slope greater than 2%, the construction ESCP plan will need to assess the sites as high risk with appropriate controls to prevent erosion and treat any sediment laden runoff from the site. A slope assessment has been carried out for all sites. Details of this assessment cannot be carried out at this stage of assessment as the construction plans are not available. This is in accordance with the LCG which states *"an ESCP should not be formalised until after a permit has been issued and all other necessary design or management plans have been finalised"*. This approach is supported as an ESCP plan should detail all required activities proposed and provide a clear and concise plan for contractors to follow.

3 Project Information

The project is proposed to be across six separate sites within the Northern Territory. This plan covers all associated civil, drilling, rehabilitation and maintenance activities to be carried out over the project sites. Table 2 outlines the site location for the 2020 Exploration Program. **Figure 1** shows the location of all sites assessed.

Table 2 Site location and activity summary

Lease Name	Site	Easting	Northing
Orange	Orange 3	130° 2" 15'	23° 39" 45'
Palm Valley West	PV12	132° 44" 0'	24° 0" 0'
Mereenie	Mereenie 27	131° 25" 15'	23° 57" 15'
	Mereenie 28	131° 32" 0'	23° 59" 15'
Dingo	Dingo 1	133° 53" 46'	24° 13" 28'
	Dingo 5	133° 53" 0'	24° 13" 30'
Mamlambo	Mamlambo 1	130° 2" 15'	23° 39" 45'

-1800000
-1700000
-1600000
-1500000
7300000
7200000
7100000
Elkhi Creek
Waite Creek
Alice Springs
Orange 3
87
Palm Valley 12
Dingo 5
Mamlambo 1
West Mereenie 27
West Mereenie 28
Hugh Creek
Finke River
Lake Neale

CENTRAL PETROLEUM
2020 EXPLORATION PROJECT

Flood Impact Assessment
Site Locations

FIGURE 1

Indicative Well Pad Location

0 25 50 km

Coordinate System:	GDA 1994 MGA Zone 56
Scale:	1:1,250,000 at A4
Project Number:	620.13770
Date:	5/05/2020
Drawn by:	PM

SLR

H:\Projects-SLR\620-BNE\620-BNE\620.13770 Surface Water Assessment – CP 2020 Gas Well Program (NT)\06 SLR Data\01 CADGIS\GIS\ArcGIS\62013770_A3L_FS_WellLocations.mxd

3.1 Disturbance Areas

The project sites are proposed to have the maximum disturbance areas shown in **Table 3**. The disturbance areas may be changed slightly in order to minimise any environmental or heritage impacts. In the event that larger disturbance areas (greater than 10%) are required outside of the nominated disturbance areas identified in **Table 3**, the ESCP should be revised to ascertain that the proposed mitigation measures are sufficient for the additional disturbance.

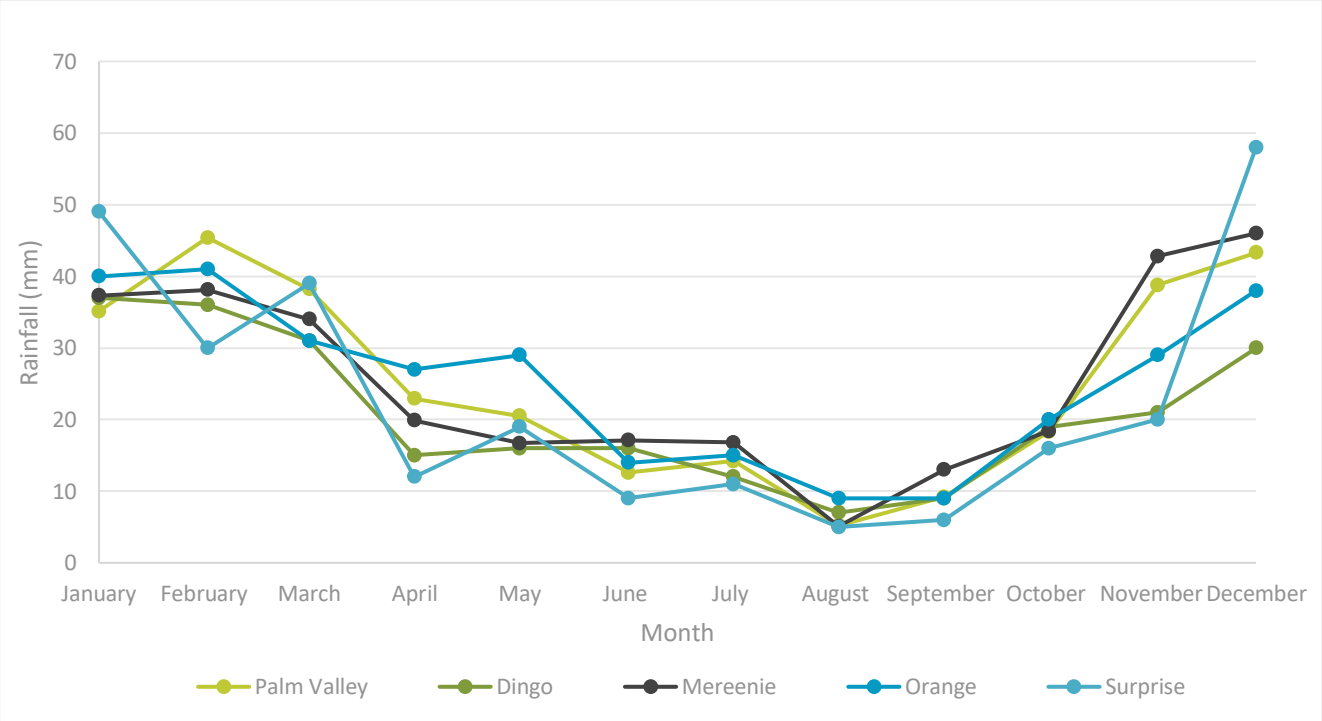
Table 3 Disturbance Areas

Lease Name	Site	Easting	Northing	Disturbance Area
Dingo	Dingo 1	133° 53" 46'	24° 13" 28'	**35ha** clearance area including **1.5ha** disturbance area.
	Dingo 5	133° 53" 0'	24° 13" 30'	**84ha** clearance area including **1.5ha** disturbance area.
Mereenie	Mereenie 27	131° 25" 15'	23° 57" 15'	**31ha** clearance area including **1.5ha** disturbance area.
	Mereenie 28	131° 32" 0'	23° 59" 15'	**24ha** clearance area including **1.5ha** disturbance area. Additional **2.5ha** clearing area for access road construction and **3.6ha** for pipeline works. **1.5ha** disturbance area for construction of the joint camp (Mereenie 27 &28)
Palm Valley West	PV12	132° 44" 0'	24° 0" 0'	**11.5ha** clearance area including **1.5ha** disturbance area. Additional 5-6ha clearing area for access road construction.
Orange	Orange 3	130° 2" 15'	23° 39" 45'	**38.5ha** clearance area including **1.5ha** disturbance area.
Mamlambo	Mamlambo 1	130° 2" 15'	23° 39" 45'	**21.6ha** clearance area including **1.5ha** disturbance area. Additional **5-6ha** clearing area for access road construction. Camp infrastructure is located within existing cleared area.

4 Climate

The project experiences two distinct seasons: a hot, wet season from November to March and a warm, dry season from May to September. April and October are transitional months between the wet and dry seasons. Annual rainfall is highly variable but the majority of rainfall, and thus potential surface water impacts, occurs between December and March each year, under the influence of the seasonal monsoon weather system in Northern Australia (Figure 2). This data has been derived from the closest Bureau of Meteorology (BOM) rainfall gauge to the sites.

Figure 2 Average Rainfall (mm) for each project site



5 Sources of Erosion and Sedimentation

The following activities have been identified as activities that could cause soil erosion and generate sediment unless controlled:

- Stripping of vegetation, subsoil and topsoil;
- Stockpiling of subsoil and topsoil;
- Earthworks activities;
- Construction of water management structures (i.e. clean water diversions, dirty water channels and sediment dams);
- Construction / upgrades of river crossings;
- Construction/maintenance of roads and surface facilities (i.e. surface compound, cultural centre etc); and
- Vehicle and machinery movements.

The transport of sediment off site and into natural drainage systems can have a wide range of detrimental effects including safety, social, economic and environmental impacts. Pollution can occur in the form of finer sediment fractions such as silts and clays that create turbid water, and also in the form of coarse sediments such as sand particles that travel off-site.

The potential impacts of fine and coarse sediment runoff for minor waterways are shown in **Table 4** below. The erosion and sediment control plan uses appropriate management techniques to assist in reducing potential impacts to the environment.

Table 4 Potential Impacts of Fine and Coarse Sediment Runoff (adapted from IECA 2008)

Environment	Fine Sediment (turbidity)	Coarse Sediment
Minor waterways such as creeks	• Health and biodiversity issues for aquatic life within permanent pools • Water quality and aquatic health issues associated with desilting operations, especially if the deposited sediment contains significant metal concentrations • Turbid water retained in pools • Reduced light penetration into water column	• Loss of aquatic habitats • Increased potential for creek erosion • Water quality and aquatic health issues associated with de-silting operations • Social cost of increased drainage and flooding problems • Economic cost of de-silting and rehabilitating waterways • Ecological damage resulting from de-silting activities

6 Erosion Risk Assessment

The erosion risk assessment takes into account the erosion risk due to rainfall, the erosivity of the soil and the likely soil loss volume to determine an overall risk level. This risk level allows for appropriate control measures to be applied to reduce erosion and control sediments leaving the site.

6.1 Soil Loss Estimate

A soil loss estimate has been undertaken for all project sites, with the method detailed in **Appendix A**. A summary of the estimated number of tonnes of soil loss per hectare per year is presented in **Table 5**.

Table 5 Annual Average Soil Loss Estimate

Site	R Factor	K Factor	LS factor	C Factor	P factor	Estimate Soil Loss (tonnes/ha/yr)
Orange	1200	0.025	0.24	1	1.3	11.2
Palm Valley	1200	0.03	1.47	1	1.3	68.8
Mereenie - 27	1200	0.03	0.69	1	1.3	32.3
Mereenie - 28	1200	0.025	8.68	1	1.3	27.1
Dingo	1200	0.025	0.24	1	1.3	11.2
Mamlambo	1200	0.025	0.58	1	1.3	27.2

6.2 Erosion Risk - Rainfall

An erosion risk assessment has been carried out in accordance with IECA guidelines, using the closest or longest record rainfall gauge data from the Bureau of Meteorology (BOM).

The rainfall gauges used for this assessment were:

- Station 015590 (Alice Springs Airport) for Dingo and Orange. Deep Well Rainfall gauge is closer to the site, however the Alice Springs Airport gauge provides a longer record and the Deep Well gauge was not considered to have a sufficient length of record.
- Station 015633 (Palm Valley Gauge) is the closest gauge to Palm Valley 12 site and has a sufficient length of record.
- Station 015652 (Watarrka) is located 60km south of Mereenie and was selected for the Mereenie West 27 & 28 sites. The Mereenie gauge is located closer to the site, however the gauge record is incomplete.
- Station 015664 was used for the Mamlambo site as it was located closest to the site.

The monthly average rainfall for each month is used to determine the potential erosion risk, based on the following criteria.

Table 6 Monthly Average Soil Loss Estimate

Monthly Average Rainfall (mm)	Risk Rating
0 to 30	Very Low
30+ to 45	Low
45+ to 100	Moderate
100+ to 225	High
>225	Extreme

The risk assessment has been carried out for each site and is summarised below in **Table 7**.

Table 7 Monthly Rainfall Erosion Risk Rating

Site	Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Palm Valley	Rainfall	35	45	38	23	21	13	14	5	9	18	39	43.3
	Erosion Risk	Low	Mod	Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Low	Low
Dingo	Rainfall	40	41	31	16	19	13	15	9	9	20	28	38
	Erosion Risk	Low	Low	Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Low
Mereenie	Rainfall	46	40	29	13	22	15	13	6	10	25	45	37
	Erosion Risk	Mod	Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Low	Low
Orange	Rainfall	40	41	31	27	29	14	15	9	9	20	29	38
	Erosion Risk	Low	Low	Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Low
Mamlambo	Rainfall	47.8	30.3	39.5	12.8	17.4	9.1	12.1	4.4	7.3	15.8	20.7	59
	Erosion Risk	Mod	Low	Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Mod

6.3 Erosion Risk – Wind

Wind erosion is associated with arid zone landscapes or coastal sand masses, and can result in long-term land degradation due to loss of finer topsoil and re-deposition of mobilized wind-blown sediment. The risk of wind erosion is high wherever exposed soils are subjected to wind forces. Wind speeds increase from August through to March with October to February typically the most intense.

Figure 3 shows that the mean 3pm wind speeds are at a peak in October and February. The project sites are generally exposed to prevailing winds from the east, with winds greater than 40km/h predominately experienced from the east, north and south east.

Wind rose from the Alice Springs Airport Gauge (015590) and Watarrka Gauge (015652) (**Figure 4 and Figure 5**) show the rose of wind direction vs wind speed. Wind direction tends to move from the north west to the south east throughout the program of works period from October to January.

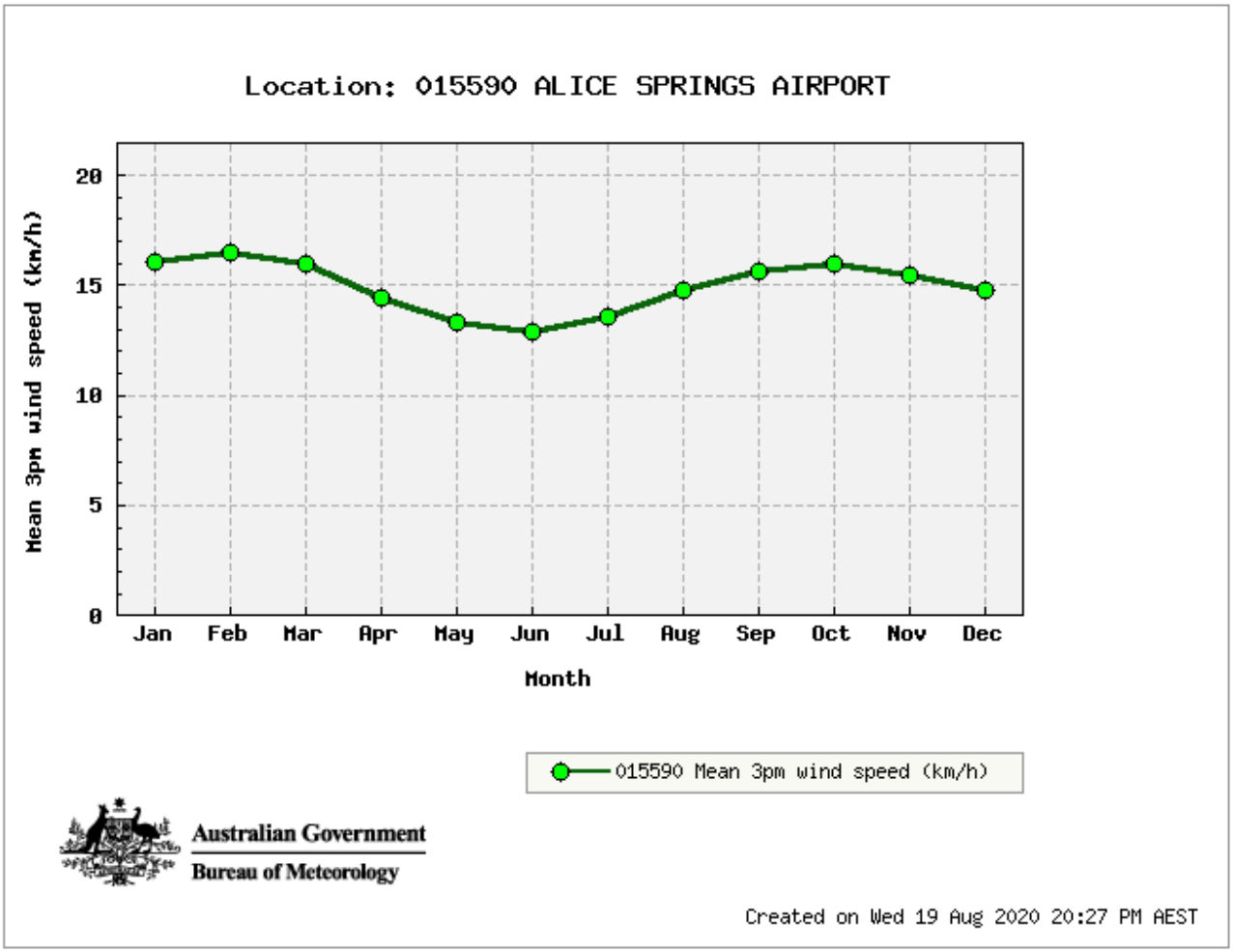


Figure 3 Mean 3pm annual wind speed – Alice Springs Airport Gauge.

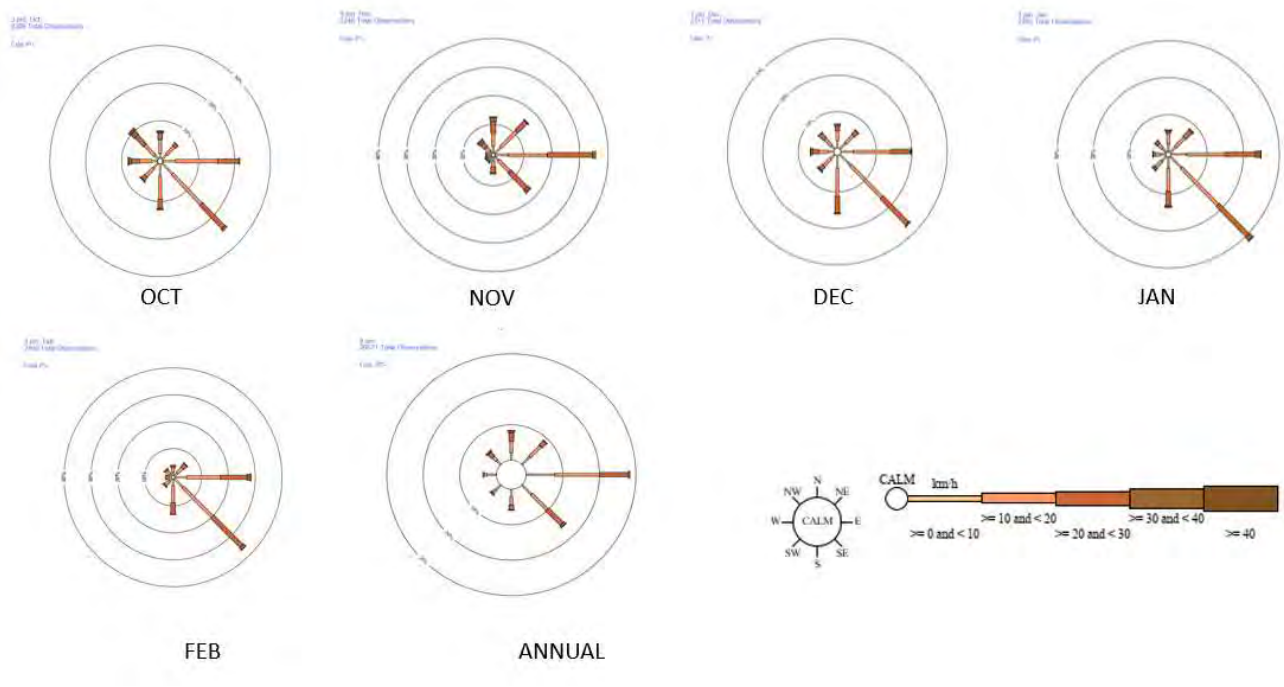


Figure 4 Rose of wind directions – Alice Springs Airport Gauge (015590).

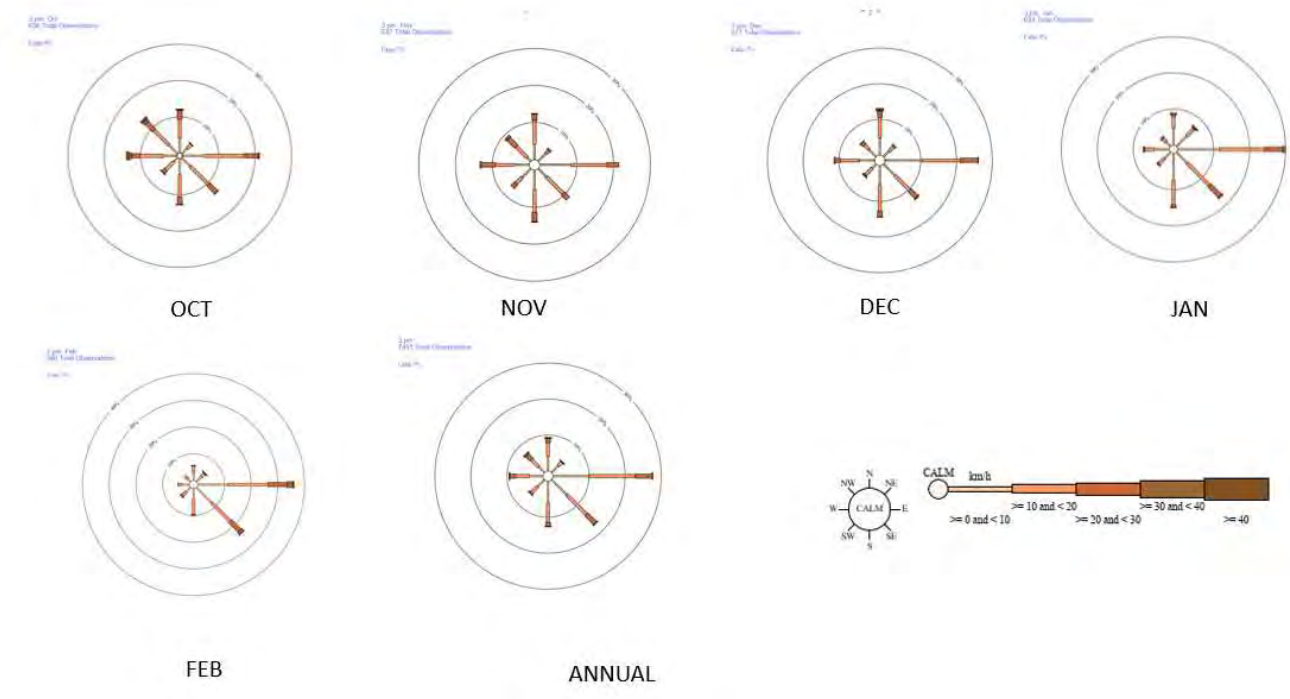


Figure 5 Rose of wind directions - Watarrka Gauge (015652)

6.4 Erosion Risk Rating

Erosion risk ratings for the project sites have been based on the methods outlined in IECA. This method is based on the average monthly erosivity, average monthly rainfall depth and the estimated soil loss. The risk rating outlined in Tables 4.4.1 – 4.4.3 in IECA 2008 is summarised in **Table 8** below.

Table 8 Erosion Risk Rating Criteria (IECA, 2008)

Risk rating	Monthly Rainfall Erosivity (R factor)	Ave. Monthly Rainfall Erosion Risk (mm)	Estimate Soil Loss (t/ha/yr)
Very low	0 to 60	0 to 30	0 to 150
Low	60+ to 100	30+ to 45	150+ to 225
Moderate	100+ to 285	45+ to 100	225+ to 500
High	285+ to 1500	100+ to 225	500+ to 1500
Extreme	>1500	>225	>1500

Based on the project construction timing, the monthly erosivity fluctuates between 190 and 360, with rainfall erosivity increasing month to month from November to February. The low expected average rainfall means that all sites are very low to low from March to November, with some sites increasing to moderate for December, January and February. The annual estimated soil loss (tonnes per hectare per year) is considered very low. A summary of the maximum risk ratings for each site is outlined below in **Table 9**.

Table 9 Site Based Risk Assessment

Site	Monthly Rainfall Erosivity (R factor)	Avg. Monthly Rainfall Erosion Risk	Estimate Soil Loss (t/ha/yr)
Orange	190-360	Low	Very Low
Palm Valley	190-360	Moderate	Very Low
Mereenie - 27	190-360	Moderate	Very Low
Mereenie - 28	190-360	Moderate	Very Low
Dingo	190-360	Low	Very Low
Mamlambo	190-360	Moderate	Very Low

Based on the results of the site based risk assessment (in **Table 9**), it is concluded that rainfall erosivity presents the highest risk of erosion to the project sites. However, this risk is only present if a rainfall event occurs during the construction and pre-stabilised period. As the works are proposed in the lead up to the wettest part of season, it is important that site clearing and stabilization activities occur as soon as practicable (preferably prior to December). Care must be taken for waterway crossings, with site specific requirements determined as part of the civil design considerations. Terrain features surrounding each site, as location of Stream Order 1 streams (in accordance with NT Government mapping) is provided in **Appendix B**.

Wind erosion risk is also a significant factor due to the arid nature of the site. Dust suppression, mulching and stabilising of the disturbed areas needs to occur promptly to prevent on-going erosion to the cleared areas.

7 Erosion Control Measures

7.1 General Erosion and Sediment Controls and Management Principles

The site has been assessed as very low to moderate risk of erosion, if disturbance works are completed prior to increased rainfall periods which generally occur in December through to March. All measures proposed in the following section should be assessed for suitability given the site features and availability of supplies. Generally, other devices from the same device type (as defined by IECA) can be employed if required.

The proposed water management and ESC measures will be designed to minimise the potential impact on downstream water quality. Wind and water erosion of disturbance areas cannot be eliminated completely however, measures will be taken to minimise the impact by:

- Conducting best practice land clearing procedures for all proposed disturbance areas. This includes clearing when soil moisture conditions are optimal, working machinery across the slope and preventing wheel ruts which can concentrate overland flow paths, timing and staging of works to minimise exposure of bare soil, and removing windrows and machinery tracks;
- Noting that the prevailing winds are from the east and south-east, existing vegetation breaks should be retained to protect disturbed areas, in addition to other erosion control measures such as irrigation/dust suppression and mulching of exposed areas.
- Undertake disturbance works, as much as is practically possible, during the dry season (April to November) and during periods when good weather is forecast;
- Dust suppression through irrigation/watering will be required to manage dust generation until a time that the sites are stabilised.
- Appropriate storage of soil stockpiles in areas away from roadways and other drainage lines. Suitable sediment control measures will be installed downslope of soil stockpiles and upslope clean water runoff will be diverted (where possible). Refer to the standard drawings in **Appendix D**;
- Minimising the disturbance footprint;
- Coordinating works to minimise the exposure duration of disturbed soils;
- Separation/diversion of ‘clean’ water catchment runoff from disturbed areas (where practical) to minimise sediment-laden runoff volumes requiring treatment;
- Containment of all contaminated water on-site prior to treatment or disposal in a suitable manner;
- Minimising soil erosion (i.e. rehabilitation, drainage and erosion control measures) at the source, rather than trapping resultant sediment;
- Ensuring sediment-laden runoff is treated via designated sediment control devices;
- Clearly identifying/communicating no-go areas to maintain disturbance areas and traffic movement to the designated areas;
- Revegetation of disturbed areas as soon as possible following the completion of ground disturbance activities;

- Effective dust suppression measures;
- Any liquid wastes, fuels and oils stored on-site will be sufficiently bunded to contain any potential spills. Accidental spillage or poor management of fuels, oils, lubricants, hydraulic fluids, solvents and other chemicals during the construction phase will be controlled through spill management actions (including the availability of spill kits) to prevent water quality and ecological impacts and no further mitigation measures are considered necessary. Captured liquid wastes, fuels and oils should be pumped out by a liquid waste contractor and disposed of at an appropriately licenced facility; and
- Implementing an effective monitoring and maintenance program for the site.

7.2 Minimising Disturbances

Wherever possible, the Project should attempt to avoid disturbing areas of vegetation. Land disturbance would be minimised by clearing the smallest practical area of land required for the works and leaving sites disturbed for the shortest possible time where practical. This will be achieved by:

- Restricting the areas to be cleared of existing vegetation to the areas being actively worked as well as no closer than 50 metres from defined watercourse/gully lines;
- Clearly identifying and delineating areas required to be disturbed and ensuring that disturbance is limited to those areas;
- Clearing vegetation only as required to achieve the works and minimising machinery disturbance; and
- Limiting the number of roads and tracks established.

7.3 Control Measures and Practices

To prevent sediment from mobilising to adjacent overland flow paths and creeks, sediment controls should be in place to prevent release into the environment.

The default classification of sediment control techniques is outlined in **Table 10** for sheet and concentrated flow treatment techniques. IECA recommends either Type I, 2 or 3 devices to be employed depending on the annual soil loss estimates and erosion risk assessments. From our analysis, Type 3 devices are recommended. These include rock check dams, sediment fence (or the like) and U-shaped sediment control structures. These elements have primarily been used throughout the plans, however a more comprehensive list of ESC measures is provided in **Table 9**.

Furthermore, clean water diversions have been used to separate the flow sources and allow for treatment of only dirty water sources.

Standard Drawings for each control measure are provided in **Appendix D**.

Table 10 ESC Measures (IECA, 2008)

Type 1	Type 2	Type 3
Sheet Flow Techniques		
Buffer Zone capable of infiltrating 100% of stormwater runoff or process water	Buffer zone capable of infiltrating the majority of flows from design storms.	Buffer Zone
Infiltration basin or sand filter bed capable of infiltrating 100% of flow	Block & Aggregate Drop Inlet Protection	Excavated drop inlet protection
	Compost/mulch berm	Fabric drop inlet protection
	Filter sock	Fabric Wrap Field Inlet sediment trap
	Filter sock drop inlet protection	Filter fence
	Mesh and aggregate drop inlet protection	Modular sediment trap
	Rock and aggregate drop inlet protection	Straw bale barrier
		Sediment fence
Concentrated Flow Treatment Techniques		
Sediment Basin (sized in accordance with design standard	Filter Tube Dam	Coarse Sediment Trap
	Rock filter Dam	Modular Sediment Trap
	Sediment Basin (smaller than design standard)	U-Shaped Sediment Trap
	Sediment Trench	
	Sediment Weir	

7.3.1 Soil Stripping and Stockpiling

Topsoil is a valuable resource for erosion control as it provides the basis for successful land stabilisation once earthworks have been completed. Topsoil can greatly increase the chances of groundcover germination and survival, and in many cases the topsoil will contain a viable seed bank that will germinate and survive well if appropriate conditions are maintained. This means that the correct management of topsoil can provide significant environmental and economic returns, as it is a cost-effective method of achieving land stabilisation without the need to import additional materials.

Best practice (IECA 2008) soil management measures shall be implemented where appropriate:

- Topsoil to be preserved for reuse on the site wherever possible;
- Strip and stockpile topsoil immediately before bulk earthworks, and confine any soil disturbance to the immediate construction stage;
- To the maximum degree practicable, topsoils should not be mixed with subsoils during the stripping and stockpiling procedure, especially if the subsoils are dispersive;

- If it is desirable to retain the seed content of the soil, then the stockpiling should consist of long low mounds no greater than 1 to 1.5 m in height, otherwise topsoil stockpiles to not exceed 3m in height. Long term stockpiles (i.e. >12 months) may need to be mulched or temporarily vegetated to prevent weed infestation;
- Stripped topsoil to be used as soon as possible, and preferably not stockpiled for more than 12 months. Long term stockpiling can degrade its biological and chemical qualities;
- Maintain all stockpiles in a free draining condition to avoid long-term soil saturation;
- Soil should be removed from stockpiles in a manner that avoids vehicles travelling over the stockpiles if possible;
- Exposed sub-soils should be covered as soon as practicable, especially if dispersive;
- After spreading topsoil, ensure the surface is left in a scarified (roughened) condition to assist moisture infiltration and inhibit soil erosion;
- When working adjacent to a waterway, avoid spreading topsoil at a significantly different elevation from where it originated;
- Ensure all exposed sub-soils are covered, especially if dispersive;
- All disturbed soils shall be stabilised against erosion prior to wet-season rains; and
- Soil stockpile areas are to be rehabilitated as soon as reasonable and practicable after the material has been removed.

7.3.2 Initial site works and land clearing

- No land-disturbing activities on the site shall occur until all perimeter ESC measures, and drainage control measures have been constructed in accordance with IECA;
- In the event that the extent of the disturbance area is outside of the erosion and sediment control measures, the ESCP must be updated and resubmitted to DENR for approval;
- Land-disturbing activities must be undertaken in such a manner that allows all reasonable and practicable measures to be undertaken to allow stormwater to pass through the site in a controlled manner and at non-erosive forces and minimise or prevent environmental harm resulting from work-related soil erosion and sediment runoff;
- Land disturbing activities must not cause un-necessary soil disturbance if an acceptable alternative construction process is available that achieves the same or equivalent outcome;
- Sediment which is deposited off site should be recorded and notified to the relevant authority for appropriate remediation actions to be determined;
- Land clearing and site grubbing should be carried out within 4 weeks. Site clearing works should not be carried out if rainfall is predicted;
- Vegetation should be retained in watercourses, gullies and all other concentrated flow paths. All vegetation (including ground cover) should be retained where possible;
- All land clearing must be carried out in accordance with Federal, Territory and local government requirements, the associated EMP and IECA;
- All disturbed soils shall be stabilised against erosion prior to wet-season rains; and

- Disturbed areas shall be stabilised with a minimum vegetation cover of similar density for the locality. It is noted that most areas have poor vegetation cover, and therefore a level of cover consistent with that in the locality is proposed.

7.3.3 Roads / Access Tracks

ESC planning, design and construction of roads and access tracks shall be undertaken in accordance with the guidelines presented in Appendices J and K of the 'Best Practice Erosion and Sediment Control' guideline (IECA, 2008). Surface drainage shall be optimised and stabilised, thereby reducing roadside erosion and sedimentation. Applicable construction methodologies for each proposed access track shall be determined in conjunction with the civil design.

To ensure any potential surface water impacts associated with the site access tracks and haul roads are minimised, the following measures will be undertaken:

- Provide cross fall drainage at 3% either side of the road crown (or from infall and outfall cross falls) to shed runoff from the road surface (if possible);
- Some access road construction treatments will be required where overland flow paths cross access roads. This will be required to reduce scour of the access track. Additional erosion measures may be required upstream to reduce erosion and lower velocities if erosion is evident;
- All access tracks shall be regularly inspected to determine whether wheel rutting is concentrating runoff and causing erosion. Particularly, all access roads should be inspected and re-profiled (where needed) prior to the wet-season to prevent concentration of sheet flow;
- The design and location of proposed structures should be reviewed by the on-site construction operator and moved/ increased in frequency if not deemed appropriate. Any changes resulting in significant alteration to ESC devices, methods or strategies should be reviewed and approved by a suitably qualified person and an amendment to the ESCP noted;
- Road drainage should be carried out, noting the design considerations outlined within the NT Road Drainage Fact Sheet;
- Table drains, mitre drains, culverts and cross drains are to be used where required to safely convey the water from the haul road and access track surfaces so as to prevent runoff from eroding them or adjacent land. Mitre drain spacing should not exceed 50 m even on soils with low erodibility. Cross Drains are placed every 20 to 90 m depending on the road grade and soil erodibility as required;
- Sediment fencing, vegetation filters, and level spreaders are used to control the sediment at the end of mitre drains, and controls are periodically inspected to maintain their performance; and
- Cut and fill batters associated with service tracks are formed to a safe slope and stabilised by vegetation. Where cut batters are greater than 1.5 m, stabilisation methods are to be applied to these areas such as laying back, revegetation and drainage. Stabilisation is assisted by spreading topsoil and/or by applying chemical or organic mulch over the exposed batter surface. Fill batters are constructed with grades no steeper than 2(H):1(V).

7.3.4 Clean Water Diversions

Clean water diversions direct 'clean' water runoff from upstream catchments around the potentially disturbed and/or contaminated areas of the site. The local topographical conditions at each site are such that the use of clean water diversions is likely to be required for catchments upslope of small disturbance areas.

Any clean water diversion structures will be designed to convey the 2-year ARI design discharge in accordance with Table 4.3.1 of the IECA guideline and will include suitable channel lining measures, as required.

7.3.5 Conveyance Channels

Runoff from areas exposed during the works will be controlled by construction of temporary conveyance channels and bunds/ banks that will direct sediment laden runoff to suitably designed and constructed ESC devices. Proposed conveyance channels will be designed following finalisation of the final landform.

Conveyance channels will be designed to convey runoff from a 2-year ARI rainfall event in accordance with Table 4.3.1 of the IECA guideline. Energy dissipation and sediment trapping structures (i.e. check dams) may be required (at regular intervals to limit erosion, however this will be determined during the design of the conveyance channels).

7.3.6 Dirty water treatment

7.3.6.1 Check Dams

Check dams are used in channels to trap sediment and reduce the potential for scouring to occur. They can be made from a number of different materials including rock, coir logs, hay bales etc. Check dams are typically installed at regular intervals – typically closer together on steeper slopes.

It is important that check dams are installed such that flows cannot pass around the sides and that they overflow over the check dams themselves. The use of sandbags and hay bales are limited to temporary erosion and sediment control in channels during construction, as these devices tend to deteriorate over time. Where sandbags are used, it is important not to overfill them as this can cause gaps when the sandbags are wedged together. Three quarters to two thirds full is generally the right amount of material within each sandbag.

7.3.6.2 Sediment Fences

Sediment fences act as minor sediment dams. They temporarily detain runoff, trapping sediment and allowing filtered water to pass. Sediment fences should be constructed around the base of any small areas of exposed land that are not subject to concentrated overland flows and that are not adequately protected by existing structures. Sediment fencing should be installed around the extent of the disturbance area where sediment-laden water could potentially enter clean downstream receiving waters. They are placed on the contour, or slightly convex to the contour, and each end of the fence should be turned to create a stilling pond up slope of the fence. Sediment fences require regular maintenance. Trapped sediments should be removed, pickets straightened, filter cloth re-secured and tightened as required.

7.3.6.3 Rock Chutes

Cut fill batters associated with construction of the well pad may also require treatment. This may require rock chutes to safely get the runoff down the fill batters. This is most likely for the Palm Valley pad but also very possible for the other pads, depending on the final landform. This will need to be assessed by the on-site civil contractor.

7.3.6.4 Sediment Basins/ Sumps

Sediment basins or sumps can be used to capture runoff from disturbed areas prior to discharge to the environment. The soil loss estimate completed for all sites estimates the soil loss value to be less than 150t/ha/yr and therefore sediment dams are not required. In the event that

1. Site survey and construction designs show disturbed areas with greater than 2% slope; or
2. Erosion is occurring, or sediment is overwhelming the proposed structures

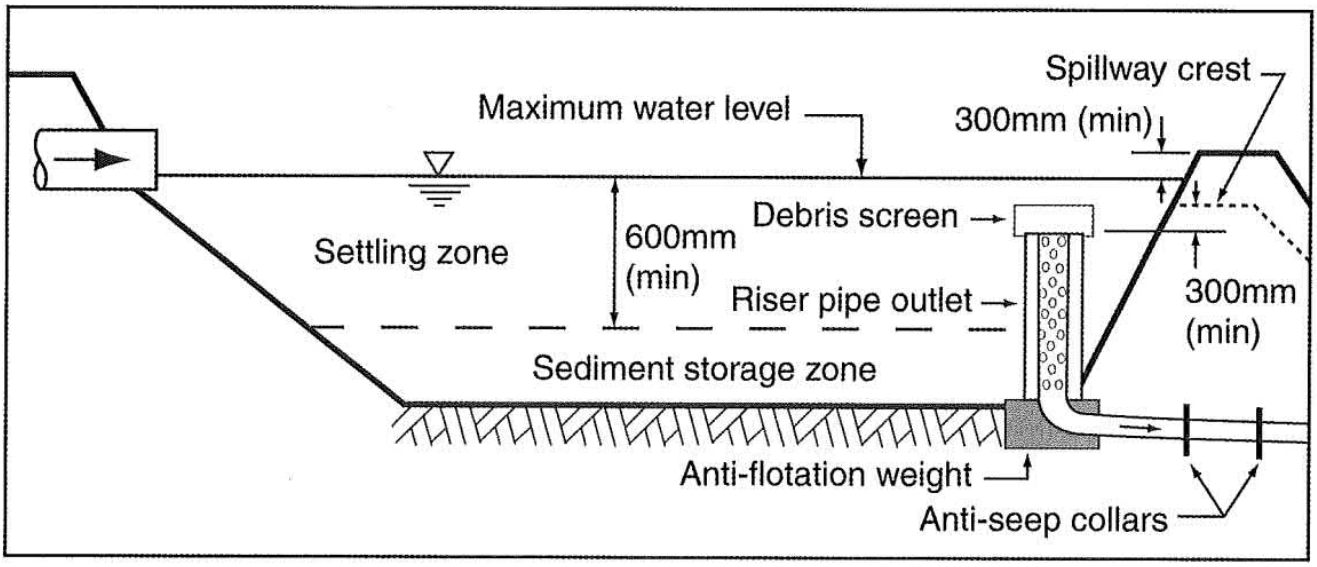
sediment dams should be installed.

The standard design details of basins, if required, and assuming a catchment area of up to 2 ha are provided in **Table 11**.

Table 11 Type 1 Sediment Basin Design Parameters

Parameter	PV12	Dingo	M27	M28	Orange 1	Mamlambo
Annual soil loss (t/ha/yr)	11.7	11.2	32.3	27.1	11.2	27.1
Sed Storage (m^3/yr)	35.1	33.7	96.9	81.4	33.7	81.4
Hydraulic Efficiency 3:1 (He)	1.2	1.2	1.2	1.2	1.2	1.2
1:1 ARI Q m^3/s	0.120	0.102	0.116	0.116	0.105	0.120
Catchment Area (ha)	2.0	2.0	2.0	2.0	2.0	2.0
1:1 ARI 15min Rainfall Intensity (mm)	43.0	36.8	41.6	41.6	37.6	43.3
Settling zone surface area (m^2)	497.9	497.9	497.9	471.8	497.9	497.9
Settle zone Depth (m)	0.6	0.6	0.6	0.6	0.6	0.6
Total Basin Volume (m^3)	333.9	332.5	395.6	364.5	332.5	380.2

Figure 6 Sediment Basin Design schematic



8 Erosion and Sediment Control Plan

An ESCP has been developed for each site. The key principles used for each site are:

- Place clean water topsoil berms to divert flow away from well pads, access roads and other planned infrastructure;
- Use compost berms/sandbags/ fibre rolls in table drains for proposed access road to slow flow velocity, enable coarse sediment drop out and prevent scour;
- Use dirty water compost berms, rock chutes with outlet control and sediment fences (where required) to capture sediment from the disturbed infrastructure area; and
- U-shaped sediment control structures utilised on the downstream side of access road causeways and/or concentrated flow paths to remove sediment from concentrated flow paths which intersect disturbed areas.

Section 4.3 of IECA provides further guidance on design requirements. These measures will need to be employed as per the plan, with regular inspections and maintenance (as required). In the event that the measures are not effective in capturing sediment, further controls may be necessary, and should be implemented as per the IECA guideline.

8.1 ESCP mitigation measures

All ESCP plans are provided in **Appendix C** which outline the recommended mitigation measures.

9 Monitoring and Maintenance

9.1 Monitoring

The performance of ESC devices will decline if they are not maintained. All ESC devices (including sediment dams) shall be inspected regularly as part of the site's environmental inspection program. Notifications of non-compliance will specify the type(s) of non-compliance, the corrective actions needed and a time schedule for achieving compliance.

Regular visual inspections of rehabilitated areas will be undertaken to ensure water is safely conveyed from the areas and that a stable landform is being created. The inspections will also include assessing vegetation cover to ensure that erosion potential is minimised.

Table 12 contains the inspection schedule used to ensure the ESC's are functioning effectively at the site. The inspections will also determine the scheduling of maintenance required for the ESC structures.

Table 12 ESC Inspection Schedule

To Be Inspected	Frequency
All ESC Structures and Stockpiles	**Palm Valley 12, Mereenie West 27 & 28** Weekly (December to April), monthly (May to November) as well as following any significant rainfall events (i.e > 15mm in 24hr period). **Dingo 1/5, Orange 3** Weekly (December to April), monthly (May to November) as well as following any significant rainfall events (i.e > 15mm in 24hr period). **Mamlambo** Weekly (December to April), monthly (May to November) as well as following any significant rainfall events (i.e > 15mm in 24hr period).
Rehabilitated Areas (Water Management Structures and Vegetation Cover)	Monthly as well as following heavy rainfall events (i.e > 15mm in 24hr period)
Road Drainage works	Quarterly as well as following heavy rainfall events (i.e > 15mm in 24hr period)
Equipment That Utilise Hydrocarbons	Daily for spills and leaks

9.2 Maintenance

All erosion and sediment control measures are to be maintained in a functioning condition until individual areas have been deemed "successfully" rehabilitated. Where controls are observed to not be functioning correctly, the controls must be restored to meet the required standard. Where significant erosion is observed to be occurring on a regular basis, additional controls are to be implemented.

9.2.1 Sediment Dams

In the event that sediment dams are required, sediment dams are to be regularly drawn down following rainfall (within 5 days) and desilted (if required) to ensure that the Settling Zone Volume is available within the dams to accept runoff from future rainfall events. This is to ensure that the dams are operated in accordance with the requirements of the IECA guidelines to minimise the chances of an uncontrolled discharge. The drawn down water can be released downstream, provided the water quality requirements are met).

If sediment does build up to the Sediment Zone Volume the dams will need to be desilted with the sediment disposed of in a suitable manner. It is recommended that depth markers are installed to assist with determining when the sediment dams require desilting. It is believed that the sediment dams will require desilting, on average, once a year which would typically be undertaken prior to the commencement of the wet season.

9.2.2 Drainage Channels

Any signs of erosion along the length of the drains should be noted and remedial works undertaken as required. Where significant erosion is observed, additional erosion controls are constructed e.g. establishment of vegetation cover, use of temporary sediment devices until the vegetation is established, scour protection (rock check dams) of the channel surface.

9.2.3 Temporary ESC Structures

Regular visual checks are to be made of any temporary sediment controls such as sediment fences, check dams etc to ensure that they are functioning adequately and repaired where required.

9.2.4 Roads / Access Tracks

Periodic maintenance of the roads and access tracks will include checking the drainage systems to remove any debris that may block culverts, cross drain outlets and table drains. Any erosion will be remediated with additional ESC measures implemented, as required.

9.2.5 Rehabilitated Areas

Regular visual inspections of the rehabilitated areas are to be undertaken in accordance with **Table 12** and the approved Rehabilitation Plan.

The objectives of the rehabilitation plan are

- Progressively rehabilitate significantly disturbed land which is not required for ongoing activities
- Return all disturbed areas to a safe and stable landform as close as possible to the surrounding environment
- Ensure significantly disturbed land is re-established to its pre-disturbed condition and land use

- No residual contamination
- No land management issues for future land managers.

CP will submit to the DENR an annual rehabilitation report with information including:

- Area of disturbed land available for rehabilitation at the start of the reporting period
- Area of disturbance that occurred during the reporting period
- Area where rehabilitation commenced during the reporting period
- Area of disturbed land remaining to be rehabilitated at the end of the reporting period (including land not currently available for rehabilitation)
- Photographic monitoring point GPS locations and results of monitoring undertaken during the reporting period
- Monitoring of progressive rehabilitation, including flora type and density, fauna activity and soil stability
- Any erosion and sedimentation issues
- Any stakeholder consultations and results of discussions related to rehabilitation
- Any issues that may affect the rehabilitation success factors noted in Section 7.8.5 and remedial actions taken or required to be undertaken to allow the success factor to be realised
- Monitoring of contaminated sites
- Weed monitoring.

10 Emergency Procedures and Incident Reporting

Following an environmental incident, an Environmental Incident Report is to be completed to ensure that appropriate causation, remediation and monitoring is developed, implemented and documented. Please refer to Section 9.5 of the Environmental Management Plan (2020) for Emergency Preparedness and Section 10 for Incident Reporting.

11 Roles and Responsibilities

Key roles and responsibilities, as related to ESC management, are shown in **Table 13**. Details of the ESC monitoring will be provided to all of the relevant Regulators as part of the overall environmental reporting process.

Table 13 Responsibilities relating to ESC Management

Position	Responsibility
SLR	Revision of this ESCP, in consultation with the Proponent, to the satisfaction of regulators
Central Petroleum's Site Supervisor	Establishment of best practice culture and monitoring Enforcement of the requirements of this ESCP
Central Petroleum's HS&E Team	Water quality monitoring in accordance with this ESCP and the WMP

Position	Responsibility
	Monitoring and maintenance of water management structures in accordance with this ESCP and the WMP Internal water management inspections Required environmental monitoring reporting
All construction personnel	Undergo appropriate inductions and training Comply with the relevant Acts, Regulations and Standards. Compliance with this ESCP Promptly report to management on any non-conformances or breaches of the system.

12 Training

It will be the responsibility of the HSE Manager to provide training to staff and contractors on ESC and soil management. The training should include inductions, toolbox talks and a review of this ESCP. Specific training should be provided to operators and site contractors prior to soil stripping and stockpiling to ensure effective management of soils. General training should be given to all staff to ensure that ESC structures and features are properly managed at the site. Any environmental issues discovered as part of the monitoring program, should be raised at the toolbox meetings.

13 Limitations

All project sites assessed as part of this ESCP have a low to moderate risk of erosion. The assessments carried out are based on available survey data (SRTM or client supplied LiDAR) which has varying levels of accuracy. Furthermore, the placement of devices should be assessed on site to ensure construction principles and outcomes are achieved.

All measures should be assessed for adequacy prior to and during construction activities. In the event that erosion is evident, sediment is observed being deposited downstream, or significant rainfall is forecast, then further measures may be required.

This plan forms the Primary Erosion and Sediment Control Plan.

APPENDIX A

Soil Loss Estimate

Soil Loss Estimate

IECA (2008) requires a soil loss estimate to be carried out to determine the type of controls the project should adopt to manage erosion potential. This is done using the Revised Universal Soil Loss Equation (RUSLE). The equation used is

A = R. K. LS. C. P

Where A = annual soil loss due to erosion (t/ha/yr)
R = rainfall erosivity factor
K = Soil erodibility factor
LS = topographic factor derived from slope length and gradient
C = cover and management factor
P = erosion control practice factor

Each of the parameters have been described in detail in the following sections

Parameter Selection

Rainfall erosivity factor

The rainfall erosivity factor (R) is defined as the mean annual sum of individual storm erosion index values accounting for storm kinetic energy and rainfall intensity. The IECA guidelines provide a range of values for places of interest across Australia. Unfortunately, only values for Darwin and Katherine are provided for the Northern Territory. As the project sites are located in a vastly different climatic region, it was considered inappropriate to use either of these values for the project site.

Furthermore, the IECA guideline provides the following equation to estimate the R factor for the region of interest.

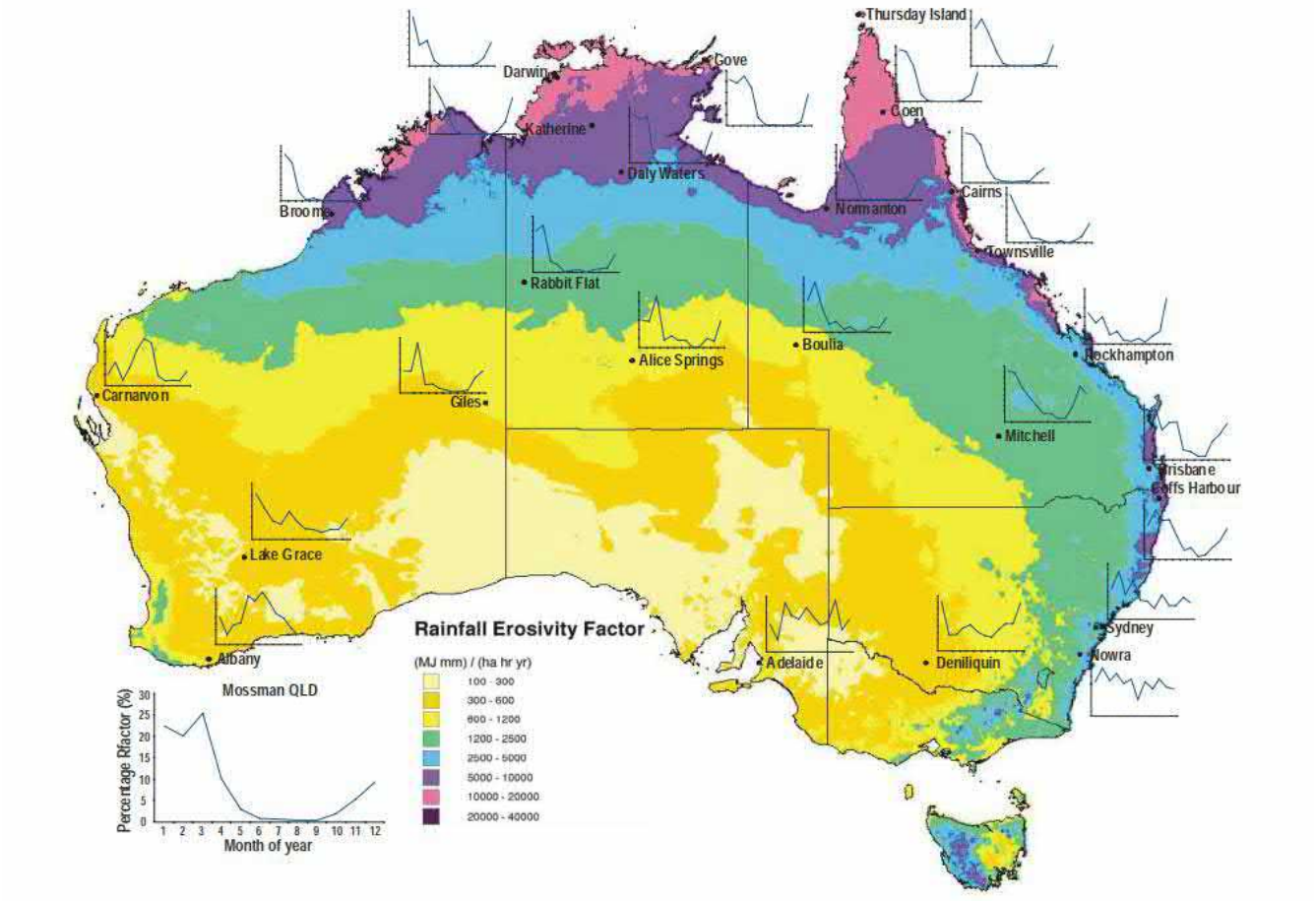
$$R = 164.74\ (1.1177)^{S}\ S^{0.6444}$$

Where S = 2yr ARI 6hr rainfall event.

The region of interest has an approximate 2yr 6hr ARI rainfall intensity of 36.3mm, which provides a large over-estimation of the R value.

A literature review of available data showed there is a significant variation in estimated R factors across Australia. The *Prediction of Sheet and Rill Erosion Over the Australian Continent, Incorporating Monthly Soil Loss Distribution* published by the CSIRO National Land & Water Resource Audit (2001) provides some guidance on R factors. A national map of values is re-produced below in Figure B1.

Figure B1 Rainfall Erosivity Factors (R Factos), CSIRO 2001.



The paper provides an R factor estimate of 600-1200 for the project sites. The paper was cross referenced for other sites listed in the IECA document to check validity. Darwin, Katherine and Mt Isa were all found to have IECA values within the paper's guidelines. Therefore, it is considered appropriate to use a conservative R Factor of 1200 for all project sites.

For Monthly R percentage factors, the data presented for Alice Springs was used, as it was the closest to the project sites. Typically, November to January are 5-15% with a peak in February of 28%.

Soil erodibility factor

The soil erodibility factor (K) is defined by IECA as a numeric representation of the ability of soils to resist the erosive energy of rain.

K factors should generally be determined from laboratory analysis of soil data. However, as this data is not readily available for the project sites, the NT Government Natural Resource Maps was used to inspect soil type data which was located nearest to the project sites.

Inspection of the NT Natural Resource (NR) Maps found the following information

Table B1.1 NR Map Soil Classifications (NT Government)

NT NR Map Soil Classification				
Project location	Soil Group	Soil type	Soil Symbol	pH
Orange	Calcarosol	Loamy sand / clayey sand	LS / CLS	8-8.5
Palm Valley	Calcarosol	Sandy loam / clay loam / sandy	SL / CL / S	8.5-9
Mereenie 27 & 28	Ruddsol	Sandy loam / loamy sand / clayey sand	SL / LS / CS	7-8.5
Dingo	Tenosol	Clayey sand / loamy sand	CS / LS	7 - 8.5
Mamlambo	Calcarosol	Loamy sand / clayey sand	LS / CLS	7.5-8.5

The IECA guideline provides a soil erodibility factor based on soil type. The IECA K factor table is provided below.

Table B1.2 Soil Erodibility Factor - K Factor (IECA,2008)

Soil texture	Symbol	Estimated clay content (%)	K-factor [1]
Sand	S	< 10	0.015
Clayey sand	CLS	5–10	0.025
Loamy sand	LS	5–10	0.020
Sandy loam	SL	10–15	0.030
Fine sandy loam	FSL	10–20	0.035
Sandy clay loam	SCL	15–20	0.025
Loam	L	about 25	0.040
Loam, fine sandy	Lfsy	about 25	0.050
Silt loam	SiL	about 25 and more than 25% silt	0.055
Sandy clay loam	SCL	20-30	[0.043]
Clay loam	CL	30–35	0.030
Silty clay loam	SiCL	30–35 and more than 25% silt	0.040
Fine sandy clay loam	FSCL	30–35	0.025
Sandy clay	SC	35–40	0.017
Silty clay	SiC	35–40 and more than 25% silt	0.025
Light clay	LC	35–40	0.025
Light medium clay	LMC	40–45	0.018
Medium clay	MC	45–55	0.015
Heavy clay	HC	> 50	0.012

Using the soil types and K factors provided in Table A1.1 and Table A1.2, the higher of the K factor ranges have been applied for each site. A summary of the assessment is provided below in Table A1.3.

Table B1.3 Site Based Soil Erodibility Factor

Project location	Soil Symbol	pH	K factor range
Orange	LS / CLS	8-8.5	0.02 – 0.025
Palm Valley	SL / CL / S	8.5-9	0.015- 00.3
Mereenie 27 & 28	SL / LS / CLS	7-8.5	0.025 - 0.03
Dingo	CLS / LS	7 - 8.5	0.02 – 0.025
Mamlambo	LS / CS	7.5-8.5	0.02 – 0.025

Topographic factor

The topographic factor represents the length slope combination for each of the sites. Generally largest catchment directing sheet flow towards the disturbance area was used for this assessment.

Table B1.4 Soil Erodibility Factor - LS Factor (IECA,2008)

Slope gradient (%)	Slope length (m)												
	5	10	20	30	40	50	60	70	80	90	100	150	200
1	0.09	0.11	0.13	0.15	0.16	0.17	0.18	0.19	0.19	0.20	0.20	0.23	0.24
2	0.14	0.18	0.24	0.28	0.31	0.34	0.36	0.39	0.41	0.43	0.44	0.52	0.58
3	0.17	0.24	0.34	0.41	0.47	0.52	0.57	0.61	0.65	0.69	0.72	0.87	1.00
4	0.21	0.30	0.44	0.54	0.63	0.71	0.78	0.85	0.91	0.97	1.03	1.26	1.47
5	0.24	0.36	0.54	0.68	0.80	0.91	1.01	1.10	1.19	1.27	1.35	1.70	2.00
6	0.28	0.42	0.64	0.81	0.97	1.11	1.24	1.36	1.47	1.58	1.68	2.14	2.54
8	0.34	0.53	0.83	1.08	1.31	1.51	1.70	1.88	2.05	2.21	2.37	3.07	3.70
10	0.42	0.68	1.09	1.44	1.75	2.04	2.31	2.56	2.81	3.04	3.27	4.06	4.94
12	0.52	0.85	1.39	1.85	2.27	2.66	3.02	3.37	3.70	4.02	4.33	5.77	7.07
14	0.62	1.02	1.69	2.26	2.79	3.28	3.74	4.18	4.61	5.02	5.42	7.27	8.95
16	0.71	1.19	1.98	2.67	3.31	3.90	4.46	5.00	5.52	6.02	6.51	8.78	
18	0.80	1.35	2.27	3.07	3.82	4.51	5.17	5.81	6.42	7.02	7.59		
20	0.89	1.50	2.55	3.47	4.32	5.12	5.88	6.61	7.32	8.01	8.68		
25	1.09	1.88	3.23	4.43	5.54	6.59	7.60	8.57	9.51				
30	1.28	2.23	3.86	5.32	6.69	7.99	9.23						
40	1.61	2.83	4.98	6.92	8.74								
50	1.88	3.33	5.89	8.22									

The LS factors were calculated for each site. The results are presented in Table A1.5.

Table B1.5 Site Based Topographic Factor

Project location	LS Factor
Orange	0.24
Palm Valley	1.47
Mereenie - 27	0.69
Mereenie - 28	0.54
Dingo	0.24
Mamlambo	0.58

Cover and Management Factor – C Factor

The C-factor measures the combined effect of all the interrelated cover and management variables. Due to the arid nature of the site, no appreciable grass cover is expected for the site, and therefore a C factor of 1 is given, in accordance with Table E9 of ISCA guidelines.

Erosion Control Factor – P factors

The P factor measure the combined effect of all support practices and management variables. As the project sites are likely to be a compacted and smooth construction phase condition, a conservative P factor value of 1.3 has been selected for all sites.

Annual Soil Loss Estimate

The Annual Soil Loss Estimate was calculated with the above-determined parameters. The assessment found the site soil loss estimates ranged from 11.2 to 406.2t/ha/yr. Approximately 50% of this soil loss occurs during the February/March monsoon season.

Table B1.6 Annual Soil Loss Estimate

Site	R Factor	K Factor	LS factor	C Factor	P factor	Estimate Soil Loss (t/ha/yr)
Orange	1200	0.025	0.24	1	1.3	11.2
Palm Valley	1200	0.03	1.47	1	1.3	68.8
Mereenie - 27	1200	0.03	0.69	1	1.3	32.3
Mereenie - 28	1200	0.025	8.68	1	1.3	27.1
Dingo	1200	0.025	0.24	1	1.3	11.2
Mamlambo	1200	0.025	0.58	1	1.3	27.2

APPENDIX B

Regional topography and stream orders

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Orange 1
Regional Topography
& Stream Order

FIGURE 1B

- NT Gov Stream Order
- Indicative Well Pad
- Proposed Clearance Areas

STRM (mAHD)

High : 700
Low : 500

0 250 500 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:20,000 at A4
Project Number:	620.13770
Date:	19-Oct-2020
Drawn by:	NB

SLR

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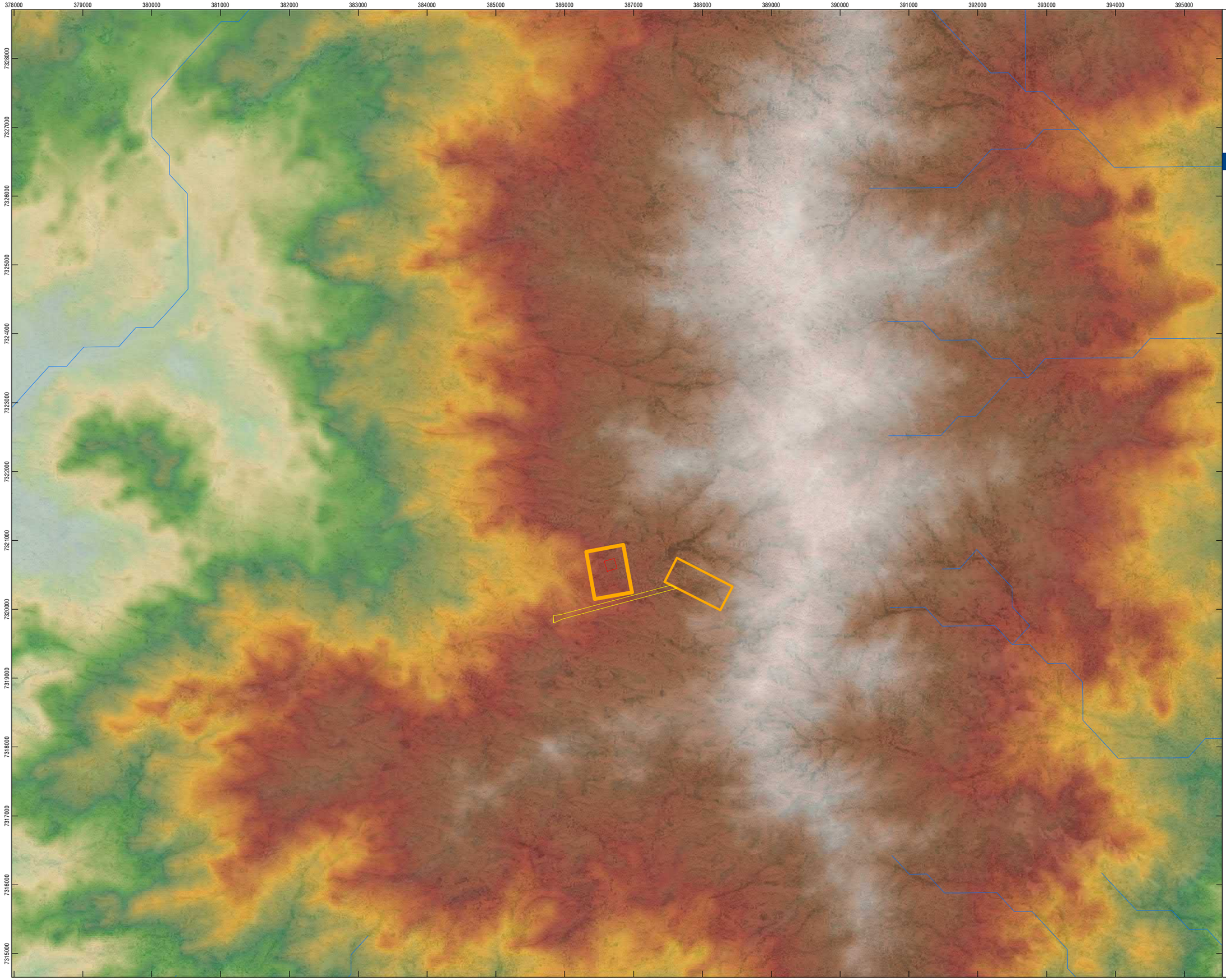

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary ESCP
Dingo 1
Regional Topography
& Stream order

FIGURE 2B

NT Gov Stream Order

Indicative Well Pad

Proposed Clearance Areas

STRM (mAHD)

High : 573.527

Low : 496.173

0 750 1,500 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:50,000 at A4
Project Number:	620.13770
Date:	19-Oct-2020
Drawn by:	NB

SLR

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Palm Valley 12
Regional Topography
& Stream Order

FIGURE 3B

NT Gov Stream Order

Indicative Well Pad

Proposed Clearance Areas

STRM (mAHD)

High : 1000

Low : 600

0 125 250 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:10,000 at A4
Project Number:	620.13770
Date:	19-Oct-2020
Drawn by:	NB

SLR

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan
Mereenie West 27
Regional terrain & stream order

FIGURE 4B

- Access track buffers
- NT Gov Stream Order
- Indicative Well Pad
- Proposed Clearance Areas

SRTM (mAHD)

High : 850

Low : 700

0 250 500 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:20,000 at A4
Project Number:	620.13770
Date:	19-Oct-2020
Drawn by:	NB

SLR

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Mereenie West 28
Regional Topography
& Stream Order

FIGURE 5B

- NT Gov Stream Order
- Indicative Well Pad
- Proposed Clearance Areas

SRTM (mAHD)

- High : 880
- Low : 700

0 250 500 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:15,000 at A4
Project Number:	620.13770
Date:	19-Oct-2020
Drawn by:	NB

SLR

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Mamlambo
Regional Topography
& Stream Order

FIGURE 5B

- NT Gov Stream Order
- Indicative Well Pad
- Proposed Clearance Areas

SRTM (mAHD)

- High : 650
- Low : 500

0 500 1,000 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:45,000 at A4
Project Number:	620.13770
Date:	19-Oct-2020
Drawn by:	NB

SLR

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APPENDIX C

Site Specific ESCP Plans

375800 375900 376000 376100 376200 376300 376400 376500 376600

7340400 7340300 7340200 7340100 7340000 7339900 7339800

580 581 579 578 577 576 575 574

Table drain check dams to be used to reduce scour and promote sediment drop out. Berms to be located every 2m of elevation change or more frequent if scour is observed.

Onsite confirmation of site survey to determine appropriate drainage and fall. Bund max height of 300mm.

Notes

- Dirty water treatment involves check dams, sediment fences, rock chutes, and possibly sediment basin/sumps. The type of device shall be determined once the civil design of the pad has been completed. Level spreaders may be also required to distribute concentrated flow over existing established vegetation areas.
- Wind erosion shall be minimised by ensuring clearing works are carried out under optimal soil moisture conditions. Exposed soils on well pad areas should be roughened. Rehabilitation to occur as per the approved Rehabilitation Plan.
- The ESC measures have been designed in accordance with the 'best practice erosion and sediment control guideline (IECA,2008).
- ESC measure locations are indicative only. Final location to be determined during construction
- ALL ESC measures shall be inspected and maintained as required throughout the course of the works and following each incidence of rain.
- All sediment collected in the devices shall be regularly removed and of unsuitable for reuse, disposed of in an approved manner.
- ESC measures shall be installed prior to any ground disturbance.
- All temporary ESC measures shall be removed when no longer required.
- Based on the sequencing of the construction works and preparation of the secondary ESC plan, additional ESC measures may be required to retain sediment laden runoff.

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan
Orange 1
Well Pad

FIGURE C1

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Level Spreader
- Indicative Well Pad
- Proposed Clearance Areas
- 1m Contour (SRTM)
- Indicative Flow Directions
- No Go Zone
- Orange 3 Camp

0 50 100 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:2,500 at A4
Project Number:	620.13770
Date:	14/10/2020
Drawn by:	PM

SLR

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan
Orange 1
Well Pad

FIGURE C2

Table drain check dams to be used to reduce scour and promote sediment drop out. Berms to be located every 2m of elevation change or more frequent if scour is observed.

Onsite confirmation of site survey to determine appropriate drainage and fall. Bund max height of 300mm.

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Level Spreader
- Indicative Well Pad
- Proposed Clearance Areas
- 1m Contour (SRTM)
- Indicative Flow Directions
- No Go Zone
- Orange 3 Camp

0 50 100 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:6,241 at A4
Project Number:	620.13770
Date:	14/10/2020
Drawn by:	PM

SLR

Notes

- Dirty water treatment involves check dams, sediment fences, rock chutes, and possibly sediment basin/sumps. The type of device shall be determined once the civil design of the pad has been completed. Level spreaders may be also required to distribute concentrated flow over existing established vegetation areas.
- Wind erosion shall be minimised by ensuring clearing works are carried out under optimal soil moisture conditions. Exposed soils on well pad areas should be roughened. Rehabilitation to occur as per the approved Rehabilitation Plan.
- The ESC measures have been designed in accordance with the 'best practice erosion and sediment control guideline (IECA,2008).
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- All sediment collected in the devices shall be regularly removed and of unsuitable for reuse, disposed of in an approved manner.
- ESC measures shall be installed prior to any ground disturbance.
- All temporary ESC measures shall be removed when no longer required.
- Based on the sequencing of the construction works and preparation of the secondary ESC plan, additional ESC measures may be required to retain sediment laden runoff.

387000

388000

7320000

253

260

257

258

500

505

489

475

532

451

456

447

398

378

282

398

Appropriate treaments to be applied to any new construction works.

Depending on finished surface levels, Dirty water treatment maybe required on either side of the pad, This may include a rock-chute down fill batter (if flows are concentrated down a steep batter).

Notes

- Dirty water treatment involves check dams, sediment fences, rock chutes, and possibly sediment basin/sumps. The type of device shall be determined once the civil design of the pad has been completed. Level spreaders may be also required to distribute concentrated flow over existing established vegetation areas.
- Wind erosion shall be minimised by ensuring clearing works are carried out under optimal soil moisture conditions. Exposed soils on well pad areas should be roughened. Rehabilitation to occur as per the approved Rehabilitation Plan.
- The ESC measures have been designed in accordance with the 'best practice erosion and sediment control guideline (IECA,2008).
- ESC measure locations are indicative only. Final location to be determined during construction
- ALL ESC measures shall be inspected and maintained as required throughout the course of the works and following each incidence of rain.
- All sediment collected in the devices shall be regularly removed and of unsuitable for reuse, disposed of in an approved manner.
- ESC measures shall be installed prior to any ground disturbance.
- All temporary ESC measures shall be removed when no longer required.
- Based on the sequencing of the construction works and preparation of the secondary ESC plan, additional ESC measures may be required to retain sediment laden runoff.

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan Dingo 1 Well Pad

FIGURE C3

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Indicative Well Pad
- Proposed Clearance Areas
- 2m Contours (SRTM)
- No Go Zone
- Dingo 5 camp

0 25 50 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:5,000 at A4
Project Number:	620.13770
Date:	14/10/2020
Drawn by:	PM

SLR

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387000

Depending on finished surface levels,
Dirty water treatment maybe required on
either side of the pad,
This may include a rock-chute down fill batter
(if flows are concentrated down a steep batter).

253
260
265
489
500
505
532
545

NO GO ZONE

Appropriate treaments to be
applied to new access roads -
check dams to be utilised.

Notes

- Dirty water treatment involves check dams, sediment fences, rock chutes, and possibly sediment basin/sumps. The type of device shall be determined once the civil design of the pad has been completed. Level spreaders may be also required to distribute concentrated flow over existing established vegetation areas.
- Wind erosion shall be minimised by ensuring clearing works are carried out under optimal soil moisture conditions. Exposed soils on well pad areas should be roughened. Rehabilitation to occur as per the approved Rehabilitation Plan.
- The ESC measures have been designed in accordance with the 'best practice erosion and sediment control guideline (IECA,2008).
- ESC measure locations are indicative only. Final location to be determined during construction
- ALL ESC measures shall be inspected and maintained as required throughout the course of the works and following each incidence of rain.
- All sediment collected in the devices shall be regularly removed and of unsuitable for reuse, disposed of in an approved manner.
- ESC measures shall be installed prior to any ground disturbance.
- All temporary ESC measures shall be removed when no longer required.
- Based on the sequencing of the construction works and preparation of the secondary ESC plan, additional ESC measures may be required to retain sediment laden runoff.

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan Dingo 5 Well Pad

FIGURE C4

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Indicative Well Pad
- Proposed Clearance Areas
- 2m Contours (SRTM)
- Indicative Flow Direction
- No Go Zone
- Dingo 5 camp

0 25 50 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:2,700 at A4
Project Number:	620.13770
Date:	14/10/2020
Drawn by:	PM

SLR

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Notes

- Dirty water treatment involves check dams, sediment fences, rock chutes, and possibly sediment basin/sumps. The type of device shall be determined once the civil design of the pad has been completed. Level spreaders may be also required to distribute concentrated flow over existing established vegetation areas.
- Wind erosion shall be minimised by ensuring clearing works are carried out under optimal soil moisture conditions. Exposed soils on well pad areas should be roughened. Rehabilitation to occur as per the approved Rehabilitation Plan.
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- ESC measure locations are indicative only. Final location to be determined during construction
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- All sediment collected in the devices shall be regularly removed and of unsuitable for reuse, disposed of in an approved manner.
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- All temporary ESC measures shall be removed when no longer required.
- Based on the sequencing of the construction works and preparation of the secondary ESC plan, additional ESC measures may be required to retain sediment laden runoff.

U-Shaped Sediment trap or sediment basin (or other approved device).location to be determined based on site inspection.
Works within defined watercourses/overland flow paths should be avoided.

Additional treatment measures may be required downstream of the access track (from exisitng track to well pad). Check dams or similar should be used if flows are being concentrated (i.e. not maintaining sheet flow).

NO GO ZONE

269000 269100 269200 269300 269400 269500 269600 269700 269800

7344400 7344300 7344200 7344100 7344000 7343900 7343800

CENTRAL PETROLEUM 2020 EXPLORATION PROJECT

Preliminary Erosion and Sediment Control Plan Palm Valley 12 Well Pad

FIGURE C5

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Level Spreader
- Indicative Well Pad
- Proposed Clearance Areas
- 1m Contours (SRTM)
- Indicative Flow Direction
- No Go Zone

0 25 50 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:2,500 at A4
Project Number:	620.13770
Date:	19/10/2020
Drawn by:	PM

SLR

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan
Mereenie West 27
Well Pad

FIGURE C6

ESC Measures

- Clean Water diversion channels
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Level Spreader
- 1m Contours (LiDAR)
- Indicative Well Pad
- Proposed Clearance Areas
- Indicative Flow Directions (existing)
- No Go Zone
- Access track buffers

0 25 50 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:4,000 at A4
Project Number:	620.13770
Date:	14/10/2020
Drawn by:	PM

SLR

Notes

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- Based on the sequencing of the construction works and preparation of the secondary ESC plan, additional ESC measures may be required to retain sediment laden runoff.

146500
147000
147500
148000
7343500
7343000
7342500

Check dams to be used in table drains. Spacing interval should be based on every 2m of elevation change, or more frequent if scour is observed.

Floodway. Stabilisation of access track with gravel and rock protection in accordance with IESC 2008 to be required.

U-shaped sediment traps shouild be used downstream of all access road causeways to capture sediment.

Clean water diversions should be implimented in accordance with the flood impact assessment diversion requirements.

Clean water diversions should be implimented in accordance with the flood impact assessment diversion requirements.

NO GO ZONE

NO GO ZONE

NO GO ZONE

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan
Mereenie West 28
Overall Plan

FIGURE C7

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Level Spreader
- 1m Contours (LiDAR)
- Indicative Well Pad
- Proposed Clearance Areas
- Indicative Flow Direction
- No Go Zone

0 100 200 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:5,500 at A4
Project Number:	620.13770
Date:	14/10/2020
Drawn by:	PM

SLR

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146400 146500 146600 146700 146800 146900 147000 147100 147200 147300 147400 147500 147600 147700

7343800 7343700 7343600 7343500 7343400 7343300 7343200 7343100 7343000 7342900 7342800

NO GO ZONE

NO GO ZONE

NO GO ZONE

NO GO ZONE

Table drains - mulch berms to be used every2m of elevation change. Interval frequency to be increased if scour becomes evident.

Table drains - mulch berms to be used every 2 of elevation change. Interval frequency to be increased if scour becomes evident.

Table drain turnout in accordance with NT Road Drainage Guideline. Concentrated flow discharge may require additional control such as U-shaped sediment trapt.

Clean water diversion bund to divert flows away from access road. Locate at appropriate location once access track is confirmed. Sufficient length of berm required to divert flow around well pad.

Notes

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Mereenie West 28
ESCP - Access

FIGURE C8

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Level Spreader
- Indicative Well Pad
- Proposed Clearance Areas
- Indicative Flow Direction
- No Go Zone

0 50 100 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:4,000 at A4
Project Number:	620.13770
Date:	16/10/2020
Drawn by:	NB

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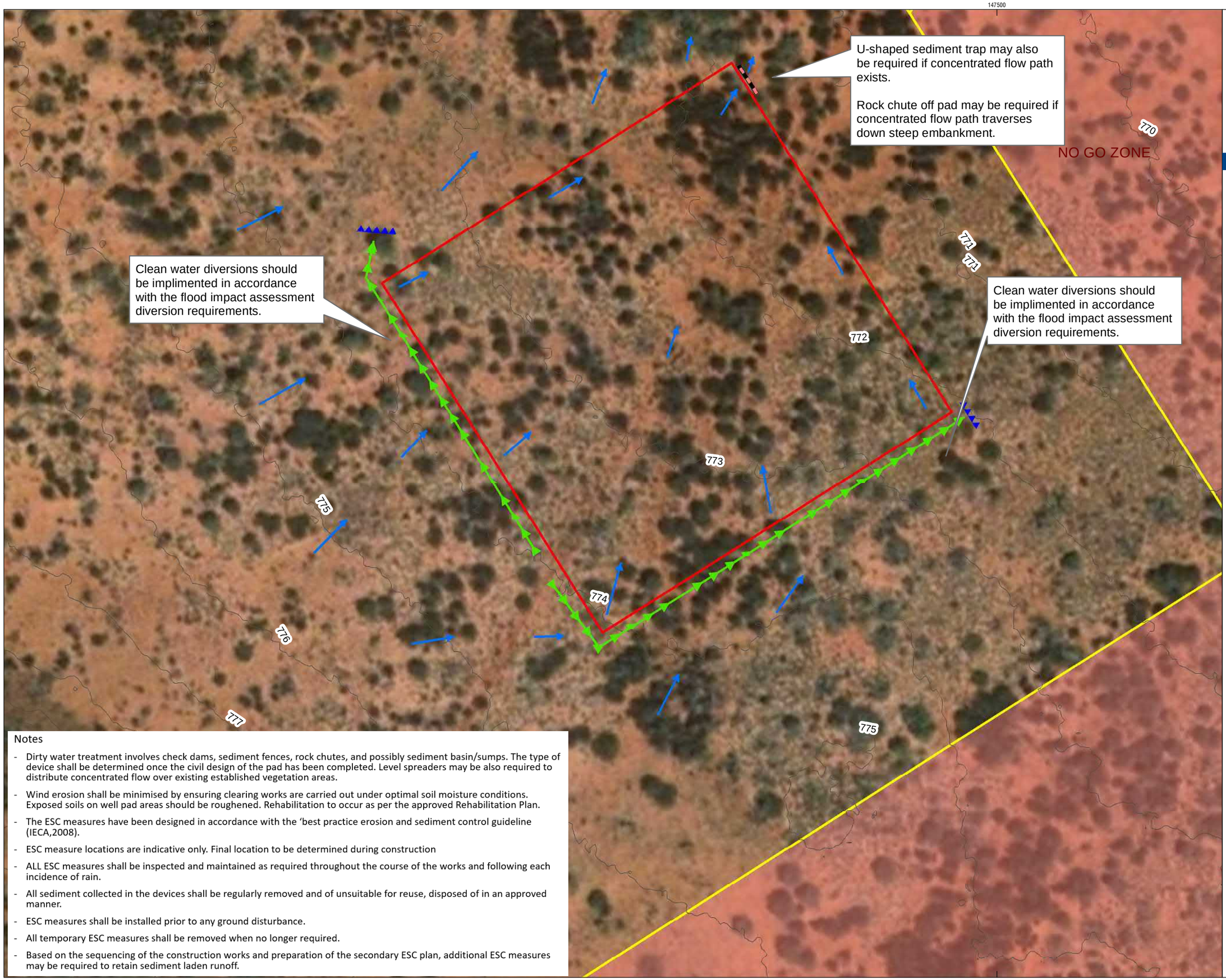

Notes

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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan
Mereenie West 28
Well Pad

FIGURE C9

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Level Spreader
- 1m Contours (LiDAR)
- Indicative Well Pad
- Proposed Clearance Areas
- Indicative Flow Direction
- No Go Zone

0 10 20 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:1,000 at A4
Project Number:	620.13770
Date:	19/10/2020
Drawn by:	PM

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NO GO ZONE

560

559

558

557

556

Clean water diversions required on upstream side of well pad, if concentrated flow path si visable on-site.

Location of dirty water treatment bunds to be determined on-site. Dependant on civil design of pad and assessment of terrain.

Notes

- Dirty water treatment involves check dams, sediment fences, rock chutes, and possibly sediment basin/sumps. The type of device shall be determined once the civil design of the pad has been completed. Level spreaders may be also required to distribute concentrated flow over existing established vegetation areas.
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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan Mamlambo Well Pad

FIGURE C10

- SRTM Contours
- NT Stream Order

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Level Spreader
- Indicative well pad
- Proposed Clearance Areas
- Indicative Flow Direction
- No Go Zone

0 10 20 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:1,500 at A4
Project Number:	630.13770
Date:	15/10/2020
Drawn by:	PM

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NO GO ZONE

560

559

558

557

556

Clean water diversions required on upstream side of well pad, if concentrated flow path si visable on-site.

Location of dirty water treatment bunds to be determined on-site. Dependant on civil design of pad and assessment of terrain.

Notes

- Dirty water treatment involves check dams, sediment fences, rock chutes, and possibly sediment basin/sumps. The type of device shall be determined once the civil design of the pad has been completed. Level spreaders may be also required to distribute concentrated flow over existing established vegetation areas.
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CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan Mamlambo Well Pad

FIGURE C11

- SRTM Contours
- NT Stream Order

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Level Spreader
- Indicative well pad
- Proposed Clearance Areas
- Indicative Flow Direction
- No Go Zone

0 10 20 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:1,500 at A4
Project Number:	630.13770
Date:	15/10/2020
Drawn by:	PM

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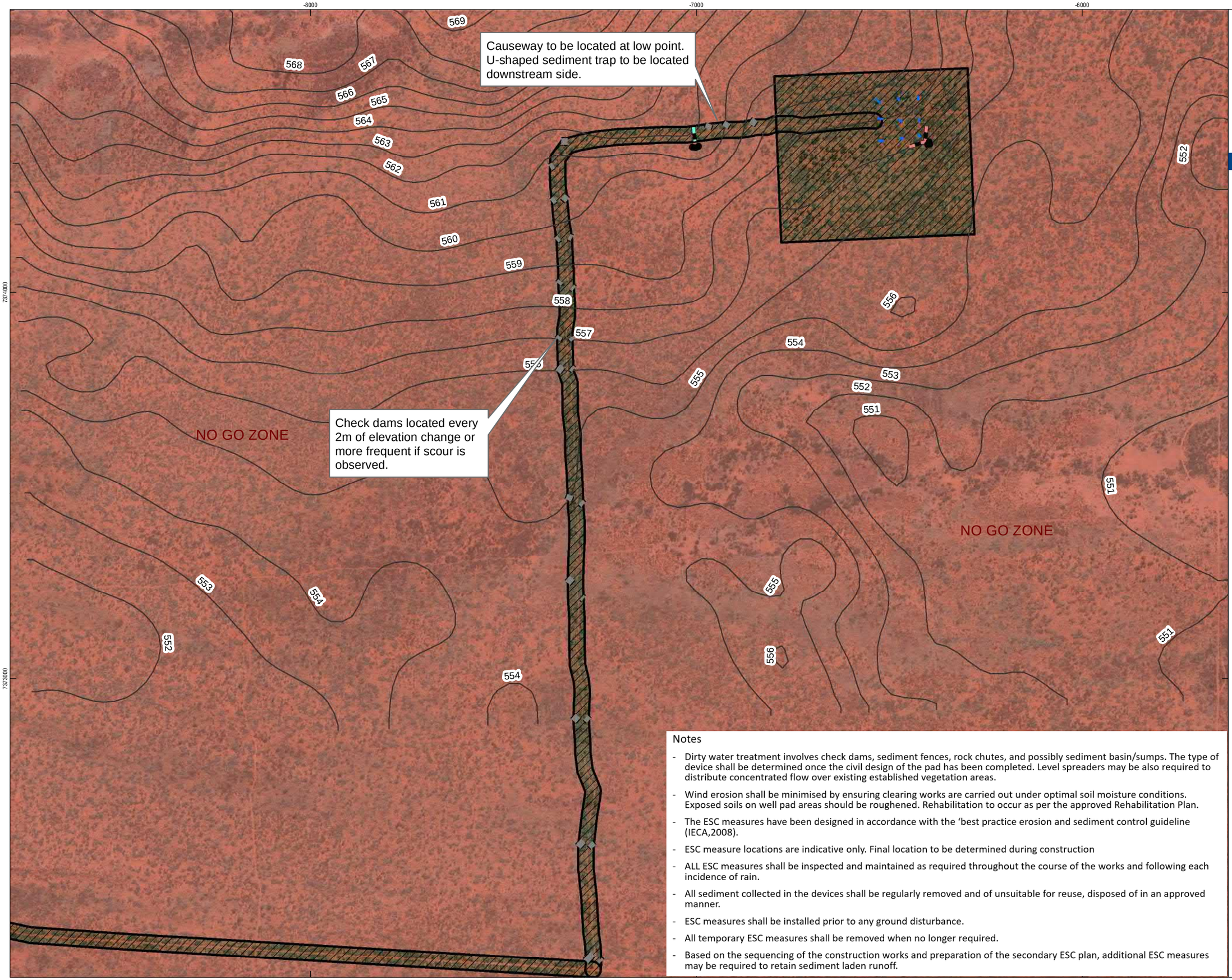

CENTRAL PETROLEUM
2020 EXPLORATION PROGRAM

Preliminary Erosion and Sediment Control Plan Mamlambo Access Road

FIGURE C12

- SRTM Contours

ESC Measures

- Clean Water diversion bunds
- Dirty water treatment
- At-grade causeway crossings
- Check dams
- U-shaped sediment trap
- Sediment Basin
- Level Spreader
- Proposed Clearance Areas
- Indicative Flow Direction
- No Go Zone

Notes

- Dirty water treatment involves check dams, sediment fences, rock chutes, and possibly sediment basin/sumps. The type of device shall be determined once the civil design of the pad has been completed. Level spreaders may be also required to distribute concentrated flow over existing established vegetation areas.
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0 100 200 m

Coordinate System:	GDA 1994 MGA Zone 53
Scale:	1:8,919 at A4
Project Number:	620.13770
Date:	15-Aug-2020
Drawn by:	PM

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APPENDIX D

Standard Drawings

MATERIALS

FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN FABRIC, AT LEAST 700mm IN WIDTH AND A MINIMUM UNIT WEIGHT OF 140g/m^2. ALL FABRICS TO CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).

FABRIC REINFORCEMENT: (IF USED) WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.

SUPPORT POSTS/STAKES: 1500mm^2 (MIN) HARDWOOD, 2500mm^2 (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND REQUIRED TYPE OF FABRIC (IF SPECIFIED). IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, FABRIC TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. INSTALL THE FABRIC IN A U-SHAPE, EXTENDING THE WING WALLS EITHER UP THE SIDE SLOPES AND/OR UP THE CHANNEL INVERT (AS DIRECTED) TO A POINT WHERE THE GROUND LEVEL IS AT LEAST 100mm HIGHER THAN THE CREST OF THE SPILL-THROUGH WEIR.

3. ENSURE THAT THE EXPECTED CHANNEL FLOW WILL ENTER THE SEDIMENT TRAP, EITHER BY EXTENDING THE WING WALLS UP THE BANK SLOPE, OR CONSTRUCTING SANDBAG FLOW DIVERSION BANKS.

4. UNLESS DIRECTED BY THE SITE SUPERVISOR, EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE ALIGNMENT OF THE SPILL-THROUGH WEIR AND WING WALLS.

5. ALONG THE LOWER SIDE OF THE TRENCH, APPROPRIATELY SECURE THE STAKES INTO THE GROUND SPACED NO GREATER THAN 1m.

6. CONSTRUCT THE SEDIMENT TRAP FROM A CONTINUOUS ROLL OF FABRIC.

7. SECURELY ATTACH THE FABRIC TO THE SUPPORT POSTS/STAKES USING 25mm STAPLES OR TIE WIRE AT MAXIMUM 150mm SPACING WITH THE FABRIC EXTENDED AT LEAST 200mm INTO THE TRENCH.

8. INSTALL A SPILL-THOUGH WEIR AT THE LOWEST POINT IN THE FENCE. THE WEIR MUST BE AT LEAST 300mm ABOVE ADJACENT GROUND LEVEL, AND BELOW THE LOWEST GROUND LEVEL AT THE ENDS OF THE WING WALLS.

9. SECURELY TIE A HORIZONTAL CROSS MEMBER (WEIR) TO THE ADJACENT SUPPORT POSTS. CUT THE FABRIC DOWN THE SIDE OF THE POSTS AND FOLD THE FABRIC OVER THE CROSS MEMBER AND APPROPRIATELY SECURE THE FABRIC.

10. IF DIRECTED, INSTALL A SUITABLE SPLASH PAD IMMEDIATELY DOWN-SLOPE OF THE SPILL-THROUGH WEIR TO CONTROL SOIL EROSION DOWNSTREAM OF THE SEDIMENT TRAP.

11. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC AND MESH TO PREVENT WATER FROM FLOWING UNDER THE FENCE.

MAINTENANCE

1. INSPECT THE SEDIMENT TRAP AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC FROM POST TO POST.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.
4. IF THE FABRIC IS SAGGING BETWEEN STAKES, INSTALL ADDITIONAL SUPPORT POSTS/STAKES.

5. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 150mm.

6. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

7. REPLACE THE FABRIC IF THE SERVICE LIFE OF THE EXISTING FABRIC EXCEEDS SIX MONTHS.

REMOVAL

1. WHEN DISTURBED AREAS UP-SLOPE OF THE SEDIMENT TRAP ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE SEDIMENT TRAP MUST BE REMOVED.

2. REMOVE MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

Catchments & Creeks Pty Ltd

Drawn:	Date:		
GMW	Apr-10	U-Shaped Sediment Trap	UST-02

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION FOR THE BERM, CLEARING ONLY THE AREA THAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT.

3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY.

4. FORM THE BERM FROM THE MATERIAL, AND TO THE DIMENSION SPECIFIED IN THE APPROVED PLANS.

5. IF FORMED FROM SANDBAGS, THEN ENSURE THE BAGS ARE TIGHTLY PACKED SUCH THAT WATER LEAKAGE THROUGH THE BAGS IS MINIMISED.

6. CHECK THE ALIGNMENT OF THE BERM TO ENSURE POSITIVE DRAINAGE IN THE DESIRED DIRECTION.

7. ENSURE THE BERM DISCHARGES TO A STABLE OUTLET.

8. ENSURE THE BERM DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT FLOW CONTROL BERMS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. INSPECT THE BERM FOR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD. MAKE REPAIRS AS NECESSARY.

3. CHECK THAT FILL MATERIAL OR SEDIMENT HAS NOT PARTIALLY BLOCKED THE DRAINAGE PATH UP-SLOPE OF THE EMBANKMENT. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

4. DISPOSE OF ANY COLLECTED SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

5. REPAIR ANY PLACES IN THE BERM THAT ARE WEAKENED OR IN RISK OF FAILURE.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE BANK IS FINISHED AND THE AREA IS STABILISED, THE FLOW CONTROL BERM SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

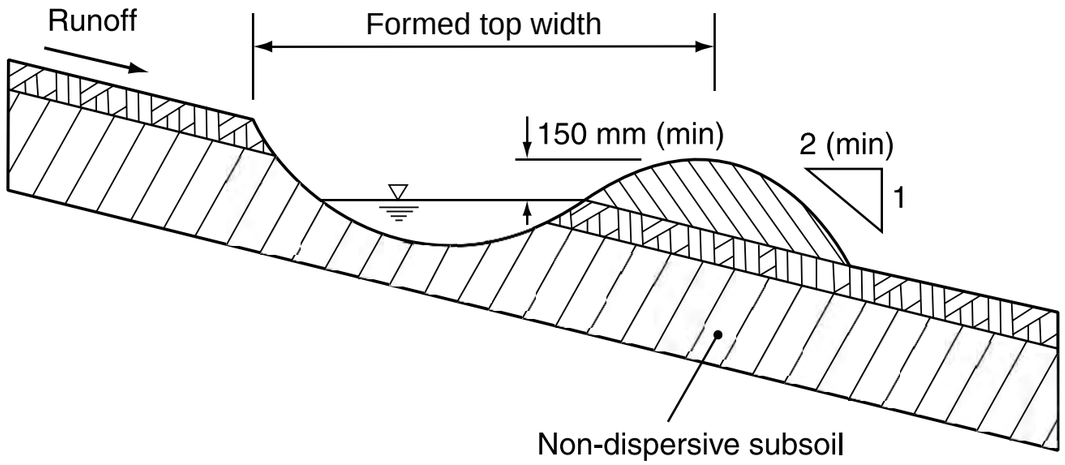
4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED IN THE APPROVED PLAN.

Table 1 - Recommended dimensions of flow control berms

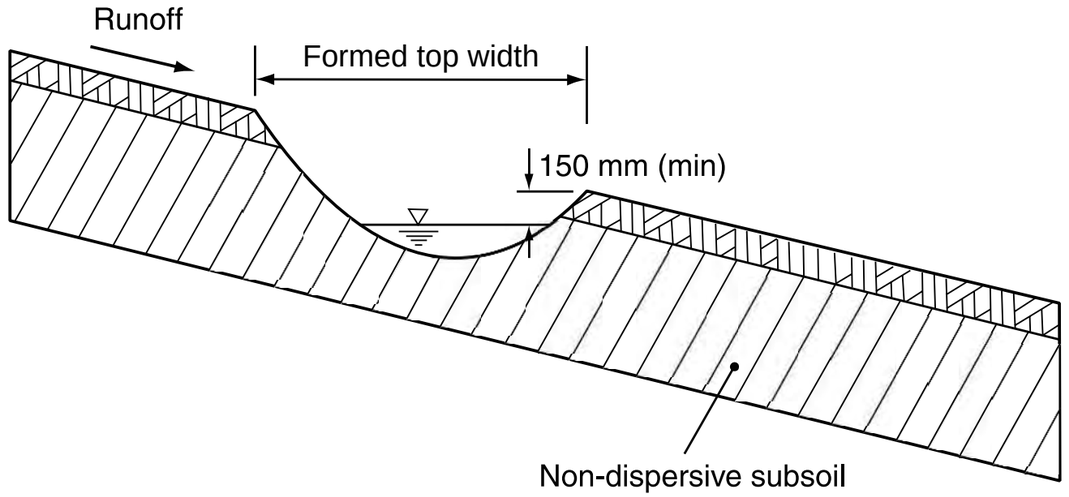
Parameter	Earth banks	Vegetated banks	Compost berms	Sandbag berms
Height (min)	500 mm	500 mm	300 mm	N/A
Top width (min)	500 mm	500 mm	100 mm	N/A
Base width (min)	2500 mm	2500 mm	600 mm	N/A
Side slope (max)	2:1 (H:V)	2:1 (H:V)	1:1 (H:V)	N/A
Freeboard	300 mm	150 mm	100 mm	50 mm

Drawn:	Date:		
GMW	Dec-09	Flow Control Berms	CB-01

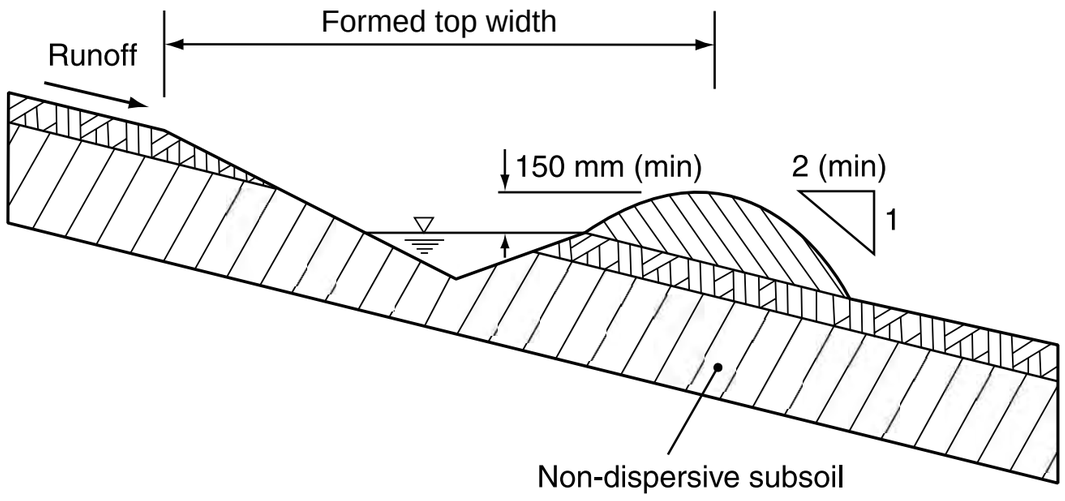
Catchments & Creeks Pty Ltd



(a) Parabolic catch drain with down-slope bank



(c) Parabolic catch drain without bank



(b) Triangular V-drain with down-slope bank

Constructed dimensions of parabolic catch drains		
Drain type	Formed top width with or without bank	Formed depth with or without bank
Type-A	1.6 m	0.30 m
Type-B	2.4 m	0.45 m
Type-C	3.6 m	0.65 m

Constructed dimensions of triangular V-drains		
Drain type	Formed top width with or without bank	Formed depth with or without bank
Type-AV	2.0 m	0.30 m
Type-BV	2.7 m	0.45 m
Type-CV	3.9 m	0.65 m

NOT TO SCALE

Drawn:	Date:		
GMW	Dec-09	Catch Drains	CD-01

Catchments & Creeks Pty Ltd

INSTALLATION (EARTH-LINED)

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION FOR THE CATCH DRAIN, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

3. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.

4. GRADE THE DRAIN TO THE SPECIFIED SLOPE AND FORM THE ASSOCIATED EMBANKMENT WITH COMPACTED FILL. NOTE THAT THE DRAIN INVERT MUST FALL 10cm EVERY 10m FOR EACH 1% OF REQUIRED CHANNEL GRADIENT.

5. ENSURE THE SIDES OF THE CUT DRAIN ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE AND THE EMBANKMENT FILL SLOPES NO STEEPER THAN 2:1.

6. ENSURE THE COMPLETED DRAIN HAS SUFFICIENT DEEP (AS SPECIFIED FOR THE TYPE OF DRAIN) MEASURED FROM THE DRAIN INVERT TO THE TOP OF THE EMBANKMENT.

7. ENSURE THE DRAIN HAS A CONSTANT FALL IN THE DESIRED DIRECTION FREE OF OBSTRUCTIONS.

8. ENSURE THE DRAIN DISCHARGES TO A STABLE OUTLET SUCH THAT SOIL EROSION WILL BE PREVENTED FROM OCCURRING. SPECIFICALLY, ENSURE THE DRAIN DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT ALL CATCH DRAINS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING STORM EVENTS AND REPAIR ANY SLUMPS, BANK DAMAGE, OR LOSS OF FREEBOARD.

2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE DRAIN. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

3. DISPOSE OF ANY SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE CATCH DRAIN IS FINISHED AND THE AREA IS STABILISED, THE TEMPORARY DRAIN AND ANY ASSOCIATED BANKS SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED WITHIN THE APPROVED SITE REHABILITATION PLAN.

Catchments & Creeks Pty Ltd

Drawn:	Date:		
GMW	Dec-09	Catch Drains - Earth Lined	CD-02

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO PLANTING.

3. CLEAR THE LOCATION FOR THE CATCH DRAIN, CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

4. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY. DO NOT USE DEBRIS TO BUILD THE BANK.

5. GRADE THE DRAIN TO THE SPECIFIED SLOPE AND FORM THE ASSOCIATED EMBANKMENT WITH COMPACTED FILL. NOTE THAT THE DRAIN INVERT MUST FALL 10cm EVERY 10m FOR EACH 1% OF CHANNEL GRADIENT.

6. ENSURE THE SIDES OF THE CUT DRAIN ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE AND THE EMBANKMENT FILL SLOPES NO STEEPER THAN 2:1.

7. ENSURE THE COMPLETED DRAIN HAS SUFFICIENT DEEP (AS SPECIFIED FOR THE TYPE OF DRAIN) MEASURED FROM THE DRAIN INVERT TO THE TOP OF THE EMBANKMENT. WHERE NECESSARY, CUT THE DRAIN SLIGHTLY DEEPER THAN THAT SPECIFIED ON THE PLANS SUCH THAT THE CORRECT CHANNEL DIMENSIONS ARE ACHIEVED FOLLOWING PLACEMENT OF THE TURF.

8. ENSURE THE DRAIN HAS A CONSTANT FALL IN THE DESIRED DIRECTION FREE OF OBSTRUCTIONS.

9. TURF SHOULD BE USED WITHIN 12-HOURS OF DELIVERY, OTHERWISE ENSURE THE TURF IS STORED IN CONDITIONS APPROPRIATE FOR THE WEATHER CONDITIONS (e.g. A SHADED AREA).

10. MOISTENING THE TURF AFTER IT IS UNROLLED WILL HELP MAINTAIN ITS VIABILITY.

11. TURF SHOULD BE LAID ON A MINIMUM 75mm BED OF ADEQUATELY FERTILISED TOPSOIL. RAKE THE SOIL SURFACE TO BREAK THE CRUST JUST BEFORE LAYING THE TURF.

12. DURING THE WARMER MONTHS, LIGHTLY IRRIGATE THE SOIL IMMEDIATELY BEFORE LAYING THE TURF.

13. ENSURE THE TURF IS NOT LAID ON GRAVEL, HEAVILY COMPACTED SOILS, OR SOILS THAT HAVE BEEN RECENTLY TREATED WITH HERBICIDES.

14. FOR WIDE DRAINS AND HIGH VELOCITY CHUTES, LAY THE FIRST ROW OF TURF IN A STRAIGHT LINE DIAGONAL TO THE DIRECTION OF FLOW. STAGGER SUBSEQUENT ROWS IN A BRICK-LIKE (STRETCHER BOND) PATTERN. THE TURF SHOULD NOT BE STRETCHED OR OVERLAPPED. USE A KNIFE OR SHARP SPADE TO TRIM AND FIT IRREGULARLY SHAPED AREAS.

15. FOR NARROW DRAINS, LAY THE TURF ALONG THE DIRECTION OF THE DRAIN, ENSURING, WHEREVER PRACTICABLE, THAT A LONGITUDINAL JOINT BETWEEN TWO STRIPS OF TURF IS NOT POSITIONED ALONG THE INVERT OF THE DRAIN.

16. ENSURE THE TURF EXTENDS UP THE SIDES OF THE DRAIN AT LEAST 100mm ABOVE THE ELEVATION OF THE CHANNEL INVERT, OR AT LEAST TO A SUFFICIENT ELEVATION TO FULLY CONTAIN EXPECTED CHANNEL FLOW.

17. ON CHANNEL GRADIENTS OF 3:1(H:V) OR STEEPER, OR IN SITUATIONS WHERE HIGH FLOW VELOCITIES (i.e. VELOCITY >1.5m/s) ARE LIKELY WITHIN THE FIRST 2-WEEKS FOLLOWING PLACEMENT, SECURE THE INDIVIDUAL TURF STRIPS WITH WOODEN OR PLASTIC PEGS.

18. ENSURE THAT INTIMATE CONTACT IS ACHIEVED AND MAINTAINED BETWEEN THE TURF AND THE SOIL SUCH THAT SEEPAGE FLOW BENEATH THE TURF IS AVOIDED.

19. WATER UNTIL THE SOIL IS WET 100mm BELOW THE TURF. THEREAFTER, WATERING SHOULD BE SUFFICIENT TO MAINTAIN AND PROMOTE HEALTHY GROWTH.

20. ENSURE THE DRAIN DISCHARGES TO A STABLE OUTLET SUCH THAT DOWN-SLOPE SOIL EROSION WILL BE PREVENTED FROM OCCURRING. ENSURE THE DRAIN DOES NOT DISCHARGE TO AN UNSTABLE FILL SLOPE.

MAINTENANCE

1. INSPECT ALL CATCH DRAINS AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING STORM EVENTS AND REPAIR ANY SLUMPS, BANK DAMAGE, OR LOSS OF FREEBOARD.

2. ENSURE FILL MATERIAL OR SEDIMENT IS NOT PARTIALLY BLOCKING THE DRAIN. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

3. DISPOSE OF ANY SEDIMENT OR FILL IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN THE SOIL DISTURBANCE ABOVE THE CATCH DRAIN IS FINISHED AND THE AREA IS STABILISED, THE DRAIN AND ANY ASSOCIATED BANKS SHOULD BE REMOVED, UNLESS IT IS TO REMAIN AS A PERMANENT DRAINAGE FEATURE.

2. DISPOSE OF ANY SEDIMENT OR EARTH IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. GRADE THE AREA AND SMOOTH IT OUT IN PREPARATION FOR STABILISATION.

4. STABILISE THE AREA BY GRASSING OR AS SPECIFIED WITHIN THE APPROVED PLAN.

Catchments & Creeks Pty Ltd

Drawn:	Date:		
GMW	Dec-09	Catch Drains - Grass Lined	CD-03

MATERIALS

ROCK: 150 TO 300mm EQUIVALENT DIAMETER, HARD, EROSION RESISTANT ROCK.

SANDBAGS: GEOTEXTILE BAGS (WOVEN SYNTHETIC, OR NON-WOVEN BIODEGRADABLE) FILLED WITH CLEAN COARSE SAND, CLEAN AGGREGATE, OR COMPOST.

INSTALLATION (ROCK CHECK DAM)

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. PRIOR TO PLACEMENT OF THE SEDIMENT TRAP, ENSURE THE DRAINAGE CHANNEL IS DEEP ENOUGH TO PREVENT WATER BEING UNSAFELY DIVERTED OUT OF THE DRAIN ONCE THE CHECK DAMS ARE INSTALLED.

3. LOCATE EACH CHECK DAM SEDIMENT TRAP AS DIRECTED WITHIN THE APPROVED PLANS, OR OTHERWISE AT SUCH A SPACING TO ACHIEVE THE REQUIRED SEDIMENT TRAPPING OUTCOMES.

4. IF THE CHECK DAMS ARE ALSO BEING USED TO CONTROL EROSION WITHIN THE DRAINAGE CHANNEL, THEN LOCATE EACH SUCCESSIVE CHECK DAM SUCH THAT THE CREST OF THE IMMEDIATE DOWNSTREAM DAM IS LEVEL WITH THE CHANNEL INVERT AT THE IMMEDIATE UPSTREAM CHECK DAM.

5. CONSTRUCT EACH CHECK DAM TO THE DIMENSIONS AND PROFILE SHOWN WITHIN THE APPROVED PLAN.

6. WHERE SPECIFIED, THE CHECK DAMS MUST BE CONSTRUCTED ON A SHEET OF GEOTEXTILE FABRIC USED AS A DOWNSTREAM SPLASH PAD.

7. EACH CHECK DAM MUST BE EXTENDED UP THE CHANNEL BANK (WHERE PRACTICABLE) TO AN ELEVATION AT LEAST 150mm ABOVE THE CREST LEVEL OF THE DAM.

INSTALLATION (COMPOST-FILLED SOCKS)

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. PRIOR TO PLACEMENT OF THE SEDIMENT TRAP, ENSURE THE DRAINAGE CHANNEL IS DEEP ENOUGH TO PREVENT WATER BEING UNSAFELY DIVERTED OUT OF THE DRAIN ONCE THE CHECK DAMS ARE INSTALLED.

3. LOCATE EACH SOCK AS DIRECTED WITHIN THE APPROVED PLANS, OR OTHERWISE AT SUCH A SPACING TO ACHIEVE THE REQUIRED SEDIMENT TRAPPING OUTCOMES.

4. PLACE EACH SOCK TO THE LINES AND PROFILE SHOWN IN THE APPROVED PLAN OR AS DIRECTED BY THE SITE SUPERVISOR.

5. ENSURE EACH SOCK EXTENDS UP THE CHANNEL BANKS (WHERE PRACTICAL) TO A LEVEL AT LEAST 100mm ABOVE THE CREST LEVEL OF THE CHECK DAM.

MAINTENANCE

1. INSPECT EACH CHECK DAM AND THE DRAINAGE CHANNEL AT LEAST WEEKLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. CORRECT ALL DAMAGE IMMEDIATELY. IF SIGNIFICANT EROSION OCCURS BETWEEN ANY OF THE CHECK DAMS, THEN CHECK THE SPACING OF THE DAMS AND WHERE NECESSARY INSTALL INTERMEDIATE CHECK DAMS OR A SUITABLE CHANNEL LINER.

3. CHECK FOR DISPLACEMENT OF THE CHECK DAMS.

4. CHECK FOR SOIL SCOUR AROUND THE ENDS OF EACH CHECK DAM. IF SUCH EROSION IS OCCURRING, CONSIDER EXTENDING THE WIDTH OF THE CHECK DAM TO AVOID SUCH PROBLEMS.

5. IF SEVERE SOIL EROSION OCCURS EITHER UNDER OR AROUND THE CHECK DAMS, THEN SEEK EXPERT ADVICE ON AN ALTERNATIVE TREATMENT MEASURE.

6. DE-SILT SEDIMENT TRAP IF THE SEDIMENT LEVEL EXCEEDS 1/3 THE CREST HEIGHT.

7. DISPOSE OF COLLECTED SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN CONSTRUCTION WORK WITHIN THE DRAINAGE AREA ABOVE THE CHECK DAMS HAS BEEN COMPLETED AND DISTURBED AREAS SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE DAMS MUST BE REMOVED, UNLESS THE SEDIMENT TRAPS ARE TO REMAIN AS A PERMANENT FEATURE.

2. REMOVE COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REMOVE AND APPROPRIATELY DISPOSE OF ALL MATERIALS INCLUDING ANY GEOTEXTILE FABRIC.

4. STABILISE THE DISTURBED CHANNEL WITH A LINING OF FABRIC AND ROCK, OR ESTABLISH VEGETATION AS APPROPRIATE.

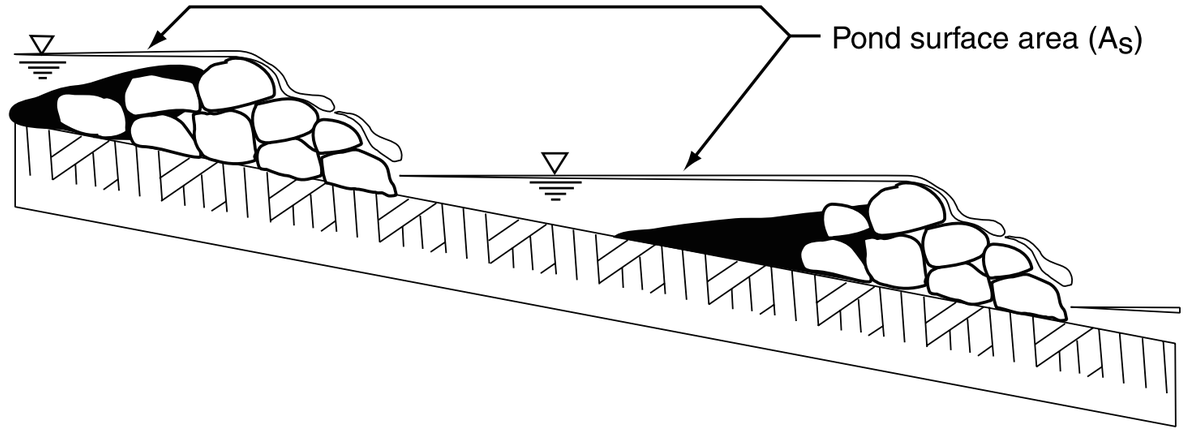


Figure 1 - Placement of check dam sediment traps

Drawn:	Date:		
GMW	Apr-10	Check Dam Sediment Trap	CDT-01

Catchments & Creeks Pty Ltd

MATERIALS

COMPOSTS MUST COMPLY WITH THE REQUIREMENTS OF AS4454.

(i) WELL-DECOMPOSED 100% ORGANIC MATTER PRODUCED BY CONTROLLED AEROBIC (BIOLOGICAL) DECOMPOSITION.

(ii) MAXIMUM OF 1% OF INERT MATERIAL.

(iii) MAXIMUM SOLUBLE SALT CONCENTRATION OF 5dS/m, AND pH RANGE OF 5.0 TO 8.5.

(iv) MOISTURE CONTENT OF 30 TO 50% PRIOR TO APPLICATION.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND EXTENT. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, MATERIAL TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN SELECTING THE LOCATION OF A COMPOST FILTER BERM, TO THE MAXIMUM DEGREE PRACTICABLE, ENSURE THE BERM IS LOCATED:

(i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;

(ii) ALONG A LINE OF CONSTANT ELEVATION (PREFERRED, BUT NOT ALWAYS PRACTICAL);

(iii) AT LEAST 1m, IDEALLY 3m, FROM THE TOE OF A FILL EMBANKMENT;

(iv) AWAY FROM AREAS OF CONCENTRATED FLOW.

3. ENSURE THE BERM IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE BERM, OR THE UNDESIRABLE DISCHARGE OF WATER AROUND THE ENDS OF THE BERM.

4. ENSURE THE BERM HAS BEEN PLACED ALONG THE CONTOUR SUCH THAT WATER WILL POND EVENLY ALONG THE LENGTH OF THE BERM.

5. ENSURE BOTH ENDS OF THE BERM ARE ADEQUATELY TURNED UP THE SLOPE TO PREVENT FLOW BYPASSING PRIOR TO WATER PASSING OVER THE BERM.

6. ENSURE 100% CONTACT WITH THE SOIL SURFACE.

7. WHERE SPECIFIED, TAKE APPROPRIATE STEPS TO VEGETATE THE BERM.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT THE BERM AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR OR REPLACE ANY DAMAGED SECTIONS.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 100mm OR 1/3 THE HEIGHT OF THE BERM.

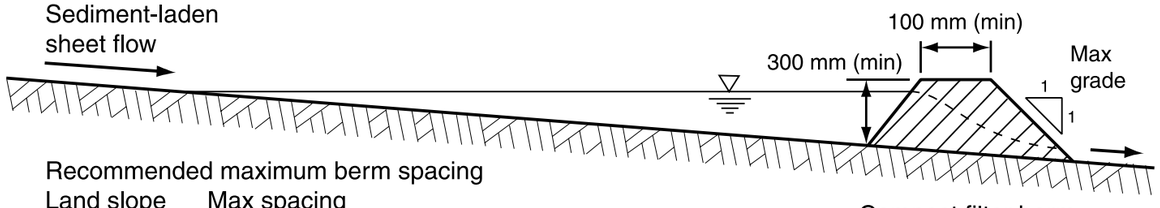
5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL (IF REQUIRED)

1. WHEN DISTURBED AREAS UP-SLOPE OF THE BERM ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE BERM MAYBE REMOVED.

2. REMOVE ANY COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.



Recommended maximum berm spacing

Land slope	Max spacing
< 2%	35 m
5%	25 m
10%	20 m
20%	12.5 m
25%	10 m

Figure 1 - Typical profile of a compost filter berm

Drawn:	Date:		
GMW	Apr-10	Compost Filter Berm	CFB-01

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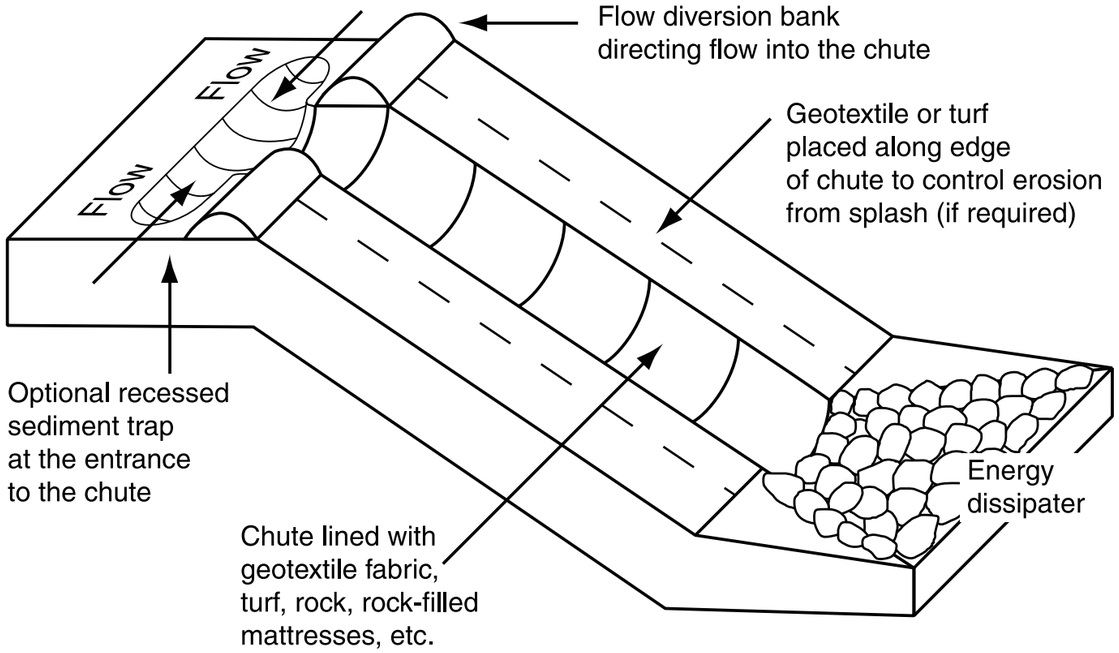
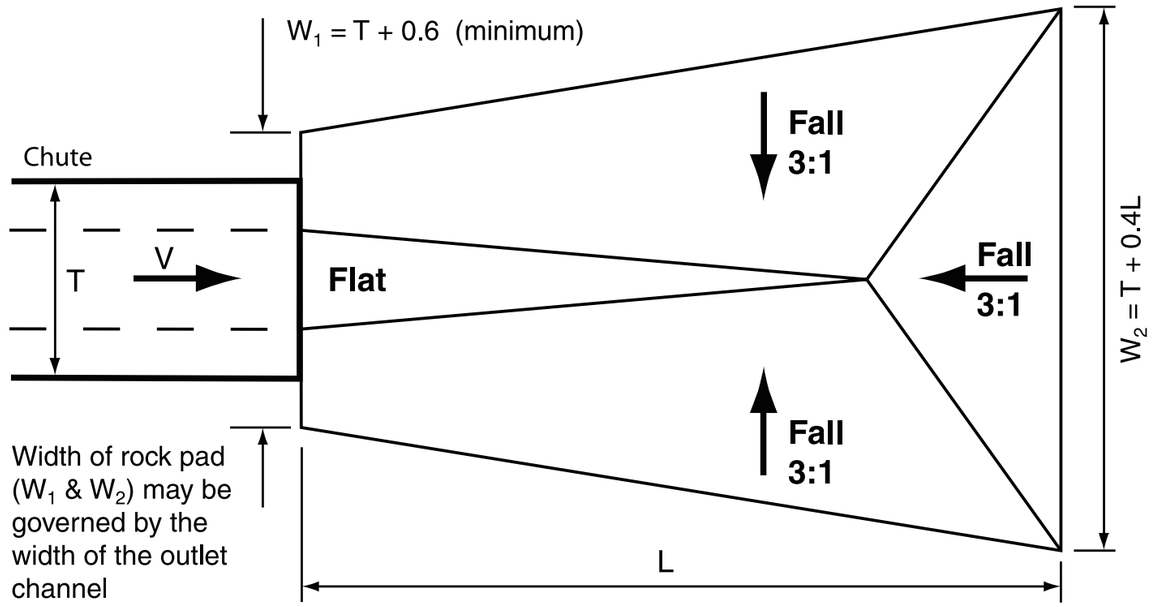
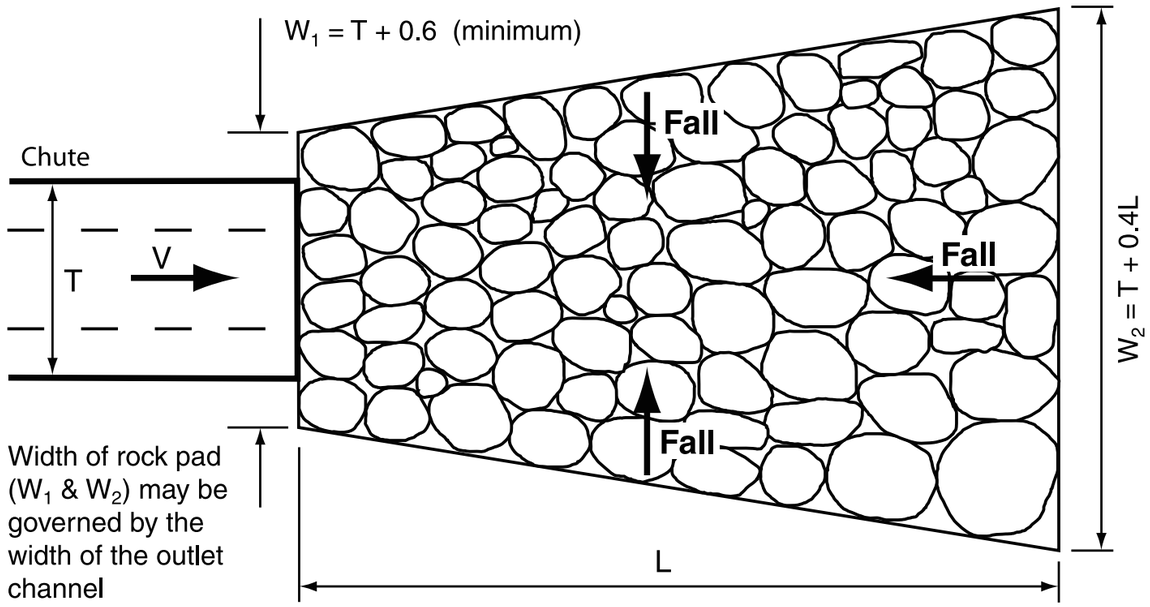


(a) Temporary drainage chute with rock pad outlet structure

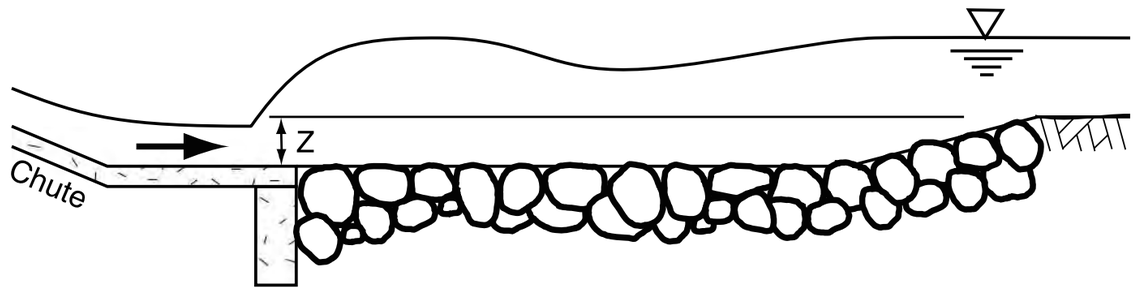


T = Maximum top width of flow at base of chute

(b) Typical layout of an outlet energy dissipater for a drainage chute



(c) Typical layout of a rock pad outlet structure for a drainage chute



(d) Typical profile of a rock pad outlet structure for a drainage chute

Notes:

1. Drawings applicable to temporary drainage chutes, **not** basin spillways.
2. A rock pad outlet structure is just one option for the design of the outlet energy dissipater.

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Drawn:	Date:		
GMW	Dec-09	Chutes - General	CH-01

MATERIAL

ROCK MULCH: 25–75mm DURABLE, WEATHER RESISTANT AND EVENLY GRADED WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL ROCK SIZE (IF SPECIFIED).

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND APPLICATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, OR METHOD OF APPLICATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. SPREAD ENOUGH ROCK TO COMPLETELY COVER THE SURFACE OF THE SOIL AT THE DENSITY OR THICKNESS SPECIFIED IN THE APPROVED PLANS. IF THE APPLICATION DENSITY IS NOT SUPPLIED, THEN APPLY AT A THICKNESS OF AT LEAST 50mm OR TWICE THE NOMINAL ROCK SIZE (WHICHEVER IS GREATER).

3. IF THE EXPOSED SOILS ARE DISPERSIVE, THEN ENSURE THESE SOILS ARE COVERED WITH A LAYER OF NON-DISPERSIVE SOIL (MINIMUM 200mm) BEFORE PLACEMENT OF ROCK.

4. MAKE ALL NECESSARY ADJUSTMENTS TO ENSURE ANY SURFACE FLOW IS ALLOWED TO PASS FREELY ACROSS THE TREATED AREA FOLLOWING ITS NATURAL DRAINAGE PATH.

MAINTENANCE

1. INSPECT ALL TREATED SURFACES FORTNIGHTLY AND AFTER RUNOFF-PRODUCING RAINFALL.

2. CHECK FOR RILL EROSION, OR DISLODGMENT OF THE ROCKS.

3. REPLACE ANY DISPLACED ROCKS TO MAINTAIN THE REQUIRED COVERAGE.

4. IF WASH-OUTS OCCUR, REPAIR THE SLOPE AND REINSTALL ROCK COVER.

5. IF THE ROCK MULCHING IS NOT EFFECTIVE IN CONTAINING THE SOIL EROSION IT SHOULD BE REPLACED, OR AN ALTERNATIVE EROSION CONTROL PROCEDURE ADOPTED.

Catchments & Creeks Pty Ltd

Drawn:	Date:		
GMW	Dec-09	Rock Mulching	MR-01

MATERIALS

ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL ROCK SIZE AND SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. SPECIFIC GRAVITY TO BE AT LEAST 2.5.

GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

INSTALLATION (CHUTE FORMATION)

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. ENSURE ALL NECESSARY SOIL TESTING (e.g. SOIL pH, NUTRIENT LEVELS) AND ANALYSIS HAS BEEN COMPLETED, AND REQUIRED SOIL ADJUSTMENTS PERFORMED PRIOR TO PLANTING.

3. CLEAR THE LOCATION FOR THE CHUTE CLEARING ONLY WHAT IS NEEDED TO PROVIDE ACCESS FOR PERSONNEL AND EQUIPMENT FOR INSTALLATION.

4. REMOVE ROOTS, STUMPS, AND OTHER DEBRIS AND DISPOSE OF THEM PROPERLY.

5. CONSTRUCT THE SUBGRADE TO THE ELEVATIONS SHOWN ON THE PLANS. REMOVE ALL UNSUITABLE MATERIAL AND REPLACE WITH STABLE MATERIAL TO ACHIEVE THE DESIRED FOUNDATIONS.

6. IF THE CHUTE IS TEMPORARY, THEN COMPACT THE SUBGRADE TO A FIRM CONSISTENCY. IF THE CHUTE IS INTENDED TO BE PERMANENT, THEN COMPACT AND FINISH THE SUBGRADE AS SPECIFIED WITHIN THE DESIGN PLANS.

7. AVOID COMPACTING THE SUBGRADE TO A CONDITION THAT WOULD PREVENT THE TURF FROM BONDING WITH THE SUBGRADE.

8. ENSURE THE SIDES OF THE CHUTE ARE NO STEEPER THAN A 1.5:1 (H:V) SLOPE.

9. ENSURE THE COMPLETED CHUTE HAS SUFFICIENT DEEP ALONG ITS FULL LENGTH.

10. ENSURE THE CHUTE IS STRAIGHT FROM ITS CREST TO THE TOE OF THE CHUTE.

11. ON FILL SLOPES, ENSURE THAT THE SOIL IS ADEQUATELY COMPACTED FOR A WIDTH OF AT LEAST ONE METRE EACH SIDE OF THE CHUTE TO MINIMISE THE RISK OF SOIL EROSION, OTHERWISE PROTECT THE SOIL WITH SUITABLE SCOUR PROTECTION MEASURES SUCH AS TURF OR EROSION CONTROL MATS.

12. PLACE AND SECURE THE TURF AS DIRECTED.

13. INSTALL AN APPROPRIATE OUTLET STRUCTURE (ENERGY DISSIPATER) AT THE BASE OF THE CHUTE (REFER TO SEPARATE SPECIFICATIONS).

14. ENSURE WATER LEAVING THE CHUTE AND THE OUTLET STRUCTURE WILL FLOW FREELY WITHOUT CAUSING UNDESIRABLE PONDING OR SCOUR.

15. APPROPRIATELY STABILISE ALL DISTURBED AREAS IMMEDIATELY AFTER CONSTRUCTION.

INSTALLATION (ROCK PLACEMENT)

1. OVER-CUT THE CHANNEL TO A DEPTH EQUAL TO THE SPECIFIED DEPTH OF ROCK PLACEMENT SUCH THAT THE FINISHED ROCK SURFACE WILL BE AT THE ELEVATION OF THE SURROUNDING LAND.

2. ROCK MUST BE PLACED WITHIN THE CHANNEL AS SPECIFIED WITHIN THE APPROVED PLANS, INCLUDING THE PLACEMENT OF ANY SPECIFIED FILTER LAYER.

3. IF DETAILS ARE NOT PROVIDED ON THE ROCK PLACEMENT, THEN THE PRIMARY ARMOUR ROCK MUST BE EITHER PLACED ON:
(i) A FILTER BED FORMED FROM A LAYER OF SPECIFIED SMALLER ROCK (ROCK FILTER LAYER);
(ii) AN EARTH BED LINED WITH FILTER CLOTH;
(iii) AN EARTH BED NOT LINED IN FILTER CLOTH, BUT ONLY IF ALL VOIDS BETWEEN THE ARMOUR ROCK ARE TO BE FILLED WITH SOIL AND POCKET PLANTED IMMEDIATELY AFTER PLACEMENT OF THE ROCK.

4. IF A ROCK/AGGREGATE FILTER LAYER IS SPECIFIED, THEN PLACE THE FILTER LAYER IMMEDIATELY AFTER THE FOUNDATIONS ARE PREPARED. SPREAD THE FILTER ROCK IN A UNIFORM LAYER TO THE SPECIFIED DEPTH BUT A MINIMUM OF 150mm. WHERE MORE THAN ONE LAYER OF FILTER MATERIAL HAS BEEN SPECIFIED, SPREAD EACH LAYER SUCH THAT MINIMAL MIXING OCCURS BETWEEN EACH LAYER OF ROCK.

5. IF A GEOTEXTILE (FILTER CLOTH) UNDERLAY IS SPECIFIED, PLACE THE FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN ONE SHEET OF FABRIC IS REQUIRED TO OVER THE AREA, OVERLAP THE EDGE OF EACH SHEET AT LEAST 300mm AND PLACE ANCHOR PINS AT MINIMUM 1m SPACING ALONG THE OVERLAP.

6. ENSURE THE GEOTEXTILE FABRIC IS PROTECTED FROM PUNCHING OR TEARING DURING INSTALLATION OF THE FABRIC AND THE ROCK. REPAIR ANY DAMAGE BY REMOVING THE ROCK AND PLACING WITH ANOTHER PIECE OF FILTER CLOTH OVER THE DAMAGED AREA OVERLAPPING THE EXISTING FABRIC A MINIMUM OF 300mm.

7. WHERE NECESSARY, A MINIMUM 100mm LAYER OF FINE GRAVEL, AGGREGATE OR SAND SHOULD BE PLACED OVER THE FABRIC TO PROTECT IT FROM DAMAGE.

8. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER LAYER. PLACE ROCK SO THAT IT FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS.

9. PLACE ROCK TO ITS FULL THICKNESS IN ONE OPERATION. DO NOT PLACE ROCK BY DUMPING THROUGH CHUTES OR OTHER METHODS THAT CAUSE SEGREGATION OF ROCK SIZES.

10. THE FINISHED SURFACE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.

11. IMMEDIATELY UPON COMPLETION OF THE CHANNEL, VEGETATE ALL DISTURBED AREAS OR OTHERWISE PROTECT THEM AGAINST SOIL EROSION.

12. WHERE SPECIFIED, FILL ALL VOIDS WITH SOIL AND VEGETATE THE ROCK SURFACE IN ACCORDANCE WITH THE APPROVED PLAN.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL CHUTES PRIOR TO FORECAST RAINFALL, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORM EVENTS, OR OTHERWISE ON A WEEKLY BASIS. MAKE REPAIRS AS NECESSARY.

2. CHECK FOR SCOUR OR DISLODGED ROCK. REPAIR DAMAGED AREAS IMMEDIATELY.

3. CLOSELY INSPECT THE OUTER EDGES OF THE ROCK PROTECTION. ENSURE WATER ENTRY INTO THE CHANNEL OR CHUTE IS NOT CAUSING EROSION ALONG THE EDGE OF THE ROCK PROTECTION.

4. INVESTIGATE THE CAUSE OF ANY SCOUR, AND REPAIR AS NECESSARY.

5. CAREFULLY CHECK THE STABILITY OF THE ROCK LOOKING FOR INDICATIONS OF PIPING, SCOUR HOLES, OR BANK FAILURES.

6. REPLACE ANY DISPLACED ROCK WITH ROCK OF A SIGNIFICANTLY (MINIMUM 110%) LARGER SIZE THAN THE DISPLACED ROCK.

7. ENSURE SEDIMENT IS NOT PARTIALLY BLOCKING FLOW ENTRY INTO THE CHUTE. WHERE NECESSARY, REMOVE ANY DEPOSITED MATERIAL TO ALLOW FREE DRAINAGE.

8. DISPOSE OF ANY SEDIMENT IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

9. WHEN MAKING REPAIRS, ALWAYS RESTORE THE CHUTE TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED.

Drawn:	Date:		
GMW	May-10	Chutes - Rock Linings	CH-06

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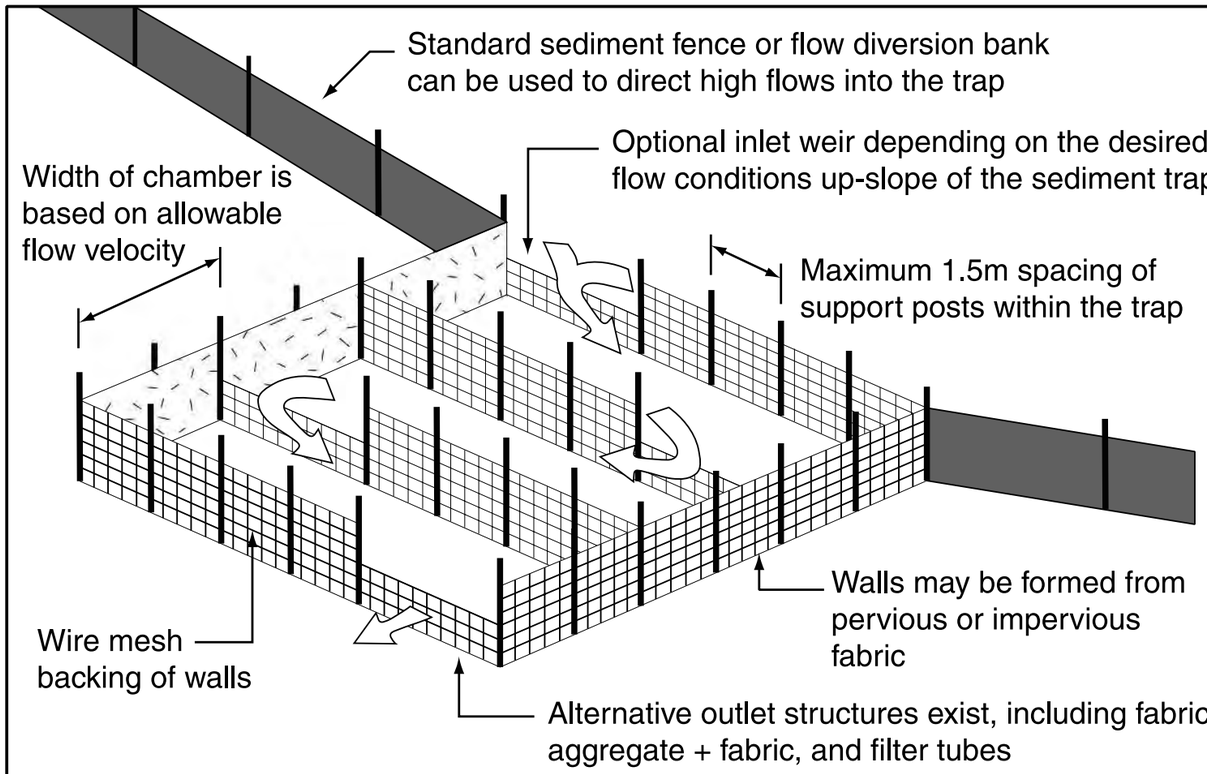
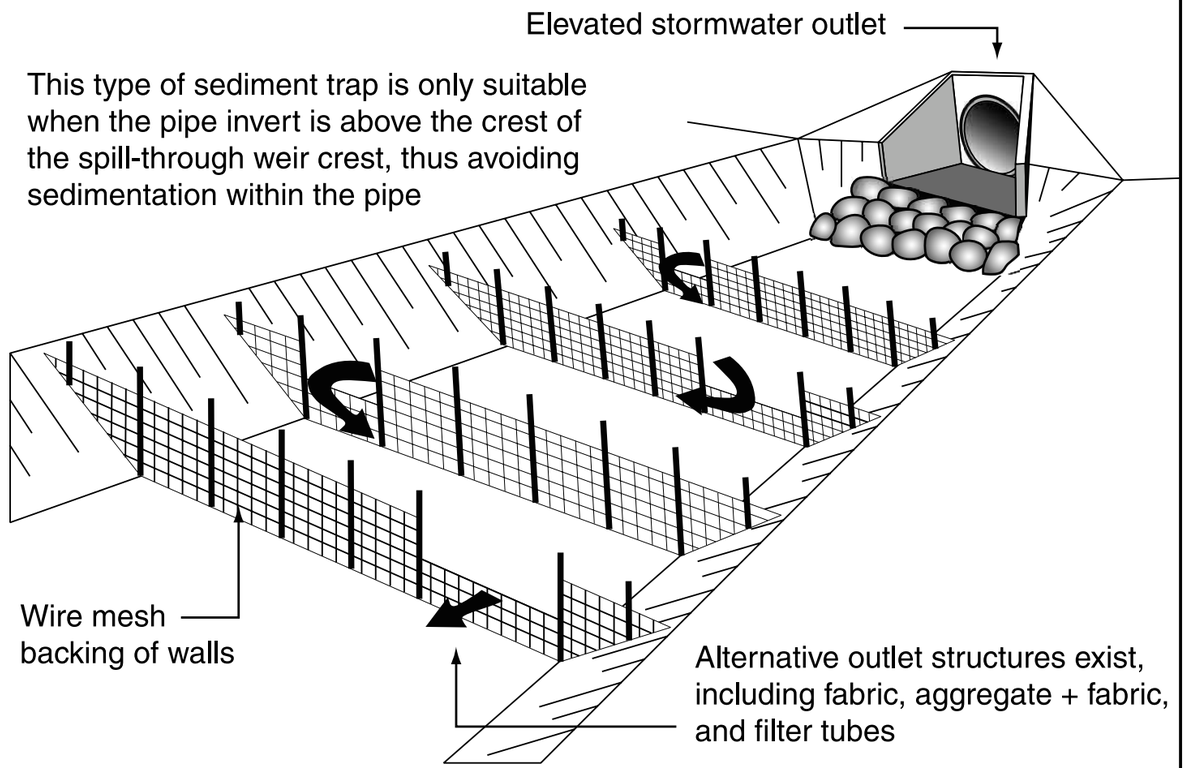
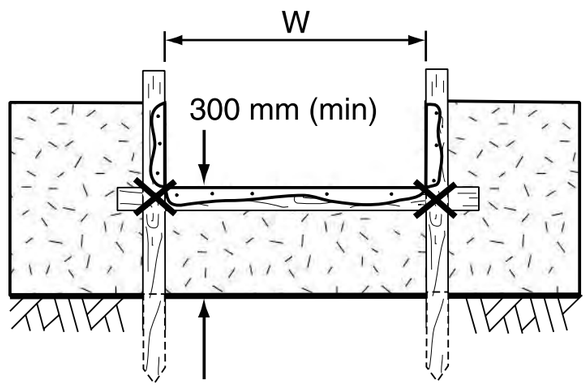


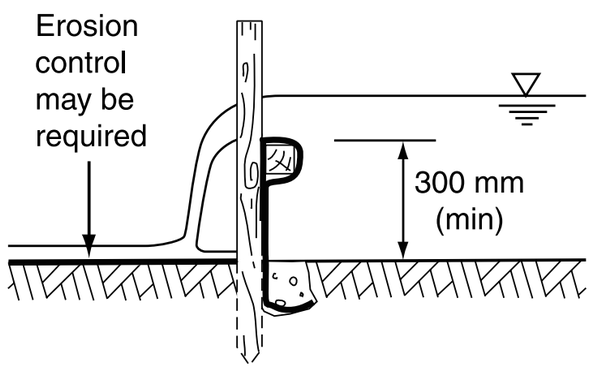
(a) Typical layout of a coarse sediment trap



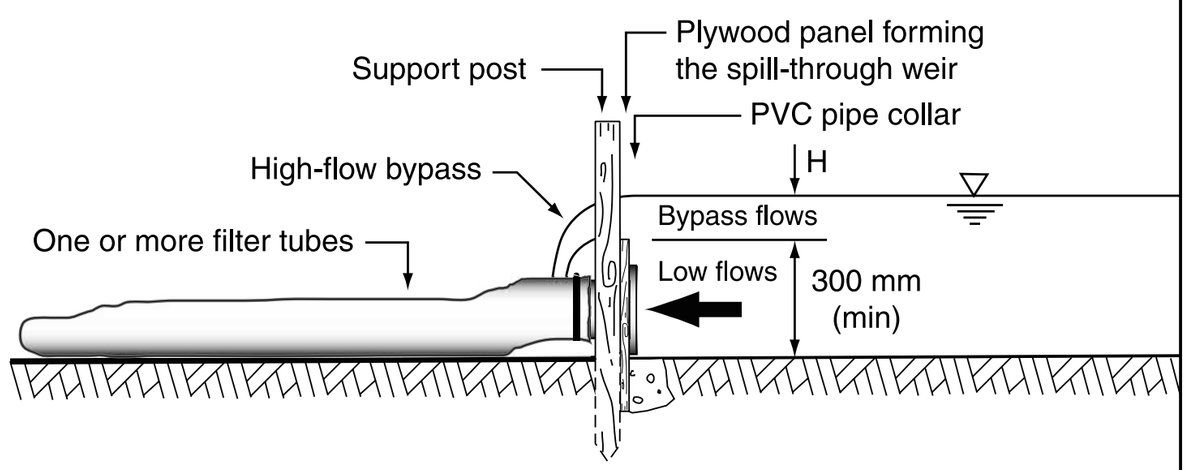
(b) Coarse sediment trap located at pipe outlet



(c) Spill-through weir



(d) Spill-through weir



(e) Alternative outlet structure incorporating a filter tube

Drawn:	Date:		
GMW	Dec-09	Coarse Sediment Trap	CST-01

Catchments & Creeks Pty Ltd

MATERIALS

SEDIMENT FENCE FABRIC: POLYPROPYLENE, POLYAMIDE, NYLON, POLYESTER, OR POLYETHYLENE WOVEN OR NON-WOVEN FABRIC, AT LEAST 700mm IN WIDTH AND A MINIMUM UNIT WEIGHT OF 140GSM. THE FABRICS SHOULD CONTAIN ULTRAVIOLET INHIBITORS AND STABILISERS TO PROVIDE A MINIMUM OF 6 MONTHS OF USEABLE CONSTRUCTION LIFE (ULTRAVIOLET STABILITY EXCEEDING 70%).

WALL REINFORCEMENT: WIRE OR STEEL MESH MINIMUM 14-GAUGE WITH A MAXIMUM MESH SPACING OF 200mm.

SUPPORT POSTS/STAKES: 1500mm^2 (MIN) HARDWOOD, 2500mm^2 (MIN) SOFTWOOD OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

AGGREGATE: 15 TO 25mm CLEAN GRAVEL OR AGGREGATE.

FILTER TUBE: MANUFACTURED FROM A NON-WOVEN GEOTEXTILE WITH OR WITHOUT UV-STABILISED REINFORCEMENT. WIDE STRIP TENSILE STRENGTH (AS3706.2) MINIMUM 20kN/m IN BOTH DIRECTIONS. PORE SIZE (EOS, O95, AS 3706.7) LESS THAN 90mm. MASS PER UNIT AREA (AS3706.1) MINIMUM 300GSM.

INSTALLATION (USING SEDIMENT FENCE FABRIC)

1. REFER TO APPROVED PLANS FOR LOCATION, EXTENT, AND REQUIRED TYPE OF FABRIC (IF SPECIFIED). IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, FABRIC TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE LOCATION OF THE SEDIMENT TRAP. REMOVE TREES, STUMPS, ROOTS AND OTHER SURFACE AND SUB-SURFACE MATTER THAT WOULD INTERFERE WITH INSTALLING AND MAINTAINING THE TRAP.

3. TAKE NECESSARY STEPS TO ENSURE INFLOW CORRECTLY ENTERS THE SEDIMENT TRAP AND DOES NOT BYPASS THE TRAP.

4. EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE OUTLINE OF THE SETTLING CHAMBERS.

5. SECURE THE SUPPORT POSTS INTO THE GROUND SPACED NO GREATER THAN 1.5m.

6. IF SPECIFIED, SECURELY ATTACH THE SUPPORT WIRE OR MESH TO THE INSIDE FACE OF THE SUPPORT POSTS WITH THE MESH EXTENDING AT LEAST 200mm INTO THE EXCAVATED TRENCH.

7. ENSURE THE MESH AND FABRIC ARE ATTACHED TO THE INSIDE FACE OF THE SUPPORT POSTS EVEN WHEN DIRECTING THE FABRIC AROUND A CORNER.

8. WHEREVER POSSIBLE, CONSTRUCT THE SETTLING CHAMBER WALLS FROM A CONTINUOUS ROLL OF FABRIC. WHERE NECESSARY, JOIN THE FABRIC EITHER BY:

(i) ATTACHING EACH END TO TWO OVERLAPPING POSTS/STAKES WITH THE FABRIC FOLDING AROUND THE ASSOCIATED STAKE ONE TURN, AND WITH THE TWO STAKES TIED TOGETHER WITH WIRE; OR

(ii) OVERLAPPING THE FABRIC TO THE NEXT ADJACENT SUPPORT POST/STAKE.

9. SECURELY ATTACH THE FABRIC TO THE SUPPORT POSTS/STAKES USING 25mm STAPLES OR TIE WIRE AT MAXIMUM 150mm SPACING WITH THE FABRIC EXTENDED AT LEAST 200mm INTO THE TRENCH.

10. SECURELY ATTACH THE FABRIC TO THE SUPPORT WIRE/MESH, IF ANY, ALONG THE FULL LENGTH OF THE FABRIC AT A MAXIMUM SPACING NOT EXCEEDING 0.5m.

11. ENSURE THE CHAMBER WALLS ARE AT LEAST 450mm HIGH, BUT NOT MORE THAN 700mm HIGH.

12. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC AND MESH TO PREVENT WATER FROM FLOWING UNDER THE CHAMBER WALLS.

INSTALLATION OF SPILL-THROUGH WEIRS

1. LOCATE THE SPILL-THROUGH WEIRS AT ALTERNATE ENDS OF THE SETTLING CHAMBERS.

2. ENSURE THE SPILL-THROUGH WEIR CREST IS AT LEAST 300mm ABOVE THE GROUND.

3. SECURELY TIE A HORIZONTAL CROSS MEMBER (WEIR) TO THE SUPPORT POSTS/ STAKES EACH SIDE OF THE WEIR. CUT THE FABRIC DOWN THE SIDE OF EACH POST/ STAKE AND FOLD THE FABRIC OVER THE CROSS MEMBER IN THE DIRECTION OF OVERFLOW. SECURELY TIE THE FABRIC TO THE SUPPORT POSTS AND CROSS MEMBER.

4. INSTALL A SUITABLE SPLASH PAD OR OTHER EROSION CONTROL MEASURES AT THE OUTLET OF THE FINAL SPILL-THROUGH WEIR TO CONTROL SOIL EROSION.

MAINTENANCE

1. INSPECT THE SEDIMENT TRAP AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. IF THE FABRIC IS SAGGING AT ANY POINT, THEN INSTALL ADDITIONAL SUPPORT POSTS/ STAKES.

5. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 200mm.

6. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN DISTURBED AREAS UP-SLOPE OF THE SEDIMENT TRAP ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE SEDIMENT TRAP MUST BE REMOVED AND THE AREA REHABILITATED.

2. REMOVE ALL MATERIALS AND COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.

Drawn:	Date:		
GMW	Apr-10	Coarse Sediment Trap	CST-02

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CONSTRUCTION

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE FOUNDATION AREA OF THE OUTLET STRUCTURE (IF ANY), AND INSTALL AS PER SEPARATE INSTRUCTIONS.

3. EXCAVATE THE SETTLING POND IN ACCORDANCE WITH THE APPROVED PLANS. UNLESS OTHERWISE SPECIFIED, THE EXCAVATED PIT SHOULD HAVE A SIDE SLOPE OF 2:1(H:V) OR FLATTER.

4. APPROPRIATELY STABILISE ANY BANK SUBJECT TO DIRECT INFLOW.

5. ESTABLISH ALL NECESSARY UP-SLOPE DRAINAGE CONTROL MEASURES TO ENSURE THAT SEDIMENT-LADEN RUNOFF IS APPROPRIATELY DIRECTED INTO THE SEDIMENT TRAP.

6. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.

MAINTENANCE

1. CHECK EXCAVATED SEDIMENT TRAPS AFTER EACH RUNOFF EVENT AND MAKE REPAIRS IMMEDIATELY.

2. INSPECT THE BANKS FOR SLUMPING OR EXCESSIVE SCOUR.

3. IF FLOW THROUGH THE STRUCTURE IS REDUCED TO AN UNACCEPTABLE LEVEL DUE TO BLOCKAGE OF THE OUTLET STRUCTURE (IF ANY), THEN MAKE ALL NECESSARY REPAIRS AND MAINTENANCE TO RESTORE THE DESIRED FLOW CONDITIONS.

4. CHECK THE STRUCTURE AND SURROUNDING CHANNEL BANKS FOR DAMAGE FROM OVERTOPPING FLOWS AND MAKE REPAIRS AS NECESSARY.

5. REMOVE SEDIMENT AND RESTORE ORIGINAL SEDIMENT STORAGE VOLUME WHEN COLLECTED SEDIMENT EXCEEDS 30% OF THE PIT VOLUME.

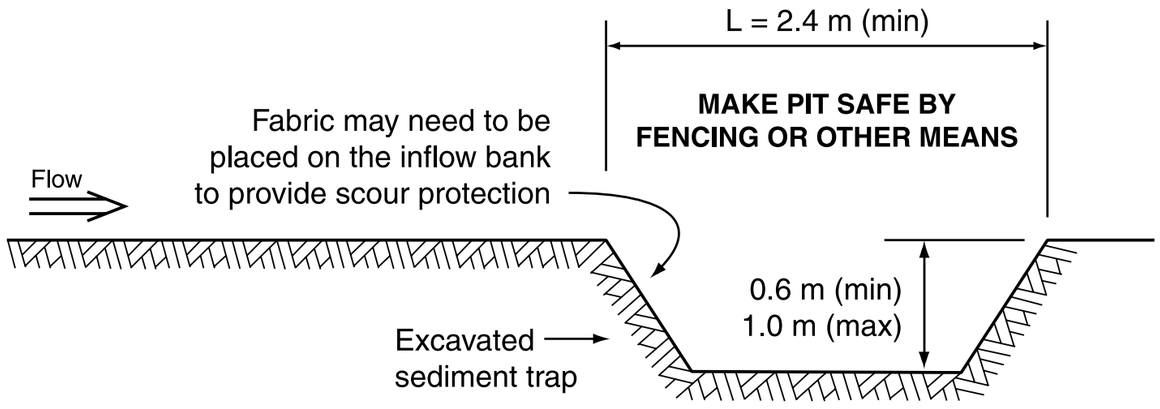
6. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

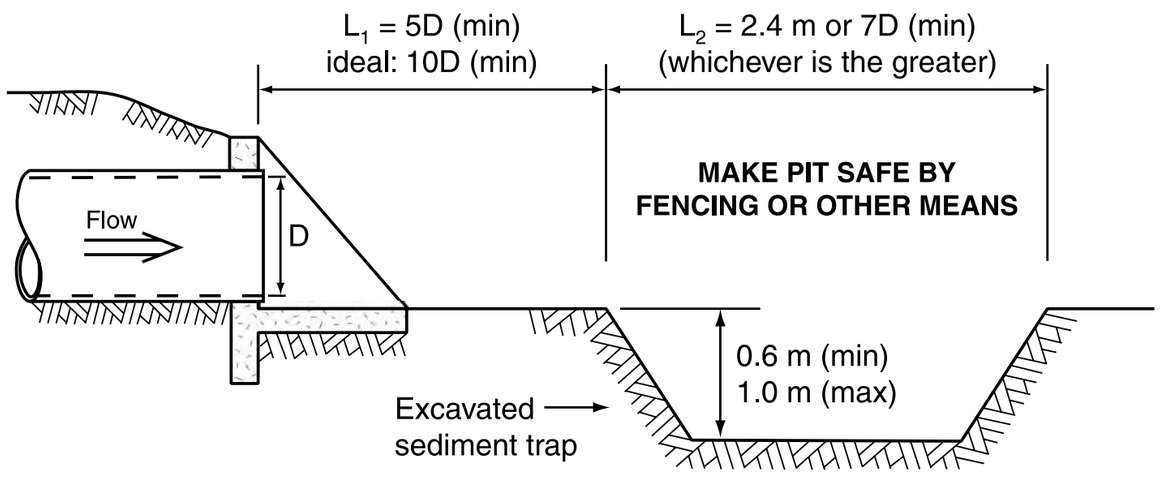
1. WHEN THE UP-SLOPE DRAINAGE AREA HAS BEEN STABILISED, REMOVE ALL MATERIALS INCLUDED DEPOSITED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

2. ALL WATER AND SEDIMENT SHOULD BE REMOVED FROM THE BASIN PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT AND STABILISE AND/OR REVEGETATE AS REQUIRED.



(a) Excavated sediment trap located within a minor drainage path



Where space is not available, make optimum use of the available space

(b) Excavated sediment trap located downstream of a stormwater outlet

Drawn:	Date:		
GMW	Apr-10	Excavated Sediment Trap	EST-01

Catchments & Creeks Pty Ltd

MATERIALS

GEOTEXTILE FABRIC: NON-WOVEN FILTER CLOTH (MINIMUM 'BIDIM' A34 OR THE EQUIVALENT), WIDE STRIP TENSILE STRENGTH (AS3706.2) MINIMUM 15kN/m IN BOTH DIRECTIONS, PORE SIZE (EOS, O95, AS 3706.7) LESS THAN 110mm, MASS PER UNIT AREA (AS3706.1) MINIMUM 200GSM.

SUPPORT POSTS/STAKES: 1500mm^2 (MIN) HARDWOOD, 2500mm^2 (MIN) SOFTWOOD, OR 1.5kg/m (MIN) STEEL STAR PICKETS SUITABLE FOR ATTACHING FABRIC.

BACKING MESH: PLASTIC OR STEEL MESH WITH A MAXIMUM MESH OPENING OF 200mm.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. UNLESS OTHERWISE DIRECTED BY THE RESPONSIBLE ON-SITE OFFICER, EXCAVATE A 200mm WIDE BY 200mm DEEP TRENCH ALONG THE PROPOSED ALIGNMENT OF THE FILTER FENCE, PLACING THE EXCAVATED MATERIAL UP-SLOPE OF THE FENCE.

3. IF THE FILTER FENCE IS TO BE STAKED WITHOUT A MESH BACKING, THEN SECURE THE SUPPORT POSTS INTO THE GROUND AT A SPACING NO GREATER THAN 1.5m.

4. IF THE FILTER FENCE IS TO BE STAKED WITH A MESH BACKING, SECURE THE SUPPORT POSTS INTO THE GROUND AT A SPACING NO GREATER THAN 2.0m, THEN SECURELY ATTACH THE BACKING MESH TO THE UP-SLOPE SIDE OF THE SUPPORT POSTS FROM A CONTINUOUS LENGTH OF MESH. EXTEND THE MESH INTO THE EXCAVATED TRENCH.

5. IF THE FILTER FENCE IS THE BE SUPPORTED BY STRAW BALES, THEN AFTER SUITABLE ANCHORING THE BOTTOM 300mm OF FABRIC, PLACE A CONTINUOUS ROW OF STRAW BALES IMMEDIATELY DOWN-SLOPE OF THE FABRIC AND WRAP THE FABRIC OVER THE TOP OF THE STRAW BALES. SECURELY ANCHOR THE FILTER FENCE WITH A SINGLE STAKE DRIVEN THROUGH THE FABRIC AND CENTRE OF EACH BALE.

6. USING A CONTINUOUS LENGTH OF NON-WOVEN GEOTEXTILE, SECURELY ATTACH THE FABRIC TO THE UP-SLOPE SIDE OF THE SUPPORT POSTS OR BACKING MESH, WITH THE FABRIC EXTENDED AT LEAST 200mm INTO THE TRENCH.

7. BACKFILL THE TRENCH AND TAMP THE FILL TO FIRMLY ANCHOR THE BOTTOM OF THE FABRIC TO PREVENT DISPLACEMENT OF THE FABRIC AND TO PREVENT THE FREE MOVEMENT OF WATER UNDER THE FABRIC.

8. IN ALL CASES, INSTALL THE FILTER FENCE IN A MANNER THAT WILL MINIMISE THE RISK OF SEDIMENT-LADEN WATER FLOWING AROUND THE FENCE.

MAINTENANCE

1. INSPECT THE FILTER FENCE REGULARLY AND AT LEAST DAILY DURING DE-WATERING OPERATIONS. MAKE REPAIRS AS NEEDED TO THE FABRIC AND SUPPORT FRAME.

2. INSPECT THE FABRIC FOR OBVIOUS LEAKS RESULTING FROM HOLES, TEARS OR JOINT FAILURE IN THE FABRIC.

3. CHECK THAT WATER HAS NOT OVERTOPPED THE FENCE AT LOW POINTS.

4. REPAIR ANY TORN SECTIONS WITH A CONTINUOUS PIECE OF FABRIC PLACED INSIDE THE OLD FABRIC, EXTENDING AT LEAST FROM SUPPORT POST TO SUPPORT POST.

5. CHECK FOR MATERIALS LEANING UP AGAINST THE FILTER FENCE. MAKE REPAIRS AS NEEDED TO THE FABRIC AND SUPPORT FRAME.

REMOVAL

1. REMOVE ALL ACCUMULATED SEDIMENT AND DISPOSE OF IT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

2. REMOVE ALL MATERIALS AND REPAIR DAMAGE TO THE GROUND SURFACE AS NECESSARY.

3. APPROPRIATELY REHABILITATE (E.G. REVEGETATE) THE GROUND AS NECESSARY TO MINIMISE THE RISK OF AN ONGOING EROSION HAZARD.

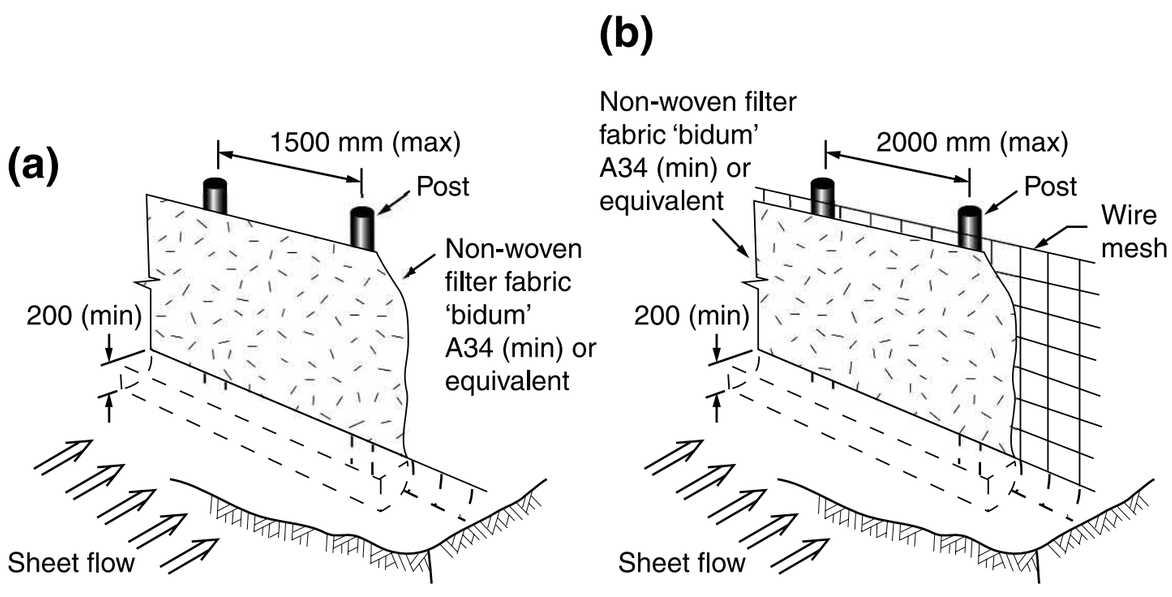


Figure 1 - Various installation methods

Drawn:	Date:		
GMW	Apr-10	Filter Fence	FF-01

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MATERIALS

FIBRE ROLLS: TYPICALLY 200 TO 250mm JUTE, COIR OR STRAW ROLL TIED WITH SYNTHETIC OR BIODEGRADABLE MESH.

STAKES: MINIMUM 25 x 25mm TIMBER STAKES.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN PLACED ACROSS NON-VEGETATED OR NEWLY SEEDED SLOPES, THE ROLLS MUST BE PLACED ALONG THE CONTOUR.

3. IF PLACED ON OPEN OR LOOSE SOIL, ENSURE THE FIBRE ROLLS ARE TRENCHED 75 TO 125mm IN SANDY SOILS AND 50 TO 75mm IN CLAYEY SOILS.

4. ENSURE THE OUTER MOST ENDS OF THE FIBRE ROLL ARE TURNED UP THE SLOPE TO ALLOW WATER TO ADEQUATELY POND UP-SLOPE OF THE ROLL, AND TO MINIMISE FLOW BYPASSING.

5. WHEN PLACED ACROSS THE INVERT OF MINOR DRAINS, ENSURE THE SOCKS ARE PLACED SUCH THAT:

(i) THE CREST OF THE DOWNSTREAM ROLL IS LEVEL WITH THE CHANNEL INVERT AT THE IMMEDIATE UPSTREAM SOCK (IF ANY);

(ii) EACH ROLL EXTENDS UP THE CHANNEL BANKS SUCH THAT THE CREST OF THE FIBRE ROLL AT ITS LOWEST POINT IS LOWER THAN THE GROUND LEVEL AT EITHER END OF THE ROLL.

6. ENSURE THE ANCHORING STAKES ARE DRIVEN INTO THE END OF EACH ROLL AND ALONG THE LENGTH OF EACH ROLL AT A SPACING NOT EXCEEDING 1.2m OR SIX TIMES THE ROLL DIAMETER, WHICHEVER IS THE LESSER. A MAXIMUM STAKE SPACING OF 0.3m APPLIES WHEN USED TO FORM CHECK DAMS.

7. ADJOINING ROLL MUST BE OVERLAP AT LEAST 450mm, NOT ABUTTED.

MAINTENANCE

1. INSPECT ALL FIBRE ROLLS PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORMS OR OTHERWISE AT WEEKLY INTERVALS.

2. REPAIR OR REPLACE DAMAGED FIBRE ROLLS.

3. REMOVE COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. ALL EXCESSIVE SEDIMENT TRAPPED BY THE ROLLS MUST BE REMOVED FROM THE DRAIN OR SLOPE IF SUCH SEDIMENT IS LIKELY TO BE WASHED AWAY BY EXPECTED FLOWS.

2. DISPOSE OF COLLECTED SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. THE BIODEGRADABLE CONTENT OF THE STRAW ROLLS MAY NOT NECESSARILY NEED TO BE REMOVED FROM THE SITE.

4. ALL SYNTHETIC (PLASTIC) MESH OR OTHER NON READILY BIODEGRADABLE MATERIAL MUST BE REMOVED FROM THE SITE ONCE THE SLOPE OR DRAIN IS STABILISED, OR THE ROLLS HAVE DETERIORATED TO A POINT WHERE THEY ARE NO LONGER PROVIDING THEIR INTENDED DRAINAGE OR SEDIMENT CONTROL FUNCTION.

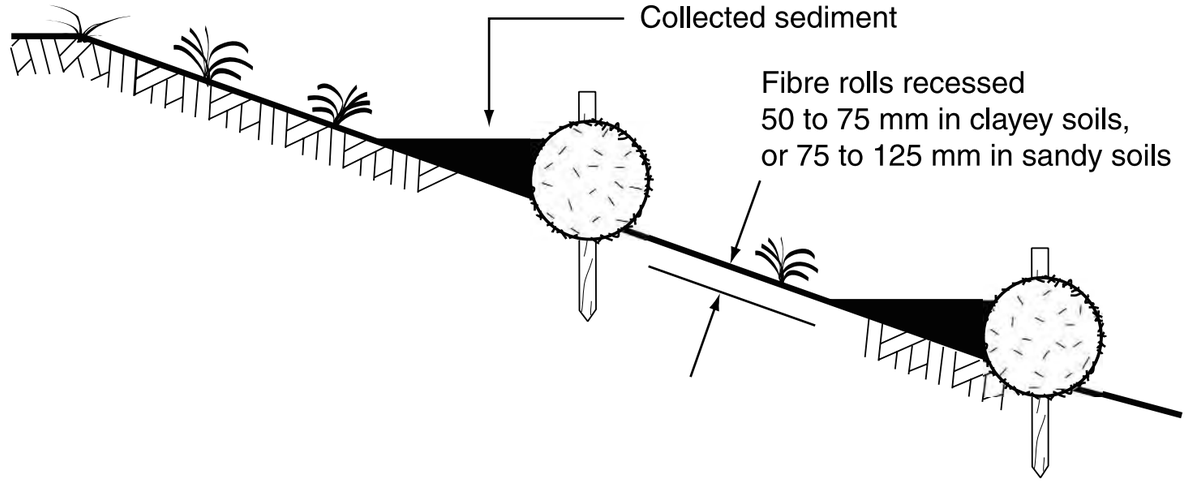

Figure 1 - Typical installation of fibre rolls

Drawn:	Date:		
GMW	Apr-10	Fibre Rolls	FR-01

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MATERIALS

(i) MULCH MUST COMPLY WITH THE REQUIREMENTS OF AS4454.

(ii) MAXIMUM SOLUBLE SALT CONCENTRATION OF 5dS/m.

(iii) MOISTURE CONTENT OF 30 TO 50% PRIOR TO APPLICATION.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND EXTENT. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, EXTENT, MATERIAL TYPE, OR METHOD OF INSTALLATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN SELECTING THE LOCATION OF A MULCH FILTER BERM, TO THE MAXIMUM DEGREE PRACTICAL, ENSURE THE BERM IS LOCATED:

(i) TOTALLY WITHIN THE PROPERTY BOUNDARIES;

(ii) ALONG A LINE OF CONSTANT ELEVATION (PREFERRED, BUT NOT ALWAYS PRACTICAL);

(iii) AT LEAST 1m, IDEALLY 3m, FROM THE TOE OF A FILL EMBANKMENT;

(iv) AWAY FROM AREAS OF CONCENTRATED FLOW.

3. ENSURE THE BERM IS INSTALLED IN A MANNER THAT AVOIDS THE CONCENTRATION OF FLOW ALONG THE BERM, OR THE UNDESIRABLE DISCHARGE OF WATER AROUND THE END OF THE BERM.

4. ENSURE THE BERM HAS BEEN PLACED SUCH THAT PONDING UP-SLOPE OF THE BERM IS MAXIMISED.

5. ENSURE BOTH ENDS OF THE BERM ARE ADEQUATELY TURNED UP THE SLOPE TO PREVENT FLOW BYPASSING PRIOR TO WATER PASSING OVER THE BERM.

6. ENSURE 100% CONTACT WITH THE SOIL SURFACE.

7. WHERE SPECIFIED, TAKE APPROPRIATE STEPS TO VEGETATE THE BERM.

MAINTENANCE

1. DURING THE CONSTRUCTION PERIOD, INSPECT ALL BERMS AT LEAST WEEKLY AND AFTER ANY SIGNIFICANT RAIN. MAKE NECESSARY REPAIRS IMMEDIATELY.

2. REPAIR OR REPLACE ANY DAMAGED SECTIONS.

3. WHEN MAKING REPAIRS, ALWAYS RESTORE THE SYSTEM TO ITS ORIGINAL CONFIGURATION UNLESS AN AMENDED LAYOUT IS REQUIRED OR SPECIFIED.

4. REMOVE ACCUMULATED SEDIMENT IF THE SEDIMENT DEPOSIT EXCEEDS A DEPTH OF 100mm OR 1/3 THE HEIGHT OF THE BERM.

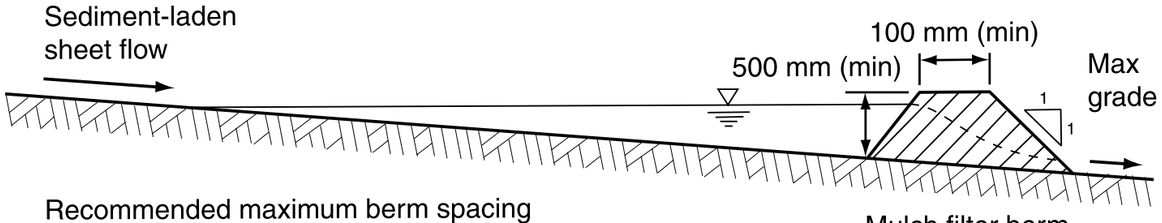
5. DISPOSE OF SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL (IF REQUIRED)

1. WHEN DISTURBED AREAS UP-SLOPE OF THE BERM ARE SUFFICIENTLY STABILISED TO RESTRAIN EROSION, THE BERM MAYBE REMOVED.

2. REMOVE ANY COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

3. REHABILITATE/REVEGETATE THE DISTURBED GROUND AS NECESSARY TO MINIMISE THE EROSION HAZARD.



Recommended maximum berm spacing

Land slope	Max spacing
< 2%	30 m
5%	25 m
10%	15 m
20%	8 m

Figure 1 - Typical placement of mulch filter berm

Drawn:	Date:		
GMW	Apr-10	Mulch Filter Berms	MB-01

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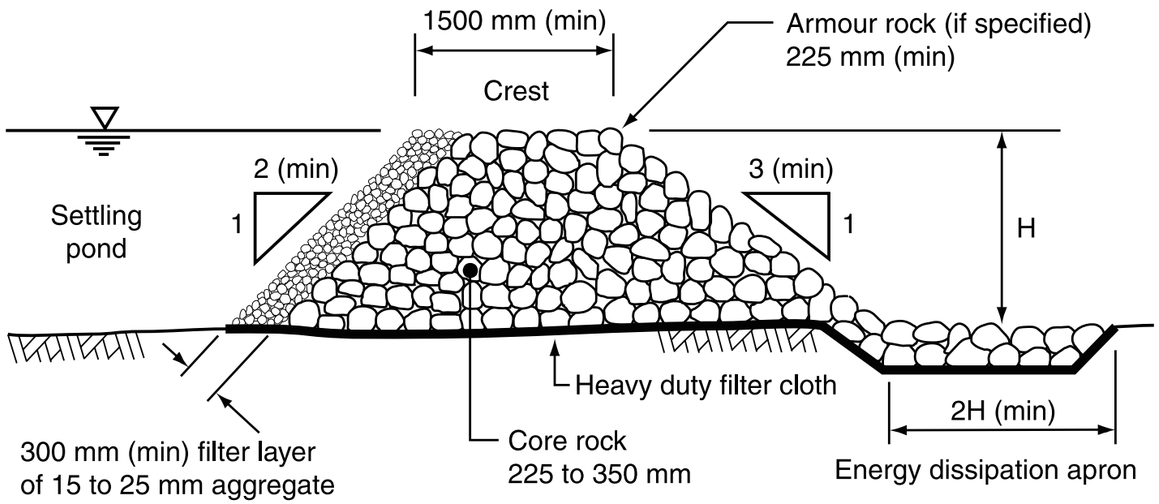
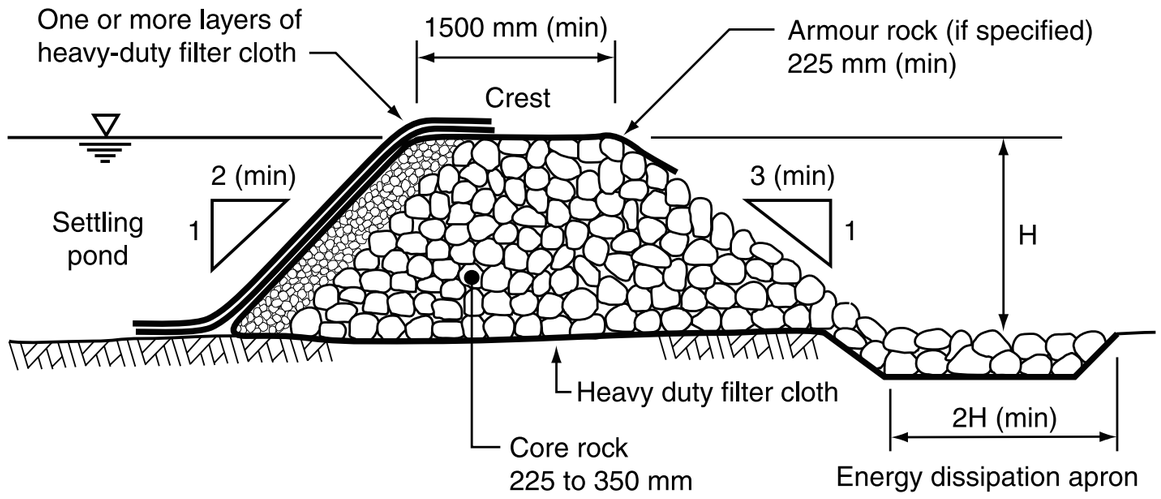
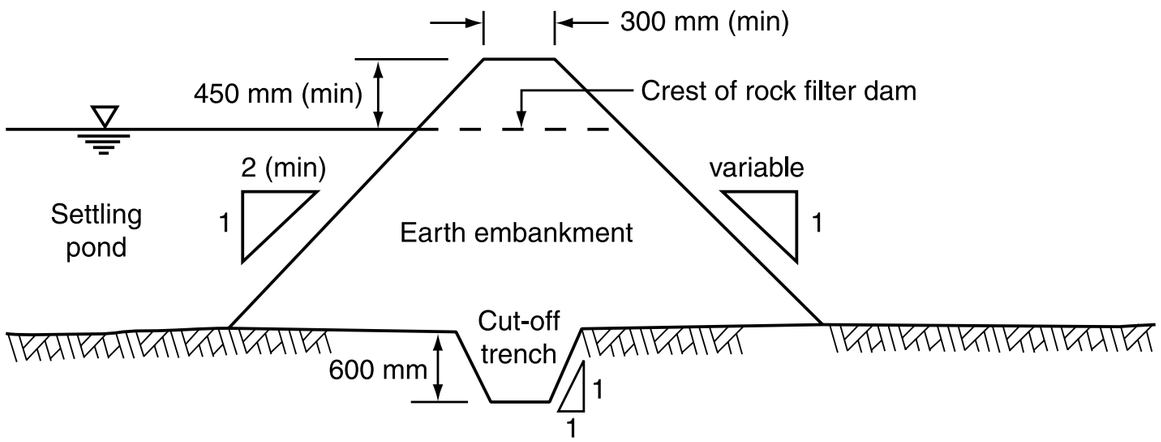


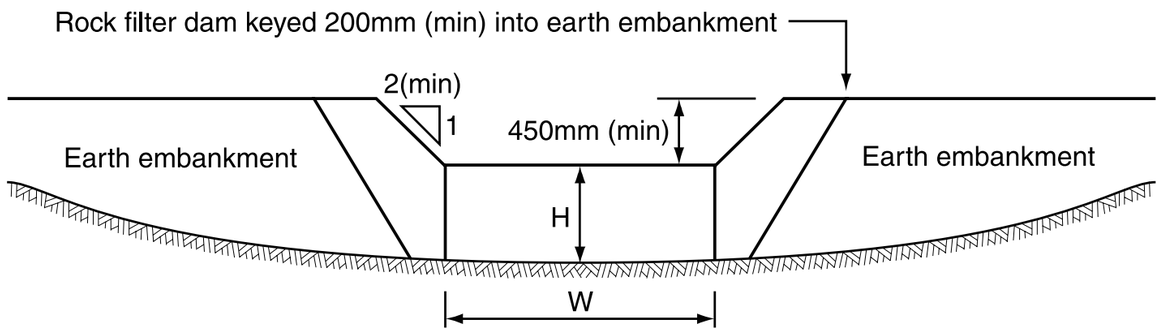
(a) Rock filter dam with aggregate filter



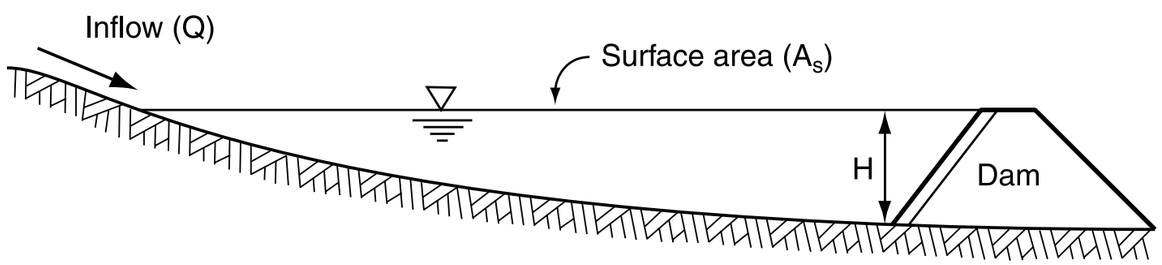
(b) Rock filter dam with geotextile and aggregate filter



(c) Typical cross-section of constructed earth abutment



(d) Typical profile of rock filter dam crest when integrated into an earth embankment



(e) Settling pond

Drawn:	Date:		
GMW	Feb-10	Rock Filter Dam	RFD-01

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MATERIALS

PRIMARY CORE ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm, OR GREATER THAN 350mm.

ARMOUR ROCK: WELL GRADED, HARD, ANGULAR, EROSION RESISTANT ROCK, WITH MEAN SIZE AS SPECIFIED IN THE APPROVED PLAN, BUT NOT LESS THAN 225mm.

AGGREGATE FILTER: 15 TO 25mm CLEAN AGGREGATE.

GEOTEXTILE FILTER FABRIC: HEAVY-DUTY NON-WOVEN, NEEDLE-PUNCHED FILTER FABRIC, MINIMUM 'BIDIM' A34 OR EQUIVALENT.

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. CLEAR THE FOUNDATION AREA OF THE ROCK FILTER DAM OF WOODY VEGETATION AND ORGANIC MATTER. DELAY CLEARING THE UP-SLOPE POND AREA UNTIL THE DAM IS FORMED AND IS ABLE TO ACT AS A SUITABLE SEDIMENT TRAP, OTHERWISE AN ALTERNATIVE TEMPORARY DOWNSTREAM SEDIMENT TRAP MAY BE REQUIRED DURING CONSTRUCTION OF THE ROCK FILTER DAM.

3. IF SPECIFIED ON THE PLANS, EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE-LINE OF THE DAM AND EARTH ABUTMENTS (IF ANY).

4. COVER THE FOUNDATION AREA AND CUT-OFF TRENCH WITH HEAVY-DUTY FILTER FABRIC BEFORE BACKFILLING WITH THE CORE ROCK. OVERLAP ADJOINING FABRIC SHEETS A MINIMUM OF 600mm.

5. CONSTRUCT THE ASSOCIATED EARTH ABUTMENT (IF ANY). ALL CUT AND FILL SLOPES SHOULD BE 2:1(H:V) OR FLATTER. THE DOWNSTREAM FACE OF EARTH ABUTMENTS SHOULD BE 3:1(H:V) OR FLATTER. EARTH ABUTMENTS SHOULD BE CONSTRUCTED OF WELL-COMPACTED, EROSION RESISTANT SOIL THAT IS FREE OF VEGETATION AND ROOTS. OVERFILL EARTH ABUTMENTS 150mm TO ALLOW FOR SETTLEMENT.

6. PLACE THE CORE ROCK FOR THE ROCK FILTER DAM. ENSURE THE UPSTREAM FACE IS 2:1(H:V) OR FLATTER, AND THE DOWNSTREAM FACE IS 3:1(H:V) OR FLATTER.

7. ENSURE THE ROCK IS MACHINE PLACED WITH THE SMALLER ROCKS WORKED INTO THE VOIDS OF THE LARGER ROCKS.

8. IF SPECIFIED, CONSTRUCT THE SPILLWAY SECTION USING THE SPECIFIED ARMOUR ROCK. THE SPILLWAY SHOULD HAVE A MINIMUM PROFILE DEPTH OF 300mm. THE SPILLWAY WEIR CREST MUST BE LEVEL ACROSS ITS FULL WIDTH. THE MAXIMUM LONGITUDINAL SLOPE OF THE ROCK SPILLWAY SHOULD BE 3:1(H:V). THE MINIMUM THICKNESS OF ARMOUR ROCK PROTECTION SHOULD BE 500mm, OR TWICE THE NOMINAL ROCK SIZE, WHICHEVER IS THE GREATER.

9. ENSURE THE SPILLWAY OUTLET SECTION EXTENDS DOWNSTREAM PAST THE TOE OF THE FORMED EMBANKMENT UNTIL STABLE CONDITIONS ARE REACHED, OR A DISTANCE EQUAL TO THE HEIGHT OF THE DAM, WHICHEVER IS THE GREATER. THE EDGES OF THE SPILLWAY SHOULD BE LEFT FLUSH WITH THE SURROUNDING GROUND.

10. INSTALL THE SPECIFIED FILTER (AGGREGATE AND/OR FILTER CLOTH) ON THE UPSTREAM FACE OF THE ROCK FILTER DAM.

11. IF FILTER CLOTH IS USED, THEN:
(i) EXTEND THE FABRIC OVER THE CREST OF THE ROCK FILTER DAM INTO THE SPILLWAY CHUTE;
(ii) CONSIDER THE PLACEMENT OF SEVERAL LAYERS OF OVERLAPPING FABRIC, THUS ALLOWING EACH LAYER TO BE REMOVED INDIVIDUALLY ONCE THE FABRIC BECOMES BLOCKED WITH SEDIMENT.

12. CLEAR THE SETTLING POND AREA OF WOODY VEGETATION AND ORGANIC MATTER TO THE DIMENSIONS SPECIFIED WITHIN THE PLANS.

13. WHERE NECESSARY, EXCAVATE THE UPSTREAM SETTLING POND AND/OR SEDIMENT STORAGE PIT IN ACCORDANCE WITH THE APPROVED PLANS. EXCAVATED PITS TYPICALLY HAVE SIDE SLOPES OF 2:1(H:V) OR FLATTER UNLESS STEEPER SLOPES ARE KNOWN TO BE STABLE.

14. STABILISE ANY ASSOCIATED EARTH EMBANKMENTS IMMEDIATELY AFTER CONSTRUCTION THROUGH APPROPRIATE COMPACTION, VEGETATION AND/OR EROSION CONTROL MATTING.

15. ESTABLISH ALL NECESSARY UP-SLOPE DRAINAGE CONTROL MEASURES TO ENSURE THAT SEDIMENT-LADEN RUNOFF IS APPROPRIATELY DIRECTED INTO THE SEDIMENT TRAP.

16. TAKE ALL NECESSARY MEASURE TO MINIMISE THE SAFETY RISK CAUSED BY THE STRUCTURE.

MAINTENANCE

1. CHECK ALL ROCK FILTER DAMS AFTER EACH RUNOFF EVENT AND MAKE REPAIRS IMMEDIATELY.

2. INSPECT ALL ROCK AND EARTH EMBANKMENTS FOR UNDERCUTTING OR UNDESIRABLE SEEPAGE FLOWS.

3. IDEALLY, ROCK FILTER DAMS SHOULD DISCHARGE (FROM FULL) OVER NO LESS THAN 8 HOURS. IF DRAINAGE IS TOO RAPID, THEN ADDITIONAL FILTER AGGREGATE MAYBE REQUIRED TO ACHIEVE OPTIMUM HYDRAULIC PERFORMANCE.

4. IF FLOW THROUGH THE STRUCTURE IS REDUCED TO AN UNACCEPTABLE LEVEL, THE UPSTREAM FILTER MEDIUM (AGGREGATE OR FILTER CLOTH) SHOULD BE REMOVED AND REPLACED.

5. IF A GREATER DEGREE OF WATER TREATMENT (FILTRATION) IS REQUIRED, EXTRA GEOTEXTILE FILTER FABRIC SHOULD BE PLACED OVER THE UPSTREAM FACE OF THE STRUCTURE.

6. CHECK THE STRUCTURE AND DOWNSTREAM CHANNEL BANKS FOR DAMAGE FROM OVERTOPPING FLOWS. MAKE REPAIRS AS NECESSARY.

7. IMMEDIATELY REPLACE ANY ROCK DISPLACED FROM THE SPILLWAY.

8. REMOVE SEDIMENT AND RESTORE ORIGINAL SEDIMENT STORAGE VOLUME WHEN COLLECTED SEDIMENT EXCEEDS 10% OF THE SPECIFIED STORAGE VOLUME.

9. DISPOSE OF SEDIMENT AND DEBRIS IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. WHEN THE UP-SLOPE DRAINAGE AREA HAS BEEN STABILISED, REMOVE ALL MATERIALS INCLUDED DEPOSITED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

2. ALL WATER AND SEDIMENT SHOULD BE REMOVED FROM THE SETTLING POND PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.

3. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT AND STABILISE AND/OR REVEGETATE AS REQUIRED TO MINIMISE THE EROSION HAZARD.

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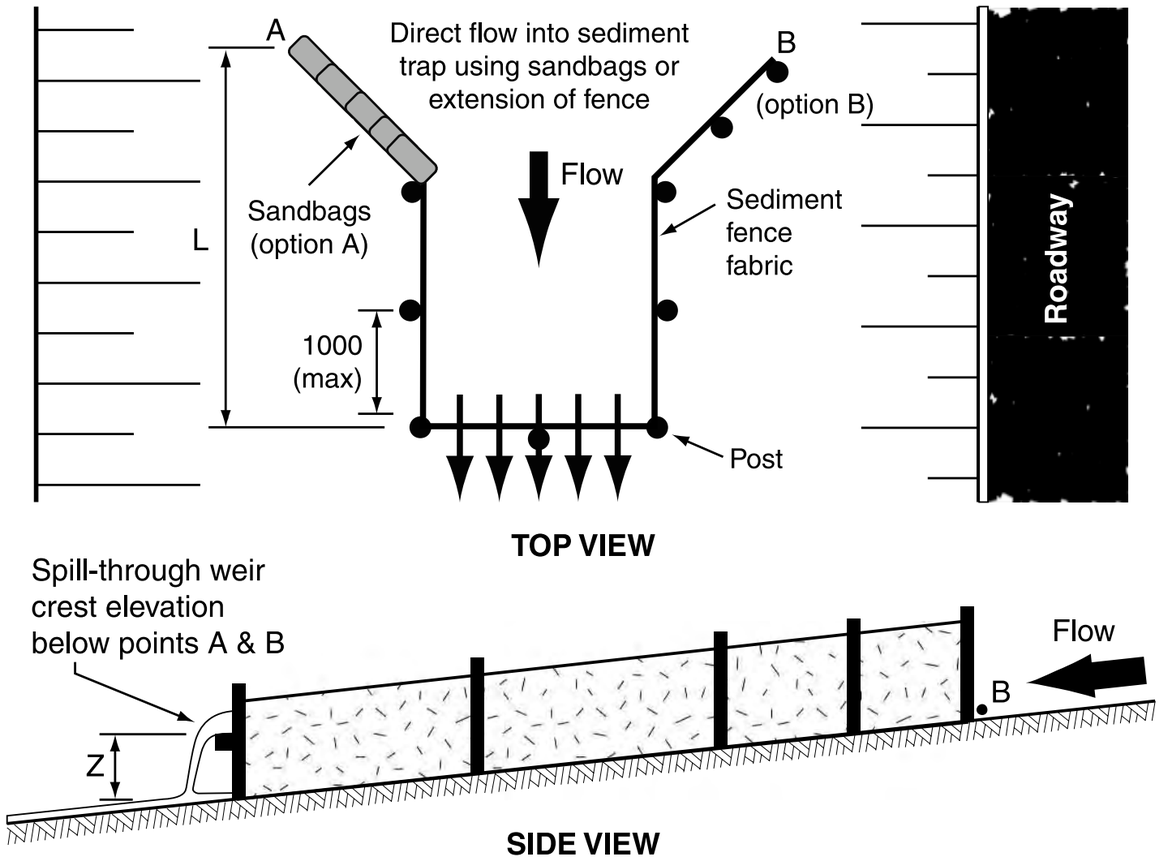
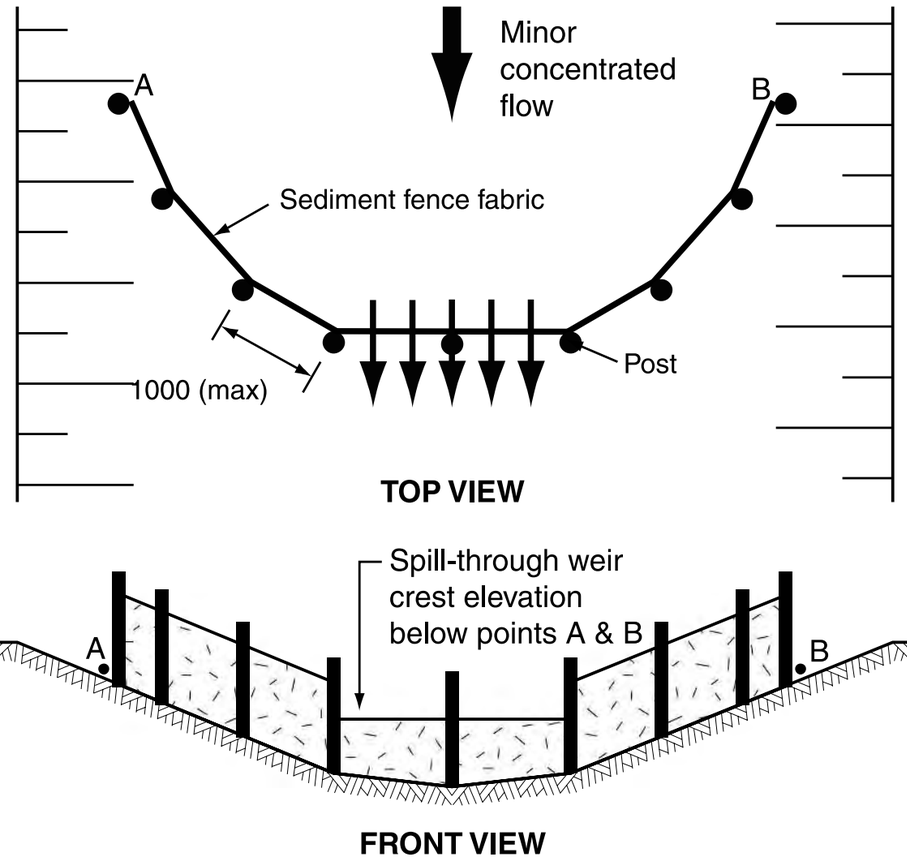
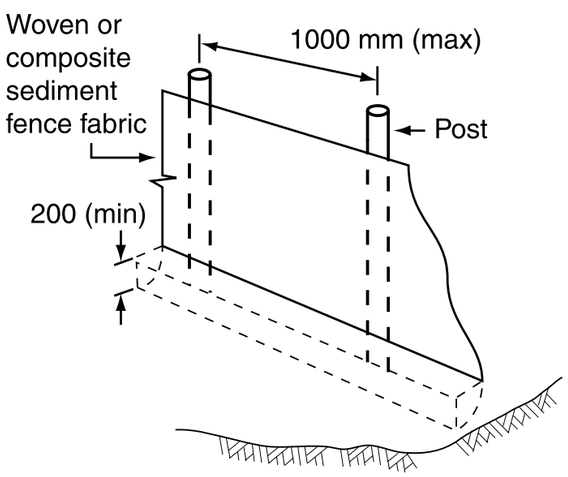
Drawn:	Date:		
GMW	Apr-10	Rock Filter Dam	RFD-02



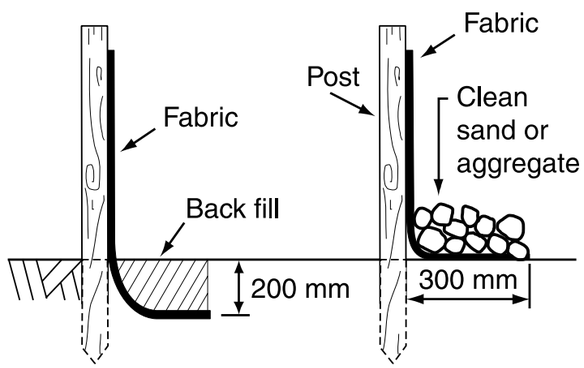
(a) Type AU 'narrow' sediment trap



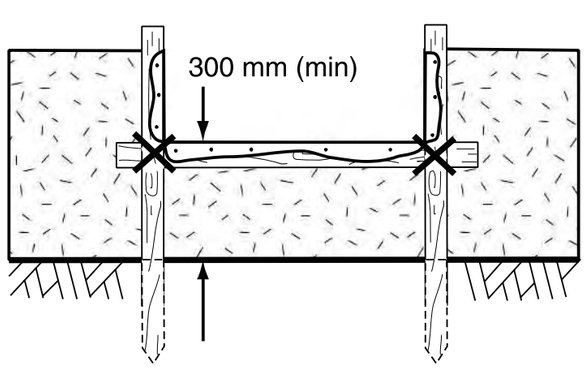
(b) Type BU 'wide' sediment trap



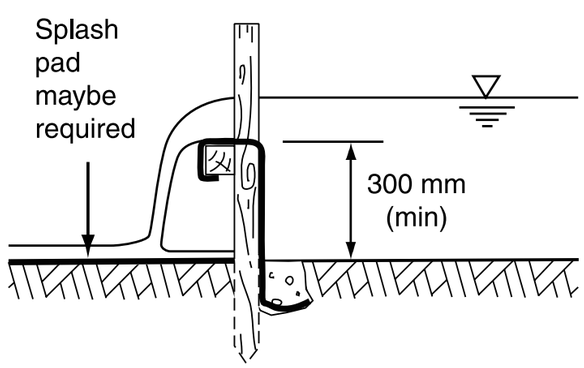
(c) Spacing of support posts



(d) Trenching of fabric



(e) Spill-through weir



(f) Sectional view of weir

Catchments & Creeks Pty Ltd

Drawn:	Date:		
GMW	Apr-10	U-Shaped Sediment Trap	UST-01

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Appendix 6 Weed Management Plan

Weed Management Plan

2020-21 Northern Territory Drilling Campaign

Document Number: 1000-630-PLN-0004

Rev	Description	Date	Reviewed by	Approved by
1	Issued for Use	9/06/20	C Lambert	C Lambert

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GLOSSARY	
CP	Central Petroleum Limited
DAWE	Department of Agriculture, Water and the Environment
DENR	Department of Environment and Natural Resources
EMP	Environment Management Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GPS	Global Positioning System
NT	Northern Territory
WoNS	Weeds of National Significance
WM Act	*Weeds Management Act 2001*
WMP	Weed Management Plan

1 Introduction

On-shore petroleum exploration and production areas can be highly susceptible to invasion by weeds. The soil disturbances and roadworks during exploration and ongoing activities can provide pathways for weed spread and colonisation. In turn, weeds pose a risk to operational phases and the subsequent rehabilitation and maintenance phases. Weeds increase vegetation biomass, heightening the risk from fires, and compete with native flora.

The development of a weed management plan (WMP) is a requirement of the *Petroleum (Environment) Regulations 2016* and consideration of the Northern Territory (NT) Government's 'Weed Management Planning Guide: Onshore Petroleum Projects' (June 2019) is paramount to ensuring risks to the environment from weeds can be managed to a level that is as low as reasonably practical and acceptable.

1.1 Objective

This WMP has been developed to ensure that the risk of weed introduction and spread, resulting from CP's activities are mitigated to protect the economic, community, industry and environmental interests of the NT.

1.2 Scope

The scope of this WMP is to outline the weed management measures that will be implemented to prevent the introduction and spread of weeds associated with the locations listed in Table 1-1 and shown in Figure 1-1.

Table 1-1: Well Locations

Location	Field Name	# Wells	Well Type	Well Name
Production Licence 7	Dingo	1	Exploration*	Dingo-1 ST or Dingo-5
Exploration Permit 82	Orange	1	Exploration	Orange-3
Operating Licence 3	Palm Valley	1	Exploration*	Palm Valley-12
Operating Licence 4	Mereenie	2	Development	West Mereenie-27 and West Mereenie-28
Production Licence 6	Surprise	1	Exploration	Mamlambo-1

* May be converted to a development well if commercial resources are realised

A reference to the well name also includes the ancillary infrastructure authorised under the EMP that this WMP supports.

In line with the scope of the EMP, after a well is completed as a development well it will be transferred to the applicable approved Field EMP. For development wells, ongoing weed management will then be undertaken in accordance with the WMP associated with the respective Field EMP.

1.3 Weed Survey

A weed survey of the proposed disturbance areas for the wells was undertaken by EcOZ in February 2020. Figure 1-2, Figure 1-3, Figure 1-4, Figure 1-5, Figure 1-6, and Figure 1-7 show the survey transects undertaken by EcOZ at each proposed location and this WMP has been based on the results of this survey. It is acknowledged that at the survey time it may not have been the optimal identification period for weeds, to compensate for this the mitigation measures have been designed to ensure that regular weeds surveys are performed to allow for the early identification of additional weeds.

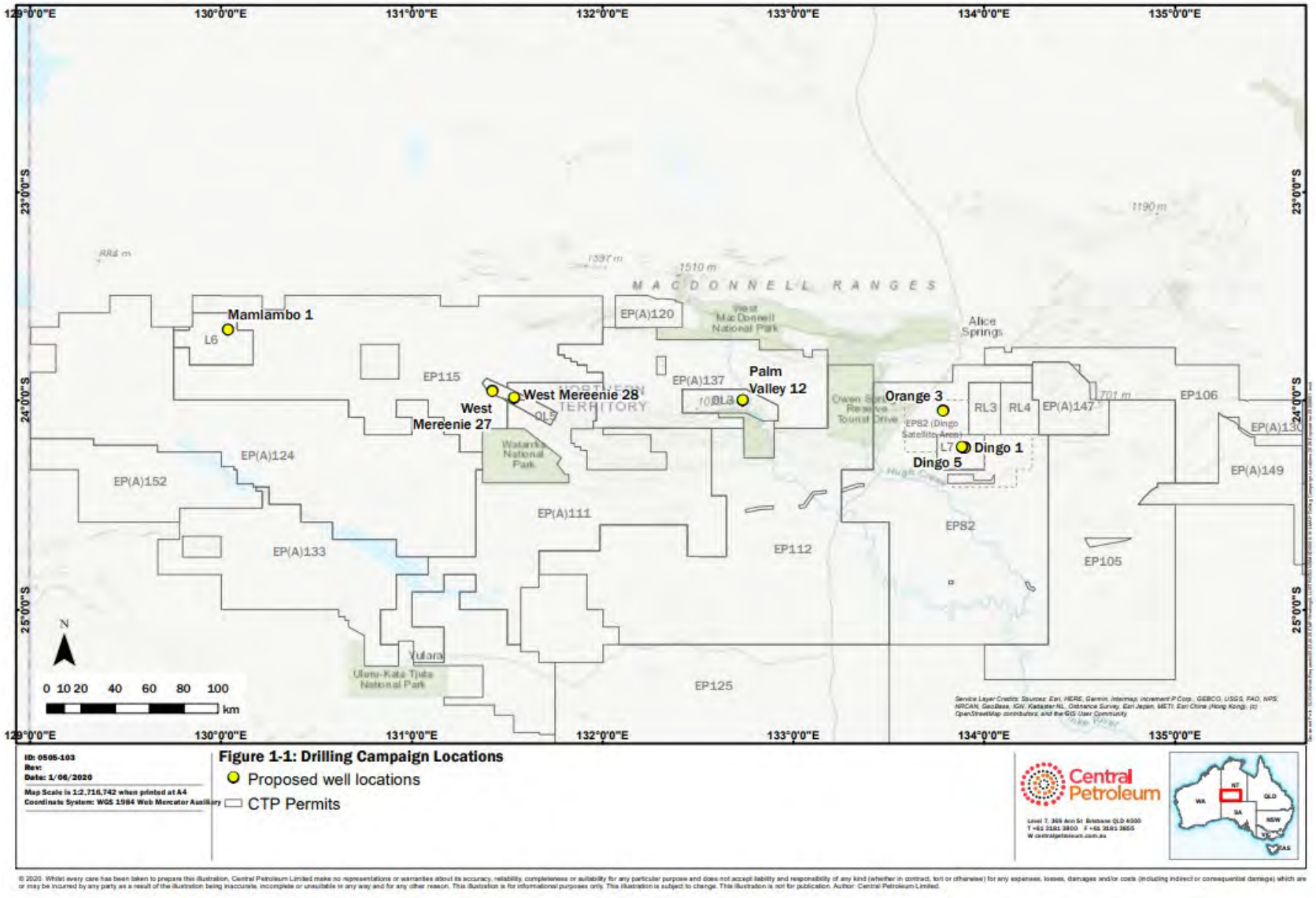

Figure 1-1: Extent of WMP

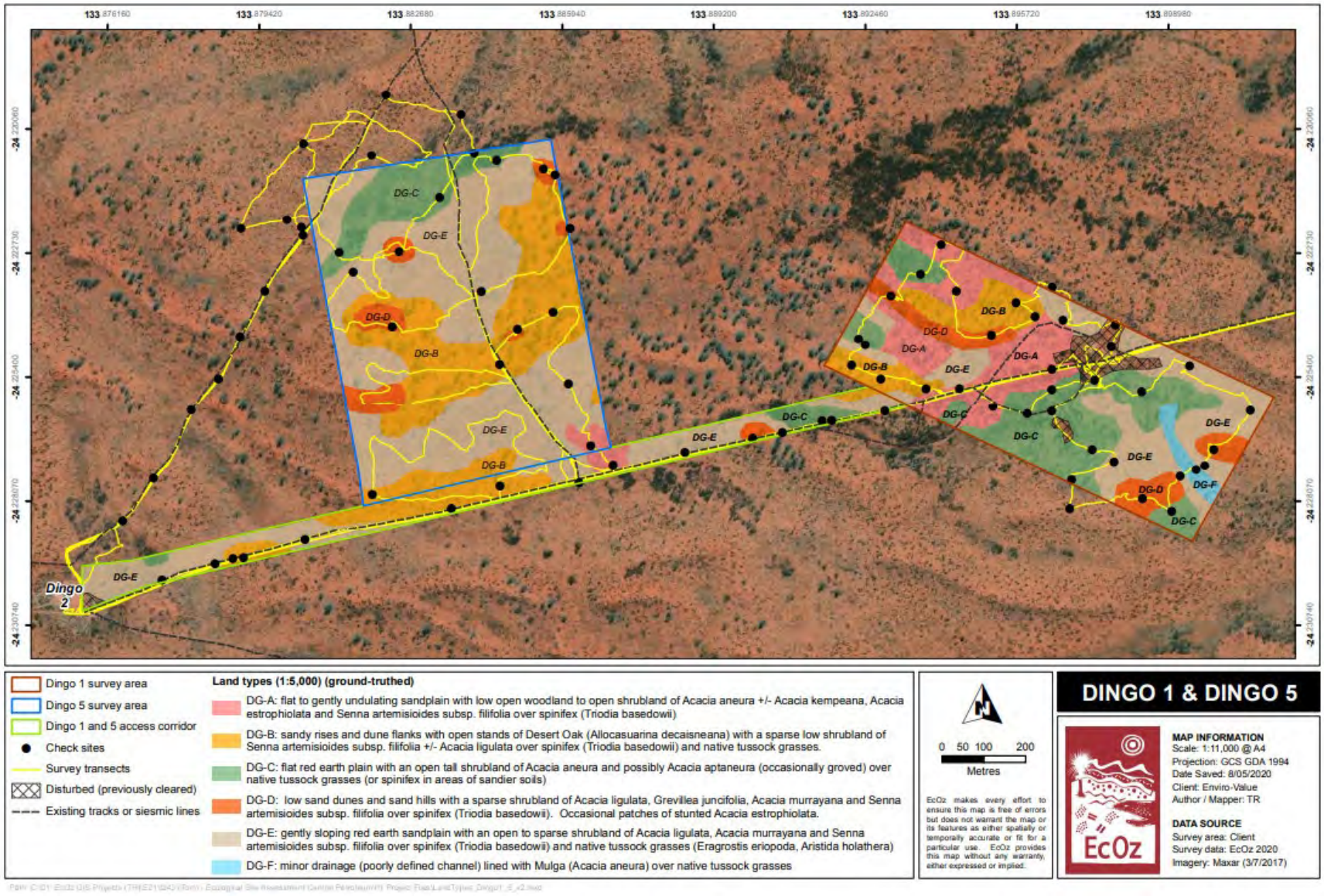

Figure 1-2: Dingo 1 & Dingo 5 Weed Survey Transects

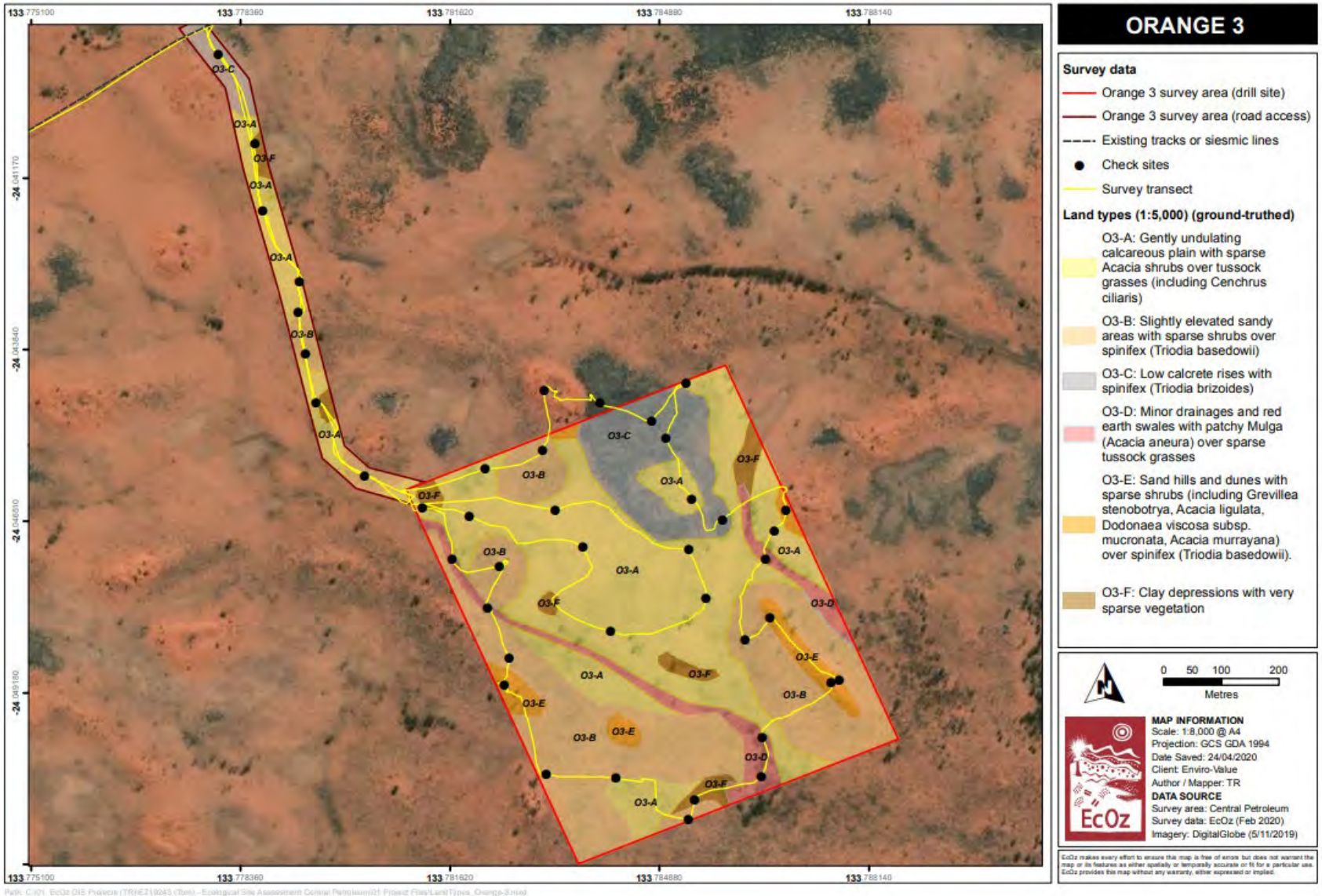

Figure 1-3: Orange 3 Weed Survey Transects

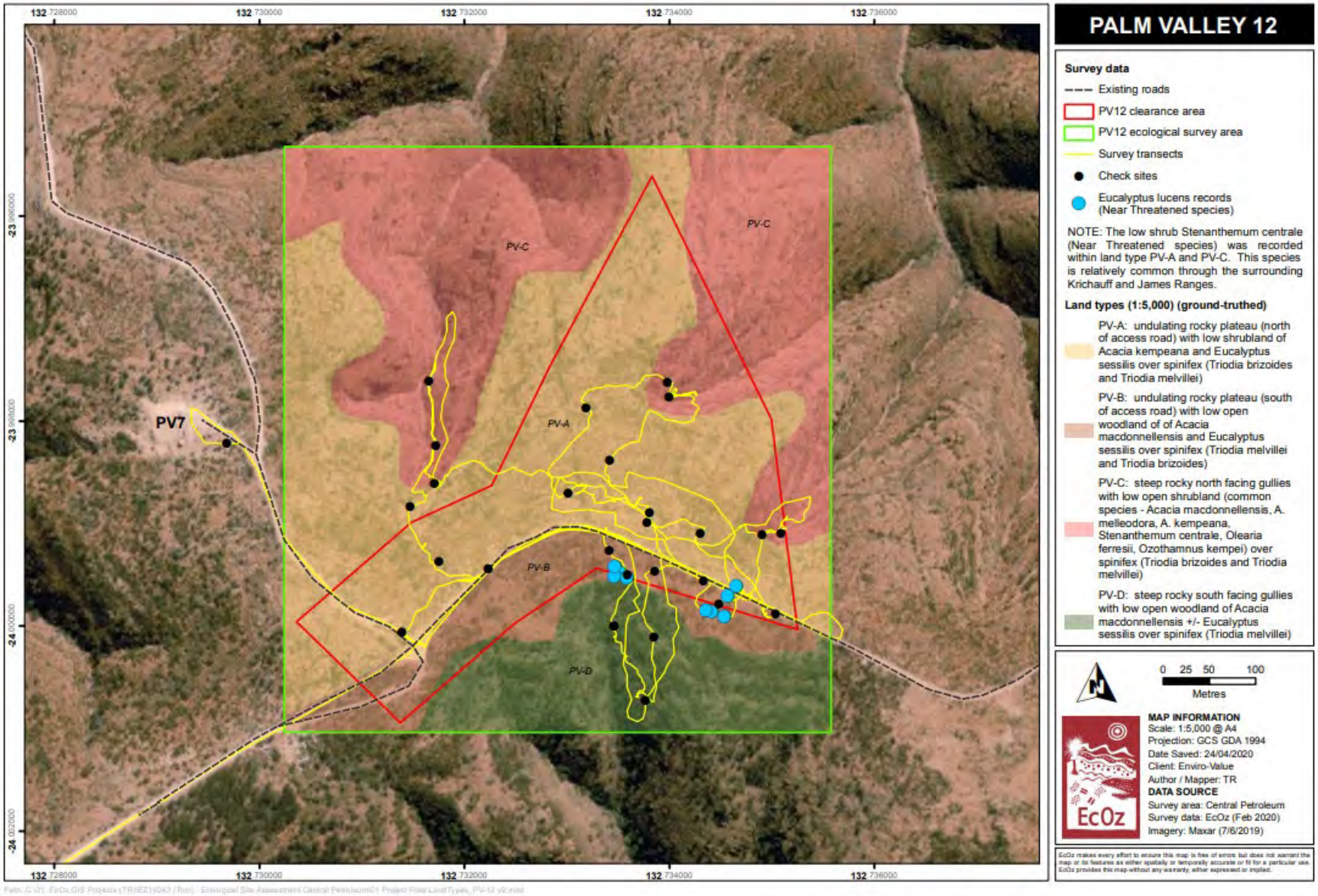

Figure 1-4: Palm Valley 12 Weed Survey Transects

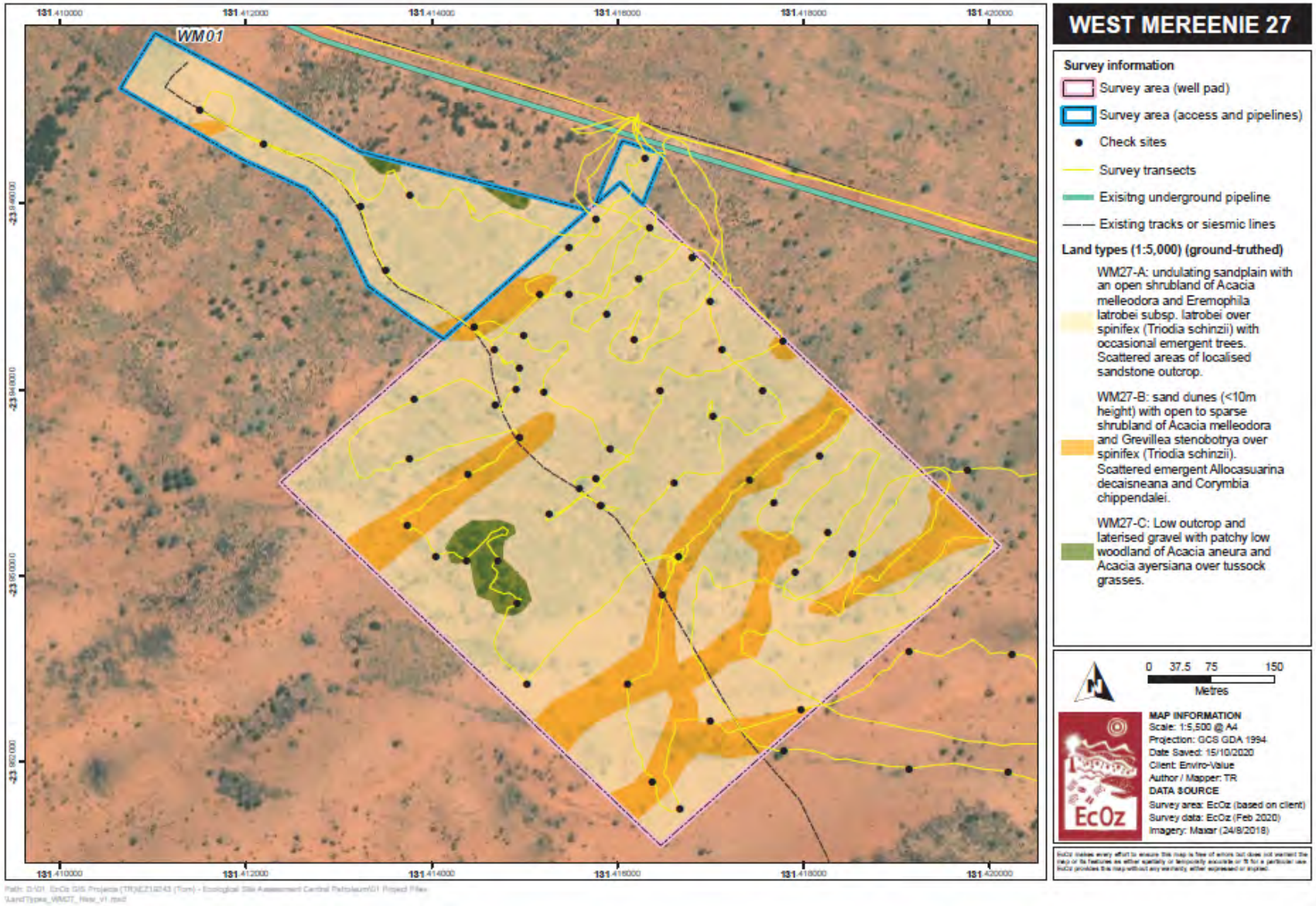

Figure 1-5: West Mereenie 27 Weed Survey Transects

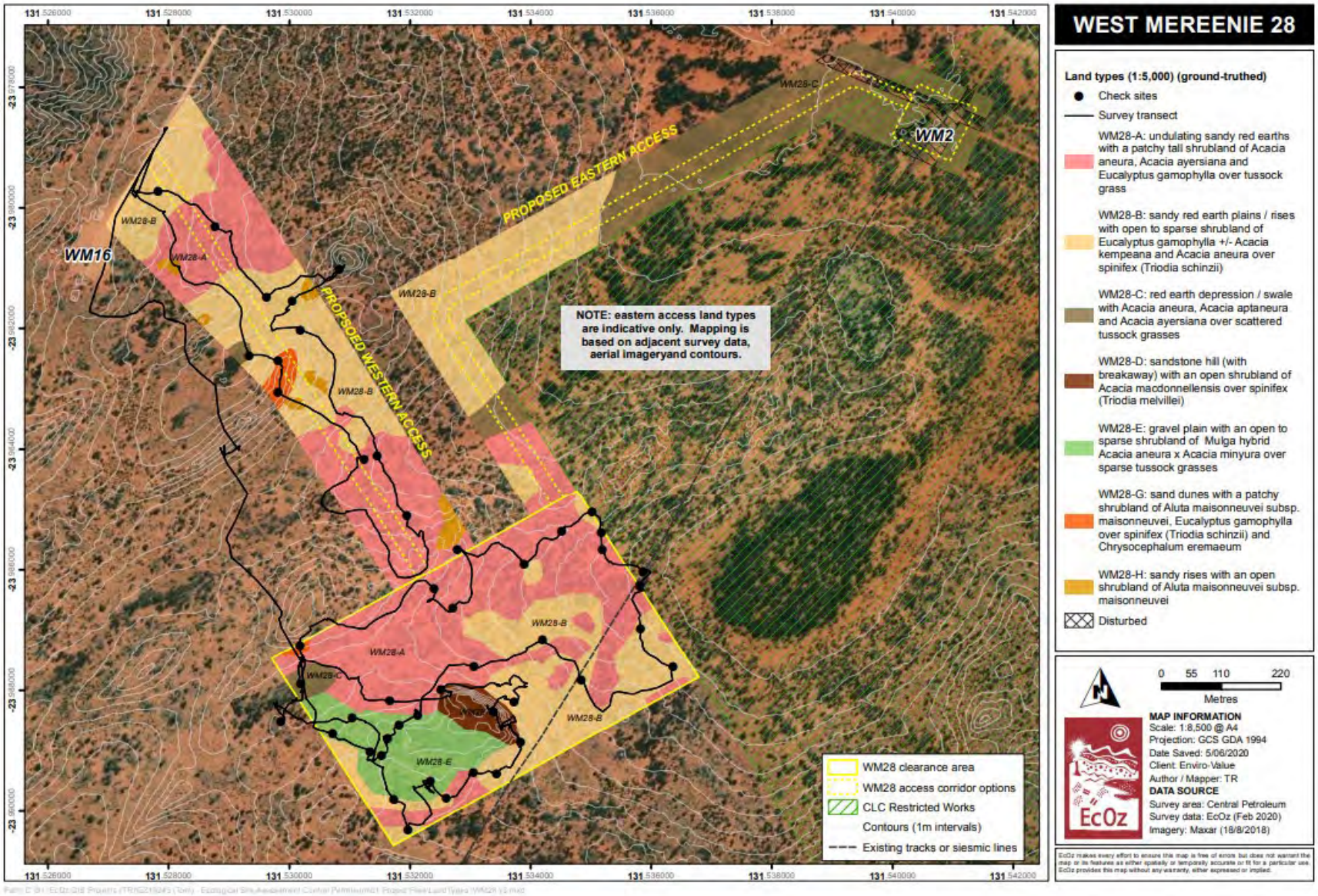

Figure 1-6: West Mereenie 28 Weed Survey Transects

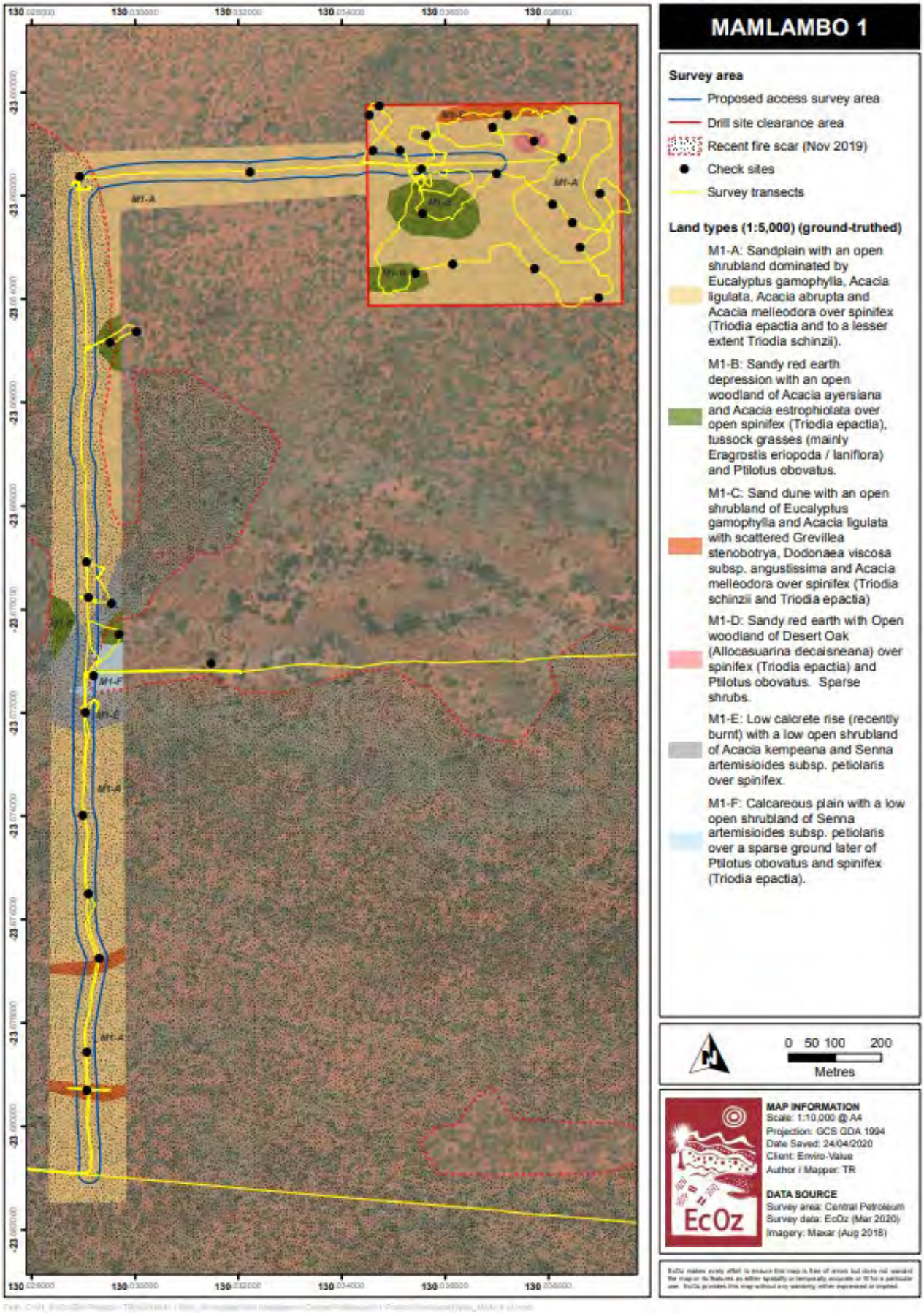

Figure 1-7: Mamlambo 1 Weed Survey Transects

2 Legal Requirements

The following presents the relevant Territory and Federal legislation and statutory obligations related to weed management.

2.1 Northern Territory

Petroleum Act 2016 / Petroleum (Environment) Regulations 2016

The *Petroleum Act 2016* provides legal framework within which persons are encouraged to undertake effective exploration for petroleum and to develop petroleum production so that the optimum value of the resource is returned to the Territory. It regulates the exploration for, and production of petroleum, including environmental protection measures which should be employed during exploration and production activities, including protection of parks and reserves and rehabilitation.

The *Petroleum (Environment) Regulations 2016* requires that regulated activities are carried out in a manner consistent with the principles of ecologically sustainable development, and by which the environmental impacts and environmental risks of the activities are identified and reduced to an acceptable level. Resource activities are regulated activities.

Under these regulations CP is required to have an approved environmental management plan (EMP) prior to undertaking petroleum exploration or production activities. EMPs must include:

- Potential environmental risks or impacts (in this instance relating to the introduction and spread of weeds)
- Appropriate environmental outcomes, environmental performance standards and measurement criteria
- Appropriate implementation strategy and monitoring, recording and reporting arrangements
- Demonstrate that there has been an appropriate level of engagement with directly affected stakeholders in developing the plan.

To assist with the implementation of this legislation the NT Government developed 'The Code of Practice for Petroleum Activities in the Northern Territory' for the petroleum industry to ensure that activities are managed according to minimum acceptable standards to ensure that risks to the environment can be managed to a level that is as ALARP and acceptable.

Weeds Management Act 2001

The control of weeds is regulated by the NT Government through the *Weeds Management Act 2001* (WM Act). Under this legislation, weed control is the responsibility of the land manager/owner. If a weed is declared, all land holders, land managers and land users must comply with the classification.

There are three classes of declared weeds under the WM Act:

- Class A: Eradicate
- Class B: Control
- Class C: Prevent entry.

The WM Act enables the relevant minister to approve statutory weed management plans. Management obligations in these plans must be adhered to. Currently there are statutory management plans for 10 high priority weed species in the Northern Territory. The weed species these apply to and copies of the plans can be found at https://nt.gov.au/environment/weeds/weed-management-planning.

Where a high priority weed species is identified they must be addressed in accordance with the relevant statutory management plan.

Regional Weed Management Plan

The proposed wells are located within the Alice Springs Regional Weed Management Plan. The aim of this regional plan is to provide direction for managing weed threats in the region by:

- Identifying priority weeds, priority landscape areas and priority pathways of weed spread

- Providing a platform for the Regional Weed Reference Group to operate
- Guiding future funding and resource investment.

2.2 Federal

Environment Protection and Biodiversity Conservation Act 1999

The objectives of the *Environment Protection and Biodiversity Conservation* Act 1999 (EPBC Act) are, amongst other things to:

- Provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance
- Promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources
- Promote the conservation of biodiversity
- Promote a co-operative approach to the protection and management of the environment involving governments, the community, landholders and indigenous peoples
- Assist in the co-operative implementation of Australia's international environmental responsibilities.

The EPBC Act provides for the identification and listing of key threatening processes. A threatening process is defined as a key threatening process if it threatens or may threaten the survival, abundance or evolutionary development of a native species or ecological community. Key threatening processes include invasive species, such as weeds, which have a major impact on Australia's environment, threatening our unique biodiversity and reducing overall species abundance and diversity (DAWE, undated).

There are currently eleven threat abatement plans declared under the EPBC Act of which the 'Threat Abatement Plan to Reduce Impacts on Northern Australia's Biodiversity by the Five Listed Grasses (2012)' and the 'Threat Abatement for Ecosystem degradation, habitat loss and species decline in arid and semi-arid Australia due to the invasion of buffel grass (*Cenchrus ciliaris and C. pennisetiformis)* (April 2015)'may be relevant to weed management within the proposed locations.

Weeds of National Significance

Weeds of National Significance (WoNS) are nationally agreed priority flora species for control and management. Weed species are determined based on rankings for invasiveness, potential to spread, and impact on socio-economic and environmental assets (Australian Weeds Committee, 2007). There are currently 32 WoNS with each having an endorsed strategic plan which outlines tactics and actions for control. All WoNS are also declared weeds under the NT WM Act.

2.3 Weeds considered under this WMP

Weeds are defined in this WMP as any flora species that may cause environmental degradation or nuisance to the safe operation at CP's facilities. This includes declared weeds under the WM Act, WoNS, invasive species, or other flora that is present in a location that may impact on the safe operation of CP's facilities.

3 Dedicated Weeds Officer

As per the Code of Practice: Onshore Petroleum Activities in the Northern Territory, petroleum activities are required to have a dedicated Weeds Officer. The Weeds Officer is responsible and accountable for weed related requirements including baseline weed assessments, ongoing monitoring, training of workers and contractors, and oversight of weed control mechanisms.

The dedicated Weeds Officer under this WMP is provided in Table 3-1. CP currently utilises the services of a skilled and experienced individual from a special firm to act as the dedicated Weeds Officer. The Weeds Officer is available as required to ensure weed related activities are undertaken.

Table 3-1: Dedicated Weeds Officer Details

Name	Company	Contact Number	Contact E-mail
Bill Low	Low Ecological Services Pty Ltd	(08) 89 555 222	lowecol@lowecol.com.au

4 Existing Weeds

Situational or environmental weeds at the well locations have the potential to increase risk through:

- Ground vision impairment – being unable to spot hazards or spills
- Increased risk of fire due to increased fuel loads
- Increased risk of fauna interactions, for example snakes etc.

Weed infestations can also harbour feral animals and hinder their control. They pose a risk to flora though out-competing native species and replacement of native plant communities.

No declared weeds, WoNs or weeds under EPBC Act Threat Abatement Plans were observed during the 2020 weed survey. If weeds under EPBC Act Threatened Abatement Plans are identified, management of the weeds will be undertaken in accordance with the relevant Threat Abatement Plan.

Cenchrus ciliaris, Buffel grass, a significant threat weed under the Alice Springs Regional Weed Management Plan 2013-2018 was identified throughout all locations.

Table 4-1: Existing weeds

Common Name / Scientific Name	Status	Description	Photograph
Buffel Grass ***Cenchrus ciliaris***	Not declared Significant threat weed under the Alice Springs Regional Weed Management Plan 2013-2018	Long lived dense tussock grass with deep tap-root system up to 1m tall. Stalks are tough and branched with swollen bases. Leaves are produced at the basal and higher nodes. Rhizomes up to 0.5 m long. Flower- varies in colour from straw to purple. Long cylindrical, dense, spike-like, 2.5–15 cm long. Leaves- blueish-green, hairy with pointed tips, flat or folded. Seed heads- Dense, hairy, cylindrical spike up to 15 cm long and 2 cm wide. Seeds enclosed in a cluster of bristles, giving 'fluffy' appearance.	

5 Weeds to Watch

There is potential for additional weed species to enter a disturbed site through a number of means and once there establish quickly. On-shore petroleum activities; infrastructure corridors (such as gas pipelines and roads/tracks); commercial activities; and river corridors are all pathways for weed spread that require priority management attention.

5.1 Priority and Alert Weeds

The Alice Springs Regional Weed Management Plan (2013-2018) provides information on priority weeds[1], and alert weeds[2] and these are provided in Table 5-1. Figure 5-1 provides an overview of the indicative location of priority weeds within the Alice Springs Regional Weed Management Plan area. To date none of these priority weeds have been detected within the well locations.

Table 5-1: Priority and Alert Weeds

Weed Listing	Scientific Name	Common Name	Declared Weed Status
Priority	*Tamarix aphylla*	Athel pine	B
Priority	*Opuntia and Cylindropuntia spp.*	Cacti	A
Priority	*Parkinsonia aculeata*	Parkinsonia	B
Priority	*Calotropis procera*	Rubber bush	B
Alert	Prosopis spp	Mesquite	A
Alert	Acacia nilotica	Prickly acacia	A
Alert	Cenchrus setaceus	Fountain grass	B

Any sightings of the priority or alert weeds in Table 5-1 are to be referred to the Weeds Officer and contact is to be made with the Weeds Management Branch prior to attempting removal.

[1] Present in the region and requires priority management attention
[2] Not yet naturalised in the region, but if established would have a high level of impact

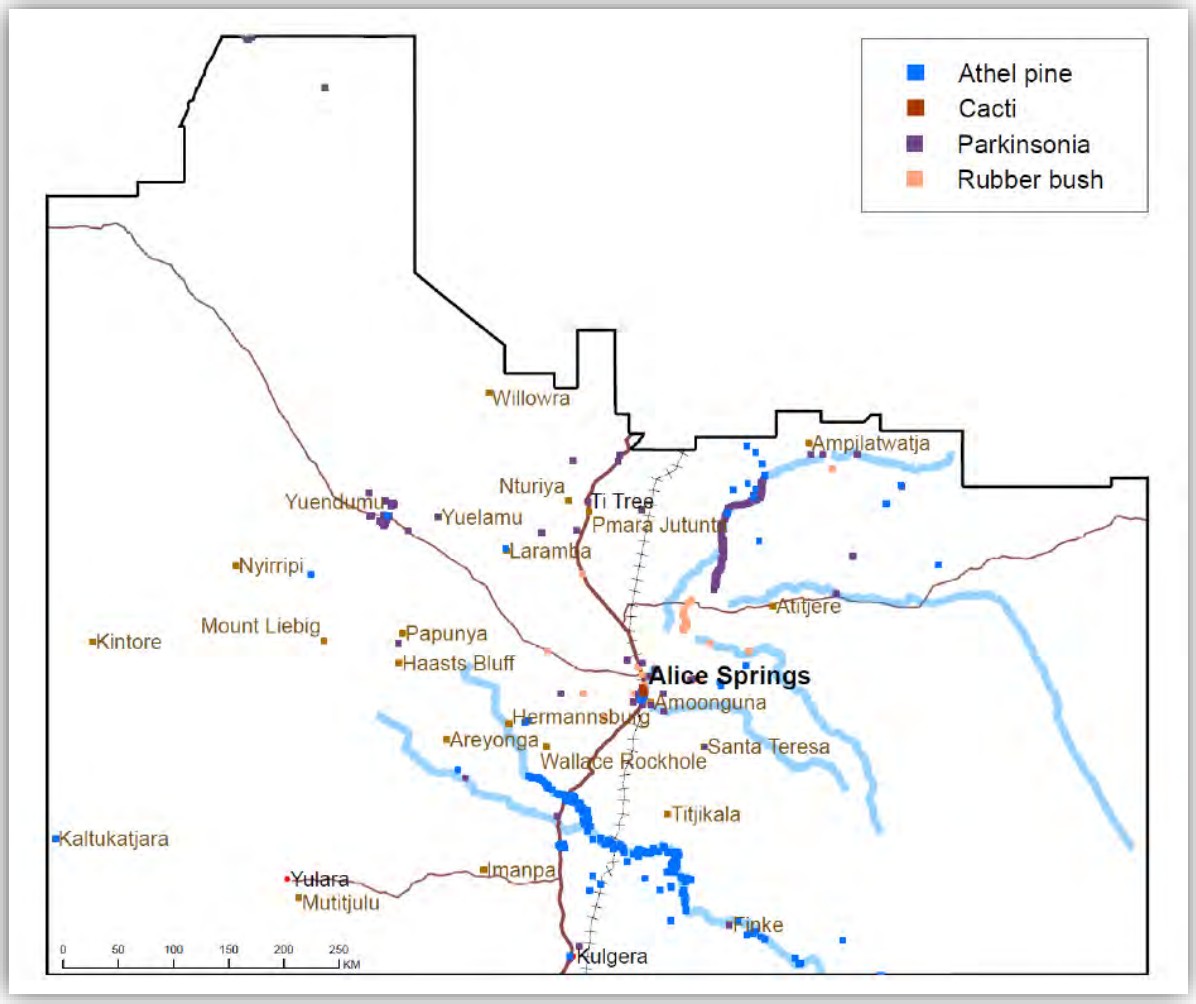

Figure 5-1: Indicative distribution of priority weed species within the Alice Springs Regional Weed Management Plan area

5.2 Declared Weeds

A desktop search of the Department of Environment and Natural Resources (DENR) NR Maps database was peformed to identify weed records within 50 km of the well locations. Table 5-2 provides a list of the NT declared weed records from the desktop results for each of the well locations.

Table 5-2: Declared Weeds within 50 km of Wells

Scientific name	Common name	Listing	Well Location				
			Dingo	Orange	Palm Valley	West Mereenie	Mamlambo
Andropogon gayanus	Gamba grass	A	✓	✓			
Alternanthera pungens	Khaki weed	B			✓	✓	
Argemone ochroleuca	Mexican poppy	B	✓		✓		
Asphodelus fistulosus	Onion weed	A				✓	
Calotropis procera	Rubber bush	B	✓	✓			
Carthamus lanatus	Saffron thistle	B	✓	✓			
Cenchrus echinatus	Mossman river grass	B	✓	✓	✓	✓	✓
Cenchrus setaceus	Fountain grass	B	✓	✓		✓	
Cylindropuntia fulgida	Rope cactus - fulgida	A	✓	✓			
Cylindropuntia imbricata	Rope cactus - Devils rope	A	✓	✓			
Datura ferox	Thornapple - Longspine	A		✓			
Datura inoxia	Thornapple - inoxia	C		✓			
Datura wrightii	Thornapple - wrightii	C		✓			
Echium plantagineum	Patterson's curse	A	✓	✓			
Emex australis	Spiny emex	B		✓		✓	
Jatropha gossypiifolia	Bellyache bush	A		✓			
Lantana camara	Lantana - common	B		✓			
Lycium ferocissimum	African boxthorn	A		✓			
Opuntia elatior	Prickly pears - elatior	A		✓	✓		
Opuntia puberula	Prickly pears - puberula	A					
Opuntia stricta	Prickly pears - stricta	A	✓	✓	✓		
Parkinsonia aculeata	Parkinsonia	B	✓	✓	✓		
Prosopis pallida	Mesquite	A	✓	✓	✓		
Prosopis velutina	Mesquite - velutina	A		✓			
Ricinus communis	Castor oil plant	B	✓	✓	✓		
Senna obtusifolia	Senna - Sicklepod	B		✓			
Senna occidentalis	Senna - Coffee	B	✓	✓			
Sida acuta	Sida - Spiny head	B	✓	✓		✓	
Sida cordifolia	Sida - Flannel weed	B			✓		
Sida rhombifolia	Sida - Paddys lucerne	B		✓		✓	
Tamarix aphylla	Athel pine	A		✓	✓		
Tribulus cistoides	Caltrop - cistoides	B					✓
Tribulus terrestris	Caltrop - terrestris	B	✓	✓	✓	✓	✓
Xanthium spinosum	Burr - Bathurst	B	✓	✓	✓		
Xanthium strumarium	Burr - Noogoora	B	✓	✓			

5.3 Statutory Weeds

No statutory weeds have been identified during weed surveys of the well locations. The following statutory weeds (for which a weed management plan exists) have been identified within a 50 km buffer zone of at least one of the well locations:

- Athel pine
- Bellyache bush
- Gamba grass
- Mesquite.

Management of these weeds if they are detected will be as per the relevant statutory weed management plan (available at https://nt.gov.au/environment/weeds/weed-management-planning).

6 Weed Introduction and Spread Risk

Table 6-1 provides an overview of the risk of weed introduction and spread, as well as mitigation measures that can be applied at each of the well locations.

Table 6-1: Risks and mitigation measures for project stages

Project stage	Risk	Mitigation measures
Civil works / well construction	Spread of weeds due to vehicles driving to each location	▪ Vehicles from known weed infested areas are to have a weed-free certificate, issued by an appropriately qualified person before entering any location covered by this WMP ▪ Photos and/or GPS locations of any Declared weeds reported to Weeds Officer when observed by CP personnel ▪ If sand, soil or gravel is brought on site such as for hardstand areas and pipe bedding, it will be sourced from material that does not contain declared weed seeds or plants
Well suspended / decommissioned	Well pads not frequented by CP staff allowing existing weeds to spread without being noticed	▪ CP personnel to be made aware of risks of weed spread ▪ Suspended / decommissioned wells to be included in weed surveys and annual audits ▪ Progressively rehabilitate areas when no longer required and monitor rehabilitation to prevent weed establishment
Weed control	Weeds not adequately controlled/insufficient effort or poor timing of weed control Weeds not removed/stacked during weed control efforts, resulting in further spread.	▪ Annual monitoring of areas that have been treated, as many seeds remain viable for more than five years ▪ Aim to remove weed seedlings before they flower and produce seed
Weed survey	Insufficient survey effort Weeds present on site not identified during survey	▪ Weed survey results to be submitted to DENR annually ▪ Use of NT government spatial data sets to locate areas of weed infestations within close proximity to each location ▪ CP personnel to be trained in weed identification

7 Action Plan

Table 7-1 provides the key objectives, actions and timing for weed control associated with the 2020-21 drilling campaign. While the focus of this WMP is to ensure weeds are kept in control in accordance with CP and NT Government requirements, it is important that weed control is performed in a manner that preserves the environmental features of the site. Care should still be taken to ensure that non-target species are not removed or sprayed.

Table 7-1: Key objectives, actions, and timing for weed control

Step	Objective	Actions	Timeframe
Weed Identification	Weed species and area of infestation are identified and monitored	▪ Weed surveys to be undertaken annually by dedicated Weeds Officer ▪ Weed species identified to be photographed (and/or areas of infestation recorded with GIS and mapped), report to be provided to CP Environment Coordinator and included within WMP ▪ Weed survey findings used to determine control programs in consultation with CP or suitable contractors ▪ CP personnel to be trained in identification of weeds, particularly declared weeds, WoNS and weeds under EPBC Act Threat Abatement Plans ▪ CP personnel to familiarise themselves with declared weeds that have potential to enter the site	▪ Annual weed survey, as determined by Weeds Officer ▪ As part of ongoing operations – e.g. quarterly internal and annual external audits
Weed prevention	No new declared weeds, WoNS or environmental weed individuals or infestations	▪ Vehicles and/or equipment coming from a weed infested area is required to be weed free and needs to provide a weed free certificate before entry ▪ Vehicles coming from known weed-infested areas or interstate, are to have a weed-free certificate ▪ If areas containing weeds are accessed, all equipment and machinery will be cleaned. Vehicles will be washed or blown down to prevent transfer of weeds to uncontaminated areas ▪ Any fill brought to site must be sourced from weed free area ▪ No unnecessary clearing to minimise ground disturbance ▪ Road grading in areas of weeds should be from the outside of the infestation back into the centre of the infestation ▪ No off-road driving where avoidable ▪ Continual monitoring of operational areas and 'hotspots' ▪ Any weed sightings to be reported to the Weeds Officer	Ongoing as part of activities

Step	Objective	Actions	Timeframe
Weed Control	▪ Existing weeds are controlled using effective methods. ▪ Personnel and infrastructure are protected from increased fire risk due to weed infestations ▪ No spread of weeds already present at site ▪ No new weed species present	▪ Appropriate control and/or removal method selected Weeds Officer based on species present and extent of infestation ▪ Maintain a 4m fire break around infrastructure ▪ Plan a rapid response to seasonal changes to maximise the effectiveness of control ▪ When feasible, local traditional owners, Rangers or contractors should be engaged to assist with mechanical and chemical control of weed species ▪ CP personnel will also undertake weed control when they are available during normal operations ▪ Control activities are mapped using the same methods as undertaken in the 2020 survey to ensure consistent capture of information. This will enable the Weeds Officer to be more aware of the spread or containment of existing weeds and the effectiveness of weed control	Control/removal scheduled to occur prior to weed seeding where practicable - timing with seasons and predicted rainfall Usually Nov-March)
	Weed control methods result in no environmental harm	▪ Only suitably trained personnel will use chemicals and herbicides, in accordance with CP's chemical handling and storage procedures ▪ Relevant stakeholders will be consulted prior to chemical herbicide being used ▪ Assess areas outside of operational areas prior to weed control to identify conservation-listed flora ▪ Ensure non-target conservation-listed species are not impacted by weed control ▪ Minimise drift by spraying on low-wind days. ▪ No use of residual herbicide pellets within 2-3 canopy diameters of trees or shrubs ▪ Follow-up surveys will refine the impacts of weed removal of the potential for future vegetation re-growth	▪ During weed control activities as part of operational procedures ▪ Prior to weed control in areas outside of operational area.
Disposal of weeds and chemicals	▪ Weeds disposed of in environmentally friendly manner ▪ No further weed spread from disposal ▪ Correct disposal of chemical containers	▪ Weed plant material (leaves, seeds, flowers, branches etc.) that are physically removed will be brunt in a burn pit or removed from site (e.g. via waste bins). ▪ It is illegal to transport declared weeds. If declared weeds enter the site, these should be burnt and then buried on site at a depth sufficient to prevent emergence of seeds or seedlings ▪ Chemical containers disposed of correctly e.g. through drumMUSTER	On completion of weed control activities
Reporting	Compliance with NT government requirements.	Annual update provided to DENR to include weed control activities, updated locations of weed spread	Report provided to DENR on completion of annual survey

8 Weed Prevention

Preventing the introduction of weeds into an area is the most effective method of control. Avenues for spread and introduction of weeds species include but are not limited to:

- Movement of contaminated machinery, vehicles and equipment
- Spreading of contaminated gravel, road fill, topsoil
- By attachment to and through ingestion by animals (both feral and native)
- Discharge or pooling of water in any areas where water can pool and weed seeds can collect.

Weed invasion can be minimised by:

- having knowledge of weeds in the region to enable early identification of new invaders
- maintaining wash-down procedures to and from the facilities
- disposing of weeds and seed material correctly
- controlling the spread of existing weed infestations.

Taking note of rainfall conditions and timing weed control accordingly can be important in preventing and limiting weed growth. Weeds are opportunistic and often germinate quickly on disturbed ground. Once established, weeds can be difficult to remove permanently and can require ongoing and expensive maintenance programs. Many plants capitalise on events of high rainfall, experiencing periods of fast growth and mass germination and reproduction.

9 Weed Control

Weeds can be controlled by mechanical means, chemical means, or a combination of both. These methods are detailed below.

9.1 Physical Control

Physical control refers to hand-pulling or the use of tools and equipment such as shovels, brushcutters, and axes to physically remove the species. Hand-pulling can be labour intensive for large outbreaks but is an effective method for controlling weed seedlings prior to seed set. Hand-pulling can also be useful for controlling weeds in and around infrastructure e.g. around the pipes at CP- Fresh water tank.

To ensure physical control does not inadvertently result in further infestations, physical control of weeds should not be undertaken when weeds are seeding. After manual removal, weeds of some species need to be buried, burnt or stacked in a pile ensure seed material does not result in reinfestation. An alternative is to transport weeds off-site via a waste contractor. For any Declared Weeds that may occur in the future, transport restrictions may apply. In addition, after physical control, the site should be monitored as soil disturbance following manual removal can provide optimal conditions for a new infestation of weeds.

9.2 Chemical Control

There are several types of chemical control agents, each designed for a specific purpose and species. The recommended groups have been explained below.

9.2.1 Foliar spraying

Foliar spraying refers to diluted herbicide being sprayed over the foliage of the plant until it is covered (but not dripping). The use of spray dye is recommended as a visual cue to ensure evenness of coverage. Foliar spraying should only be used when plants are actively growing so the chemical is circulated through the plant down to the roots. It is most effective on new growth a few days to weeks after a rain event. Foliar spraying is usually best undertaken in the early morning and late evening

when the Delta T (the relationship between temperature and humidity) is within the range of 2-10. Ideal conditions are mild temperatures, little to no wind and moderate to high humidity. Evaporation during hot and/or windy conditions reduces absorption of the chemical. It is essential that the operational instructions for each chemical are followed stringently to maximise the effectiveness of the spraying in control the weed. Foliar spraying is an effective and widely used application method but care should be taken to avoid spray drift and off-target damage.

9.2.2 Foliar spraying with Glyphosate

Glyphosate is a common broad-spectrum herbicide that can be sprayed on both broad leaf plants and grasses. Glyphosate must be applied to a plant while it is actively growing to be effective. As plants are commonly water stressed in the arid zone the time frames during which Glyphosate can be used are restricted. An effective way to control invasive grasses with Glyphosate is to first slash then spray the regrowth. This method can be combined with the use of Flupropanate, a residual herbicide, which will control both mature tussocks and the germination of residual seed banks for up to two years.

The Australian Pesticides and Veterinary Medicines Authority reviewed the safety of glyphosate in 2016 and found no grounds to place it under formal reconsideration. The product labels contain relevant poisons scheduling, first aid, and safety directions detailing personal protective equipment when handling and using products containing glyphosate and this information should always be followed.

9.2.3 Adjusting Water quality

The water quality of water used in spraying applications needs to be considered to maximise the effectiveness of foliar spraying control methods. If Alice Springs potable water is used, with a known high water quality then no additives are required. However, if local bores are used, then the water quality needs to be tested to determine what additives might be needed. For example. 'hard water' (water with 150-300 mg/L $CaCO^3$) that is slightly alkaline is common in central Australia and alters the effectiveness of herbicides such as glyphosate, 2,4-D amine, MPA amine and dicamba (McDougall, 2012). The solubility of these herbicides is reduced leading to less absorption by the weeds. In addition, 'hard water' can cause some chemicals to precipitate, blocking nozzles, pre-filters and causing additional wear of spray rigs (McDougall, 2012). To "soften" hard water it is recommended to add softening agents and adjust the pH of the water in spray applicators.

9.2.4 Residual Herbicides

Residual (long-acting) herbicide pellets can be effective in the ground for a period of up to ten years but are only active after rainfall. They can be an effective method to provide long term control of weeds in areas where it is difficult to slash. When using residual herbicides, it is important to ensure all pellets are raked just into the surface to prohibit off site migration. Residual herbicides should not be used within three canopies distance from any tree or shrub or within 100m of any waterways. Two residual herbicides are described below:

- **Flupropanate** is a grass-selective residual herbicide that has been found to be effective in the control of Buffel grass. Flupropanate stays residual in the soil for approximately two years and can thus also prevent new germinations. Flupropanate is selective for Buffel grass when applied at recommended rates which can allow for the retention of native grasses and forbs, increasing competition and reducing the chance of Buffel grass recolonising an area. Another advantage of Flupropanate is it can be applied when invasive grasses are not actively growing, expanding time periods for control programs. Flupropanate and Glyphosate can also be used as a mixture to quickly kill Buffel grass infestations and minimise the likelihood of new germinations.
- **Graslan** is a residual herbicide that is selective for woody weeds and is useful for long term control in hard to access areas.

9.3 Records of Chemical Use

In the NT, detailed records of agricultural chemical use are required to be kept for a minimum of two years by businesses registered as professional ground sprayers. Required records include:

- Name and address of person who used the product
- Product name
- Amount of product and dosage used
- Application method
- Product expiry date
- Date and time the product was used
- Exact location of where the product was used
- Type of crops, pastures or plants in the area
- Temperature and wind speed/direction
- Target pest or disease.

10 Existing Weed Control Methods and Timing

Control methods and timing for existing weeds (i.e. Buffel grass) is provided in

Table 10-1. This is a guide only and is highly dependent on rainfall and weather each year.

Table 10-1: Buffel grass control methods and timing

Common Name / Scientific Name	Germination / Flowering	Seed life span	Control Method	Timing for weed control
Buffel Grass *Cenchrus ciliaris*	**Germination** Following ~20-25mm rain event **Flowering** Winter – Spring	~4 years (but plants long-lived)	**Chemical:** Foliar spraying with Glyphosate (360g/L) Roundup Biactive® or other aquatic-sensitive Glyphosate product. Chemical control will require at least two treatments within a growing season. The initial treatment should occur following rain, when there is active growth. A follow up treatment should be undertaken in two to four weeks' time if regrowth is evident. Large bulky plants can be slashed and when 1/3 regrowth, sprayed to conserve chemicals	Nov - Feb For best control, apply during periods of active growth or immediately following a rainfall event in summer months.
			Residual Chemical: Foliar spraying Flupropanate at an application rate of 1000L/Ha or 1L/10m². Spray dye is recommended as a visual cue to ensure evenness of coverage. It may take 6-8 weeks before there are signs that the plants are being affected. Flupropanate can also be used in a granular form.	

11 Administrative Provisions

11.1 Notification Process

The Weed Management Branch will be notified within 48 hours of the discovery of a new declared weed species (i.e. not previously identified in weed surveys or recorded in the NR Maps system) within the well locations.

Initial notification will be by telephone with follow up written notification provided within seven (7) working days. Written notification is to include a preliminary species identification and location (easting and northing).

11.2 Recording

Records of weed surveys will be maintained by CP. Weed surveys will normally be undertaken by the Weeds Officer.

Data on weed distribution will be maintained in CP's geographical information system and be provided to the NT government as part of the annual report on performance against the WMP, or when requested by the Weeds Management Branch.

Data will be collected as per the requirements of the Northern Territory Weed Data Collection Manual - Section One Technical Data Description (Weed Management Branch, 2015).

11.3 Reporting

A report on the performance against this WMP will be submitted to DENR on an annual basis. At a minimum, this is to include:

- Details of activities implemented to address weed spread and introduction risks (e.g. vehicle wash down/ blow down locations, examples of track construction from working from weed free areas into weed infested areas to reduce spread)
- Details of survey and monitoring events, including dates, personnel, maps and track data
- Submission of all weed data collected
- 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 dot point 1 above).

12 References

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Department of Agriculture, Water and the Environment. April 2015. Threat Abatement Advice for Ecosystem degradation, habitat loss and species decline in arid and semi-arid Australia due to the invasion of buffel grass (*Cenchrus ciliaris and C. pennisetiformis),* available at: https://www.environment.gov.au/biodiversity/threatened/threat-abatement-advices/buffel-grass-introduction.

Appendix 7 Bushfire Management Plan

Scope

The following Bushfire Management Plan has been developed in accordance with the requirements of the Code of Practice, clause A.3.7 and is consistent with DEPWS's Bushfire Management Planning Guide: Onshore Petroleum Projects (2020). The Bushfire Management Plan relates to CP's 2020-21 drilling campaign that is described in the accompanying EMP.

In line with the scope of the EMP, where a well is completed and becomes a development well it's ongoing environmental management will be as per the applicable Field EMP. Ongoing bushfire management requirements for the well would also become part of the existing bushfire management plan that applies to the applicable Field EMP.

Background Information

Table A7 -1 provides background information relating to each of the proposed drilling locations.

Table A7 - 1 BMP Background Information

<table>
<tr><th>Aspect</th><th>Information</th></tr>
<tr><td>Well Details</td><td>
<table>
<tr><th>Well Location</th><th>Field Name</th><th># Wells</th><th>Well Type</th><th>Resource</th><th>Well Name</th></tr>
<tr><td>Production Licence 7</td><td>Dingo</td><td>1</td><td>Exploration</td><td>Gas</td><td>Dingo-1 ST or Dingo-5</td></tr>
<tr><td>Exploration Permit 82</td><td>Orange</td><td>1</td><td>Exploration</td><td>Gas</td><td>Orange-3</td></tr>
<tr><td>Operating Licence 3</td><td>Palm Valley</td><td>1</td><td>Exploration</td><td>Gas</td><td>Palm Valley-12</td></tr>
<tr><td>Operating Licence 4</td><td>Mereenie</td><td>2</td><td>Development</td><td>Gas</td><td>West Mereenie-27 and West Mereenie-28</td></tr>
<tr><td>Production Licence 6</td><td>Surprise</td><td>1</td><td>Exploration</td><td>Oil</td><td>Mamlambo-1</td></tr>
</table>
</td></tr>
<tr><td>Property Land Use</td><td>The Orange-3 well and Dingo wells are located on pastoral leases. Baseline assessments indicate that the well locations may have been previously grazed but are not part of an active grazing regime
The West Mereenie and Palm Valley-12 wells form part of established operating oil/gas fields and are located on Aboriginal land
The Mamlambo-1 well is located on Aboriginal land</td></tr>
<tr><td>NT Fire Management Zone</td><td>All proposed wells are in the Alice Springs Fire Management Zone.</td></tr>
<tr><td>NT Fire Protection Zone</td><td>Dingo wells – N/A
Orange-3 well: Alice Springs
Mamlambo-1 well: N/A
West Mereenie wells – N/A
Palm Valley-12 well – N/A</td></tr>
<tr><td>Bush Fire Seasons</td><td>Bushfire (wild fires) risk is generally high between December to March, medium between April and May and October and November, and Low between June and September.</td></tr>
</table>

Aims and Objectives

The aim of the bushfire management plan is to successfully construct and minimise the potential and impact of fires from CP's activities to people, environment, culturally significant sites, public infrastructure and community lands.

The objectives of the bushfire management plan are to:

- Protect personnel – Maintain the safety of all personnel at each well location by managing the fire risk and spread where possible. If the fire event cannot be managed, personnel are to be evacuated in accordance with the relevant Emergency Response Plan
- Protect neighbours – Prevent instances of accidental fires caused by CP's activities which can impact on CP's assets and neighbour's livelihood
- Protect assets – Protect CP's assets by removing fuel in the vicinity of infrastructure and maintaining fire breaks.

Fire Regime and Fire History

Fire history and fire scar mapping available from 2000 using the NAFI website[46] is summarised for each survey area in Table A7-2.

Table A7 - 2 Baseline Fire Analysis

Well Location	Description
Dingo Wells	▪ Low fire frequency ▪ Burnt once in the last 20 years ▪ Last fire was in 2011, which burnt entire survey area (part of large-scale fire)
Orange-3	▪ Low fire frequency ▪ Burnt once in the last 20 years ▪ Last fire was in 2011, which burnt the western half of survey area (part of large-scale fire)
Palm Valley-12	▪ Low fire frequency ▪ Burnt once in the last 20 years. ▪ The last fire occurred on the northern side of the existing access road in 2002, which was a controlled burn organised and undertaken by rangers from Finke Gorge National Park in conjunction with Palm Valley Gas Field ▪ The majority of vegetation to the south was most likely burnt last in the 1970s
West Mereenie-27	▪ Low fire frequency ▪ Burnt once in the last 20 years ▪ Last fire was in 2011, which burnt entire survey area (part of large-scale fire)
West Mereenie-28	▪ Low fire frequency ▪ No fire scars in the last 20 years
Mamlambo-1	▪ Low fire frequency ▪ Some areas burnt twice in last 20 years (large scale fires) ▪ Survey area was burnt in 2011 as part of wide-scale fires throughout the region (edge of fire scar only so impacts may only be minor) ▪ Access track area was recently burnt in 2019 as part of wide-scale fires throughout the region

[46] https://www.firenorth.org.au/nafi3

Fire Risk

CP has undertaken an environmental risk assessment, based on the scope of activities to be conducted under this EMP. The fire risks identified through the assessment process were:

- Site activities increase risk of ignition
- Vehicle and equipment movements as a potential risk of starting a bushfire
- Personnel smoking on-site increasing risk of starting a bushfire
- Spread of high fuel loads (buffel grass) within cleared areas which may increase fire intensity.

In addition to the fire risks from CP activities, the risk of wildfires (started by others or lightning) remains present in each of the well locations. Wildfire risk is generally low between December to May, medium in June and November and high between July and October.

Potential Impacts on Existing Fire Management

The proposed wells will be located on a small cleared area (up to 3 ha) which ensures there will be no impacts on existing fire management. CP will be using existing access tracks and previously disturbed areas (to the greatest extent possible) to minimise new disturbance and therefore minimising potential changes to existing fire patterns and paths.

Coordination with landholder and Land Users

Activities under the EMP will require a land access agreement with the landholder/s. Through this process, CP will ensure that the project does not affect the landholder's fire management obligations and strategies.

Where a watch and act or emergency warning is issued by the NT Government for areas containing CP's assets, CP will liaise with the affected landholder to ensure any control efforts / evacuations are coordinated.

Fire Management Actions

The fire management actions that form part of CP's activities under this EMP are summarised in Table A7-3.

Table A7 - 3 Summary Bushfire Management Actions

Activity	Management Controls
Site design and layout	▪ Infrastructure development will consider safety in design and placement to reduce the risk of ignition sources to the extent practicable, including siting of flares, chemical storage, designated smoking areas etc ▪ A 4 m firebreak to be in place for all infrastructure (included in the lease design) ▪ Horizontal, inground flare to be used ▪ Flares will be located at least 25 m from vegetation (including vegetation stockpiles)
Civil construction	▪ All vegetation to be removed from well lease, camp, aboveground pipeline routes and access tracks ▪ Fire extinguishers to be available in vehicles and mobile machinery

Activity	Management Controls
Drilling, testing and completion	▪ Fire extinguishers to be available at the drill rig ▪ Designated smoking areas provided ▪ Ignition sources to be kept outside hazardous zones ▪ Gas to be flared (except on fire ban days) ▪ Establishment of exclusion zones to occur prior to flaring activities ▪ Onsite risk assessment to be conducted each day during a flaring event ▪ Permit to burn to be obtained for flaring during the fire danger period
Camps	▪ Designated smoking areas provided ▪ No open fires permitted
General	▪ Staff members responsible for managing bushfire risk to be competent in the role they perform ▪ Daily monitoring for fire alerts to be undertaken ▪ Six Monthly maintenance checks of the firebreaks, fire trails and vegetation removal (including weeds) within all cleared areas until rehabilitation commences ▪ Determine whether a controlled burn is required to reduce fuel loads prior to medium and high risk wildfire months ▪ Undertake monitoring of seasonal conditions and fuel loads ▪ Conduct annual fire mapping to monitor fire frequency changes ▪ Emergency response plans to include response requirements for fires ▪ Inductions to include bushfire risks, hazardous zones, controls and emergency response procedures ▪ When a fire danger period has been declared, no burning (other than flaring) may take place except where a permit to burn has been obtained ▪ Storage of chemicals to be in accordance with the relevant Australian Standards ▪ Sufficient water to be available onsite to enable CP to provide an initial response to an accidental fire at the well lease / camp ▪ If unable to control fire notify Bushfires NT and properties where spread is likely to go

Bushfire Alerts

The NT government has created a three-tier bushfire alert system. The three alerts are:

- Advice – areas which have either a small fire which is controllable, planned fuel reduction burning or an area likely to be affected by smoke
- Watch and act – an area that has a bushfire approaching a community, changing with conditions or will threaten property or life if not controlled
- Emergency warning – An area that is in immediate danger from the bushfire and you must act now to protect your life

The Onsite Company Representative is responsible for monitoring for bushfire alerts (primarily via the https://securent.nt.gov.au/alerts website) and notifying CP personnel and contractors who may be attending the site. Communication of these alerts will generally be via the daily toolbox meetings. Where bushfire alert information becomes known after the toolbox meeting, the Onsite Company Representative will communicate directly to the drilling rig and via telephone to CP personnel and contractors not on the site.

The Onsite Company Representative will also communicate with the relevant CP operational personnel and the landholder where a watch and act or emergency warning is issued to ensure any control efforts / evacuations are coordinated.

Bushfire Response

In the event that a bushfire is identified that may affect CP's assets or an accidental onsite fire cannot be controlled, the applicable site emergency response plan is to be initiated and followed. The emergency response plan is to consider situations where it is both safe and unsafe to leave the location.

Recording and Reporting

All fire incidents, near misses and potential hazards will be logged through CPs incident reporting system for further investigation and initiating corrective actions.

Stakeholder Contact Details

Location	Stakeholder	Contact Details	Contact Name
All	Emergency	000 or 112 from mobile	24/7 contact line
All	Bushfire NT	08 8922 0840 (head office) 08 8952 3066 (Alice Springs) bushfires.nt@nt.gov.au	NA
All	NAFI	https://firenorth.org.au/nafi3/	Website
All	Bureau of Meteorology	www.bom.gov.au	Website
All	Secure NT	https://securent.nt.gov.au/alerts	Website
All	Police, Fire and Emergency Services	https://www.pfes.nt.gov.au/incidentmap	Website
All	Central Land Council	08 8951 6211	NA
Mamlambo-1 Well	Landholder	08 8962 2343	Haasts Bluff Aboriginal Land Trust
Dingo Wells	Landholder	"redacted"	"redacted"
Palm Valley-12 Well	Landholder	08 8954 4702	Ntaria Aboriginal Land Trust
West Mereenie Wells	Landholder	08 8962 2343	Haasts Bluff Aboriginal Land Trust
Orange-3 Well	Landholder	08 8955 0310	Simpsons Gap Ranger Station

Appendix 8 Emergency Response Plans

Emergency Management Plan

Central Petroleum

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1. Introduction

1.1 Purpose

The Emergency Response Plan is designed to direct and guide the Site Emergency Response Team (SERT) to respond effectively to site emergencies and resume normal operations. It identifies persons responsible for managing and/or assisting in an emergency and provides general guidelines and tools to assist in the process.

1.2 Scope

An emergency is defined as an event (actual or imminent) which endangers or threatens to endanger life, property or the environment, and in the context of this plan requires a coordinated response.

This plan is applicable to all employees, contractors and visitors to Central Petroleum tenures and the following assets and associated infrastructure operated by Central Petroleum:

- well sites
- gathering lines
- gas processing facilities
- oil storage tanks
- site offices and workshops
- camp.

This plan is to be used in conjunction with CTP's Emergency Management Plan (MSTD-PLN001 VX).

Areas under the control of a principal contractor are not covered under this plan however CTP's contract manager/owner must review and approve the contractors' plans and if necessary, create a bridging document detailing any additional requirements and support required as well as establishing clear notification protocols.

All ERP's shall be reviewed annually and if changes to plant and conditions occur.

1.3 Emergency response Training

All personnel shall receive Emergency Response training in an ongoing manner at each operational site. This training shall consist of both in field and desktop scenarios. Each site shall ensure the training is held (where operational viable) every 6 weeks.

1.4 Emergency Management Approach

CTP uses a two-tiered approach to emergency management as outlined in Figure 1.

Figure 1

Level	Examples	Document	Owner
Level 1 – Emergency Response	▪ Control of the situation does not require external support ▪ Non-life-threatening ▪ Not expected to escalate ▪ Limited damage to the environment, assets or reputation	Site Emergency Response Plan	Site Emergency Response Team leader
Level 2 - Emergency Management	▪ Control of the situation requires external support ▪ Life is at risk ▪ Major damage to the environment, assets ▪ or reputation ▪ Situation may have personnel, technical, operational or public affairs implications ▪ Highly likely to impact CTP's reputation	Emergency Management Plan	Emergency Management Team leader

In addition to and supporting this plan, the Emergency Management Team (EMT) and Emergency Management Plan (EMP) outlines the responsibilities, actions and resources available at head office to support site in the event of a significant emergency.

1.5 Response Priorities

In managing an incident, the SERT will focus their response to ensure:
- our **people** are accounted for and safe.
- we minimise impact on the **environment**
- our **assets** are protected
- CTP's **reputation** is safeguarded.

1.6 Related Documents

Whilst this plan has been designed to be a standalone document, references are made throughout to various other documents which may be useful in the event of an emergency. It is the responsibility of all SERT members to be familiar with the processes and standards within their area of responsibility, and conduct regular exercises to ensure readiness

2. Site Emergency Response Team

2.1 Roles and Responsibilities

The following specific roles and responsibilities are essential to ensure effective management and accountability during an emergency:
- first responder
- SERT leader – the Person in Charge (PIC) on site
- SERT coordinator (supported by a log keeper)
- SERT first aider

Operators, technicians and logistics personnel will assist the SERT leader and may be required to undertake multiple roles depending on the nature of the emergency, its duration and complexity.

If for some reason the SERT leader is unable / unavailable to perform their duties, an alternate person must be identified. Should for some reason SERT members be unable to perform their duties, the SERT leader will allocate other suitably trained persons. On shift SERT role information is to be displayed on the notice board or in the site emergency response room.

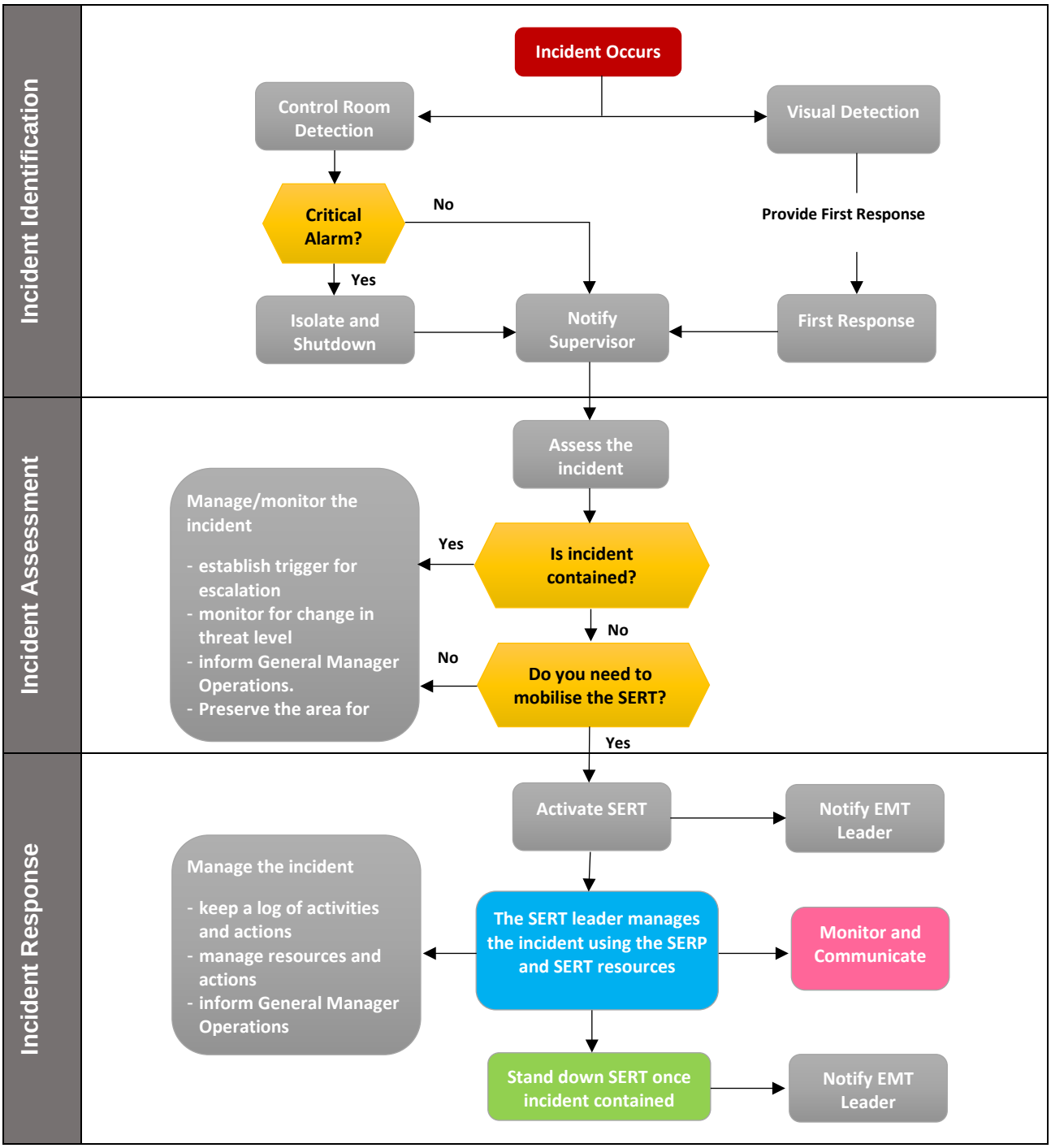
Depending on the nature and severity of the emergency, the EMT may be activated to support issues such as:
- regulatory and stakeholder notifications
- additional manning
- sourcing assets required to support the site, such as aviation
- medical or other emergency services
- mutual aid or contractor resources.

For more detailed information regarding the above SERT roles, refer to the role cards in Section 4.1.

3. Emergency Response Process

Identification, assessment and response processes are outlined in Figure 2 below. Further guidance is available in the role cards in Section 4.1.

Figure 2



3.1 Identification

When an event (actual or imminent) endangers or threatens to endanger life, property or the environment, the first responder must, if safe to do so, take action aligned with the first responder role card. It's important everyone is familiar with the responsibilities and initial actions of the first responder.

3.2 Notification

Once immediate action is taken, the first responder must raise the alarm and advise the production supervisor as to the nature of the emergency and any assistance required. An alarm can be raised:

- in person
- by radio (using prefix 'Emergency, Emergency, Emergency)
- by landline or mobile phone (not in restricted areas)
- by SOS alarm on a tracker.

3.2 Assessment

Once notified and briefed, the production supervisor will assess the incident in line with the Emergency Assessment and Escalation Matrix (Figure 3) and call on their experience to determine if the SERT should be activated. Note that even if the thresholds are not met, the SERT may still be activated at the discretion of the PIC on site.

Figure 3

	Site Emergency Response Team	Emergency Management Team
Activation	The SERT may activate if any of the below criteria is met	The EMT may be activated if any of the below criteria are met
Escalation/Notification	If the team is activated, the SERT leader notifies and provides a summary to the EMT leader	If the EMT is activated, the EMT leader contacts the EMT members and notifies the CEO
Risk Impact	Serious	Critical or Extreme
Injury / Illness to workers	Injury or ill health requiring medical treatment	Fatality or injury/ill health requiring extensive medical treatment (e.g. amputation, spinal injuries, etc.)
Loss of workforce capacity (pandemic or industrial action)	Loss of key staff impacting on operational output or threat of industrial action	Operations compromised due to staff being unavailable
Personnel and asset security	Non-specific threat to CTP staff e.g. protests, suspicious packages, bomb threats, etc.	Community protest action e.g. threats to CTP staff, bomb threat, suspicious packages, security incidents
Environment and / or Community	Localised and / or short-term environment and/or community incident/emergency	Extensive environmental or community incident such as significant contamination, offsite pollution or fatality
Natural Disaster	Predicted or localised damage to facilities/assets e.g. storms, external fires, flooding	Storm, fire, flood damage. Forecast natural disaster (widespread). Multiple locations impacted
Fire and Explosion	Small localised fires or explosions extinguishable by site resources	Uncontrolled fire/explosion requiring external emergency support
Property Damage	Serious damage to CTP assets / third party property	Major damage to CTP assets / third party property
Loss of Containment (LOC) – chemical spill, solid, vapor, liquid.	Major accident event or event requiring HAZMAT response, or non-hazardous substance spill that meets response activating SERP scenario. Any spill to water	Uncontrolled release unable to be isolated and contained within an hour after activating SERT scenario
Laws, regulations, civil actions	Breach of regulations regarding investigations and reporting to authorities. Possible prosecution/fine	Litigation/prosecution by regulator which could lead to temporary plant closure
Stakeholders / Media	Local media coverage. Health and / or safety concerns to local community	State/ national or social media with potential to impact performance of site/team operations
Facility, Plant or System failure / Cyber attack	Significant breach/IT incident affecting one site/location. Loss of access to single location <4hrs	Significant breach /IT incident affecting more than one site/location. Loss of access to single location for >4hrs
Customer interruption / Supply disruptions	Customer service interruption up to 1 day. Product shortfall at facility or supply point >10 TJ per day	Potential customer service interruption up to 3 days. Supply shortage impacting major customers >25TJ per day
Third party failure (Inc. contractor, supplier or partner	Restricted impact which can be rectified in the normal course of business e.g. haulage contract	Supply or services disrupted with threat of serious impacts e.g. customers or critical functions
Financial	Cash flow: <$1m	Cash flow: >$1m

3.3 Activation

The decision to activate the SERT in an emergency is the responsibility of the PIC and, once activated, they will assume the role of SERT leader and will engage the appropriate personnel to fulfil the SERT roles. If activated, the SERT leader must notify and brief the EMT leader as soon as practical.

3.4 Response

Initial briefing

The SERTL will provide an initial briefing (see role card for guidance) covering:

- incident details (where, what, when and how)
- SERT priorities (what's the focus of response activity)
- confirm SERT roles
- answering any questions from the team.

Develop response actions

Once briefed, the SERT will commence activities aligned with their role cards and using the emergency action guides to:

- identify priorities and tasks e.g. immediate actions
- assign resources/accountability to execute (timing)
- agree communication protocols (next meeting time).

Once actions have been developed, the SERT leader will if necessary, schedule the next meeting and SERT members will commence delivery of their allocated tasks.

All of the above information will be captured by the SERT coordinator and the log keeper in order to ensure actions are clear and accurate.

SERT meetings

At any subsequent meetings, the SERT leader will provide further updates and members will update the team on their actions / progress.

Role handover

The management of some events/incidents could be time consuming and require EMT members to rest. It is the responsibility of the SERT leader and coordinator to monitor team members and rotate personnel with suitable replacements, if necessary. It is essential that replacement team members receive a thorough hand-over briefing prior to commencing.

If an incident is likely to run for an extended period, it is recommended that the initial handover commences early. For reasons of information continuity and familiarisation with the incident, consideration should be given to changing the team every 6-8 hours.

3.5 Stand-down and recovery

An emergency response ends when the SERT leader is satisfied that objectives have been met and priority shifts to achieving business continuity and recovery. Only the SERT leader can decide to 'stand-down' the SERT and switch the focus to recovery. The stand-down should be undertaken in consultation with the General Manager Operations.

When external emergency services are involved, stand-down must be done in consultation with the relevant agencies.

When standing down, the SERT leader must:

- ensure that all teams are informed of the stand down
- identify and document outstanding issues that need to be addressed after the team is deactivated and assign responsible personnel to address these issues
- ensure evidence is preserved to aid in any investigation

- ensure affected areas are barricaded
- that witness accounts are taken
- where possible, photograph evidence
- capture lessons learned as soon as possible after the event (debrief)
- ensure the site emergency response room is immediately re-stocked.

In addition, before recommencing operations the following questions should be asked:
- has all plant and equipment been tested and confirmed safe?
- have relevant emergency service providers confirmed that normal activities can recommence?
- have relevant government agencies/departments agreed that normal activities can recommence?
- could employees be suffering from the effects of the incident?
- are there any unauthorised personnel remaining on site?

4. Emergency Response Resources

4.1 Role Cards

Role cards act as prompts and are used as an aid in the event of an emergency. A set of role cards to support this plan are provided in section 6.

4.2 Emergency Action Guides

Emergency Action Guides have been developed and outline typical responses for specific types of emergencies. A set of Emergency Action Guides to support this plan are provided in section D.

4.3 Chemical Response Guidance

All chemicals stored and used on site are to be managed in accordance with the corresponding Safety Data Sheets. Hard copies of Safety Data Sheets are stored in the warehouse with electronic copies available via the Chemwatch website.

Other procedures available in relation to chemicals management include:
- Chemical Management - MSTD11-PC002
- Managing Risks with Chemicals in Workplaces - MSTD09-PC005
- Emergency Response Procedure - Chemical Management MSTD13-PC005

4.4 Plant and Pipeline Shutdown / Isolation

In the event of a loss of containment event, emergency shutdown devices (ESDs) are to be used, however if isolation identification is not clear then the SERT members can access Piping and Instrument Diagrams (P&IDs) on M: files. In these instances, the isolation should be undertaken, and any associated documentation should be completed post event and prior to restart. In the event of a power outage there are master sets of PID's in the control room, supervisor's office & ESS control room.

4.5 Emergency Equipment

Emergency equipment is provided at CTP facilities in accordance with the site's hazards and possible emergency situations are identified in the site Risk Register. The following equipment is positioned in appropriate locations, clearly identified, and maintained.
- Portable radios
- Portable gas detectors
- First aid equipment
- On site ambulance
- Fire extinguishers
- Confined space rescue equipment
- Working at heights rescue equipment
- Self-contained breathing apparatus
- Oil and chemical spill kits
- Safety showers / eyewash stations.

Where applicable, sites are to be equipped with fixed fire and gas detection and fire-fighting equipment in accordance with the relevant fire codes and legislation.

4.6 Medical Support

Medical emergencies fall into three categories:

1. Minor medical emergencies (dealt with on-site by a trained first aider)
2. Medical emergencies or injuries requiring more than first aid (dealt with under the guidance of an emergency expert
3. Critical or life-threatening medical emergencies which require immediate evacuation of the patient.

The site is supported with a 24/7 dial-in medical service with an on-call doctor for routine medical support or emergency medical advice. In addition, the Kings Canyon medical facility can provide additional support. Medical advice and support will be provided by:

- on-site first aid trained personnel (available on all shifts)
- primary emergency advice:
  - RFDS 24-hour emergency operations center
  - Health Direct 24/7 service
- secondary Emergency Advice:
  - Alice Springs Hospital
  - Kings Canyon clinic.

The Royal Flying Doctor Service is also available to support emergencies.

If medical assistance or a Medivac is required, the initial medical provider will seek advice from the Air Medical Services Doctor or the Royal Flying Doctor Service Call Centre who will coordinate the ongoing actions.

The SERT leader, in consultation with a medical provider, has the authority to initiate a Medivac.

The initial medical provider will consult with the doctor(s) to determine the appropriate level of transport, resources and medical assistance required for a Medivac flight.

Patients will be transferred to the nearest care facility as determined by the initial medical provider in consultation with the Royal Flying Doctor Service call center or the doctor associated with the treatment.

4.7 Aviation Resources

Sites may have the capacity to facilitate both Helicopters (rotary) and Planes (fixed wing) in the event of an emergency, however, the preferred option is fixed wing aircraft.

Further details regarding the airstrip / helipad and its safety protocols are outlined in section E.

4.8 Site Emergency Response Room

The site conference room has been established for use if the SERT is activated. This room will be the coordination center and communications hub. All SERT members are to meet there to manage and support operations in the event of an emergency. The room is equipped with:

Plans	▪ Site Emergency Response Plan ▪ Emergency Management Plan
Communication	▪ Telephones – landline and satellite ▪ Digital site Radios ▪ Video/conference calling facilities ▪ Access to Wi-Fi/internet
General	▪ Basic stationery – pens, note pads ▪ Whiteboard and markers ▪ Emergency information board ▪ Site maps indicate location of emergency equipment and muster points ▪ Clock

The on-site emergency response room will be maintained in a 'ready-for-use' state and is the responsibility of the Administration and Logistics Coordinator. The room will be regularly inspected, and equipment tested every time an emergency exercise is undertaken (approximately every 6 weeks).

4.9 Communication

On-site communications during emergency situations is via site digital radios on the:

- Main field channel No. 1; or
- Emergency channel No. 2.

Personnel are to use the radio on the "field" channel to transmit information. Radio communication should be kept to a minimum, so the channel is available for use when required. The PIC will determine when to switch to channel 2 (emergency channel) if at all.

The designated phone in the emergency response room should be used to communicate with the EMT and other sites. Emergency contacts are detailed in section 6. There are two phones in the emergency response room, we should decide which one is to be utilised in an emergency.

4.10 Emergency Management Team / Plan

Any emergencies with the potential for critical or extreme outcomes are to be managed in conjunction with the EMT. In an emergency, the objectives of the EMT are to:

- provide support and logistics to the site
- ensure a coordinated response from all parties involved e.g. the state emergency services
- Monitor the site personnel and their ability to manage the situation, especially if there is a long duration.
- control and minimise impacts/losses (human, financial, resource, reputation) related to an escalating incident and to protect those with a vested interest in CTP
- develop an effective communication strategy for all stakeholders e.g. insurers, government and the media
- recover and resume CTP operations.

5. Stakeholder Management and Communications

In an emergency, it is important that all communication remains open, honest, timely and accurate.

External Communication

Any communication with external parties (not related to the immediate emergency response) is to be handled centrally via the EMT leader.

Internal Communication

The SERT leader / coordinator will ensure all relevant personnel are kept up-to-date and will provide regular updates to the EMT leader.

Managing Enquiries

If any person receives a call from an external party e.g. journalist, community member, government official, etc., they must inform the caller that they are not an authorised spokesperson and are not in a position to comment, however, will organise for someone to call them back. A message should be logged capturing the follow information.

- callers name
- organisation / affiliation
- contact details
- who they want to speak with
- what the message / query is about

Social Media

Nothing should be posted on any social media platforms. Centrals disciplinary process with be followed for any anyone identified as having post any incident related content.

6. Post Emergency Review

At the earliest possible time following the emergency, the General Manager Operations or delegate is to organise and facilitate a post-emergency review to identify any lessons learnt (positive and negative).

If appropriate, any improvements or amendments should be considered and, if necessary, a change management process be undertaken to update the framework and any supporting documents, followed by the appropriate training.

7. Emergency Contacts

7.1 Central Emergency Contacts

Name	Position	Contact Details
"redacted"	General Manager Operations/Duty Manager	"redacted" / 07 3181 3830
"redacted"	Engineering Manager/Duty Manager	"redacted" / 07 3181 3806
"redacted"	Chief Operating Officer	"redacted"
"redacted"	Risk and HSE Manager	"redacted"
"redacted"	HSSE Coordinator	"redacted"
Brisbane emergency phone	To be used whilst emergencies are in progress	07 3181 3860

7.2 Mereenie Contact Information

Role / Detail	Contact Details	
Production Supervisor	"redacted" "redacted" 08 8954 3773	"redacted" "redacted" Supervisor Office
Logistics and Administration Coordinators	08 8954 3700	Robyn Smart / Deidre White
Kitchen / Ambulance (Satellite Phone)	"redacted"	
Operations Centre (Satellite Phone)	"redacted"	
Emergency Alert Number	**1300 134 406**	**ISS First Response (24/7)**
Mereenie Emergency Number	**08 8954 3822**	

7.3 Mereenie Emergency Services

Service		Contact Details
Police / Fire / Ambulance (Emergency)		**000**
Medical	Remote Health & Royal Flying Doctors Service[1]	08 89517840 / 08 8951 7777 (24/7)
	RFDS Port Augusta Communications centre	1800 630 784 for plane's ETA's
	Health Direct Medical Operative (24/7)	1800 022 222
	Alice Springs Hospital (24/7)	08 8951 7777
	Kings Canyon Medical Clinic[2]	08 8956 7807
	St John Ambulance - Alice Springs Office	08 8959 6600
	Mall Medical Clinic - Alice Springs	08 8952 2744
Police	Police - Alice Springs Station	08 8951 8822
	Police (non-emergency)	131 444
Fire	Fire and Rescue (non-emergency)	08 8999 3473
Emergency	Emergency Services (flood, storms, etc)	132 500

[1] Doctor on call for all Medical Evacuations via Alice Springs
[2] Clinic can be dispatched by 000 if required

7.4 Palm Valley Site Contact Information

Role / Detail	Contact Details	
Production Supervisor	"redacted" "redacted" "redacted"	"redacted" "redacted" Supervisor Mobile Phone
Logistics and Administration Coordinators	"redacted"	"redacted"
Kitchen (Satellite Phone)	0xxx xxx xxx	
Operations Centre (Satellite Phone)	0xxx xxx xxx	
Emergency Alert Number	**1300 134 406**	**ISS First Response (24/7)**
Palm Valley Emergency Number	"redacted"	

7.5 Palm Valley Emergency Services

Service		Contact Details
Police / Fire / Ambulance (Emergency)		**000**
Medical	Remote Health & Royal Flying Doctors Service[3]	08 89517840 / 08 8951 777
	RFDS Port Augusta Communications centre	1800 630 784 for plane's ET
	Health Direct Medical Operative (24/7)	1800 022 222
	Alice Springs Hospital (24/7)	08 8951 7777
	Hermannsburg Medical Clinic[4]	08
	St John Ambulance - Alice Springs Office	08 8959 6600
	Mall Medical Clinic - Alice Springs	08 8952 2744
Police	Police - Alice Springs Station	08 8951 8822
	Police (non-emergency)	131 444
Fire	Fire and Rescue (non-emergency)	08 8999 3473
Emergency	Emergency Services (flood, storms, etc)	132 500

In the event of an emergency, the SERT leader is authorised to contact the above, however, any con government, regulatory bodies, etc., must be undertaken centrally by the EMT leader.

7.6 Dingo / BECGS Site Contact Information

Role / Detail	Contact Details	
Production Supervisor	"redacted" "redacted" "redacted"	"redacted" "redacted" Supervisor Mobile Phone
Senior Operators Phone (Mobile Phone)	"redacted"	Senior Operator
Dingo Emergency Number	"redacted"	On call Operator (24hr resp
Logistics and Administration Coordinators	"redacted" 08 8968 5805	Site Logistics Coordinator
On call (Mobile Phone)	"redacted"	On call Operator (24hr resp

[3] Doctor on call for all Medical Evacuations via Alice Springs
[4] Clinic can be dispatched by 000 if required

Emergency Alert Number	**1300 134 406**	**ISS First Response (24/7)**

7.7 Dingo / BECGS Emergency Services

Service		Contact Details
Police / Fire / Ambulance (Emergency)		**000**
Medical	Remote Health & Royal Flying Doctors Service[5]	08 89517840 / 08 8951 7777
	RFDS Port Augusta Communications centre	1800 630 784 for plane's ETA
	Health Direct Medical Operative (24/7)	1800 022 222
	Alice Springs Hospital (24/7)	08 8951 7777
	St John Ambulance - Alice Springs Office	08 8959 6600
	Mall Medical Clinic - Alice Springs	08 8952 2744
Police	Police - Alice Springs Station	08 8951 8822
	Police (non-emergency)	131 444
Fire	Fire and Rescue (non-emergency)	08 8999 3473
Emergency	Emergency Services (flood, storms, etc)	132 500

In the event of an emergency, the SERT leader is authorised to contact the above, however, any conta government, regulatory bodies, etc., must be undertaken centrally by the EMT leader.

[5] Doctor on call for all Medical Evacuations via Alice Springs

8. Role Cards

8.1 First Responder

Role Card

Section 1 – Responsibilities	
In the event of an incident, please remain calm and be prepared to assist where possible (depending on your experience and competency). Please provide as much information as possible to the production supervisor.	
Immediate Actions	**Complete**
▪ Raise the alarm ▪ Check for DANGER - do not put yourself at risk - Is the scene safe? ▪ Implement appropriate actions to prevent or contain the situation, if possible ▪ Provide assistance e.g. assess for life threatening injuries - Are they responsive? - Are they breathing? - Any bleeding? ▪ If safe and appropriate to do so, shut down any equipment ▪ Evacuate or leave the scene, if warranted ▪ Notify the production supervisor providing as much detail as possible e.g. - Location - Incident details - Number of casualties and their condition	
During an Emergency	**Complete**
▪ Follow the production supervisor/SERT leader's instructions	
Post Incident	**Complete**
▪ Participate in the SERT post-emergency review ▪ Propose changes to the Site Emergency Response plan and any procedures, as a result of the incident	

8.2 Site Emergency Response Team leader (SERTL)

Role Card

Section 1 – Responsibilities

The SERT leader is responsible for:
- activation and stand-down of the SERT
- notifying the EMT leader upon activation
- overall management of the emergency response including recovery.

The SERT leader is the final decision maker in relation to analysis, option development, selection and execution of the incident response

Immediate Actions	Complete

- Review the first responder's brief
- Take immediate action, if necessary
- Work through the SERT leader activation checklist (Section 2)
- Using your knowledge and experience and the Emergency Assessment Matrix (Section 3), determine if the SERT should be activated

Activate	Not Activate
▪ Determine which SERT members (Section 4) are required ▪ Engage SERT coordinator to contact SERT members ▪ Notify the EMT leader of activation and provide a situation update ▪ Proceed to the designated site emergency response room ▪ Conduct an initial team brief using information from section 2 ▪ Confirm the SERT member roles and activities	▪ Await updates from operations personnel and reassess the incident as required

During an Emergency	Complete

- Authorise any immediate assistance and specialist support (internal or external)
- Consolidate assumptions and identify the worst case and most likely impacts
- Decide on the priority objectives.
- Manage and lead the SERT to ensure the efficient and effective resolution of the emergency, ensuring the impact on people, assets, environment, value and reputation is minimised
- Facilitate open communication and ensure regular updates are provided
- Ensure the General Manager Operations is regularly updated on the incident
- Approve necessary expenses related to the management of the emergency
- Facilitate and support the implementation of any business continuity plans by the respective teams
- Ensure an accurate record is kept of all SERT actions and decisions
- Declare the emergency is over and stand-down teams
- Coordinate transition to recovery stage
- Decide on the team structure to manage the recovery process

Post Incident	Complete

- Determine the level of investigation required and initiate the process – GM ops
- Debrief the SERT
- Conduct a post-emergency review – GM ops.
- Propose changes to the site emergency response framework and any procedures, as a result of the incident. – ALL

Section 2 – Activation checklist					
Date		**Time**		**Name**	
Incident Description					
What happened?					
Where did it happen?					
When did it happen?					
How did it happen?					
Is everybody accounted for?					
Are there any casualties?					
How have you been notified and how accurate is the information?					
Incident Status					
Is the incident contained or escalating?					
What is potentially at risk?					
What are your objectives?					
What actions are being taken?					
Who is taking action?					
What resources / equipment / manpower is being used?					
Initial incident assessment					
What are the likely impacts on health, safety, environment and/or community?					
What are the likely community, government, media or reputational impact?					
What is the operational impact (short, medium or long term)?					
How effective is the response?					
What support is needed?					
What support does the SERT need from the EMT (in the longer term)?					
Follow up					
Exchange / confirm contact details for first responder					
Decision					
Based on the information provided, assistance requested and your experience, consider the actual or potential impacts and determine whether to activate the SERT using the 'Emergency Assessment Matrix (see section 3).					
Yes			**No**		
Rationale					

Section 3 – Assessment and Escalation Matrix

The SERT leader will:

- use this guide to quickly assess actual or potential incident consequences and notification thresholds. Note that you may choose to activate / notify at levels lower than those detailed;
- Contact the EMT leader if the SERT is activated;

	Site Emergency Response Team	Emergency Management Team
Activation	The SERT may activate if any of the criteria below is met	The EMT may activate if any of the below criteria is met
Escalation / Notification	If this team is activated, the SERT leader notifies and provides a summary to the EMT leader	If the EMT is activated, the EMT leader contacts EMT members and notifies the CEO
Risk Impact	Minor to Serious	Critical or Extreme
Injury / Illness to workers	Injury or ill health requiring medical treatment	Fatality or Injury/ill health requiring extensive medical treatment (e.g. amputation, spinal injuries, etc.)
Loss of workforce capacity (pandemic or industrial action)	Loss of key staff impacting operational output or threat of industrial action	Operations compromised due to staff being unavailable
Personnel and asset security	Non-specific threat to CTP staff e.g. protests, suspicious packages, bomb threat, etc.	Community protest action e.g. threats to CTP staff, bomb threat, suspicious packages, security incidents
Environment and / or Community	Localised and/or short-term environmental and/or community incident/emergency	Extensive environmental or community incident such as significant contamination, offsite pollution or fatality
Natural Disaster	Predicted or localised damage to facilities/assets e.g. storms, external fires, flooding	Storm, fire, flood damage. Forecast natural disaster (widespread). Multiple locations impacted
Fire and Explosion	Small localised fires or explosions extinguishable by site resources	Uncontrolled fire/explosion requiring external emergency support
Property Damage	Serious damage to CTP assets/third party property	Major damage to CTP assets/third party property
Loss of Containment (LOC) – chemical spill, solid, vapor, liquid.	Major accident event, or event requiring HAZMAT response, or non-hazardous substance spill that meets response activating SERP scenario. Any spill to water	Uncontrolled release unable to be isolated and contained within an hour after activating SERT scenario
Laws, regulations, civil actions	Breach of regulations regarding investigations and reporting to authorities. Possible prosecution/fine	Litigation/prosecution by regulator which could lead to temporary plant closure
Stakeholders / Media	Local media coverage. Health and/or safety concerns to local community	State/national or social media with potential to impact performance of site/team operations
Facility, Plant or System failure / Cyber attack	Significant breach/IT incident affecting one site/location. Loss of access to single location <4hrs	Significant breach/IT incident affecting more than one site/location. Loss of access to single location for >4hrs
Customer interruption / Supply disruptions	Customer service interruption up to 1 day. Product shortfall at facility or supply point >10 TJ per day	Potential customer service interruption up to 3 days. Supply shortage impacting major customer >25TJ per day
Third party failure (inc. contractor, supplier or partner	Restricted impact which can be rectified in the normal course of business. e.g. haulage contract	Supply or services potentially disrupted with threat of serious impacts e.g. customers or critical functions
Financial	Cash flow: <$1m	Cash flow: >$1m

Section 4 – SERT Member Details		
Role	Name	Engaged
Mandatory		
SERT leader		
Coordinator		
Log keeper		
SERT Members		
First aid		
Team member		
Team member		
Team member		
Team member		
Team member		

8.3 Site Emergency Response Team Coordinator

Role Card

Section 1 – Responsibilities	
The SERT coordinator's primary role is to support the SERT leader. The function of the coordinator is to: ▪ manage and coordinate staff while providing quality control and coordination of the SERT's planning process ▪ ensure that staff have the information, guidance and facilities required to fulfil their roles ▪ manage the SERT's time, coordinate briefings, and manage the site emergency response room ▪ align the planning of the functional areas with the direction and intent of the SERT leader ▪ assume the role of SERT leader should the SERT leader be unavailable ▪ The SERT coordinator will be the primary contact p for all communications	
Immediate Actions	**Complete**
▪ Respond to the activation ▪ Contact SERT members ▪ Confirm the arrival of all SERT members ▪ Facilitate the initial team brief to the SERT	
During an Emergency	**Complete**
▪ Record and monitor all response actions (Section 2) ▪ Establish communications ▪ Provide regular situation updates to the SERT leader ▪ Implement routines and procedures in the site emergency response room including security of information, control of access, and equipment ▪ Coordinate and synchronise staff in the site emergency response room ▪ Ensure an accurate record is kept of all SERT actions and decisions ▪ Program and facilitate SERT update briefs ▪ Coordinate SERT requests for assistance ▪ Coordinate the regular update of the SERT ▪ Monitor and ensure that activities are in accordance with SERT objectives ▪ Supervise the completion of an accurate SERT log ▪ Be prepared to act as the SERT leader if required	
Post Incident	**Complete**
▪ Support recovery operations, as required ▪ Ensure SERT members attend the debriefing ▪ Coordinate and participate in the post-emergency review ▪ Carry-out all relevant SERT coordinator actions identified in the post-emergency review ▪ Propose changes to the site emergency response framework and any procedures, as a result of the incident.	

Section 2 – Site Response Activity / Event Log				
Time	Action	Owner	Due	Status

8.4 Emergency Response Team Member

Role Card

Section 1 – Responsibilities	
The SERT member's primary role is to support the SERT leader	
Immediate Actions	**Complete**
▪ Respond to the activation ▪ Proceed to muster point **and respond to the situation as directed by the SERT leader** ▪ Attend the initial brief	
During an Emergency	**Complete**
▪ If instructed & safe to do so, participate in incident response, which could include: - rescuing personnel if there is no danger - extinguishing small fires around the plant using a range of extinguishers - using a fire blanket to extinguish small fires - provide basic first aid - containing minor spills • If required (e.g. after hours when admin staff re not on site), undertake the role and responsibility of: - log keeper – documenting incoming/outgoing information and maintaining incident log sheet - coordinator – providing support to the SERT leader and coordinating movement of personnel and delivery of equipment resources and liaison with the response team - coordinate any resources/assistance required by the SERT or EMT ▪ Consider any secondary impacts as a result of the incident ▪ Assist in the development of the SERT's responses, objectives and priorities ▪ Cooperate with emergency services ▪ Prepare for the stand-down of the SERT and recovery of site	
Post Incident	**Complete**
▪ Provide ongoing advice to the recovery operations, as required ▪ Participate in the SERT post-emergency review ▪ Propose changes to the site emergency response framework and any procedures, as a result of the incident	

8.5 Emergency Response First Aid

Role Card

Section 1 – Responsibilities	
Assess and provide first aid assistance to injured people	
Immediate Actions	**Complete**
▪ Respond to the activation ▪ Proceed to muster point and respond to the situation as directed by the SERT leader ▪ Attend the initial briefing and consider the incident	
During an Emergency	**Complete**
▪ Perform triage on injured personnel ▪ Assess medical response ▪ Direct/manage medical personnel and supplies ▪ Activate external resources, if needed ▪ Consider any secondary impacts as a result of the incident ▪ Assist in the development of the SERT's response, objectives and priorities ▪ Cooperate with emergency services ▪ Prepare for stand-down and recovery of SERT	
Post Incident	**Complete**
▪ Be prepared to provide ongoing advice to the recovery operations, as required ▪ Participate in the SERT post-emergency review ▪ Propose changes to the site emergency response framework and any procedures as a result of the incident	

9. Emergency Event Guides

9.1 Emergency Event Guide 1 – Vehicle Accident

Incident	
Nature of the incident: ☐ Vehicle/Vehicle Collision ☐ Vehicle/Structure Collision ☐ Vehicle Roll Over ☐ Pedestrian Hit/Run Over ☐ Other ……	
Response Guide	
Apply Emergency Action Guide and prepare for escalation	
• Call for assistance as soon as possible • Assess and ensure the scene is safe – withdraw personnel from danger (if required) • Prioritise causalities – undertake a primary assessment of any causalities • Mobilise SERT, if additional resources are needed • Mobilise competent first aider to treat injured persons (if required) at scene or first-aid station • Mobilise the following if necessary - electrician if there is an electrical risk, equipment to stabilise vehicle, fire control equipment	
Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Call a medical facility for assistance/guidance	
Arrange escort for external emergency support / back-up	
Notify General Manager Operations	
What to Do	
Consider the following, to **minimise danger:** 1. **Other traffic**: - use hazard lights on vehicles to warn oncoming traffic - switch headings on if at night - ask bystander/s to extend the warning perimeter to at least 100mts away to warn & control oncoming traffic - Battery disconnect 2. **Fire:** - switch off the vehicle's motor and, for diesel vehicles, shut off any emergency fuel switches - stop people from smoking nearby - if there is a fire under the bonnet, and you have a fire extinguisher and it safe to do so, release the bonnet catch (but don't open fully) and aim the extinguisher through the gap 3. **Fumes**: - stay clear of fumes if petrol/diesel is leaking and ensure there are no naked flames or people smoking nearby 4. **Damaged vehicles:** - if airbags have not been activated, stay clear of the steering wheel and front dashboard - if not in gear, apply the handbrake or put the vehicle in gear 5. **Spilt fuel or chemicals:** - if the accident involves a vehicle carrying hazardous material, stay clear. Take note of the signs indicating what is being carried e.g. type of sign and code number and call 000 for advice - if there are clouds of vapour, spilt liquids, bottles, gas cylinders or unusual odors, avoid contact with these substances and have everyone stay upwind if possible, to avoid fumes 6. **Fallen or damaged powerlines** - remain at least 6m from any fallen power lines and don't attempt to move the cables - do not go near a vehicle if it is being touched by electrical cables advise the patient not to move and wait for emergency services to arrive	

What to Do

Prioritise Causalities

1. Once safe to do so, assess casualties as follows: (Using the vehicle medical booklet to assist)
   - Are they conscious?
   - Are their airways clear and open?
   - Are they breathing?
   - Are they bleeding?

Injuries and Ongoing Management

- Common injury types:
  - airway blockages
  - head injuries
  - chest injuries
  - spinal injuries

1. Unless necessary (for example if the vehicle could explode), do not move a patient until help arrives as it could lead to further injury;
2. Continue to monitor their breathing as this can rapidly deteriorate. Be ready to perform CPR should this occur - Do not use mouth-to-mouth method if victim ingested or inhaled any substance;
3. Record observations (if possible) until help arrives e.g. breathing, pulse, skin colour and temperature. Any changes could indicate a serious change in their condition;
4. If the patient is conscious, continue to reassure them. Let them know that help is on the way.

NOTICE

- **Try to remain calm as anxiety can spread quickly.**

Post Event Actions

- Clean up any oil/fuel spills, as per site environmental procedures;
- Monitor for possible fire;
- Secure the scene for incident investigation - do not move anything unless a person's life depends upon it;
- Photograph & preserve the scene.

9.2 Emergency Event Guide 2 – Transporting Incident – Rollover/Injuries

Incident
Nature of the incident: ☐ Heavy Haulage / Road transport ☐ Bulk vessel (transported) ☐ Road Tanker / Tanker truck ☐ Other ……

Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible; ▪ Assess and cautiously approach from upwind - ensure the scene is safe – withdraw personnel from danger (if required); ▪ Mobilise the SERT if additional resources are needed – carry suitable volumes of fresh water; ▪ Mobilise competent first-aider(s) to treat injured persons (if required) at scene or first-aid station; ▪ Assist external personnel with notifications and calls for assistance.	

Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Arrange escort for external back-up	
Notify General Manager Operations	

What to Do

1. Interacting personnel enter after considering their Safety needs and wear appropriate PPE;
2. Attempt to Identify the spill - refer to the HAZCHEM code, Truck Placarding, Driver or SDS for methods of control / management;
3. Alert Management / SES / Police or 000 of situation ASAP, note location, HAZCHEM concerned, areas of impact;
4. Ensure all personnel are safe and clear of area -Stay upwind and clear of any Vapour, Fumes, Smoke and Spills.
5. Use safety related equipment as required, to safely extract personnel if in immediate danger;
6. Extricate personnel and team to a safe distance and clear of fumes (Upwind);
7. Consider decontamination of personnel – clothing / footwear / equipment – water to dilute substance;
8. Divert or stop traffic (do not start vehicles if a low flash-point product has been split) – if tanker truck is involved in a fire, ISOLATE for 800 metres (1/2 mile) in all directions;
9. If Spill fluid loss evident, undertake measures to prevent spread of spilled product – if possible - (i.e. block drains, dam ditches, boom watercourses, close water intakes);
10. Isolate spill or leak area for at least 100 metres (330 feet) in all directions;
11. Remove all sources of ignition to reduce the potential fire hazard;
12. Stop further leakage - close valves, attempt to stop leaks, if safe to do so;
13. Never attempt to perform a rescue without support or adequate forethought;
14. Consider all details as described in Event Guide 1.

Refer to: MSTD13-PL002 ERP Spill response procedure for assistance with methods of containment or prompts during the containment process (if fluid) or the ***Australian-Emergency-Response-Guide-Book-2018*** in M-Files.

Post Event Actions

- Secure the scene for incident investigation;
- Team debrief / Mental anguish and concerns.

9.3 Emergency Event Guide 3 – Security Incident

Incident		
Nature of the incident: ☐ Unauthorised Access ☐ Missing Person(s) ☐ Other ……	☐ Threat of Violence ☐ Suspicious Package	☐ Assault ☐ Bomb Threat

Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible; ▪ Assess and ensure the site is safe – withdraw personnel from danger (if required); ▪ Mobilise the SERT if additional resources are needed.	

Additional Response – as required	
Ambulance – Police (Dial 000)	
Arrange escort for external back-up	
Notify General Manager Operations	

What to Do

Bomb Threat / Suspicious Package

NOTICE

- Under no circumstances should any person attempt to move or disarm a bomb or open a suspicious package
- Bomb threats create a specific type of emergency and require a swift and positive response. If a bomb threat is received, by whatever means, ALL action taken will be under the guidance and direction of the SERT leader
- If the threat is received via phone, do not hang up as the call could possibly be traced

Telephone

- Try to obtain as much information as possible from the caller. When did you put it there? Where did you put it? What does it look like? What kind of bomb is it? What will make it explode?
- Try to assess if the caller is male or female? Do they have an accent? Are there any distinctive background noises?

Post

- Do not open a letter or package if it looks suspicious.

1. Remain calm and treat the threat seriously
2. Activate the evacuation alarm, consider ESD of the plant and, if necessary, de-pressure and isolate affected equipment
3. Complete the bomb/extortion threat report
4. Call the police on 000
5. Make a decision to evacuate personnel
6. Devise and implement (with assistance of police) a search plan
7. Devise and implement an evacuation plan
8. Assess the long-term and short-term threats
9. Make a decision to resume normal activities

Threat of Violence/Assault

NOTICE

- Avoid directly confronting a person who is threatening violence
- If the violence escalates, do not try to deal with the violent person by yourself – seek help

1. Allow the person to talk
   - Try not to interrupt. If you do, then do so in a calm, gentle and assured manner.
2. Observe but do not turn your back on the person
   - Avoid direct eye contact
   - Do not walk in front of the person and remain far enough away to avoid being assaulted
   - Note physiological changes in the person such as reddening of the face, clenching fists, grimaces, voice becoming louder, heavy breathing, narrowing of their gaze, and so forth.
3. Diffuse the situation
   - Put the person at ease, empathise with their situation/concerns and let them know you understand. Try to identify their grievances and negotiate a peaceful solution
4. Contact human resources for support

Unauthorised Access to Site

1. Initiate search for any unauthorised personnel
   - Identify where they were last seen and what they were doing
2. Secure people, facilities and vehicles
   - Activate general alarm and muster, if necessary
   - Consider shutting down safety critical systems if they cannot be maintained safely if unattended
3. If located:
   - Approach the individual and clearly communicate where they are and the area's restrictions
   - Try to find out why they are on site (follow the guidelines provided)
4. Call the police on 000 or escort the individual off site

Missing Person

1. Obtain information on the time and location of their last sighting
   - Use trackers, work information, last known sighting
2. Try and establish communication via phone, radio or tracker
3. Initiate search
4. Dispatch SERT member to last known location, plan to drive the route taken by missing personnel. Ensure contact is maintained with the SERT member undertaking the search
5. Determine any requirements for outside assistance or additional support and notify authorities, if necessary
6. If the police are required for a search and rescue, allow them to take control of the situation
7. EMT leader to communicate with next of kin

Post Event Actions

- Secure the scene for incident investigation
- Ensure that the termination of the emergency is communicated
- Follow up with any witnesses/bystanders to ensure they are ok

9.4 Emergency Event Guide 3 – Bushfire / Flood

Incident	
Nature of the incident: ☐ Bushfire ☐ Storm ☐ Flood ☐ Other ……	
Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible; ▪ Assess and ensure the scene is safe – withdraw personnel from danger (if required); ▪ Mobilise the SERT if additional resources are needed; ▪ Mobilise competent first aider to treat injured persons (if required) at scene or first-aid station.	
Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Arrange escort for external back-up	
Notify General Manager Operations	

What to Do

Bushfire

1. Obtain information about the fire including location, wind direction, strength, size and type of fire, and if there are any injured/missing personnel
2. Get weather information and pay attention to the wind direction, check local fire info at: www.firenorth.org.au/nafi3/
3. Consider checking fire breaks, if safe to do so
4. Initiate contact with emergency services and neighbours in surrounding properties
5. Activate alarms and muster, as required

NOTICE

- The control of a bushfire rests with the Rural Fire Brigade until the fire reaches the site boundaries at which time management can then take control
- Should fire breaks be crossed, the SERT leader shall review what plant must be shut down or additional fire breaks be prepared
- During a fire, to ensure the safety of personnel, the environment and equipment, consideration must be given to shutting the plant down.

Adverse Weather

1. Obtain information about the emergency including location, size and extent of event, potential for damage, flooding or storm, and if personnel have been injured or are missing
2. Regularly check weather information and pay attention to warnings from: http://www.bom.gov.au/nt/
3. Road condition reports from: https://roadreport.nt.gov.au/road-map
4. Initiate contact with emergency services, alert road transport companies used by CTP of current conditions.
5. Ensure that no critical activity is started which cannot be completed before the event due to possible evacuation
6. If adequate warning, prepare site by removing any items which may become loose during a storm, flood, etc.
7. Consider whether the plant should be shut down or develop protocols for shutdown
8. Consider if it is safe for people to remain on-site and if so – where.
9. Activate alarms and muster, as required

Post Event Actions

- Secure the scene for incident investigation

9.5 Emergency Event Guide 4 – Electric Shock

Incident

Nature of the incident:

☐ Electric Shock ☐ Flash Burn Injury ☐ Vehicle Roll Over

☐ Unconscious ☐ Respiratory Condition ☐ Other ……

Response Guide

Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible ▪ Assess and ensure the scene is safe – withdraw personnel from danger (if required) ▪ Mobilise the SERT if additional resources are needed ▪ Mobilise electrician to arrange isolations (if required) ▪ Mobilise competent first-aider to treat injured persons (if required) at scene or first-aid station ▪ Call Ambulance – Dial 000 ▪ Arrange clean potable water for initial treatment of flash burns	

Additional Response – as required

Call a medical facility for assistance/guidance	
Arrange escort for external back-up	
Notify General Manager Operations	

What to Do

Treatment for Electric Shock

1. Check for danger to yourself, bystanders and the patient
2. Before trying to assist the patient, switch off or isolate power
3. If the patient is in contact with high voltage lines, do not approach. Wait until power is disconnected by an authorised electrician
4. Reassure and calm the patient and do not leave them alone

   If patient is unconscious
   - Check for signs of life: if unconscious, follow DRSABCD (Danger, Response, send for help, Airway, Breathing, CPR, Defibrillation)

   If patient is conscious
   - Place them in a comfortable position propped up against a wall to avoid further injury and/or breathing difficulties
5. Apply cool running water to the burnt area for 20 minutes
6. If possible, remove jewellery and clothing from burnt areas
7. Cover the burnt area with a loose and light non-stick dressing, preferably clean, dry, non-fluffy material such as plastic cling film
8. Seek professional medical assistance

NOTICE

- In the event of any electrical shock, the patient should be transported by ambulance or company vehicle for medical attention

Post Event Actions

- Secure the scene for incident investigation

9.6 Emergency Event Guide 5 – Fire / Explosion

Incident		
Nature of the incident: ☐ Building ☐ Plant and Equipment ☐ Bulk Fuel/Oil ☐ Electrical ☐ Chemical ☐ Other ……		
Response Guide		
Apply Emergency Action Guide and prepare for escalation		
▪ Call for assistance as soon as possible; ▪ Assess and ensure the scene is safe – withdraw personnel from danger (if required); ▪ Shut down plant and systems that may be affected by the fire or provide first response fire-fighting, if safe to do so; ▪ Mobilise the SERT if additional resources are needed; ▪ Mobilise competent first-aider(s) to treat injured persons (if required) at scene or first-aid station; ▪ Establish exclusion zones if required (800 mtrs – 1600 mtrs – as required); ▪ Arrange isolation of energy sources; ▪ Assess work permit (where applicable) at job site and refer to emergency plan; ▪ Consult signage/labelling to identify hazardous materials and any response requirements.		
Additional Response – as required		
Ambulance – Fire – Police (Dial 000)		
Arrange escort for external back-up		
Notify General Manager Operations		

What to Do

Treatment Plant

NOTICE

NOTE: Major plant fires will not be fought using firefighting equipment, plant ESD will be used.

- Only provide basic firefighting on small fires (wastepaper bin size), if close enough or safe to do so.

1. Shut down and depressurise plant and systems that may be affected by the fire
2. If possible, isolate all energy sources and keep ignition sources clear of the hazardous area
3. Evacuate to the muster point, ensuring it is at a safe distance (up to 800 mts) and upwind and conduct head count of all POB.
4. Notify the EMT leader
   - discuss and determine if any additional assistance is required
5. Initiate search and rescue for the missing personnel, if and when safe to do so, and only after confirmation with the SERT leader

Tanks

1. Stop pumps, close valves, if safe to do so, and activate alarm
2. Don't go into bunded areas or onto tanks, or areas where escape may be limited
3. Activate foam generators if safe to do so – SERTL. (*SOP number* for site:).
4. Do not attempt to remove vehicles/road tankers unless action approved by SERTL

Post Event Actions

- Secure the scene for incident investigation

9.7 Emergency Event Guide 6 – Confined Space

Incident	
Nature of the incident: ☐ Person Trapped ☐ Person Injured ☐ Fire ☐ Toxic Atmosphere ☐ Electrical ☐ Engulfment ☐ Other ……	
Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible ▪ Assess and ensure the scene is safe – withdraw all unnecessary personnel from area ▪ Mobilise the SERT if additional resources are needed ▪ Mobilise competent first-aider to treat injured persons (if required) at scene or first-aid station ▪ Mobilise electrician – arrange isolations (if required) ▪ Access Work Permit at job site and refer to the emergency plan	
Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Check gas monitoring results on work permit	
Test atmosphere with monitor before entering the confined space – check wind direction	
Arrange escort for external back-up	
Notify General Manager Operations	
What to Do	
1. If personnel are trapped or unable to escape the CS – STOP all persons from entering the location unless authorised and fitted with appropriate lifesaving equipment / PPE 2. SERT Leader shall ensure that isolations remain intact and that no other oxygen depleting events may unfold during the extraction. 3. The Rescue plan for the task would indicate the requirement to have BA, first aid, a method of extraction and suitable numbers to complete the task – ensuring this is correct and the gear is available, then; 4. SERT Leader shall order the insertion of team members in BA only when prepared, and ready to respond 5. Other team members shall be waiting in support including the SERT first aider with a Satellite phone with access to medical support online (if required) 6. Vehicle (ambulance if possible) is at the ready to remove patient as required 7. Ambulance has oxygen with mask and defibrillator available 8. Spotters shall be used to ensure that all persons remain clear of the situation unless required to assist	
Post Event Actions	
▪ Secure the scene for incident investigation	

9.8 Emergency Event Guide 7 – Spill / Release – Road Haulage – Wet Weather

Incident
Nature of the incident: ☐ Heavy Haulage / Road transport ☐ Bulk transport vessel ☐ Bulk Chemical Load ☐ Other ……

Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Site responder - Call for assistance as soon as possible ▪ If on scene -Assess and cautiously approach from upwind - ensure the scene is safe – withdraw personnel from danger (as required), use available extinguishers, shielding, breathing support; ▪ Mobilise the SERT for additional resources as needed – carry ELSA gear, extinguishers, tools, spill gear. ▪ Mobilise competent first-aider(s) to treat injured persons (if required) at scene or first-aid station ▪ Assist external personnel with notifications and calls for assistance	

Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Arrange escort for external back-up	
Notify General Manager Operations	

What to Do

1. Ensure vehicles can safely navigate to and from areas of concern – provide alternate routes if possible;
2. Ensure all personnel are safe and clear of area -Stay clear of Vapour, Fumes, Smoke and Spills;
3. Use safety related equipment as required, to safely extract personnel if in immediate danger;
4. Different PPE (Face shields, goggles, heavy gloves, Gum boots) may be required in Wet weather situations to safely perform any task;
5. Extricate personnel and team to a safe distance and clear of potential hazardous fumes (Upwind);
6. Attempt to Identify the spill - refer to the HAZCHEM code, Truck Placarding, Driver or SDS for methods of control / management;
7. Alert Management / SES / Police or 000 of situation ASAP, note location, HAZCHEM concerned, areas of impact;
8. Divert or stop traffic (do not start vehicles if a low flash-point product has been split) if tanker truck or Chemical event is involved in a fire, ISOLATE for 800 metres in all directions;
9. Consider equipment – dependent on location, proximity or safety – what can or should be saved?
10. Interacting personnel enter only when wearing appropriate PPE;
11. If fluid form, attempt to prevent spread of spilled product from the vehicle itself (shut valves – internal / external) if safe to do so, using hazard specific PPE;
12. Remove all sources of ignition to reduce any potential of fire;
13. Notify EMT and advise situation and request assistance if needed – advise SES, Police – update as required;
14. Never attempt to perform a rescue without support or adequate forethought;

Refer to: MSTD13-PL002 ERP Spill response procedure for assistance with methods of containment or prompts during the containment process (if fluid) or the ***Australian-Emergency-Response-Guide-Book-2018*** in M-Files.

Post Event Actions

- Secure the scene for incident investigation;
- Team debrief / Mental anguish and concerns.

9.9 Emergency Event Guide 7 – Spill / Release Site related

Incident	
Nature of the incident: ☐ Warehousing movements ☐ Plant Failure ☐ Bulk site storage vessel ☐ Other ……	
Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible; ▪ Assess and cautiously approach from upwind - ensure the scene is safe – withdraw personnel from danger (if required or able); ▪ Mobilise the SERT if additional resources are needed - carry ELSA gear, extinguishers, tools, spill gear; ▪ Mobilise competent first-aider to treat injured persons (if required) at scene or first-aid station; ▪ Assist external personnel with notifications and calls for assistance.	
Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Arrange escort for external back-up	
Notify General Manager Operations	
What to Do	
1. Notify EMT (radio) and advise situation and request assistance if needed; 2. Consider ESD of plant – dependent on location, proximity or safety need; 3. Ensure all personnel are safe and clear of area -Stay clear of Vapour, Fumes, Smoke and Spills; 4. Interacting personnel consider wearing ELSA gear if attempting to extract any personnel – advise ERTL of intent – obtain support and clearance; 5. Different PPE (Face shields, goggles, heavy gloves, Gum boots) may be required to safely perform the task; 6. Remove all sources of ignition to reduce the potential fire hazard; 7. Establish source of spill/leak, and determine the extent of pollution; 8. Stop further leakage (e.g. stop pumping or in case of pipeline leak give warnings to stop the flow), close valves, attempt to stop leaks, move object on its side; 9. Isolate spill or leak area for at least 100 metres (330 feet) in all directions to prevent spread of spilled product (if the situation requires- i.e. block drains, dam ditches, boom watercourses, close water intakes); 10. Divert or stop traffic (do not start vehicles if a low flash-point product has been split); 11. Attempt to collect spilled and ponding hydrocarbon and return product to safe containment; 12. Use safety related equipment as required, to safely extract personnel if in immediate danger; 13. Consider decontamination of personnel – clothing / footwear / equipment – water to dilute substance; 14. Never attempt to perform a rescue without support or adequate forethought; **Refer to:** MSTD13-PL002 ERP Spill response procedure for assistance with methods of containment or prompts during the containment process (if fluid) or the ***Australian-Emergency-Response-Guide-Book-2018*** in M-Files.	
Post Event Actions	
▪ Secure the scene for incident investigation; ▪ Team debrief / Mental anguish and concerns.	

9.10 Emergency Event Guide 10 – Aircraft Accident / Spill Event

Incident	
Nature of the incident: ☐ Helicopter Down ☐ Plane Down ☐ Emergency Landing ☐ Other ……	
Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible ▪ Assess and ensure the scene is safe – withdraw personnel from danger (if required) ▪ Mobilise the SERT if additional resources are needed ▪ Mobilise competent first-aider to treat injured persons (if required) at scene or first-aid station ▪ Assist pilot and crew with notifications and calls for assistance	
Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Arrange escort for external back-up	
Notify General Manager Operations	

What to Do

1. Fire response team and vehicle to attend site – with a satellite phone;
2. If personnel are on the plane and fire is a barrier - Safely attempt to approach and extinguish any fire (or keep at bay) whilst personnel exit or are assisted;
3. Interacting personnel consider wearing ELSA gear when attempting to extract any onboard aircraft personnel.
4. Extricate personnel and team to a safe distance and clear of fumes (Upwind);
5. Isolate spill or leak area in all directions to prevent spread of spilled product (i.e. block drains, dam ditches, boom watercourses, close water intakes);
6. Remove all sources of ignition to reduce the potential fire hazard;
7. SERT first aid responder to provide immediate assistance – call Medical doctor / advise nearest clinic for support if required for in-field assistance;
8. Call 000 to advise of incident;
9. Monitor the downed aircraft and maintain safety vigil from a safe distance;
10. Do not attempt to touch or move the aircraft or any items which may have been thrown from the impact area.

Post Event Actions

- Secure the scene for incident investigation (CASA and Police incident scene)

9.11 Emergency Event Guide 8 – Medical Trauma

Incident		
Nature of the incident: ☐ Person Trapped ☐ Person Injured ☐ Fire ☐ Toxic Atmosphere ☐ Electrical ☐ Engulfment ☐ Other ……		
Response Guide		
Apply Emergency Action Guide and prepare for escalation		
▪ Call for assistance as soon as possible ▪ Assess and ensure the scene is safe – withdraw personnel from danger (if required) ▪ Mobilise the SERT if additional resources are needed ▪ Mobilise competent first-aider to treat injured persons (if required) at scene or first-aid station ▪ Mobilise electrician and arrange isolations (if required) ▪ Access Work Permit at job site and refer to the emergency plan		
Additional Response – as required		
Ambulance – Fire – Police (Dial 000)		
Arrange escort for external back-up		
Notify General Manager Operations		

What to Do

1. First responder shall:
2. Follow DRSABCD (Danger, Response, Send for help, Airway, Breathing, CPR, Defibrillation);
3. After the area assessment begin most appropriate actions;
4. Remove the patient and clear the area of personnel if potential for harm is, or may become evident (as required);
5. Keep others aware of dangers and delegate an assistant to help in key tasks;
6. Give preference to the SERT First aider to deliver emergency care to an injured person;
7. If an ambulance is available – bring the vehicle (and all medical equipment) to the site of the injured person;
8. Ensure a Satellite phone is at the scene and turned on;
9. SERT leader shall activate the SERT to ensure the area is made safe.

Post Event Actions
▪ Secure the scene for incident investigation

9.12 Emergency Event Guide 9 – Well Blowout

Incident	
Nature of the incident: ☐ Oil Well ☐ Gas Well ☐ Other ……	
Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible ▪ Activate the emergency shutdown ▪ Assess and ensure the scene is safe – withdraw personnel from danger (if required) ▪ Mobilise the SERT if additional resources are needed ▪ Mobilise competent first-aider to treat injured persons (if required) at scene or first-aid station ▪ Mobilise electrician and arrange isolations (if required)	
Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Arrange escort for external back-up	
Notify General Manager Operations	
What to Do	
1. Use DRS – Danger, Response, Send for help; 2. Close the surface valves or the Blowout Preventer (BOP) using all necessary safety equipment and care; 3. Evacuate non-essential personnel and establish exclusion zones; 4. Contact Company Drilling manager for information on how to further control the situation; 5. Initiate the necessary well controls and monitor results; 6. Account for personnel – both contractor and staff.	
Post Event Actions	
▪ Secure the scene for incident investigation	

9.13 Emergency Event Guide 11 – Bites / Stings

Incident	
Nature of the incident: ☐ Snake Bite ☐ Spider Bite ☐ Bee / Wasp Sting ☐ Other ……..	
Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible ▪ Secure scene and withdraw personnel from danger (if required) ▪ Try to identify what caused the poisoning/bite/sting ▪ Establish exclusion zones, if required ▪ Mobilise the SERT if additional resources are needed ▪ Mobilise competent first-aider to treat injured persons (if required) at scene or first-aid station ▪ Arrange escort for internal backup	
Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Arrange transport of persons to medical facility	
Arrange escort for external back-up	
Notify General Manager Operations	

What to Do

Managing a Snake Bite

NOTICE

- Do not wash venom **off the skin as this will assist identification. Do not use a constrictive bandage (i.e. arterial tourniquet)**
- Do not try and catch the snake – identification is no longer required for antivenom

1. Check for signs of life: if patient is unconscious, follow DRSABCD (Danger, Response, Send for help, Airway, Breathing, CPR, Defibrillation) procedures;
2. Keep the patient calm;
3. Apply a pressure bandage firmly starting just above the fingers or toes and moving up the limb as far as possible;
4. Immobilise casualty:
   - apply a splint to immobilise the limb
   - check circulation of fingers or toes
   - ensure patient doesn't move
5. Call for an ambulance/medical assistance.

What to Do

Managing a Spider Bite

1. Follow DRABCD (Danger, Response, Airway, Breathing, CPR, Defibrillation) procedures
2. Lie patient down
3. Keep patient calm
4. Immobilise patient:
   - apply a splint to immobilise the limb
   - check circulation in fingers or toes
   - ensure patient doesn't move
5. Call for an ambulance/medical assistance.

Managing a Sting / Allergy

NOTICE

- Person with a known allergy may be carrying an EpiPen® and may request assistance in administering the drug

1. Follow DRABCD (Danger, Response, Airway, Breathing, CPR, Defibrillation) procedures;
2. Lie patient down;
3. Keep patient calm;

4. Administer
   - EpiPen® if available and required (EpiPen injection time use is indicated on the pen – 10 second & new 3 second);
5. Apply ice or cold compresses to help reduce the pain and/or swelling;
6. Call for an ambulance/medical assistance.

Post Event Actions

- Secure the scene for incident investigation

9.14 Emergency Event Guide 12 – Pipelines

Incident	
Nature of the incident: ☐ **Rupture** ☐ **Leak** ☐ **Blowout** ☐ **Other ……**	
Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible ▪ Assess and ensure the scene is safe – withdraw personnel from danger (if required) ▪ Mobilise the SERT if additional resources are needed ▪ Mobilise competent first-aider to treat injured persons (if required) at scene or first-aid station ▪ Mobilise electrician and arrange isolations (if required) ▪ Access Work Permit at job site and refer to the emergency plan	
Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Check gas monitoring results on work permit	
Test atmosphere with gas monitor before entering the confined space	
Arrange escort for external back-up	
Notify General Manager Operations	

What to Do

Leak

NOTE: If there is a leak, the response should be consistent with the information presented in the spill/release Emergency Action Guide.

Ruptures

1. Identify the location of the failure and isolate the affected section of the pipeline, suspend operations if necessary;
2. Arrange for the safe shutdown of plant, equipment, vehicles in the affected area;
3. Establish a perimeter around the affected area, evacuate or restrict access;
4. Determine if any outside assistance is required;
5. Establish gas or other testing protocols prior to entering the area or introducing any potential ignition sources e.g. equipment;
6. If the spill has leaked into any water courses, install booms/barriers to limit any flows. Establish spoon drains/berms/dirt bunds to contain any flow or runoff;
7. Review forecast weather information;
8. Monitor and manage the leaked product ensuring personnel remain safe.

Post Event Actions

- Secure the scene for incident investigation;
- Determine the likely amount of spillage.

9.15 Emergency Event Guide 13 – Gas Leak (Minor)

Incident	
Nature of the incident: ☐ Rupture ☐ Leak ☐ Blowout ☐ Other ……	
Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Communicate to personnel to vacate the area and notify SERT Coordinator and SERT Leader ▪ Mobilise the SERT if additional resources are needed ▪ Shut down or isolate plant as required, cease vehicle / equipment movements, cordon off the area ▪ Organise Work Permit and or Initiate immediate repairs or other actions as required. ▪ Monitor progress of repairs or situation until condition made safe ▪ Advise team members of satisfactory completion of repairs or of safe condition	
Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Check gas monitoring during process of repairs or making safe	
Test atmosphere with monitor before entering the area	
Log details of condition, time and task progress	
Notify General Manager Operations	

What to Do

Leak

NOTE: The ESD systems provide the main control mechanism for all Gas escapes: no attempt should be made to disperse or extinguish a Gas cloud or fire unless the extinguisher is readily at hand and the fire smaller than a waste bin in size.

1. Identify the location of the leak and isolate the affected section of the pipeline, suspend operations if necessary;
2. Arrange for the safe shutdown of plant, equipment, vehicles in the affected area;
3. Establish a perimeter around the affected area, evacuate or restrict access;
4. Determine if any outside assistance is required;
5. Establish gas or other testing protocols prior to entering the area or introducing any potential ignition sources e.g. equipment;
6. Make emergency repairs to eliminate gas escaping from the affected area;
7. Review forecast weather information;
8. Prepare a Permit and work order to finalise after immediate repairs undertaken;
9. Prepare and enter information to incident report in INX;
10. Determine the likely amount of release.

Post Event Actions

- Secure the scene for incident investigation
- De-brief team re incident, non-dissemination or disclosure of information to friends or media

9.16 Emergency Event Guide 14 – Gas Leak (Major)

Incident	
Nature of the incident: ☐ Rupture ☐ Leak ☐ Blowout ☐ Other ……	
Response Guide	
Apply Emergency Action Guide and prepare for escalation	
▪ Call for assistance as soon as possible ▪ Activate the ESD system – as required ▪ Mobilise the SERT ▪ Shut down or isolate plant as required, cease vehicle / equipment movements, cordon off the area ▪ Assess the scene – move personnel further from danger (if required) ▪ Notify EMT if additional resources are needed ▪ Mobilise competent first aider to treat injured persons (if required) at scene or first-aid station ▪ SERT refer to the emergency plan	
Additional Response – as required	
Ambulance – Fire – Police (Dial 000)	
Monitor emergency situation and advise EMT	
Restrict entry to all affected areas	
Notify General Manager Operations	
Notify external emergency response as directed or required	
What to Do	
Leak	
1. The ESD systems provide the main control mechanism for all Gas escapes: no attempt should be made to disperse or extinguish a Gas cloud or fire; 2. Identify the location of the failure and isolate the affected section of the leak, suspend operations if necessary; 3. Arrange for the safe shutdown of plant, equipment, vehicles in the affected area; 4. Establish a perimeter around the affected area, evacuate or restrict access; 5. Determine if any outside assistance is required; 6. If repairs are possible – undertake using caution; 7. Review forecast weather information; 8. Assign a team member to gather and record information about the leak and the incident timeline; 9. Determine the likely leak volume.	
Post Event Actions	
▪ Secure the scene for incident investigation ▪ De-brief team re incident, non-dissemination or disclosure of information to friends or media	

10. Additional Information

10.1 Aviation Guidance

Aircraft must contain enough fuel for the return leg of journey as additional fuel stocks are not available on site

Site Airstrip Basic Information

- Airstrips are generally maintained all-weather dirt runway
- Site coordinates (To be supplied):
  - Latitude/Longitude:
  - Elevation
- The runway is on a magnetic bearing of:
- The strip dimensions are:
- Runway / Site call sign and frequency: (if required) Frequency:
- Pilot should establish radio communications with Site 30 minutes from runway to allow for runway checks and local weather condition reports

Note: Any concerns or hazards associated with the runway or landing position:

When arriving at night (or following periods of wet weather), the RFDS pilot may determine that an airstrip inspection is required prior to landing.

1. If an inspection is deemed necessary, the RFDS Operations Communications Centre will contact you to arrange some someone to be present at the airfield at least 15 minutes prior to the aircraft's arrival.
2. The pilot must be able to contact a person at the airfield to confirm the runway is serviceable and free of hazards.
3. Contact between the aircraft and the ground will be made via **UHF Channel 13.**
4. If verbal confirmation via **UHF Channel 13** is not forthcoming, the pilot will independently assess the situation and may not land.

Site Airstrip Night Landing

Lighting is required to be initiated at least 30 minutes before the estimated time of arrival of the aircraft in the way prescribed by RFDS night landing requirements.

Parking

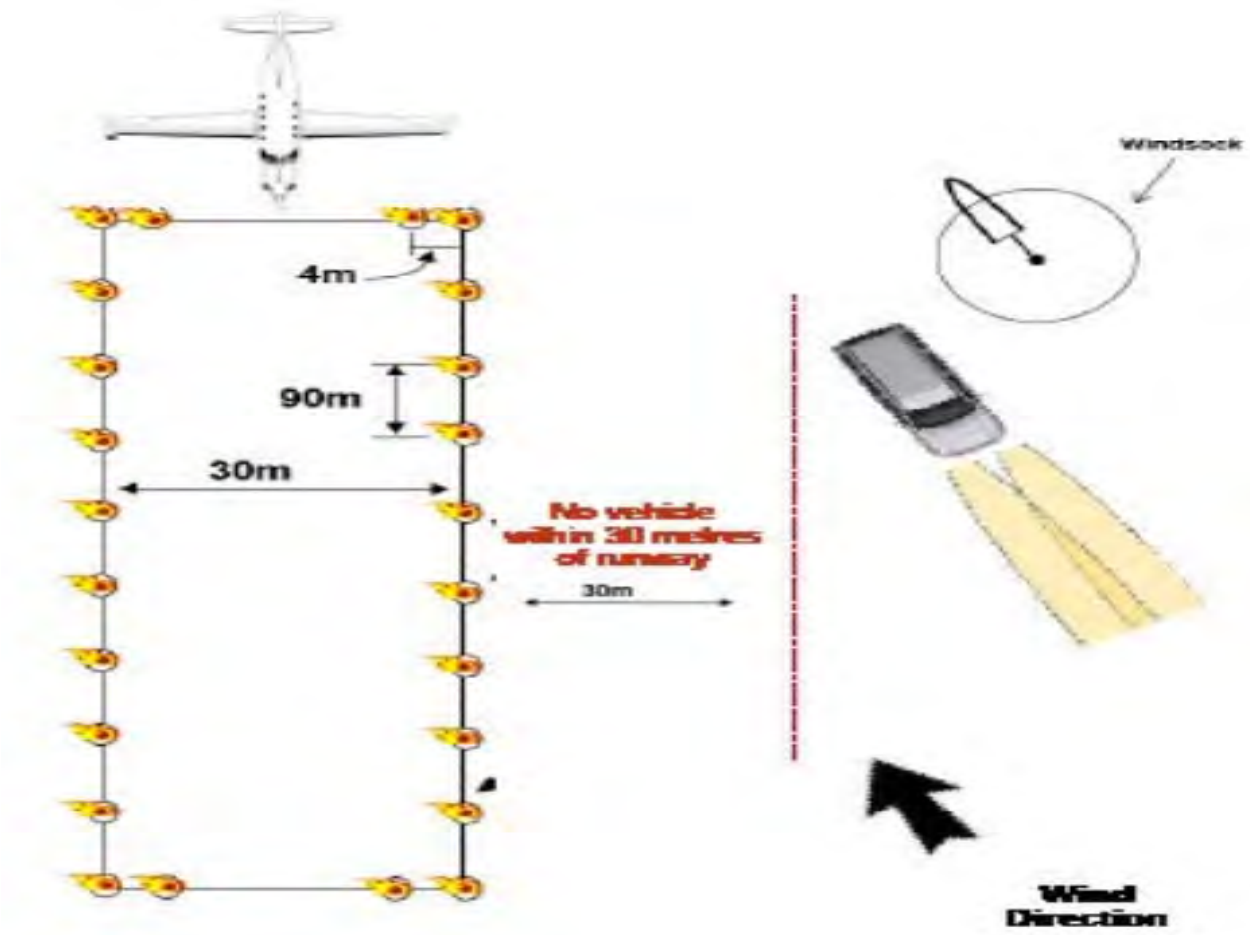
- Park your vehicle so that it is pointing into the wind.
- Turn your headlights on high beam and hazard lights on.
- No vehicle is to be parked at either end of the runway.
- All vehicles must be at least 30 metres from the side of the airstrip.
- If possible, park as close as practicable to the windsock (do not attempt to illuminate the windsock with car lights).
- If parking here is not possible, park in a clear location at least 30 metres from the side of the strip.

Stay listening to UHF channel 13

1. The pilot will contact you as they approach your area to confirm the airstrip is serviceable and safe.
2. Speak up if there are any issues
3. The aircraft may NOT land if the pilot is unable to contact you.
4. In the event the aircraft is circling overhead, and you haven't had contact from them, there may be radio issues. If you have checked the airfield as per this procedure, turn on your vehicle's hazard lights to indicate it is safe to land.
5. If you have radio issues, call the RFDS Operations Communications Centre on 1800 RFDS SA (1800 733 772).

After aircraft departure
Flares / lights must be left lit for 30 minutes in the event the aircraft must return to land due to an emergency.

Figure 1



Before the aircraft is due to land, check the strip to ensure it is clear of wildlife, stock or debris. Condition of runway surface is to be determined and any issues communicated to the pilot.

Site Helipad basic information

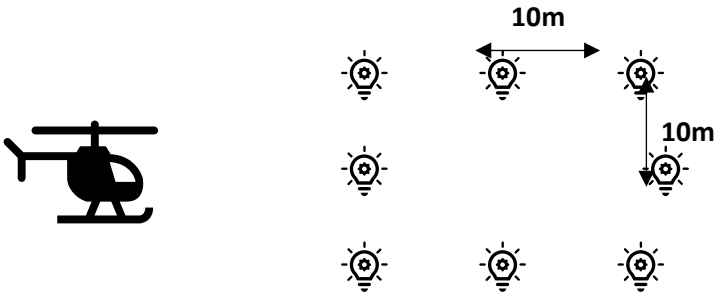
- Helipad is a maintained all-weather dirt pad
- Site coordinates:
  - Latitude/Longitude:
- The helipad is located:
- The pad dimensions are 30 x 30 meters
- Site call sign:
- Frequency:
- Pilot should establish radio communications 30 minutes prior to landing on site to allow for checks and local weather condition reports

The helipad has a final approach and take-off area which is circular and equal to twice the length of a helicopter. Should a larger than normal helicopter be used, and concern is raised regarding the landing site, the airstrip should be used.

Site Helipad Night Landing

Lighting is required to be initiated at least 30 minutes before the estimated time of arrival of the aircraft in the way prescribed by RFDS night landing requirements.

Figure 1



Five (5) minutes before the helicopter is due to arrive, inspect the landing area to ensure the site is free of lose objects that could be blown away.

Helicopter Safety Procedure

All personnel are to be instructed as to the safest way to approach the helicopter including:

- removing and securing any loose clothing when approaching or when showing wind direction
- only approaching the helicopter when the pilot gives you the thumbs up
- approaching and leaving the helicopter in a crouched position in the pilot's field of vision, never toward the rear of the helicopter
- always follow the pilot's instructions as they are responsible for the safety of the flight
- If the helicopter is taking off immediately, move at least 10 metres away with your gear and crouch down. Remain there until the helicopter has gone.

Appendix 9 Consultation

NT 2020-21 Drilling Campaign - Communication log

Date	Topic Discussed	Engagement Type	CP Representative	Stakeholders	Information Provided	Outcome	Objections / Claims from Stakeholder	CP Response / Actions to Objections / Claims
25 Nov 2019	- Update on CP's 2020 exploration program in the region - Organise Local Community Meetings (LCM)	Face to face	James van Rooyen, Bob & David Little	"redacted"	The CP's 2020 exploration program presentations and conversations were general in nature	- See note 1	None received	Not applicable
25 Nov 2019	- CP's 2020 exploration program as well as the proposed Dingo wells	Face to face	James van Rooyen	"redacted"	The CP's 2020 exploration program presentations and conversations were general in nature .	- See note 2	None received	Not applicable
26 Nov 2019	- CP's 2020 exploration program including the proposed Dingo and Orange wells	Face to face	James van Rooyen, Bob & David Little	"redacted"	The CP's 2020 exploration program presentations and conversations were general in nature	- See note 3	None received	Not applicable
26 Nov 2019	- Update on CP's 2020 exploration program including the proposed wells at Dingo and Orange	Face to face	James van Rooyen, Bob & David Little	"redacted"	The CP's 2020 exploration program presentations and conversations were general in nature	- See note 4	None received	Not applicable
26 Nov 2019	- Update on CP's 2020 exploration program including the proposed wells at Mereenie	Face to face	James van Rooyen	"redacted"	The CP's 2020 exploration program presentations and conversations were general in nature	- See note 5	None received	Not applicable
27 Nov 2019	- Update on CP's 2020 exploration program including the proposed wells at Palm Valley	Face to face	James van Rooyen, Bob & David Little	"redacted"	The CP's 2020 exploration program presentations and conversations were general in nature	- See note 6	None received	Not applicable
28 Nov 2019	- Update on CP's 2020 exploration program including the proposed wells at Mereenie, Surprise and Mamlambo	Face to face	James van Rooyen, Bob Little	"redacted"	The CP's 2020 exploration program presentations and conversations were general in nature	- See note 7	None received	Not applicable

Date	Topic Discussed	Engagement Type	CP Representative	Stakeholders	Information Provided	Outcome	Objections / Claims from Stakeholder	CP Response / Actions to Objections / Claims
17 Feb 2020	- Update on CP's 2020 exploration program as well as the development wells at Mereenie and Palm Valley. - Reviewed applications for the SSCC. - Confirmed timings for the Liaison Committee meetings in the week commencing 23 March at Mereenie	Face to face	James van Rooyen	"redacted"	The CP's 2020 exploration program presentations and conversations were general in nature	- Confirmed the receipt and progress of the sacred site clearance certificates. - Booked timings for LCM's week commencing 23 March.	None received	Not applicable
19 Feb 2020	- Presentation update on the Mereenie development well program, timing, activities and impacts - Confirmed timings for the Liaison Committee meetings	Face to Face. At Papunya NT remote community	James van Rooyen, Bob Little and David Liddle	"redacted"	The CP's 2020 exploration program presentations and conversations were general in nature	- 2nd visit with Douglas and representatives from the communities. Positive feedback with the dates locked for the final details to be presented at the LCM's in March	None received	Not applicable
March to June 2020	- Impact of Covid-19 on LCMs	Multiple calls and emails	James van Rooyen	"redacted"	Not applicable	- Discussing options for LCM's considering the travel restrictions and Biosecurity measures. - Agreed to be re-scheduled for late July / early August.	None received	Not applicable
Dec to August 2020	- CP's 2020 exploration program as well as the proposed Dingo well	Multiple calls and emails	James van Rooyen	"redacted"	Map of proposed well location for ecological visits (as per presentation)	- Access granted and keen for further information about the development and timing	None received	Not applicable

Date	Topic Discussed	Engagement Type	CP Representative	Stakeholders	Information Provided	Outcome	Objections / Claims from Stakeholder	CP Response / Actions to Objections / Claims
Dec to August 2020	- CP's 2020 exploration program as well as the proposed Orange well	Multiple calls and emails	James van Rooyen	"redacted"	Map of proposed well location for ecological visits (as per presentation)	- Access granted and keen for further information about the development and timing	None received	Not applicable
5 Sep 2020	- Liaison committee meeting to discuss the CP's 2020 exploration program as well as the proposed development wells at Mereenie	Online meeting facilitated by the Central Land Council	James van Rooyen, Cam Lambert	"redacted"	- The activity the CP proposes to carry out, - The locations of the activities, - The anticipated environmental impacts and environmental risks of the activity, - The proposed environmental outcomes in relation to the activity, and - The possible consequences of carrying out the activity to the stakeholder's. - Discussions around water sources, fracking and Covid were covered in the meeting	- The T/O's and CLC were satisfied that sufficient information was provided. - No additional clarifications were requested - Anticipated final approval of the program is anticipated week commencing 26 October for the full program of recompletions and development wells.	None received	Not applicable
9 Nov 2020	- Liason Committee meeting is Planned to discuss the CP's 2020 Dingo and Orange Drilling program as well as the ongoing Dingo Development activities	Face to Face meeting facilitated by the Central Land Council in Alice Springs	James van Rooyen, Cam Lambert	"redacted"	- We plan on presenting the previous years operations from Dingo Field, Next years production activities and the exploration activities thatCP proposes to carry out, - The locations of the activities, - The anticipated environmental impacts and	-		

					environmental risks of the activity, - The proposed environmental outcomes in relation to the activity, and - The possible consequences of carrying out the activity to the stakeholder's.			
9 Nov 2020	- Planned Meeting with the Owner of Orange Creek Station	Face to Face meeting Central and Orange creek land owner	James van Rooyen, Cam Lambert;	"redacted"	- Overview of current operations, - Drilling of Dingo 5 and the anticipated environmental impacts and environmental risks of the activity, - The proposed environmental outcomes in relation to the activity, and - The possible consequences of carrying out the activity to the stakeholder's. -	-		
9 Nov 2020	- Planned Meeting with the Owner of Owen Springs East	Face to Face meeting Central and Owen Springs East land owner	James van Rooyen, Cam Lambert;	"redacted"	- Drilling of Orange 3 and the anticipated environmental impacts and environmental risks of the activity, - The proposed environmental outcomes in relation to the activity, and - The possible consequences of carrying out the activity to the stakeholder's. -	-		
19 Nov 2020	- Planned meeting with TOs from Ntaria (Hermannsberg) and Kintore communities to	Face to Face meeting facilitated by the Central Land Council	James van Rooyen, Cam Lambert	"redacted"	- Community town hall presentations organised by both the CLC and Central Petroleum.	-		

	discuss Mamlambo and Palm Valley 12	in Alice Springs		"redacted"	- The upcoming exploration activities, Namely Mamlambo and Palm Valley 12 to the respective communities. - The locations of the activities, - The anticipated environmental impacts and environmental risks of the activity, - The proposed environmental outcomes in relation to the activity, and - The possible consequences of carrying out the activity to the stakeholder's. - Employment opportunities and any other business.			

Central Petroleum Community Engagement – November 2019

1. Central Land Council

Meeting Monday, 25 November 2019 @3:30pm held at CLC office

CLC: Julie-Ann Stoll, Paul Cleary (upcoming replacement for Julie-Ann), Tony Corbett

CTP: James van Rooyen, Bob Liddle

A meeting was held with the CLC to give an update on Centrals 2020 exploration program, development opportunities, current operations and to review our movements for the week of 25-29 November 2019.

A presentation was given *(see appendix 1)* outlining CTP's exploration and development projects for next year and also indicated what remote communities and Traditional Owners we were going to give a high-level overview of our operations to community.

Discussions also included the current EMP processes, Fugitive Omissions baseline water testing and baseline Methane testing across fields and if it would be required for the new programs. It was suggested that this was for fracking only.

We then discussed timing of the application for the Sacred Site Clearance Certificates from CTP followed by approvals required (also the timely manner of the turnover of approvals). It was indicated that the best approach would be through timely LCM's for each of the area's and that this could be done late January or early February. This would be impacted by the mining officers from the CLC going on holidays from 13 December through to mid-January.

We also discussed the formation of the CAC, CTP's Governance processes for donations, school visits and excursions and also the long-standing commitment within our field communities.

Finally, we received permission from the CLC to enter remote communities to discuss our upcoming programs with the general communities under the assumption we were not to talk about royalties, compensation or exact locations with the Traditional Owners of the lands.

Additional feedback/comments/follow-up action from the Meeting:

CTP needs to submit all sacred site clearance certificate applications ASAP.

2. Dingo 1 Redrill

Monday, 25 November 2019 @ 5:30pm held at Doubletree Hilton

LANDOWNER: "redacted"

CTP: James van Rooyen

"redacted" is the lease holder of Orange Creek where Dingo 1,2 and 3 are located.

Discussions were held to inform "redacted" on CTPs plans to re-enter Dingo 1 to target the pioneer formation to increase reserves and production rates from the Dingo field.

Central currently enjoys both a professional and personal relationship with "redacted" and he was very positive with the plans for 2020 and he indicated that will have no issues gaining land access approvals for any future works (flora and fauna surveys, Drilling and even Fracking).

Communications were also exchanged on local employment opportunities such as the widening of the track, pad construction and operations support. "redacted" currently provides Civil and operations support to CTP with road construction/management and any other works as required across all of our current fields.

"redacted" recommended getting the paperwork through to him so that he could review.

Additional feedback/comments/follow-up action from the Meeting:

CTP's Legal Dept. to send through access agreement to "redacted"

3. Dingo 1 Redrill, Ooraminna & Orange - Santa Teresa

Tuesday, 26 November 2019_10:00am

TO: "redacted" **and select members of their community.**

CTP: James van Rooyen, Bob & David Liddle

Travelled to Santa Teresa to meet with "redacted" including other locals. Discussed the updated exploration program and the fact that the planned drilling of Ooraminna in 2020 had been delayed. We gave a map to "redacted" to give him more of an insight about the upcoming Sacred Site Clearances that would We received an overview of the CTP sponsored local Women's football team managed by "redacted" that had done very well and had won the Grand Final for 2019. The Jerseys were also worn by the men's team who also did exceptionally well. The sponsorship was very well received.

We informed the community to let his Mob know that we were submitting applications to the CLC and that formal LCM meetings would be organised by the CLC early in 2020 to review the program.

Additional feedback/comments/follow-up action from the Meeting:

Nil

4. Dingo 1 Redrill & Orange 7_Titjikla (Maryvale Station)

Tuesday, 26 November 2019_2:00pm

TO: "redacted" **(~ 10 persons)**

CTP: James van Rooyen, Bob & David Liddle

A meeting and informal discussions were held in the local community hall with TO's and the local community of Titjikala with CTP personnel. This was the first time that CTP staff had visited this community. We thanked them for allowing us to come onto their country and for attending. We introduced ourselves, our roles and CTP.

James chaired the discussions with an introductory overview of the company and continued to discuss CTPs intentions on re-drilling Dingo 1 and the new prospect well of Orange. Also was an opportunity to introduce the work that CTP had done to date with the CAC. There was a comment that the community were "feeling left out" on previous CTP trips to Alice Springs and this was countered with we operate over very large areas and we were here today.

"redacted"is a current employee at Palm Valley and holds strong relations within his community of Titjikala. "redacted" is thelocals of his current employment and praised CTP for their ongoing support to local engagements and the support he receives himself within the company and being able to leave site while on shift to attend this meeting The meeting was well received by "redacted" , TOs and the community were appreciative of the discussions and the visit. Business cards were also exchanged.

Additional feedback/comments/follow-up action from the Meeting:

Nil

5. Mereenie Development, Stairway Opportunities and recompletions _Alice Springs

Tuesday, 26 November 2019_6:00pm

TO: "redacted"

CTP: James van Rooyen

"redacted" had planned to meet at Mereenie with representatives from his community. However, the CLC meetings that he had in Alice Springs ran over and we were unable to catch up at Mereenie.

However, we were able to manage a meeting in Alice Springs for a general update on the CY2020 exploration program and the upcoming work.

"redacted" was appreciative of the recent donation of 15x hay bales that CTP had approved so that they were able to manage the brumbies at Mereenie. "redacted" will use the hay to capture and muster them, from here he will sparingly divide the brumbies within the remote communities of Mereenie and relocate them. The Brumbies at Mereenie were causing an environmental issue therefore worked with "redacted" to benefit both the company and his mob with the removal and relocation at a very low cost-effective strategy.

We informed "redacted" to let his Mob know that we were submitting applications to the CLC and that formal LCM meetings would be organised by the CLC early in 2020 to review the program.

Additional feedback/comments/follow-up action from the Meeting:

JvR to send further details to "redacted" before the official LCM's are conducted by CLC.

6. Palm Valley Deep & West_Palm Valley

Wednesday, 26 November 2019_11:00am

TO: "redacted" , family members and local community (estimated 30+ attendees)

CTP: James van Rooyen, Bob & David Liddle

Morning tea was served on arrival James opened the meeting with a welcoming and thanking "redacted" and mob on behalf of CTP to continue to operate Palm Valley on their lands.

"redacted" acknowledged James' introduction and reciprocated by introducing all attendees from his mob (by their first name only) including his own family members.

Discussions were underway for CTPs plans on 2x new wells within the Palm Valley vicinity namely PV Deep and PV West. Maps were also shown to "redacted" and others thoroughly explaining that road access to PV West will be difficult. Also, the meeting was addressed to confirm that a formal application needed to be made to the CLC. The CLC will then contact the T/O's and LCMs will be organised by the CLC end of Jan early Feb of 2020 to formally introduce the wells and commence the land access and Sacred Site process.

Revisited the Hermannsburg Precinct after engagements and purchased personal items from the art centre. Overnight at Palm Valley Camp.

Additional feedback/comments/follow-up action from the Meeting:

Nil

7. Mamlambo, Surprise, Mereenie Development _Inkuntji (Haasts Bluff)

Thursday, 27 November 2019_12:30pm

TO: "redated" and 5x other Community locals

CTP: James van Rooyen, Bob Liddle

Travelled to Inkuntji to meet with Traditional(s) Owner "redacted", son and other community locals from the area. "redacted" and mob were intrigued on our discussions on what CTPs intentions were for 2020 for the new drill Mamlambo and Mereenie development.

James informed the group in great detail on what the works involved and included drawings of well construction and aquifer protection which became a very effective communication tool and proved helpful as a way of relaying more information.

We discussed fracking and they relayed stories from GasLand where taps were on fire. We discussed this movie and the causes and how they were not related to fracking. The Mob ere appreciative of the discussions as they had never actually understood what fracking was.

A request for a small donation to the local Church Christmas lunch (via the Community Store) was made. We are working with the local store to finalise this request which will be presented to management by the end of week.

During the meeting we were able to meet Simon who was one of the artist CTP sponsored through the "Walk-a-while" foundation to travel to Melbourne to promote aboriginal music. Simon was so very grateful and reported that it was a successful trip.

We ended the visit with confirmation that CLC will be organising an LCM by the end of January, early February 2020 to confirm our CY2020 works.

Additional feedback/comments/follow-up action from the Meeting:

Requests were made for sponsorship towards the Community Xmas Church Lunch. All documents from CTP have been sent.

Central Petroleum Limited

(ASX: CTP)

2020 Operations and Activities

Week Commencing 25 November 2019

Central Petroleum

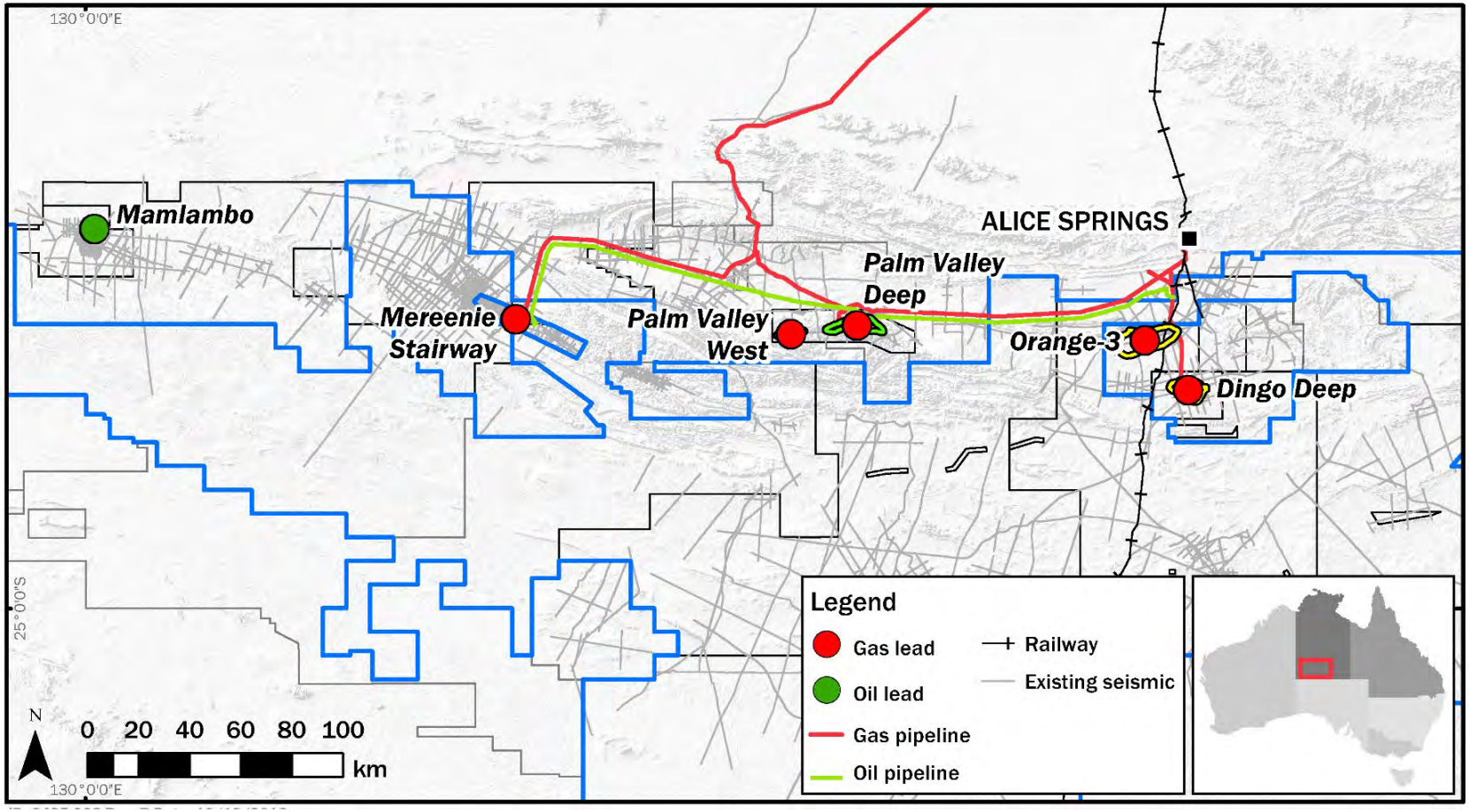
Current Production Operations

- Dingo, Mereenie, Palm Valley & Surprise.
  - No current changes to the field current operating parameters
  - Continue to work with CLC, DPIR, DENR and traditional owners
  - Continue to push for more local spending
  - Continue to increase our local sponsorship (see separate hand out on sponsorship commitments.)
  - Continue to push local employment. BECGS now fully operated from Alice Springs labour.

Planned Exploration 2020

- Focus on targets where Central has 100% interest
- Within granted exploration and production licenses
- No additional seismic is required
- In-field or near-field opportunities that leverage existing facilities
- Generally lower risk within proven plays
- Opportunity to quickly monetise resources

General Overview



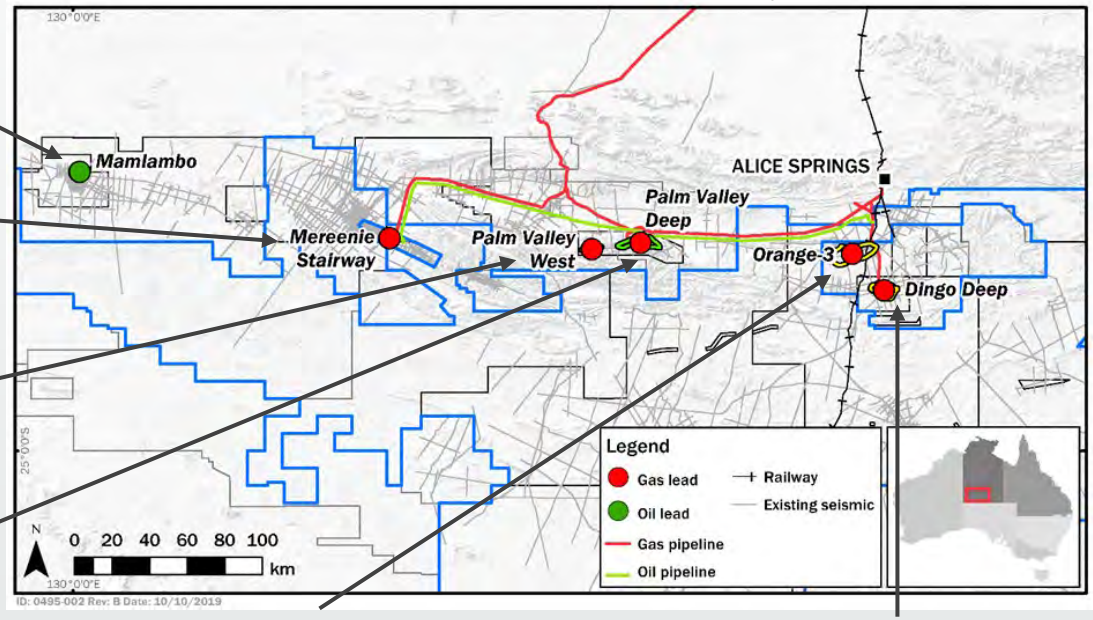
CY2020 Exploration Programme

1. *Estimated mean prospective resource*
2. *2C Contingent Resource*

See following page for full context of volumes quoted and Cautionary Statement

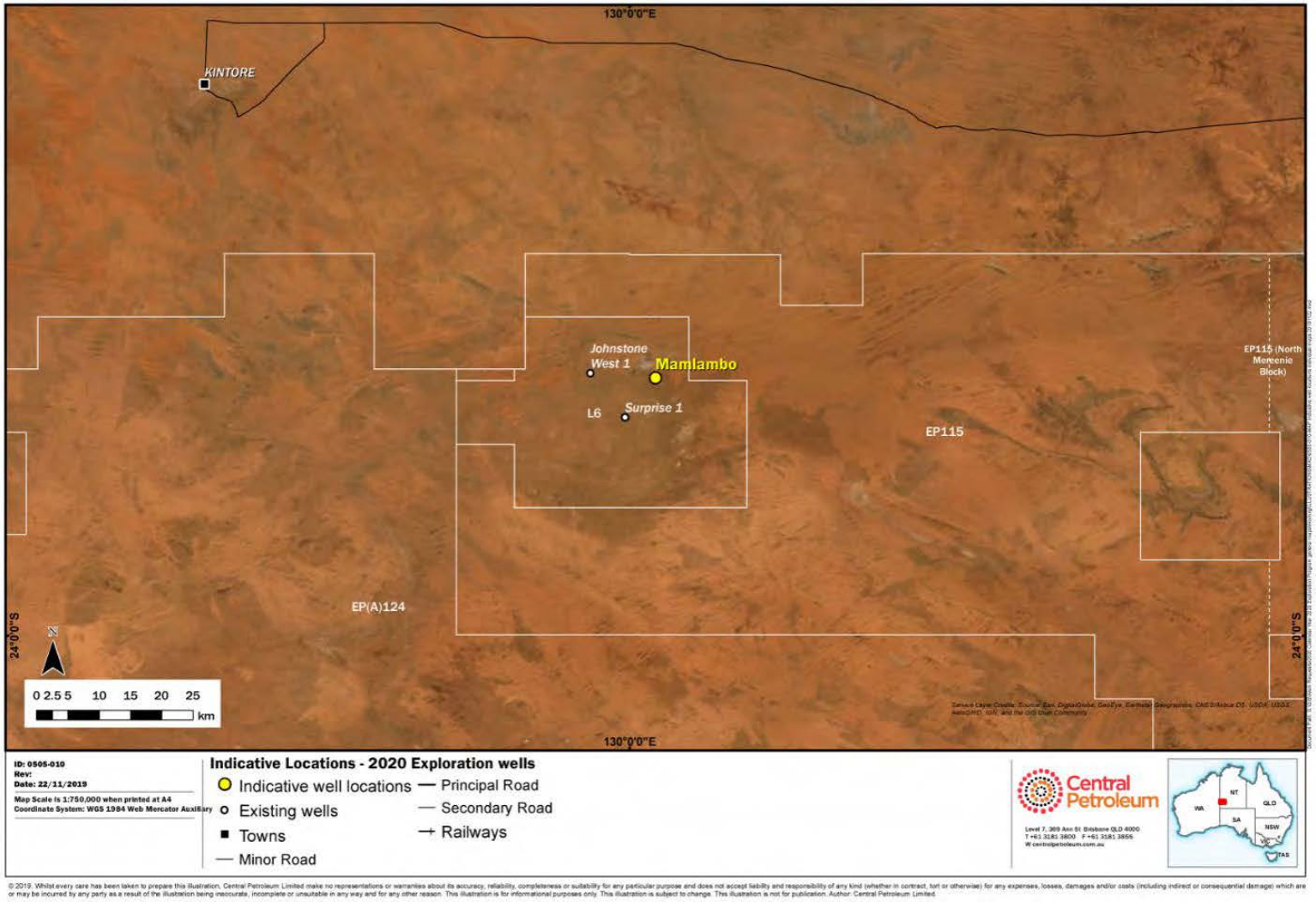
- **Mamlambo** Large structure currently defined on an existing seismic grid only 8 km from Surprise. Expected to be oil
- **Mereenie Stairway**

  Reperforating and testing existing wells. Undeveloped section of Mereenie with potential to convert 2C to 2P. Potential for 2 x new wells
- **Palm Valley West New well** Low cost opportunity to firm up strong lead. Volumetrically significant potential tie-in to Palm Valley
- **Palm Valley Deep New well** Deeper reservoir (proven regionally), untested within the field. Opportunity to significantly increase reserves at Palm Valley with additional opportunity to sidetrack into the proven productive Pacoota section to accelerate production.



- **Orange-3 New well.** Existing wells have proven gas at shallow Arumbera level (Dingo productive zone) with additional targets in deeper section. Volumetrically significant with with proximity to Dingo gas pipeline and production facilities.
- **Dingo Deep Deepening existing Dingo1** Targeting the Pioneer Formation, proven to work on a regional basis. Opportunity to significantly increase reserves at Dingo with additional opportunity to side-track into the proven productive Arumbera section to accelerate production.

Mamlambo proposed location



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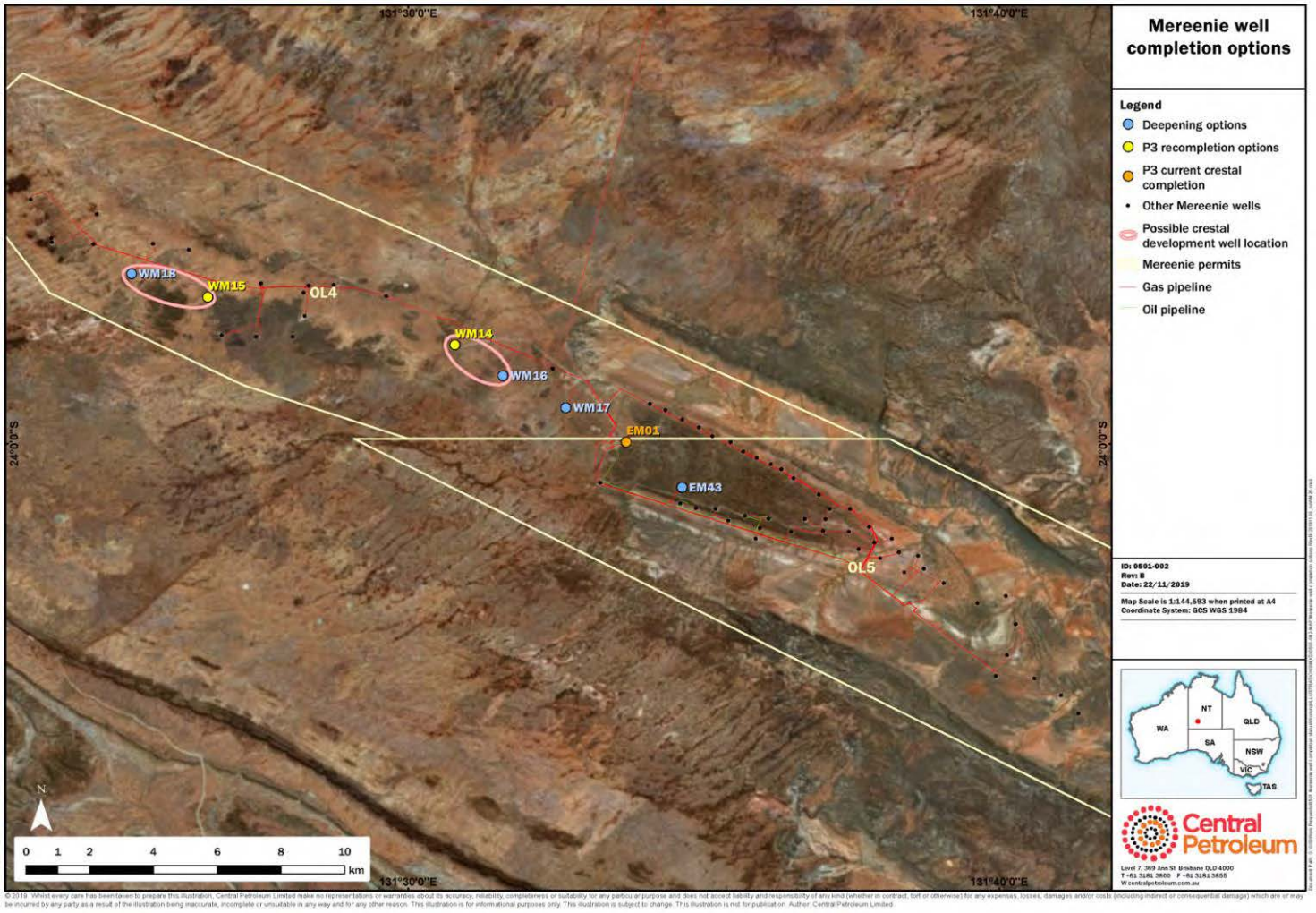
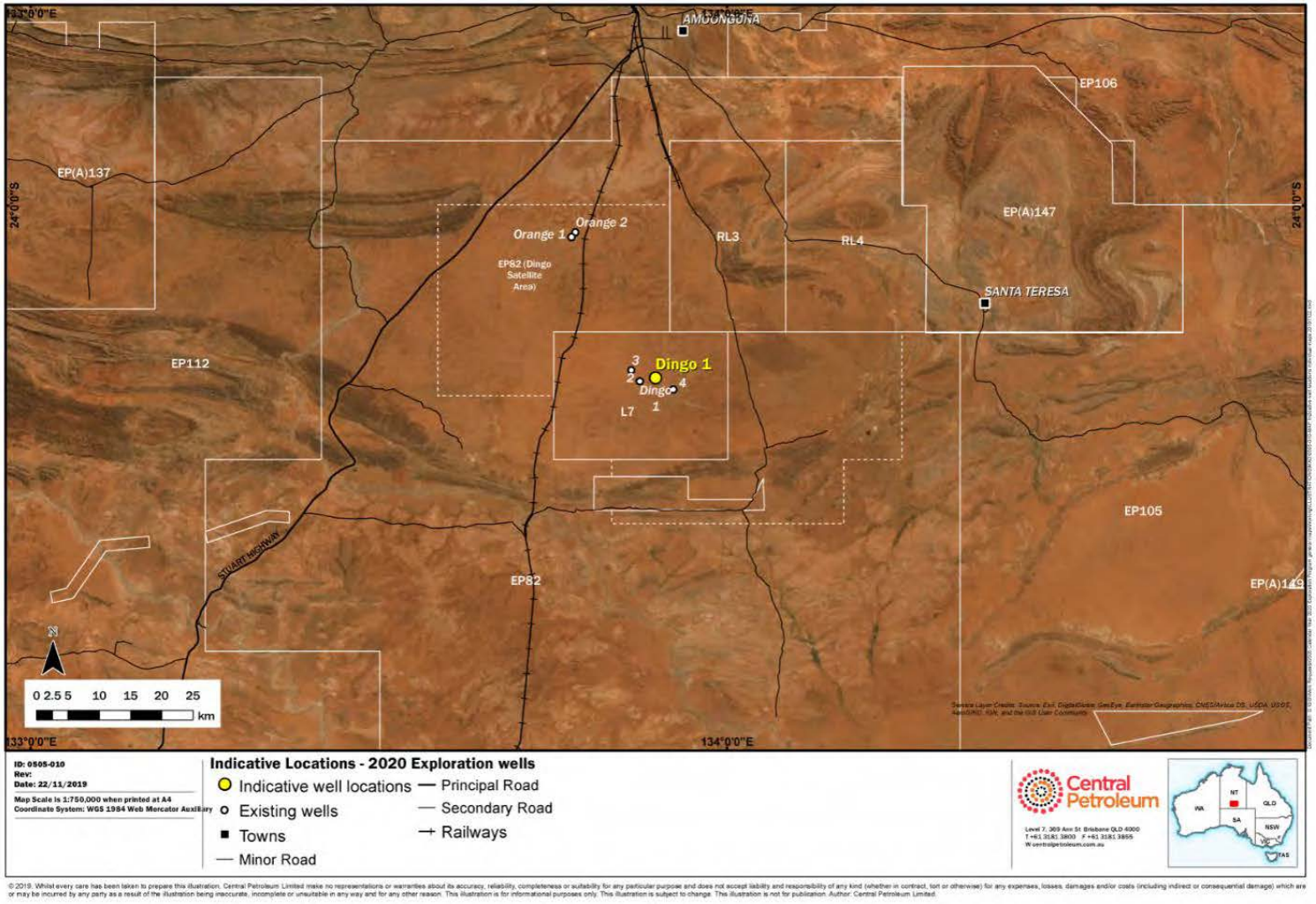
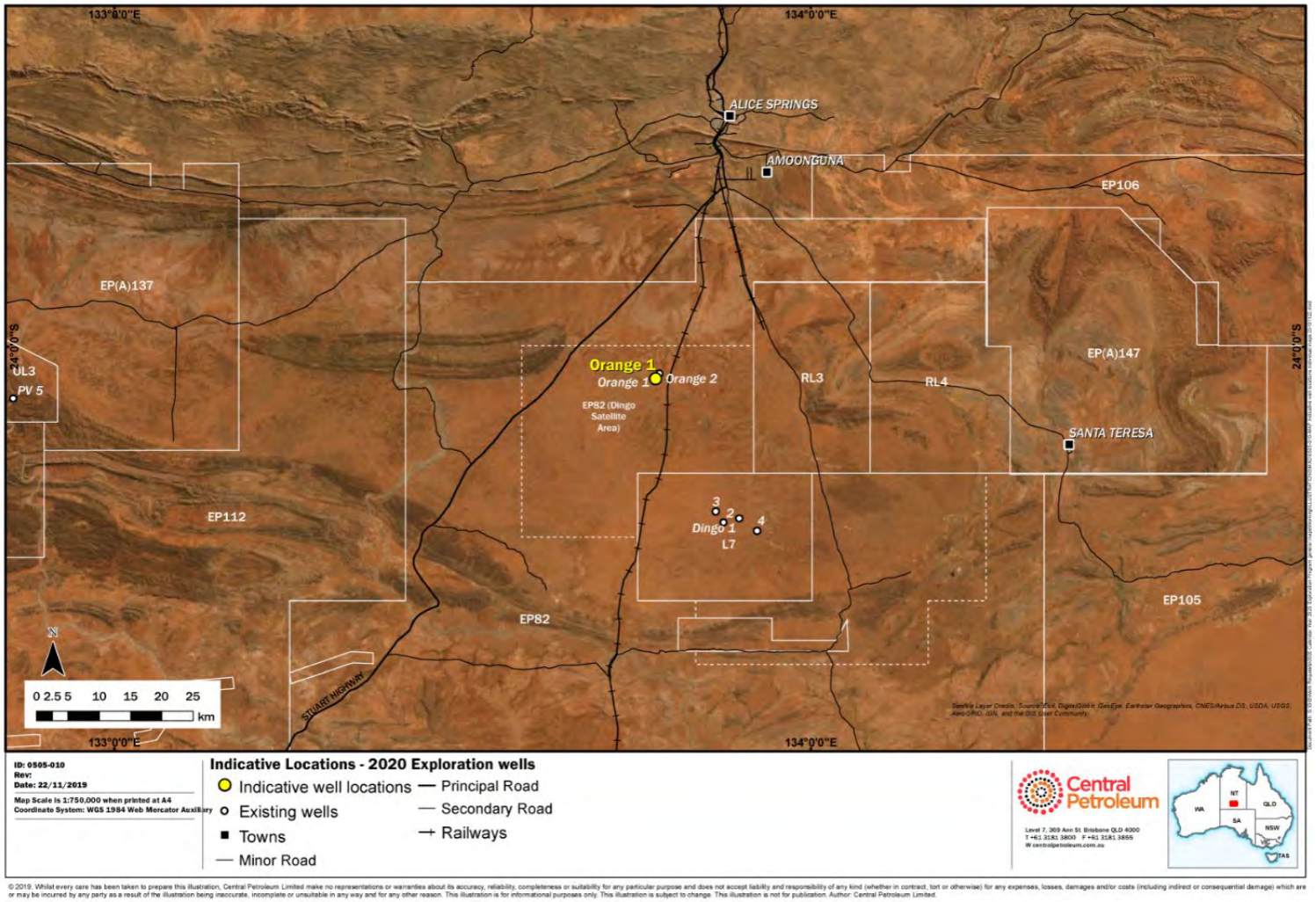
Mereenie – Potential development wells and recompletions



Dingo 1 Re-Drill / Deepening



Orange 3



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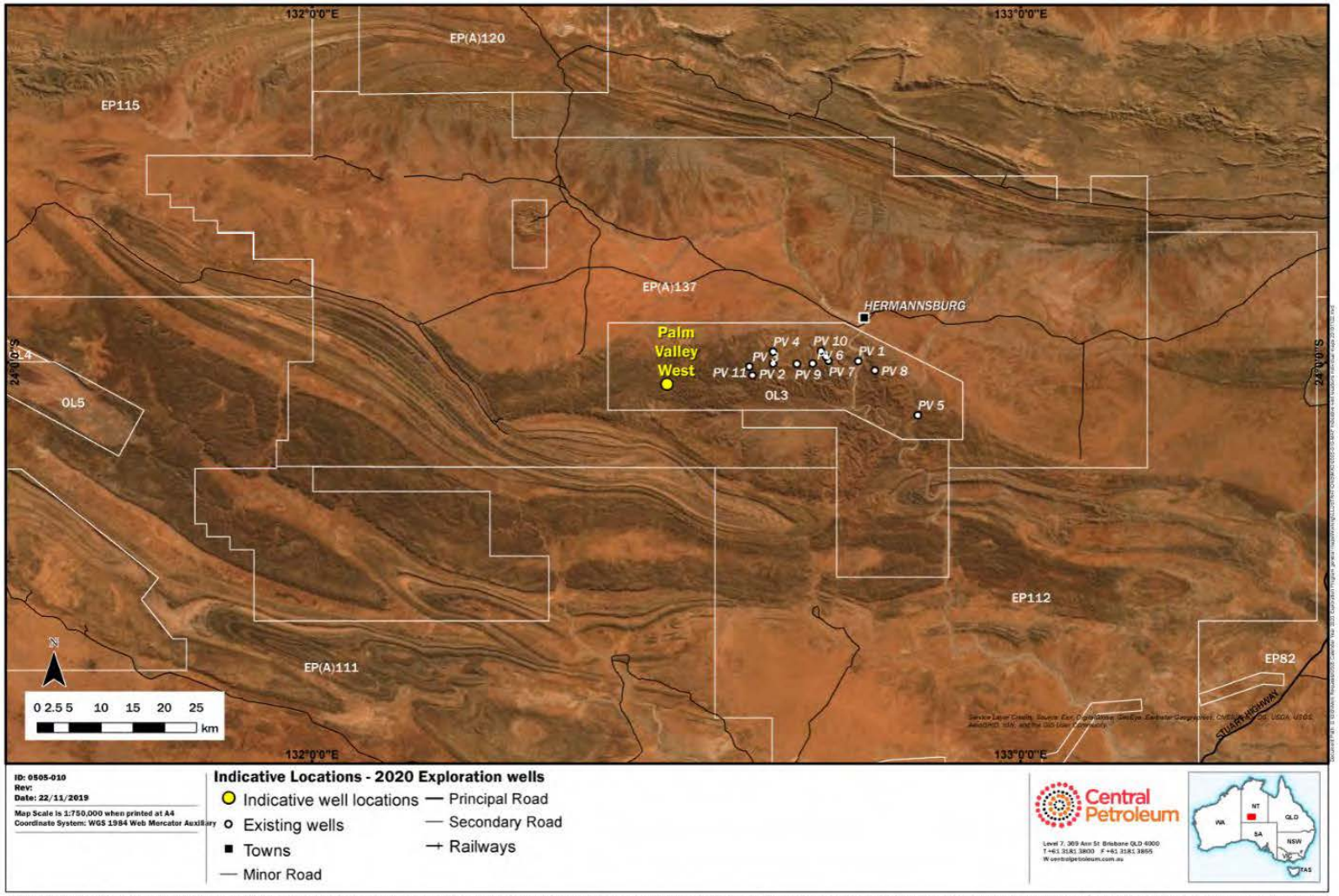
Palm Valley West – Proposed location



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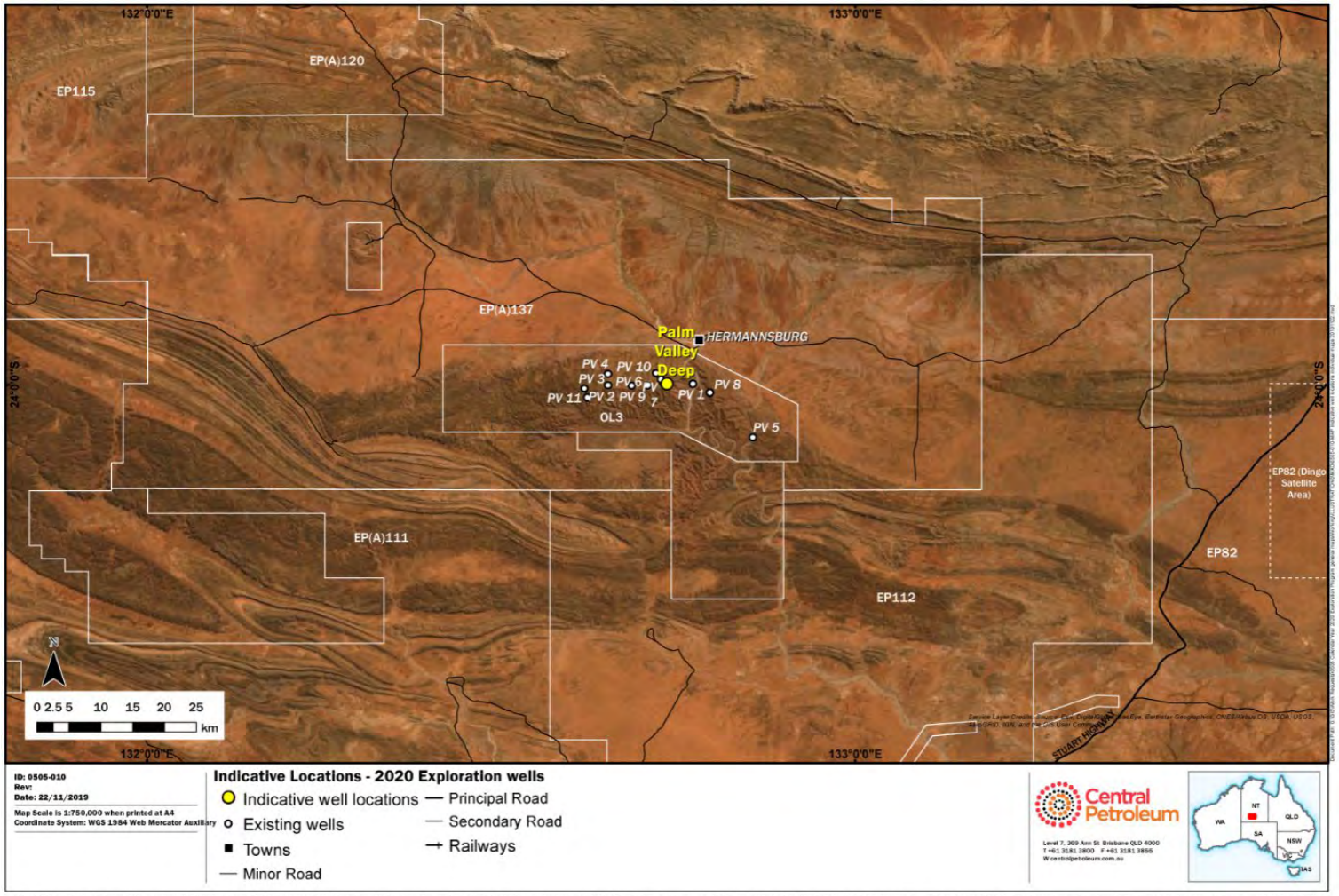
Palm Valley 12 (Deep)



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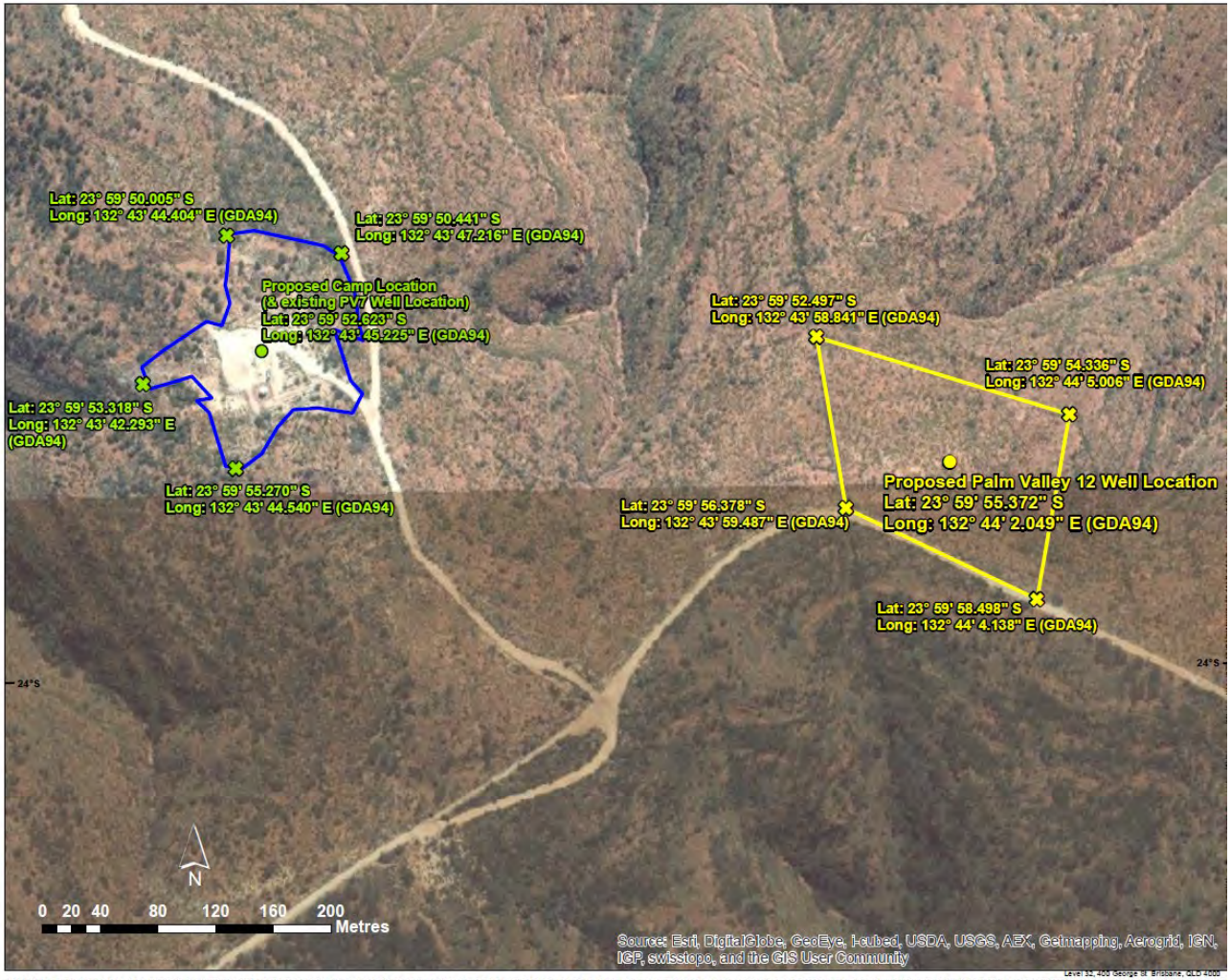
Palm Valley 12 (Deep) Previously Cleared



Proposed Palm Valley 12 Well & Campsite Locations

Legend

- Proposed Palm Valley 12 Campsite Area points
- Proposed Palm Valley 12 Camp and Existing Palm Valley 7 Location
- PV 12 Clearance Area Corner Points
- Proposed Palm Valley 12 Well Location
- Proposed Palm Valley 12 Clearance Area (19,115 square metres)
- Previously Cleared Area Captured From 12/10/1997 Aerial Photo (approx. 13,672 square metres)

Map Scale is 1:3,549 when printed at A3
Coordinate System: GDA 1994 MGA Zone 53
D190-MAP-005 | Revision: | 26/02/2015

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General Points and Time Line.

- All wells are targeting “Conventional Targets”. No Shale drilling
- No Intention for Hydraulic Stimulation. (No Fraccing)
- Target well site locations are being finalised by now
- Formal Application to Land owners, CLC, AAPA and NTG in December
- Wishing to complete Ecology surveys ASAP
- Traditional Owners/land owners: present formal programs to land owners and representatives from January 2020 through to June 2020
- Encourage feedback and questions along the way
- Formalities (Sacred Site Clearance approvals, Access Agreements, EMP, WOMPS (Drilling Programs)) December – through to July 2020

General Points and Time Line.

- Central wishes to commence Drilling / recompletions from July 2020
- Water to be sourced from licenced sources and approved for drilling
- Opportunities for employment for local labour during the entire process through contractors

Feedback and Contact

Central Petroleum

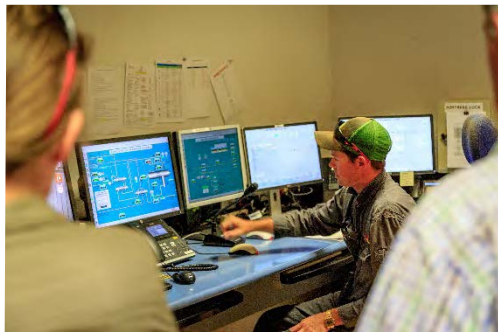
Level 7, 369 Ann Street

Brisbane, QLD 4000

Ph: 07 31813800

Email: Info@centralpetroleum.com.au

Direct Contact: James van Rooyen – Drilling and Completions Manager

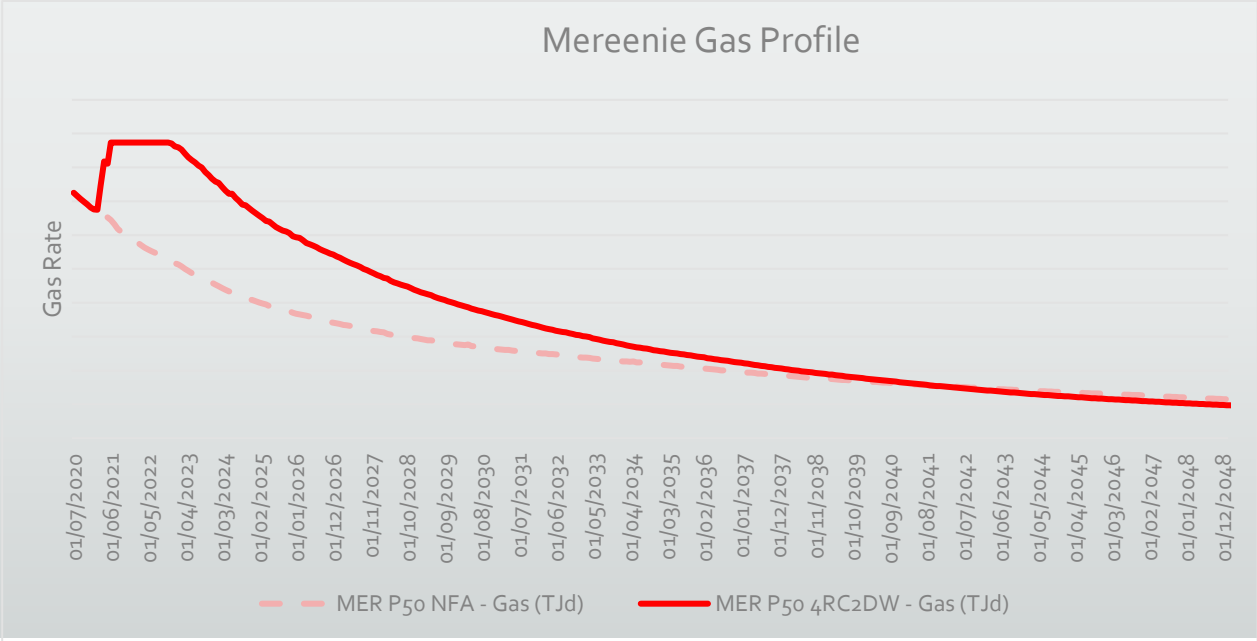


OL 4&5 Mereenie 2021 Development Program

Central Petroleum Limited (ASX: CTP)

Mereenie 2021 Development Program Summary

- To maintain continuous plateau (Flat line or existing) production additional wells need to be drilled or existing wells enhanced or re-completed.
- If there was no sub surface development production would decline naturally.
- Four (4) existing wells have been identified as good candidates to re-complete (West Mereenie 14,15,19 and 20)
- Two new wells have been identified and surface targets located to offer increased field production. These wells are West Mereenie 27 and 28

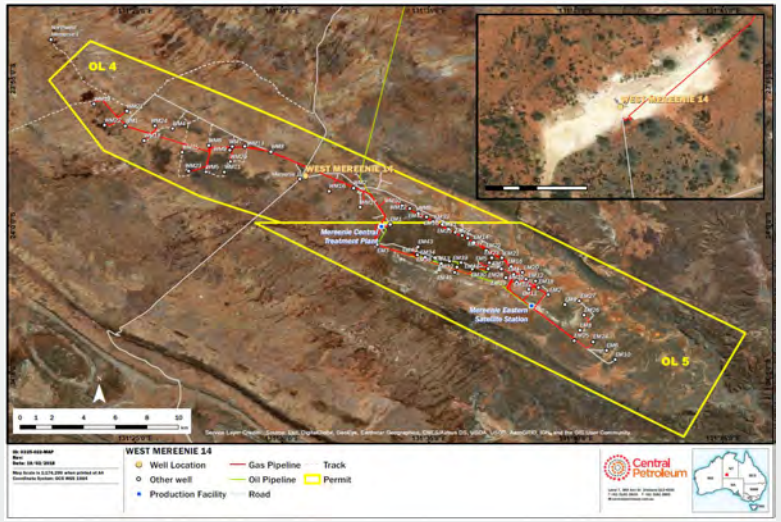


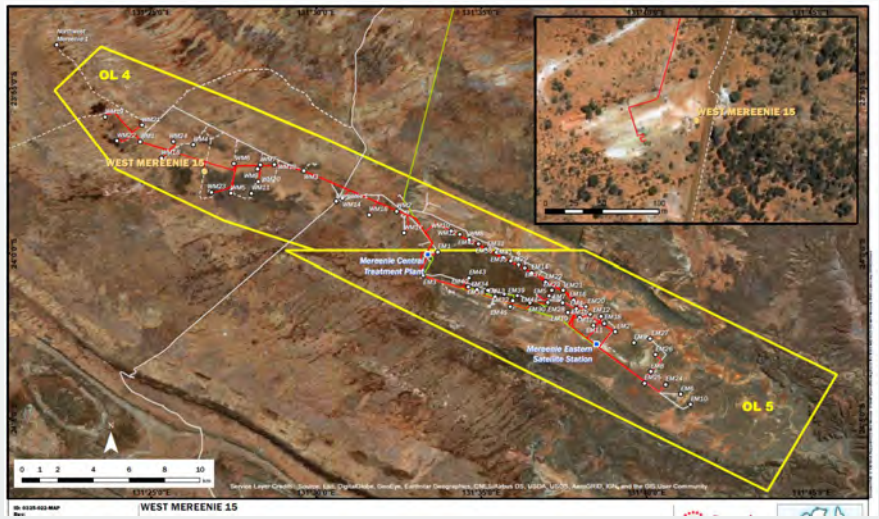
West Mereenie Re-Completion Project

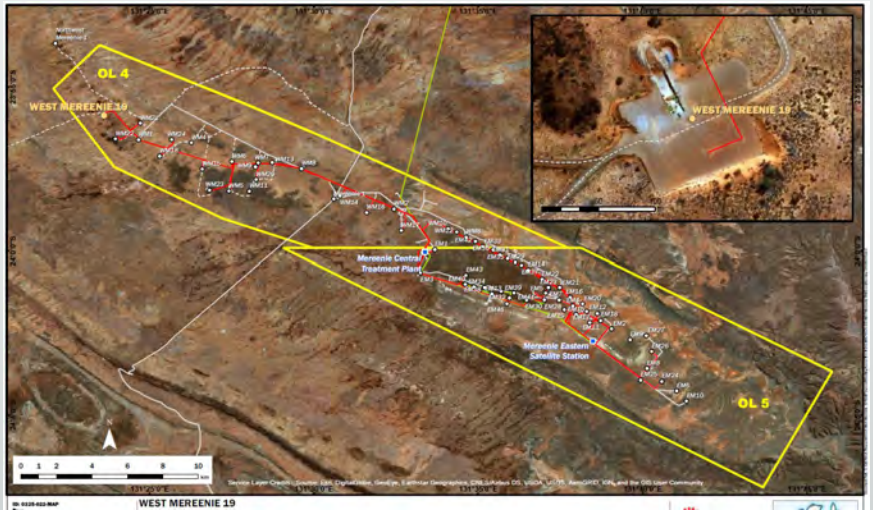
- West Mereenie Wells 14,15,19 and 20 Identified as ideal candidates.
- All re-completion work is done on existing cleared well pads (no clearing required)
- We re-use and re-life and existing wells. (No new drilling is required)
- All work is done under an approved Well Operations Management Plan (WOMP) and Environmental Management Plan approved by DITT and DEPWS (NT Government approved Program)
- No fracking is required.
- Very little Chemical and water use.
- Crews (15 persons) stay at the existing Mereenie Camp
- Timing – field activities are planned for approximately mid-February 2021 for around two-three (2-3) months.

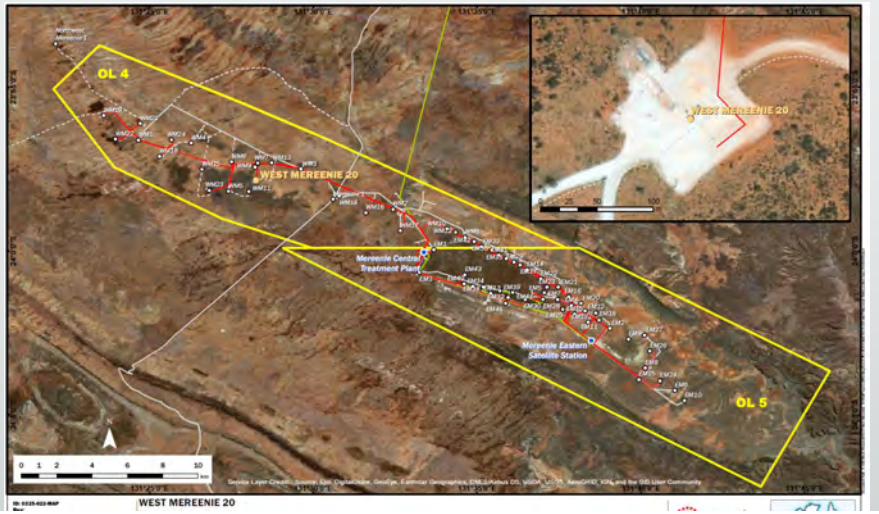
West Mereenie Re-Completion Project

- Well Locations WM 14,15,19 and 20:



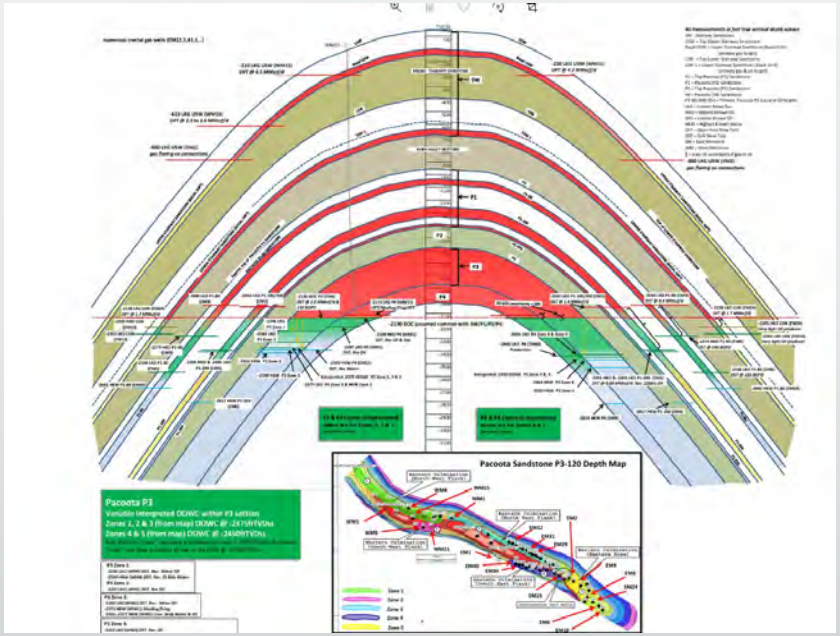




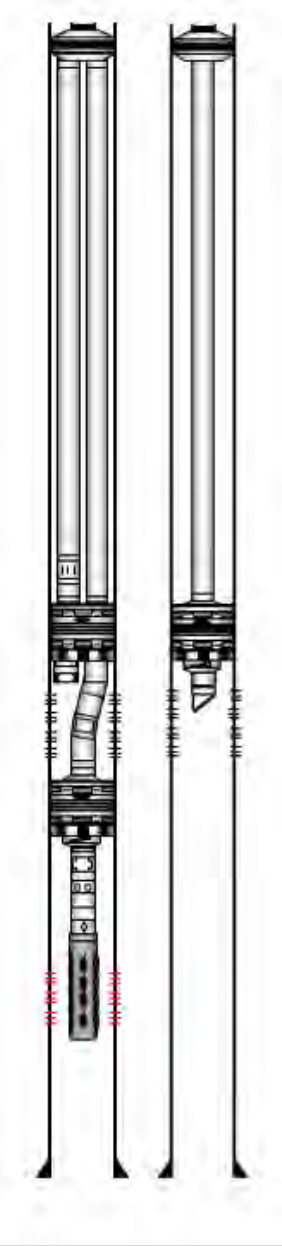


West Mereenie Re-Completion Project

- Why: Increasing well production by converting it from one zone to a two zone well
- Expecting: better production from existing wells



- Before and after
- Right image shows the inside of a single zone well
- Left image shows after the recompletion the ability to produce from two zones
- Enhanced production from existing wells



West Mereenie Re-Completion Project

- What is a recompletion and what does it look like in the field ?
- Small rig is moved onto existing well pad
- Rig sets up over the existing well
- Safety and Environmental checks done
- Gas production from that well is stopped
- Internal completion (tubing) is removed
- Well is modified (no fracking) with perforations and clean up
- New tubing is installed
- Well is commissioned and handed over to production operations

West Mereenie Re-Completion Project - Logistics

- Timing – February
- Rig is mobilised ~ 10 semi trailer loads
- All approvals in place with NT Government
- Traffic Management Plan in place
- Notices in local area shops of small increase in traffic
- Low impact on environment as the rig will fit onto existing well pads
- Low noise operations
- 12 hour operations (could be 24 hours if required)
- 15 personnel on site during day and accommodated in existing camps
- Crews only permitted on the lease and camp

Figure 4-2 Example rig and equipment layout on W20 with flare pit

West Mereenie Drilling Project (WM 27&28)

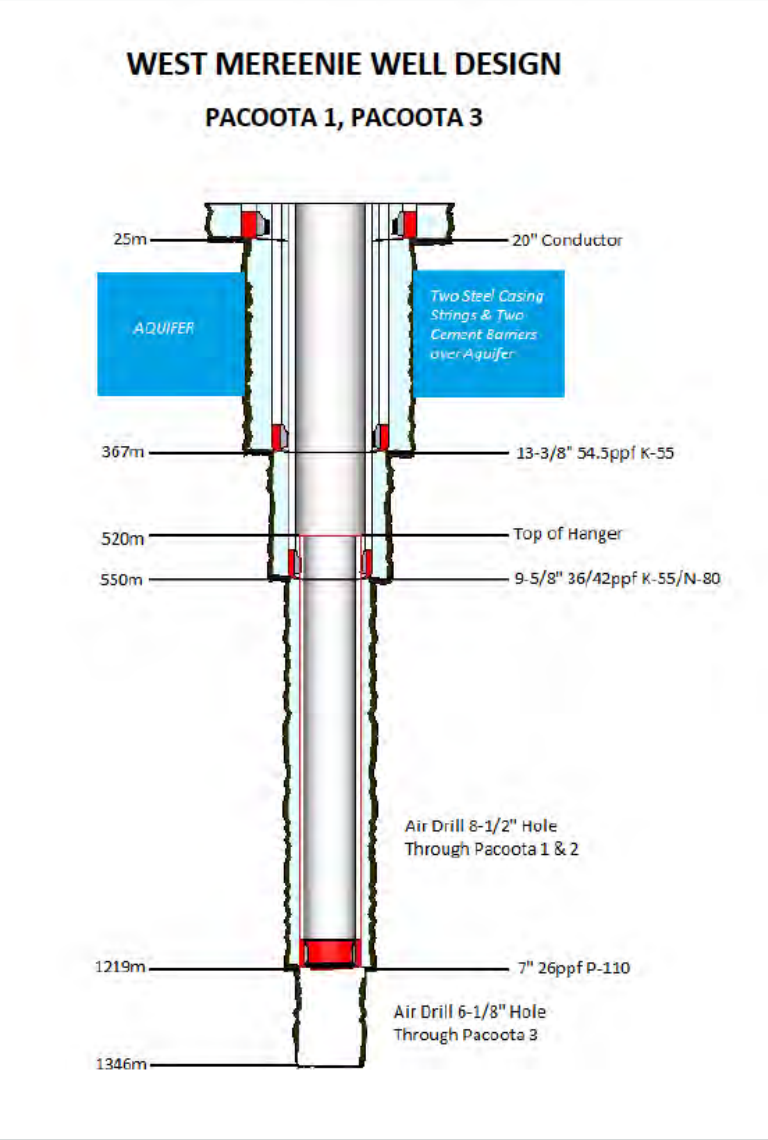
- Brand new wells.
- Locations have been chosen based on the best compromise between down hole targets and surface constraints.
- Drilling of new wells is done in phases.
  - Site Clearances
    - Area clearance by CLC (access agreement and Sacred Sites)
    - AAPA clearance
    - Environments and ecology surveys.
- Civil Construction of well pad and access tracks
- Mobilisation of drilling rig, equipment, mobile camp and personnel
- Drilling of the well
- Construct new gathering system (pipe) from well to existing field gathering network
- Hand well over to production operations if oil or gas is present..

West Mereenie Drilling Project (WM 27&28)

- All work is done under an approved Well Operations Management Plan (WOMP) and Environmental Management Plan approved by DITT and DEPWS (NT Government approved Program)
- No fracking is required.
- Crews (60 persons) stay at the established mobile camp (WM-13)
- Rig is mobilised with 20-30 truck loads
- Timing – field activities are planned for approximately March 2021 for around two-three (2-3) months.

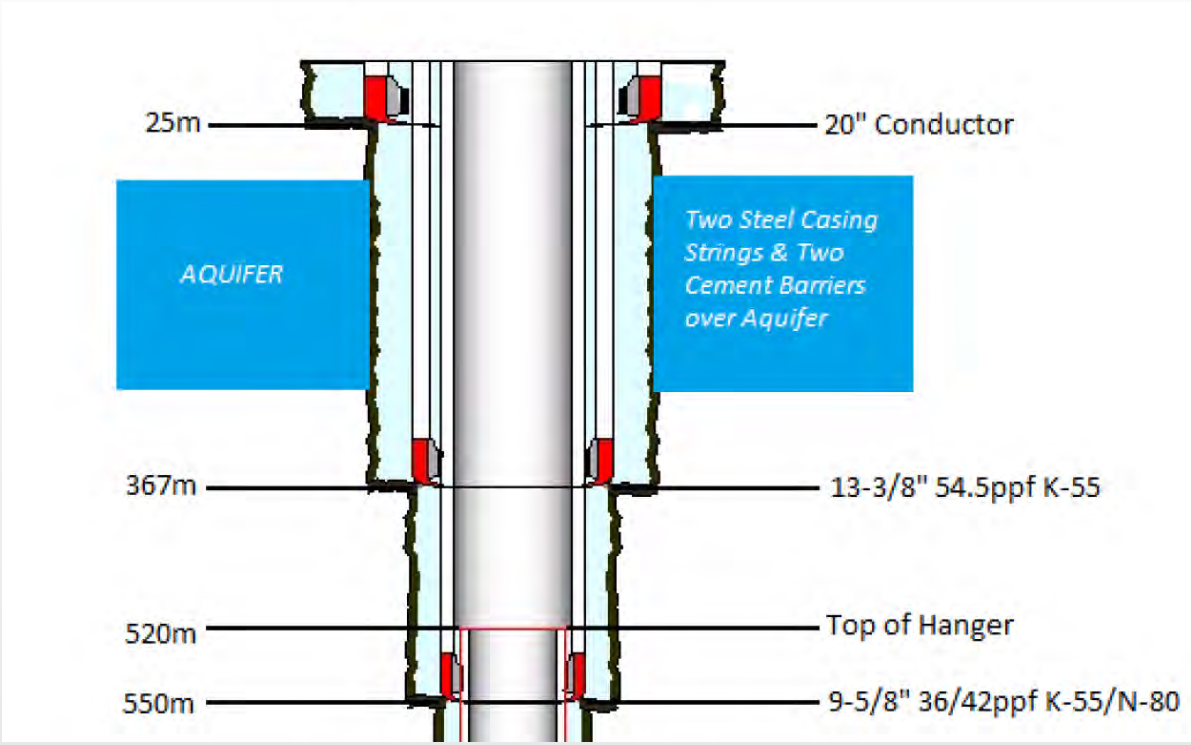
West Mereenie 27/28 Drilling

- Drilling vertically with air through the Pacoota 1 and Pacoota 3 reservoir.
- Well design Approved by multiple Government departments (DITT, DEPWS and water licencing)
- Fully approved (Environment Management Plan will be in place to cover all phases, Cultural clearances and sacred site clearances by CLC and APPA and your mob)
- Full Environmental, Ecology and Heritage surveys conducted to ensure the least impact on Flora, Fauna and the Environment.
- All Environmental risks reduced to as low as reasonably practical.
- Up to 60 persons required for the well construction phase
- **No Fracking**.

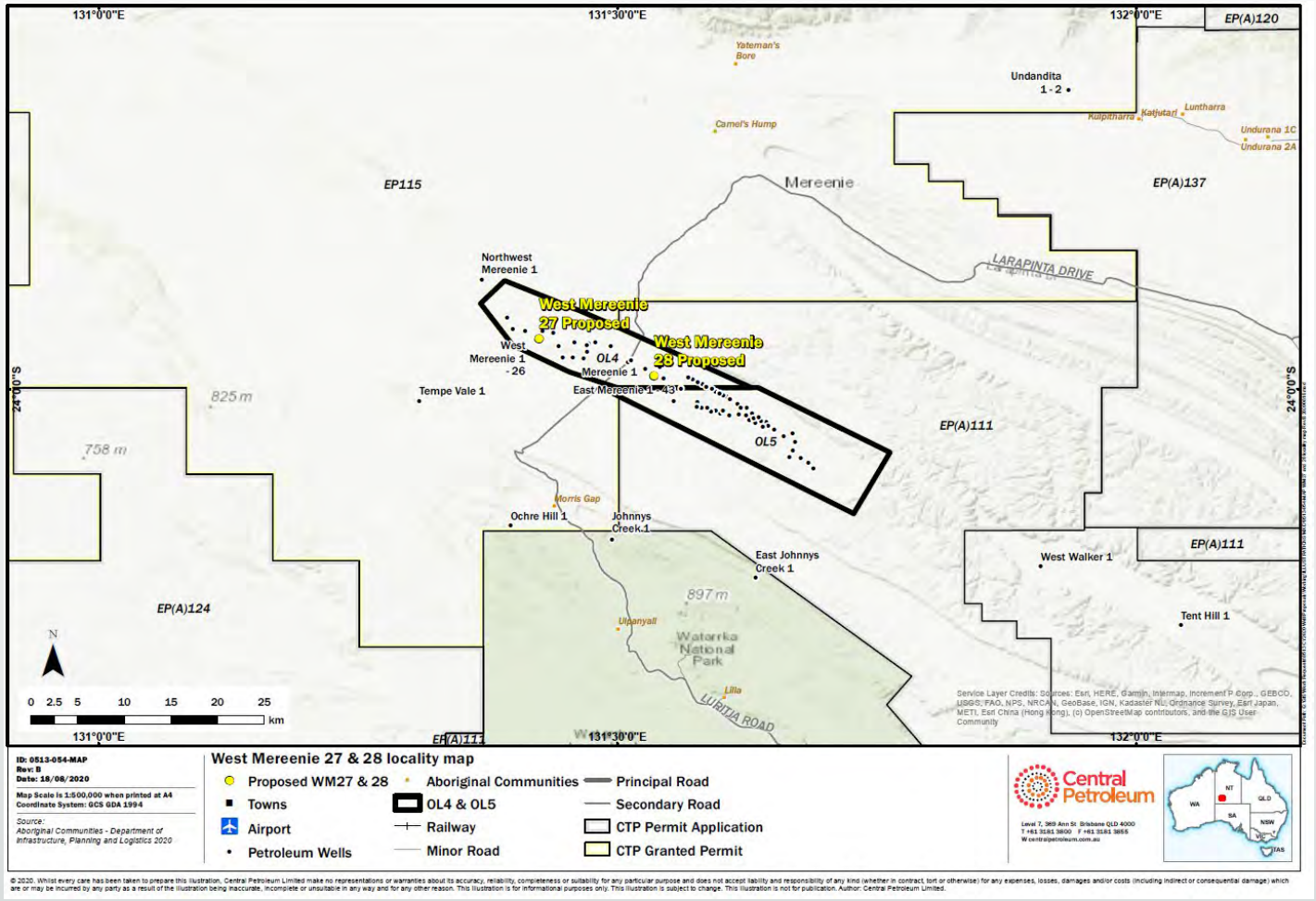


West Mereenie 27/28 Drilling – water + environment protection

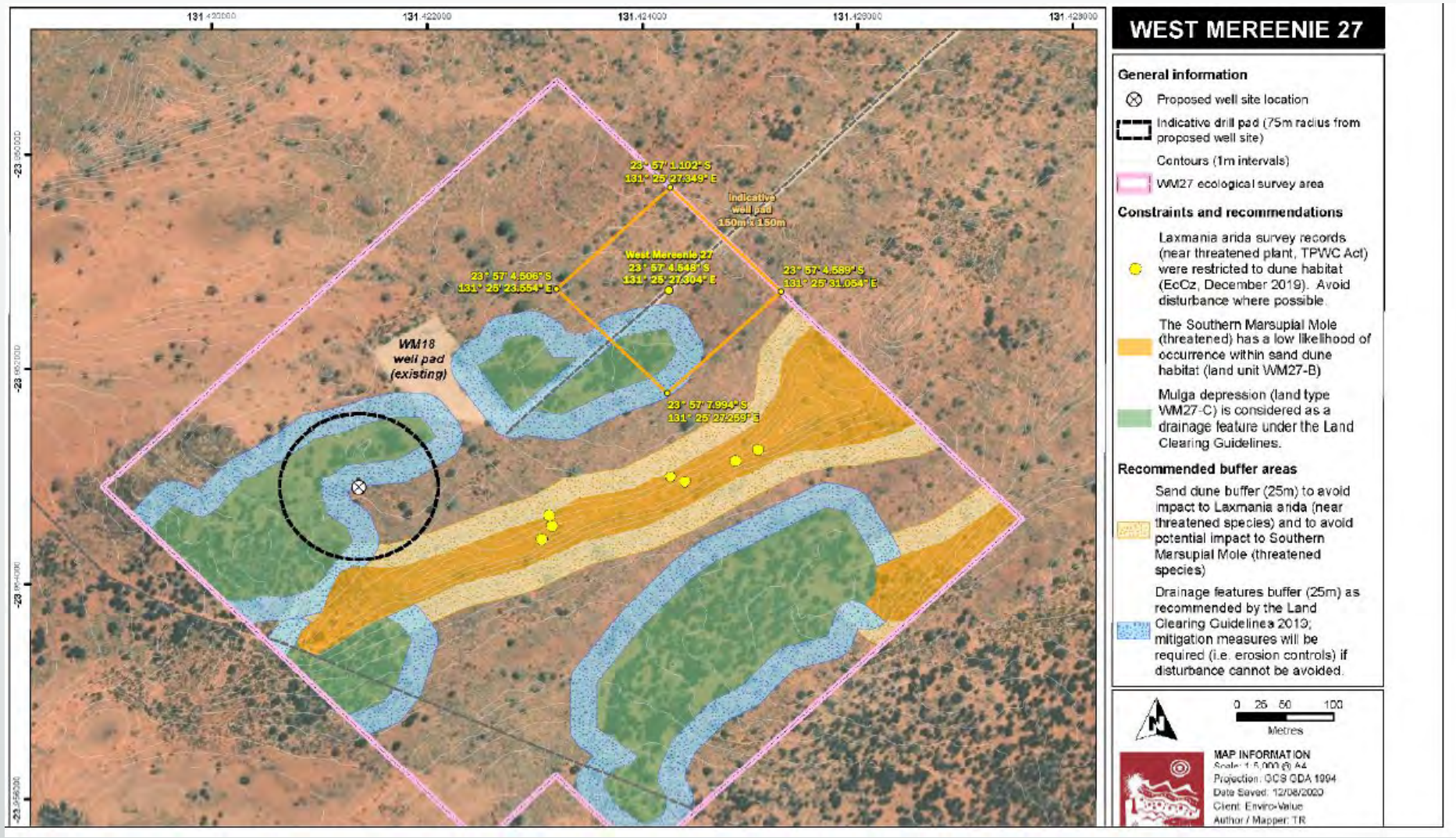
- Wells drilled with water based drilling fluid.
- Low toxicity and bio-degradable products used where possible.
- Aquifers will be protected with two steel casing strings & two cement barriers. (fully isolated)



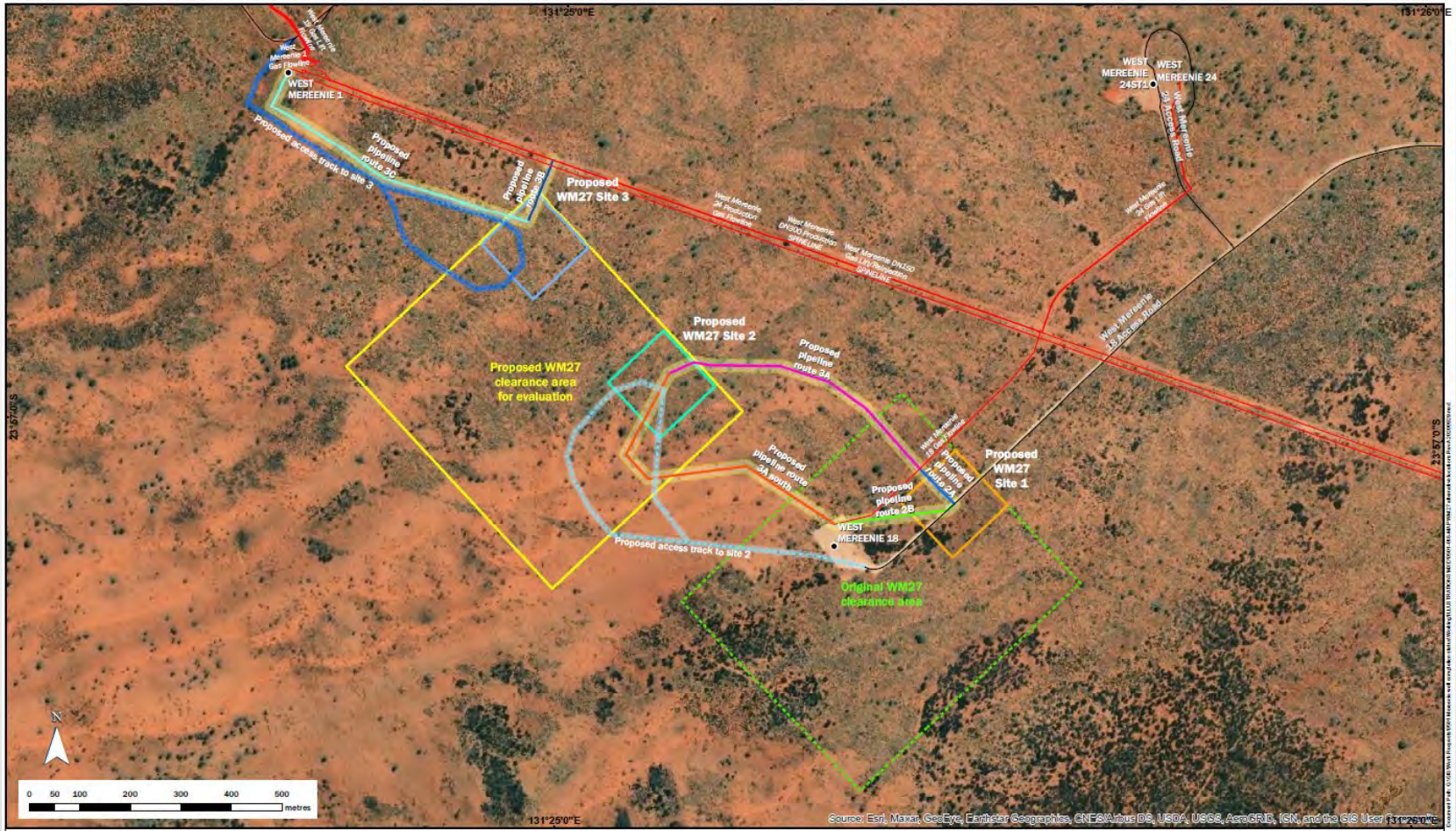
West Mereenie 27/28 Drilling – Locations



West Mereenie 27/28 Drilling – Locations



West Mereenie 27/28 Drilling – Locations



ID: 0501-001
Rev: A
Date: 29/09/2020

Map Scale is 1:7,193 when printed at A3
Coordinate System: GDA 1994 MGA Zone 52

Proposed WM27 access tracks / pipeline routes

- Existing wells
- Existing gas pipeline
- Existing roads

Proposed access tracks
- Proposed access track to site 2
- Proposed access track to site 3

Proposed access track to site 2 (12m buffer)
Proposed access track to site 3 (12m buffer)

Proposed pipeline routes
- Proposed pipeline route 2A
- Proposed pipeline route 2B
- Proposed pipeline route 3A
- Proposed pipeline route 3A south
- Proposed pipeline route 3B
- Proposed pipeline route 3C

Proposed WM27 pipeline routes 25m buffer

- WM27 proposed well pad location 1
- WM27 proposed well pad location 2
- WM27 proposed well pad location 3
- Proposed WM27 clearance area for evaluation
- Original WM27 clearance area

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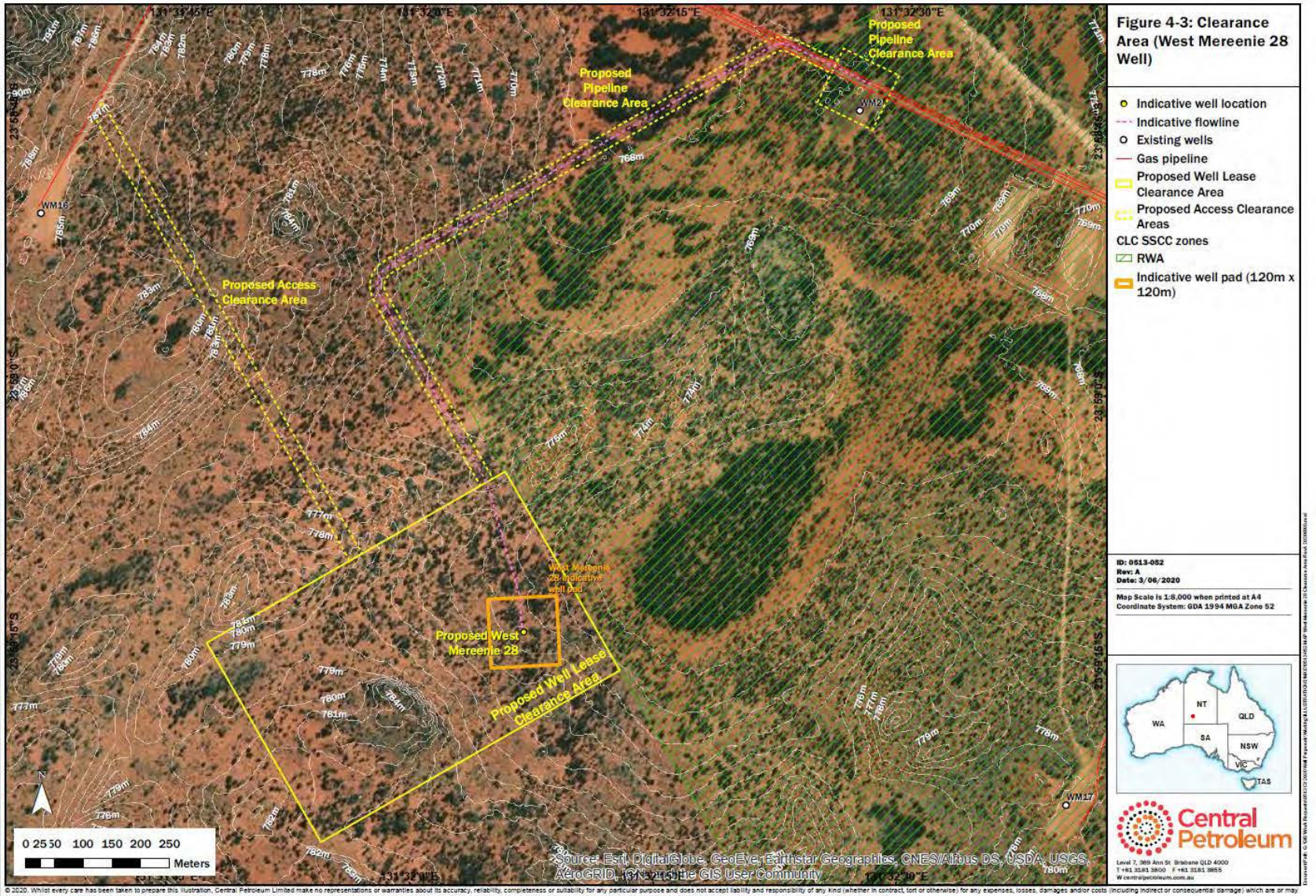
West Mereenie 27/28 Drilling – Locations



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Drilling – Logistics

- If approval is granted, field activities:
  - Civil works
  - Mobilisation of rig and camp
  - Drilling
  - Timing: March 2021
- Approximately 60 persons on site.

Drilling – Logistics

If approval is granted, field activities:

- On completion of drilling if the well is successful
- Field gathering network tie in
- Hand well to production to sell the gas.

Environmental Outcomes, Risks and Controls

- Comprehensive risk assessments undertaken across all areas
- Multiple layers of controls implemented to mitigate the impacts as a result of the planned activities.
- Environmental Management Plan detailing how impacts to the environmental will be avoided and minimized is currently with the NT Environment Minister for final approval
- Central have never had a reportable environmental incident since taking over operations in September 2015

Outcomes / Objectives	Risks / Impacts	Controls
Minimise impacts on conservation areas and significant fauna / flora	Injury to fauna, loss of vegetation, increased weeds	- Minimum clearing undertaken - Flora and fauna survey conducted - Regular inspections
Minimise and control soil erosion / sedimentation and maintain the viability of soil through preventing contamination	Erosion, sedimentation, contamination	- Erosion and sedimentation plans - Complete remediation of any spills or leaks / spill response kits - Minimal volumes of fuels, oils and other chemicals will be stored and used - Regular inspections
All heritage and culturally significant sites are identified and protected	Disturbance to heritage sites	- Heritage survey conducted - CLC and Traditional owners consulted - Aboriginal Areas Protection Authority certificate application in progress and (fieldwork stage) with site visits currently planned

Environmental Outcomes, Risks and Controls

Outcomes / Objectives	Risks / Impacts	Controls
Avoid impacts to surface water and groundwater	Disturbance to drainage patterns, erosion and sedimentation, depletion of ground water, contamination	- Regular monitoring of ground and surface water conditions - Dual casing for all drilling to protect aquifers - Minimise groundwater usage - Regular inspections
Activities are not the cause of fires in the region	Fire, community	- Bushfire management plans in place include firefighting equipment, fire breaks
Mange capacity of road infrastructure up to and within the MRN Maintain and enhance community relationships	Traffic, noise, complaints	- Regular consultation with the community and stakeholders - Traffic management plans and community notification prior to commencing activities - All visitors to have appropriate CLC approval and be inducted on environmental issues prior to arrival at site
Activities do not negatively impact air quality	Dust generation, emissions, combustion	- Watering roads to minimise dust as required - Emissions management plan in place including restrictions on venting of gas and efforts to minimise flaring

- There may be unintended consequences as a result of an incident during the activities however comprehensive response plans and protocols are in place.
- There should be no impacts to stakeholder rights e.g. access to site during the planned activities, etc. however in order to manage safety on site we do ask that you inform the Site Supervisor upon arrival.

Drilling – Cultural & Environmental Protection Measures

Environment and Cultural Heritage Protection.

- As mentioned
  - Flora and Fauna, heritage survey conducted
  - CLC and Traditional owners consulted (part of todays process)
  - Aboriginal Areas Protection Authority certificate application in progress and (fieldwork stage) with site visits currently being planed
  - NT Gov't approval. All approvals granted (including water usage, protection and NO FRACKING)
- CTP will implement controls to mitigate the following key risks
  - Impacts to ground water e.g. decline / contamination in aquifer water levels due to cross-flow of groundwater to another formation
  - Impacts to soil productivity and viability
  - Air pollutants in areas surrounding drilling activities including greenhouse gas emissions
  - Decrease in population of conservation significant flora / fauna habitat and native species
  - Impacts / disturbance to sacred sites or culturally sensitive sites

Questions / Feedback / Further Contact

- Opportunity to ask any question relating to anything raised today.
- Feedback ?
- Further Contact:
  - CLC – Tony Corbett
  - Central – James van Rooyen – jamesvanrooyen@centralpetroleum.com.au
  - Central – Cameron Lambert – cameronlambert@centralpetroleum.com.au
  - Phone: 07 31813800

Thank you for your time

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