Silverton Wind Farm:

Vegetation Monitoring Report - 2020

FINAL REPORT

Prepared for GE Renewable Energy

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Contents

1. Introduction 1

1.1 Project background 1
1.2 Purpose 1
1.3 Relationship to other plans 2
1.4 Current land management 2

2. Methods 4

2.1 Pre-survey climate 4
2.1.1 Dynamic nature of arid lands 4
2.2 Monitoring sites within PGSW 4
2.3 Photopoint monitoring within PGSW 8
2.4 Feral goats and PGSW 9
2.4.1 Goat management infrastructure 9
2.4.2 Landholder estimates of goat populations 9
2.4.3 Scat counts 9
2.4.4 Monitoring of goat presence by GE. 10
2.5 Condition of PGSW 10
2.5.1 Vegetation condition 10
2.5.2 Grazing pressure 11
2.5.3 Finer scale responses 12
2.5.4 Palatability of plant species 12
2.6 Disturbance areas of the Wind Farm 12
2.7 Introduced flora species of the Wind Farm 13
2.8 Data analysis 13
2.9 Mapping 23
2.10 Limitations 23

3. Results 24

3.1 Pre-survey climate 24
3.2 Sites assessed in the PGSW 31
3.3 Photopoint monitoring in the PGSW 33
3.4 Feral Goats and the PGSW 33
3.4.1 Goat management infrastructure 33
3.4.2 Landholder estimates of feral goat population 33
3.4.3 Scat counts 35
3.4.4 Monitoring of goat presence by GE 36
3.5 Condition of PGSW 37
3.5.1 Species composition of the community 37
3.5.2 Factors influencing species richness and composition 40
3.5.3 Porcupine Grass 47
3.5.4 Threatened flora 49

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3.5.5 Condition of woody species 49
3.5.6 Litter cover 53
3.6 Disturbance areas of the Wind Farm 55
3.7 Introduced flora species of the Wind Farm 55
3.7.1 Field survey results 55
3.7.2 Vehicle hygiene for the Wind Farm 77
4. Discussion and conclusions 78
4.1 Condition of PGSW community 78
4.2 Roadside drainage 79
4.3 Introduced species of the Wind Farm 79
4.4 Seed collection for the Wind Farm 82
4.5 Recommendations 83
4.6 Conclusion 86
References 87
Appendices 89
Appendix 1 Photopoint monitoring 90
Appendix 2 Browsing condition – from AREA 2017 121
Appendix 3 Flora recorded within PGSW 127
Appendix 4 Introduced flora species recorded 137
Appendix 5 VMP Vehicle and Machinery hygiene / decontamination checklist 139
Appendix 6 PCT 359 - Porcupine Grass - Red Mallee - Gum Coolabah hummock grassland low sparse woodland 141
Appendix 7 Conditions compliance table 145
Compliance with relevant BAMP performance criteria to end of December 2020 146

Tables

Table 3-1 Location of monitoring plots (GDA94 Zone 54) 31
Table 3-2 Estimates of goat numbers provided by leaseholders 35
Table 4-1 Annual weed management summary 79
Table 4-2 Recommended amendments to annual weed management summary 81
Table 4-3 Recommended amendments to actions and associated subplans 83

Figures

Figure 1 Location of Silverton Wind Farm, NSW. 3
Figure 2 Locations of permanent monitoring plots 5
Figure 3 Monitoring plot layout 8
Figure 4 Survey effort of disturbance areas 15

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Figure 5 Monthly rainfall totals in the year prior to each survey (Note: difference in months on x-axis due to COVID delayed survey in 2020) 25
Figure 6 Monthly rain days in the year prior to each survey (Note: difference in months on x-axis due to COVID delayed survey in 2020) 26
Figure 7 Monthly maximum temperature (peak) in the year prior to survey (Note: difference in months on x-axis due to COVID delayed survey in 2020) 27
Figure 8 Mean monthly maximum temperature in the year prior to survey (Note: difference in months on x-axis due to COVID delayed survey in 2020) 28
Figure 9 Infrastructure for goat management 34
Figure 10 Herbivore scats recorded in 5 x 5 metre subplots. 36
Figure 11 Change in native species richness in 20 x 20 metre quadrats from 2018 to 2020 38
Figure 12 Change in species richness in 20 x 20 metre quadrats from 2018 to 2020 38
Figure 13 Species richness in 20 x 20 metre quadrats by position relative to the goat fence 39
Figure 14 Species richness in 20 x 20 metre quadrats by PGSW structural variant 40
Figure 15 NMDS of native species composition and abundance in the 20x20 monitoring plots in 2020, attributed by position relative to the goat fence. 41
Figure 16 NMDS of native species composition and abundance in the 20x20 monitoring plots in 2020, attributed by the aspect of the monitoring plots (note: no plots have a SW aspect). 42
Figure 17 NMDS of native species composition and abundance in the 20x20 monitoring plots in 2020, attributed by the elevation of the monitoring plots. 43
Figure 18 Plot of species richness of 20x20m plots in 2020 by elevation. 44
Figure 19 Plot of species richness of 20x20m plots in 2020 by elevation and position relative to goat fence. 44
Figure 20 NMDS of native species composition and abundance in the 20x20 monitoring plots in 2020, attributed by the slope of the monitoring plots. 45
Figure 21 NMDS of native species composition and abundance in the 20x20 monitoring plots in 2020, attributed by the structural variant of the community. 46
Figure 22 Condition of Porcupine Grass individuals in 5 x 5 metre subplots in 2020. 49
Figure 23 Overall condition of woody species recorded in 2020 50
Figure 24 Condition of woody species below the browse line in 2020 51
Figure 25 Condition of woody species above browse line in 2020 52
Figure 26 Canopy condition of woody species in 2020 53
Figure 27 Summary of change in litter cover within the 20 x 20 metre monitoring plots 54
Figure 28 Change in litter cover within each 20 x 20 metre monitoring plots 54
Figure 29 Weed species to be controlled for elimination 61
Figure 30 Weed species to be controlled within the wind farm 69

Photos

Photo 1 Condition of PGSW during mapping of the community, 13 December 2017 29
Photo 2 Condition of PGSW at the time of baseline survey, 23 October 2018 29
Photo 3 Condition of PGSW, 28 October 2019 (year 1 monitoring survey). Note the poor condition of Porcupine Grass tussocks in the foreground. 30

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Photo 4 Condition of PGSW, 3 December 2020 (year 2 monitoring survey) Note that while some Porcupine Grass tussocks have resprouted and Gum Coolibah *Eucalyptus intertexta* has new growth following the rain event, many Porcupine Grass tussocks appear dead. 30
Photo 5 Landscape of PGSW, showing apparent extensive death of Porcupine Grass tussocks during the 2020 surveys. Note some tussocks associated with minor drainage lines are in better condition. 47
Photo 6 Grey tussocks with no evidence of resprouting, assumed dead (2020 survey). 47
Photo 7 Resprouting adult tussock (2020 survey) 48
Photo 8 Porcupine Grass recruits (2020 survey) 48
Photo 9 Typical road surface lower than adjoining undisturbed land in 2020, the rock on the right side of the photo appears to be acting as a catch-drain for seed or introduced species. 56
Photo 10 Example of road surface adjoining undisturbed land within inadequate drainage protection in 2020, increasing opportunity for introduced species to spread into remnant vegetation. 56
Photo 11 Turbine hardstand with inadequate drainage controls to prevent introduced species impacting on adjacent vegetation in 2020. 57
Photo 12 Minimal recruitment of introduced or native species observed in 2020 on compacted ground associated with turbine hardstands. 57
Photo 13 Example of regeneration occurring on rehabilitated disturbance areas in 2020. 58
Photo 14 Example of establishment of introduced species and regeneration occurring on rehabilitated disturbance areas in 2020. 58

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1. Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by GE Renewable Energy (GE) to undertake the 2020 monitoring of the vegetation of Silverton Wind Farm (STWF) in accordance with the operational Biodiversity Adaptive Management Plan (BAMP) (Biosis 2018a).

Silverton Wind Farm is located approximately 5 kilometres north of Silverton and 25 kilometres north-west of Broken Hill in the Unincorporated Area of the Far West District of New South Wales (NSW) (Figure 1). The turbines are located on the ridgelines in and around the Mundi-Mundi and Barrier Ranges.

The Silverton Wind Farm project is being undertaken by Powering Australian Renewables (PowAR)., a partnership between AGL, QIC and Future Fund. PowAR engaged GE-CATCON (a consortium led by GE and Civil and Allied Technical Construction Pty Ltd (hereafter referred to as CATCON) under an Engineer, Procure and Construct (EPC) Contract to deliver the Silverton Wind Farm construction works. GE is now responsible for management of the STWF site during the operational phase. Provisional Facility Practical Completion was achieved on the 27 October 2020.

Condition 18(c) of the Project Approval required that prior to the commencement of construction, a Biodiversity Management Plan was to be prepared for the project for the site. The BAMP (Biosis 2018a) was developed to satisfy that condition and the Statement of Commitments (2009) for the operational phase of the wind farm (See BAMP Appendix 2 for details). In particular, the BAMP specifies the implementation, monitoring and reporting activities for the recovery of the critically endangered Porcupine Grass Sparse Woodland (PGSW) as recommended in the Porcupine Grass Sparse Woodland Recovery Plan (Biosis 2018b).

This 2020 report has been prepared to document the condition of PGSW at Silverton Wind Farm for the second year of monitoring, following the baseline surveys conducted in 2018 (Biosis 2020a) and first year of monitoring in 2019 (Biosis 2020b).

This monitoring is a component of the monitoring and adaptive management approach outlined in the BAMP. In particular, monitoring of PGSW is to be undertaken as an initial three-year investigation following the baseline survey in 2018. The monitoring also includes factors that influence vegetation condition, such as climatic conditions, feral goat and introduced flora populations,

The purpose of this monitoring is to inform refinement of on-going management to improve the condition of PGSW within the wind farm area. A comprehensive review of monitoring and management will be undertaken after three years to ensure there is a net gain in the conservation value of this community. The three-year review is due following monitoring surveys at the end of 2021.

1.2 Purpose

This document provides the 2020 vegetation monitoring results of the PGSW community within Silverton Wind Farm.

The objectives of the monitoring are to:

- Conduct vegetation monitoring of the PGSW community in accordance with the requirements of the BAMP.
- Liaise with landholders to gather goat population data.

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- Collate and map of any additional data on weed populations.
- Analyse and report on the condition based on the 2020 survey results.
- Compare monitoring results from 2020 with the surveys conducted in 2018 (Biosis 2020a) and 2019 (Biosis 2020b).

These measures of diversity, structure and function will assist in site management decision-making and provide evidence to demonstrate the attainment of a net improvement in vegetation health and condition. The monitoring data will be used to inform management actions such as management of goats, weed control, seed collection and planting of native flora (if deemed necessary).

1.3 Relationship to other plans

The primary document relevant to this report are the vegetation monitoring reports from previous vegetation surveys at the site (Biosis 2020a, Biosis 2020b).

For further background to the project, this Vegetation Monitoring report is also to be read in conjunction with the BAMP (Biosis 2018a), which describes the specific monitoring and management measures to be undertaken during the operational phase of the wind farm to protect and enhance the biodiversity values of the study area. In particular, it provides a cohesive document that details the methods, actions, monitoring and reporting identified for the Barrier Range Dragon Management Plan (Biosis 2018c), Goat Management Plan (Biosis 2018d), Porcupine Grass Sparse Woodland Recovery Plan (Biosis 2018b) and Vegetation Management Plan (Biosis 2018e), into one cohesive implementation document. This allows for an integrated approach to on-ground monitoring and management of biodiversity at the Silverton Wind Farm.

1.4 Current land management

The Silverton Wind Farm has been constructed on NSW Crown Land offered as leasehold under the authority of the *Western Lands Act 1901*. The land supporting PGSW is currently used by two independent lessees for grazing purposes, including grazing by Feral Goats, under two separate General Purpose Leases. A wind farm lease (Special Purpose Lease) was assigned to PARF as part of financial close on the Silverton Wind Farm project.

A goat fence was constructed around the majority of the PGSW in May 2014 to exclude and manage goats for the purposes of protecting PGSW and the endangered Barrier Range Dragon (Figure 9).

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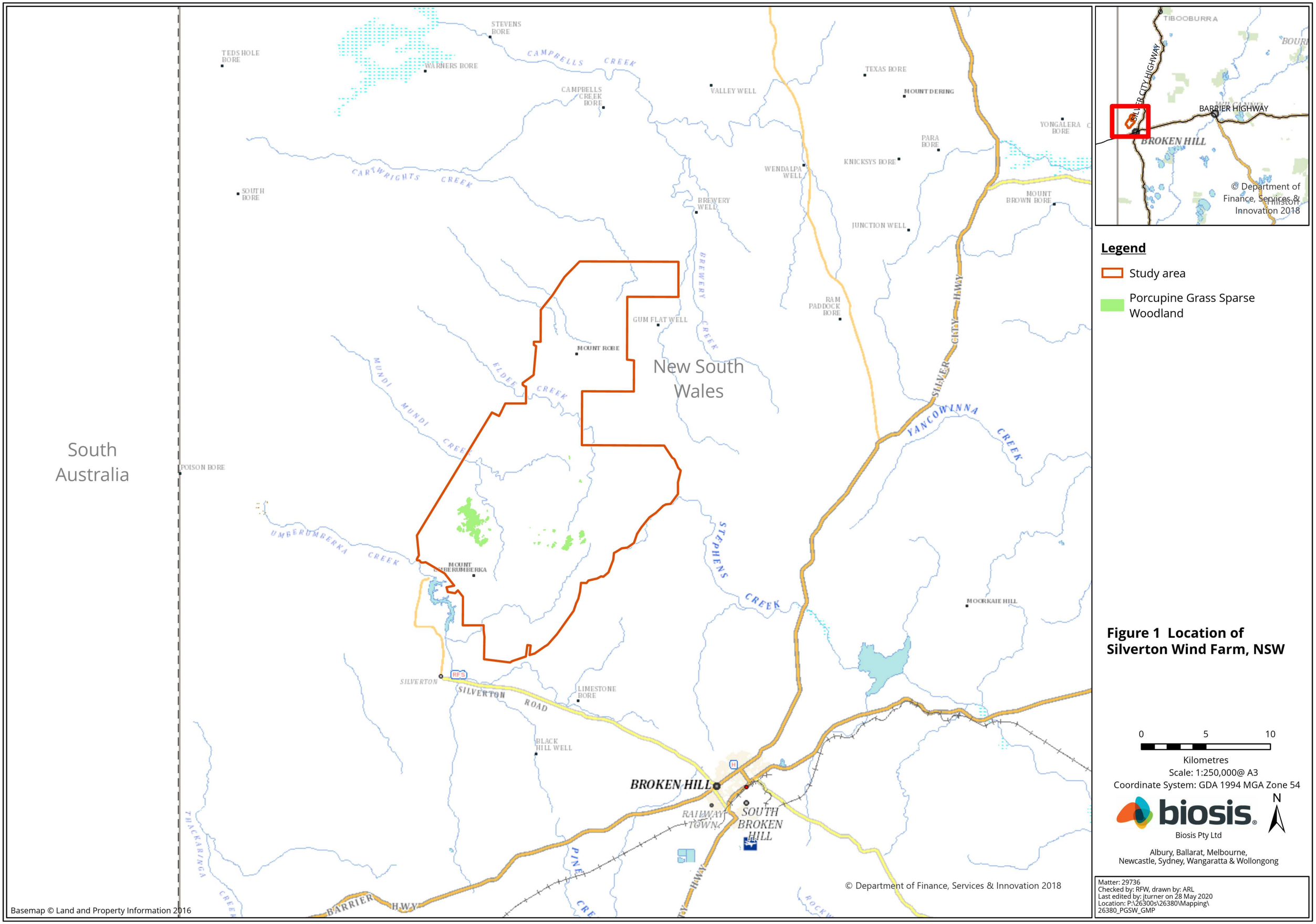

Legend

- Study area
- Porcupine Grass Sparse Woodland

Figure 1 Location of Silverton Wind Farm, NSW

0 5 10

Kilometres

Scale: 1:250,000@ A3

Coordinate System: GDA 1994 MGA Zone 54

N

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2. Methods

In accordance with the BAMP and associated plans, vegetation monitoring commenced with the collection of baseline data in 2018. This was followed by a program of management, regular monitoring and subsequent adaptive response to monitoring results.

The monitoring focuses on the condition of the PGSW, and also assesses the previously disturbed areas (that were disturbed during the construction phase) of the wind farm and weed incursions at the wind farm.

2.1 Pre-survey climate

Monthly climate data for the duration of the monitoring program has been downloaded from the Bureau of Meteorology website http://www.bom.gov.au. Data from the weather station at Broken Hill Airport (Station ID 047048) is analysed, as it is the nearest to the study area.

Climate data analysed includes:

- Monthly rainfall total
- Monthly minimum and maximum temperature
- Average rainfall by month
- Average minimum and maximum temperature.

2.1.1 Dynamic nature of arid lands

The Silverton Wind Farm is located in the arid zone, where the climate is noted not only for low average rainfall, but high variability in rainfall between years. Extended drought periods are interspersed by rainfall events of varying magnitude, stimulating the growth of flora from dormant seedbanks. Large infrequent rainfall events also provide cues for the recruitment of long-lived perennial plants through flushes of biomass, fruits and seeds (Keith & Tozer 2012). This increased plant growth also triggers population increases in associated fauna species, as resources become abundant.

This inherent variability makes it difficult to detect true change resulting from management actions, particularly in the short term. Having climate data at hand will assist in monitoring the interrelatedness of seasonal weather events and management activities.

2.2 Monitoring sites within PGSW

Twenty stratified survey sites (quadrats and associated subplots) have been established and permanently marked within the three known variants of the community, according to area of the variant and proximity to an established goat proof fence (Biosis 2020a) (Figure 2).

In accordance with the NSW vegetation survey standards (Sivertsen 2009), each survey site comprises a 20 x 20 metre quadrat, with woody stems recorded in an associated 0.1 hectare plot. To measure fine scale responses, additional 5 x 5 metre subplots have also been established using the same south-west (SW) corner as the 20 x 20 metre quadrat. The quadrat location was recorded in the SW corner, and the quadrat was aligned with two sides from the SW corner following magnetic north and east. This plot layout is shown in Figure 3.

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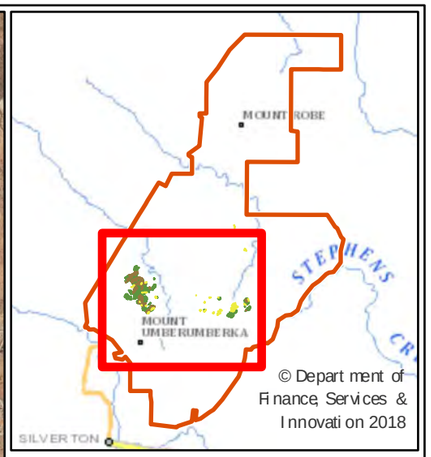
Wrangee Road

2.2

2.3



Legend

- Study area
- Infrastructure
- Infrastructure with PGSW downslope
- Goat fencing
- Turbine
- Vegetation monitoring site
- O&M building

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 2.1 Location of permanent vegetation monitoring sites - Overview

0 500 1,000

Metres

Scale 1:37,500 @A3

Coordinate System: GDA 1994 MGA Zone 54

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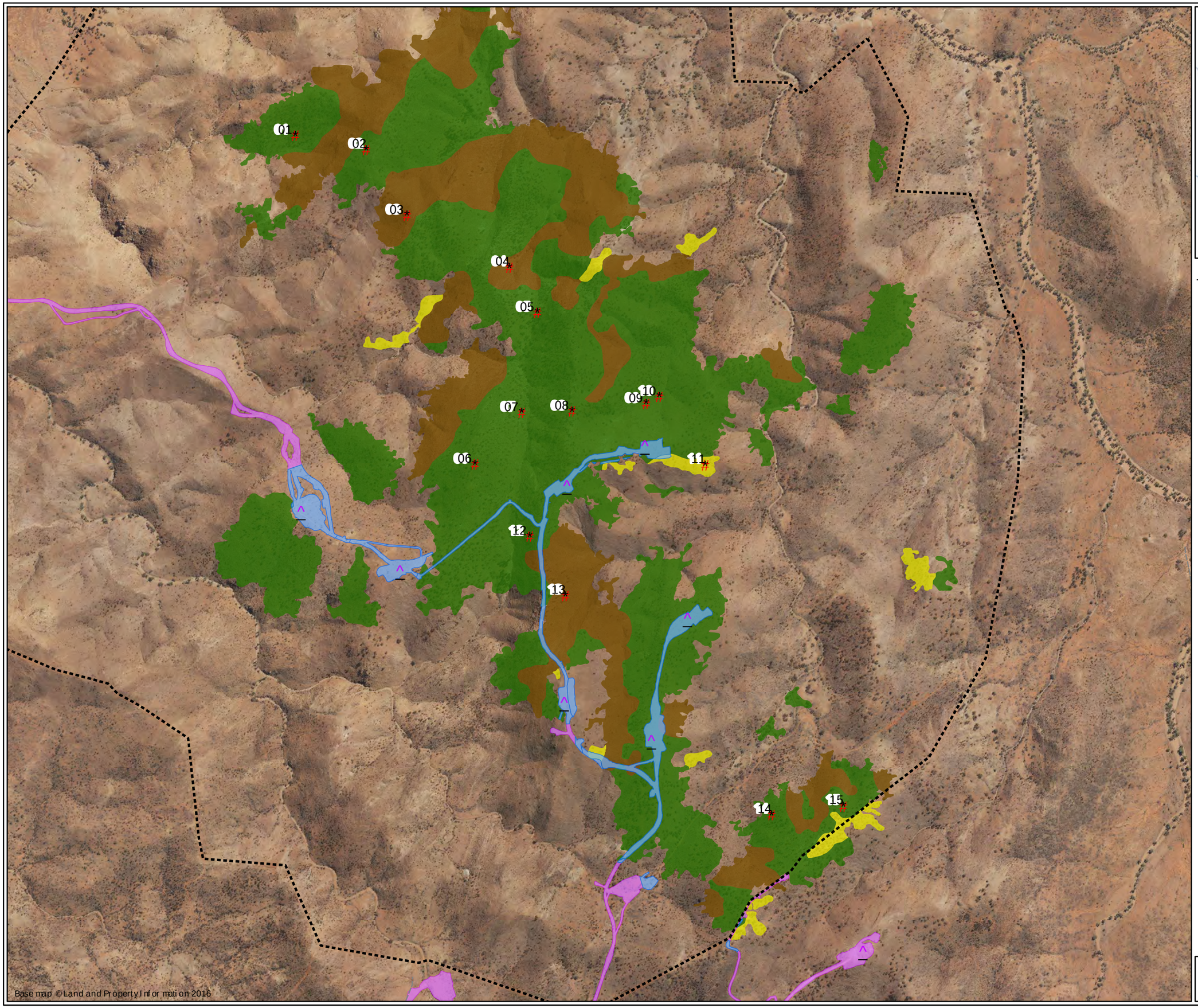
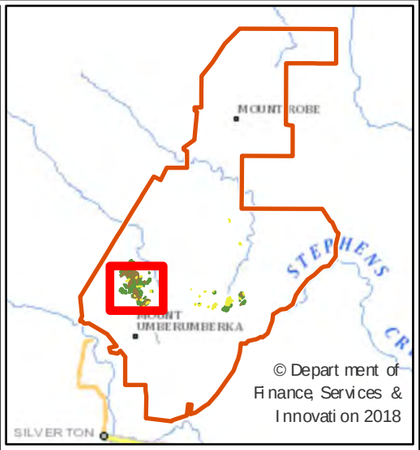
Base map © Land and Property Information 2016





Legend

- Study area
- Infrastructure
- Infrastructure with PGSW downslope
- Goat fencing
- Turbine
- Vegetation monitoring site

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 2.2 Location of permanent vegetation monitoring sites - Goat fence / west

0 500

Metres
Scale 1:12,500 @A3
Coordinate System GDA 1994 MGA Zone 54

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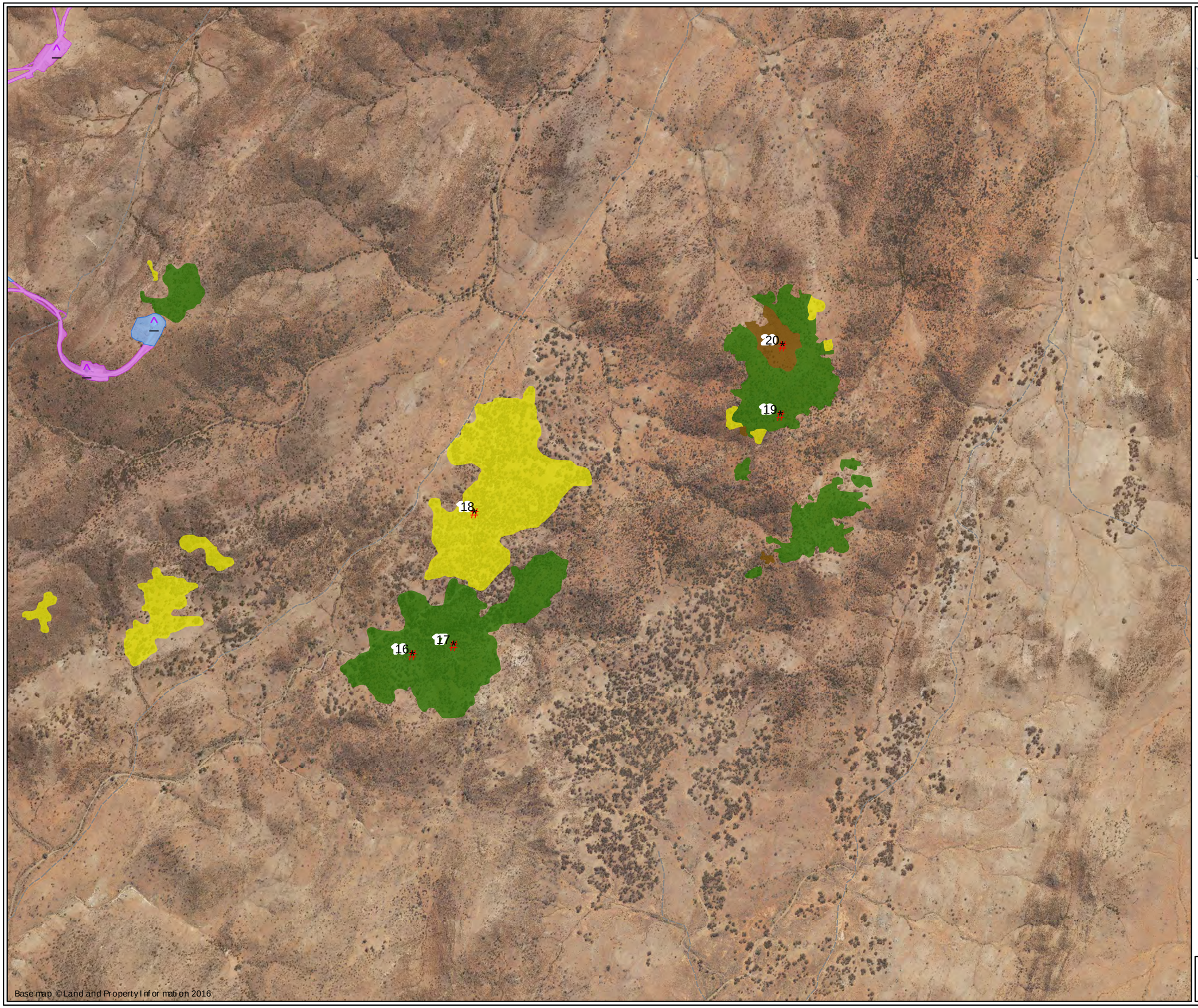

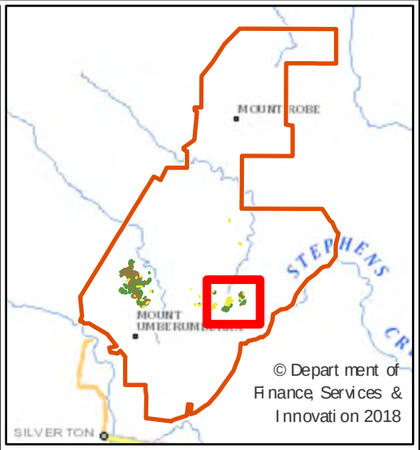

Legend

- Study area
- Infrastructure
- Infrastructure with PGSW downslope
- Turbine
- Vegetation monitoring site

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 2.3 Location of permanent vegetation monitoring sites - outside goat fence / east

0 500

Metres
Scale 1:12,500 @A3
Coordinate System GDA 1994 MGA Zone 54

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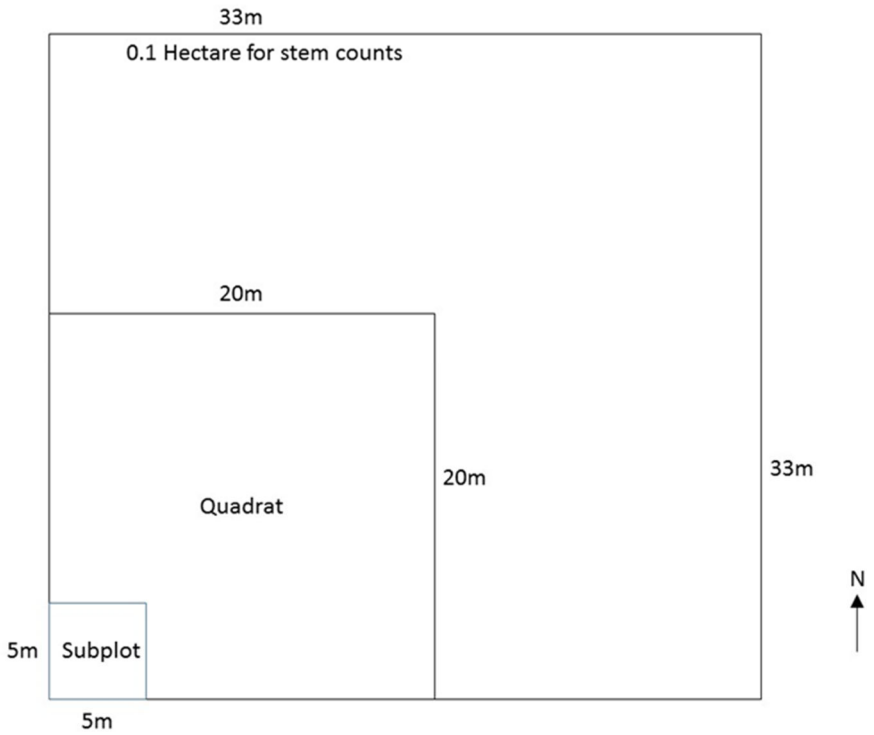

Figure 3 Monitoring plot layout

Field survey was planned to occur in October 2020, however due to COVID-19 restrictions on travel, the survey was delayed. Survey of the monitoring sites was conducted by three qualified botanists (Renée Woodward, Georgina Zacks and Jane Kenny) between the 1 and 5 December 2020.

The monitoring sites were prepared for survey as follows:

- Prior to commencing survey, site locations, aerial photography and layers identifying existing infrastructure and existing ecological data were loaded into hand held tablet computers running ArcGIS Collector to allow navigation across the wind farm.
- Sites were accessed on foot and by vehicle.
- Where site marking required renewal, sites were remarked by re-drilling into the rock in the SW corner of a site using a hammer drill, into which a ring bolt was attached using epoxy glue. The rock was sprayed with pink spray paint to increase visibility, and a numbered tag was attached to the ring bolt using a cable tie (See Appendix 1).
- ArcGIS collector was used for opportunistic data collection. Quadrat data was collected on paper data sheets and entered into excel on return to the office.

2.3 Photopoint monitoring within PGSW

Photopoints were captured at each site using the following method:

- Site photos were captured with reference to the 2018 and 2019 photo set using the Open Camera Application on the hand held tablet. Cameras were set to a suitable resolution, and geotagging function turned on so all photos have associated coordinates.
- Camera date and time was checked for accuracy and 'time stamp' function was turned on.

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- On arriving at the survey site, Open Camera was started and given time to calibrate to the survey location to ensure accuracy of geotagged co-ordinates.
- A minimum of 12 site photos were captured as follows:
  - Photo of the site tag.
  - From the SW corner (including the corner in image), a portrait and a landscape photo was captured at bearings 0, 45 and 90 degrees.
  - From both the NE corner (including the corner in image), a portrait and a landscape photo was captured at bearings 270, 225 and 180 degrees.
- Field photos have the following requirements:
  - Ensure tapes are placed around the quadrat before taking photos.
  - All strata are to be in view.
  - Step back to ensure corner of the plot is included.
  - Capture ground and sky unless located in a valley and no sky visible.

Any additional photos were also captured as appropriate to capture site condition/species.

2.4 Feral goats

2.4.1 Goat management infrastructure

Exclusion fencing was erected around the majority of the PGSW by leaseholder Blore in May 2014 as part of the Mundi Mundi Conservation Project (Blore 2008), funded by the Total Grazing Pressure Program, Western Local Land Services (LLS). The goat proof fence was erected to temporarily exclude and manage goats for the purposes of protecting PGSW and endangered Barrier Range Dragon. Under the funding agreement, PGSW fencing maintenance is the responsibility of the leaseholder but no timeframes are specified.

2.4.2 Landholder estimates of goat populations

At the time of the vegetation survey, data on the annual goat population over the preceding year have been requested from leaseholders within the project area.

2.4.3 Scat counts

Abundance and grazing activity by herbivores, including goats, are regularly estimated by scat counts. These have been shown to correlate with actual densities of animals in other studies (Russell, Letnic, & Fleming 2011).

Macropod, goat and rabbit scats were counted in all 5 x 5 metre subplots as an approximate measure of herbivore activity. Counts in the ongoing monitoring are of all recent/fresh (black) scats. Counts are absolute, for statistical assessment on a continuous scale (Biosis 2018a). As scats dry rapidly in the arid environment, all scats were removed from the plot in 2019 and 2020 as they were counted to enable reduce the risk of double counting in future years.

The scats of large macropods likely to occur on the site (e.g. Red Kangaroo *Macropus rufus*, Eastern Grey Kangaroo *M. giganteus*, Western Grey Kangaroo *M. fuliginosus* and Euro *M. robustus*) cannot not be reliably differentiated and so the results for these species have been pooled (Russell, Letnic, & Fleming 2011).

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2.4.4 Monitoring of goat presence by GE.

In accordance with the BAMP (Action 2.4), GE conducted monthly monitoring of goat presence within the exclosure at monthly intervals. Surveys are conducted from all turbines within the goat fence (T29-T35) and a count of the number of goats observed from each vantage point was documented.

2.5 Condition of PGSW

Porcupine Grass Sparse Woodland is a distinctive and naturally restricted community first identified by NGH Environmental (2008a) following baseline surveys for the Silverton Wind Farm Project. Given the highly restricted distribution of the community, it was subsequently listed as a critically endangered community (NSW Scientific Committee 2010) under the NSW *Threatened Species Conservation Act 1995* (replaced by the *Biodiversity Conservation Act 2016* (BC Act). This community has been formally assigned to the Plant Community Type (PCT) PCT359: Porcupine Grass - Red Mallee - Gum Coolibah hummock grassland / low sparse woodland on metamorphic ranges on the Barrier Range, Broken Hill Complex Bioregion (OEH 2017a).

As detailed in Section 2.1.3 of the PGSW Recovery Plan (Biosis 2018b), variations in species and structural diversity of PGSW is common in its limited geographic range. The PCTs with which PGSW intergrades do not include the characteristic Red Mallee, Gum Coolabah or Porcupine Grass (OEH 2017a). Therefore, PGSW occurs as:

- Porcupine Grass hummock grassland with key eucalypt species present.
- Porcupine Grass hummock grassland without key eucalypt species present.
- Eucalypt species present without/with minimal Porcupine Grass.

Although the community determination (NSW Scientific Committee 2010) identifies Porcupine Grass as a typical community dominant, areas with a canopy layer dominated by Red Mallee and/or Gum Coolabah located on rocky hills containing (or able to be identified as previously having contained) Porcupine Grass, are considered to be part of the listed threatened community, even if these areas currently do not contain Porcupine Grass (Biosis 2018b).

The following section details the monitoring methods to measure the condition of PGSW over time as required by the BAMP.

2.5.1 Vegetation condition

Vegetation condition (floristics and structure) was measured in the 20 permanent quadrats, each measuring 20 x 20 metres, using a simplified form of the NSW vegetation survey standards (Sivertsen 2009). Abundance of all flora species is recorded in a nested 5 x 5 metre subplot (Section 2.5.3).

The quadrat location is recorded in the SW corner, and the quadrat is aligned with two sides from the SW corner following magnetic north and east (Figure 3). Within the 20 x 20 metre quadrats (30 x 30 metre for woody stem sizes), the following variables were recorded:

- Structure of vegetation (vegetation strata type, height, dominant species and percent cover of strata), including percent cover of litter, cryptograms, rock and bare ground.
- Projective Foliage Cover (PFC) of all plant species assessed as a relative percentage cover.
- Lineal metres of coarse woody debris (CWD) >10 centimetres diameter.
- Woody stem sizes (within the 30 x 30 metre quadrat).

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- Tree health (observations of canopy intactness, insect damage, mistletoe load, epicormic/lignotuber growth etc.).
- Whether regeneration is observed for each woody species.
- Disturbance notes.

A reference specimen has been collected for all plant species where sufficient material was available.

2.5.2 Grazing pressure

Woody species occur in low abundance within the community. Therefore the assessment of all woody individuals (greater than 30 centimetres height) within the 20 x 20 metre quadrats has been undertaken through an adaptation of the method used by AREA Environmental Consultants and Communication to assess the browsing impacts of goats in Mutawintji NP (AREA 2017). This method is provided in Appendix 2.

In 2020, a waypoint was recorded for each woody individual within the 20 x 20 metre quadrat. For all woody species (greater than 30 centimetres height) the following has been documented:

- Height, width at widest point, height of browse line (the boundary between upper normal plant growth and lower stripped and eaten-back growth that indicates the height reached in feeding by the larger browsers) for plants > 2 metres tall
- Condition above browse line:
  - Good = No dead wood.
  - Dead Wood Fair = Trees with <50% dead wood.
  - Dead Wood Poor = Trees with >50% dead wood.
- Condition below browse line including all plants less than 2 metres in height:
  - Unbrowsed.
  - Low-Moderate browsing.
  - High-Intense browsing.
- Totally browsed (no living growth below browse line).
- Canopy condition/evidence of dieback (No evidence, branchlets dead, small branches dead, main branches dead, dead individual).

A condition state of each woody plant to show the current browse state:

- **Uninterrupted** - Fresh new growth with no or very little sign of browsing. Plant growing periodically in relation to natural growth stimuli (rainfall and temperature).
- **Arrested** - Plant in hedged or topiarised form due to intense browsing. New growth continuously eaten and not extending beyond previous browse levels preventing the plant from growing to its natural potential.
- **Retrogressed** - Death of all or some stems previously browsed with new growth occurring from the lower stems. Stem death arises from stresses induced by browse.
- **Released** - New growth from browsed stem not browsed due to temporary or permanent relaxation of browse pressure or plant grown beyond browse line.

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2.5.3 Finer scale responses

Nesting of additional smaller subplots is required for measuring fine scale responses of annual plant abundance, which will improve the ability to identify individual species responses to management actions and climatic conditions.

Twenty 5 x 5 metre subplots have been established, using the same SW corner as the 20 x 20 metre quadrats (Figure 3). Within these subplots, absolute abundances of all flora species were recorded.

In 2020, more detailed counts of Porcupine Grass were also documented, being the number of resprouting adults, dead adults and new recruits within the 5x5 metre subplot.

2.5.4 Palatability of plant species

In their review of the 2018 and 2019 vegetation monitoring reports, BCD requested that future reports provide an assessment of whether each species is likely to increase or decrease with herbivore grazing, following Lunt et al. (2007). Given the number of additional species documented in 2020, Biosis are in the process of collating available knowledge of species palatability. Therefore this additional requested assessment will be provided in the 2021 vegetation monitoring report.

2.6 Disturbance areas of the Wind Farm

Alana Philp (GE) notified Biosis on 17 August 2020 that there had been > 25 millimetres of rain recorded on site in the previous week at Silverton Wind Farm. This aligns with cumulative rainfall of 24.2 millimetres at Broken Hill Airport between 7 August and 16 August 2020. Therefore monitoring following a significant rainfall event was triggered. As handover from CATCON had not yet occurred, this is the first audit conducted by Biosis of the condition of construction disturbance, which will be used to inform on-going management of these areas.

A field survey was due to commence on 21 September 2020. However, another significant rainfall event on Saturday 19 September resulted in widespread flash flooding across the north west of New South Wales, with 32.6 millimetres of rain recorded in the 24 hours to 9am on Sunday 20 September (being a second significant rainfall event). Therefore the survey was delayed by one day to ensure roads were open and safe to traverse to and within the site. It was necessary to modify staffing to ensure survey could occur at the appropriate times whilst ensuring accordance with COVID travel restrictions.

A field investigation of the site was undertaken from 22 to 26 September by Dr Caragh Heenan (Project Zoologist with arid zone experience) and Matilda Terry (Research Assistant). A subsequent survey was conducted on the 27-28 October and 30 October -1 November (being 12 weeks following the August event) by and one month following the September rain event, and a final survey was completed on 15-17 December 2020 (three months following the September event). The second two surveys were conducted by Georgina Zacks (Botanist) and Matilda Terry (Research Assistant).

Survey was prioritised as follows:

1. All areas of disturbance above (upslope of) Porcupine Grass Sparse Woodland (PGSW).
2. The site main road in to the Operations and Maintenance building (due to higher traffic volumes and potential for weed introduction further into site).
3. Rehabilitated areas.
4. Turbine hardstands.
5. Roadsides.

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While the areas above PGSW were inspected entirely, it was necessary to subsample across items 2 to 5 to ensure adequate spatial and topographic coverage of the windfarm, as well as the diversity of disturbance types (Figure 4). These areas were assessed for incursions of introduced species, erosion and the success of rehabilitation measures.

During the December survey, two traverses following creeklines were also undertaken to document introduced species within the PGSW community. These traverses provide additional insight into the distribution and abundance of weeds in the PGSW community resulting from long-term grazing in the region.

Locations of populations of introduced species observed during ongoing site management by GE operational staff, or during ecological monitoring programs are to be provided to the Project Ecologist who will map them in the annual vegetation monitoring report and shapefiles will be provided for inclusion in an annual weed management program.

2.7 Introduced flora species of the Wind Farm

As outlined in the 2019 vegetation monitoring report (Biosis 2020b), environmental 'close out' information from CATCON associated with the construction of the wind farm was being finalised. Provisional Facility Practical Completion was achieved on the 27 October 2020. CATCON provided written confirmation to AGL that all rehabilitation actions required during the construction phase of the project were complete, however no reporting of pre or post construction conditions at close out was provided to Biosis.

Following handover of management from CATCON, GE are responsible for monitoring and subsequent management of introduced weed species focussing on three key areas:

- Existing weed populations (No spatial data was able to be provided by previous consultants).
- Areas of construction disturbance.
- Opportunistic observations of new populations documented during the monitoring program.

As outlined in the BAMP (Biosis 2018 - Section 6.5.2), inspections of the site will occur twice yearly, including at one and three months following significant rain events (> 25 millimetres) to ensure no new weed incursions have established. The management of weed incursions will be implemented in accordance with the BAMP (Biosis 2018a) and the associated VMP (Biosis 2018e).

2.8 Data analysis

Prior to analysis, field data was collated and reformatted in Microsoft Excel 2016 then tabulated for analysis. Analyses were undertaken in R version 3.5.3 within RStudio version 1.2.1335 focussing on:

- Climatic conditions prior to survey.
- Species composition within the PGSW community.
- Species richness at each site.
- Cover and abundance of introduced and native flora.
- Ground layer responses (vegetation, litter and bare ground, litter).
- Condition of woody species (particularly the condition above and below the browse line if present).
- Natural regeneration.

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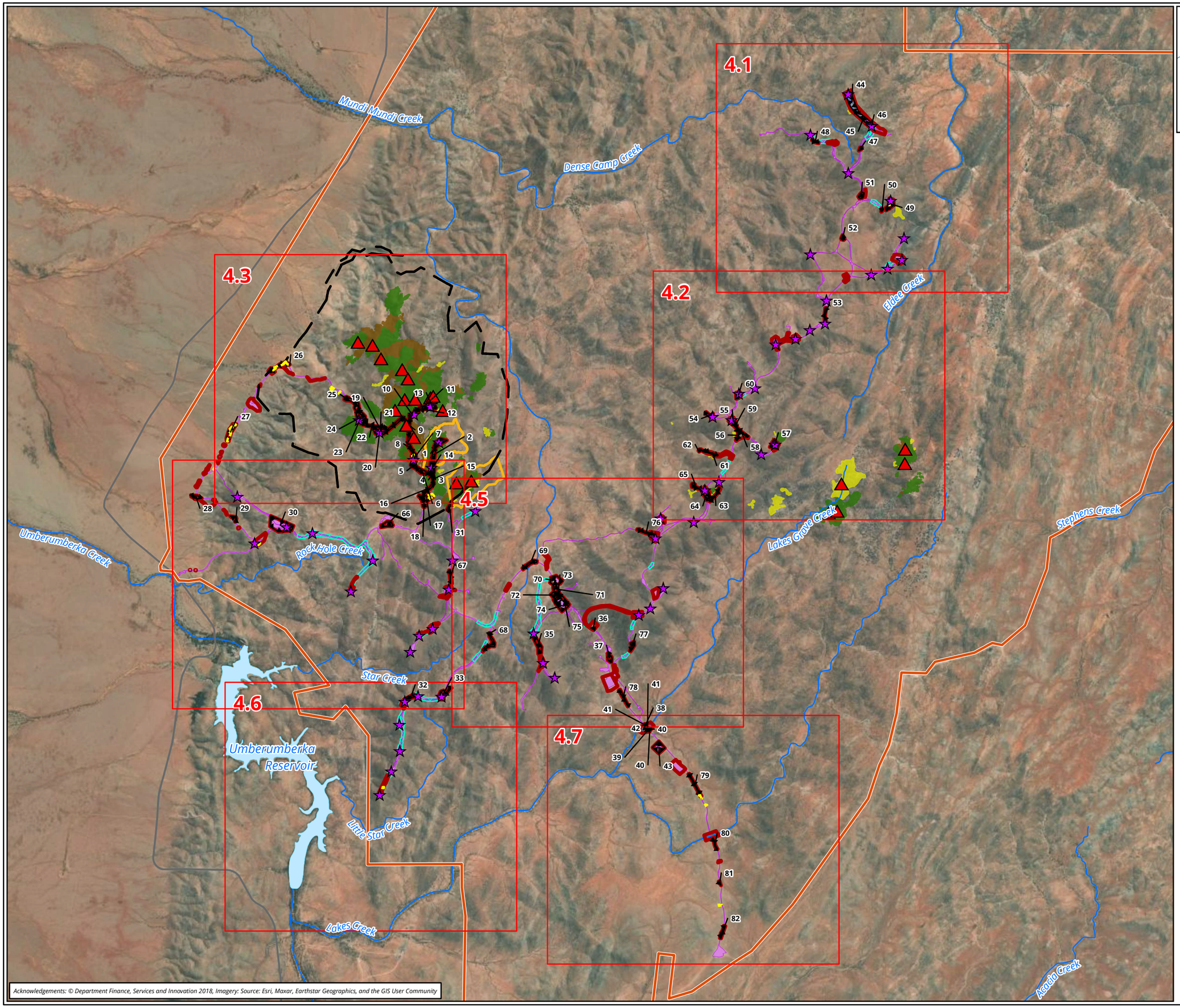
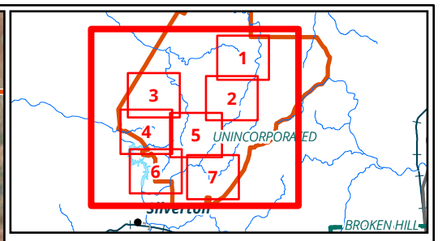
- Targeted analyses to investigate the influence of:
  - Position relative to the goat fence (in or out).
  - Structural variant of PGSW community.
  - Topographic features of survey sites (including slope, aspect and elevation).





Legend

- Silverton Wind Farm boundary
- Goat fence
- Turbine
- Wind farm infrastructure
- Infrastructure with PGSW downslope
- PGSW monitoring site
- Weed monitoring site (numbered)
- Weed survey effort
- Non-mapped disturbance area
- Search of undisturbed PGSW habitat
- Roadside BRD habitat

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 4 Weed survey effort - Overview

0 970 1,940

Metres

N

Scale: 1:60,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 21 July 2021,
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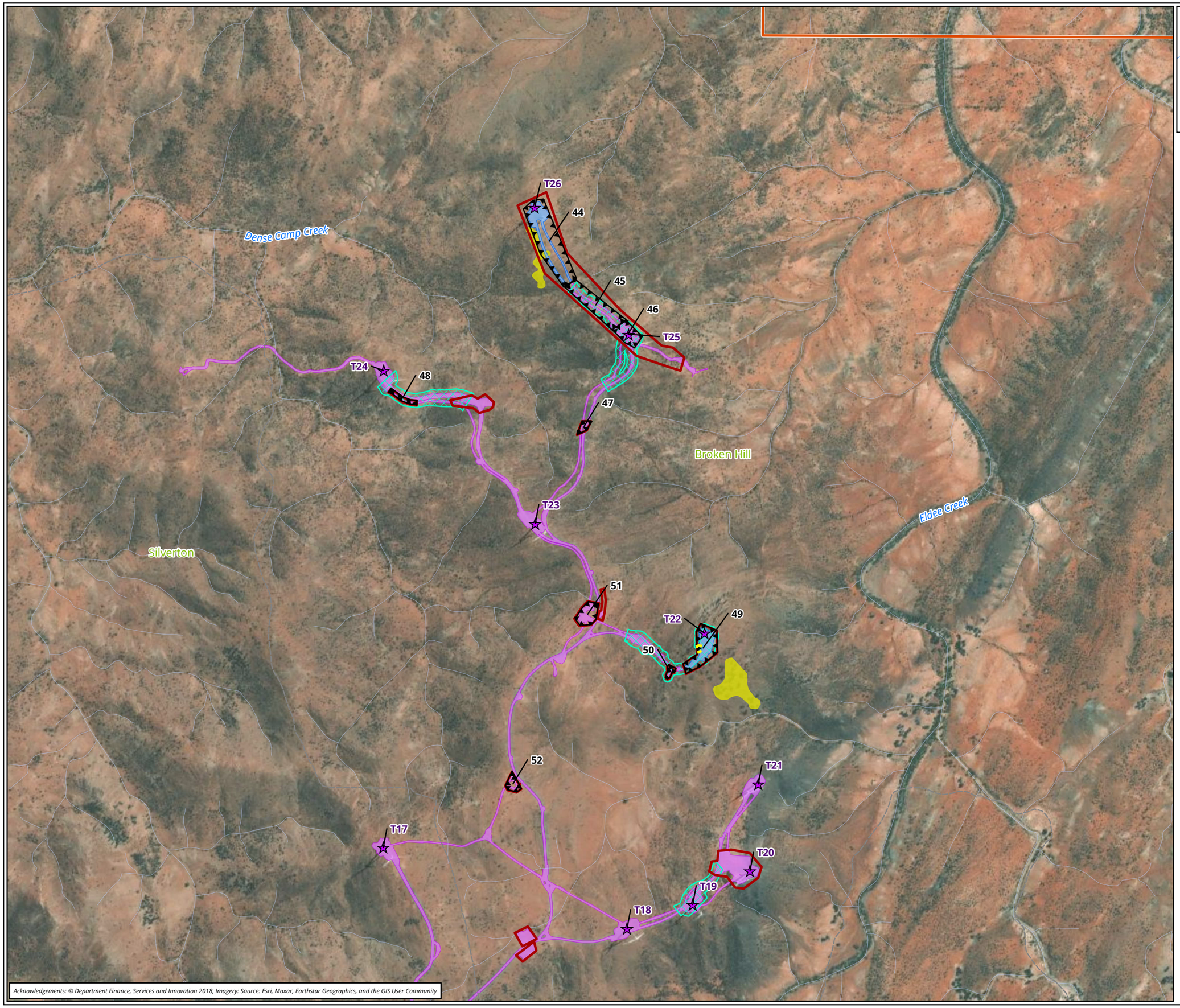

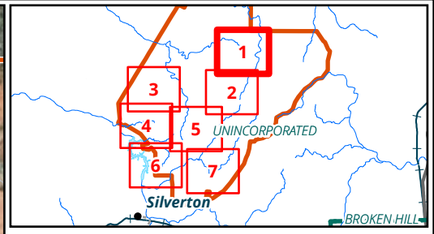

Legend

- Silverton Wind Farm boundary
- Turbine
- Wind farm infrastructure
- Infrastructure with PGSW downslope
- Weed monitoring site
- Weed survey effort
- Non-mapped disturbance area
- Roadside BRD habitat

PGSW structural variants

- Eucalypts only

Figure 4.1 Weed survey effort

0 250 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 21 July 2021,
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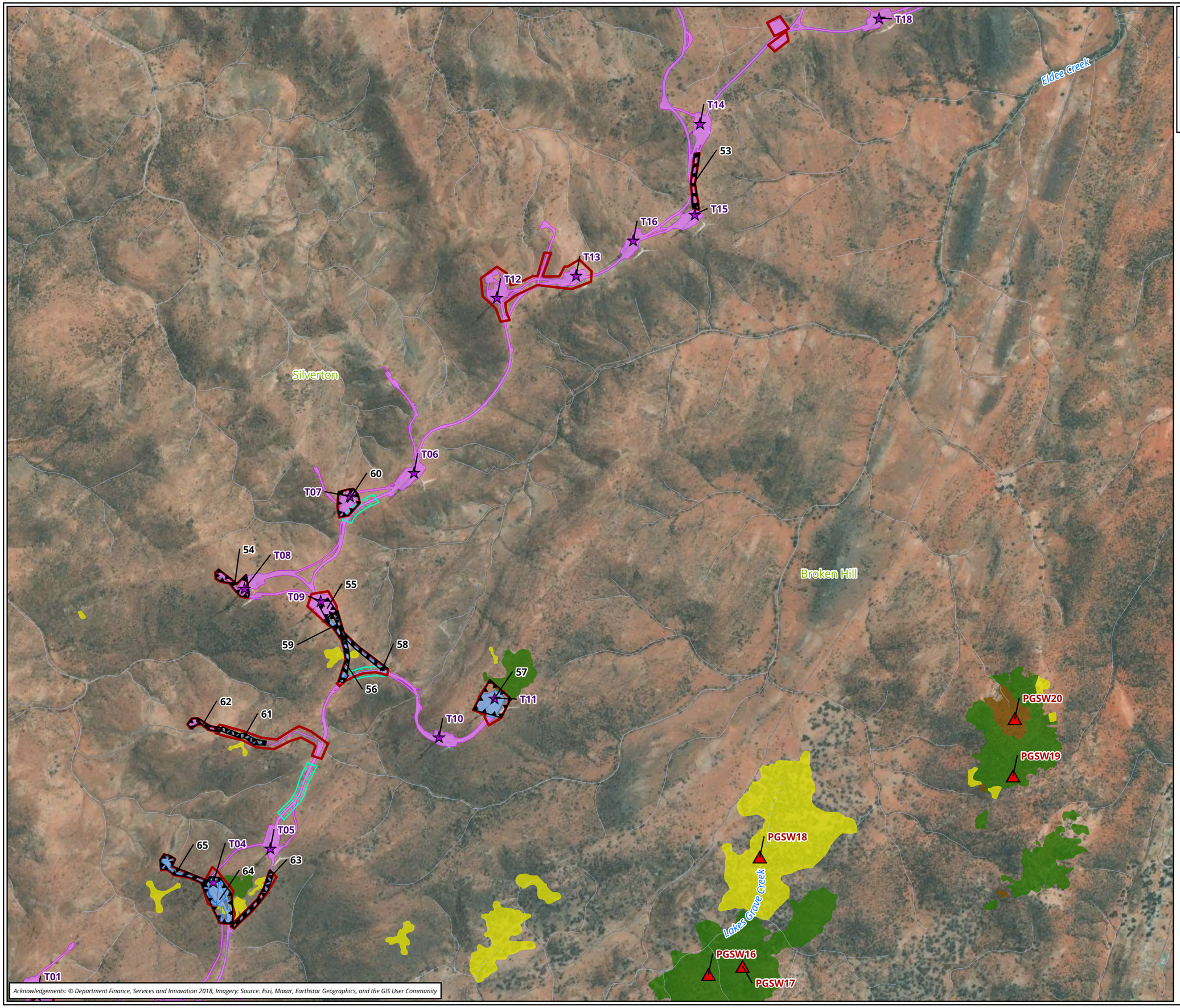

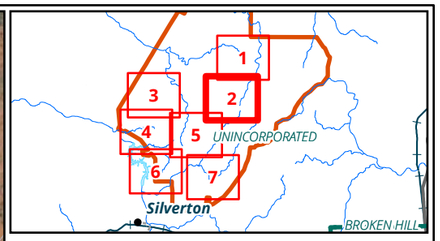

Legend

- Silverton Wind Farm boundary
- Turbine
- Wind farm infrastructure
- Infrastructure with PGSW downslope
- PGSW monitoring site
- Weed monitoring site
- Weed survey effort
- Roadside BRD habitat

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 4.2 Weed survey effort

0 250 500
Metres

N

Scale: 1:15,000 @ A3
Coordinate System: GDA 1994 MGA Zone 54

biosis

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Date: 21 July 2021,
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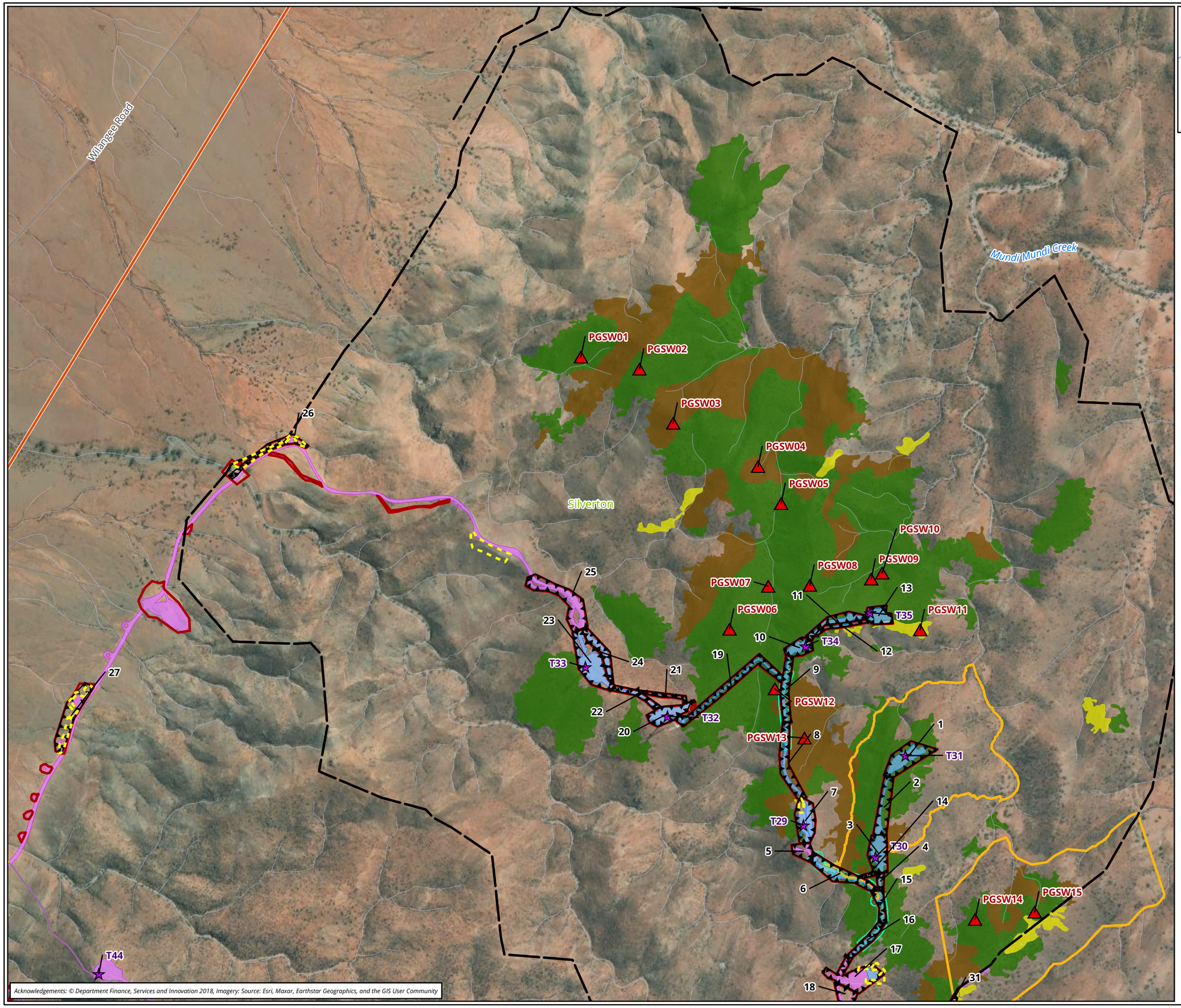

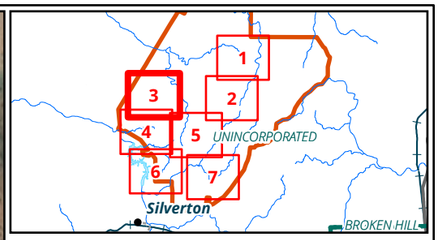

Legend

- Silverton Wind Farm boundary
- Goat fence
- Turbine
- Wind farm infrastructure
- Infrastructure with PGSW downslope
- PGSW monitoring site
- Weed monitoring site
- Weed survey effort
- Non-mapped disturbance area
- Search of undisturbed PGSW habitat
- Roadside BRD habitat

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 4.3 Weed survey effort

0 250 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

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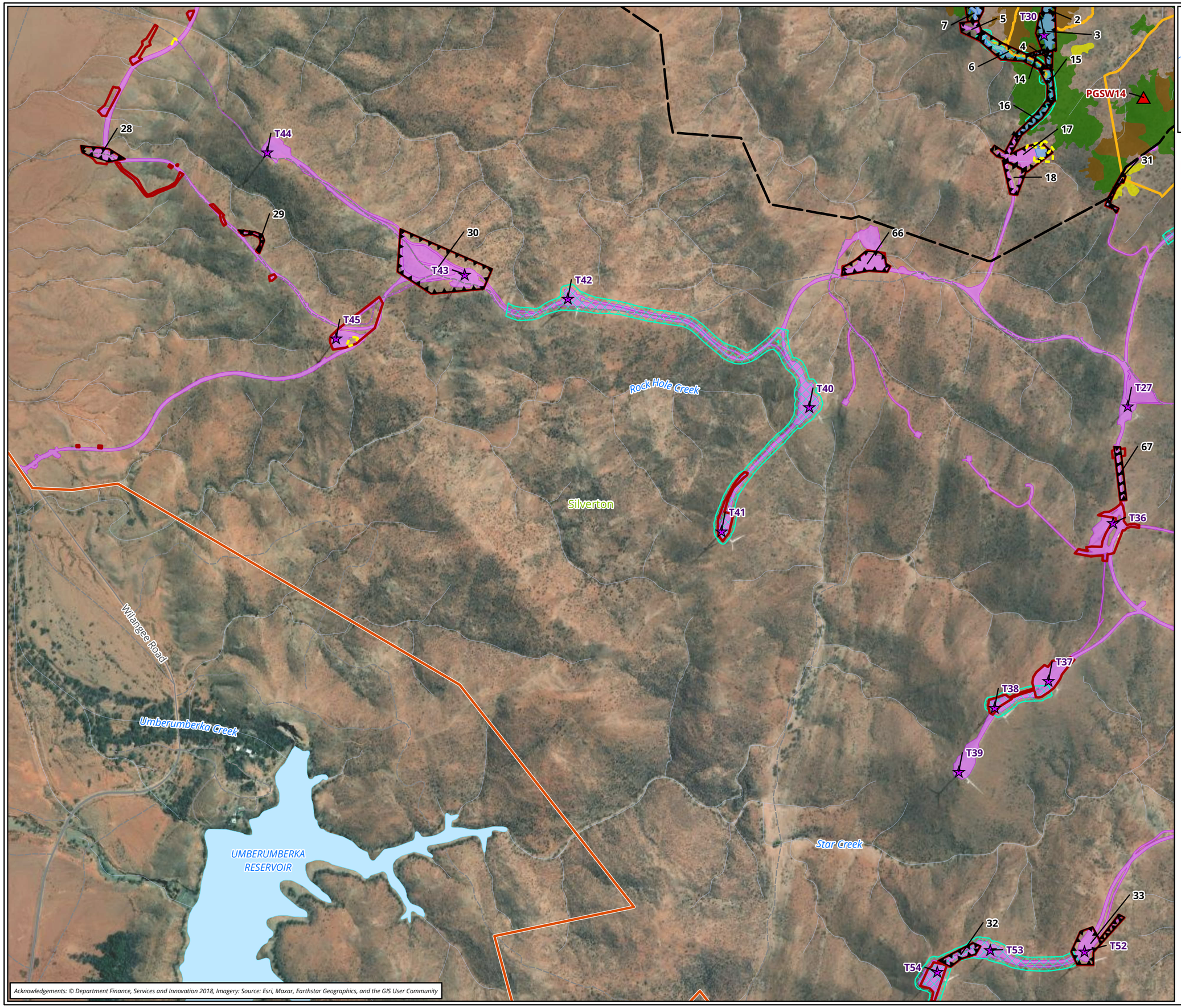

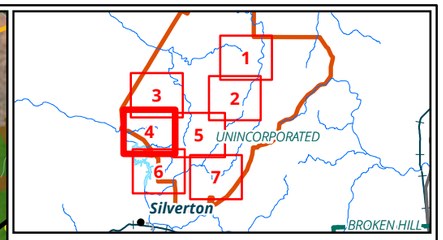

Legend

- Silverton Wind Farm boundary
- Goat fence
- Turbine
- Wind farm infrastructure
- Infrastructure with PGSW downslope
- PGSW monitoring site
- Weed monitoring site
- Weed survey effort
- Non-mapped disturbance area
- Search of undisturbed PGSW habitat
- Roadside BRD habitat

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 4.4 Weed survey effort

0 250 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

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Date: 21 July 2021,
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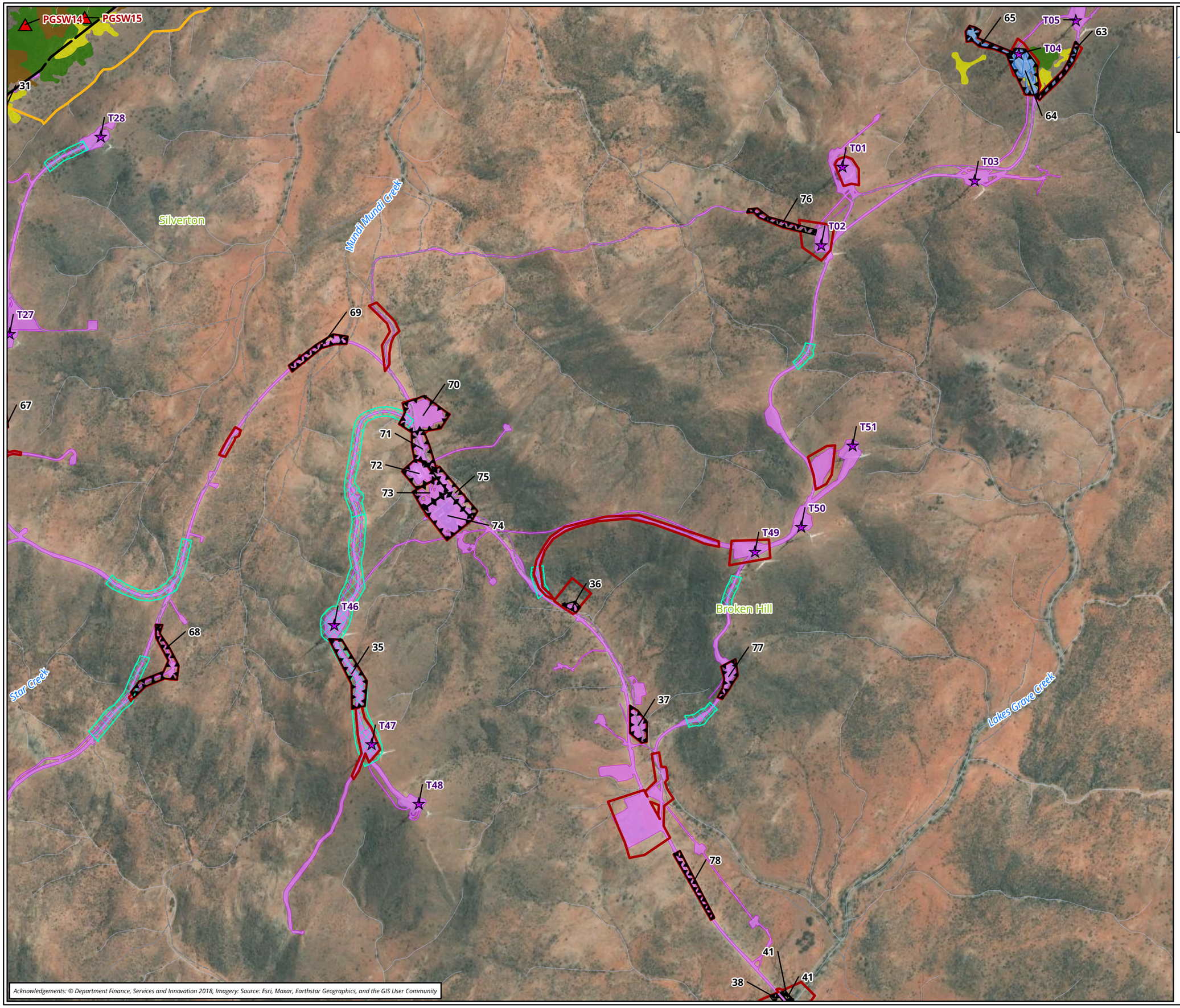

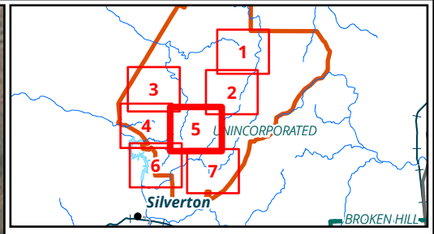

Legend

- Silverton Wind Farm boundary
- Goat fence
- Turbine
- Wind farm infrastructure
- Infrastructure with PGSW downslope
- PGSW monitoring site
- Weed monitoring site
- Weed survey effort
- Search of undisturbed PGSW habitat
- Roadside BRD habitat

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 4.5 Weed survey effort

0 250 500
Metres

N

Scale: 1:15,000 @ A3
Coordinate System: GDA 1994 MGA Zone 54

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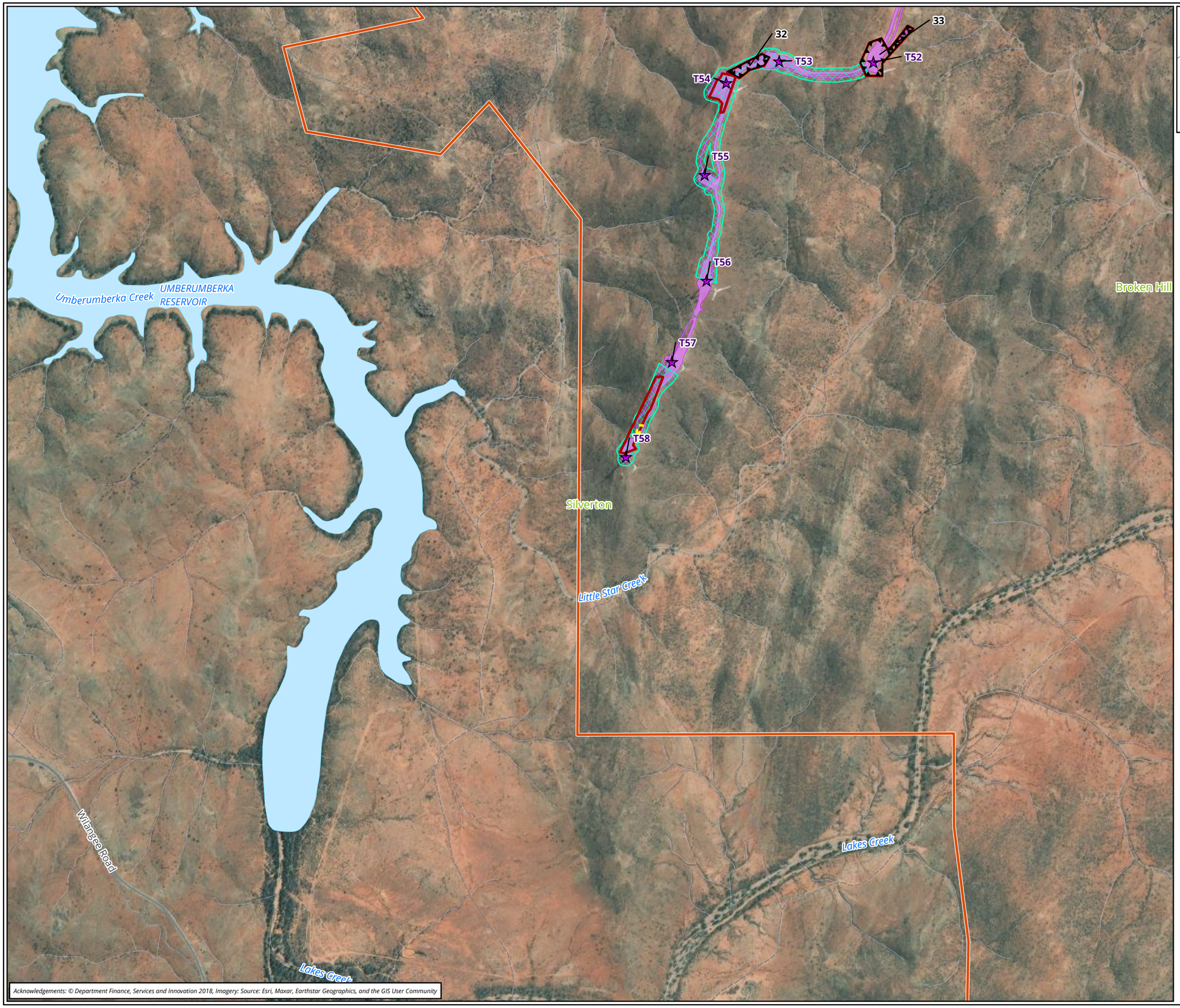

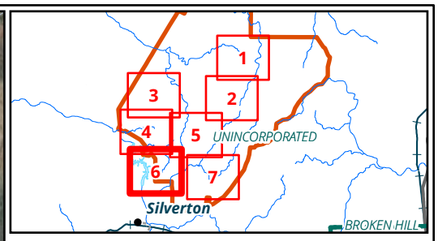

Legend

- Silverton Wind Farm boundary
- Turbine
- Wind farm infrastructure
- Weed monitoring site
- Weed survey effort
- Non-mapped disturbance area
- Roadside BRD habitat

Figure 4.6 Weed survey effort

0 250 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 21 July 2021,
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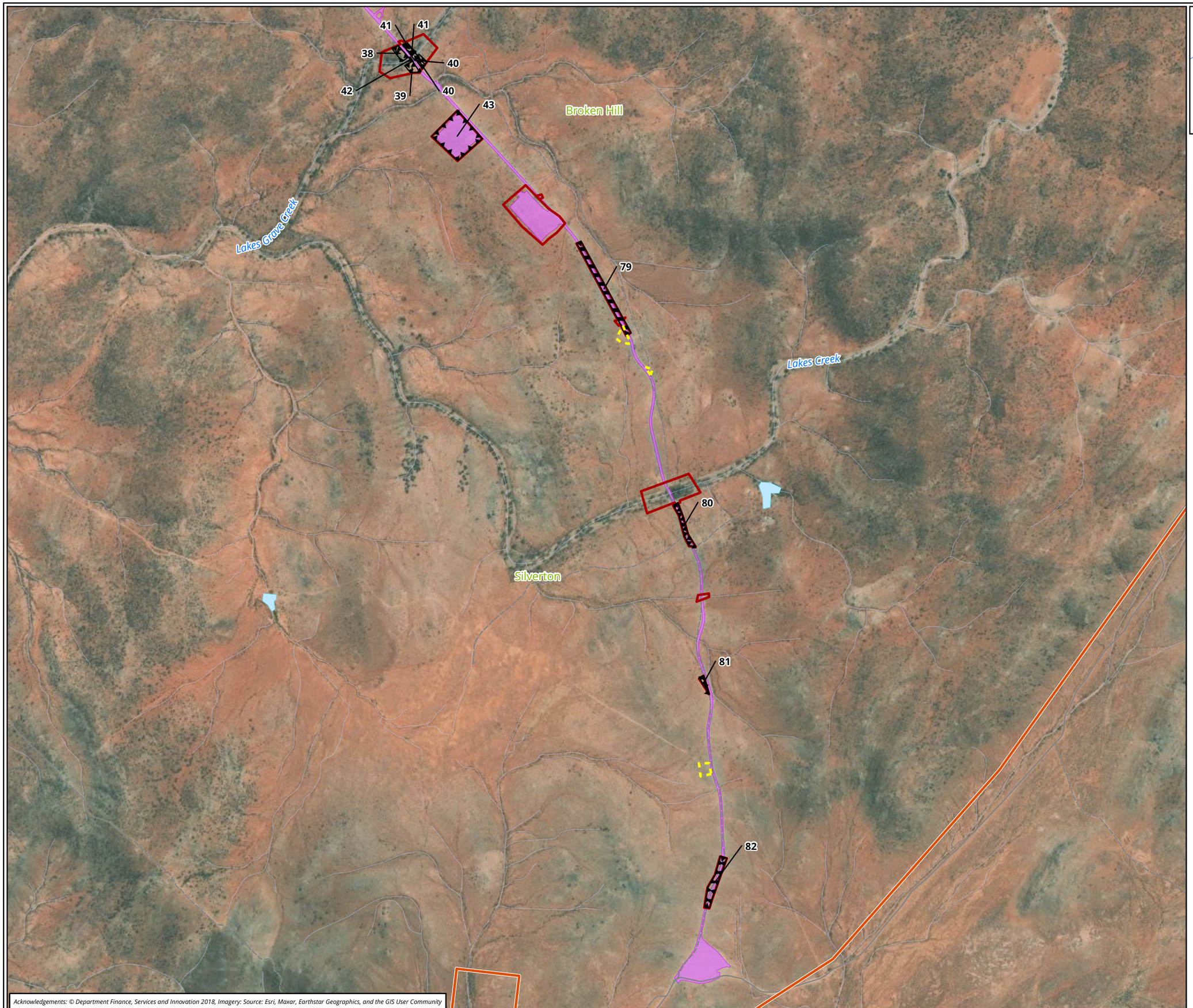

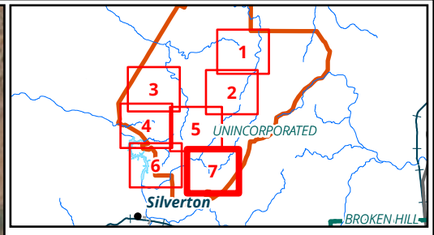

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Weed monitoring site
- Weed survey effort
- Non-mapped disturbance area

Figure 4.7 Weed survey effort

0 250 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

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2.9 Mapping

Mapping was conducted using hand-held GPS-enabled tablets and aerial photo interpretation. The accuracy of this mapping is therefore subject to the accuracy of the tablets (generally ± 7 metres) and dependent on the limitations of aerial photo rectification and registration.

Mapping has been produced using a Geographic Information System (GIS). Electronic GIS files which contain our flora spatial data are available to incorporate into GE mapping projects informing ongoing management of the site.

2.10 Limitations

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are a number of reasons why not all species will be detected at a site during survey, such as low abundance, patchy distribution, species dormancy, seasonal conditions, and migration and breeding behaviours. In many cases these factors do not present a significant limitation to assessing the overall biodiversity values of a site.

The current monitoring was conducted in spring during an extended drought, which is not an optimal time for survey. Although there has been two significant rainfall events prior to the current survey of PGSW, a lack of subsequent rainfall means that the district is still considered drought affected. This meant that many individuals had already desiccated or failed to reach reproductive maturity at the time of the PGSW survey. Therefore some species could not be identified. Field notes and specimens of these species were captured where possible, which may allow some back identification into the 2020 dataset following subsequent surveys.

Although two rainfall events occurred prior to the 2020 survey, conditions remained dry overall, with the region still drought affected (Section 3.1). Therefore, species diversity and abundance is expected to be greater than previous years, but may be lower relative to any survey conducted following average annual or greater rainfall.

3. Results

3.1 Pre-survey climate

In the year prior to the survey in December 2020, total rainfall in the pre-survey 12 month period was 126 millimetres, slightly greater than that in the year prior to the 2019 monitoring (123.2 millimetres) and 2018 monitoring (73.0 millimetres), but still well below the long term mean of 247.7 millimetres. Therefore the region was still classified as drought affected.

However, there were two significant rainfall events in August and September 2020, with the September event causing localised flash flooding in the district. These events saw higher than average rainfall totals for those months (Figure 5). Although these significant falls were supplemented by a higher number of rain days through that period Figure 6, other falls were small in magnitude and rainfall totals for the remainder of the period were lower than average.

The highest daily temperature in the year prior to the monitoring was 46.3 degrees Celsius on 16 December 2019 Figure 7, being the highest temperature on record at that weather station. The average maximum temperature (35.4) was higher than the long term average (31.6) and the previously two years (32.2 and 34.6 respectively). Otherwise, average monthly temperatures did not vary greatly from the long-term average Figure 8.

Biosis ecologists were on-site between 11 and 13 December 2017 to map and validate the full extent of PGSW (Biosis 2018b) (Photo 1). While the far west was already in drought in 2017 (annual rainfall in 2017 was 108.6 millimetres), the impact of the ongoing dry conditions on PGSW from 2018 to 2020 (Photo 2-Photo 4) is evident in a photographic comparison over the survey period (first photograph not from the same location as subsequent photos, which were taken with a similar landscape view). The poor condition of Porcupine Grass tussocks has increased its vulnerability to collapse, particularly following trampling by goats or macropods (Photo 3). In 2020, although the eucalypt canopy has recovered at this site, it appeared that many of the now grey Porcupine Grass tussocks have died, with patchy resprouting evident in some individuals (Photo 4).

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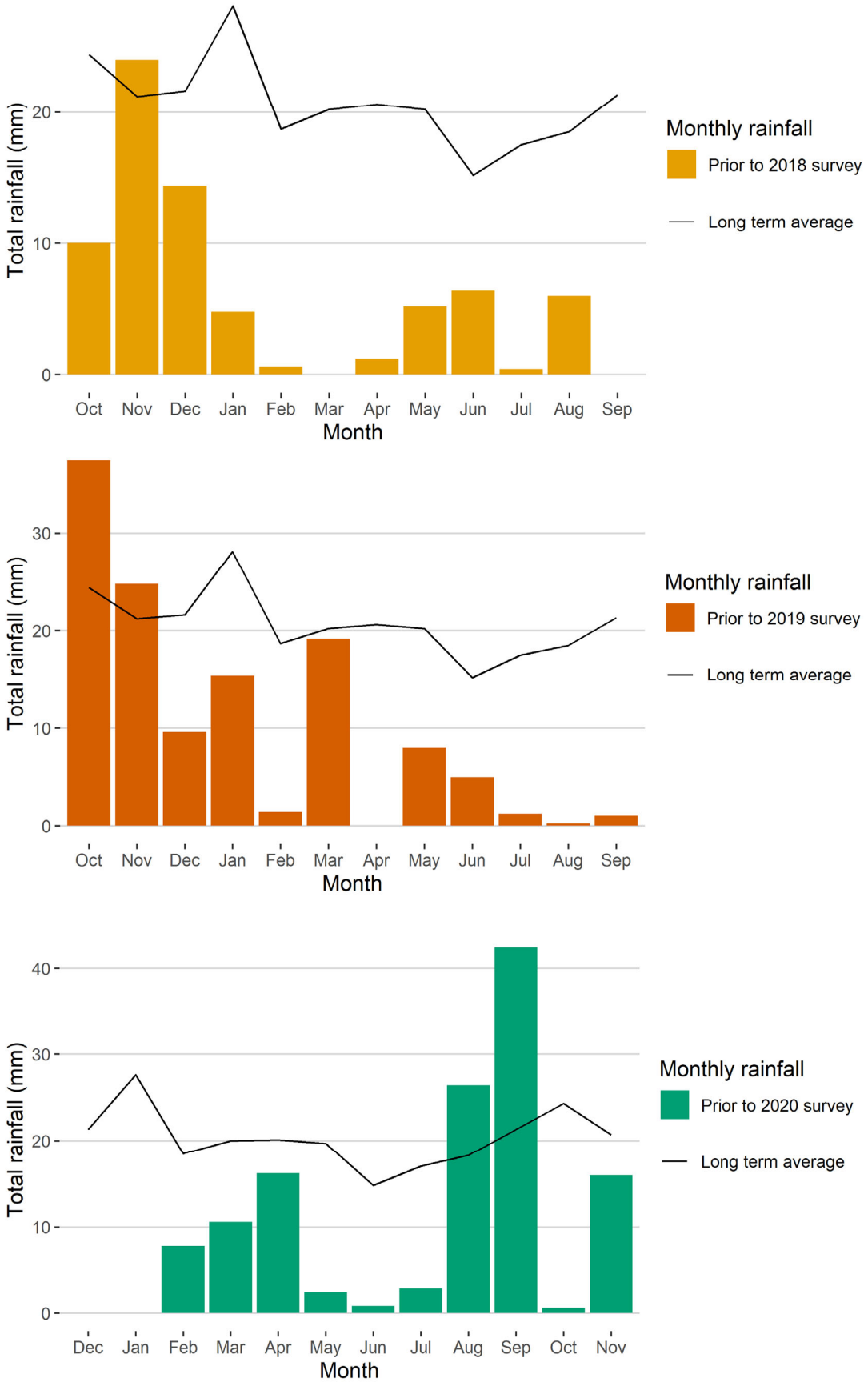


Figure 5 Monthly rainfall totals in the year prior to each survey (Note: difference in months on x-axis due to COVID delayed survey in 2020)

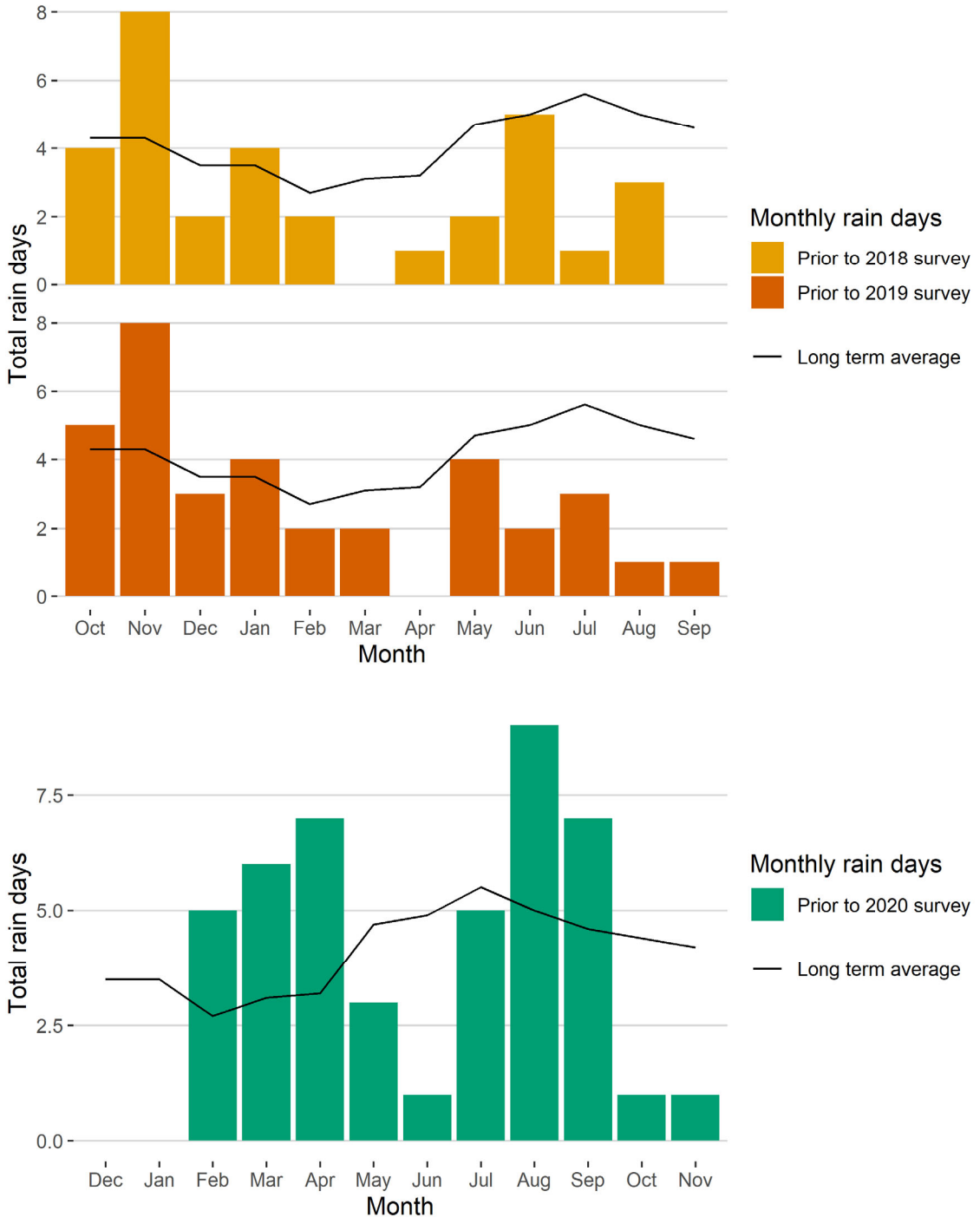


Figure 6 Monthly rain days in the year prior to each survey
(Note: difference in months on x-axis due to COVID delayed survey in 2020)

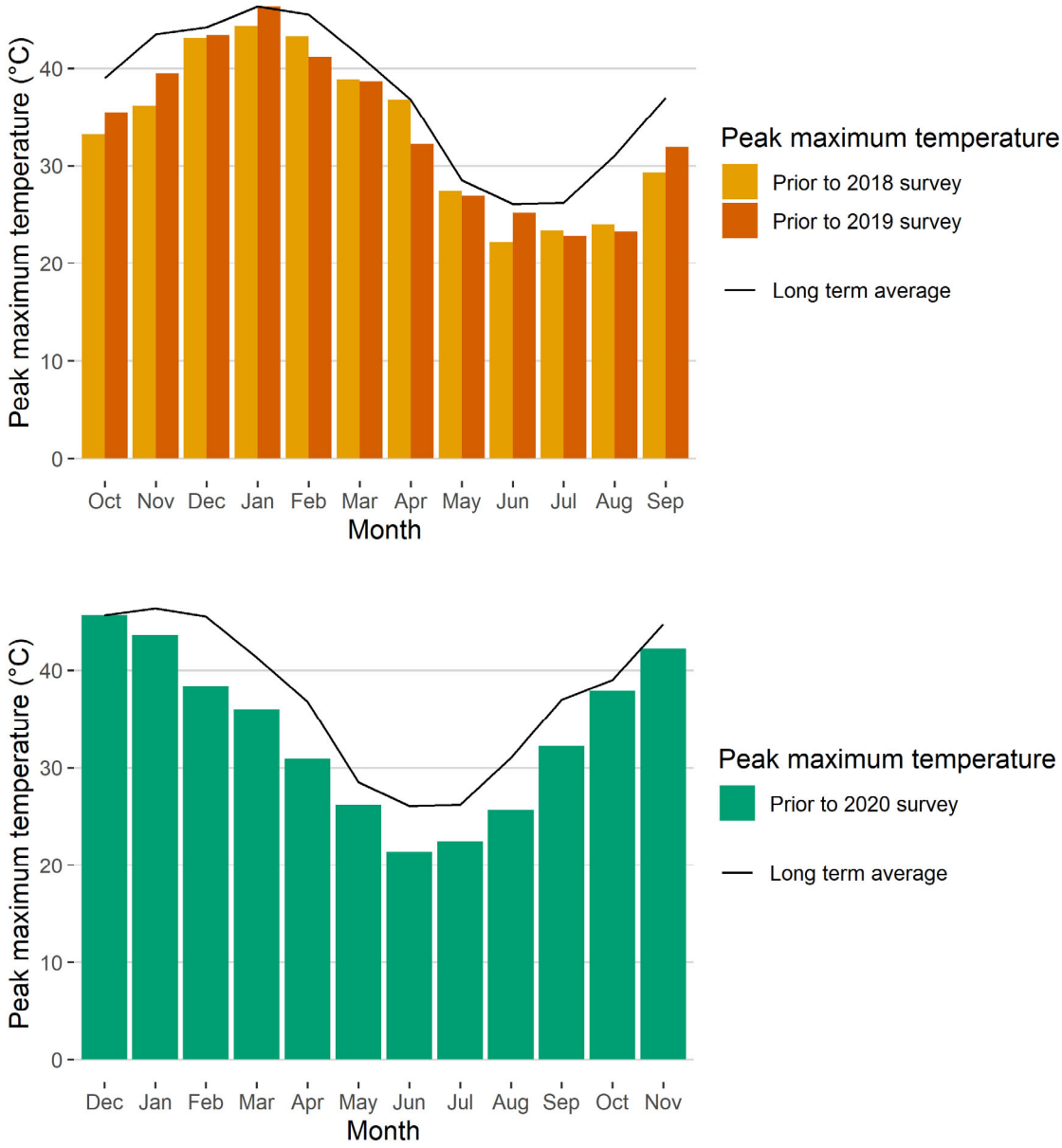


Figure 7 Monthly maximum temperature (peak) in the year prior to survey (Note: difference in months on x-axis due to COVID delayed survey in 2020)

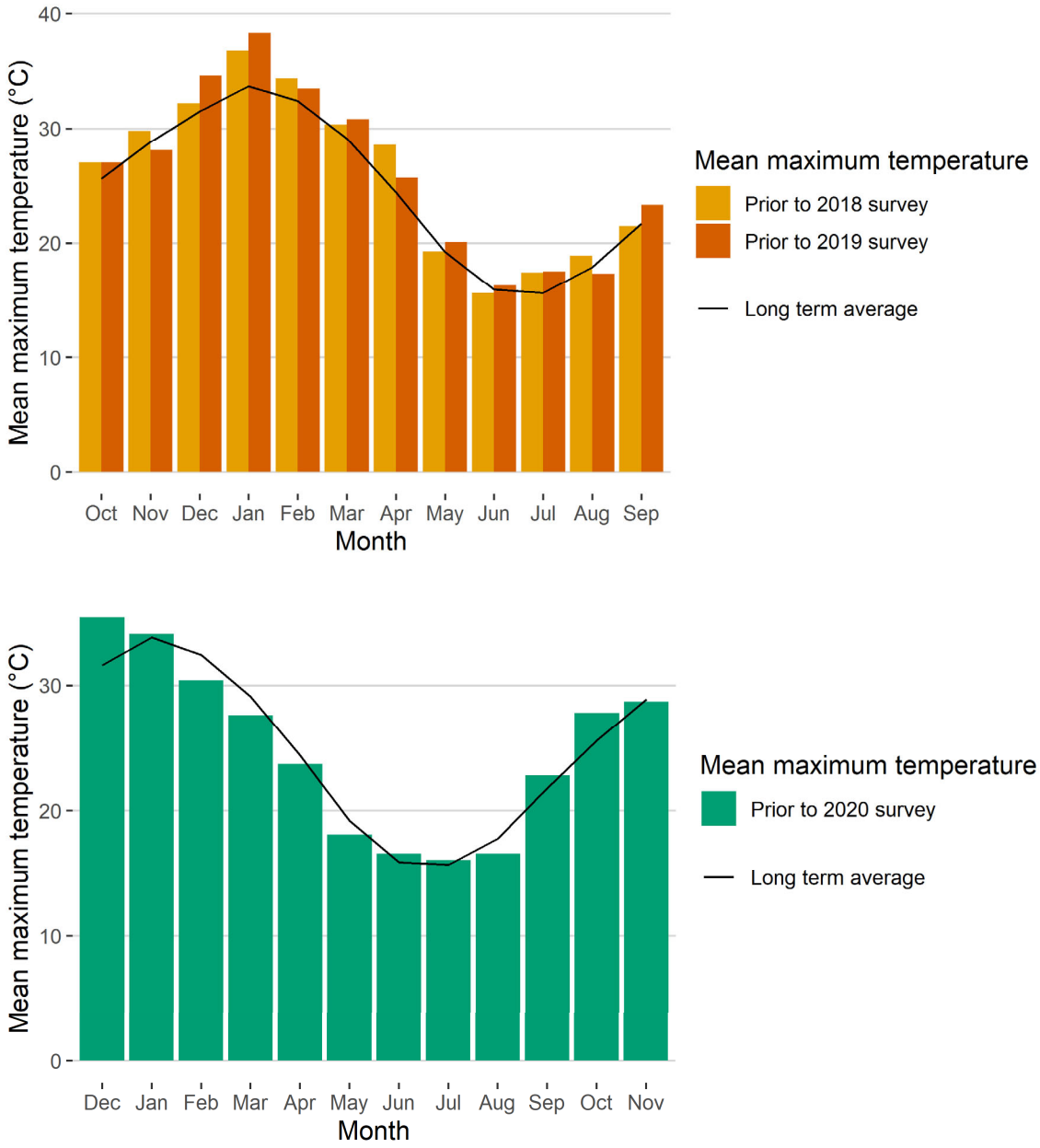


Figure 8 Mean monthly maximum temperature in the year prior to survey (Note: difference in months on x-axis due to COVID delayed survey in 2020)

Photo 1 Condition of PGSW during mapping of the community, 13 December 2017

Photo 2 Condition of PGSW at the time of baseline survey, 23 October 2018

Photo 3 **Condition of PGSW, 28 October 2019 (year 1 monitoring survey). Note the poor condition of Porcupine Grass tussocks in the foreground.**

Photo 4 **Condition of PGSW, 3 December 2020 (year 2 monitoring survey) Note that while some Porcupine Grass tussocks have resprouted and Gum Coolibah *Eucalyptus intertexta* has new growth following the rain event, many Porcupine Grass tussocks appear dead.**

3.2 Sites assessed in the PGSW

Twenty monitoring plots (Table 3-1 and Figure 2) were established during baseline survey in October 2018. These sites were re-monitored in October 2019. Surveys in 2020 were delayed due to COVID-19 travel restrictions, so were conducted between 1 and 5 December 2020.

Although PGSW06 is located in the Porcupine Grass with eucalypts variant, the above ground parts of the only Red Mallee *Eucalyptus socialis* in the plot died prior to the 2019 survey and had not resprouted in the 2020 survey.

Table 3-1 Location of monitoring plots (GDA94 Zone 54)

Site Number	Community variant	Goat fence*	Zone	Easting	Northing	Elev'n	Aspect	Slope
PGSW01	Porcupine Grass with eucalypts	In	54	521924.2	6485480.2	326	S	21
PGSW02	Porcupine Grass with eucalypts	In	54	522175.9	6485428.3	425	W	16
PGSW03	Porcupine Grass only	In	54	522320.7	6485195.8	414	W	22
PGSW04	Porcupine Grass only	In	54	522685.1	6485009.8	367	NE	36
PGSW05	Porcupine Grass with eucalypts	In	54	522784.2	6484850.5	383	W	17
PGSW06	Porcupine Grass with eucalypts	In	54	522562.6	6484310.6	455	SE	16
PGSW07	Porcupine Grass with eucalypts	In	54	522728.6	6484495.0	371	E	19
PGSW08	Porcupine Grass with eucalypts	In	54	522907.6	6484499.1	411	E	9
PGSW09	Porcupine Grass with eucalypts	In	54	523171.1	6484526.2	338	N	31
PGSW10	Porcupine Grass with eucalypts	In	54	523218.3	6484551.7	322	NE	16
PGSW11	Eucalypts only	In	54	523381.2	6484307.8	357	SE	20
PGSW12	Porcupine Grass with eucalypts	In	54	522757.4	6484054.3	418	W	29
PGSW13	Porcupine Grass only	In	54	522884.2	6483842.9	393	E	23
PGSW14	Porcupine Grass with eucalypts	In	54	523617.0	6483063.6	361	W	17
PGSW15	Porcupine Grass with eucalypts	In	54	523872.6	6483094.8	385	N	16
PGSW16	Porcupine Grass with eucalypts	Out	54	530012.5	6482542.8	323	E	7

Site Number	Community variant	Goat fence*	Zone	Easting	Northing	Elev'n	Aspect	Slope
PGSW17	Porcupine Grass with eucalypts	Out	54	530159.0	6482577.0	327	N	13
PGSW18	Eucalypts only	Out	54	530233.0	6483046.8	321	E	4
PGSW19	Porcupine Grass with eucalypts	Out	54	531321.0	6483395.5	393	S	7
PGSW20	Porcupine Grass only	Out	54	531328.7	6483641.8	385	NW	16

**Note: Position relative to fence utilised to improve management of feral goats*

3.3 Photopoint monitoring in the PGSW

Photo-point monitoring was undertaken in conjunction with quadrat monitoring between 1 and 5 December 2020.

Comparison of the photos taken at the 20 monitoring quadrats between 2018 and 2019 revealed little change in perennial plant cover (Appendix 1) and declining condition of PGSW due to the continued dry conditions.

In 2020, it is evident that the overall decline in vegetation condition has continued. Although the canopies of some eucalypts are bright green with new growth, many also show signs of ongoing dieback and decline. The ephemeral flush in response to the significant rainfall events is evident between the Porcupine Grass tussocks at most sites, however the majority of individuals were desiccating in the dry conditions at the time of survey. Whilst the rainfall in 2020 has provided a brief respite to the prolonged drought, the continued decline of the community under drought conditions is notable when compared with Photo 1, which was taken in December 2017.

3.4 Feral Goats and the PGSW

3.4.1 Goat management infrastructure

As outlined in Section 1.4, a goat fence was constructed around the majority of the PGSW in May 2014 to exclude and manage goats for the purposes of protecting PGSW and the endangered Barrier Range Dragon (Figure 9). When goats were grazed in PGSW within the goat fence, they were harvested approximately every two months, with an average of approximately 500 goats within the fenced area.

Since 2014, goats have been excluded from within the goat fence during the following periods:

- June 2014 to April 2015
- September 2015 to February 2016
- August 2017 to present, excluding during construction of the wind farm within the goat fence when the gate remained open to provide site access. Mustering of goats continued during construction in the area.

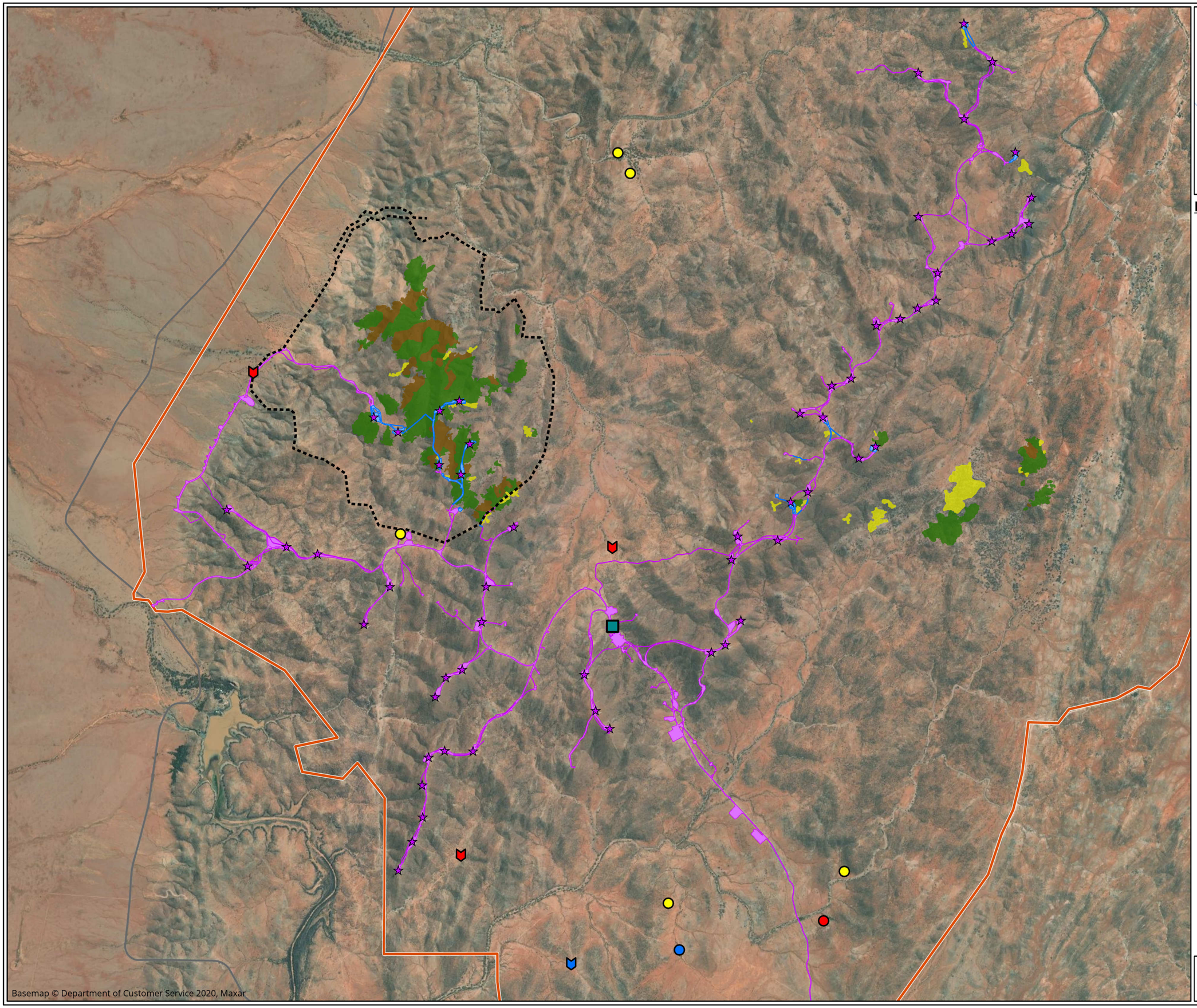
During monthly monitoring of goats within Area 7 by GE on 18 June 2020, it was noted that a number of goats were inside the goat fence. It was also observed the area was being used as a holding paddock with about 200 goats at T32. The leaseholder was contacted to arrange removal, and confirmed 400 goats were being held in the area and fed hay. All goats were subsequently mustered in week commencing 20 July 2020.

The condition of the goat fence is checked on a monthly basis by GE and the leaseholder will also provide notification of any damage to fences. To date, no fencing repairs have been required.

3.4.2 Landholder estimates of feral goat population

Conversations with the two leaseholders that manage land supporting PGSW indicated that 2020 goat numbers continue to be low when compared with average and good rainfall years, and lower than in 2018 and 2019 (Table 3-2).

Aerial mustering of goats has continued through 2020 on a sporadic basis, with high market prices continuing to ensure the economic viability of this method (Table 3-2). This combination of drought, additional infrastructure and aerial mustering continues to see the low numbers of goats across the district.



Legend

- Study area
- Infrastructure
- Infrastructure with PGSW downslope
- Turbine
- O&M building

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Goat management infrastructure

- Yard
- Fencing

Trapped

- Dam
- Trough

Untrapped

- Dam
- Trough

Figure 9 Infrastructure for goat management

0 0.5 1 1.5 2 2.5

Kilometres
Scale 1:50,000 @ A3
Coordinate System: GDA 1994 MGA Zone 54

N

Biosis Pty Ltd

Albury, Ballarat, Melbourne,
Newcastle, Sydney, Wangaratta & Wollongong

Matter: 29736
Checked by: RFW, drawn by: JPT
Last edited by: jturner on 30 August 2021
Location: P:\26300s\26380\Mapping\
26380_PGSW_GMP

Table 3-2 Estimates of goat numbers provided by leaseholders

Timing	Blore (inside goat fence)	Lawrence (outside goat fence)	Anecdotal price per head
2008/9 (During drought at time of the EIS (NGH Environmental 2008a))	Around 7000 goats a year	2159 – 1973*	
2012-14 (High rainfall period post Millennium Drought)	Around 6000 in the year (Goat fence installed in April 2014)	Around 8000 a year (Additional management infrastructure in place)	$30
2018	Around 50-100 from within goat fence	3239	
2019	About 50	2694 '10 goat mob is big', hardly any kids observed during autumn/spring breeding	$150
2020	Around 10-12 gats from within the goat fence. About 200 were harvested from outside the fence. There were also about 400 goats being held and fed within the goat fence in June that were then removed in July.	810	

*Low numbers due to combination of drought and lack of management infrastructure

3.4.3 Scat counts

Counts of recent herbivore scats in the 5 x 5 metre subplots are summarised in Figure 10. As scats dry rapidly in the hot, dry environment, scats were removed from the monitoring plots during the 2019 count so that future counts at each site could be clearly attributed to the time since the last survey. However, it is apparent that many old/dry scats had remained within the plots in 2019, as when the survey was conducted in 2020, significantly higher scat counts were documented than in 2019 during which very few scats were recorded. Field observations in 2020 noted that by far the greatest proportion of scats counted in the plots were old and dry, with only occasional/localised fresh scats. It is anticipated that counts of scats during the 2021 will be much lower than 2020, and therefore in alignment with data from 2019.

Despite this discrepancy, it is evident that the number of goat scats are lower within the goat fence, indicating that the fence is continuing to aid management of this species at the site. Rabbit scats continue to occur in low abundance across all monitoring plots, in alignment with comments from leaseholders that rabbits are in very low numbers in the district.

From the scat counts, macropods are more abundant inside the goat fence, which will be contributing to total grazing pressure on PGSW within the goat fence.

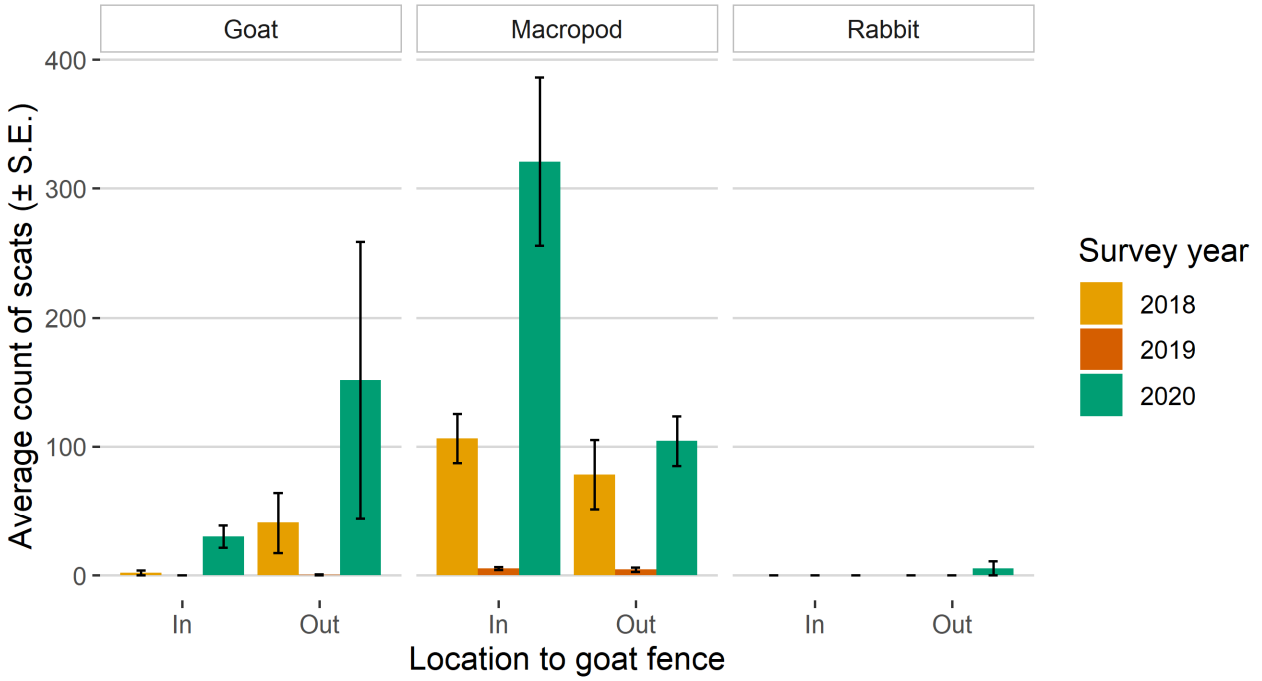


Figure 10 Herbivore scats recorded in 5 x 5 metre subplots.

3.4.4 Monitoring of goat presence by GE

As noted in Section 3.4.1, during monthly monitoring of goats within Area 7 by GE on 18 June 2020, it was noted that a number of goats were inside the goat fence. It was also observed the area was being used as a holding paddock with the leaseholder reporting about 200 goats were being grazed within the fence. The goats were subsequently mustered in the week commencing 20 July 2020. This is reflected in the observations by Alana Philp (GE) throughout 2020

Month	Date surveyed:	Monitored by:	Gate closed?*	T 29	T 30	T 31	T 32	T 33	T 34	T 35
January	25/1/20	A Philp	Yes	0	0	0	0	22	0	0
February	21/02/20	A Philp	No	0	0	0	0	14	0	0
March	26/3/20	A Philp	No	0	0	0	0	8	0	0
April	16/4/20	A Philp	No	0	0	0	0	7	0	0
May	5/12/20	A Philp	No	0	0	0	0	11	0	0
June	18/6/20	A Philp	Yes	0	0	0	23	13	0	0
July	23/7/20	A Philp	Yes	0	0	0	0	0	0	0
August	19/8/20	A Philp	Yes	0	0	0	0	0	0	0
September	17/9/20	A Philp	Yes	0	0	1	0	0	0	0
October	15/10/20	A Philp	Yes	0	0	0	0	0	0	0
November	19/11/20	A Philp	Yes	0	0	0	0	0	0	0
December	16/12/20	A Philp	Yes	0	0	0	0	0	0	0

**Note: this field documents whether the gate into the goat exclosure was closed on the date of survey*

3.5 Condition of PGSW

3.5.1 Species composition of the community

Across all surveys to date, 145 native flora species have been recorded within the PGSW community. The current survey documented 100 native species, of which 47 were recorded for the first time (Appendix 3). These additional species are predominantly ephemeral species that have germinated or resprouted in response to the significant rainfall events, particularly species from the daisy family. As mentioned in Section 2.7, many individuals had failed to reach reproductive maturity or already desiccated at the time of the PGSW survey in December. Therefore some species could not be identified.

Although the vegetation was drying out and senescing at the time of survey in 2020, the significant rainfall events had triggered a response in the vegetation such that mean native species richness in the monitoring plots had increased more than three times that of the previous two surveys, from 8.4 and 9.1 per plot in 2018 and 2019 respectively, to 29.2 in 2020 (Figure 11). Annual change in species richness at each monitoring plot is shown in Figure 12.

A total of 18 introduced flora species have been recorded within PGSW across all surveys, of which 12 were recorded for the first time in 2020 (Appendix 3, Table A 1). Given the remote location of most monitoring plots (Figure 2) relative to access tracks, and that all the introduced species other than those listed below have been recorded in the area during previous surveys, the majority of the species recorded in the monitoring plots are considered to be widespread throughout the landscape as a result of the long-term grazing history of the Barrier Range:

- Cretan weed *Leontodon rhagadioloides*
- Cat-head *Tribulus terrestris*
- Rat's-tail Fescue *Vulpia* spp. (although *Vulpia myuros* has been recorded previously, and specimens in the current survey had shed seed, which is required for identification)

As in previous years, this analysis indicates that species richness is lower in sites within the goat fence (Figure 13). Similarly, this analysis of the structural variants continues to indicate that the two monitoring plots within the *eucalypts only* structural variant are the most floristically diverse, with the *Porcupine Grass with eucalypts* variant supporting a few additional species per monitoring plot than the *Porcupine Grass only* vegetation (Figure 14). The occurrence of each native and introduced species in the monitoring plots (overall, relative to the position of the goat fence and by structural variant) is summarised in Appendix 3, Table A 2.

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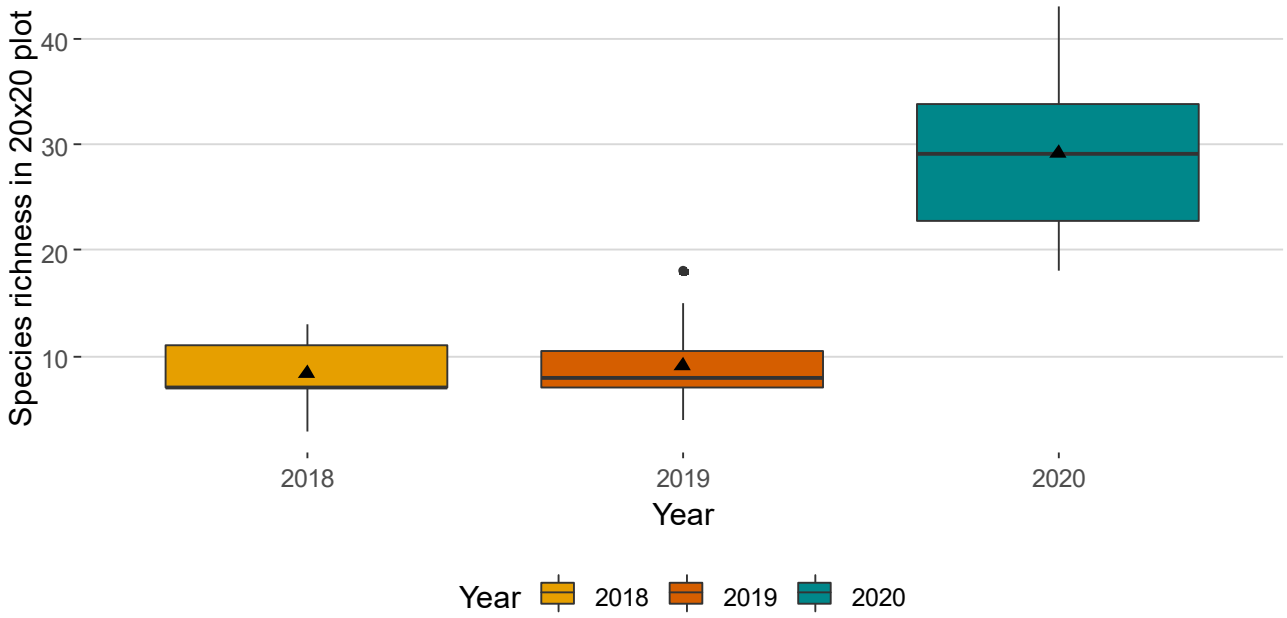

Figure 11 Change in native species richness in 20 x 20 metre quadrats from 2018 to 2020

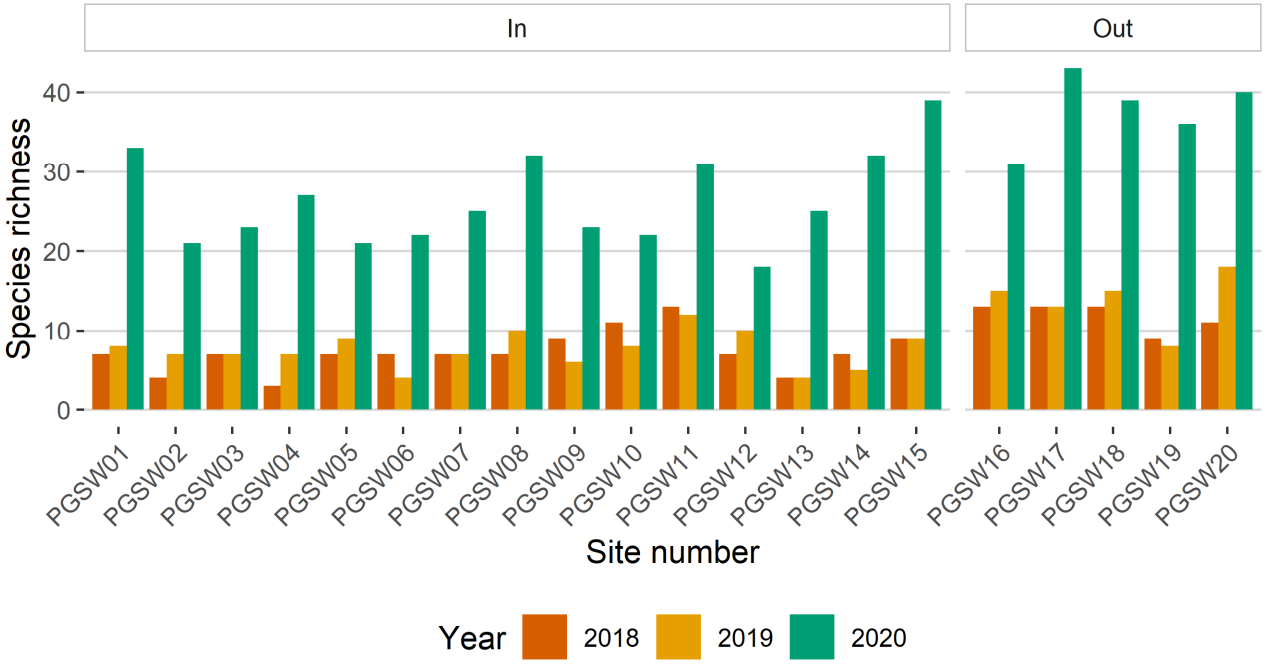

Figure 12 Change in species richness in 20 x 20 metre quadrats from 2018 to 2020

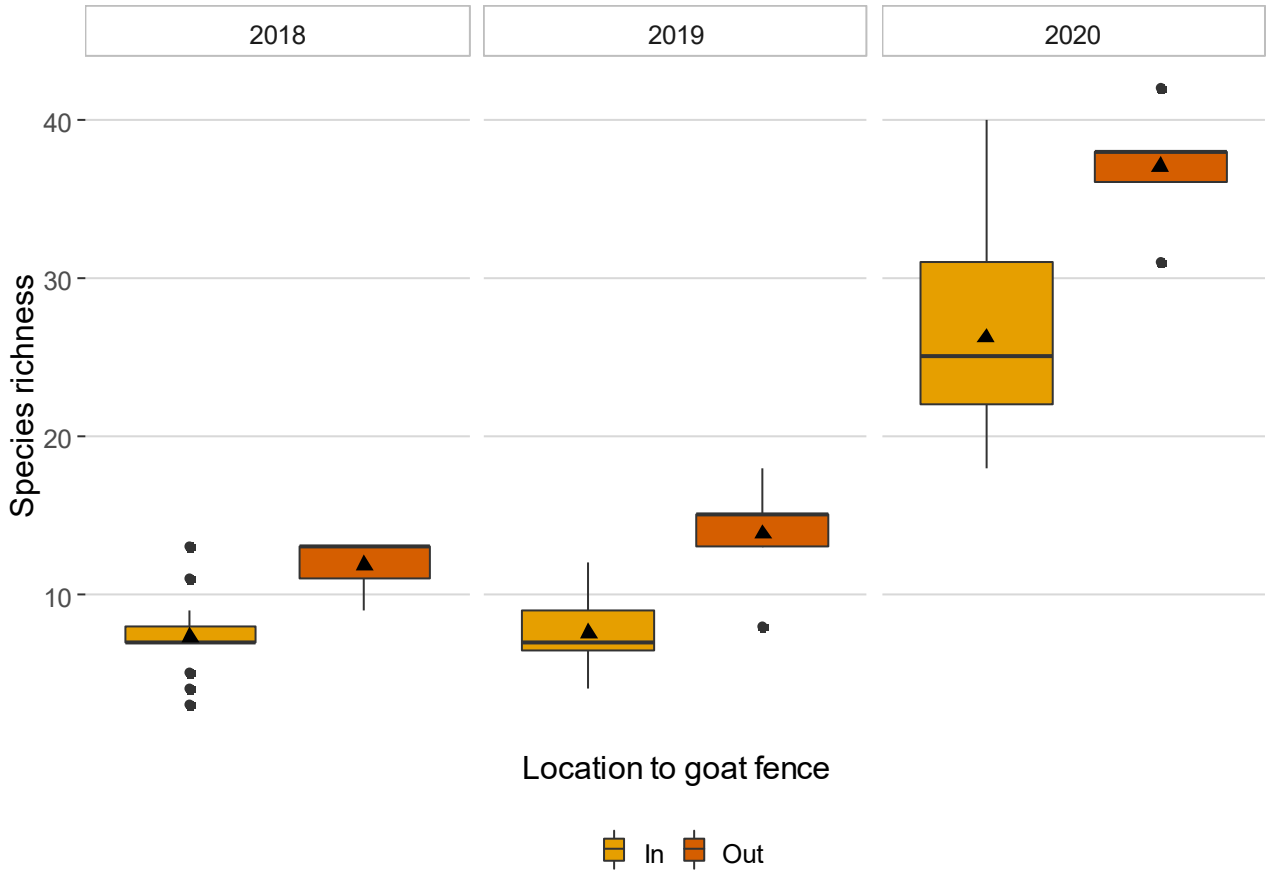

Figure 13 Species richness in 20 x 20 metre quadrats by position relative to the goat fence

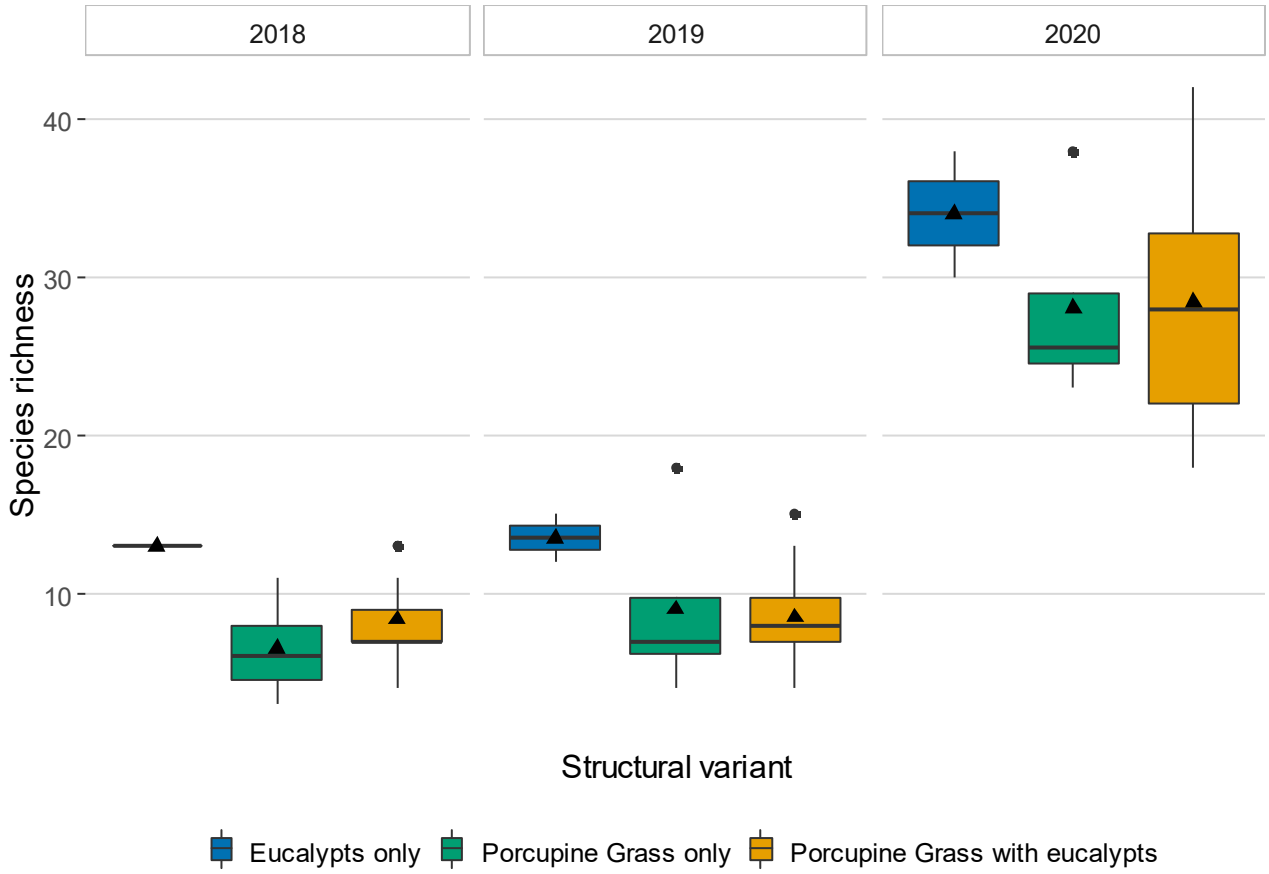

Figure 14 Species richness in 20 x 20 metre quadrats by PGSW structural variant

3.5.2 Factors influencing species richness and composition

Over the three years of monitoring to date, it has been documented that the sites within the goat fence have lower species richness than sites outside the goat fence (Figure 11). Anecdotally, Biosis field staff indicated that areas of PGSW outside the goat fence were in less rugged terrain, potentially with greater soil depth, fertility and topographic protection than those within the goat fence (Biosis 2020b). Therefore, other factors were investigated that might contribute to variation in site species richness and composition was undertaken.

An NMDS ordination of the native species composition and abundance in the 20x20 monitoring plots demonstrates that there is a significant difference between plots inside and outside the goat fence (ANOSIM p <0.001), as well as indicating species that are most likely to be contributing to that difference (Figure 15). Attributing the sites with their aspect (Figure 16), there is lower influence but also a significant difference based on aspect of the monitoring plot (ANOSIM $p < 0.5$). The structural variant of the community was not significant ($P > 0.1$), with particular overlap in species assemblage between the Porcupine Grass only community, and the Porcupine Grass with eucalypt forms (Figure 21). In particular, the more exposed north-facing sites (Figure 16), and the highest elevation (Figure 17) sites are generally in the lower right quarter of the NMDS, furthest from the sites outside the goat fence. There is a general trend of decreasing species richness with increasing elevation (Figure 18), however this is primarily driven by sites outside the goat fence (Figure 19), with species richness and abundance in plots outside the goat fence being similar irrespective of elevation. However, there are no high elevation sites within PGSW outside the goat fence to provide a comparison Figure 19. As these lower sites outside the goat fence are south -east of the main Barrier Range, they are also somewhat sheltered by the Range from northerly and westerly winds. Additionally, sites outside the goat fence are generally less steep than those inside the goat fence (Figure 20). Therefore, in general, this analysis supports the field observations that sites outside the goat fence are topographically protected from drying climatic conditions when compared with the generally steeper exposed sites inside the goat fence.

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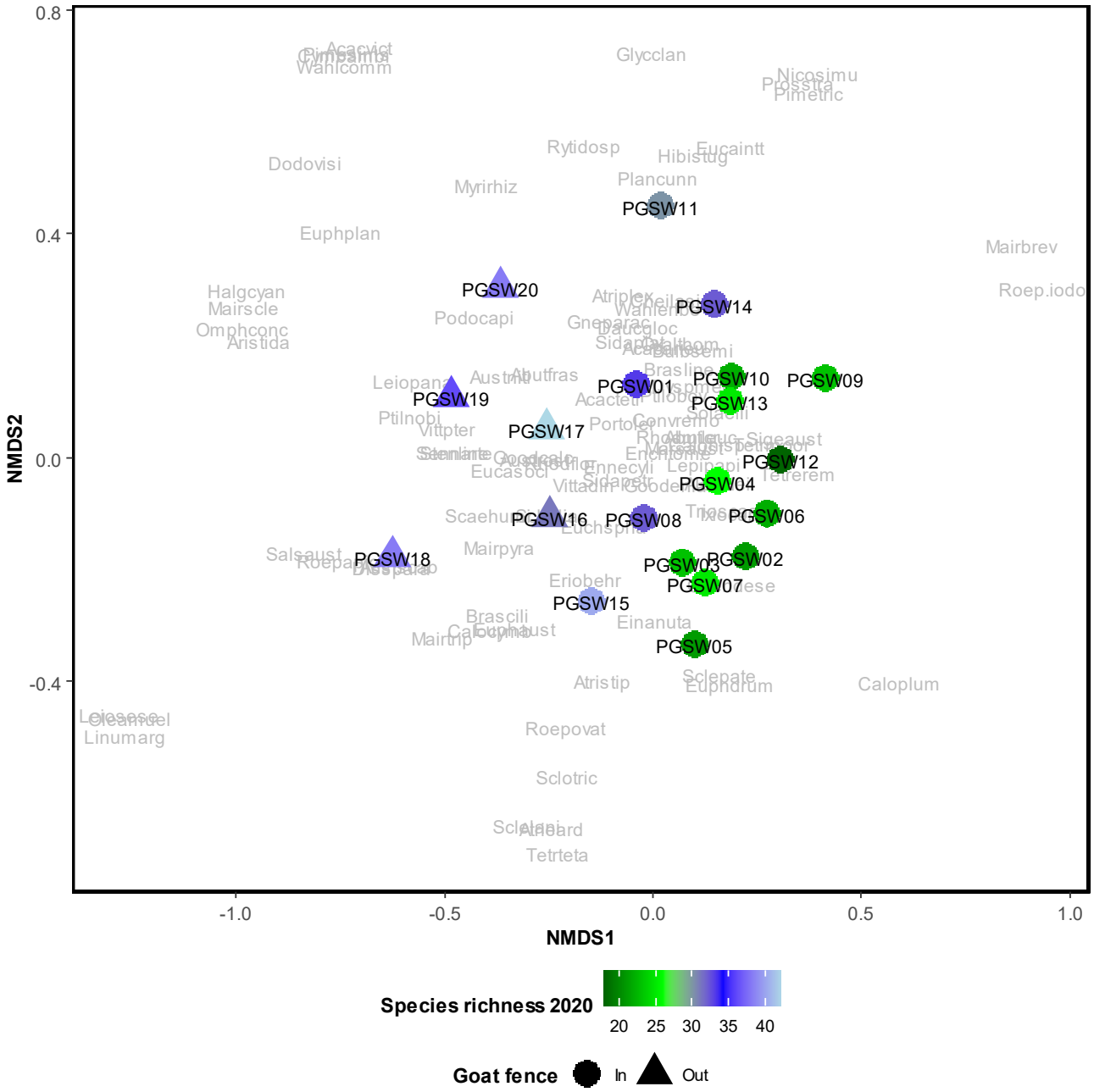

Figure 15 NMDS of native species composition and abundance in the 20x20 monitoring plots in 2020, attributed by position relative to the goat fence.

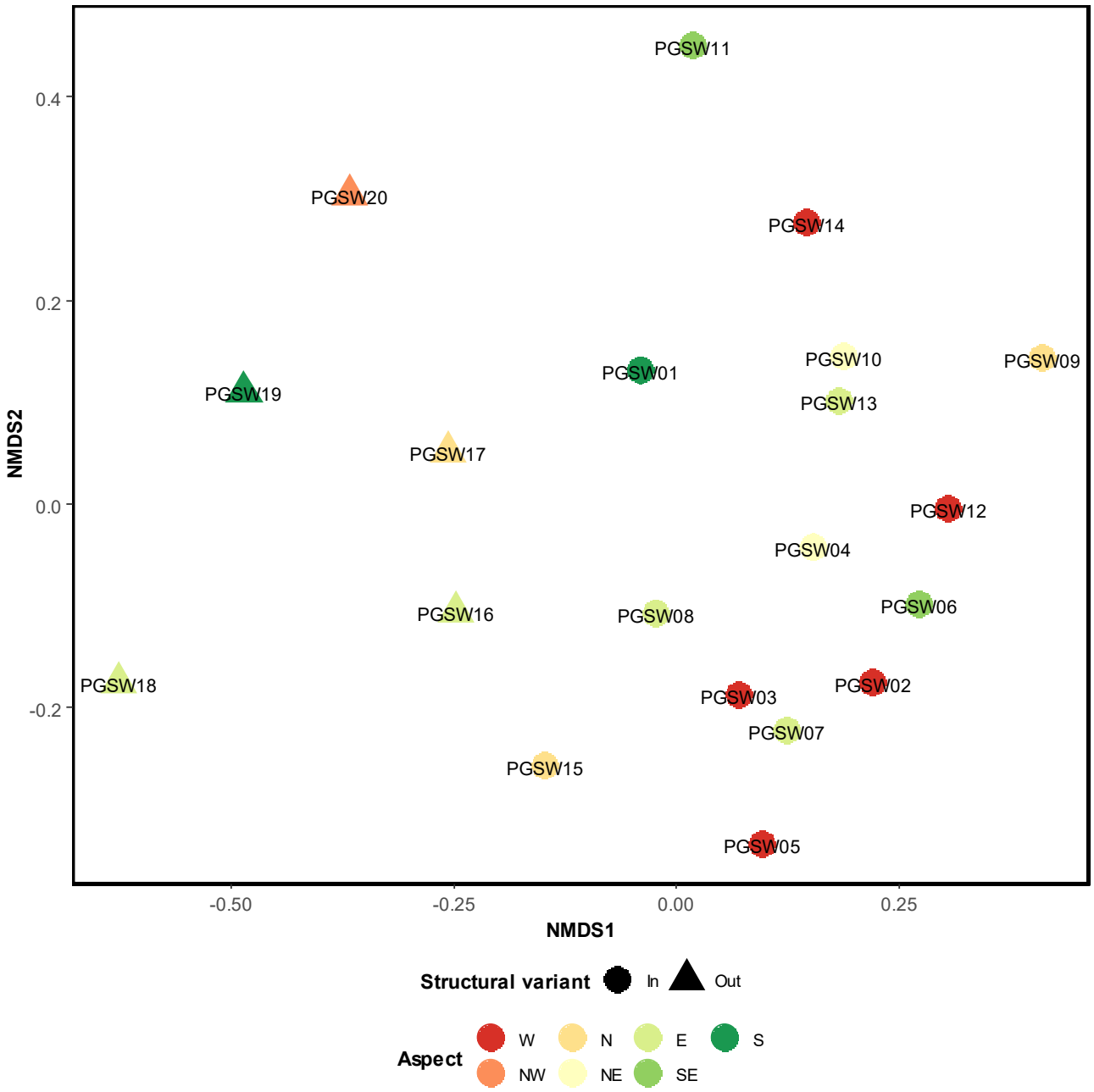

Figure 16 **NMDS of native species composition and abundance in the 20x20 monitoring plots in 2020, attributed by the aspect of the monitoring plots (note: no plots have a SW aspect).**

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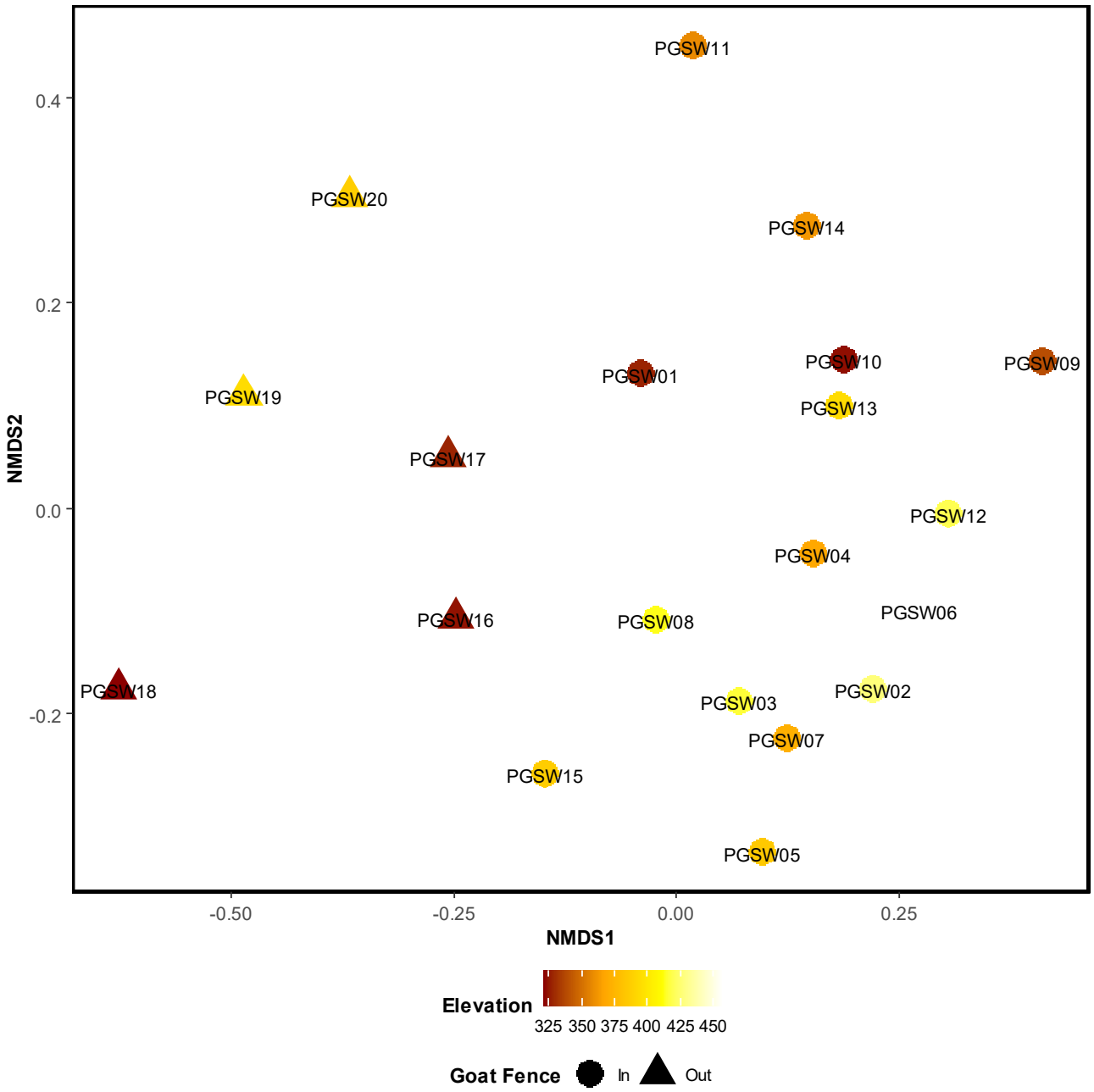

Figure 17 NMDS of native species composition and abundance in the 20x20 monitoring plots in 2020, attributed by the elevation of the monitoring plots.

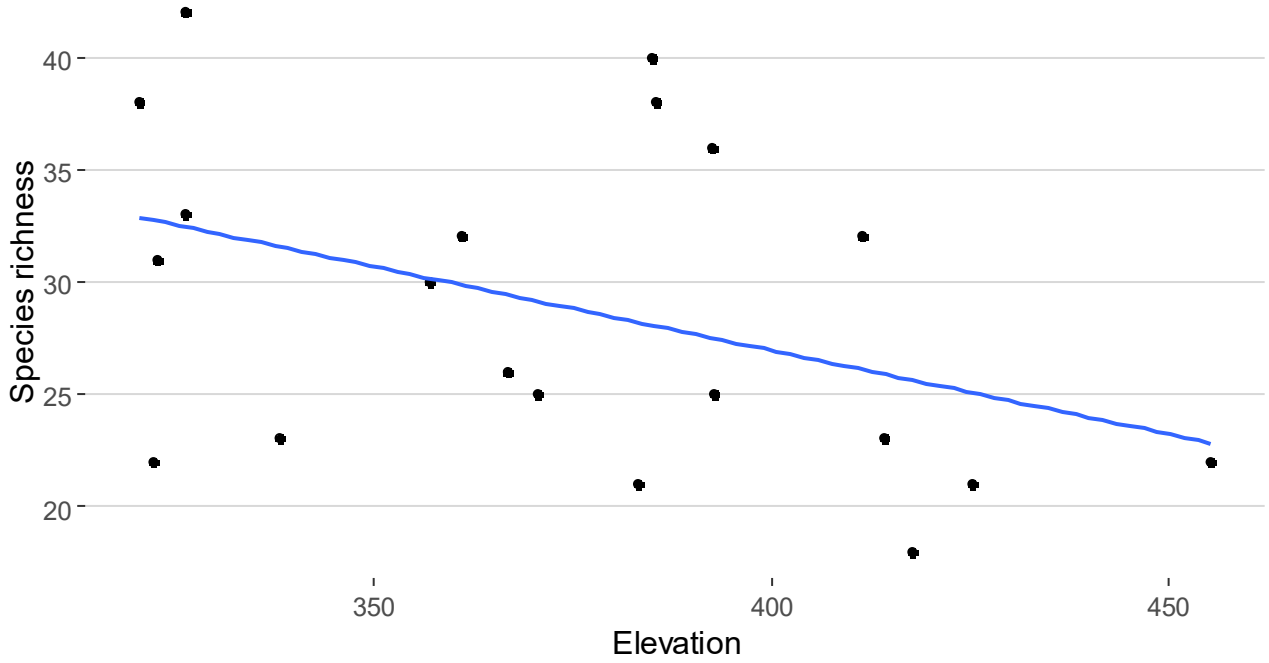

Figure 18 Plot of species richness of 20x20m plots in 2020 by elevation.

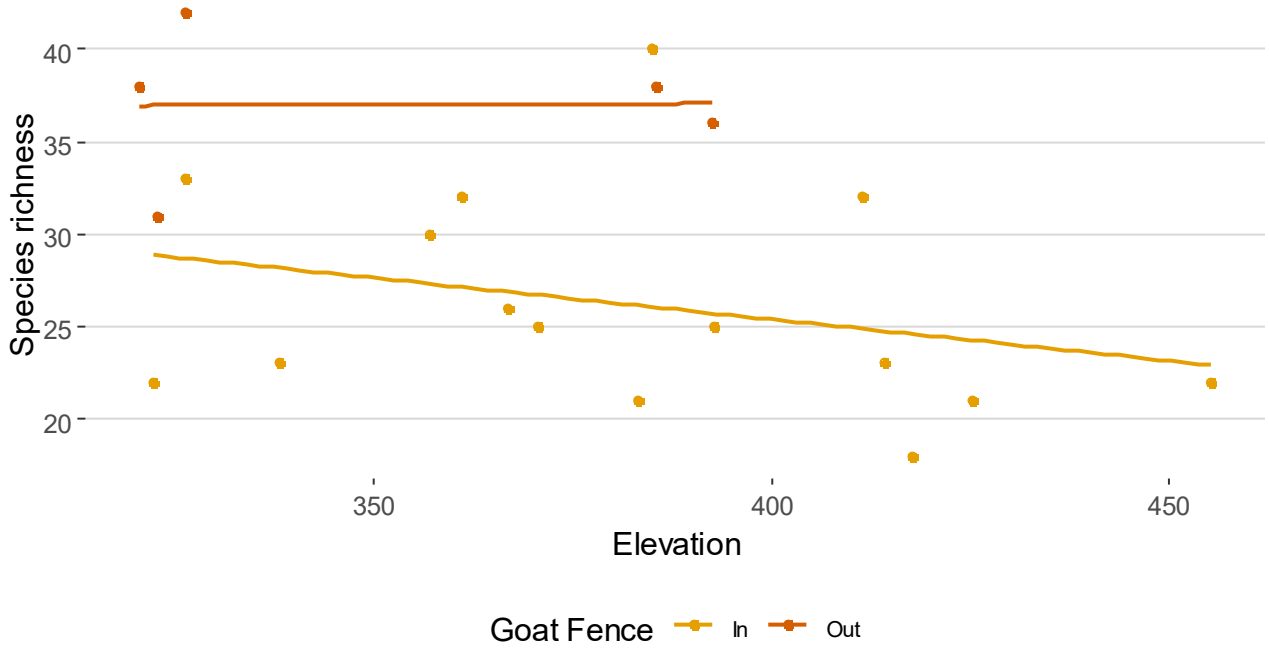

Figure 19 Plot of species richness of 20x20m plots in 2020 by elevation and position relative to goat fence.

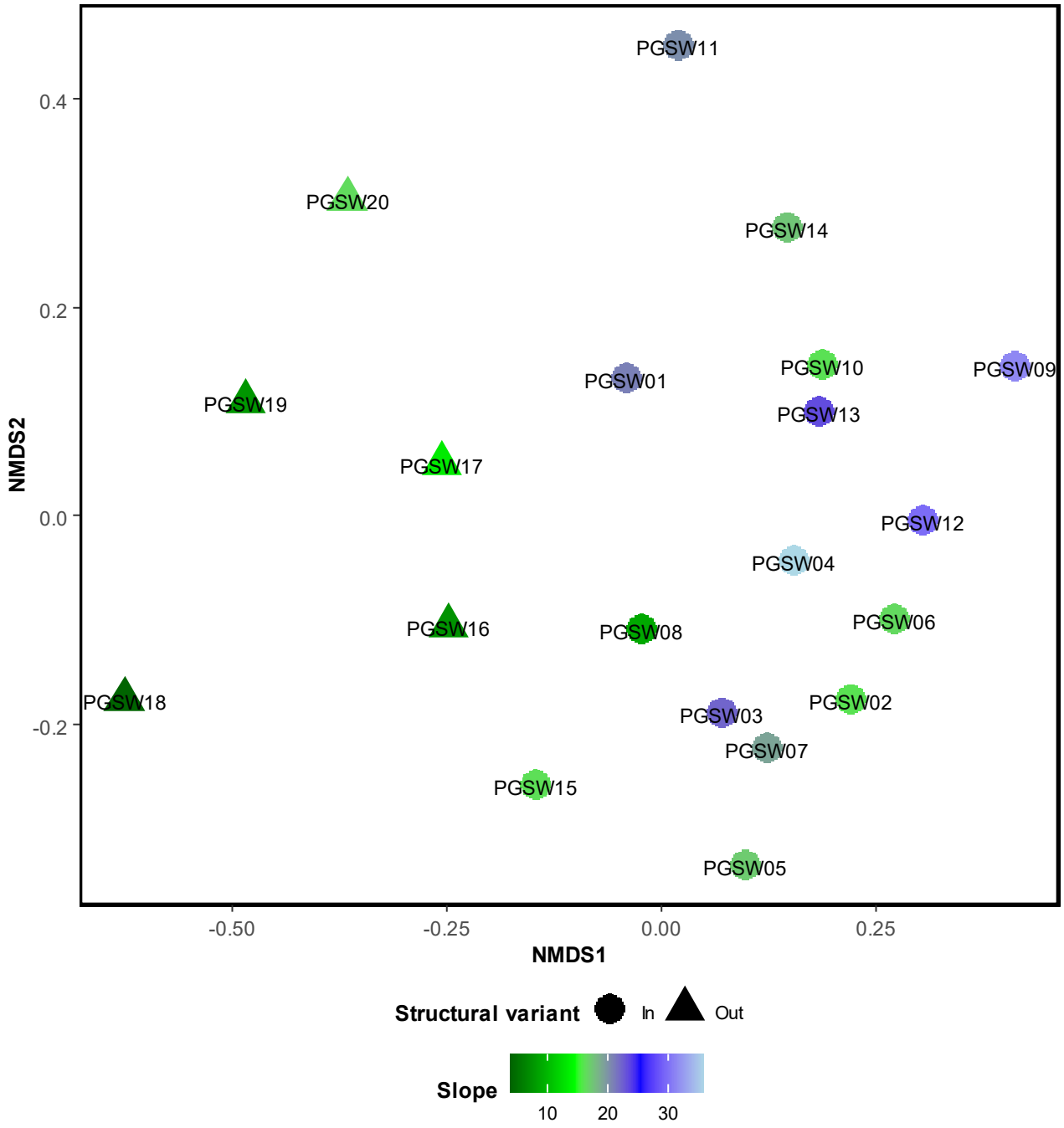

Figure 20 NMDS of native species composition and abundance in the 20x20 monitoring plots in 2020, attributed by the slope of the monitoring plots.

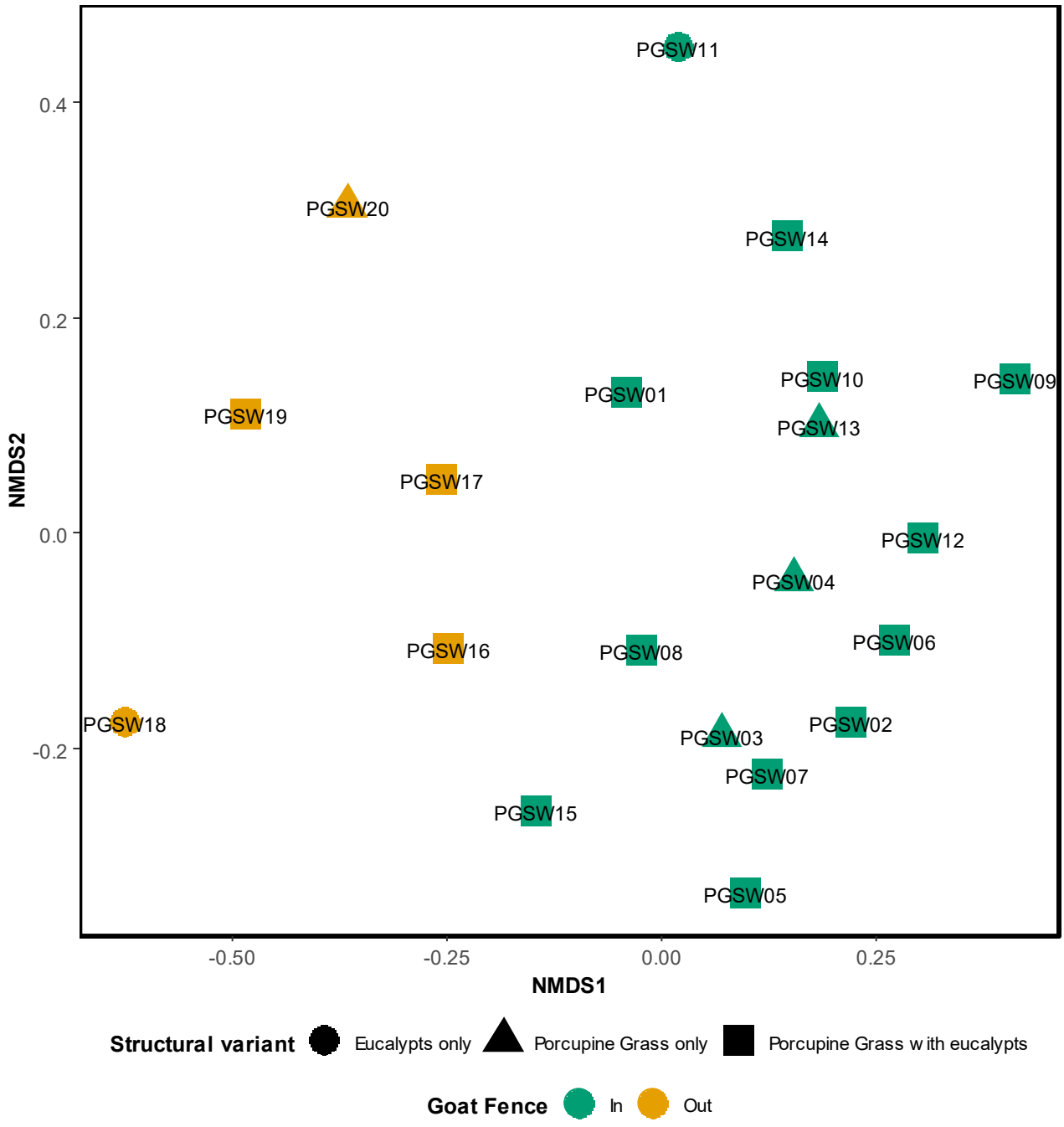

Figure 21 NMDS of native species composition and abundance in the 20x20 monitoring plots in 2020, attributed by the structural variant of the community.

3.5.3 Porcupine Grass

As seen in Photo 4, Photo 5 and throughout Appendix 1, the prolonged drought has resulted in most of the Porcupine Grass tussocks across the wind farm senescing and turning grey, such that many individuals are assumed to be dead (Photo 6). Within the 5x5 quadrats, on average there was 11.8 (±13.3 sd) individuals that appeared dead, 2.20 (±4.10 sd) that had resprouted (Photo 7), and 1.8 (±2.67 sd) new recruits (Photo 8) (Figure 22).

Photo 5 **Landscape of PGSW, showing apparent extensive death of Porcupine Grass tussocks during the 2020 surveys. Note some tussocks associated with minor drainage lines are in better condition.**

Photo 6 **Grey tussocks with no evidence of resprouting, assumed dead (2020 survey).**

Photo 7 Resprouting adult tussock (2020 survey).

Photo 8 Porcupine Grass recruits (2020 survey)

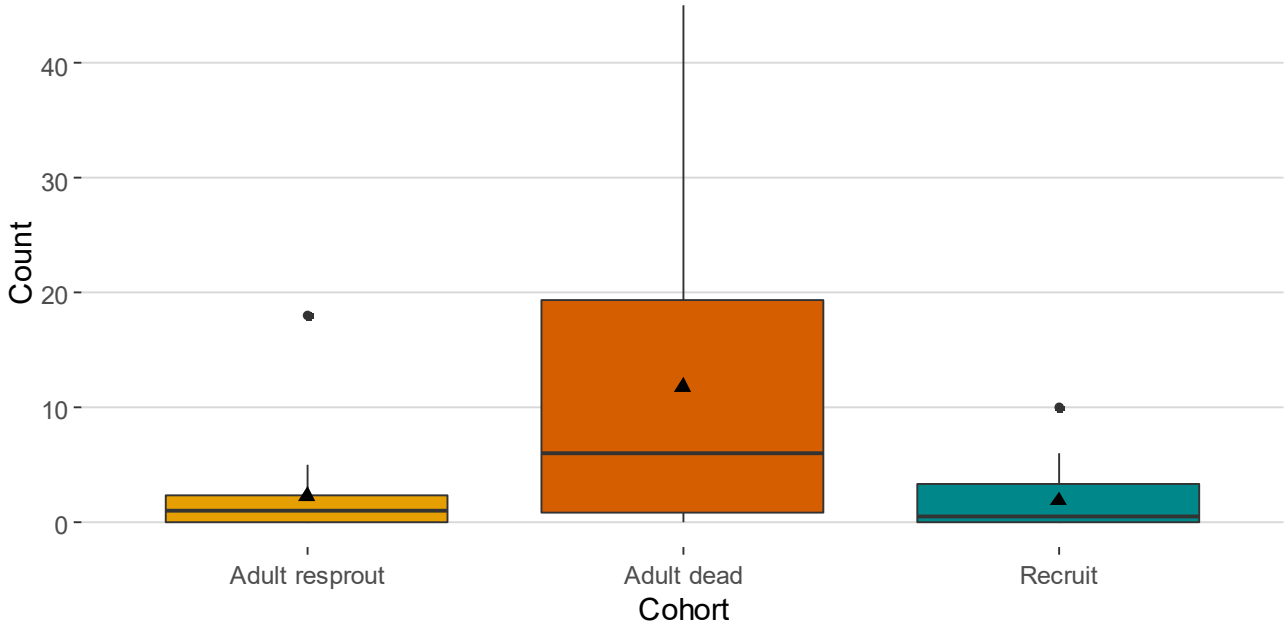

Figure 22 Condition of Porcupine Grass individuals in 5 x 5 metre subplots in 2020.

3.5.4 Threatened flora

As detailed in Section 2.2.4 of the Vegetation Management Plan (VMP) (Biosis 2018e), three threatened plant species (species listed under either the NSW *Biodiversity Conservation Act 2017* (BC Act) or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)) were identified as having the potential to be affected by the Silverton Wind Farm works (NGH Environmental 2008a, NGH Environmental 2008b). These include: Showy Indigo *Indigofera longibractea*, Yellow-keeled Swainsona *Swainsona flavicarinata* and Creeping Darling Pea *Swainsona viridis*. Additionally, there are unconfirmed records of Purple Wood Wattle *Acacia carneorum* on the flats of the Mundi Mundi sandplain surrounding Silverton Wind Farm (Blore 2008). It has not been found on the hills, where PGSW occurs. This species is listed as vulnerable under both the BC Act and the EPBC Act.

As in previous surveys, none of the above listed species have been recorded within PGSW or within the study area during the current survey, nor have any other threatened flora species.

3.5.5 Condition of woody species

Woody species occur in low numbers in the PGSW community, and individuals were under-recorded in 2019 (Section 2.5.2). In 2020, a waypoint was recorded for all woody species (trees and mid-level shrubs greater than 30 centimetres) were waypointed and assigned a unique identifier within the plot. Less than 10 individuals were recorded at 17 of the 20 sites.

While in 2018, the overall condition of woody species tended to be higher inside the goat fence, in 2019 the overall condition of all species was found to be generally lower inside the goat fence Figure 23), which included the condition above and below the browse line (Figure 24 and Figure 25).

In 2020, overall condition (Figure 23), condition below the browse line (Figure 24) and condition above the browse line (Figure 25) of woody species had generally improved, except for the condition of Dead Finish *Acacia tetragonophylla* that had declined across all categories, and some individuals are in a retrogressed

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state. It is noted that the number of woody species in 2020 is lower than in previous years due to the death of many individuals within the plots since 2018, including the single Red Mallee in PGSW06.

The impact of the long term drought is evident in the canopy condition of the woody species, with most individuals showing dieback of branchlets and small branches, as well as numerous individuals suffering dieback of main branches (Figure 26).

Figure 23 Overall condition of woody species recorded in 2020

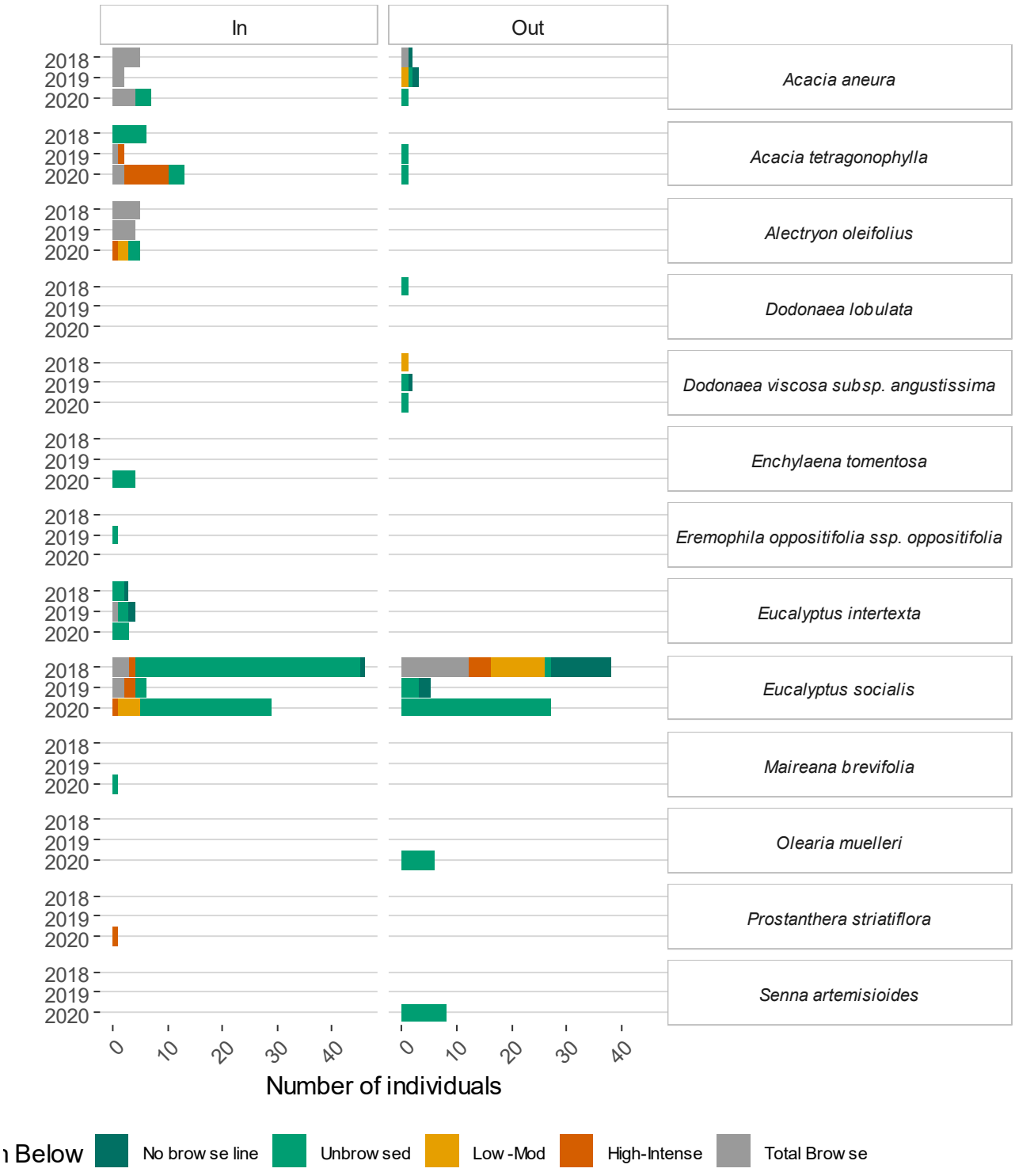

Figure 24 Condition of woody species below the browse line in 2020

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Figure 25 Condition of woody species above browse line in 2020

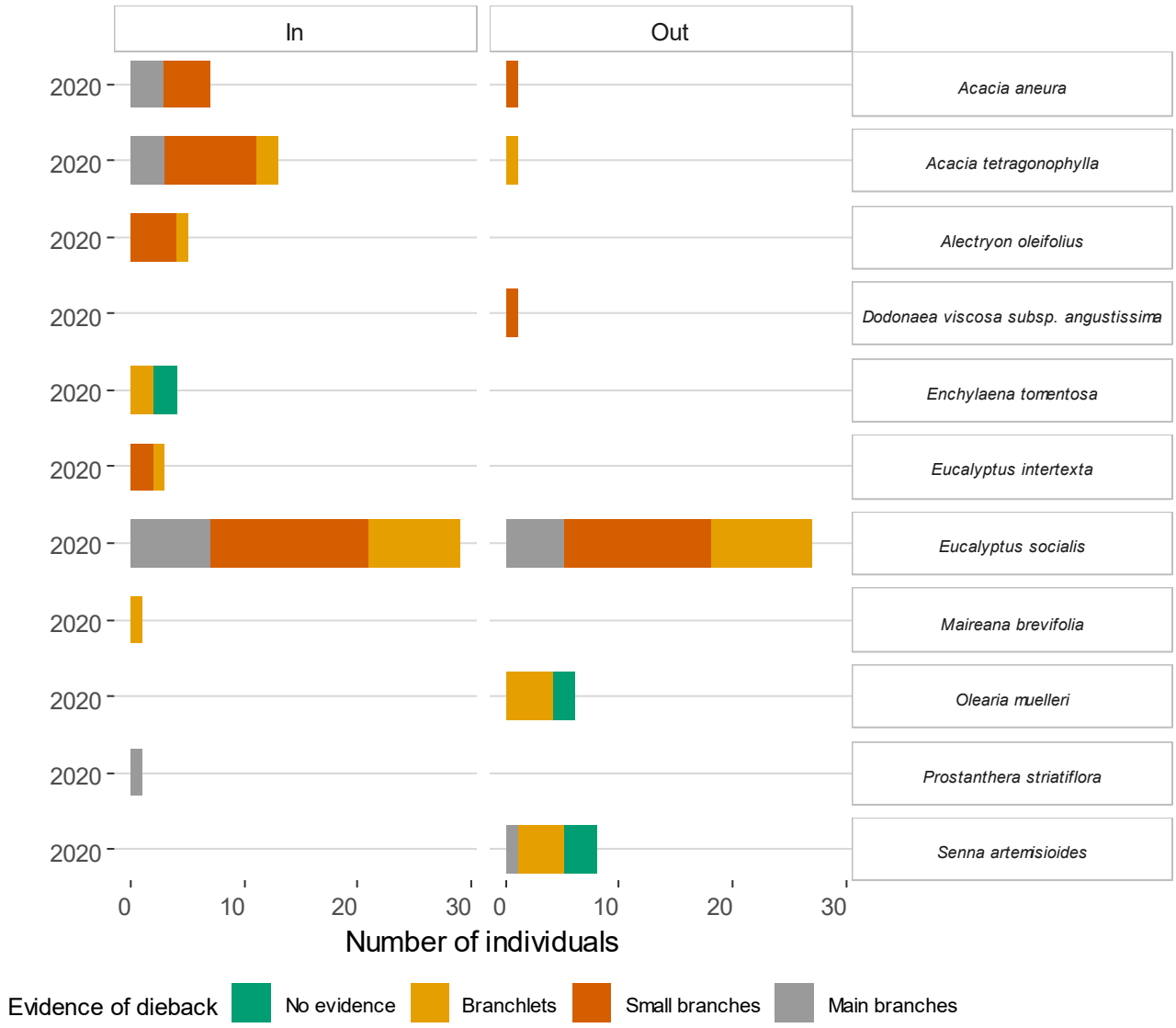

Figure 26 Canopy condition of woody species in 2020

3.5.6 Litter cover

In 2018, litter cover was generally higher in the 20 x 20 metre monitoring plots outside the goat fence compared with those inside the goat fence. Litter cover decreased overall in 2019, with a greater decrease in sites outside the goat fence such that sites both inside and outside the goat fence support 15 - 20 per cent litter cover on average. In 2020, litter inside the goat fence continued to decline, whilst on average, litter cover remained stable outside the goat fence (Figure 27 and Figure 28). This decline is likely a result of limited vegetative growth over the last three years.

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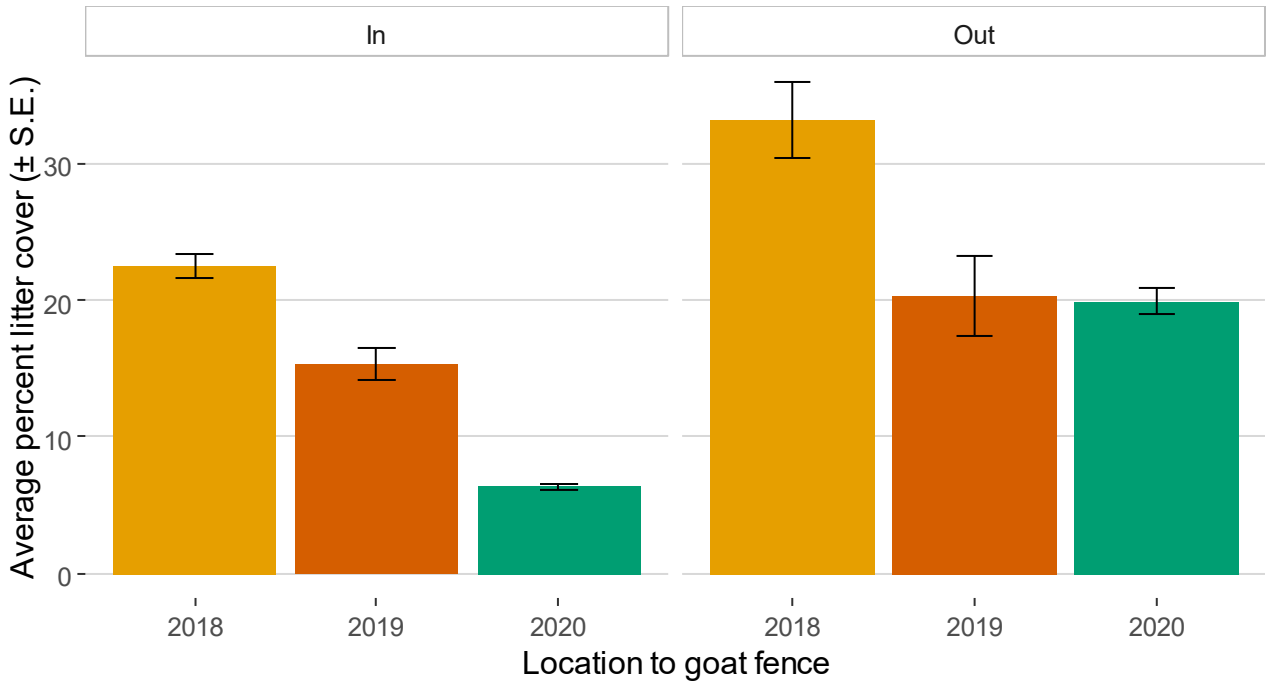

Figure 27 Summary of change in litter cover within the 20 x 20 metre monitoring plots

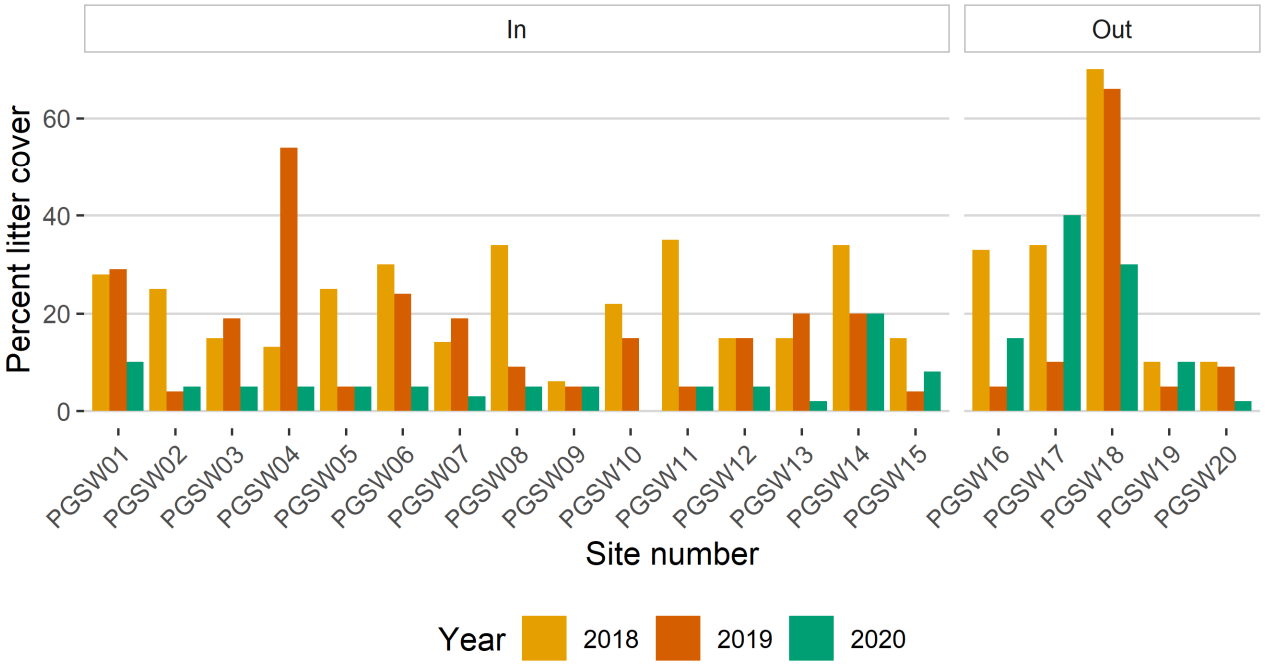

Figure 28 Change in litter cover within each 20 x 20 metre monitoring plots

3.6 Disturbance areas of the Wind Farm

Prior to the current survey, all monitoring by Biosis was conducted during a period of extended severe drought, and was limited to the monitoring at PGSW monitoring plots. As noted in Section 2.6, the surveys conducted in 2020 provided the first opportunity to assess areas of construction disturbance for introduced species and erosion following the significant rainfall events.

Key observations during the field survey include:

- Introduced species are more abundant in drainage lines and on lower slopes.
- Construction of roads across the site has often resulted in the road surface sitting lower than the adjoining undisturbed land, providing protection from weed dispersal downslope via run-off as weed seed is likely to accumulate on the roadside (Photo 9).
- However, there are areas of roadside and hardstand, including areas upslope and adjacent to PGSW, where roadside drainage controls are inadequate and pose risk to the PGSW community through erosion, sedimentation and introduction of weed species into the community (Photo 10 and Photo 11).
- Very little recruitment (native or introduced) has occurred on heavily compacted substrates associated with turbine hardstands (Photo 12).
- Additional areas of construction disturbance have been documented beyond the mapped areas provided by CATCON (Figure 4).
- Initial recruitment of native species is occurring across the rehabilitated areas, however the response to date has been patchy and many exotic species have also been documented at these sites (Photo 13 and Photo 14).

3.7 Introduced flora species of the Wind Farm

3.7.1 Field survey results

Prior to the current survey, observations of introduced species by Biosis had been low (2020b). However, as predicted in the 2019 vegetation monitoring report (Biosis 2020b), many species documented by NGH (2008b) have persisted in the soil seed bank and are now present across the site following high winter-spring rainfall. These introduced species have potential to disperse throughout the site, particularly within areas of soil disturbance resulting from construction, grazing by goats, or degradation due to the extended drought.

Introduced plant species documented within the study area are detailed in Appendix 4. Sixteen introduced species have been recorded in 2020 in the PGSW monitoring plots (Appendix 3), which are located in the grazing land of the Barrier Range. These plots are considered indicative of the introduced species that would be present at the site if the wind farm had not been constructed.

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Photo 9 **Typical road surface lower than adjoining undisturbed land in 2020, the rock on the right side of the photo appears to be acting as a catch-drain for seed or introduced species.**

Photo 10 **Example of road surface adjoining undisturbed land within inadequate drainage protection in 2020, increasing opportunity for introduced species to spread into remnant vegetation.**

Photo 11 **Turbine hardstand with inadequate drainage controls to prevent introduced species impacting on adjacent vegetation in 2020.**

Photo 12 **Minimal recruitment of introduced or native species observed in 2020 on compacted ground associated with turbine hardstands.**

Photo 13 Example of regeneration occurring on rehabilitated disturbance areas in 2020.

Photo 14 Example of establishment of introduced species and regeneration occurring on rehabilitated disturbance areas in 2020.

Priority weed species for control at the Silverton Wind Farm include species recorded from the study area or immediately adjacent to the study area (Figure 29). Priority weeds are to be controlled with the aim of elimination from the site, and include:

- The NSW State and regional priority weed African Boxthorn *Lycium ferocissimum* (WLLS 2017) recorded from the study area.
- Introduced species that have been recorded in low numbers in the study area:
  - Camel Melon *Citrullus lanatus*
  - Downy Thornapple *Datura inoxia*
  - Onion Weed *Asphodelus fistulosus*
  - Paddy Melon *Cucumis myriocarpus*
  - White Horehound *Marrubium vulgare*

Introduced species that are to be controlled within and immediately adjacent to the asset and infrastructure areas shown in (Figure 30), with priority given to treating areas in proximity to key environment assets, particularly PGSW. Treatments will be undertaken quarterly at a minimum with additional treatment one and three months post significant rain events (>25 millimetres) (to mitigate opportunistic weed seed germination and flowering events) and additionally as required based on maintenance inspections. These species are:

- Introduced species that have been identified as high risk, high priority for a number of current Western LLS Region regional weed programs (WLLS 2017), though are considered unfeasible to contain or eradicate from the region:
  - Caltrop *Tribulus terrestris*
  - Sow Thistle *Sonchus oleraceus*
  - Wards Weed *Carrichtera annua*
  - Winged Sea Lavender *Limonium lobatum* is now widespread in the local area and impact of chemical treatment would likely outweigh the benefits. Therefore management of this species will be focused on the areas of BRD habitat and the areas above PGSW, to reduce downslope movement into these priority habitats.
- Introduced species for which the general biosecurity duty applies:
  - Mexican Poppy *Argemone mexicana*
  - Saffron thistle *Carthamus lanatus*
  - Patterson's Curse *Echium plantagineum*
  - Spiny Emex *Rumex hypogaeus* (formerly *Emex australis*)

Other introduced species were recorded from the study area (Appendix 4), however these additional species are not considered a priority species requiring prevention, eradication, or containment within the definitions of the Regulations associated with the Biosecurity Act 2015 (A. McKinnon WLLS, pers comm 2021).

It is noted that the 2018 Vegetation Monitoring Report (Biosis 2020a) indicated that *Trifolium glomeratum* was recorded at site PGSW13, however it has since been confirmed that this was a misidentification of a dead and dry specimen of Hard-headed Daisy *Brachyscome lineariloba*.

Whilst the majority of disturbance at the site occurred during construction, scheduled maintenance activities also have the potential to introduce and promote the spread of weeds and pathogens within the study area.

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Under the NSW Biosecurity Act 2015 (Biosecurity Act) landowners and occupiers are under legal obligations to manage weed species in line with the General Biosecurity Duty which states:

- *All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.*

As such GE, in dealing with weeds present within the study area, is obliged under the general biosecurity duty to prevent, eliminate and minimise the risk of potential biosecurity impacts.

This data is to be utilised to inform a weed management program in accordance with the BAMP and VMP to be implemented by GE and the weed management contractor to maintain low densities of introduced species across the site. Efficacy of the management will be monitored by the Project Ecologist during future scheduled survey of the disturbance areas and adjacent vegetation in accordance with the BAMP.

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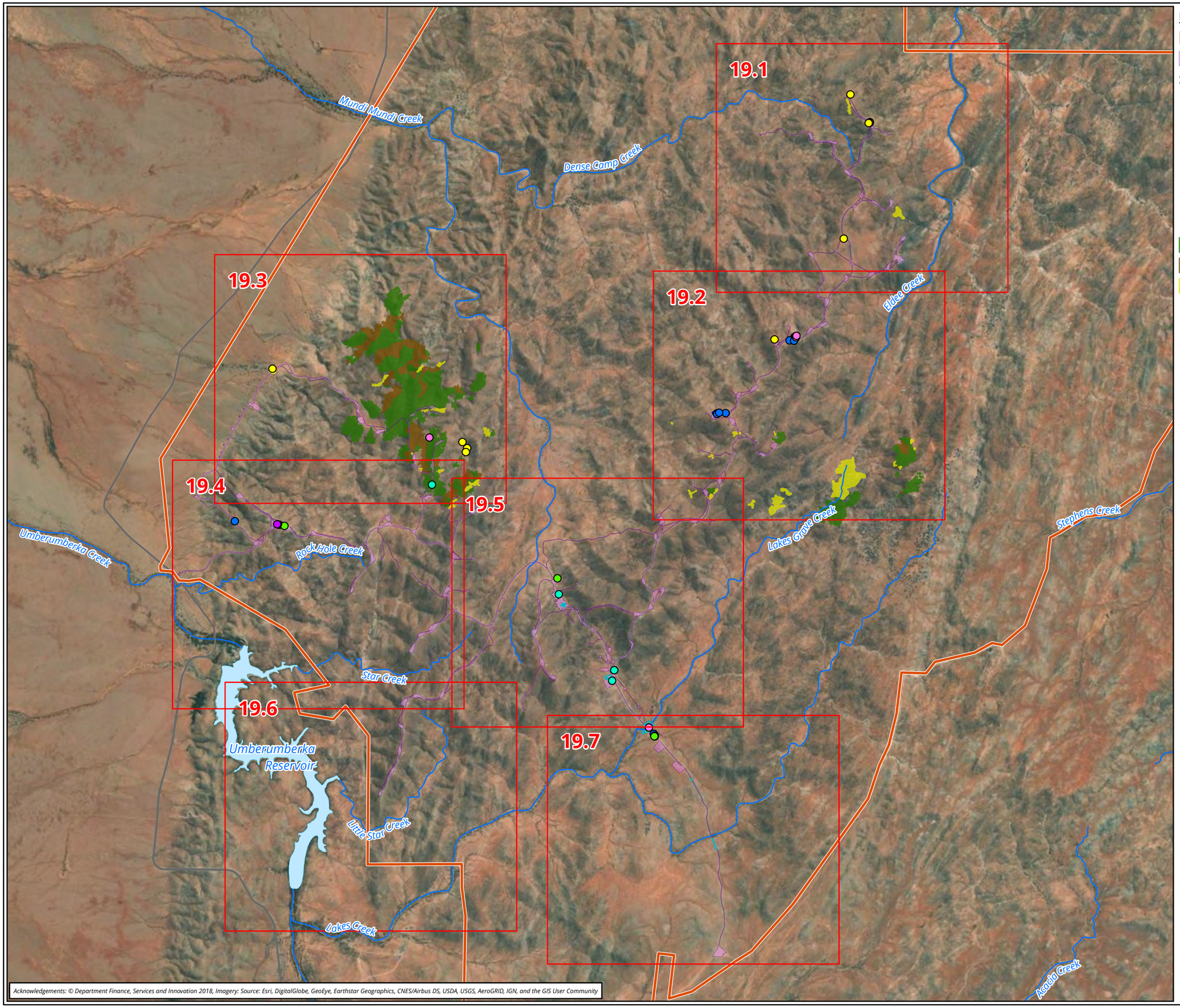

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure

Species records

- Asphodelus fistulosus
- Citrullus lanatus
- Cucumis myriocarpus
- Datura inoxia
- Lycium ferocissimum
- Marrubium vulgare

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 19 Weed species to be controlled for elimination - Overview

0 0.5 1 1.5 2 2.5
Kilometres

N

Scale: 1:60,000 @ A3
Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 31 May 2021,
Checked by: ERB, Drawn by: JPT, Last edited by: jturner
Layout: F19_Weeds_Overview
Location: P:\31100s\31198\Mapping\
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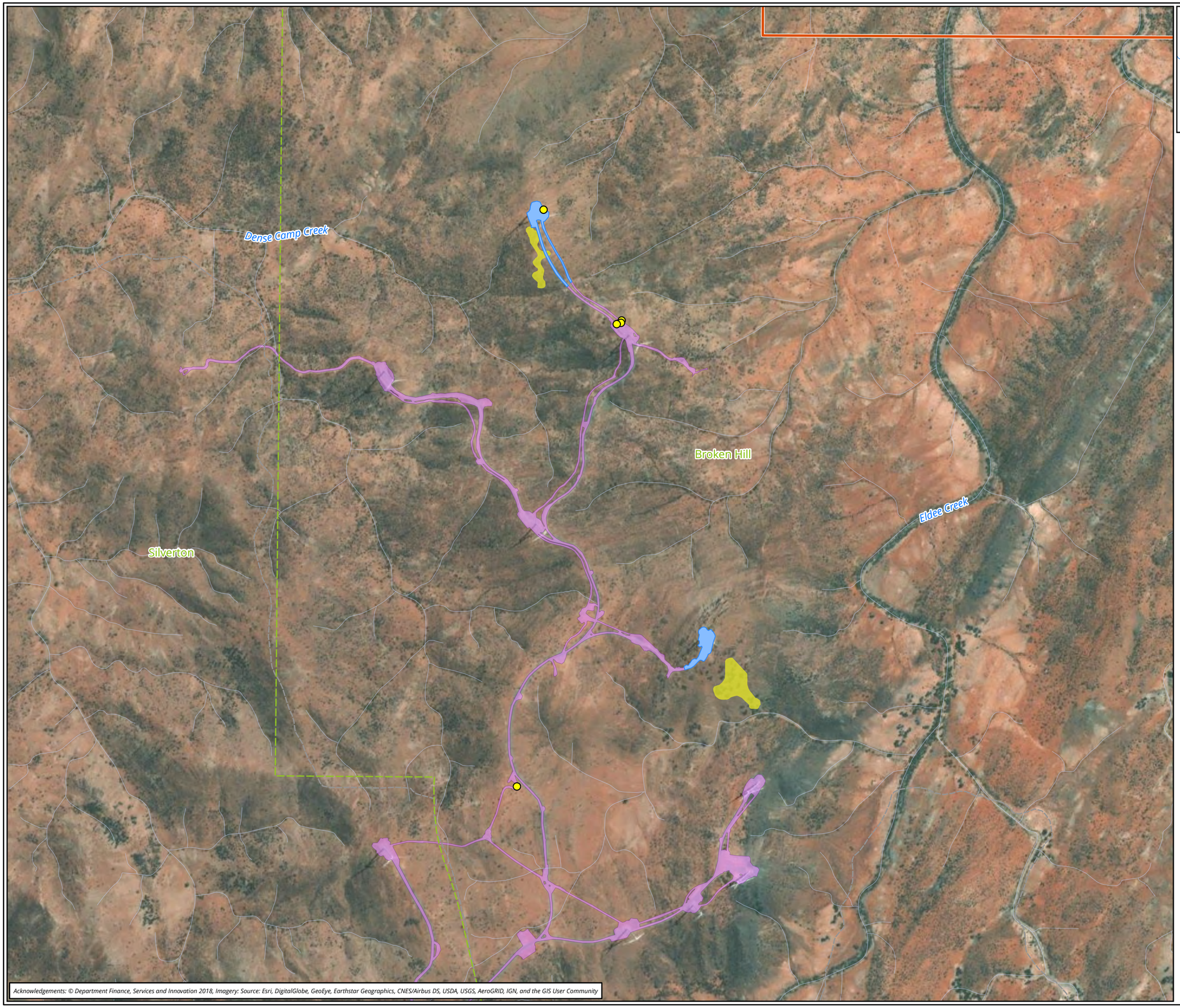

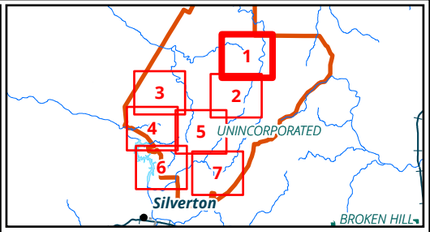

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Infrastructure with PGSW downslope

Species records

- Citrullus lanatus

PGSW structural variants

- Eucalypts only

Figure 19.1 Weed species to be controlled for elimination

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 31 May 2021,
Checked by: ERB, Drawn by: JPT, Last edited by: jturner
Layout: F19_Weeds
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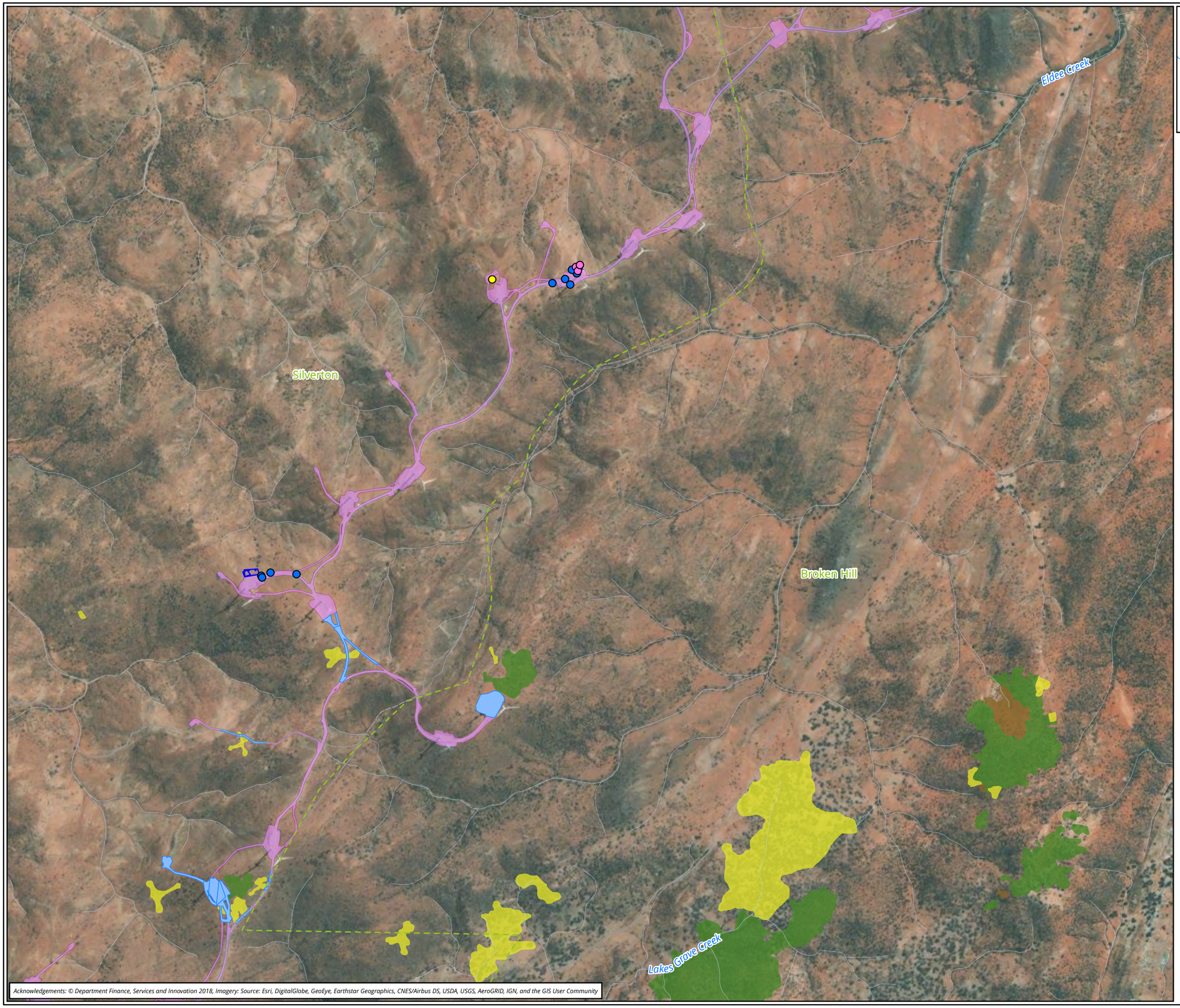

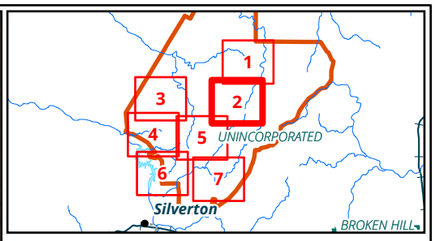

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Infrastructure with PGSW downslope

Species records

- Citrullus lanatus
- Lycium ferocissimum
- Marrubium vulgare
- Marrubium vulgare

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 19.2 Weed species to be controlled for elimination

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 31 May 2021,
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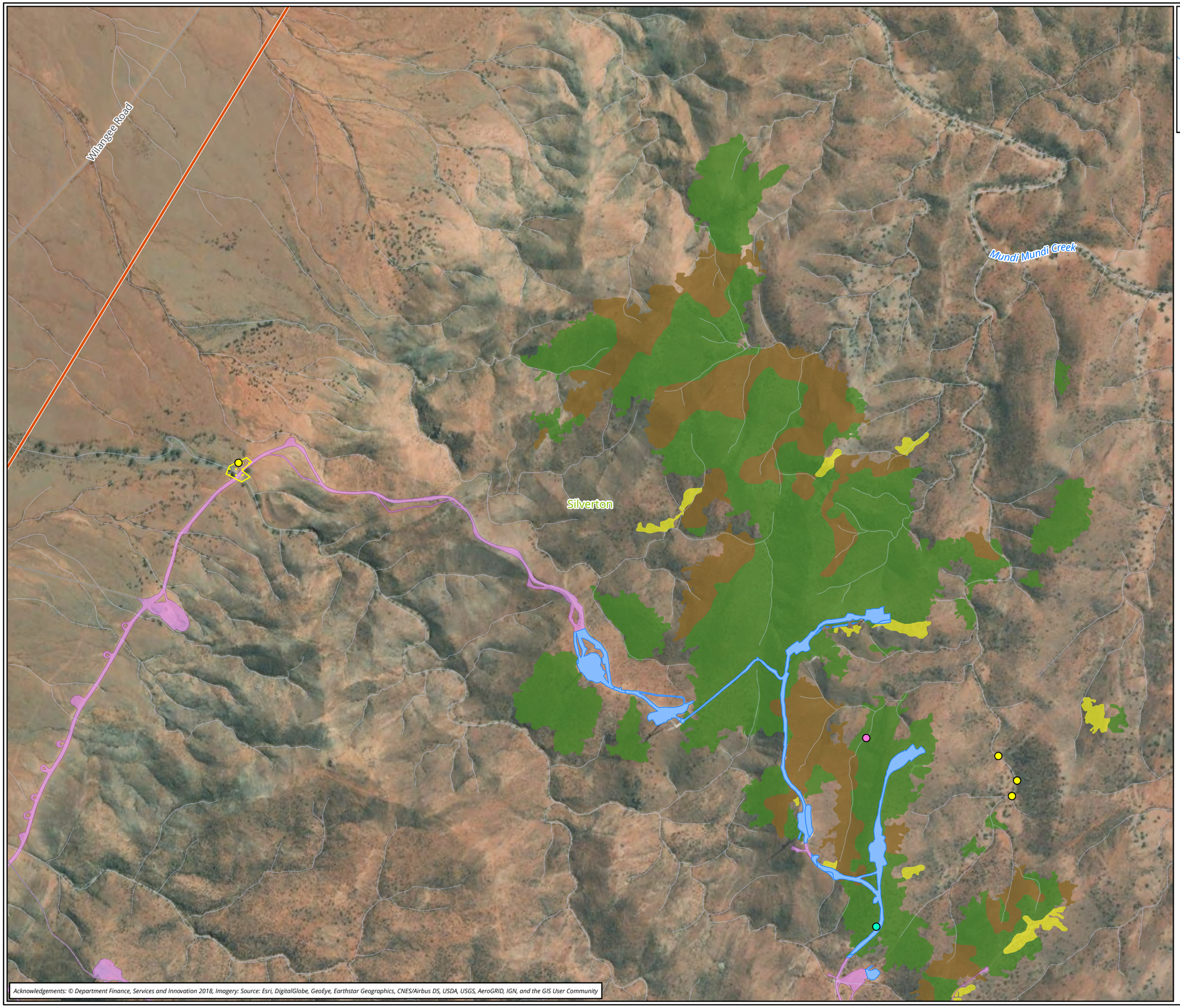

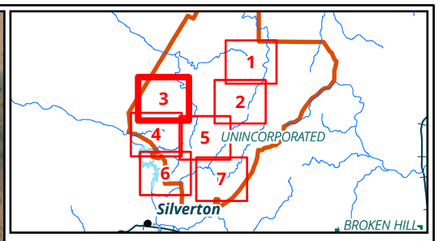

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Infrastructure with PGSW downslope

Species records

- Asphodelus fistulosus
- Citrullus lanatus
- Lycium ferocissimum
- Citrullus lanatus

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 19.3 Weed species to be controlled for elimination

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 31 May 2021,
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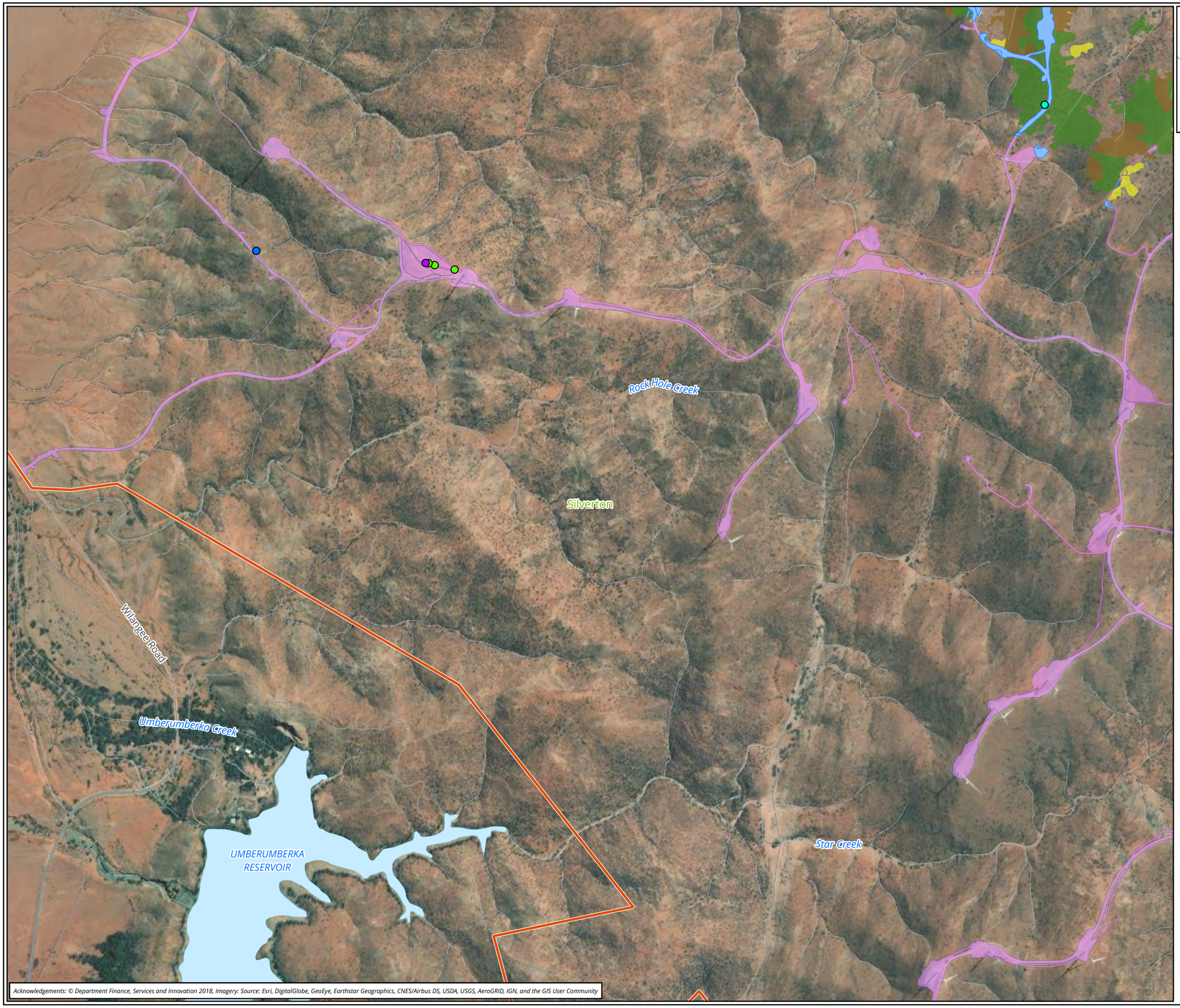

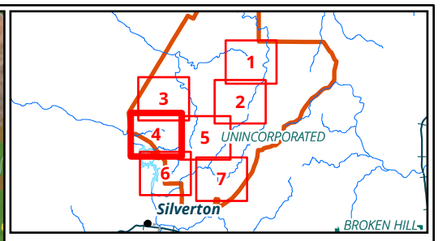

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Infrastructure with PGSW downslope

Species records

- Asphodelus fistulosus
- Cucumis myriocarpus
- Datura inoxia
- Marrubium vulgare

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 19.4 Weed species to be controlled for elimination

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 31 May 2021,
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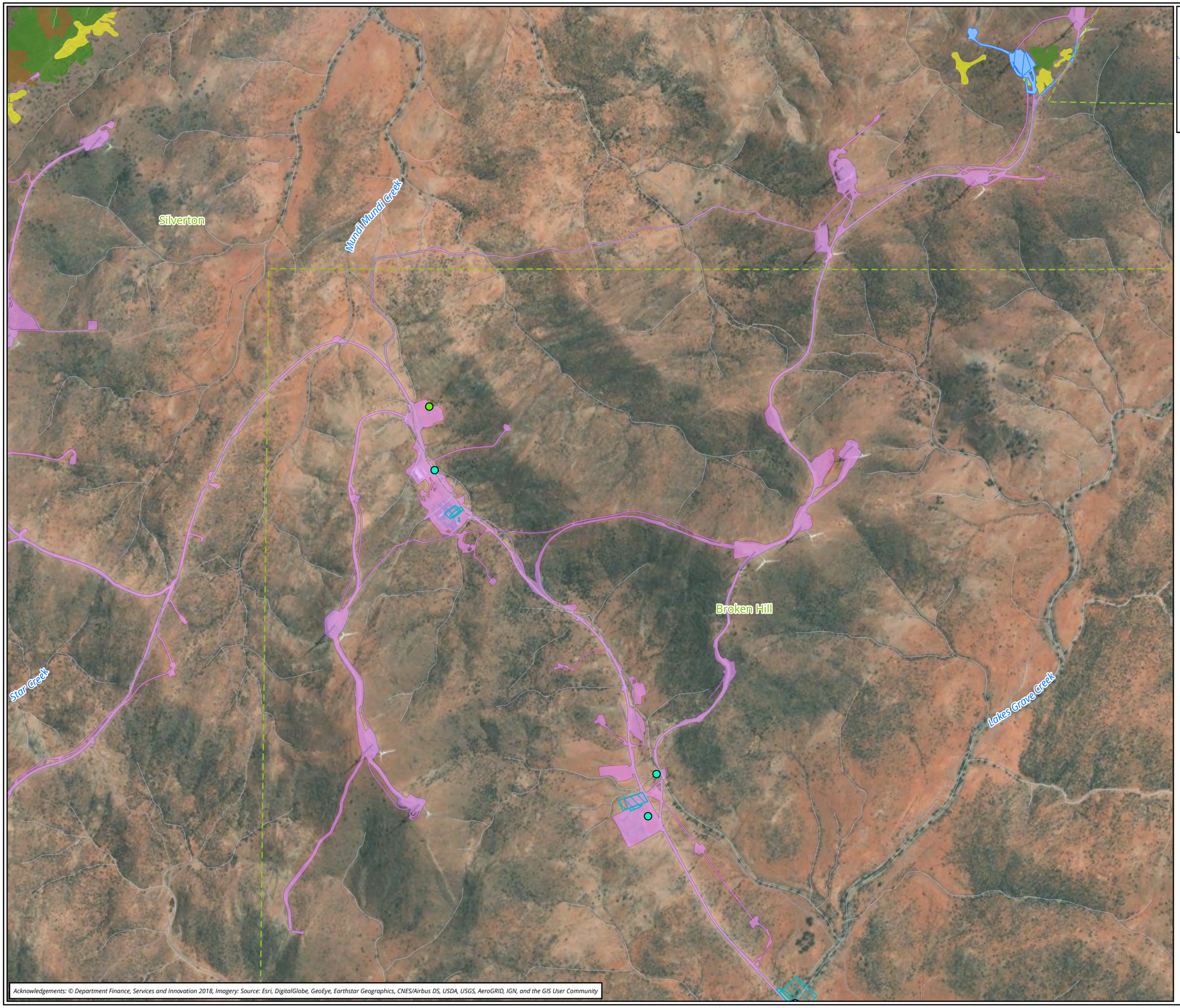

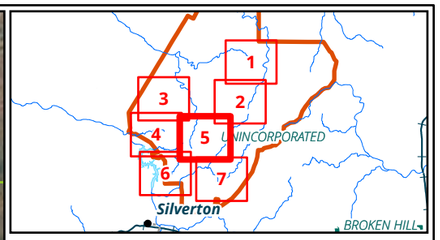

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Infrastructure with PGSW downslope

Species records

- Asphodelus fistulosus
- Datura inoxia
- Lycium ferocissimum
- Asphodelus fistulosus

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 19.5 Weed species to be controlled for elimination

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

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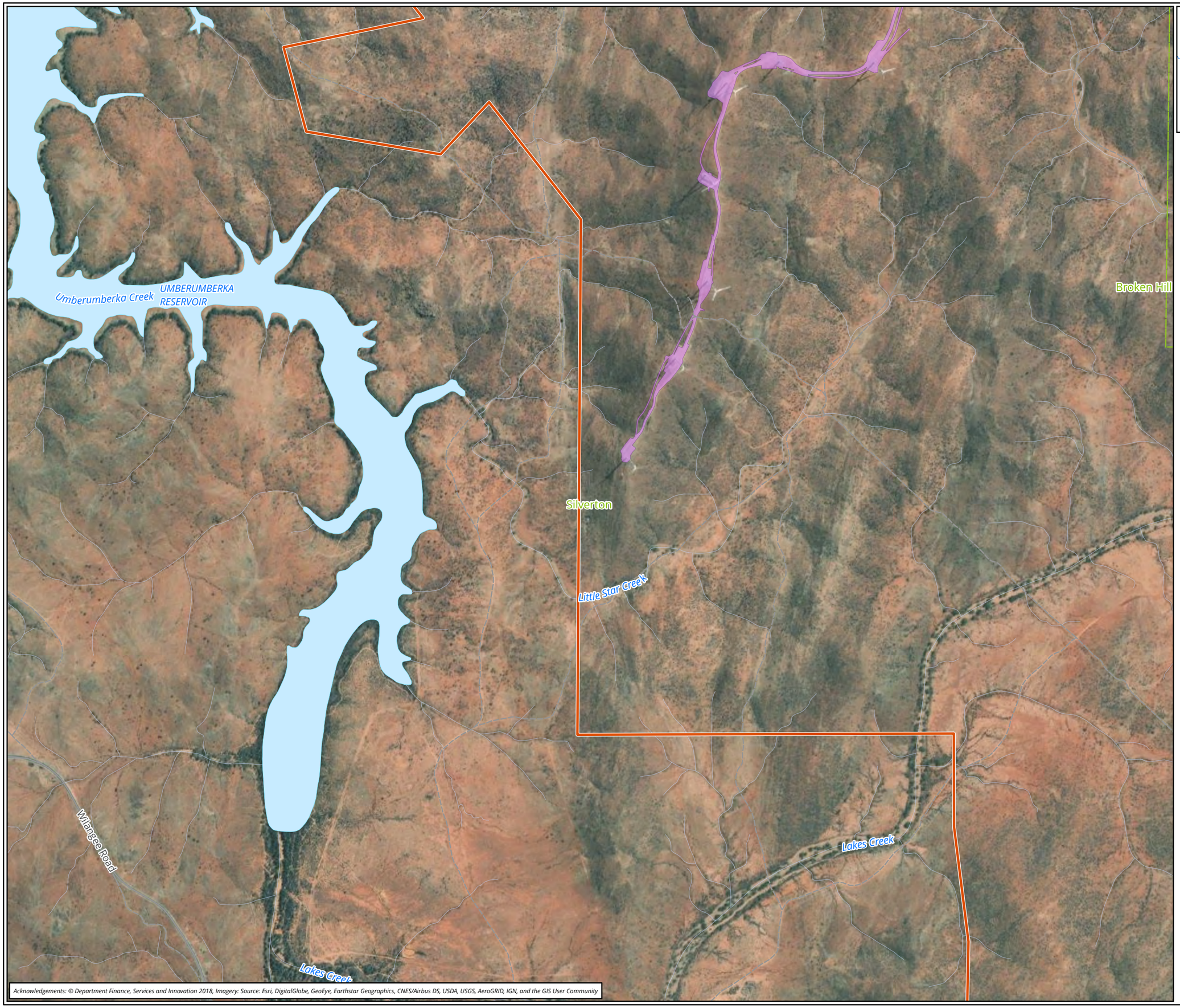

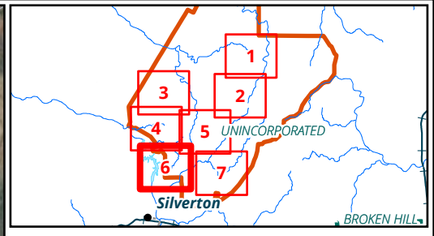

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure

Figure 19.6 Weed species to be controlled for elimination

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
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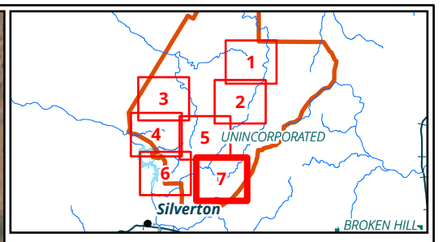

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure

Species records

- Citrullus lanatus
- Datura inoxia
- Lycium ferocissimum
- Marrubium vulgare
- Asphodelus fistulosus
- Datura inoxia

Figure 19.7 Weed species to be controlled for elimination

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 31 May 2021,
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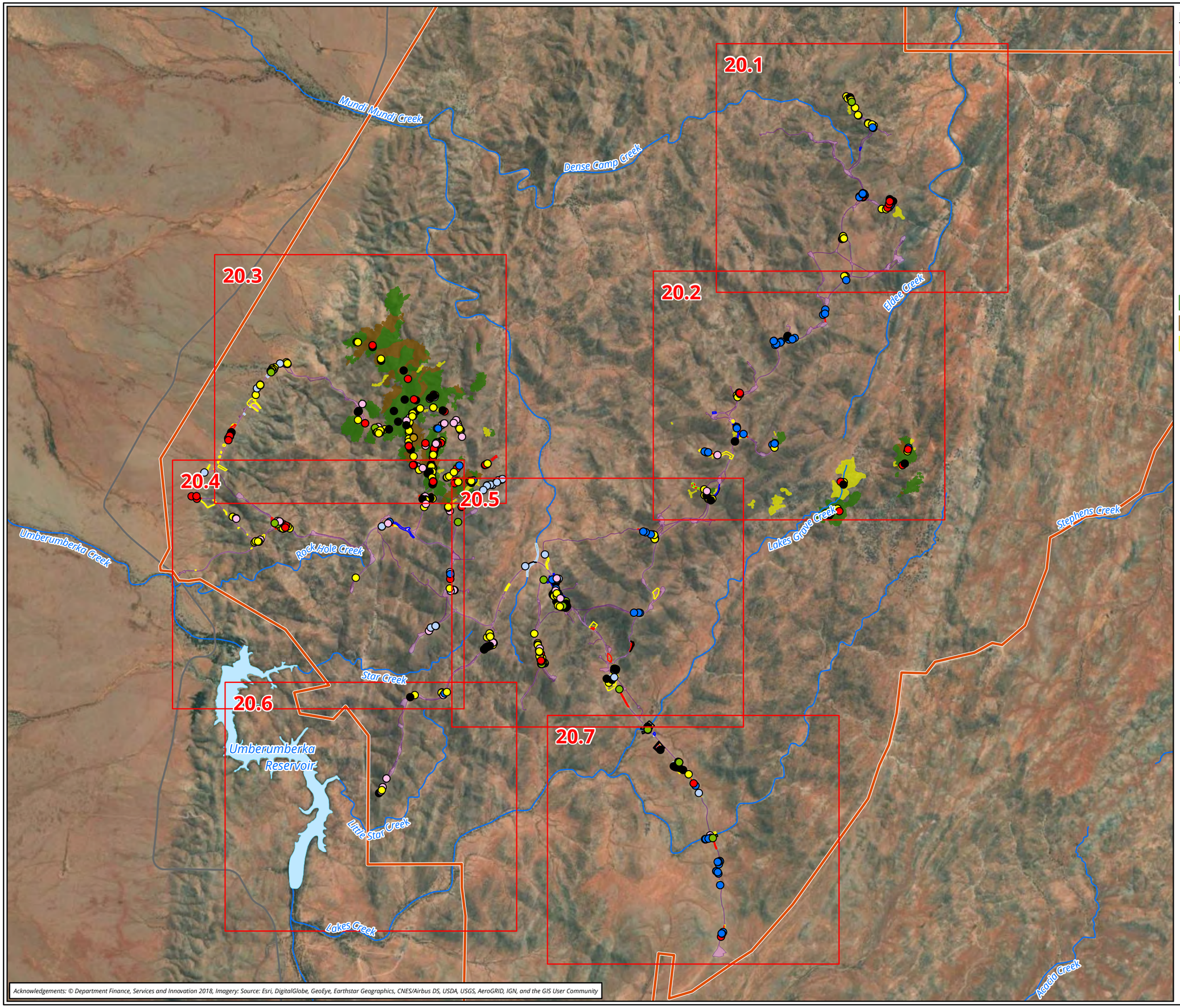

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure

Species records

- Argemone ochroleuca subsp. ochroleuca
- Carrichtera annua
- Carthamus lanatus
- Echium plantagineum
- Rumex hypogaeus
- Limonium lobatum
- Sonchus oleraceus
- Tribulus terrestris

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

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Figure 20 Weed species to be controlled in disturbance areas and adjacent - Overview

0 0.5 1 1.5 2 2.5

Kilometres

N

Scale: 1:60,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 31 May 2021,
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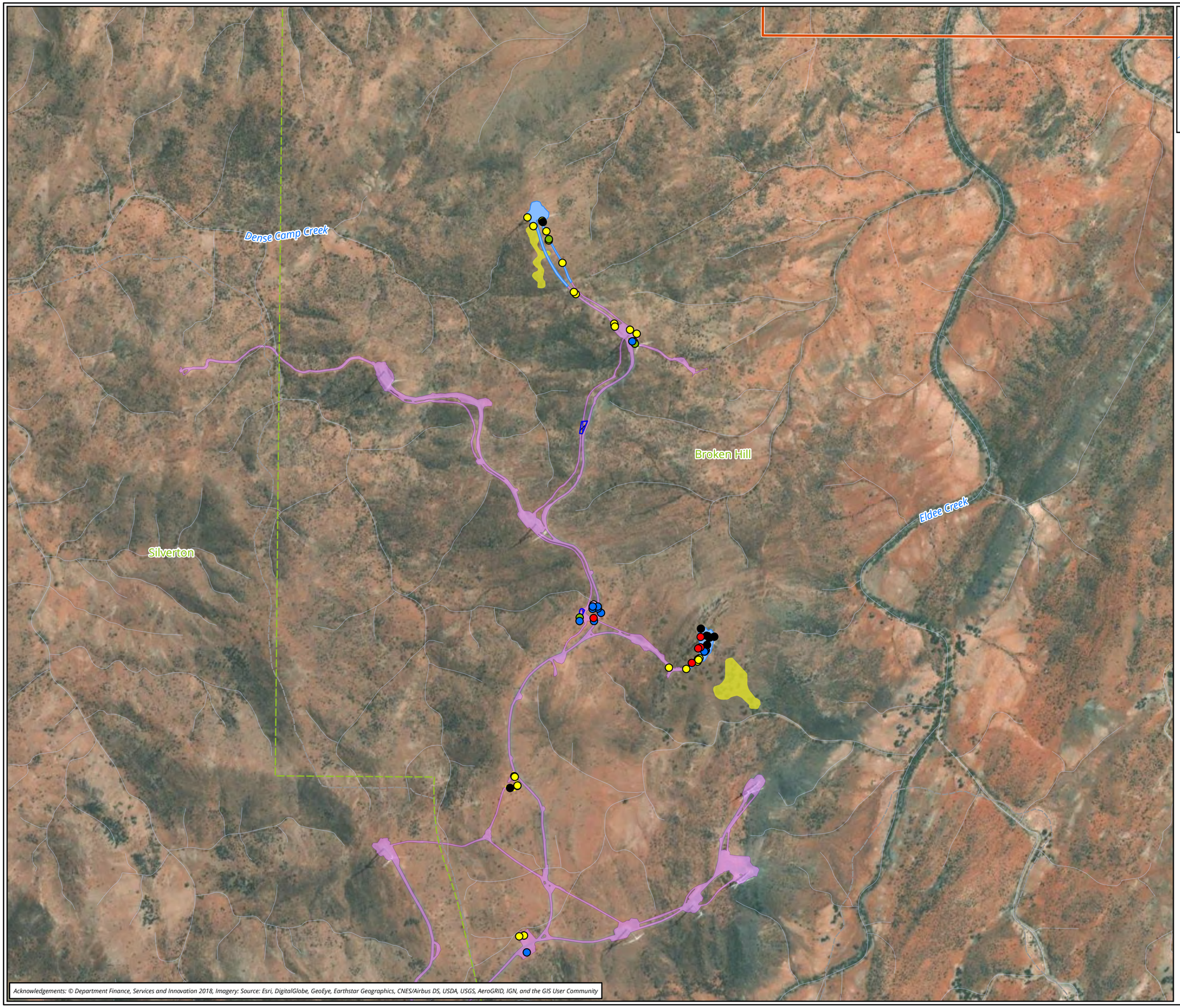

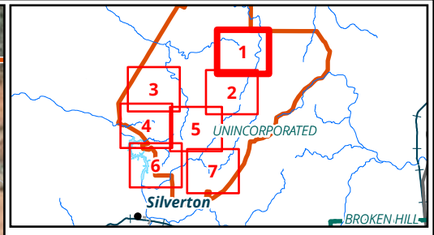

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Infrastructure with PGSW downslope

Species records

- Argemone ochroleuca subsp. ochroleuca
- Carrichtera annua
- Carthamus lanatus
- Limonium lobatum
- Sonchus oleraceus
- Tribulus terrestris
- Argemone ochroleuca subsp. ochroleuca
- Carrichtera annua
- Carthamus lanatus
- Limonium lobatum
- Sonchus oleraceus

PGSW structural variants

- Eucalypts only

Figure 20.1 Weed species to be controlled in disturbance areas and adjacent

0 100 200 300 400 500

Metres

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

N

biosis

Matter: 33377,
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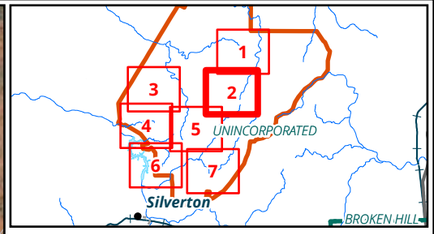

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Infrastructure with PGSW downslope

Species records

- Carrichtera annua
- Carthamus lanatus
- Limonium lobatum
- Sonchus oleraceus
- Tribulus terrestris
- Carrichtera annua
- Carthamus lanatus
- Centaurea aspera
- Limonium lobatum
- Sonchus oleraceus

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Silverton
Eldee Creek
Broken Hill
Lakes Grave Creek

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Figure 20.2 Weed species to be controlled in disturbance areas and adjacent

0 100 200 300 400 500
Metres

N

Scale: 1:15,000 @ A3
Coordinate System: GDA 1994 MGA Zone 54

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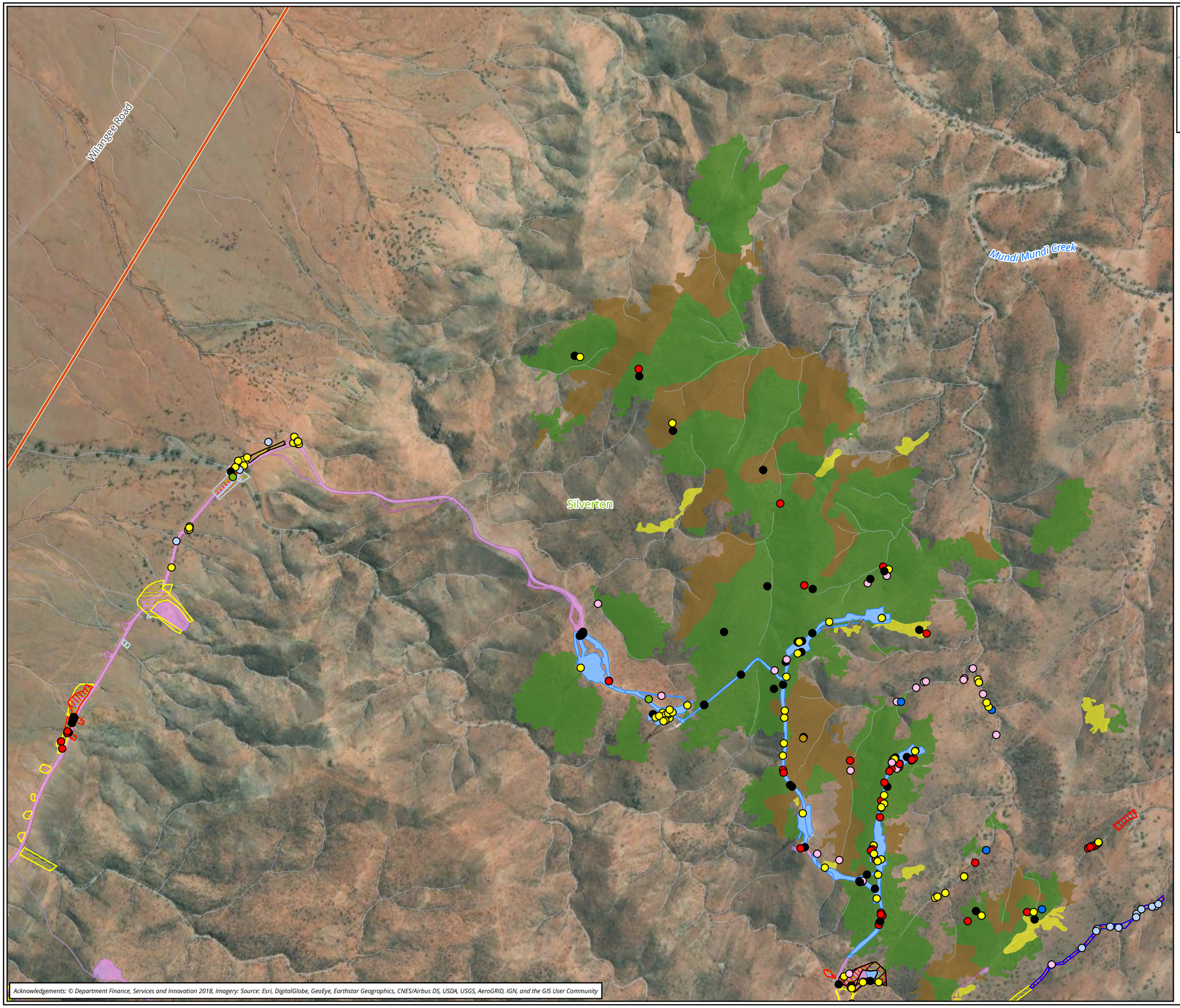

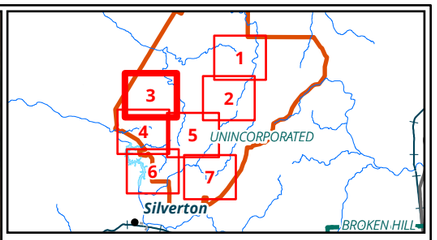

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Infrastructure with PGSW downslope

Species records

- Argemone ochroleuca subsp. ochroleuca
- Carrichtera annua
- Carthamus lanatus
- Echium plantagineum
- Rumex hypogaeus
- Limonium lobatum
- Sonchus oleraceus
- Tribulus terrestris
- Carrichtera annua
- Carthamus lanatus
- Echium plantagineum
- Limonium lobatum
- Sonchus oleraceus

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 20.3 Weed species to be controlled in disturbance areas and adjacent

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
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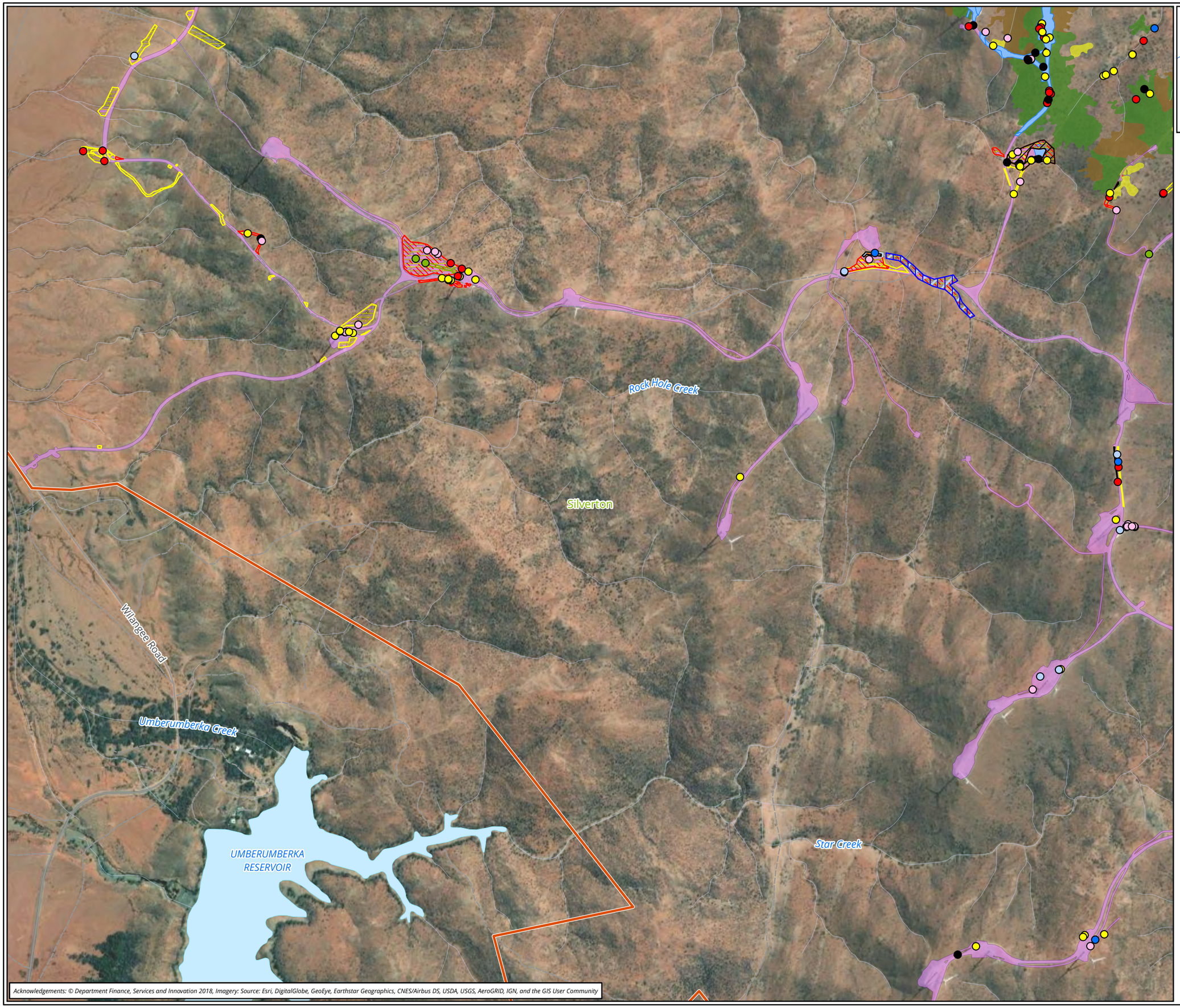

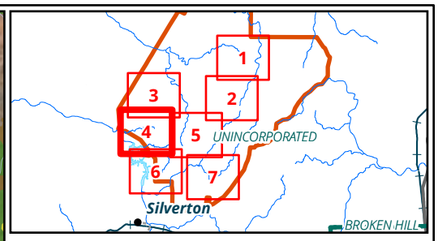

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Infrastructure with PGSW downslope

Species records

- Argemone ochroleuca subsp. ochroleuca
- Carrichtera annua
- Carthamus lanatus
- Echium plantagineum
- Limonium lobatum
- Sonchus oleraceus
- Tribulus terrestris
- Argemone ochroleuca subsp. ochroleuca
- Carrichtera annua
- Carthamus lanatus
- Echium plantagineum
- Limonium lobatum
- Sonchus oleraceus

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 20.4 Weed species to be controlled in disturbance areas and adjacent

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 31 May 2021,
Checked by: ERB, Drawn by: JPT, Last edited by: jturner
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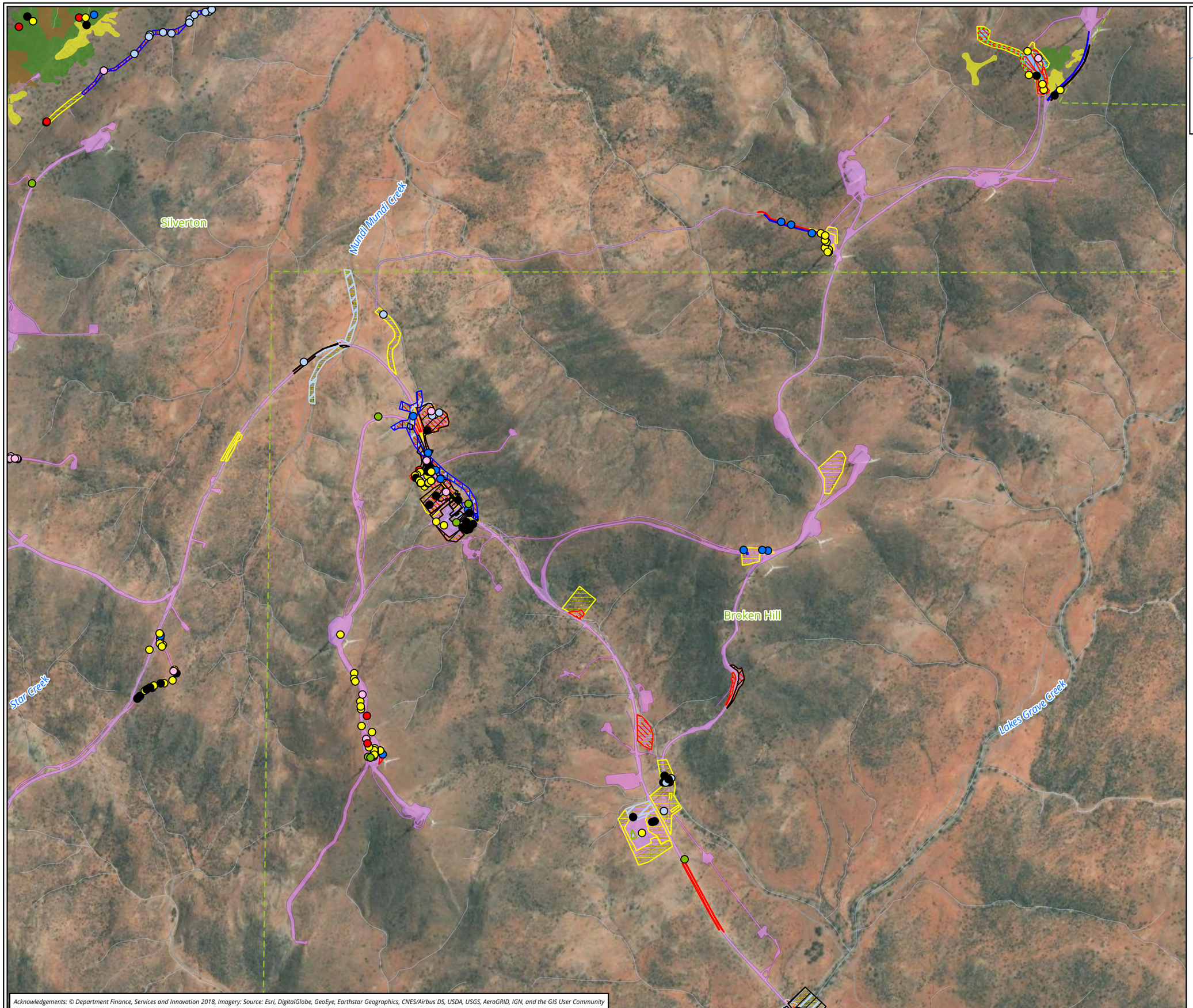

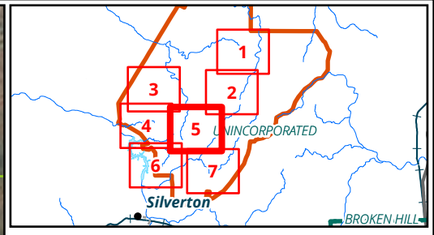

Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure
- Infrastructure with PGSW downslope

Species records

- Argemone ochroleuca subsp. ochroleuca
- Carrichtera annua
- Carthamus lanatus
- Echium plantagineum
- Limonium lobatum
- Sonchus oleraceus
- Tribulus terrestris
- Argemone ochroleuca subsp. ochroleuca
- Carrichtera annua
- Carthamus lanatus
- Centaurea aspera
- Echium plantagineum
- Limonium lobatum
- Sonchus oleraceus

PGSW structural variants

- Porcupine grass with eucalypts
- Porcupine grass only
- Eucalypts only

Figure 20.5 Weed species to be controlled in disturbance areas and adjacent

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
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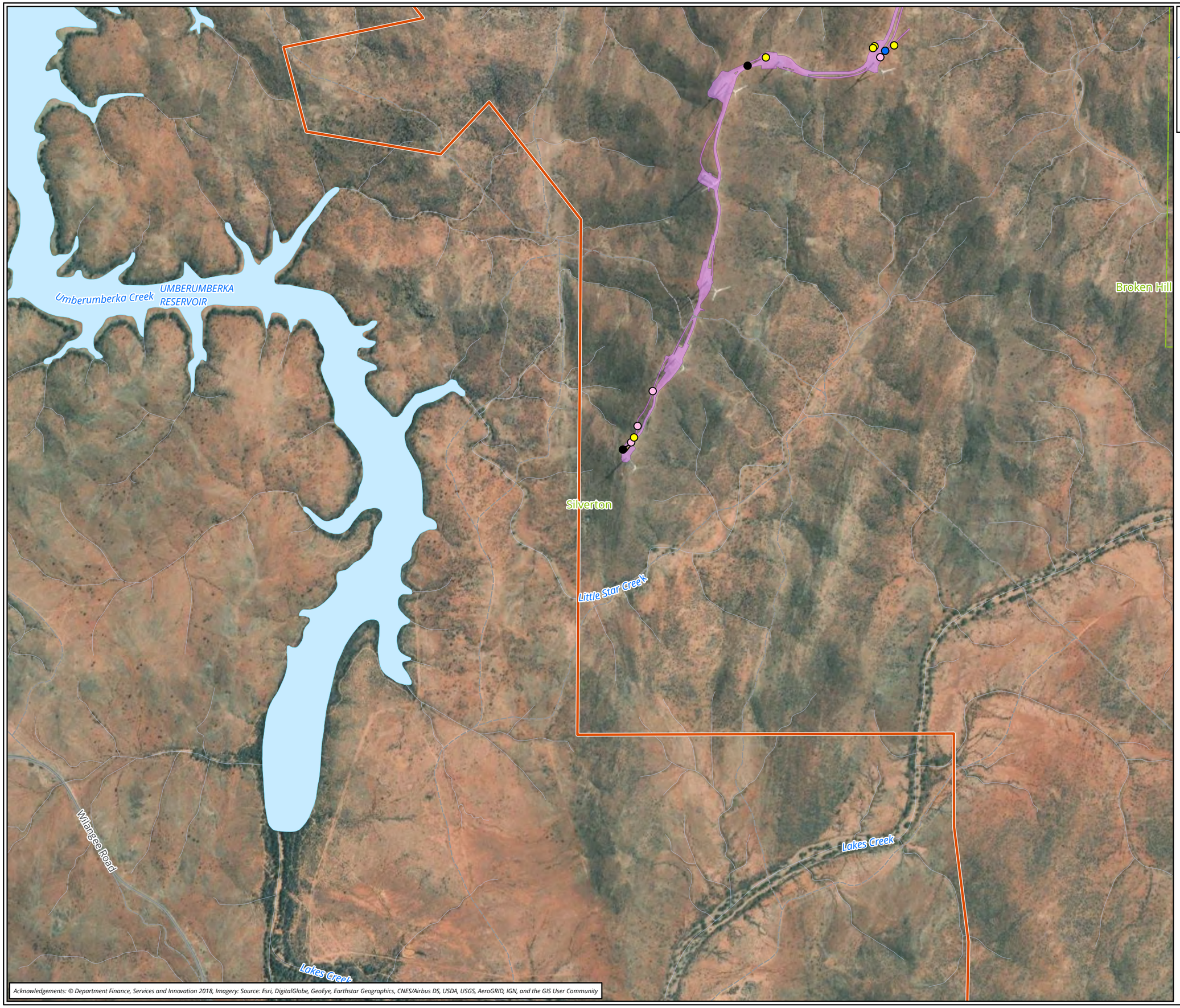
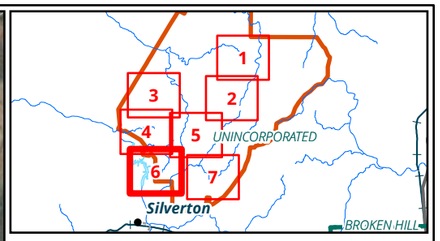




Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure

Species records

- Carthamus lanatus
- Limonium lobatum
- Sonchus oleraceus
- Tribulus terrestris
- Limonium lobatum
- Sonchus oleraceus

Figure 20.6 Weed species to be controlled in disturbance areas and adjacent

0 100 200 300 400 500

Metres

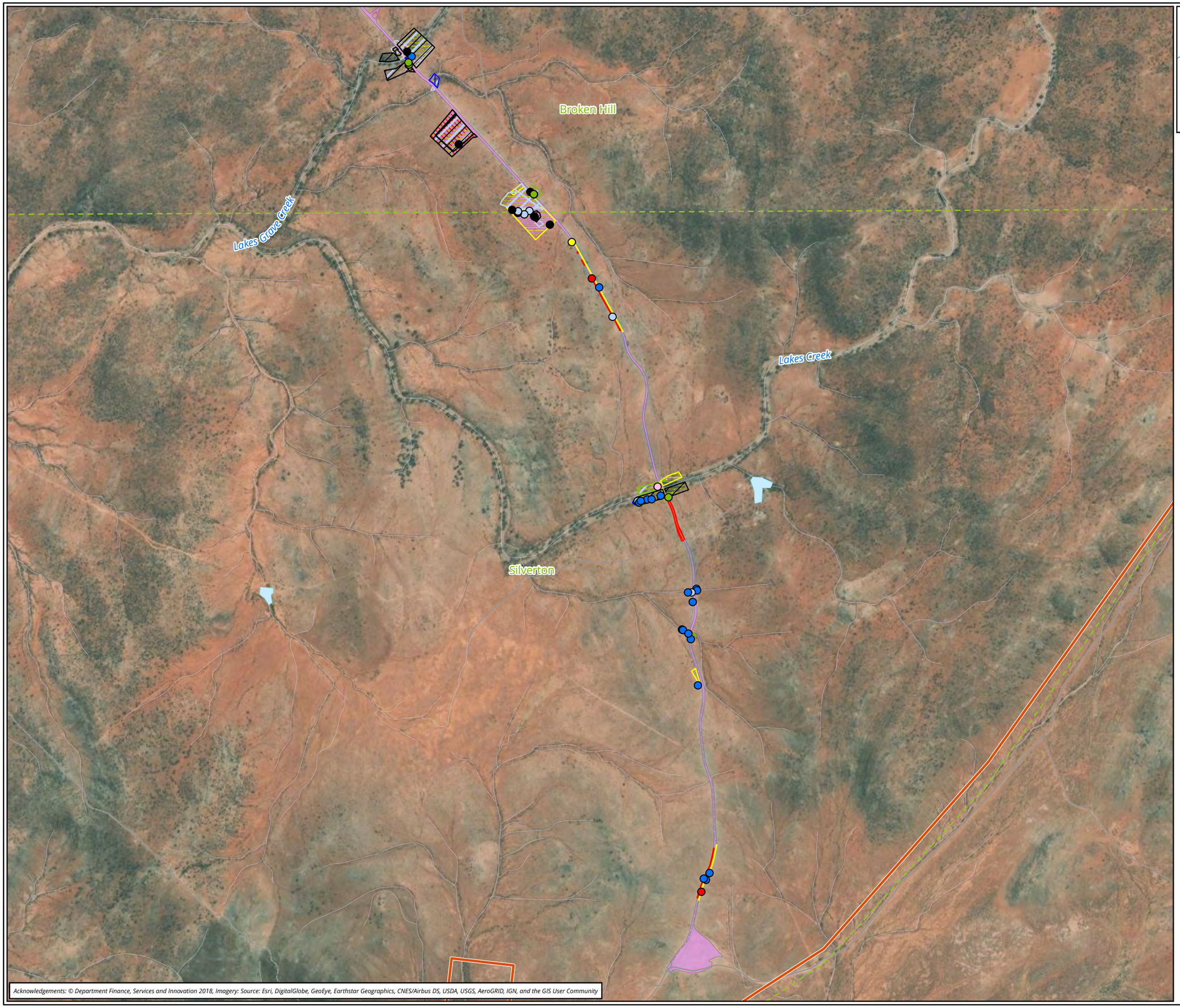
N

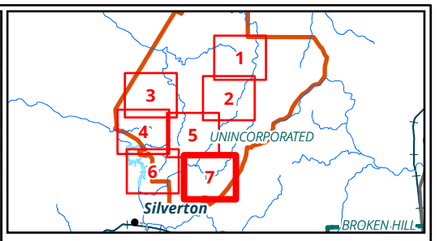
Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 31 May 2021,
Checked by: ERB, Drawn by: JPT, Last edited by: jturner
Layout: F20_Weeds
Location: P:\31100s\31198\Mapping\
Silverton.aprx





Legend

- Silverton Wind Farm boundary
- Wind farm infrastructure

Species records

- Argemone ochroleuca subsp. ochroleuca
- Carrichtera annua
- Carthamus lanatus
- Echium plantagineum
- Limonium lobatum
- Sonchus oleraceus
- Tribulus terrestris
- Argemone ochroleuca subsp. ochroleuca
- Carrichtera annua
- Carthamus lanatus
- Echium plantagineum
- Limonium lobatum
- Sonchus oleraceus

Figure 20.7 Weed species to be controlled in disturbance areas and adjacent

0 100 200 300 400 500

Metres

N

Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 54

biosis

Matter: 33377,
Date: 31 May 2021,
Checked by: ERB, Drawn by: JPT, Last edited by: jturner
Layout: F20_Weeds
Location: P:\31100s\31198\Mapping\Silverton.aprx

3.7.2 Vehicle hygiene for the Wind Farm

In accordance with the BAMP and VMP, all personnel and vehicles entering the study area are required to implement strict hygiene protocols to reduce the potential introduction or spread of pests, weeds or diseases. Exotic weed species are the primary focus of these measures, however other pests / diseases may require hygiene procedures during the operational phase of the wind farm as necessary. All vehicles and equipment exiting a known or potentially contaminated site will be decontaminated to prevent the spread of pests, weeds or diseases. It is noted that the construction phase of the wind farm posed the greater potential for the introduction of exotic species to the site. During the operation phase of the wind farm, the majority of vehicle traffic travels to the Operations and Maintenance (O&M) building.

Due to site constraints, particularly a lack of access to plumbed water, a vehicle washdown bay was determined unsuitable for the site. Therefore, all vehicles attending Silverton Wind Farm must undergo off-site vehicle hygiene. Vehicles are to be audited during the monthly vehicle checks conducted by GE and issued with a hygiene declaration. This would remain current for one month if the following conditions were met:

- A vehicle and machinery hygiene / decontamination checklist (Appendix 5) has been completed during vehicle decontamination as well as during the monthly site audit.
- The vehicle only travels the same route for example: Broken Hill to site and back.
- The vehicle remains on constructed tracks and hardstands.

A new hygiene certificate will be required if:

- The vehicle travels to another location.
- On month has passed.
- A new vehicle is coming to site.

Hygiene checks / decontamination will focus on ensuring no weed vegetation / seed / mud / soil material enters the site (or leaves known infestation areas within the site), with all machinery, vehicles and equipment including footwear will be cleaned prior to entering the site, and when working within a known contaminated area within the site, prior to exiting the contaminated area. Good biosecurity hygiene practises will be routine for any site visit.

A hygiene / decontamination checklist for vehicles and machinery is provided in Appendix 5.

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4. Discussion and conclusions

The extended severe drought that was documented in the baseline surveys in 2018 (Biosis 2020a) and in 2019 (Biosis 2020b) has continued through to the present survey in 2020, with the region still considered drought affected (Section 3.1). However, in August and September 2020, there were two significant rainfall events that triggered the response of ephemeral native and introduced flora species, which had not been previously recorded during the vegetation monitoring.

Documentation of project compliance relevant to this report are detailed in Appendix 7.

4.1 Condition of PGSW community

Significant rainfall events in 2020 triggered a response in the vegetation such that mean native species richness in the monitoring plots had increased more than three times that of the previous two surveys (Section 3.5.1). As documented in previous surveys, species richness was highest outside the goat fence, and in the *eucalypts only* structural variant of the community. In general, the condition of woody species improved in response to the rainfall events (3.5.5), however the canopy of eucalypts are still showing stress from the continuing drought conditions, with dieback of branchlets and small branches, as well as the dieback of main branches in numerous individuals. Many dead shrubs were documented in the monitoring plots. In addition, the prolonged drought has resulted in most of the Porcupine Grass tussocks across the wind farm turning grey and senescing, such that many individuals are assumed to be dead (Photo 6). As there had not been follow-up rainfall many individuals had failed to reach reproductive maturity or already desiccated at the time of the PGSW survey in December 2020, and overall the condition of the vegetation is considered to be continuing to decline due to drought (Section 3.5). Ongoing rainfall is required to improve the condition of the extant individuals and enable the recruitment of new plants within the community, and it is unlikely that the condition of these individuals will improve until rainfall increases.

Over the three years of monitoring to date, it has been documented that the sites within the goat fence have lower species richness than sites outside the goat fence. Anecdotally, Biosis field staff indicated that areas of PGSW outside the goat fence were in less rugged terrain, potentially with greater soil depth, fertility and topographic protection than those within the goat fence (Biosis 2020b). Therefore, an investigation of other factors that might contribute to variation in site species richness and composition was undertaken. There is a general trend of decreasing species richness with increasing elevation, primarily driven by sites outside the goat fence, with species richness and abundance between plots outside the goat fence being similar irrespective of elevation. However, there are no sites within PGSW outside the goat fence at elevations as high as those within the fence to provide a full comparison of the influence of elevation outside the goat fence. Overall, this assessment confirms that sites outside the goat fence are generally topographically protected from drying climatic conditions when compared with the generally steeper exposed sites inside the goat fence in alignment with field observations. The less extreme environmental conditions at these sites are likely to be a contributing factor in the higher species richness documented at these monitoring plots.

Given the number of additional species documented in 2020, Biosis are in the process of collating available knowledge of species palatability for assessment in the 2021 vegetation monitoring report.

As outlined in the Goat Management Plan (Biosis 2018d) and previous monitoring reports (Biosis 2020a, Biosis 2020b), harvesting feral goats by leaseholders has led to a reduction in goat numbers generally. The focus on goat management is to maintaining goats at a level where they remain economically viable for harvest. As stated in the 2019 report, this management focus is a challenge as the commercial approach may be in conflict with conservation management, where eradication or suppression at very low numbers is the

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goal (Russell, Letnic, & Fleming 2011). The maintenance of commercial numbers of feral goats within the landscape may ultimately be at odds with the conservation management of PGSW. However, the drought conditions continue to impact on feral goats, with reduced numbers in the landscape due to a combination of low levels of palatable vegetation and ongoing goat management by leaseholders in the area (Section 3.4.2). Goats continue to be excluded from the community within the goat fence, and from field observations, scat counts and landholder discussions, all herbivore numbers are at a very low levels in the district (Section 2.4).

4.2 Roadside drainage

The 2020 surveys observed that whilst the construction of roads across the site has often resulted in the road surface sitting lower than the adjoining undisturbed land, there are areas of roadside and hardstand, including areas upslope and adjacent to PGSW, where roadside drainage controls are inadequate and pose risk to the PGSW community through erosion, sedimentation and introduction of weed species into the community (Section 3.6).

Biosis have been informed by AGL that CATCON will install sediment traps on the road and hardstands adjacent to PGSW areas..

Biosis will to conduct two surveys of these disturbance areas in 2021, pending travel constraints due to COVID-19. These surveys will check the implementation and effectiveness of these management measures.

4.3 Introduced species of the Wind Farm

Implementation of the weed management measures described in the BAMP (Section 7.5) require that:

1. All NSW DPI Priority Weeds are controlled to current levels or less.
2. All other priority weeds will be limited to current levels.
3. Any new weed incursions that are identified within the site (particularly areas of construction disturbance) will be eliminated.

In particular, Table 4.2 of the VMP (Biosis 2018e) includes the following requirements (Table 4-1)

Table 4-1 Annual weed management summary

Maintenance Activity	Key areas	Frequency (from VMP)
Control of targeted NSW state and regional priority weeds	Mapped priority weed locations. Any new infestations/priority weed locations found during routine inspections.	Ongoing, all year. Refer to Appendix 3 of VMP for timing for individual species.
Control of other priority herbaceous and perennial weed species	Roadsides, roadside batters, all temporary disturbance areas (including soil/subgrade stockpile areas), riparian zones and waterway crossings (including creek lines and ephemeral drainage lines), asset surrounds and carparks, gates and cattle grates, fence lines, and beneath and adjacent to existing power cables to	Ongoing program. At a minimum treatments will be undertaken quarterly and 1 and 3 months post significant rain events (>25 mm) (to mitigate opportunistic weed seed germination and flowering periods) and as required based on maintenance inspections.

Maintenance Activity	Key areas	Frequency (from VMP)
	manage temporary disturbed areas and exotic seed rain.	

As discussed, there is no reference baseline data on weed populations at the Silverton Wind Farm against which to measure items 2 and 3 above. Additionally, due to the pulse dynamics of arid flora, weed cover and abundance will fluctuate greatly, it is recommended that the weed management objectives are amended as highlighted (in italics) to reflect Section 3.7.1:

- All NSW DPI Priority Weeds are controlled to ~~current~~ *2020* levels or less, *with the aim of elimination from site (note:* African Boxthorn *Lycium ferocissimum is the only priority weed recorded to date).*
- All other priority weeds will be limited to current levels *or less assets and adjacent areas,based on the results of the 2020 post rainfall surveys.* (Section 3.7.1)
- *All weed incursions within areas of construction disturbance be treated in accordance with the VMP and BAMP.*
- Any new weed incursions that are identified within the site *assets and adjacent areas, relative to the results of the 2020 post rainfall survey* will be eliminated.

An additional monitoring item is recommended for the bushland management contractor to:

- Document the date, extent and target species of weed management measures implemented during each treatment program.

To maintain low weed densities across the study area, an annual weed management program will be implemented, with all known locations and identified risk areas within the Silverton Wind Farm works areas treated as per obligations outlined in Western Local Land Service (2017).

It is recommended that the following key actions are implemented:

- Immediate initiation of weed management treatments in accordance with the BAMP and VMP as specified above, incorporating the recommended amendments if approved by the Department of Planning, Industry and Environment (DPIE). Management is to be implemented by a contractor with sound knowledge of flora of the site to minimise impacts to native species, particularly in the regeneration areas.
- Continuation of the GE Renewable vehicle hygiene policy (Appendix 5).
- Monitoring of construction disturbance on an ongoing basis as required by the BAMP.
- Update the BAMP to include the specific weed management and monitoring measures, rather than referring to the VMP.

Update action 2.14 in VAMP and associated plans to reflect the following:

- An annual weed management program is implemented with a strong focus on high impact areas and weed seed vector routes within the study area.
- Priority weeds limited to 2020 cover levels.
- New weeds identified and treated.

Table 4-2 Recommended amendments to annual weed management summary

Maintenance Activity	Key areas	Frequency	Status
Baseline mapping of NSW DPI Priority Weeds	Seek mapping of priority weeds from previous reporting Map populations of NSW priority weeds observed during baseline surveys in Spring 2018. Spatial data will be distributed between GE, Vegetation Management Contractor and Project Ecologist.	No shapefiles were available as reported in 2018 vegetation monitoring report (Biosis 2020a).	No change
Control of targeted NSW state and regional priority weeds	Mapped priority weed locations (Figure 29). Any new infestations/priority weed locations found during routine inspections.	Ongoing, all year. Refer to Appendix 3 for timing for individual species.	Baseline mapping of priority weeds now available
Control of high threat species currently present in low abundance	Mapped priority weed locations (Figure 30). Any new infestations/priority weed locations found during routine inspections.	Ongoing, all year. Refer to Appendix 3 of the VMP for timing for individual species.	New action
Control of other priority herbaceous and perennial weed species, targeted to high risk, high priority species.	Roadsides, roadside batters, all temporary disturbance areas (including soil/subgrade stockpile areas), riparian zones and waterway crossings (including creek lines and ephemeral drainage lines), asset surrounds and carparks, gates and cattle grates, fence lines, and beneath and adjacent to existing power cables to manage temporary disturbed areas and exotic seed rain.	Ongoing program. At a minimum treatments will be undertaken quarterly and 1 and 3 months post significant rain events (>25 mm) (to mitigate opportunistic weed seed germination and flowering periods) and as required based on maintenance inspections.	Action refined to reflect species of management concern (AP pers. comm. 2021 following conversations with WLLS). Mapping of weed presence now available.
Monitoring	Mapped priority weed locations, temporary disturbance areas/restoration areas, and all asset/infrastructure maintenance areas.	Twice-yearly site inspections by the Project Ecologist or more frequently as required e.g. 1and 3 months after significant rain events (>25 mm) or if required following maintenance inspections	No change
Mapping updates	Spatial data will be updated with any new infestations/priority weed locations and shared between GE, Vegetation	Ongoing, all year.	No change

Maintenance Activity	Key areas	Frequency	Status
	Management Contractor and Project Ecologist.		

Due to the extent of roads at the site, twice-yearly survey effort by the project ecologist is to be prioritised as follows:

1. Areas of disturbance above (upslope of) PGSW (to be inspected entirely).
2. The site main road in to the Operations and Maintenance building (key weed vector - subsampled, with higher priority on drainage lines and on lower slopes).
3. Areas of Barrier Range Dragon Habitat (subsample).
4. Rehabilitated areas (subsample).
5. Additional roadside areas (limited subsample, with higher priority on drainage lines and on lower slopes).
6. Turbine hardstands (limited subsample).

4.4 Seed collection for the Wind Farm

Construction works have been completed by CATCON and written approval that works have been complete is provided, however Biosis have not been provided with reporting regarding the rehabilitation works completed at site by CATCON. Ongoing monitoring of areas rehabilitated as part of the Silverton Wind Farm Works will be the responsibility of GE.

Despite limited rainfall at site, initial recruitment of native species is occurring across the rehabilitated areas. However the response to date has been patchy and many exotic species have also been documented at these sites. At present, it is recommended that control of introduced species is ongoing in these areas to provide the opportunity for natural regeneration to occur from adjoining areas of native vegetation following rainfall in the region. At this stage a restoration plan is not required to be 'developed and implemented for disturbed areas where regeneration fails or is likely to require additional support' in accordance with the VMP Section 4.2.1.

A small amount of seed collection was occurring in 2018, however the region has been in drought since that time. Although there was some rain in 2020, the region continues to be drought affected. Therefore it is not an optimal time for seed collection. When this drought breaks, collection of seed in accordance with the VMP is to be prioritised during the time that the plant species reproduce in response to the rain. This will allow storage for any future rehabilitation works that may be required.

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4.5 Recommendations

It is recommended that the following changes are incorporated into the relevant management plans for Silverton Wind Farm for implementation.

Table 4-3 Recommended amendments to actions and associated subplans

(Amendments/updates to existing actions are indicated in **bold**), subheadings indicate the plans to which the action needs to be applied.

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Timing	Status
BAMP and all subplans							
2.28	**BAMP reporting**	**Annual summary reporting**	**Progress on the implementation of management measures outlined in the BAMP and the results and analysis of monitoring will be reported annually to relevant stakeholders.**	**Annual summary reporting detailing activities completed against BAMP management actions submitted to BCD and DPIE.**	**Project ecologist**	**Annually**	New action (was previously required in-text in the BAMP). Annual reporting submitted to date has documented the monitoring, management measures and recommendations regarding the subplans (BRD, PGSW and Feral Goats) but not a summary report against the overarching BAMP.
BAMP and VMP							
1.7	Hygiene protocols	Strict hygiene protocols implemented to reduce the potential introduction or spread of invasive flora and fauna species as per Section 4.1.2.	No new invasive species introduced.	**All vehicles attending all personnel working on the Silverton Wind Farm must undergo off-site vehicle hygiene.**	Project Manager / all site personnel	Ongoing	Amendment to existing action - After investigation into options, GE advised that offsite hygiene protocols are to be implemented due to site

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Timing	Status
				• **Hygiene checklist is to be completed during off-site cleaning (**Appendix 5**)** • **Vehicles are to be audited during the monthly vehicle checks conducted by GE and a checklist completed again.** • **The vehicle may then be issued with a hygiene declaration. This would remain current for one month if the conditions in Section 4.1.2 are met.** **Vehicles to remain on-track at site (Noting most traffic only travels to the O&M building).** Inspection checklists submitted.			constraints (particularly access to plumbed water).
2.14	Weed control	Weed control works will be implemented in accordance with Section 4.3.	• **An annual weed management program is implemented with a strong focus on high impact areas and weed seed vector routes within the study area.** • Priority weeds limited to current cover levels **(from 2020 baseline)** • New weeds identified and treated.	Weed management operational checklists submitted. Weed Control Works Sheets submitted.	Vegetation management contractor / Project Ecologist	Ongoing.	Amendment to existing action
2.25	Review of VMP	Annual review of VMP management actions as per	Review annual reports. Update management actions as	Annual works plan prepared **and implemented. VMP updated as**	Project Ecologist in	Annually **if required**	Amendment to existing action

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Timing	Status
	management actions.	Section 4.4.	appropriate	**required and submitted to DPIE and BCD.**	consultation with GE and Vegetation Management Contractor		
2.27	**Seed collection**	**Collection and storage of seed for additional rehabilitation works (if required)**	**Seed collection will be prioritised during recruitment and growth periods following significant rain events in accordance with Section 4.2.4**	**Seed collection**	**Restoration ecologist**	**Following significant rain events when seed set is suitable for collection**	New action (was previously required in-text of the VMP)

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4.6 Conclusion

As noted in the 2019 monitoring report, the impacts of the extended drought on the PGSW community are likely to be similar to the impacts of fire outlined in the BAMP (Biosis 2018a). Young plant growth may be more palatable to herbivores than older biomass, (Keith & Tozer 2012), limiting recruitment and opportunities for replenishing the soil seed bank.

With the documented ongoing decline in condition of PGSW, the 2019 recommendation is still relevant: that feral goats continue to be excluded from PGSW from the present until at least one year following the declared end of this extended drought, to allow recruitment and recovery of the community, as this will provide the greatest opportunity for improvement in vegetation condition.

It is noted that this continued exclusion of all goats is greater than originally recommended in the Goat Management Plan due to the documented severe impact of the drought on the PGSW vegetation. If total grazing pressure is contained following drought, recruitment can occur and improvement in vegetation condition would be expected. Ongoing mustering will need to occur in the fenced area to actively remove any stray goats during the exclusion period. As in 2019, it is recommended that resumption of grazing following the breaking of the drought is only undertaken based on advice from the Project Ecologist and following an assessment of ongoing vegetation monitoring data.

Monitoring of the PGSW community will provide an important opportunity to gain further insight into the composition and condition of the Critically Endangered PGSW, as well as the influence of the current management regimes. The recovery of the community following the drought should also provide insight regarding its overall condition. If diversity and cover respond quickly then it is probably resilient, if there is little recovery then health of the community may be compromised. These insights will inform future conservation management of the community.

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Appendices

Appendix 1 Photopoint monitoring

Year	Site tag	Looking north-east	Looking south-west
Site 1 Inside goat fence **PCT359 - Porcupine Grass hummock grassland with key eucalypt species present**			
2018			
2019			

Year	Site tag	Looking north-east	Looking south-west
2020			
Site 2 **Inside goat fence** **PCT359 - Porcupine Grass hummock grassland with key eucalypt species present**			
2018			

Year	Site tag	Looking north-east	Looking south-west
2019			
2020			

Year	Site tag	Looking north-east	Looking south-west
Site 3 Inside goat fence **PCT359 - Porcupine Grass hummock grassland without key eucalypt species present**			
2018			
2019			

Year	Site tag	Looking north-east	Looking south-west
2020			
Site 4 Inside goat fence **PCT359 - Porcupine Grass hummock grassland without key eucalypt species**			
2018			

Year	Site tag	Looking north-east	Looking south-west
2019			
2020			

Year	Site tag	Looking north-east	Looking south-west
Site 5 Inside goat fence **PCT359 - Porcupine Grass hummock grassland with key eucalypt species**			
2018			
2019			

Year	Site tag	Looking north-east	Looking south-west
2020			
Site 6 **Inside goat fence** **PCT359 - Porcupine Grass hummock grassland with key eucalypt species**			
2018			

Year	Site tag	Looking north-east	Looking south-west
2019			
2020			

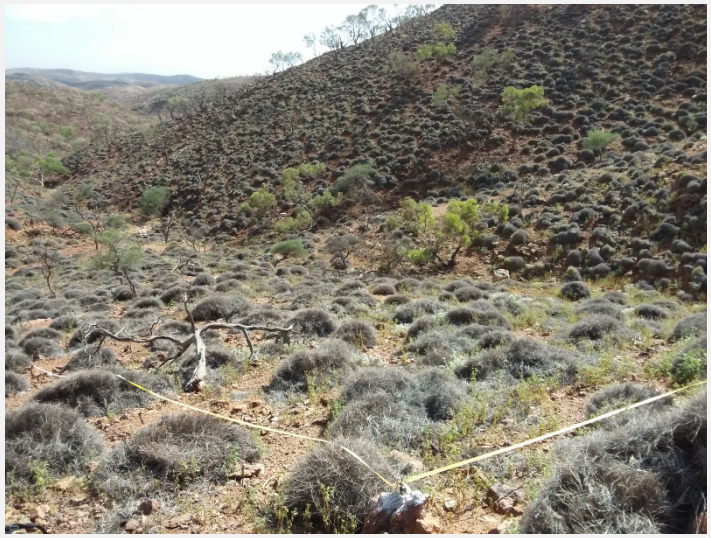
Year	Site tag	Looking north-east	Looking south-west
Site 7 Inside goat fence **PCT359 - Porcupine Grass hummock grassland with key eucalypt species.**			
2018			
2019			

Year	Site tag	Looking north-east	Looking south-west
2020			
Site 8 Inside goat fence **PCT359 - Porcupine Grass hummock grassland with key eucalypt species.**			
2018			

Year	Site tag	Looking north-east	Looking south-west
2019			
2020			

Year	Site tag	Looking north-east	Looking south-west
Site 9 Inside goat fence **PCT359 - Porcupine Grass hummock grassland with key eucalypt species**			
2018			
2019			

Year	Site tag	Looking north-east	Looking south-west
2020			
Site 10 **Inside goat fence** **PCT359 - Porcupine Grass hummock grassland with key eucalypt species**			
2018			

Year	Site tag	Looking north-east	Looking south-west
2019			
2020			

Year	Site tag	Looking north-east	Looking south-west
Site 11 **Inside goat fence** **PCT359 - Eucalypt species present without/with minimal Porcupine Grass**			
2018			
2019			

Year	Site tag	Looking north-east	Looking south-west
2020			
Site 12 **Inside goat fence** **PCT359 - Porcupine Grass hummock grassland with key eucalypt species present**			
2018			

Year	Site tag	Looking north-east	Looking south-west
2019			
2020			

Year	Site tag	Looking north-east	Looking south-west
Site 13 **Inside goat fence** **PCT359 - Porcupine Grass hummock grassland without key eucalypt species present**			
2018			
2019			

Year	Site tag	Looking north-east	Looking south-west
2020			
Site 14 **Inside goat fence** **PCT359 - Porcupine Grass hummock grassland with key eucalypt species present**			
2018			

Year	Site tag	Looking north-east	Looking south-west
2019			
2020			

Year	Site tag	Looking north-east	Looking south-west
Site 15 **Inside goat fence** **PCT359 - Porcupine Grass hummock grassland with key eucalypt species present**			
2018			
2019			

Year	Site tag	Looking north-east	Looking south-west
2020			
Site 16 **Outside goat fence** **PCT359 - Porcupine Grass hummock grassland with key eucalypt species present**			
2018			

Year	Site tag	Looking north-east	Looking south-west
2019			
2020			

Site 17 **Outside goat fence**
PCT359 - Porcupine Grass hummock grassland with key eucalypt species present

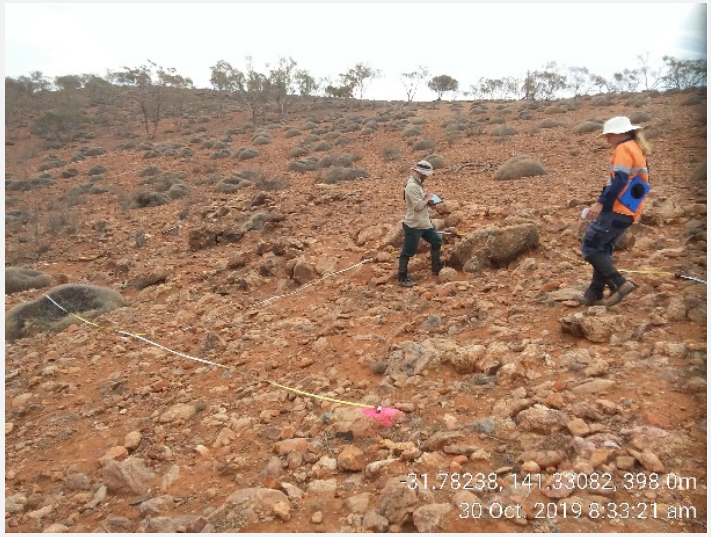
Year	Site tag	Looking north-east	Looking south-west
2018			
2019			

Year	Site tag	Looking north-east	Looking south-west
2020			
Site 18 **Outside goat fence** **PCT359 - Eucalypt species present without/with minimal Porcupine Grass**			
2018			

Year	Site tag	Looking north-east	Looking south-west
2019			
2020			

Year	Site tag	Looking north-east	Looking south-west
Site 19 **Outside goat fence** **PCT359 - Porcupine Grass hummock grassland with key eucalypt species present**			
2018			
2019			

Year	Site tag	Looking north-east	Looking south-west
2020			
Site 20 **Outside goat fence** **PCT359 - Porcupine Grass hummock grassland without key eucalypt species present**			
2018			

Year	Site tag	Looking north-east	Looking south-west
2019			
2020			

Appendix 2 Browsing condition – from AREA 2017

2.1.2 Belt transects (Appendix 1)

The length and width of belt transects were determined to ensure an accurate representation of the overall plant density and diversity was captured within each habitat.

Belt transects were either 50 or 100 metres in length except for the vegetation exclosure which was 20 metres in length and either 2, 4 or 10 metres wide (**Table 2-1**).

Within each belt transect all trees and shrubs were identified (samples taken) and details recorded included:

- Height, width at widest point, height of browse line for plants > 2m.
- Condition above browse line:
    - Good = No dead wood.
    - Dead Wood Fair = Trees with < 50% dead wood.
    - Dead Wood Poor = Trees with > 50% dead wood).
- Condition below browse line including all plants less than 2m in height:
    - Unbrowsed.
    - Low-Moderate browsing.
    - High-Intense browsing.
    - Totally browsed (no living growth below browse line).
- Presence or absence of regeneration.
- A condition state to show the current state of plants.

2.1.3 Condition state (Appendix 1)

Condition states were based on McDonald, J. (2009) and assessed as follows:

- **Uninterrupted** - Fresh new growth with no or very little sign of browsing. Plant growing periodically in relation to natural growth stimuli (rainfall and temperature) (see **Table 2-2** Fig 1 and Fig 2)
- **Arrested** - Plant in hedged or topiarised form due to intense browsing. (see **Table 2-2** Fig 3 and Fig 4) New growth continuously eaten and not extending beyond previous browse levels preventing the plant from growing to its natural potential.
- **Retrogressed** - Death of all or some stems previously browsed with new growth occurring from the lower stems. (see **Table 2-2** Fig 5 and Fig 6). Stem death arises from stresses induced by browse.
- **Released** - New growth from browsed stem not browsed due to temporary or permanent relaxation of browse pressure. or Plant grown beyond browse line. (**Table 2-2** Fig 7 and 8)

Examples of how these relate to plants seen in the field are provided on **Table 2-2.**

Table 2-2: Condition states based on McDonald, J. (2009)

Uninterrupted Note: All stems and foliage intact from the base upwards		
	Fig 1. Acacia aneura (Mulga) uninterrupted at 3m	**Fig 2.** Dodonea viscose sub spatulata uninterrupted at 3 m

Arrested Note: Plants have been intensely browsed and the growth form is hedged with plants unable to grow to full potential		
	Fig 3. Dodonea viscose sub spatulata severely arrested	**Fig 4.** Marieana pyramidata arrested

Retrogressed

Note: Plants re-sprouting from the lower part of the plant and many previously browsed stems are dead

Fig 5. Acacia aneura (Mulga) retrogressed

Fig 6. Marieana pyramidata retrogressed

Released

Note: Plants are established trees or have managed to grow beyond a distinct browse line.

Fig 7. Acacia aneura (Mulga) released

Fig 8. Flindersia maculosa (Leopard wood) released

Appendix 3 Flora recorded within PGSW

Notes to tables:

Status – EPBC Act:	**Source of Records**
CE – Critically Endangered	A – PGSW Recovery Plan (Biosis 2018b)
EN – Endangered	B – EIS Biodiversity addendum (NGH Environmental 2008b)
VU – Vulnerable	C – PGSW TS determination (NSW Scientific Committee 2010)
Status – BC Act:	D – VIS flora survey database (OEH 2017b)
E1 – endangered species (Part 1, Schedule 1)	E – PCT description (OEH 2017a, Appendix 4)
E2 – endangered population (Part 2, Schedule 1)	F – 2018 Baseline monitoring (Biosis 2020a)
E4 – presumed extinct (Part 4, Schedule 1)	G – 2019 Vegetation monitoring (Biosis 2020b)
E4A – critically endangered	H – 2020 Vegetation monitoring (This report)
V – vulnerable (Part 1, Schedule 2)	

Table A 1 Flora species recorded within PGSW

(Species in **bold** were recorded for the first time in the 2020 PGSW survey)

Scientific name	Common name	EPBC Act	BC Act	Source							
				A	B	C	D	E	F	G	H
Indigenous species											
Abutilon fraseri	Dwarf Lantern-flower				x						x
Abutilon leucopetalum				x	x				x	x	x
Acacia aneura	Mulga			x	x	x		x	x	x	x
Acacia salicina	Cooba					x		x			
***Acacia* spp. (seedling)**	**Wattle**										**x**
Acacia tetragonophylla	Dead Finish			x	x	x	x	x	x	x	x
Acacia victoriae				x		x	x	x	x	x	x
Alectryon oleifolius	Western Rosewood			x					x	x	x
Amyema maidenii				x							
Amyema preissii				x							
Aristida nitidula				x						x	
***Aristida* spp.**											**x**
Asteraceae spp.									x		x
Atriplex angulata	Fan Saltbush					x	x	x			
Atriplex eardleyae	**Small Saltbush**										**x**
Atriplex pumilio				x							
Atriplex spp.									x		x
Atriplex stipitata	Mallee Saltbush			x	x			x	x	x	x
Atriplex vesicaria	Bladder Saltbush					x		x		x	
Austrostipa nitida											**x**
Austrostipa scabra	Speargrass				x				x	x	x

Scientific name	Common name	EPBC Act	BC Act	Source							
				A	B	C	D	E	F	G	H
Austrostipa spp.					x				x	x	x
Boerhavia dominii	Tarvine			x							
Brachyscome ciliaris	Variable Daisy				x						x
Brachyscome lineariloba	Hard-headed Daisy				x						x
Bulbine semibarbata	Wild Onion				x						x
Calotis cymbacantha	**Showy Burr-daisy**										**x**
Calotis hispidula	Bogan Flea			x	x						x
Calotis plumulifera	**Woolly-headed Burr-daisy**										**x**
Cheilanthes austrotenuifolia	Rock Fern			x					x	x	
Cheilanthes lasiophylla				x					x	x	x
Cheilanthes sieberi subsp. *sieberi*	Rock Fern					x		x			
Chenopodium desertorum	Desert Goosefoot			x		x	x	x	x	x	x
Convolvulus erubescens	Pink Bindweed								x	x	x
Cymbopogon ambiguus	Lemon Grass			x		x	x	x	x	x	x
Daucus glochidiatus	Native Carrot				x	x		x	x	x	x
Dissocarpus paradoxus	Cannonball Burr			x					x	x	x
Dodonaea lobulata					x				x	x	
Dodonaea viscosa subsp. *angustissima*	Narrow-leaf Hop-bush					x		x		x	x
Dysphania melanocarpa	**Black Crumbweed**										**x**
Einadia nutans	Climbing Saltbush			x					x		x
Enchylaena tomentosa	Ruby Saltbush			x	x	x	x	x	x	x	x
Enneapogon cylindricus	Jointed Nineawn					x		x	x	x	x
***Eragrostis* spp.**											**x**
Eremophila oppositifolia subsp. oppositifolia					x						
Eriochlamys behrii	**Woolly Mantle**										**x**
Eriochloa crebra	Cup Grass, Tall Cupgrass			x							
Erodium crinitum	Blue Crowfoot				x						
***Erodium* spp.**	**Crowfoot**										**x**
Eucalyptus intertexta	Gum Coolibah			x	x	x	x	x	x	x	x
Eucalyptus socialis	Red Mallee			x	x	x	x	x	x	x	x
Euchiton sphaericus	Star Cudweed								x		x
Euphorbia australis											**x**
Euphorbia drummondii	Caustic Weed			x					x	x	x

Scientific name	Common name	EPBC Act	BC Act	Source							
				A	B	C	D	E	F	G	H
Euphorbia planiticola	**Plains Spurge**										**x**
Glycine clandestina	Twining glycine			x					x	x	x
Gnephosis arachnoidea	**Erect Yellow-heads**										**x**
Goodenia calcarata											**x**
Goodenia pusilliflora					x						
***Goodenia* spp.**											**x**
Halgania cyanea	Rough Halgania										x
Hibiscus sturtii* var. *grandiflorus											**x**
Hibiscus sturtii var. *sturtii*	Hill Hibiscus			x							
Ixiochlamys cuneifolia	**Silverton Daisy**										**x**
Leiocarpa panaetioides	**Wooly Buttons**										**x**
Leiocarpa semicalva subsp. *semicalva*										x	x
Lepidium papillosum	Warty Peppercress				x						x
Linum marginale	**Native Flax**										**x**
Maireana brevifolia											**x**
Maireana pyramidata	Black Bluebush				x	x		x	x		x
Maireana sclerolaenoides					x				x		x
Maireana sedifolia	Pearl Bluebush			x	x						
Maireana spp.	Cotton Bush, Bluebush, Fissure-weed								x		
Maireana trichoptera					x				x	x	
Maireana triptera	Three-wing Bluebush				x						x
Marsdenia australis	Doubah			x							x
Myriocephalus rhizocephalus	Woolly-heads				x						x
Nicotiana simulans											**x**
Olearia muelleri	Mueller's Daisy Bush								x		x
Omphalolappula concava	Burr Stickseed				x						x
Oxalis perennans				x							
Oxalis thompsoniae											**x**
Pimelea simplex* subsp. *simplex											**x**
Pimelea trichostachya											**x**

Scientific name	Common name	EPBC Act	BC Act	Source							
				A	B	C	D	E	F	G	H
Pittosporum angustifolium	Butterbush				x						
Plantago cunninghamii	**Sago-weed**										**x**
Poaceae spp.									x		
Podolepis capillaris	Invisible Plant			x	x						x
Portulaca oleracea	**Pigweed**										**x**
Prostanthera striatiflora	**Jockey's Cap**										**x**
Pterocaulon sphacelatum	Applebush									x	
Ptilotus nobilis	**Yellowtails**										**x**
Ptilotus obovatus	Smoke Bush			x	x	x	x	x	x	x	x
Ptilotus spp.									x		
Pycnosorus pleiocephalus									x	x	
Rhagodia spinescens	Thorny Saltbush			x	x				x	x	
Rhagodia ulicina				x							
Rhodanthe floribunda	**Common White Sunray**										**x**
Rhodanthe microglossa	Clustered Sunray				x						x
Rhodanthe pygmaea	Pigmy Sunray				x					x	
Rhyncharrhena linearis	Purple Pentatrope								x	x	
***Rytidosperma* spp.**											**x**
Salsola australis											**x**
Salsola tragus	Buckbush,Soft Rolpoly, Saltwort								x		
Scaevola humilis											**x**
Sclerolaena diacantha	Grey Copperburr				x				x	x	x
Sclerolaena lanicuspis	Woolly Copperburr				x						x
Sclerolaena obliquicuspis						x	x	x	x		
Sclerolaena patenticuspis				x					x		x
Sclerolaena spp.	Copperburr, Poverty-bush								x	x	
Sclerolaena tricuspis	**Giant Redburr**										**x**
Senna artemisioides subsp. X artemisioides					x	x		x	x	x	x
Senna artemisioides* subsp. X *petiolaris	**Woody Cassia**										**x**
Setaria paspalidioides				x							
Sida ammophila	Sand Sida								x		

Scientific name	Common name	EPBC Act	BC Act	Source							
				A	B	C	D	E	F	G	H
Sida petrophila				x	x	x	x	x	x	x	x
Sida platycalyx	**Lifesaver Burr**										**x**
Sida spp.									x		
Sigesbeckia australiensis											**x**
Solanum ellipticum	Velvet Potato Bush				x				x	x	x
Solanum quadriloculatum	Tomato Bush				x				x	x	
Solanum spp.									x		x
Solanum sturtianum	Thargomindah Nightshade			x		x	x	x		x	
Spergularia spp.											**x**
Stenopetalum lineare	Threadcress				x						x
Tetragonia eremaea											**x**
Tetragonia moorei					x						x
Tetragonia tetragonioides	**New Zealand Spinach**										**x**
Thyridolepis mitchelliana	Mulga Mitchell Grass									x	
Triodia scariosa subsp. *scariosa*				x	x	x	x	x	x	x	x
Vittadinia cuneata				x							
Vittadinia pterochaeta	**Rough Fuzzweed**										**x**
***Vittadinia* spp.**	**Fuzzweed**										**x**
Wahlenbergia communis	Tufted Bluebell			x						x	x
***Wahlenbergia* spp.**	**Bluebell**										**x**
Roepera apiculata	Common Twinleaf				x					x	x
Roepera iodocarpa	Violet Twinleaf				x						x
Roepera ovata	Dwarf Twinleaf				x						x
Introduced species											
Acetosa vesicaria	Bladder Dock					x					x
Alyssum linifolium	**Flax-leaf Alyssum**										**x**
Carrichtera annua	Ward's Weed				x						x
Carthamus lanatus	**Saffron Thistle**										**x**
Centaurea melitensis	**Maltese Cockspur**										**x**
Emex australis	Spiny Emex								x		
Herniaria cinerea											**x**
Lamarckia aurea	**Goldentop**										**x**
Leontodon rhagadioloides	**Cretan Weed**										**x**
Limonium lobatum	Winged Sea Lavender				x						x

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Scientific name	Common name	EPBC Act	BC Act	Source							
				A	B	C	D	E	F	G	H
Lysimachia arvensis	**Scarlet Pimpernel**										**x**
Medicago minima	**Woolly Burr Medic**										**x**
Silene apetala											**x**
Sisymbrium erysimoides	Smooth Mustard				x						x
Sonchus oleraceus	Common Sowthistle				x						x
Tribulus terrestris	**Cat-head**										**x**
***Vulpia* spp.**	**Rat's-tail Fescue**										**x**

Table A 2 Total number of plots within which each flora species was recorded within PGSW in 2020, indicating their occurrence in monitoring plots by the location relative to the goat fence, as well as structural variant of the community.

(Species in **bold** were recorded only inside or outside the goat fence. For structural variant data, numbers are in bold where the species was only recoded in one of the variants).

Species	Total sites	Goat fence		Structural variant		
		Outside	Inside	Eucalypts only	Porcupine Grass only	Porcupine Grass with eucalypts
Abutilon fraseri	**4**	1	3	2		2
Abutilon leucopetalum	**4**	1	3			**4**
Acacia aneura	**3**	1	2	1		2
***Acacia* spp. (seedling)**	**1**		**1**		**1**	
Acacia tetragonophylla	**5**	2	3	1	1	3
Acacia victoriae	**1**	**1**			**1**	
Acetosa vesicaria	**5**	2	3		2	3
Alectryon oleifolius	**4**		**4**	1	1	2
Alyssum linifolium	**1**	**1**		**1**		
***Aristida* spp.**	**3**	**3**		1	1	1
Atriplex eardleyae	**1**		**1**			**1**
***Atriplex* spp.**	**2**		**2**			**2**
Atriplex stipitata	**3**	1	2			**3**
Austrostipa nitida	**6**	3	3	2		4
Austrostipa scabra	**6**	3	3	1		5
Austrostipa spp.	**8**	3	5	1	**1**	6
Brachyscome ciliaris	**4**	1	3	1		3
Brachyscome lineariloba	**12**	3	9	1	3	8

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Species	Total sites	Goat fence		Structural variant		
		Outside	Inside	Eucalypts only	Porcupine Grass only	Porcupine Grass with eucalypts
Bulbine semibarbata	**12**	3	9	1	2	9
Calotis cymbacantha	**4**	2	2			**4**
Calotis hispidula	**20**	5	15	2	4	14
Calotis plumulifera	**2**		**2**			**2**
Carrichtera annua	**12**	5	7	2	1	9
Carthamus lanatus	**2**	1	1		1	1
Centaurea melitensis	**1**	1				**1**
Cheilanthes lasiophylla	**3**	1	2		**3**	
Chenopodium desertorum	**17**	3	14	2	3	12
Convolvulus remotus	**16**	4	12	2	3	11
Cymbopogon ambiguus	**1**	1			**1**	
Daucus glochidiatus	**12**	4	8	1	3	8
Dissocarpus paradoxus	**3**	**3**		1		2
Dodonaea viscosa subsp. angustissima	**2**	**2**			1	1
Dysphania melanocarpa	**10**	1	9		3	7
Einadia nutans	**1**		1			**1**
Enchylaena tomentosa	**18**	5	13	2	2	14
Enneapogon cylindricus	**13**	5	8	1	3	9
***Eragrostis* spp.**	**1**	**1**			**1**	
Eriochlamys behrii	**2**		**2**			**2**
Erodium spp.	**5**	1	4		2	3
Eucalyptus intertexta	**4**		**4**	1		3
Eucalyptus socialis	**10**	4	6	2	1	7
Euchiton sphaericus	**7**	2	5		2	5
Euphorbia australis	**7**	3	4	1	2	4
Euphorbia drummondii	**2**		**2**			**2**
Euphorbia planiticola	**3**	**3**			1	2
Glycine clandestina	**2**		**2**	1		1
Gnephosis arachnoidea	**10**	3	7	1	2	7
Goodenia calcarata	**11**	4	7	1	2	8
***Goodenia* spp.**	**2**		**2**			**2**
Halgania cyanea	**1**	**1**				**1**

Species	Total sites	Goat fence		Structural variant		
		Outside	Inside	Eucalypts only	Porcupine Grass only	Porcupine Grass with eucalypts
Herniaria cinerea	**1**		**1**			**1**
Hibiscus sturtii var. *grandiflorus*	**2**	1	1		1	1
Ixiochlamys cuneifolia	**12**	1	11	1	2	9
Lamarckia aurea	**1**		**1**		**1**	
Leiocarpa panaetioides	**3**	**3**			1	2
Leiocarpa semicalva* subsp. *semicalva	**1**	**1**		**1**		
Leontodon rhagadioloides	**1**	**1**		**1**		
Lepidium papillosum	**20**	5	15	2	4	14
Limonium lobatum	**9**	4	5	1	2	6
Linum marginale	**1**	1		**1**		
Lysimachia arvensis	**1**	1			**1**	
Maireana brevifolia	**1**		**1**			**1**
Maireana pyramidata	**5**	3	2	1	1	3
Maireana sclerolaenoides	**1**	**1**				**1**
Maireana triptera	**1**	**1**				**1**
Marsdenia australis	**13**	3	10	2	3	8
Medicago minima	**2**	2			1	1
Myriocephalus rhizocephalus	**6**	3	3	2	2	2
Nicotiana simulans	**1**		**1**			**1**
Olearia muelleri	**1**	**1**		**1**		
Omphalolappula concava	**1**	**1**				**1**
Oxalis thompsoniae	**7**	1	6	2		5
Pimelea simplex subsp. simplex	**1**	**1**			**1**	
Pimelea trichostachya	**1**		**1**			**1**
Plantago cunninghamii	**7**	2	5	1	2	4
Poaceae indeterminate	**23**	6	17	2	6	15
Podolepis capillaris	**4**	3	1		1	3
Portulaca oleracea	**5**	2	3		1	4

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Species	Total sites	Goat fence		Structural variant		
		Outside	Inside	Eucalypts only	Porcupine Grass only	Porcupine Grass with eucalypts
Prostanthera striatiflora	**1**		**1**			**1**
Ptilotus nobilis	**4**	3	1		1	3
Ptilotus obovatus	**18**	4	14	2	4	12
Rhodanthe floribunda	**3**	1	2		2	1
Rhodanthe microglossa	**20**	5	15	2	4	14
Roepera apiculata	**4**	**4**		1		3
Roepera iodocarpa	**1**		**1**			**1**
Roepera ovata	**6**	2	4	1	1	4
Rytidosperma spp.	**4**	1	3	1		3
Salsola australis	**2**	**2**		1		1
Scaevola humilis	**11**	5	6	1	2	8
Sclerolaena diacantha	**13**	5	8	2	2	9
Sclerolaena lanicuspis	**1**		**1**			**1**
Sclerolaena patenticuspis	**9**	1	8		1	8
Sclerolaena tricuspis	**4**	1	3	1	1	2
Senna artemisioides	**7**	6	1	2	2	3
Sida petrophila	**15**	5	10	1	4	10
Sida platycalyx	**5**	1	4	1		**4**
Sigesbeckia australiensis	**11**	1	10		3	8
Silene apetala	**11**	4	7	2	2	7
Sisymbrium erysimoides	**16**	4	12	2	4	10
Solanum ellipticum	**15**	4	11		4	11
***Solanum* spp.**	**1**		**1**			**1**
Sonchus oleraceus	**17**	3	14	2	3	12
Spergularia spp.	**15**	5	10	1	2	12
Stenopetalum lineare	**6**	4	2	1	1	4
Tetragonia eremaea	**10**	1	9	1	3	6
Tetragonia moorei	**15**	2	13	1	4	10
Tetragonia tetragonioides	**1**		**1**			**1**
Tribulus terrestris	**4**		**4**		1	3
Triodia scariosa subsp. *scariosa*	**20**	5	15	2	4	14
Unknown A	**12**	9	3	2	4	6

Species	Total sites	Goat fence		Structural variant		
		Outside	Inside	Eucalypts only	Porcupine Grass only	Porcupine Grass with eucalypts
Vittadinia pterochaeta	**1**	**1**				**1**
Vittadinia spp.	**12**	4	8	2	1	9
Vulpia spp.	**2**		2		1	1
Wahlenbergia communis	**1**	**1**			**1**	
Wahlenbergia spp.	**7**	2	5	1	2	4
Total species	115	**92**	**90**	**62**	**72**	**101**

Appendix 4 Introduced flora species recorded

Notes to table:

Source of Records	**Weed status:**
A – 2018 Baseline monitoring (Biosis 2020a)	* WoNS
B - NGH Environmental (NGH Environmental 2008b)	# NSW State priority weed (WLLS 2017)
C – NGH Environmental (NGH Environmental 2008a)	^ NSW regional priority weed (WLLS 2017)
D – PGSW TS determination (NSW Scientific Committee 2010)	~ NSW other regional weed/species of concern (WLLS 2017)
E – VIS flora survey database (OEH 2017b)	
F – PGSW PCT description (NSW Scientific Committee 2010)	
G – Vegetation monitoring 2020 (This report)	

Table A 3 Introduced flora species recorded at Silverton Wind Farm

(Species in **bold** were recorded for the first time during the combined 2020 vegetation surveys)

Scientific name	Common name	Source						
		A	B	C	D	E	F	G
Acetosa vesicaria	Bladder Dock				x			x
Alyssum linifolium			x					
Arctotheca calendula	Capeweed		x					
Argemone mexicana	**Mexican Poppy**							**x**
Asphodelus fistulosus	**Onion Weed**							**x**
Brassica tournefortii~			x					
Bromus diandrus~	Great Brome		x					
Carrichtera annua~	Ward's Weed		x					x
Carthamus lanatus	Saffron Thistle		x	x				x
Cenchrus setaceum	Fountain Grass			x				x
Centaurea melitensis	Maltese Cockspur		x					x
Chenopodium murale	Nettle-leaf Goosefoot		x					
Chloris virgata	Feathertop Rhodes Grass			x				
Citrullus lanatus	**Camel Melon**							**x**
Cucumis myriocarpus	Paddy Melon							x
Echium plantagineum	Patterson's Curse		x	x				x
Erodium cicutarium	Common Storksbill		x					x
Erodium malacoides			x					x
Hedypnois rhagadioloides	Cretan Weed			x				x
Herniaria cinerea	Hairy Rupturewort		x					x
Hordeum leporinum~	Barley Grass		x					
Hypochaeris glabra	Smooth Catsear		x					x
Hypochaeris radicata	**Catsear**							**x**
Lamarckia aurea	Goldentop		x					x
Leontodon rhagadioloides	**Cretan Weed**							**x**
Limonium lobatum~	Winged Sea Lavender		x					x

Scientific name	Common name	Source						
		A	B	C	D	E	F	G
Lycium ferocissimum#^*	African Boxthorn		x	x				x
Lysimachia arvensis	Scarlet Pimpernel		x					x
Malva parviflora	Small-flowered Mallow		x					x
Medicago minima	Woolly Burr Medic		x					x
Mesembryanthemum nodiflorum	Small Ice Plant		x					
Rostraria pumila	Roughtail		x					
Rumex hypogaeus	Three -cornered Jacks	x					x	
Salvia verbenaca	Vervain		x					x
Schismus barbatus	Arabian Grass		x					
Silene apetala								**x**
Silene nocturna			x					x
Sisymbrium erysimoides	Smooth Mustard		x	x				x
Sonchus oleraceus~	Common Sowthistle		x					x
Tagetes minuta	Stinking Rodger			x				
Taraxacum officinale	Dandelion			x				
Tribulus terrestris	**Caltrop**							**x**
Trifolium glomeratum	Clustered Clover	*						
Urtica urens	Small Nettle		x					
Verbascum virgatum	Twiggy Mullein			x				
Vulpia myuros	Rat's Tail Fescue		x					
***Vulpia* spp.**	**Rat's-tail Fescue**							**x**

*This was determined to be a misidentification of a dead specimen of Hard-headed Daisy *Brachyscome lineariloba*

Appendix 5 VMP Vehicle and Machinery hygiene / decontamination checklist

Vehicle and machinery hygiene / decontamination checklist

Site:

Vehicle/Equipment:

Date:

Decontamination team:

SAFETY – Flat ground Engine off & keys removed Wheels chocked Moving/raised parts secured

	Contamination point	Decon		Contamination point	Decon
Body	Step treads		Wheels & arches	Wheel arches	
	Bumper/s			Wheel caps & rims	
	Around fuel tank caps			Tyre tread/tracks	
	Around tray body			Mudflaps	
Under carriage	Axels & differentials			Brakes	
	Struts & stabilisers		Interior / Cabin	*Remove items for disposal/cleaning*	
	Steering components			Foot wells	
	Chassis rails, inc recesses & holes			Seats	
	Spare tyre & mounts			Air vents	
	Fuel tank			Glove box, centre console	
Engine bay	Front grill			Tool boxes	
	Radiator, oil coolers			Boot or recesses, inc spare tyre well	
	Top of gearbox		Attachments	Bull bar	
	Battery recess & tray			Tow ball	
	Air filters			Winch	
	Engine mounts			Bucket, blade, boom, ripper etc	
	Engine recesses or manifold			Hydraulic arms	

Appendix 6 PCT 359 - Porcupine Grass - Red Mallee - Gum Coolabah hummock grassland low sparse woodland

VIS Classification - Community Profile Report

Plant Community Type ID (PCT ID): 359

PCT Classification Confidence Level: High

PCT Common Name: Porcupine Grass - Red Mallee - Gum Coolabah hummock grassland / low sparse woodland on metamorphic ranges on the Barrier Range, Broken Hill Complex Bioregion

PCT Scientific Name: *Eucalyptus socialis , Eucalyptus intertexta / Acacia tetragonophylla , Maireana pyramidata , Acacia aneura s. lat. , Acacia aneura , Dodonaea viscosa subsp. angustissima / Triodia scariosa subsp. scariosa , Sida petrophila , Chenopodium desertorum , Cymbopogon ambiguus*

Photo 1:

Original Entry: jbenson 21/02/2008 21/02/2008

Vegetation Description: This community contains an unusal occurrence of Red Mallee and Gum Coolabah growing in a Porcupine Grass dominated landscape on rocky ranges in the arid zone. Hummock grassland to low sparse woodland with the ground cover dominated by the hummock grass Porcupine Grass (Triodia scariosa subsp. scariosa). Scattered trees include Red Mallee (Eucalyptus socialis) with Gum Coolabah (Eucalyptus intertexta). Shrubs are very sparse and include Acacia aneura sens lat., Acacia victoriae subsp. arida., Acacia tetragonophylla, Maireana pyramidata, Enchylaena tomentosa, Senna form taxon 'artemisioides' and Atriplex vesicaria. The ground cover is dominated by Triodia scariosa subsp. scarisa. Other ground cover species include Ptilotus obovatus var. obovatus, Chenopodium desertorum, Sida petrophila, Cymbopogon ambiguous, Solanum sturtianum, Cheilanthes sieberi subsp. sieberi, Daucus glochidiatus, Atriplex angulata, Enneapogon cylindricus and Sclerolaena obliquicuspis. Occurs in the arid climate zone on soils composed of eolian red sandy loam or lithosols deposted over rocky outcrops composed of Proterozoic gneiss, phyllite, schist, sandstone and slate (Willyama complex), with a relief to 200 m forming rocky hills in the Umberumberka Range section of the Barrier Range sub-region in the Broken Hill Complex Bioregion, north of Silverton. Grades into widespread hill Mulga communities such as (ID123) and contains elements of ID169 Curly Mallee open woodland that occurs further north on the Barrier Range near Corona but the ground cover in ID169 is not dominated by Triodia. Past disturbance may include cutting of trees for use in fencing and towns such as Silverton. A short term and averted threat was a proposed wind farm (plans now modified to lessen impact on plant community). The main long term threat is grazing by goats or stock. Reduced rainfall and hotter temperatures due to climate change could also impact on the regeneration of shrub and tree species. The combination of its very limited extent and current threats leads to an assessment of this community as being threatened requiring protection and management, particulalry reduction of grazing pressure.

Emergent species: None

Upper Stratum Species: Eucalyptus socialis; Eucalyptus intertexta;

Mid Stratum Species: Acacia tetragonophylla; Maireana pyramidata; Acacia aneura s. lat.; Dodonaea viscosa subsp. angustissima; Acacia salicina; Senna form taxon 'artemisioides'; Acacia victoriae subsp. arida; Enchylaena tomentosa;

Ground Stratum Species: Triodia scariosa subsp. scariosa; Sida petrophila; Cymbopogon ambiguus; Ptilotus obovatus var. obovatus; Chenopodium desertorum; Solanum sturtianum; Cheilanthes sieberi subsp. sieberi; Daucus glochidiatus; Atriplex vesicaria; Atriplex angulata; Enneapogon cylindricus; Sclerolaena obliquicuspis;

Threatened Plants: Not Assessed

Threatened Fauna: Melastoma affine (Blue Tongue); Delma australis (Marble-faced Delma);
Diagnostic Species: Not Assessed
Height Class (Walker & Hopkins 1990): 2 - Range:0.26-0.50m (Low)
Vegetation Formation: Arid Shrublands (Acacia sub-formation);
Vegetation Class: Stony Desert Mulga Shrublands;
NSW Landscape Name: Barrier Ranges;
Classification source: Surveyed and mapped by NGH Environmental Pty Ltd (2008). Part of broad map unit 27 in Pickard & Norri
Authority: Surveyed and mapped by NGH Environmental Pty Ltd (2008). Part of broad map unit 27 in Pickard & Norris (1994). Occurs in the Umberumberka Land System (Walker 1991). Some possible links to Floristic Group 9 in Playfair & Robinson (1997) in the North Olary Plains of South Australia. Community very distinct, although there was no plot data existed as of 2008.
Pre-Euopean Mapped Or Modelled: Not mapped or modelled
Current Extent Mapped Or Modelled: Not mapped
Adequacy of plot sampling: None ***Number of plotsto define PCT:*** 0
IBRA Bioregion: Broken Hill Complex (>70%);
IBRA Sub-Region: Barrier Range (Not known); Barrier Range Outwash (Not known);
LGA: Unincorporated (>70%);
Lithology: Phyllite , Gneiss , Pegmatite , Slate
Landform Pattern: Hills
Landform Element: Hillcrest , Hillslope
Pre-European Extent: 500 ha ±30%. Estimated from extant vegetation maps: full range
Pre-European Extent Accuracy: 30
Pre-European Comments: A highly resticted community occurring on the southern Barrier Range - comprising a very small part of the 34,000 ha Umberumberk Land System (Walker 1991). Based on mapping in NGH Environmental Pty Ltd (2008) and reports on some futher unmapped areas on the Barrier Range (S. Sass pers. comm.).
Current Extent: Not Assessed
Current Extent Accuracy: 30
Current Extent Comments: Mostly not cleared due to its occurrence on rocky hills in the arid zone but some trees may have been cut in the past for smelters at Silverton. Grazing by goats may reduce regeneration of woody species. Part of the current extent is mapped by NGH Environmental Pty Ltd (2008) with about 200 ha of other arears unmapped as of 2009.
PCT Percent cleared: 20.00
% accuracy (of PCT % cleared estimate): +/-30
Variation and Natural Disturbance: It is unusal for Red Mallee to grow on rocky ranges and this may also be the western-most occurence of Gum Coolabah in NSW. Some areas on the ranges are devoid of trees and are true hummock grasslands - other areas contain scattered trees.
Fire Regime: Fire is infrequent. The hummock grass could burn occasionally depending on fuel loads.
Associated TEC Degreee of Fit:

Associated TEC Comments:

Citations: (Pickard J. & Norris E., 1994 ; Playfair R. & Robinson A., 1997 ; Walker P., 1991 ; NGH Env., 2008)
Full Reference Details: (27; 295; 386; 400;). Pickard, J. & Norris, E.H. (1994) The natural vegetation of north-western New South Wales: notes to accompany the 1:1 000 000 vegetation map sheet. Cunninghamia 3(3): 423-464; Playfair, R.M. & Robinson, A.C. (1997) (eds.) A biological survey of the North Olary Plains, South Australia 1995-1997. (Natural Resources Group, Department of Environment and Natural Resources: South Australia); Walker, P.J. (1991) Land systems of western New South Wales. Technical Report No. 25 (Soil Conservation Service of New South Wales: Sydney); NGH Environmental (2008) Biodiversity Assessment: Stage 1 Proposed Silverton Wind Farm. Prepared for Silverton Wind Farm Developments Pty Ltd;
Profile source:
PCT Definition Status: Approved

Appendix 7 Conditions compliance table

Compliance with relevant BAMP performance criteria to end of December 2020

Baseline performance criteria

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
1.1	**Mapping of PSG.W**	Finalise mapping of full extent of PSGW including areas of occurrence within the proposed Silverton Wind Farm	Map prepared of PGSW, including delineation of three observed variants of the community	Shapefile prepared and provided to DPIE	Biosis	Included in BAMP (Fig 4) and PGSWRP (Fig 10). Provided to DPIE 12/03/2019	Compliant
1.2	**Mapping of existing goat management infrastructure**	Position of existing goat control fencing and associated infrastructure to control access to water and facilitate mustering will be accurately mapped	Updated map of goat management infrastructure prepared	Shapefiles prepared showing fencing and associated infrastructure and submitted to DPIE	Project Ecologist or GE operational staff	2018 Vegetation monitoring report	Compliant
1.3	**Estimate Feral Goat populations**	Collection of landholder population estimates	All four landholders contacted to gather baseline information about goat populations and management	Records from landowner discussions documented	Project Ecologist or GE operational staff	2018 Vegetation monitoring report. Only two leaseholders contacted due to final location of wind farm	Compliant
1.4	**Baseline vegetation monitoring**	Establishment of 20 permanent plots to monitor PGSW vegetation condition and grazing pressure	Data capture method developed Vegetation monitoring quadrats established and baseline survey completed in spring 2018	Datasheets prepared Annual monitoring report submitted to DPIE	GE/ Project Ecologist	2018 Vegetation monitoring report	Compliant

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No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
1.6	**Site inductions**	Biodiversity information will be included as part of the site induction for all contract and subcontract staff working within the study area. Up to date spatial data identifying threatened species/habitat and significant vegetation communities will be provided to all personnel undertaking maintenance works.	Inductions completed for all contract and subcontract staff Staff aware of key vegetation values and issues.	Induction sheets and associated support materials	GE operational staff/Project Ecologist	Initial site inductions of all staff were conducted in December 2018	Compliant
1.7	**Hygiene protocols**	Strict hygiene protocols implemented to reduce the potential introduction or spread of invasive flora and fauna species as per the VMP.	No new invasive species introduced.	**Hygiene protocol.** **Induction material contains Hygiene Protocol.** **List of personnel inducted in Hygiene Protocols.** Inspection checklists completed and submitted.	Project Manager / all site personnel	After investigation into options, GE advised that offsite hygiene protocols are to be implemented due to site constraints. Section 3.7.2 of this report Vehicles washed in town on a regular basis and remain on-track at site, most traffic only to the O&M building. BAMP and VMP to be updated as per Table 4-3.	Partial compliance. The off-site hygiene process (section 3.2.7) has been amended to be more reasonably practicable to implement. To be approved by DPIE and BCD.

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
1.8	**Baseline weed mapping**	Documenting weed populations as per the VMP	Locations of all known occurrences of exotic flora, particularly NSW DPI priority weeds, will be recorded and collated into a mapping shapefile. Shapefiles will be distributed to GE and Vegetation Management Contractors.	Mapping shapefile prepared	Vegetation management contractor/ Project Ecologist	No shapefiles were available as reported in 2018 vegetation monitoring report	Compliant
1.12	**Baseline temporary disturbance area mapping**	Temporary disturbance areas documented as per VMP.	Locations of all temporary disturbance areas will be provided by CATCON Shapefiles will be distributed to GE and Vegetation Management Contractors.	Mapping shapefile distributed to GE and Vegetation Management Contractors..	Project Ecologist	Mapping of ASCON footprint was provided by CATCON as included in the mapping for all project reports. CATCON provided written confirmation to AGL that all rehabilitation actions required during the construction phase of the project were complete, however no reporting of pre or post construction conditions at close out was provided to Biosis.	Compliant

Ongoing performance criteria

Note: items in **bold are additions to actions in the BAMP.*

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
2.1	**Site inductions**	Biodiversity information will be included as part of the site inductions	Inductions completed for all contract and subcontract staff Staff aware of key vegetation values and issues.	**Induction package contains biodiversity information.** Signed induction sheets completed and submitted	GE operational staff	Initial inductions completed by Biosis 13/12/2018. Induction material provided to GE and subsequent ongoing inductions conducted by Alana Philp (GE)	Compliant
2.2.1	**Monitor fencing and work with General Purpose leaseholder to maintain fencing to exclude Feral Goats**	Fence lines will be inspected quarterly and documented via inspection checklist. Fences will be maintained through agreement with the leaseholder	Fences are maintained and any damage repaired within two weeks of notification. Vegetation protected.	Inspection checklists submitted. Document completion of fencing	GE operational staff / General Purpose leaseholders/ fencing contractor	Fences were visually checked from Feb 2020 Documented checks have been completed from 25/06/2020. No repairs required to date.	Compliant
2.2.2	**Implement any required additional fencing to exclude Feral Goats**	Additional fencing implemented for areas of sensitive vegetation as required where restoration measures implemented under the VMP are impeded (e.g. by Feral Goat grazing	Sensitive restoration areas protected from Feral Goat pressures as required.	Maintenance activity records submitted. Inspection checklists submitted.	GE operational staff / fencing contractor	Goat numbers extremely low due to drought conditions. No new fencing identified for implementation.	N/A

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No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
		pressure/trampling) as per Section 4.1.3. Monitoring implemented.					
2.3	**Maintain WF sub station and Operational and Maintenance facility security fences, gates and locks**	Security fences, gates and locks inspected.	Security fences, gates and locks maintained.	Inspection checklists (six monthly) submitted.	GE operational staff / leaseholders	Wind farm substation and operation and maintenance facility fences and gates inspected weekly.	Compliant
2.4	**Feral Goat exclusion**	Goats excluded in PGSW area	No Feral Goats within the exclusion fencing from June to January unless cover of ephemeral flora species is greater than 40% • Goat fenced closed • All goats removed via trapped watering points • Active mustering as required If there is greater than 40	Inspection report submitted.	Project Ecologist (monitoring) Leaseholder Blore (goat exclusion and mustering) GE Operational Staff	Goats were inside fence as noted in June 2020. Goats mustered in week commencing 20/7/2020. On 19/08/2020, AGL negotiated that goats are excluded to allow recovery of PGSW post drought despite good cover as recommended in the 2019 vegetation monitoring report.	Compliant

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
			% ground cover of annual species, the leaseholder will allow seed production to occur, and then reserves the right to utilise the vegetation as feed. Goats will again be excluded when the cover of these annual species falls to less than 40 %. If monitoring shows signs of grazing pressure during exclusion period – initiate active on ground mustering to eliminate goats within PGSW area				
2.5.1	**Ensure reduced stocking of Feral Goats**	Feral Goat population within goat fence to be reduced	Achieved maximum stocking rate of approximately 0.26 weaner goats February-May each year per hectare as per GMP • Active trapping at trapped watering points • Initiate mustering when observed goat numbers exceed 100.	Surveillance monitoring of exclusion area at monthly intervals Inspection report submitted.	Leaseholder Blore (goat exclusion and mustering)	Vegetation monitoring report 2019 – Goats excluded from August 2017 to present, excluding during construction of the wind farm within the goat fence when the gate remained open to provide site access. Mustering of goats continued during	Compliant

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
						construction in the area.	
2.5.2	**Ensure reduced stocking of Feral Goats**	Alternative Feral Goat management	Feral Goat control managed by GE contract staff if leaseholder Blore ceases management	Surveillance monitoring of exclosure at monthly intervals Inspection report submitted.	GE contract staff / GE operational staff	Leaseholder Blore continues to muster goats in the area. Monitoring by GE reported in Section 3.4.4.	Compliant
2.5.3	**Clarity on lease precedence**	If adequate management of Feral Goats cannot be achieved through negotiation, GE will request The Crown (DI Lands) and DPE provide clarification whether the Project Approval (08_022 MOD 3) or The Crown lease conditions should take precedence.	Clarification on Project Approval (08_022 MOD 3) or The Crown lease conditions provided	Clarification provided by The Crown (DI Lands) and DPE	GE	Agreement with leaseholder achieved. Not required	N/A
2.6	**Feral Goat population monitoring**	Collection of leaseholder population estimates	All four leaseholders contacted to gather baseline information about goat abundance and harvesting activities	Records from landowner discussions to be submitted	Project Ecologist or GE operational staff	Only 2 leaseholders relevant. See Section 3.4.2 of this report	Compliant
2.7	**Feral Goat population monitoring**	Scat counts in subplots as per Section 3.4.3	Decrease in goat scat abundance	Annual monitoring report submitted to DPIE	Project Ecologist	See Section 3.4.3	Compliant

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
2.8.1	**Vegetation clearance, maintenance**	Vegetation clearance and maintenance activities will be undertaken as per the specifications described in the VMP.	Vegetation clearance confined to defined specifications. Vegetation Management Contractors and Project Ecologist notified of works.	Clearance and maintenance dates documented. **Records of vegetation clearance and maintenance.**	GE / Essential Energy	Inspections on 6-12 monthly basis by a third party during Balance of Plants inspections. Growth has been minimal due to ongoing drought conditions in the region. No vegetation clearance works have been required.	Compliant - monitoring completed.
2.8.2	**Vegetation clearance biomass placement**	All removed native vegetation and biomass will be placed in areas likely to be prone to localised surface erosion and scouring as per the VMP	All native biomass produced by clearance activities placed in appropriate area. GE and Project Ecologist will be notified of works and spatial locations supplied.	Works Sheets **with photographic evidence** submitted. Spatial files supplied.	Vegetation management contractor	No vegetation clearance works have been required during operations.	N/A
2.8.3	**Vegetation clearance, monitoring**	Monitoring of vegetation clearance areas and biomass placement areas for compliance, presence of threatened species and priority weeds as per the VMP.	Vegetation clearance confirmed to be confined to defined specifications. Biomass placement appropriate. Any populations of threatened species or priority weeds identified	Ecological inspection checklists submitted. Spatial files for any threatened species/priority weeds supplied to GE and Vegetation Management Contractors.	Project Ecologist	No vegetation clearance works have been required during operations. Temporary disturbance areas assessed 1 and 3 months following 2 significant rainfall	Compliant

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No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
			and targeted for future management.			events in 2020, see Section 3.6 and 3.7. Spatial files for priority weeds provided to GE.	
2.9	**Monitoring of roads and drainage**	Inspection of all managed road assets and supporting roadside drainage facilities as per the VMP.	Road assets and supporting roadside drainage maintained. No impact to PGSW or Barrier Range Dragon habitat. No impact to threatened species.	Inspection checklists submitted.	GE operational staff	Sites have been inspected twice-yearly from handover from CATCON, also 1 and 3 months after significant rain events (> 25 millimetres). Areas uphill of or adjacent to PGSW, or in rocky outcrops or artificial Barrier Range Dragon habitats after significant rainfall events. See Section 3.6, 3.7 and 4.2.	Partial compliance following handover from CATCON, section 3.6, 3.7 and 4.2. The 2021 surveys of disturbance areas will check the upgrade and effectiveness of additional drainage management measures.
2.10 .1	**Monitoring of road and road side drainage maintenance activities.**	Monitoring of road and roadside drainage for maintenance compliance, presence of threatened species and priority weeds as per the VMP	Works confirmed to be confined to defined specifications. Sediment/silt placement appropriate. Any populations of threatened species or	Ecological inspection checklists submitted. Spatial files for any threatened species/priority weeds supplied to GE and Vegetation	Project Ecologist	Sites have been inspected twice-yearly from handover from CATCON, also 1 and 3 months after significant rain events (> 25 millimetres).	Partial compliance following handover from CATCON, section 3.6, 3.7 and 4.2. The 2021 surveys of disturbance areas will check the upgrade and

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
			priority weeds identified and targeted for future management.	Management Contractors.		Areas uphill of or adjacent to PGSW, or in rocky outcrops or artificial Barrier Range Dragon habitats will be inspected monthly and after significant rainfall events. See Section 3.6, 3.7 and 4.2.	effectiveness of additional drainage management measures.
2.10 .2	**Management of road and road side drainage maintenance**	Any damage to road assets and supporting drainages to will repaired to construction standards as per the VMP Silt removed as part of road and drainage works is locally stored on disturbed ground (bunded where required) and not distributed throughout the site.	Road assets and supporting roadside drainage maintained. No impact to PGSW or Barrier Range Dragon habitat. Silt / Spoil appropriately sited and location provided to Vegetation Management contractors and Project Ecologist.	Maintenance activity records submitted.	GE operational staff	Sites have been inspected twice-yearly from handover from CATCON, also 1 and 3 months after significant rain events (> 25 millimetres). See Section 3.6, 3.7 and 4.2.	Partial compliance following handover from CATCON, Section 3.6, 3.7 and 4.2. The 2021 surveys of disturbance areas will check the upgrade and effectiveness of additional drainage management measures and siting of silt/spoil.
2.11 .1	**Monitoring of tracks and hardstands above PGSW**	Increased visual monitoring of track and hardstand areas in areas uphill of or adjacent to PGSW (Figure	Works confirmed to be confined to defined specifications. Sediment/silt placement appropriate.	Ecological inspection checklists submitted.	Project Ecologist	Following handover from CATCON, areas uphill of or adjacent to PGSW, or in rocky outcrops or artificial	Partial compliance following handover from CATCON, section 3.6, 3.7 and 4.2. The 2021 surveys of

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No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
						Barrier Range Dragon habitats inspected twice yearly as well as 1 and 3 months after significant rainfall events See Section 3.6, 3.7 and 4.2.	disturbance areas will check the upgrade and efficacy of additional drainage management measures.
2.11.2	**Management of road and road side drainage maintenance above PGSW and in BRD habitat**	Stockpiles and excavated material including sediment removed from tracks and drains for maintenance activities will not be placed uphill of or adjacent to areas of PGSW or in rocky outcrops or artificial Barrier Range Dragon habitats.	Road assets and supporting roadside drainage maintained. No impact to PGSW or Barrier Range Dragon habitat. Silt / Spoil appropriately sited and location provided to Vegetation Management contractors and Project Ecologist.	Maintenance activity records submitted.	GE operational staff	Following handover from CATCON, areas uphill of or adjacent to PGSW, or in rocky outcrops or artificial Barrier Range Dragon habitats inspected twice yearly as well as 1 and 3 months after significant rainfall events See Section 3.6, 3.7 and 4.2.	Partial compliance following handover from CATCON, section 3.6, 3.7 and 4.2. The 2021 surveys of disturbance areas will check the upgrade and efficacy of additional drainage management measures.
2.12	**Hygiene protocols**	Strict hygiene protocols implemented to reduce the potential introduction or spread of invasive flora and fauna species as per the VMP.	Hygiene protocols implemented. No new invasive species introduced.	Inspection checklists submitted.	Project Manager / all site personnel	After investigation into options, GE advised that offsite hygiene protocols are to be implemented due to site constraints.	Partial compliance. The off-site hygiene process (section 3.2.7) has been amended to be more reasonably practicable to implement. To be approved by DPIE and BCD.

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No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
						Section 3.7.2 of this report	
2.13	**Weed monitoring**	Inspections of • mapped priority weed locations • temporary disturbance areas • restoration areas • all other asset/infrastructure maintenance areas.	Any new weed incursions mapped for inclusion in weed management program Spatial data will be updated with any new infestations/priority weed locations and distributed between GE, Vegetation Management Contractor and Project Ecologist.	Site inspection checklists submitted. Mapping shapefile prepared and shared between GE / Project Ecologist / Vegetation Management Contractor. Annual monitoring report submitted	GE operational staff/ Project Ecologist	Initial/baseline monitoring undertaken by Biosis in September, Oct and Dec 2020. Preliminary advice provided to GE on 1/10/2020 and mapping provided following Dec 2020 surveys. See Section 3.7, 4.3 and 4.5.	Compliant
2.14	**Weed control**	Weed control works will be implemented in accordance with the VMP	Priority weeds limited to current cover levels as per the VMP. New weeds identified and treated.	Weed management operational checklists submitted. Weed Control Works Sheets submitted.	Vegetation management contractor/ Project Ecologist	Weed management works to commence ASAP in 2021. DPIE and BCD to consider revised management recommendations for incorporation into an updated VMP and BAMP. See Section 3.7, 4.3 and 4.5. BAMP and VMP to be updated as per Table 4-3.	Weed management works to commence in 2021. DPIE and BCD to consider revised measures.

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
2.15	**Monitoring of temporary disturbance areas**	Temporary disturbance areas monitored for regeneration success and soil stability.	Assess regeneration success and soil stability. Implement restoration (No. 2.16) as detailed below as required.	Site inspection checklists submitted. Annual monitoring report submitted.	Project Ecologist	Asset/construction areas were assessed 1 and 3 months following 2 significant rainfall events in 2020. No additional rehabilitation measures are recommended at this stage.	Compliant
2.16	**Restoration including rehabilitation and revegetation**	Site rehabilitation will be implemented in accordance with the VMP Disturbance areas rehabilitated with topsoil reinstated where possible and landform stabilised as soon as possible following disturbance. Additional restoration implemented as required.	Initial rehabilitation implemented. Restoration Plan implemented as required. Site restored.	Site inspection checklists submitted. Restoration actions and outcomes documented in Annual Report.	Project Ecologist with input from Vegetation Management Contractors and GE staff as required.	No new works during operations that require rehabilitation at this stage. VMP and BAMP to be updated to reflect amended management measures if approved by DPIE and BCD.	Compliant
2.17	**Vegetation monitoring**	Monitoring of vegetation condition and grazing pressure in accordance with Section 2.5.	Predicted responses as the BAMP Section 6.1.1 (given seasonal constraints discussed in Section 3.1)	Annual monitoring report submitted to DPIE. Emails, meeting minutes, or other documented details	Project Ecologist	Monitoring reported in 2018, 2019 and this vegetation monitoring report. On 19/08/2020, AGL	Compliant

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No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
			• Increased litter cover • Increased abundance of native species • Increased cover of native species • 'Release' of woody species from grazing pressure • Evidence of recruitment of woody species If vegetation monitoring shows no reduction in grazing pressure during exclusion period – initiate active on ground mustering to eliminate goats within PGSW area in accordance with GMP.	showing the consultation between GE and the landholder regarding goat exclusion periods.		negotiated that goats are excluded to allow recovery of PGSW post drought despite good cover in accordance with the 2019 vegetation monitoring report	
2.25	**Review of VMP management actions.**	Annual review of VMP management actions as per Section 4.4.	Review of annual reports and management actions. Update management actions as appropriate	Annual works plan prepared.	Project Ecologist in consultation with GE and Vegetation Management Contractor	Weed site inspections commenced following 2 significant rainfall events in 2020. Recommended updates and BAMP	To be completed following consideration by DPIE and BCD

No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
						provided in sections 4.3 and 4.5. BAMP and VMP to be updated as per Table 4-3.	
2.26	**Review of BAMP**	Comprehensive review of BAMP and supporting management plans	Review all monitoring data and assess the response of biodiversity values to modified site management. Update management recommendations as appropriate in consultation with DPIE to ensure there is a net gain in the conservation value of PGSW,	**Updated** BAMP and supporting plans submitted to DPIE	GE/ Project Ecologist	Not required until January 2022.	N/A
2.27	Seed collection	Collection and storage of seed for additional rehabilitation works (if required)	Seed collection will be prioritised during recruitment and growth periods following significant rain events in accordance with Section 4.4	Seed collection inventory (including species, dates of collection and quantities).	Restoration ecologist	Following significant rain events when seed set is suitable for collection	New action (was previously required in-text of the VMP)
2.28	BAMP reporting	Annual summary reporting	Progress on the implementation of management measures outlined in the BAMP and the results and analysis of monitoring will be	Annual summary Report detailing activities completed against BAMP management actions submitted to BCD and DPIE.	Project ecologist	Annual reporting submitted to date has documented the monitoring, management measures and recommendations regarding the	New action (was previously required in-text in the BAMP).

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No.	Management Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status Dec 2020
			reported annually to relevant stakeholders.			subplans (BRD, PGSW and Feral Goats) but not a summary report against the overarching BAMP. Compliance against the management actions and monitoring has been documented on an ongoing basis. Annual report to be prepared following one year of Provisional Facility Practical Completion, being the 27 October 2021, and then annually thereafter.	

Contingency actions

No.	Managemt Action	Task / Performance Criteria	Measure / Target	Evidence of Completion	Responsibility	Comments	Compliance status April 2021
3.1	Lack of vegetation recovery	If vegetation monitoring shows no reduction in grazing pressure during exclusion period – initiate active on-ground mustering to eliminate goats within PGSW area in accordance with GMP to ensure there is a net gain in the conservation value of this community.	No Feral Goats within the exclusion fencing • Goat fenced closed • All goats removed via trapped watering points • Active mustering as required	Surveillance monitoring of exclosure at monthly intervals Inspection report submitted. Emails, meeting minutes, or other documented details showing the consultation between GE and the landholder regarding goat exclusion periods.	Leaseholder Blore/ GE operational staff	AGL negotiated that goats are excluded to allow recovery of PGSW post drought, despite good cover following significant rainfall events, in accordance with the 2019 vegetation monitoring report.	Compliant