Western Botanical

Targeted Flora and Vegetation Assessment, Lord Byron and Fish Deposits August 2020

Prepared for: Blue Cap Mining Pty Ltd, Laverton Gold Project

Report Ref: WB929

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Report No: WB929

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Version	Prepared By	Approved for Issue	Issue Date
1 Draft	G. Cockerton	G. Cockerton	4th August 2020
2 Including maps and minor amendments	G. Cockerton	G. Cockerton	6th August 2020

This report has been designed for double-sided printing

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1. Executive Summary

Blue Cap Mining Ltd with to implement a cutback and minor mine expansion at the Laverton Gold Project's Lord Byron deposit. The nearby Lord Byron, Fish and Gilt Key deposits and associated haul roads and infrastructure areas, the Study Area, were included in the assessment. The Study Area lies some 83 Km south-east of Laverton, Figure 1.

Western Botanical was engaged in early 2020 to undertake a Targeted Assessment of the flora and vegetation of the 3,068 ha Study Area with field works being implemented over the period 16th to 22nd July 2020 inclusive of travel.

The Lord Byron deposit area has been assessed in two previous reports, Western Botanical 2007 and MBS Environmental 2009. The cumulative flora statistics for the combined 1,182 ha Lord Byron, 1,057 ha Fish, 112 ha Gilt Key deposit areas plus the 717 ha linking haul roads with a 500m buffer around all infrastructure shows a total species count of 123 species from 21 families and 49 genera. No weed species have been recorded in the Study Area.

No Threatened Flora were returned in the desktop assessment. Of the 20 Priority Flora species returned in the combined database search, 17 are considered Unlikely to occur within the Study Area while three are considered Possible. Three species with Conservation listing that may occur within the Study area are *Bossiaea eremaea* P3 , *Calandrinia* sp. Menzies (F. Hort *et al.* FH 4100) P3 and *Goodenia lyrata* P3. These could not be assessed due to both dry seasonal conditions and recent fire within the Fish deposit area.

The current field survey resulted in 16 vegetation associations being described at NVIS Level 5 and 91 endemic flora species being recorded. No Threatened Flora or Priority Flora and no Threatened or Priority Ecological Communities are known within or nearby the Study Area.

Two novel taxa were recorded, *Acacia murrayana* narrow phyllode form (G. & S. Cockerton WB40247) and *Eucalyptus lesouefii* pruinose adult leaf form (G & S Cockerton WB40262). The former is widespread and common in central Australia while the taxonomy of the latter is unclear with potential hybridity being possible. Both are abundant in the local area with significant populations outside the Study Area.

2. Introduction

Blue Cap Mining Ltd with to implement a cutback and minor mine expansion at the Laverton Gold Project's Lord Byron deposit. The nearby Lord Byron, Fish and Gilt Key deposits and associated haul roads and infrastructure areas, the Study Area, were included in the assessment. The Study Area lies some 83 Km south-east of Laverton, Figure 1.

Western Botanical was engaged in early 2020 to undertake a Targeted Assessment of the flora and vegetation of the Study Area with field works being implemented over the period 16th to 22nd July 2020 inclusive of travel.

2.1. Project Background

The Lord Byron (two existing pits) and Fish (one existing pit) deposits have been previously mined by Crescent Gold Ltd with small, limited developments at both sites. The undeveloped Gilt Key deposit lies some 2.2 km south-south-east of the southern Lord Byron pit while the Fish deposit lies some 8 km east-north-east of the Lord Byron deposits. At the time of assessment, minor mining and haulage was being undertaken from the Lord Byron northern pit.

2.2. Previous surveys

The two previous surveys of the components of the Study Area are summarised in Table 1.

Table 1. Previous Surveys

Author and Date	Summary Findings
Western Botanical 2007	• Assessed and produced a Level 1 Vegetation map of the Lord Byron orebody areas. • Reported 14 vegetation associations (one of these within a mosaic and one additional mosaic unit). • Reported 87 species (86 listed, one added on review in this report) including some annuals and geophytes. • No records of Priority or Threatened Flora. • No records of weeds.
MBS Environmental 2009	• Assessed the orebody areas of the Lord Byron deposit plus the haul road to the Fish Deposit. • Reported nine vegetation associations. • Reported 32 species for the Lord Byron deposit areas and haul road to the Fish deposit area. • Species list included five erroneous identifications, one of which was *Eremophila arachnoides* subsp. *tenera,* now listed as a Priority 1 flora species (not present in the Study Area). • No records of Priority or Threatened Flora. • No records of weeds.

No reference to a previous survey report for the Fish Deposit was available to the author.

2.3. Current Survey

Sub-units and major landforms within the current 3,068 ha Study Area are presented in Table 2 and Figure 2.

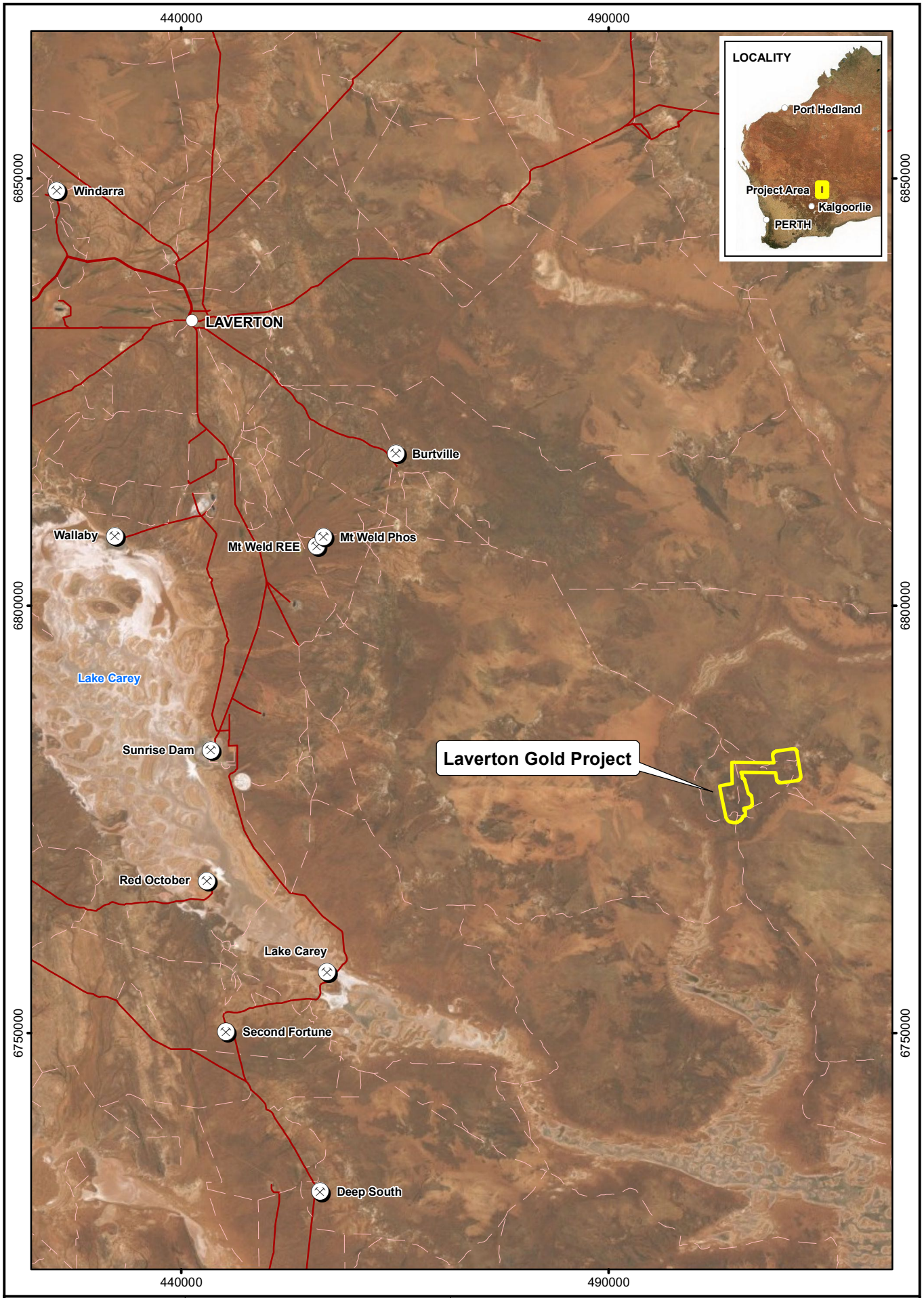
Table 2. Sub-units assessed in the 2020 Survey

Study Area Component	Area (ha)	Component Major Landforms
Lord Byron deposit areas	1,182.0	Outcropping gabbro hills Laterite capped hills Minor Chert and BIF Sandplain Hardpan plain
Gilt Key deposit area (south of Lord Byron)	112.0	Outcropping gabbro hills Minor Chert and BIF Sandplain Hardpan plain
Fish deposit area inclusive of 500m buffer	1,057.0	Sandplain Hardpan plain
Road infrastructure linking all three deposit areas inclusive of 500m buffer	717.0	Sandplain Hardpan plain
Total Area	**3,068.0**	

The sandplains and hardpan plains are large in area and are widely distributed within the Gt. Victoria Desert and Murchison bioregions, the former supporting Mulga (*Acacia aneura* and its allies) and a wide range of *Acacia* species over a predominantly hummocked grassland of Spinifex (*Triodia basedowii*); while the hardpan plains are dominated by open to dense stands of Mulga with annual grass and perennial shrub (mostly *Eremophila* and *Sida* spp.) understorey. The flora and vegetation of these two landforms are largely uniform within each unit over large areas.

By their nature, the outcropping gabbro hills, laterite capped hills and banded ironstone or chert outcrops (listed in order of diminishing areas) are small in area and are moderately to widely disjunct in distribution. There is a greater risk of endemism on these landforms than there is on the more broadly distributed extensive sand and hardpan plains.

Figure 1. Site Location Map



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

0 5 10 km

Scale: 1:600,000
MGA94 (Zone 51)

N

Western Botanical

Author: G. Cockerton | WB Ref:

CAD Ref: g1543_F07_01

Date: August 2020 | Rev: A | A4

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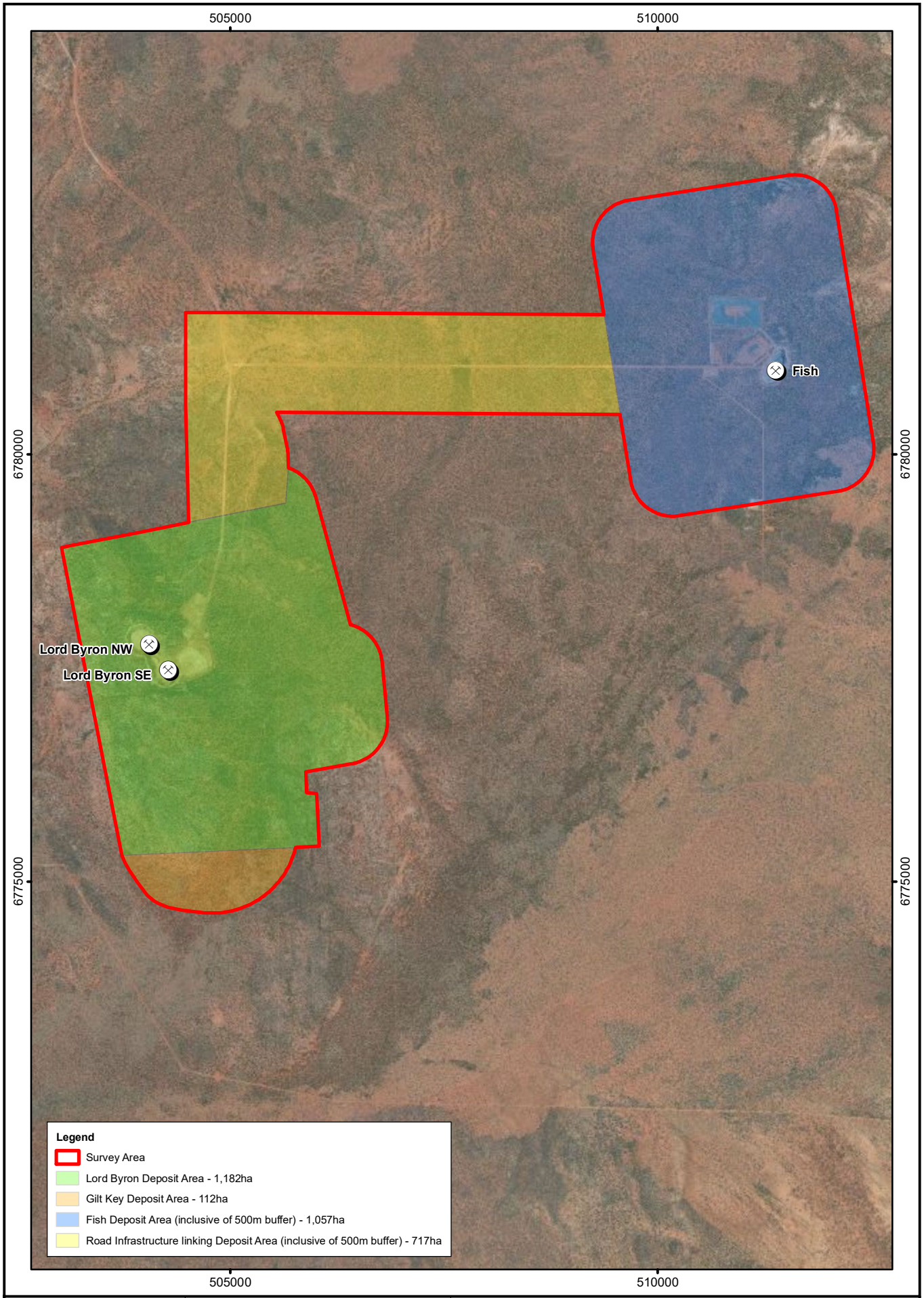
Blue Cap Mining Ltd, Laverton Gold Project
Lord Byron, Fish Deposit and Gilt Key Location

Figure 2. Subunits of the Study Area



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

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MGA94 (Zone 51)

CAD Ref: g1543_F07_02

Date: August 2020 | Rev: A | A4

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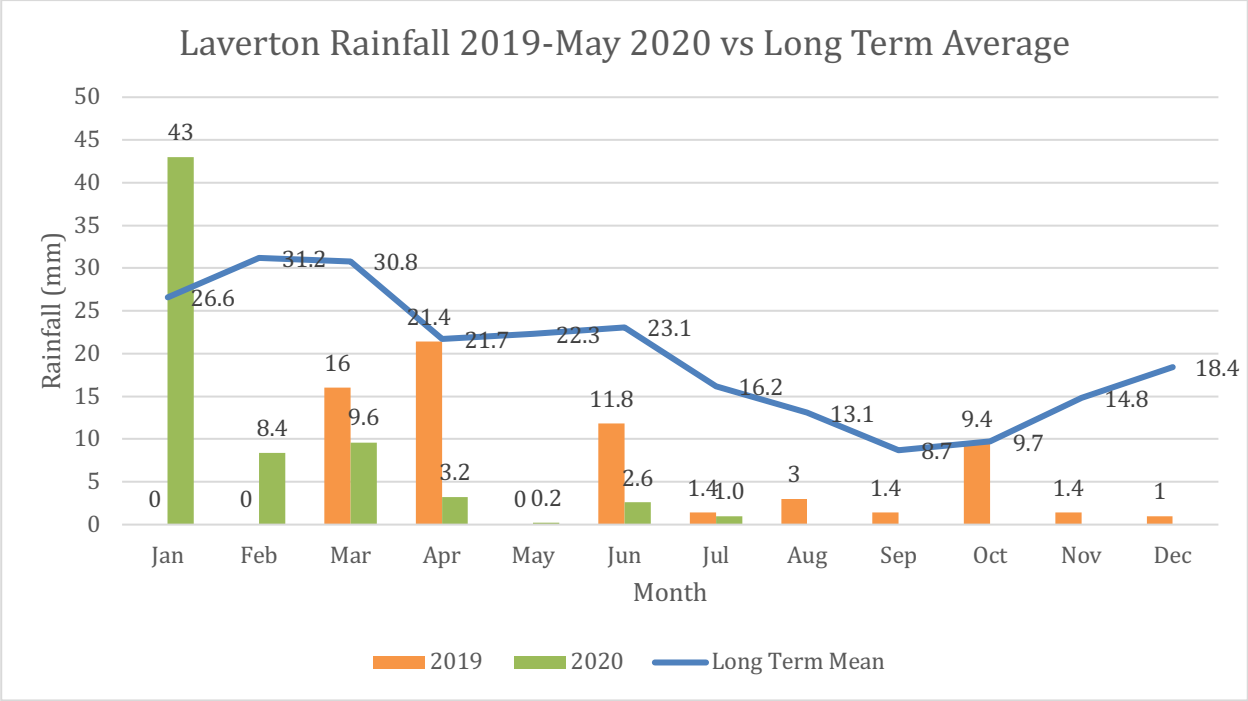
Blue Cap Mining Ltd, Laverton Gold Project
Lord Byron, Fish Deposit and Gilt Key Survey Areas

2.4. Physical Environment

2.4.1. Climate

The climate of the region is arid, with summer and winter rain approximately 190mm per annum. (Barton & Cowan, 2001). The region inclusive of the Study Area experiences hot summers with thunderstorm and occasional cyclonic rainfall while the winters are cool and relatively dry. Rainfall recorded at Laverton (Station 12045) has an annual mean of 236 mm (Bureau of Meteorology). The field survey followed an extended period of five months of below average rainfall, with little effective rainfall low rainfall observed in the region between February and July 2020, Figure 3.

Figure 3. Rainfall, Laverton (Station 12045)



2.4.2. Geology, Landforms and Soils

The western end of GVD1 is underlain by Yilgarn Craton. Within the Shield subregion, there is a higher proportion of sandplains in comparison to the entire bioregion. To the east is an arid active sand-ridge desert of deep Quaternary Aeolian sands overlying Permian and Mesozoic strata of the Officer Basin.

The Lord Byron and Gilt Key portions of the Study Area are represented by low undulating outcropping gabbro and basalt hills with associated carbonate influenced soils. Shallow laterite and ferricrete caps extend parallel to the outcropping gabbro hills east of the orebodies and areas of lower relief are then overlain by shallow Aeolian sandplains on the eastern margin. Small areas of uplifted banded ironstone and chert are also present.

The Fish deposit and Study Area is almost entirely overlain by Aeolian sandplain. Small areas of banded ironstone or chert and associated laterite and ferricrete are present on the northern margin of the now excavated Fish deposit pit area. Geology of the region is depicted in Figure 4.

2.5. Biological Environment

2.5.1. Interim Biogeographic Regionalisation of Australia

The Study Area lies on the western edge of the Shield sub-region of the Great Victoria Desert Interim Biogeographic Region (Thackway & Cresswell 1995). The region is characterised by Spinifex (*Triodia* spp) and mallee (*Eucalyptus kingsmillii, E. youngiana*) over hummock grassland dominated by *Triodia basedowii* occur on the aeolian sand plain. Scattered marble gum (*E. gongylocarpa*) and native pine (*Callitris*) occur on the deeper sands of the sand plains. Mulga and *Acacia* woodlands occur mainly on the colluvial and residual soils. Halophytes such as salt bush (*Atriplex*), Bluebush (*Maireana* (formerly *Kochia*)), and samphire (*Halosarcia, Tecticornia* (formerly *Arthrocnemum*)) occur, margins of salt lakes and in saline drainage areas.

Landforms consist of salt lakes and major valley floors with lake derived dunes. Sand plains with patches of seif dunes running east west. Areas of moderate relief with outcropping and silcrete-capped mesas and plateaus (breakaways) present. The subregion contains major a paleochannel of Ponton Creek, (Barton & Cowan, 2001).

2.5.2. Land Systems

The Land Systems of the Study Area specifically, and the Shield subregion generally have not been mapped. The adjacent Land System mapping of the north-eastern Goldfields (Pringle *et. al.* 1994) can be used as a guide to those expected in the Study Area and is discussed further within this document.

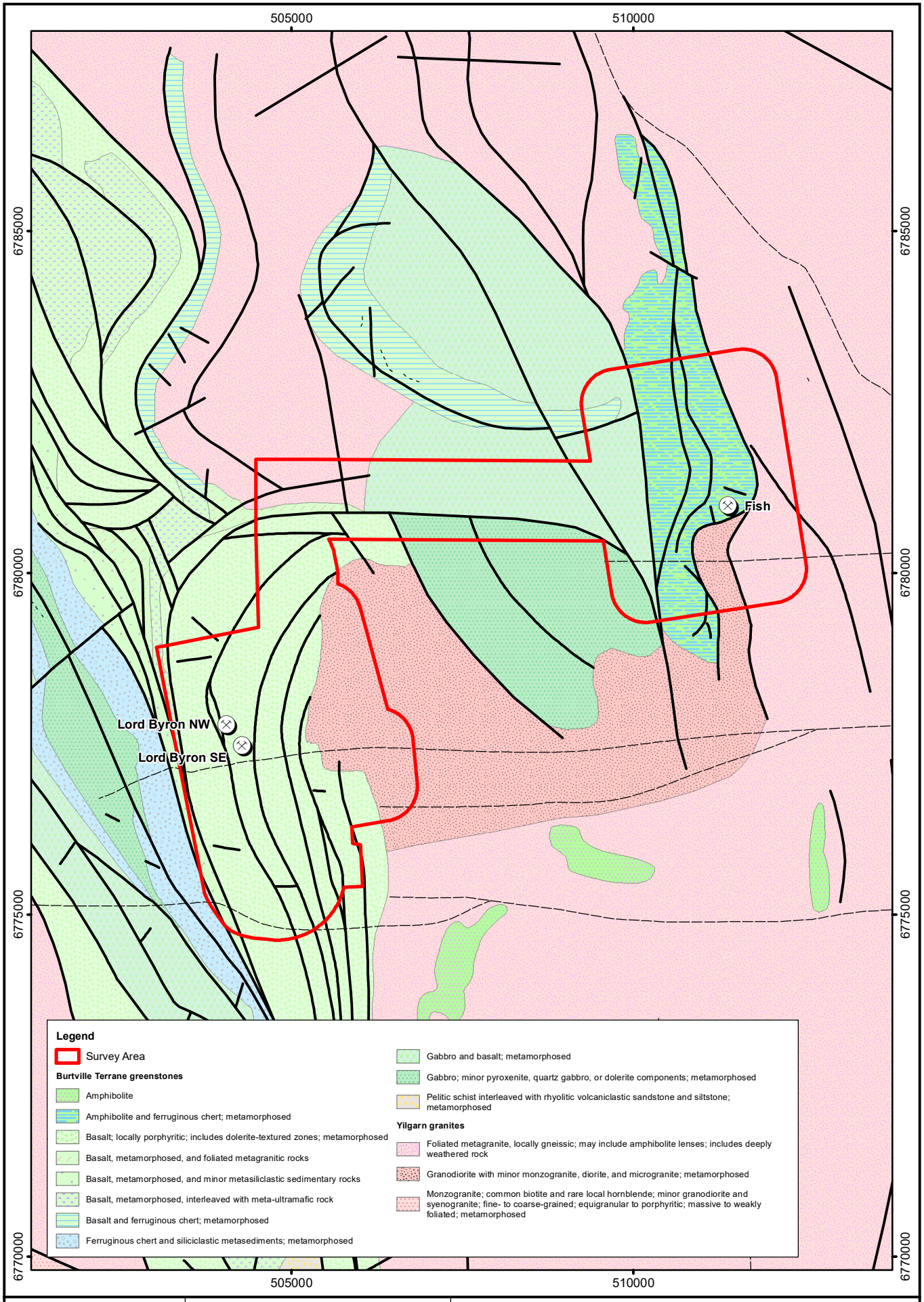
2.5.3. Beard Pre-European Vegetation

The Study Area lies within to vegetation units mapped by Beard (1990):

- GREAT VICTORIA DESERT SA Code: 18.15 Mulga *Acacia aneura* and associated species. Low woodland, open low woodland or sparse woodland; and
- GREAT VICTORIA DESERT SA Code: 1239 Hummock grassland with scattered eucalypts over wattle scrub or mallee *Triodia* spp. *Acacia* spp. Cory*mbia dichromophloia*, *Eucalyptus leucophloia, E. youngiana* Tree-and-shrub-steppe

While useful in a general sense, this scale of mapping is not particularly useful for environmental impact assessment at the scale of this proposal, Figure 5.

Figure 4. Geology of the Region Inclusive of the Study Area



0 0.5 1 km

Scale: 1:75,000
MGA94 (Zone 51)

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CAD Ref: g1543_F07_06

Date: August 2020 | Rev: A | A4

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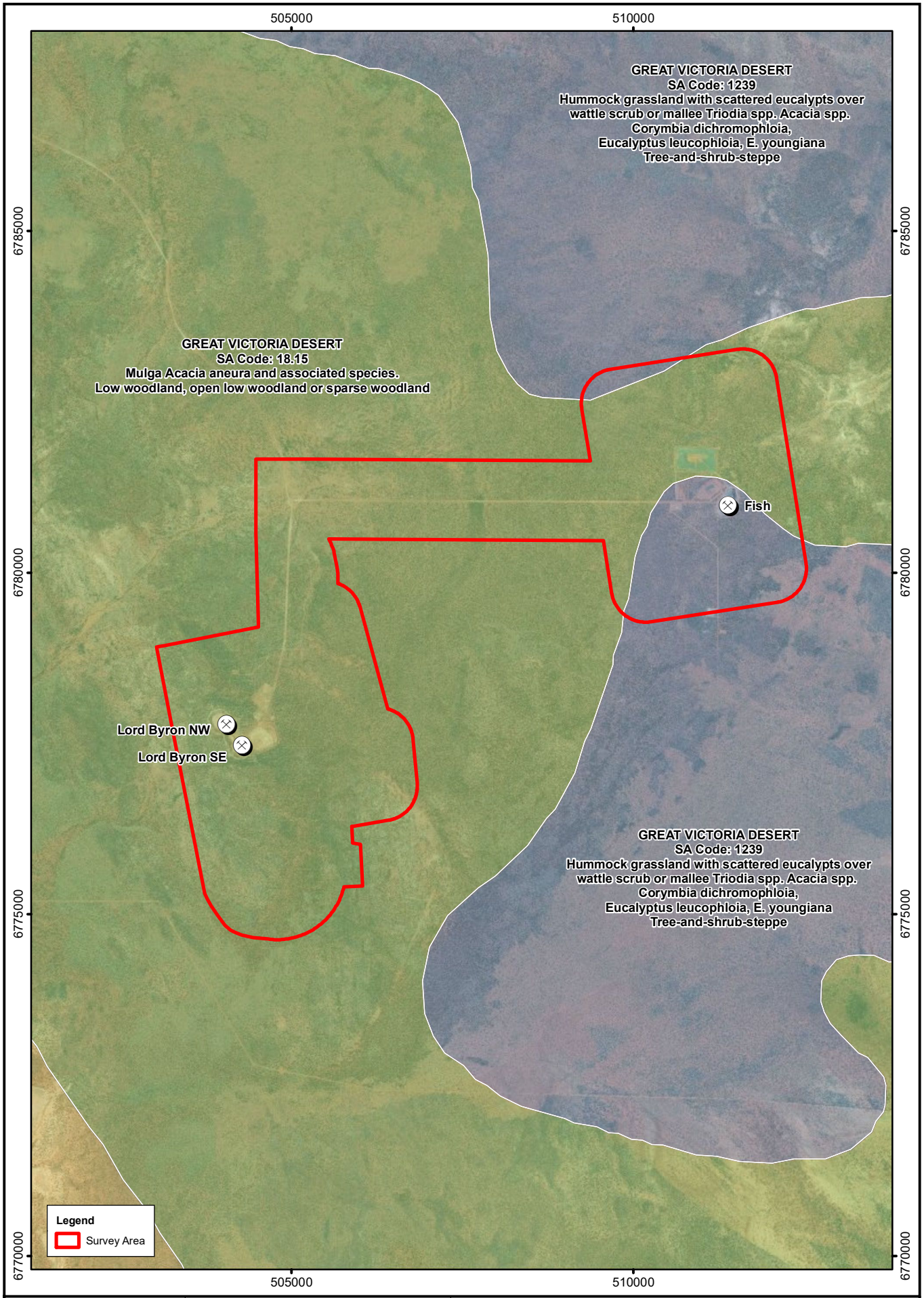
Blue Cap Mining Ltd, Laverton Gold Project
Lord Byron, Fish Deposit and Gilt Key
100k Geology (DMIRS)

Figure 5. Pre-European Vegetation of the Region



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

0 0.5 1 km

Scale: 1:75,000
MGA94 (Zone 51)

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Blue Cap Mining Ltd, Laverton Gold Project
Lord Byron, Fish Deposit and Gilt Key
Pre-European Vegetation

3. Methods

3.1. Desktop Survey

The desktop study consisted of reviewing the vegetation mapping of the Lord Byron deposit areas presented in Western Botanical 2007 and a review of the current DBCA database results [WAHERB, TPFL (Reference 06-0520FL), TEC and PEC (Reference 07-0520EC)]. A Protected Matters Search was undertaken in July 2020. Updates to the taxonomy and conservation status of species returned in the above searches and additions to the Priority Flora list that occurred during the course of the project were incorporated into the results.

3.2. Field Survey

Field survey consisted of extensive in-vehicle and on-foot traverses throughout the Study Area where descriptions of landforms and vegetation, inventories of flora, representative photographs and collections of the majority of species were taken.

3.3. Vegetation Mapping

Vegetation mapping was conducted in the field using Relevés and high resolution laminated colour aerial photography at a scale of 1:10,000. Mapping reported in Western Botanical 2007 for the Lord Byron deposit areas was used as a basis for the current project and was amended where appropriate and added to the full extent of the Study Area. Within the Study Area, areas additional to those mapped in 2007 were walked on foot and vegetation was described. Areas in the 500m buffer around the haul roads and Fish deposit were largely extrapolated from occasional traverses in representative areas.

3.4. Flora Specimen Identification

The majority of flora encountered was recognised and confidently named in the field. Specimens of *Acacia murrayana* narrow phyllode form (G. & S. Cockerton WB40247) and *Eucalyptus lesouefii* pruinose adult leaf form (G & S Cockerton WB40262) will be vouchered at the WA Herbarium for the attention of the appropriate taxonomists. All flora are named in accordance with the current terminology adopted by the WA Herbarium.

3.5. Significant Flora

Locations of any significant flora were recorded using hand held GPS with an accuracy of +/- 5m and estimates of population size and extent of populations were made.

3.6. Weeds

Locations of any weeds were recorded using hand held GPS with an accuracy of +/- 5m.

3.7. Vegetation Condition

Notes on vegetation condition were made during the course of vegetation descriptions.

4. Results and Discussion

4.1. Desktop Assessment

Previous reports on the Study Area, Western Botanical 2007 and MBS Environmental 2009, were reviewed prior to field survey. Additionally, a review of the Department of Biodiversity, Conservation and Attractions' (DBCA) WA Herbarium (WAHERB) and Threatened and Priority Flora (TPFL) Databases based on the coordinate 29.128705° S, 123.043946° E with a 20 km buffer was implemented in May 2020 prior to field assessment (Reference: 060520-FL). Results of this are presented in Table 3. A Protected Matters Search was also undertaken in July 2020.

No Threatened Flora were returned in the desktop assessment.

Of the 20 Priority Flora species returned in the combined database search, 18 are perennial plants while two are annual herbs.

The species have been attributed Likelihood of Occurrence within the Study Area based on the results presented in the previous reports and based on habitat preference of the Priority Flora, Table 3. Of these, 17 are considered Unlikely to occur within the Study Area while three are considered as Possibly occurring in the Study Area, requiring assessment in the appropriate seasonal conditions and post-fire conditions.

Table 3. Results of the DBCA's WAHERB and TPFL Databases Search

Taxon	Cons Code	Annual / Perennial	WAHERB	TPFL	Preferred Habitat	Likelihood of occurring within the Study Area
Eremophila arachnoides subsp. tenera	1	P	1	1	Calcrete platforms, margins of paleochannels	Unlikely
Philotheca linearis	1	P	1		Yellow sand adjacent to granite outcrop	Unlikely
Philotheca tubiflora	1	P	1		Weathered Archaean granite breakaway plateaux	Unlikely
Tecticornia mellarium	1	P	1	1	Salt lake beds, paleochannels	Unlikely
Tecticornia sp. Lake Way (P. Armstrong 05/961)	1	P	1	1	Salt lake beds, paleochannels	Unlikely
Vittadinia cervicularis var. oldfieldii	1	P	1		Unknown, red alluvium	Unlikely
Styphelia deserticola (formerly *S.* sp. Great Victoria Desert (N. Murdock 44)	2	P	1		Aeolian red sand dunes	Unlikely
Bossiaea eremaea	3	P	1		Aeolian sandplains	Possible
Calandrinia sp. Menzies (F. Hort et al. FH 4100)	3	A	1		Loams, gravels, hardpan plains	Possible
Calytrix hislopii	3	P	1		Weathered Archaean granite breakaway plateaux	Unlikely
Calytrix praecipua	3	P	1		Weathered Archaean granite breakaway plateaux	Unlikely
Goodenia lyrata	3	A	1		Salt lake margins, hardpan plains, drainage areas	Possible
Hybanthus floribundus subsp. chloroxanthus	3	P	1	1	Drainage lines in nickel-rich conglomerates	Unlikely
Melaleuca apostiba	3	P	1		Salt lake margins	Unlikely
Phyllanthus baeckeoides	3	P	1		Lateritic hills and breakaways	Unlikely

Taxon	Cons Code	Annual / Perennial	WAHERB	TPFL	Preferred Habitat	Likelihood of occurring within the Study Area
Thryptomene nealensis	3	P	1		Weathered Archaean granite breakaway plateaux	Unlikely
Conospermum toddii	4	P	1	1	Aeolian sandplains and dunes	Unlikely
Eucalyptus nigrifunda	4	P	1		Breakaways, salt lake margins	Unlikely
Frankenia glomerata	4	P	1		Breakaways, salt lake margins	Unlikely
Hemigenia exilis	4	v	1	1	Nickel-rich conglomerates	Unlikely

The three species that may occur within the Study area are presented in Table 4.

Table 4. Priority Flora that are considered as Possibly occurring in the Study Area

Species	Cons_Code	Life Form	Preferred Habitat
Bossiaea eremaea	P3	Perennial	Sandplains of the Bullimore Land System
Calandrinia sp. Menzies (F. Hort et al. FH 4100)	P3	Annual	Loams, gravels, hardpan plains west of Lake Carey
Goodenia lyrata	P3	Annual	Salt lake margins, hardpan plains, drainage areas

Conservation Codes and Their Meanings are presented in Appendix 4.

No State or Federally Listed Threatened or Priority Ecological Communities are known within or nearby the Study Area.

4.2. Field Survey

4.3. Landforms and Vegetation

Landform descriptions and Vegetation Associations build on those presented in Western Botanical 2007, Table 5. Four Landforms are recognised: Low Hills, Rocky Outcrops, Sandplains and Drainage Lines / Hardpan plains. These landforms are widely distributed in the eastern Murchison and western Gt. Victoria Desert bioregions.

Table 5. Landforms and Vegetation Associations of the Study Area

Landform	Dominating Geology, Soils	Code	Vegetation Association	Area (ha)	% of Study Area
Low Hills	Laterite, Ferricrete	SIMS	Stony Ironstone Mulga Shrublands	74.5	2.43%
	Gabbro, basalt with calcrete	EIWEsS	*Eucalyptus lesouefii* pruinose adult foliage form (G & S Cockerton WB40262) Woodland with *Eremophila scoparia* understorey	102.9	3.35%
	Calcrete on stony rises	CpW	*Casuarina pauper* Woodland	225.6	7.36%

Landform	Dominating Geology, Soils	Code	Vegetation Association	Area (ha)	% of Study Area
	Calcrete on stony rises	CpW/MsS mosaic	*Casuarina pauper* Woodland and *Maireana sedifolia* Shrubland mosaic	86.8	2.83%
Rocky Outcrops	Banded Ironstone Formation	BIF (ridge)	Mulga Shrublands on Banded Ironstone Formation Outcrop	10.7	0.35%
	Banded Ironstone Formation	BIF Debris Slope	Mulga Shrublands on Banded Ironstone Formation Debris Slope	163	5.31%
	Chert	ChO	Shrublands on Chert Outcrops	3.1	0.10%
Sandplains	Aeolian sand	SAMU	Sandplain Mulga-Spinifex Shrublands	27.4	0.89%
	Aeolian sand	SAMA	Sandplain Spinifex Mulga and Mallee	629.9	20.54%
	Aeolian sand	SAWS	Sandplain Spinifex and Wattles other than Mulga	27.8	0.91%
	Aeolian sand	SAGS	Sandplain Spinifex with Eucalyptus gongylocarpa	22.4	0.73%
	Aeolian sand and laterite gravel	LMWS	Lateritic Mulga and Wanderrie Shrubland	535.4	17.46%
	Aeolian sand and silt/clay	LMWS/ SAMU mosaic	Mosaic of Lateritic Mulga and Wanderrie Shrubland and Sandplain Spinifex-Mulga Shrubland	188.9	6.16%
Drainage Lines and Hardpan Plains	Depositional silt and clay	DRMS	Drainage Line Mulga Shrubland	36.1	1.18%
	Depositional silt and clay	HPMS	Hard Pan Mulga Shrubland	712.2	23.22%
	Depositional silt and clay	GRMU	Groved Mulga Shrubland	11.1	0.36%
	Depositional silt and clay over calcrete	MsS	Maireana sedifolia Shrubland	48.7	1.59%
Disturbed				160.6	5.24%
Total				3,067.1	100.00%

4.4. Vegetation Associations

Fifteen Vegetation Associations and two mosaics at the NVIS Level 5 *Association* level of detail were recognised within the Study Area, Table 5. Most of these were reported in Western Botanical 2007. Additions to the previous list of vegetation associations are both associated with Aeolian sandplains within the Fish deposit area:

- Sandplain Spinifex with Wattles other than Mulga (SAWS); and
- Sandplain Spinifex with *Eucalyptus gongylocarpa* (SAGS) communities.

Both these communities support dense stands of Spinifex Hummocked Grasslands in the mature long-unburnt state and are subject to extensive fires following lightning strikes. The majority of the Fish deposit area consists of the SAWS and SAGS community types. A relatively recent fire, estimated at having occurred less than 1 year ago, had occurred in the region of the Fish Deposit meaning that most of this portion of the Study Area was burnt with little regeneration of annuals or perennials due to the very dry seasonal conditions.

Vegetation Associations are described in the following section and are depicted in Figure 7.

4.4.1. Low Hills

4.4.1.1 Stony Ironstone Mulga Shrubland (SIMS)

The Stony Ironstone Mulga Shrubland vegetation unit occurs on gentle slopes towards the north west end and the north east tip of the Lord Byron project area (Figures 1-3). The soil is typically red silty sand with abundant cryptogram crusting and discontinuous laterite lag gravel of abundant subangular, fine gravel to medium stones, with occasional small to large quartz pebbles.

Vegetation is dominated by *Acacia aneura* (2 forms) to 7 m, with occasional *Brachychiton gregorii* to 6 m tall shrubland (PFC 50-60%), over *Acacia ramulosa* to 2m mid shrubland (PFC 5%), over a lower shrub stratum of *Eremophila latrobei ssp. glabra* to 1 m, *Eremophila punctata* 1.2 m, *Dodonaea rigida* to 1.2 m and *Dodonaea lobulata* to 1.2 m (PFC 10-30%). A species matrix is presented in Appendix 3.

Plate 1. Stony Ironstone Mulga Shrubland

Where soils and laterite gravel are very shallow, SIMS supports very open *Acacia ramulosa* subsp. *ramulosa* shrublands.

4.4.1.2. *Eucalyptus lesouefii* pruinose leaf form (G & S Cockerton WB40262) Woodland with *Eremophila scoparia* Shrubland (ElWEsS)

The undulating low gabbro & basalt rises supporting ElWEsS had an estimated 5 to 50 m relief above the surrounding landscape and included numerous small to moderately sized quartz and chert outcrops (1-3 m relief). Evidence of extensive calcrete derived from the basic rocks is reflected in the vegetation, including the dominance of *Eremophila scoparia* and occasional *Eremophila oppositifolia* var. *angustifolia, Atriplex nummularia* and *Ptilotus obovatus* upright form (G. Cockerton & G O'Keefe 12281), which all favour alkaline soils.

The upper stratum was a low woodland of *Eucalyptus lesouefii* pruinose leaf form (G & S Cockerton WB40262) to 15 m (PFC 15-30%), over a relatively uniform understorey of *Eremophila scoparia* to 2 m, with occasional *Atriplex nummularia* to 2 m (PFC 40-60%) tall shrubs, over scattered *Ptilotus obovatus* upright form (G. Cockerton & G O'Keefe 12281) to 0.8 m and *Atriplex bunburyana* 0.5 m (PFC 2-5%), over *Maireana trichoptera* 0.2 m and *Maireana georgei* 0.4 m (PFC < 1%) scattered low shrubs. There were also occasional occurrences of Mulga, *Acacia sibirica* and *Casuarina pauper* in gullies.

A species matrix is presented in Appendix 3.

Plate 2. *Eucalyptus lesouefii* pruinose leaf form (G & S Cockerton WB40262) Woodland with *Eremophila scoparia* Understorey

The ElWEsS vegetation association has some commonality with the PECW Site Type of Pringle *et. al.* 1994 in that the dominant upper stratum is *Eucalyptus lesouefii sens. str.* (typical form with glossy dark green adult leaves) with a mid to lower storey of *Eremophila scoparia* (Pringle *et. al.* 1994, p 143.). However, PECW is noted as being characterised by "alluvial plains with loam or clay soils below greenstone hills in the south of the [north-eastern Goldfields] survey area, particularly in the south-west of the Menzies 1:250,000 sheet". This contrasts strongly with the landform of the Lord Byron Study Area supporting ElWEsS which is a low hill rather than an alluvial plain.

The occurrence of the ElWEsS vegetation association on upland, outcropping gabbro with calcrete is observed within the series of low gabbro hills at and adjacent to the Lord Byron Study Area, is depicted in Figure 6 and listed in Table 6, Figure 6 and Figure 8. A species matrix is presented in Appendix 3.

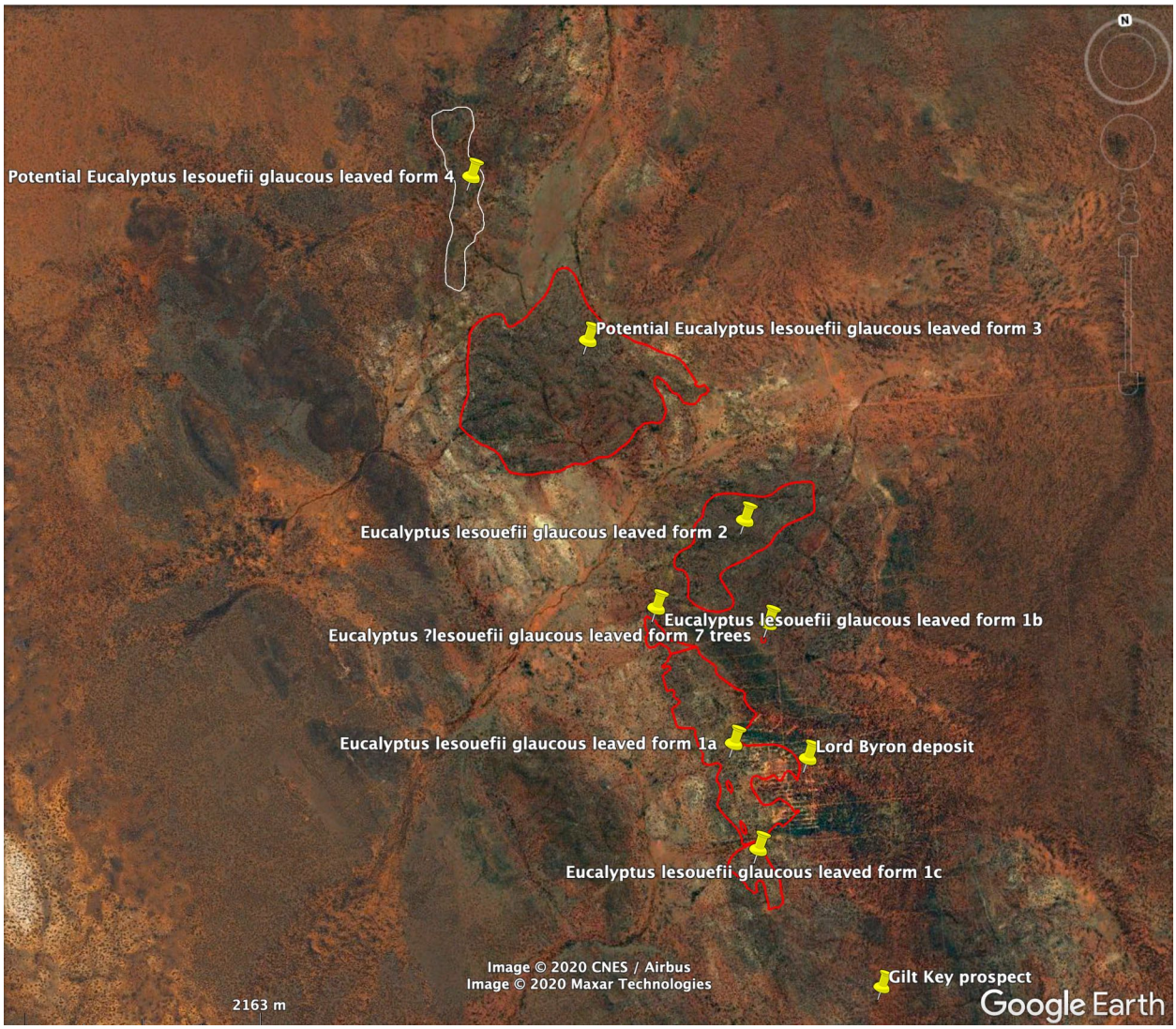


Figure 6. Outcropping gabbro hills supporting ElWEs vegetation association nearby the Study Area

Table 6. Known and interpreted occurrences of the ElWEs vegetation association near Lord Byron

Polygon ID	Confidence	Area (ha)	Location
Population 1a	Confirmed	93.4	Surrounding Lord Byron orebody area
Population 1b	Confirmed	5.7	North of Lord Byron orebody area, contiguous with population 1a
Population 1c	Confirmed	15.3	South of Lord Byron orebody area, contiguous with population 1a
Population 2	Confirmed	71.2	North of Lord Byron orebody area
Population 3	Confirmed	240	North of the Lord Byron orebody area
Population 4	Potential, extrapolated	42.2	North of the Lord Byron orebody area
Population 5	Potential, taxonomic review of specimens required	0.18	North-east of Lord Byron orebody area
	Total Area (ha)	**394.6** **42.2** **436.8**	**Confirmed** **Potential** **Total**

4.4.1.3 *Casuarina pauper* Woodland (CpW)

Casuarina pauper Woodland occurs in small patches and mostly in the southern section of the project area (Figures 1-3). This vegetation unit is associated with underlying basalt rocks that have been influenced by groundwater calcrete. The land is slightly undulating and has shallow sandy loam soil over calcrete hardpan at approximately 10-20 cm. The soil surface features a discontinuous mantle of subangular ironstone, basalt and quartz rocks to 7 cm and ferruginous gravel.

Vegetation is dominated by *Casuarina pauper* to 7 m with occasional *Acacia aneura* sens. lat. to 5 m and *Acacia sibirica* 4 m (PFC 10-20%) low woodland, over *Eremophila scoparia* to 2 m and *Acacia ramulosa* to 1.8 m, (PFC 5%) open low scrub, over *Ptilotus obovatus* upright form (G. Cockerton & G O'Keefe 12281) 0.9 m, (PFC 10%) sparse to very sparse dwarf scrub, over scattered chenopods including *Maireana georgei* and *Sclerolaena obliquicuspis*. A species inventory recorded for CPW is presented in Appendix 3.

In the western half of the prospect, CpW is extensive and forms a mosaic with small chert outcrop and minor outcrop. The outcropping is associated with red silty soils with abundant lag mantles and supports species similar to the BIF Debris Slope vegetation association. The scale of imagery provided did not allow for the delineation of the components of the mosaic to be mapped separately.

Plate 3. *Casuarina pauper* Woodland

4.4.1.4. Casuarina pauper Woodland / Maireana sedifolia Shrubland (CPW/MSS)

CpW/MsS occurs in a narrow section on the western perimeter of the project area boundaries and the *Maireana sedifolia* shrubland only occurs in a very small patch on the north west tip of the project area. In the central western part of the project area, the MMS has substantial emergent Acacia aneura sens. lat. and occasional *Casuarina pauper* (PFC 5-10%). Soil is a pale brown, sandy loam, with a lag gravel and stony mantle of scattered subangular quartz fragments to 7 cm.

The upper woodland stratum consists of *Casuarina pauper*, *Acacia aneura* sens. lat. 6 m and *Acacia sibirica* (PFC 10-20%) with understorey having a conspicuous *Maireana sedifolia* component to 1 m (PFC 10%), with associated understorey shrubs including *Eremophila scoparia* 1.5 m and *Atriplex nummularia* 1.5 m (PFC 5-20%). A species inventory recorded for CPW/MSS is presented in Appendix 3.

Plate 4. *Casuarina pauper* Woodland/*Maireana sedifolia* Shrubland (CpW/MsS)

4.4.3. Rocky Outcrops

4.4.3.1. Mulga Shrubland on Banded Ironstone Outcrop (BIF)

There are three Banded Ironstone Formation outcrops that occur within the project boundaries, two in the south east corner and one in the north east corner. These small outcrops are low and narrow and have a relief of approximately 2 m above surrounding land on the western side.

The upper stratum was a low woodland of *Acacia aneura* (2 forms) 4 m, *Acacia mulganeura* 3 m and *Grevillea berryana* 4 m (PFC 20%), over shrubs of *Philotheca brucei* 1.2 m, *Eremophila latrobei ssp. latrobei* 1 m, *Olearia humilis* 1 m and *Prostanthera althoferi ssp. althoferi* 0.7 m (PFC 20-50%) sparse low scrub to mid-dense heath, over *Sida sp. golden calyces glabrous* (H.N. Foote 32) 0.2 m and *Eriachne helmsii* 0.5 m (PFC 2%). Occasionally small patches of the undescribed Eriachne mucronata desert form glabrous (G & S Cockerton WB40048). Are present on open mid slopes.

A species inventory recorded for BIF is presented in Appendix 3.

Plate 5. Banded Ironstone Outcrop (BIF)

4.4.3.2. Mulga Shrubland on BIF Debris Slope (BIF DS)

This vegetation unit was located at the base of duricrust breakaways, mostly occurring in the southern section and a small patch towards the north eastern corner of the project area. The sample site for this vegetation unit was downslope of a BIF, lying just out of the eastern edge of the project area in the southern half. The slope was approximately 10° with a surface of discontinuous, subangular, 2-10 cm BIF fragments. Some sheets of angular rock, and occasional quartz fragments were noted.

Vegetation is dominated by an open to closed Mulga shrubland of *Acacia aneura* to 4 m, *Acacia kempeana* to 4 m, PFC (5-15%) open low woodland to low forest (< 50% PFC), over *Scaevola spinescens* 1 m, *Senna cardiosperma*, *Senna artemisioides ssp. sturtii* 1 m, *Dodonaea lobulata* 1m, *Eremophila latrobei* (filiform leaf form) 1.5 m *Dodonaea rigida* 1m and *Sida ectogama* 1 m (PFC 10-15%) low scrub to heath (< 50%), over *Ptilotus obovatus* upright form (G. Cockerton & G O'Keefe 12281) 0.5-0.8 m and *Ptilotus obovatus* (Typical Form) 0.4 m (PFC 5-10%) open dwarf scrub.

A species inventory recorded for BIF DS is presented in Appendix 3.

Plate 6. BIF Debris Slope

4.4.3.3 Chert Outcrops (ChO)

Chert outcrops were observed largely within the *Eucalyptus lesouefii* Woodland over *Eremophila scoparia* Shrubland community and were represented by small rounded to linear quartz and chert outcrops. These supported the adjacent vegetation on their perimeter but also had species that were not in common with the wider community such as the fern *Cheilanthes distans* and shrubs including *Prostanthera althoferi* subsp. *althoferi*, *Hakea arida* subsp. *recurva*, *Sida ectogamma*, *Dodonaea rigida* and *D. lobulata*.

Plate 7. Chert outcrop in the background, adjacent to the Lord Byron abandonment bund

4.4.4. Sandplains

4.4.4.1. ..... Sandpla in Mulga – Spinifex Shrubland (SAMU)

SAMU occurred in a small pocket in the south eastern of the project area and more commonly occurred with LMWS in a mosaic pattern that covers over a third of the project area. Soil of SAMU is a red silty loam with abundant small ferruginous gravel to 1.5 cm. Vegetation is dominated by Acacia aneura (several forms) to 4 m, (PFC 20-40%) low forest, over an open dwarf scrub stratum of Eremophila aff. margarethae 0.7 m (PFC 10%), over perennial grasses; Triodia basedowii 0.3 m and Eragrostis eriopoda 0.4 m (PFC 5-15%). A species inventory recorded for SAMU is presented in Appendix 3.

Plate 8. Sandplain Mulga – Spinifex Shrubland (SAMU) – Unburnt

Plate 9. Sandplain Mulga – Spinifex Shrubland – Recently Burnt

4.4.4.2. Sandplain Spinifex Mulga and Mallee Shrubland (SAMA)

SAMA occurs in the extreme south east of the project area and appears to be long unburnt. Soil is red silty sand with scattered BIF subangular fragments and abundant evidence of BIF subcropping and outcropping present. The sandy soils support *Acacia aneura* (several forms) to 6 m, *Eucalyptus longissima* to 8 m and *Acacia burkittii* to 3m (PFC 10-25%), over a tall shrub stratum of *Eremophila scoparia*, *Santalum spicatum* and *Acacia tetragonophylla* to 2 m (PFC 5-10%), over *Triodia basedowii* 0.4 m (PFC 50-70%) hummock grassland.

A species matrix is presented in Appendix 3.

Plate 10. Sandplain Spinifex Mulga and Mallee Shrubland (SAMA) post-fire showing regeneration from lignotuber of eucalypts.

4.4.5.1 Sandplain in Spinifex with Wattles other than Mulga (SAWS)

The SAWS community represents deep Aeolian sandplains with silty sandy soils. Here *Acacia* species other than the Mulga group are present over scattered low shrubs and *Triodia basedowii* hummocked grassland.

SAWS is characterised by very open *Acacia* and mallee shrubland over Spinifex Hummocked Grassland. *Acacia colletioides* 1m, *A. burkittii* 1.5m, *A. prainii* 1m, *A. ligulata* 1m, *A. heteroneura* to 1.5m, PFC 1 to 2% with scattered *Eucalyptus concinna*, E. *youngiana* 2 to 5m, PFC 5% over low shrubs *Halgania cyanea* var. Allambi Stn. (B.W. Strong 676) 0.4m, *Androcalva loxophylla* 0.3 to 0.7m, *Senna artemisioides* subsp. *artemisioides* 1m, *Alyogyne pinoniana* 0.5m (common after fire), *Codonocarpus cotiniifolius* 2.4m (common after fire), *Seringia velutina* subsp. *velutina* 0.5m, *Senna pleurocarpa* subsp. *angustifolia* 0.5m, PFC 5% over *Triodia basedowii* 0.3m, PFC 20 to 30%. A species matrix is presented in Appendix 3.

Much of this area has been burnt relatively recently, bare ground with minimal regeneration of Spinifex and shrubs and mallees with young coppice growth, however, there is also evidence of fire around 15 to 20 years ago with mid shrubs being quite small compared to their normal mature size.

Plate 11. SAWS Community, unburnt in foreground, recently burnt in background with SAMU to the rear.

4.4.5.2. Sandplain, Spinifex with *Eucalyptus gongylocarpa* (SAGS)

Areas of sandplain supporting Spinifex and *Eucalyptus gongylocarpa* (Marble Gum) are present in small patches around the Fish deposit area. Given the recent fire in this area, All the SAGS community patches had been recently burnt and therefore only the emergent tall *E. gongylocarpa* were recognisable.

SAGS is a commonly encountered community on broad deep sandplains in the eastern Murchison and western Gt. Victoria Desert bioregions and commonly has Triodia basedowii, *Acacia*, *Senna* and *Eremophila* species in the understorey.

The Priority 3 *Bossiaea eremaea* is occasionally associated with SAGS (and SAWS) vegetation associations though none were recorded within these communities within the Study Area.

Plate 12. *Eucalyptus gongylocarpa* regeneration post-fire in a small patch of the SAGS community

4.4.5.3 Lateritic Mulga – Wanderrie Shrubland (LMWS)

Lateritic Mulga Wanderrie Shrubland was located on gentle slopes characterised by discontinuous fine to medium ironstone lag gravel. LMWS is relatively extensive on the eastern part of the Lord Byron project area and exists in a mosaic with the vegetation unit Sandplain Spinifex Mulga Shrubland (SAMU) that covers over one third of the project area (see section 3.1.4).

Vegetation is dominated by *Acacia aneura* (several forms) to 6 m (PFC 30-50%) low forest, over *Acacia ramulosa* 2 m, (PFC 10%) sparse to very sparse low scrub, over *Eremophila latrobei* ssp. *glabra* 1 m, over a prominent sparse grass stratum of *Eragrostis eriopoda* 0.4 m, (PFC 10-20%). A species inventory recorded for LMWS is presented in Appendix 3.

Plate 13. Lateritic Mulga – Wanderrie Shrubland

4.4.7. Drainage Lines and Hardpan Plains

4.4.7.1. ..... Hard Pan Mulga Shrubland (HPMS)

This vegetation unit covers a relatively small area within the project boundaries, with the majority of HPMS occurring in the north eastern corner and small patches in the south western part of the project area. This vegetation unit was found in areas adjacent to drainage lines or on broad valley floors with little slope and red sandy loam soil with shallow clayey hard pan (5 cm).

Very scattered Mulga trees and shrubs to 5 m and *Acacia sibirica* (PFC 2-5%), over very scattered shrubs including *Senna cardiosperma*, *Senna artemisioides ssp. artemisioides* 1 m and *Ptilotus obovatus* (Typical Form) 0.4 m, (PFC 2-5%). HPMS also had a large component of bare ground and contained evidence of annual grasses being present. A species inventory recorded for HPMS is presented in Appendix 3.

Plate 14. Hard Pan Mulga Shrubland

4.4.7.2 Drainage Line Mulga Shrubland (DRMS)

DRMS occurred in one small linear section in the north eastern tip of the project area and consisted of a narrow drainage line with a slightly incised central channel (< 30 cm), supporting a dense Mulga overstorey and dense understorey reflecting adjacent habitats. Soil was a red silty loam with abundant ironstone, quartz and basalt gravel to small stones on the surface, with a high leaf litter component.

Vegetation is dominated by *Acacia aneura* sens. lat. to 8 m and *Acacia sibirica* 4 m, with occasional *Eucalyptus longissima* 5 m (PFC 80%) dense low forest, over *Acacia burkittii*, *Acacia ramulosa* and *Acacia tetragonophylla*, all to 2 m (PFC 10%,) low scrub to low open scrub over *Dodonaea rigida* 1.5 m and *Senna cardiosperma* 1.2 m (PFC 30%) low scrub to heath. A species inventory recorded for DRMS is presented in Appendix 3.

Plate 15. Drainage Line Mulga Shrubland

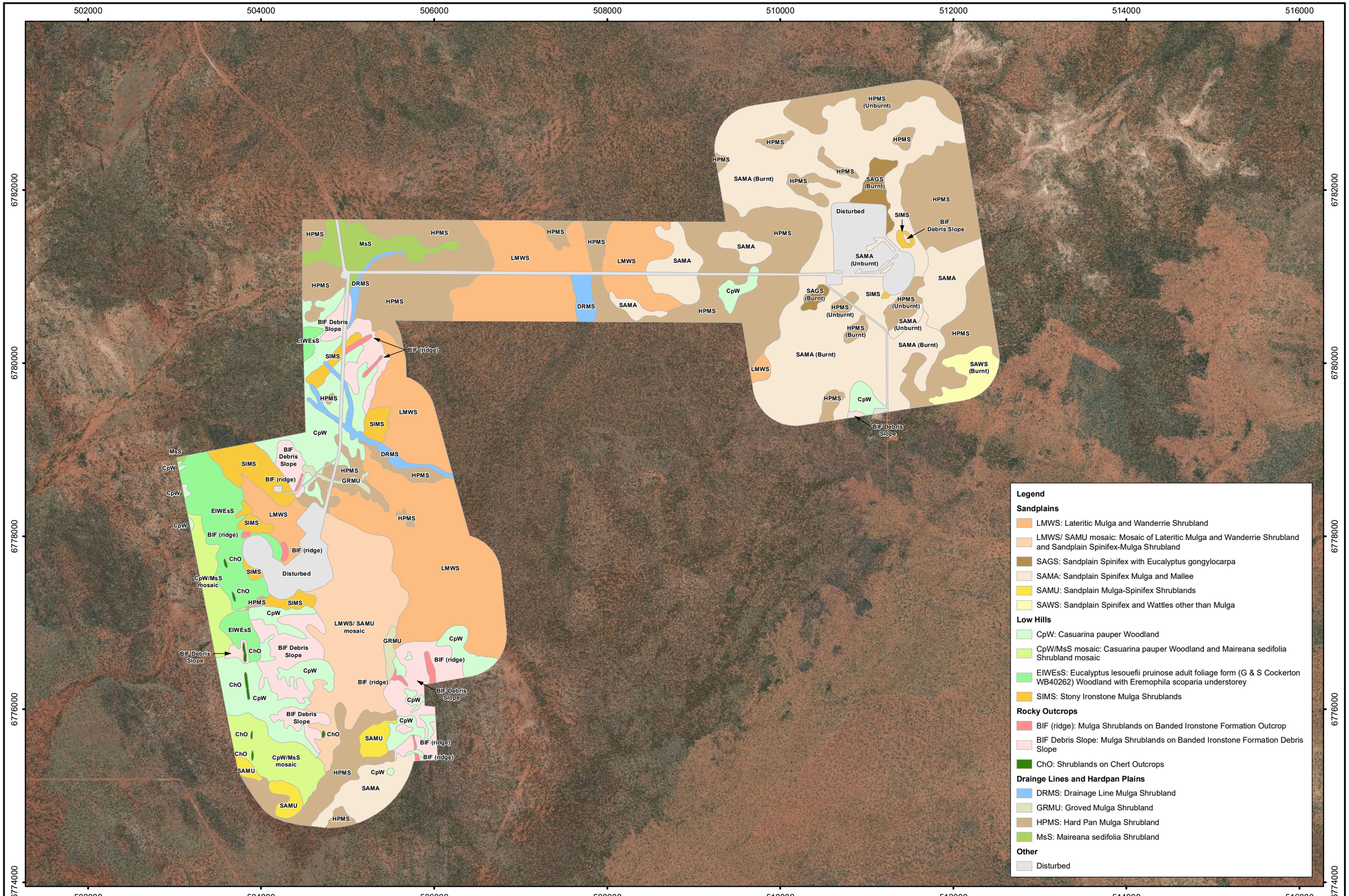
4.4.8.1. Groved Mulga Shrubland (GRMU)

Grove Mulga Shrubland (GRMU) occurred in two small patches in the north eastern corner of the Lord Byron project area and were characterised by internally draining small depressions in the landscape vegetated with dense stands of Mulga and some understorey reflecting adjacent habitats. At site 11, the Mulga (various forms of *Acacia aneura*) canopy excluded most understorey species. There were no photos or extensive species list taken for this vegetation unit though GRMU has a strong similarity to DRMS and HPMS communities.

A species inventory recorded for GRMU is presented in Appendix 3.

No image

Figure 7. Vegetation Map of the Study Area



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

0 400 800 m

Scale: 1:40,000
MGA94 (Zone 51)

g1543_F07_09

Date: Aug 2020 | Rev: A | A3

Western Botanical

Author: G. Cockerton | WB Ref:

Drawn: CAD Resources ~ www.cadresources.com.au
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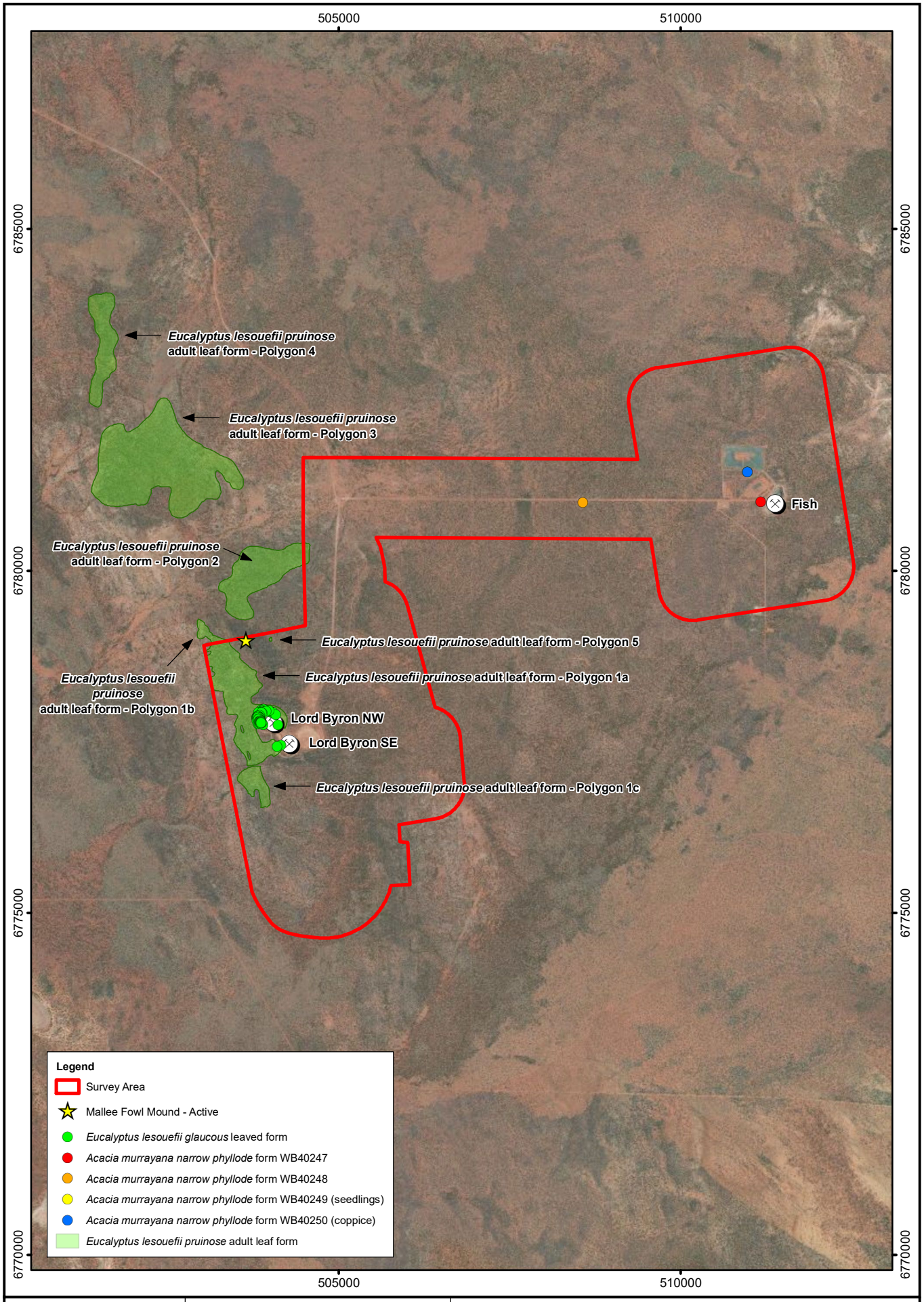
Blue Cap Mining Ltd, Laverton Gold Project
Lord Byron, Fish Deposit and Gilt Key Vegetation Associations

Figure 8. Selected Species of Interest



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

0 0.5 1 1.5 km

Scale: 1:75,000
MGA94 (Zone 51)

N

Western Botanical

Author: G. Cockerton | WB Ref:

CAD Ref: g1543_F07_07

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Date: August 2020 | Rev: A | A4

Blue Cap Mining Ltd, Laverton Gold Project
Lord Byron, Fish Deposit and Gilt Key
Flora and Fauna

4.5. Flora

The cumulative flora statistics for the combined Lord Byron, Fish, Gilt Key deposit areas plus the linking haul roads with a 500m buffer around all infrastructure shows a total species count of 129 species (with some duplication of forms or subspecies of Mulga and five likely or confirmed misidentifications of flora in the MBS 2009 report). These were from 21 families and 49 genera. The majority of these are all widespread and common species in the eastern Murchison, western Gt. Victoria Desert or north-eastern Coolgardie bioregions.

The Western Botanical 2007 survey of the Lord Byron deposit areas resulted in 86 species of native flora being recorded, inclusive of a few annuals and one geophyte. The current, July 2020, survey over the Lord Byron, Fish, Gilt Key and associated linking roads and 500m buffer resulted in 91 endemic flora species being recorded, including only two annual species which were both present in recently burnt areas on sandplain.

The MBS Environmental 2009 document reported 30 species within the Lord Byron deposit areas inclusive of the haul road alignment to the Fish deposit. MBS Environmental 2009 also listed *Eremophila arachnoides* subsp. tenera which is now listed as a Priority 1 flora species. While a confirmed record of this species is found nearby (29 km north-east of Lord Byron on a calcrete platform within the Lake Rason paleochannel, PERTH 07487118), the species was not observed at Lord Byron – Fish deposit areas and it is regarded as highly unlikely to be present due to strongly contrasting habitats.

Removing the erroneous identifications reported in MBS Environmental 2009, the total species count is now 124 endemic flora and no weed species.

An annotated cumulative species list is presented in Appendix 1.

4.6. Significant Flora

4.6.1. Threatened and Priority Flora

No listed Threatened or Priority Flora were recorded during the field surveys within the Study Area.

Seasonal conditions in 2007 were relatively dry though some winter rainfall had been received, allowing assessment of some annuals and geophytes. However, while 43mm was received in January in a decayed cyclonic event, the period February to July 2020 was very dry with no effective rainfall, and was not conducive to annuals being represented at this time. Therefore, the absence of conservation significant annual herbs and grasses such as *Goodenia lyrata* P3 and *Calandrinia* sp. Menzies (F. Hort et al. FH 4100) P3 could not be assessed in the current 2020 survey.

One species, *Bossiaea eremaea* P3 was observed south of the Fish deposit, outside the Study Area at 51 J 512546mE, 6777974 mN and 51 J 512542 mE, 6777974mN with two plants at each point. Specimens of this will be vouchered at the WA Herbarium in due course.

4.6.2. Species of Interest

Five flora Species of Interest (SOI) were recorded, four representing undescribed species that are not as yet formally recognised by the WA Herbarium, and one representing a population near the northern limit of its known range:

- *Acacia murrayana* narrow phyllode form (G & S Cockerton 40247), informal name
- *Eucalyptus lesouefii* pruinose adult foliage form (G & S Cockerton WB40262), informal name
- *Ptilotus obovatus* upright form (G. Cockerton & G. O'Keefe 12281), informal name
- *Eriachne mucronata* desert form glabrous (G & S Cockerton WB40048), informal name
- *Alectryon oleifolius* subsp. *canescens*, at northern limit of known range

One active Mallee Fowl mound was recorded at the northern extremity of the Lord Byron Study Area.

These are discussed below.

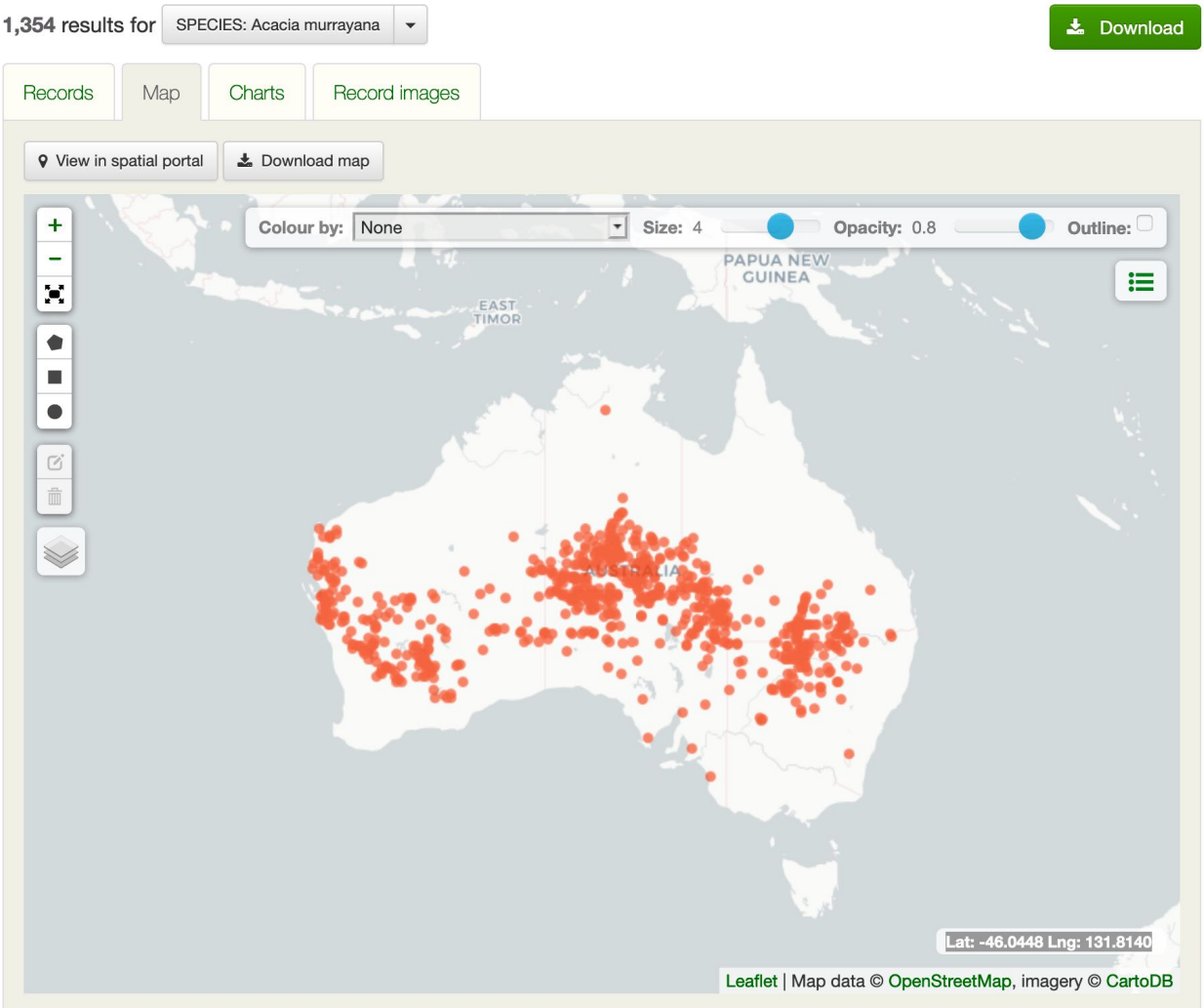
Locations of *Acacia murrayana* narrow phyllode form (G & S Cockerton 40247), *Eucalyptus lesouefii* pruinose adult foliage form (G & S Cockerton WB40262) within the Lord Byron abandonment bund are presented in Figure 8 and Appendix 2.

4.6.2.1 Undescribed Species

***Acacia murrayana* narrow phyllode form (G & S Cockerton 40247)**

One species that represents a well-known but undescribed taxon, *Acacia murrayana* narrow phyllode form (G & S Cockerton 40247) was recorded within and outside the Study Area, associated with shallow red sand over calcrete. This highly variable species is widespread in Central Australia and is not considered to warrant conservation listing (pers. comm. Bruce Maslin). Based on the material collected during this survey and material held at Herbaria in Australia, this species is being described by Mr. Bruce Maslin, WA Herbarium (pers. comm. Bruce Maslin).

Figure 9. Distribution of *Acacia murrayana* sens. lat. in Australia (AVH)



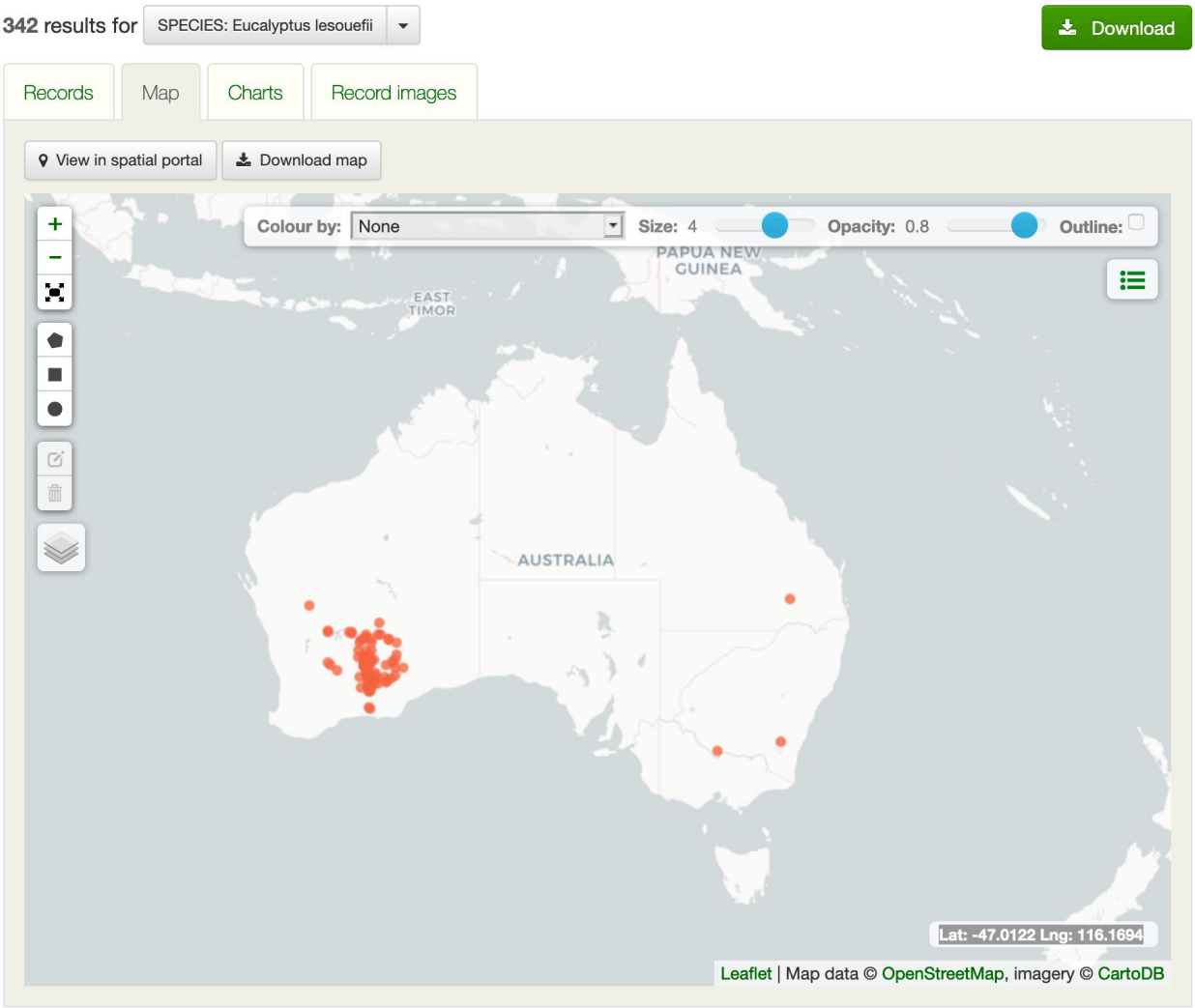
Within the Study Area, *Acacia murrayana* narrow phyllode form was recorded adjacent to the Fish deposit pit and wastedump and adjacent to the haul road from the Fish Deposit, Figure 8. Outside the Study Area, *Acacia murrayana* narrow phyllode form was observed occurring within the SAWS Vegetation Association between Laverton and the Reed October minesite, on the eastern, northern and western periphery of Lake Carey.

Eucalyptus lesouefii pruinose adult foliage form (G & S Cockerton WB40262)

A eucalypt, noted here as *Eucalyptus lesouefii* pruinose adult foliage form (G & S Cockerton WB40262), is present within and adjacent to the Lord Byron deposit area on an outcropping gabbro and basalt hill. It is also present on similar landform and geology some 4 Km north-north-west of the Lord Byron deposit.

This species was reported in Western Botanical 2007 as typical *Eucalyptus lesouefii* which has pruinose juvenile foliage and glossy dark green adult foliage. However, based on observations made during the current survey and in consultation with Mr. Malcolm French (eucalypt specialist), the pruinose foliage retained in the adult tree may mean this form could be regarded a new subspecies of *E. lesouefii*. However, the issue of potential hybridity with nearby *E. gypsophila* occurring on the gypseous and carbonate influenced dunes adjacent to salt lakes in the region (outside the Study Area) requires investigation before this can be ascertained. Trees produce copious amounts of apparently well-formed and viable seeds.

Figure 10. Distribution of *Eucalyptus lesouefii* in Australia



Note: points in eastern states represent cultivated trees.

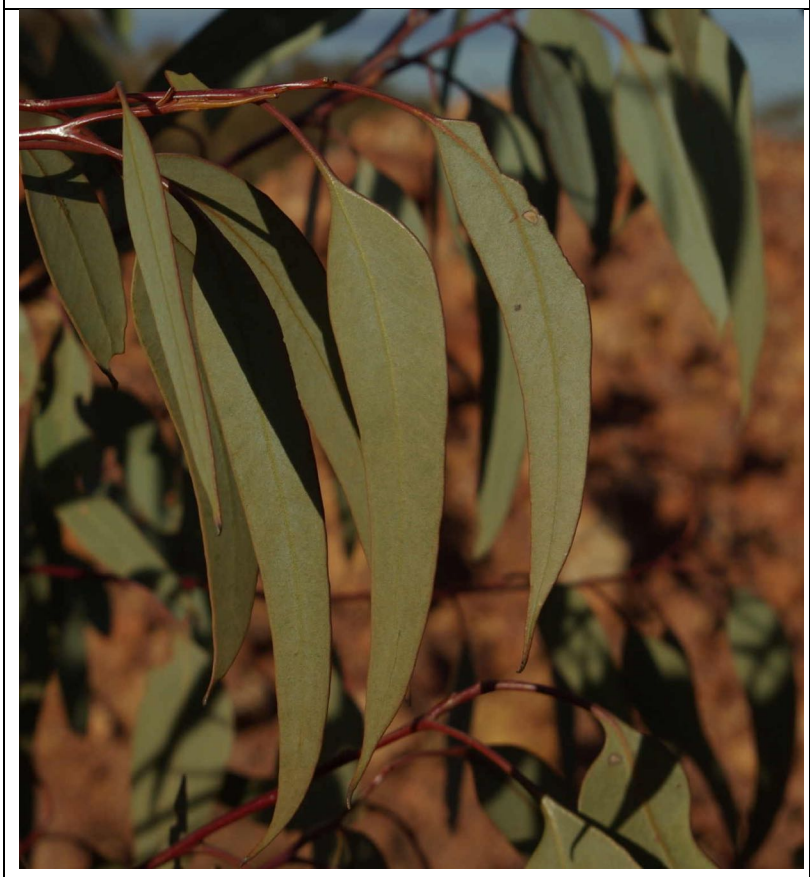


Plate 16. Composite images of *Eucalyptus lesouefii* pruinose adult foliage form (G & S Cockerton WB40262)

Many thousands (conservatively estimated at over 5,000 plants) of mature individuals of this tree were observed during the field survey and the populations outside the Study Area are uniform in structure and species composition compared with those within the Study Area. Multiple representative specimens of this species will be vouchered at the WA Herbarium in due course.

Within the abandonment bund situated around the two Lord Byron pits, 59 individuals of mature *Eucalyptus lesouefii* pruinose adult foliage form were individually mapped, mostly on the north and western sides of the northern Lord Byron pit. A further 239 juvenile saplings from 1m to 5m in height were also present on disturbed soils on the perimeter of the pit in this area. It is estimated therefore that fewer than 0.12% of mature trees of *Eucalyptus lesouefii* pruinose adult foliage form would be taken in a pit cut back that conformed to the extent of the current abandonment bund. However, no plan for a pit cutback has been sighted by the author at this stage.

The vegetation Association supporting *Eucalyptus lesouefii* pruinose adult foliage form has been tentatively mapped outside the Study Area; Figure 8. Areas of each of the 3 confirmed sub-populations (sub-populations 1a-c, 2 and 3 with a total area of 394.6 ha) and two tentative sub-populations (sub-populations 4 and 4 with a total area of 42.2 ha) are presented in Table 6.

Ptilotus obovatus* upright form (G. Cockerton & G. O'Keefe 12281), *informal name

A formally unrecognised but very widespread form of the highly variable *Ptilotus obovatus,* referred to here as *Ptilotus obovatus* upright form (G. Cockerton & G. O'Keefe 12281), is common within the Study Area on low rises with calcrete influenced soils. This species is also very widespread on similar landforms in the Laverton to Wiluna region and does not warrant conservation listing. This was reported as *Ptilotus obovatus* Ironstone Hills form (G. Cockerton & G. O'Keefe 12285) in Western Botanical 2007.

Eriachne mucronata desert form glabrous (G & S Cockerton WB40048), informal name

A perennial grass, here termed *Eriachne mucronata* desert form glabrous (G. Cockerton & S. Cockerton WB40048), is common and widespread in Western Australia, though often found in small, disjunct occurrences on stony environments. Western Botanical has recorded the species from Warburton in the Gt. Victoria Desert and Central Ranges bioregions to the eastern Murchison bioregion, from Leonora to Wiluna.

Eriachne mucronata desert form glabrous (G. Cockerton & S. Cockerton WB40048), was found at several locations within the Study Area, both on rocky hill tops (either chert or gabbro) and on hardpan pains (HPMS) and Lateritic Mulga – Wanderrie Shrubland (LMWS) associations and is known from the Wanjarri Nature Reserve north of Leinster.

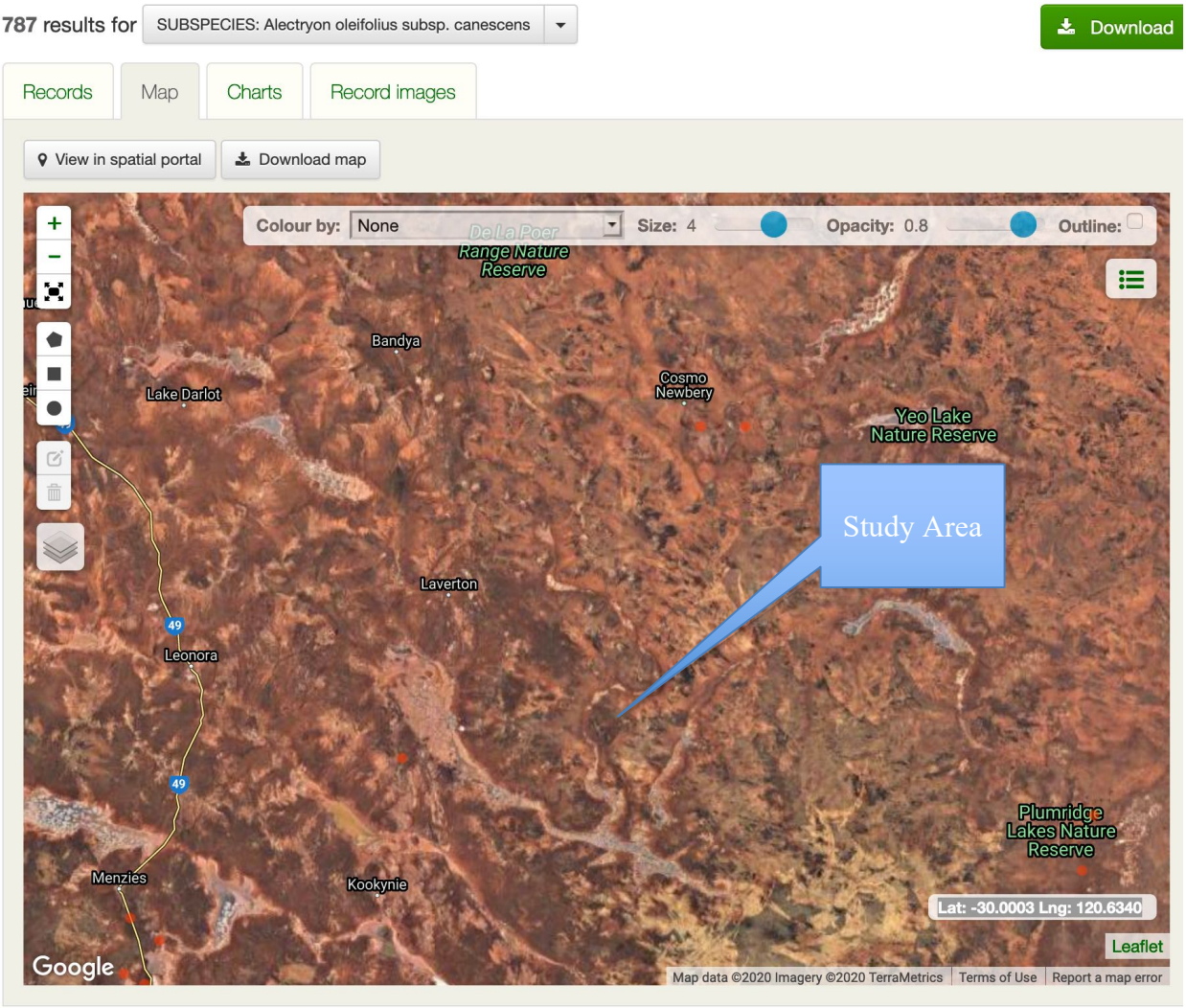
It currently is curated within the variable (poorly sorted) *Eriachne mucronata* group, though clearly represents a separate species. It differs from the informally recognised *Eriachne mucronata* desert form (Qld and NT distribution) which has densely hairy leaves in having glabrous leaves (WA distribution). It is not considered to have a limited distribution and would not attract conservation listing.

Plate 17. Images of *Eriachne mucronata* desert form glabrous (G. Cockerton & S. Cockerton WB40048), Wanjarri Nature Reserve, 2018

4.6.2.2. Species occurring near Limit of Range

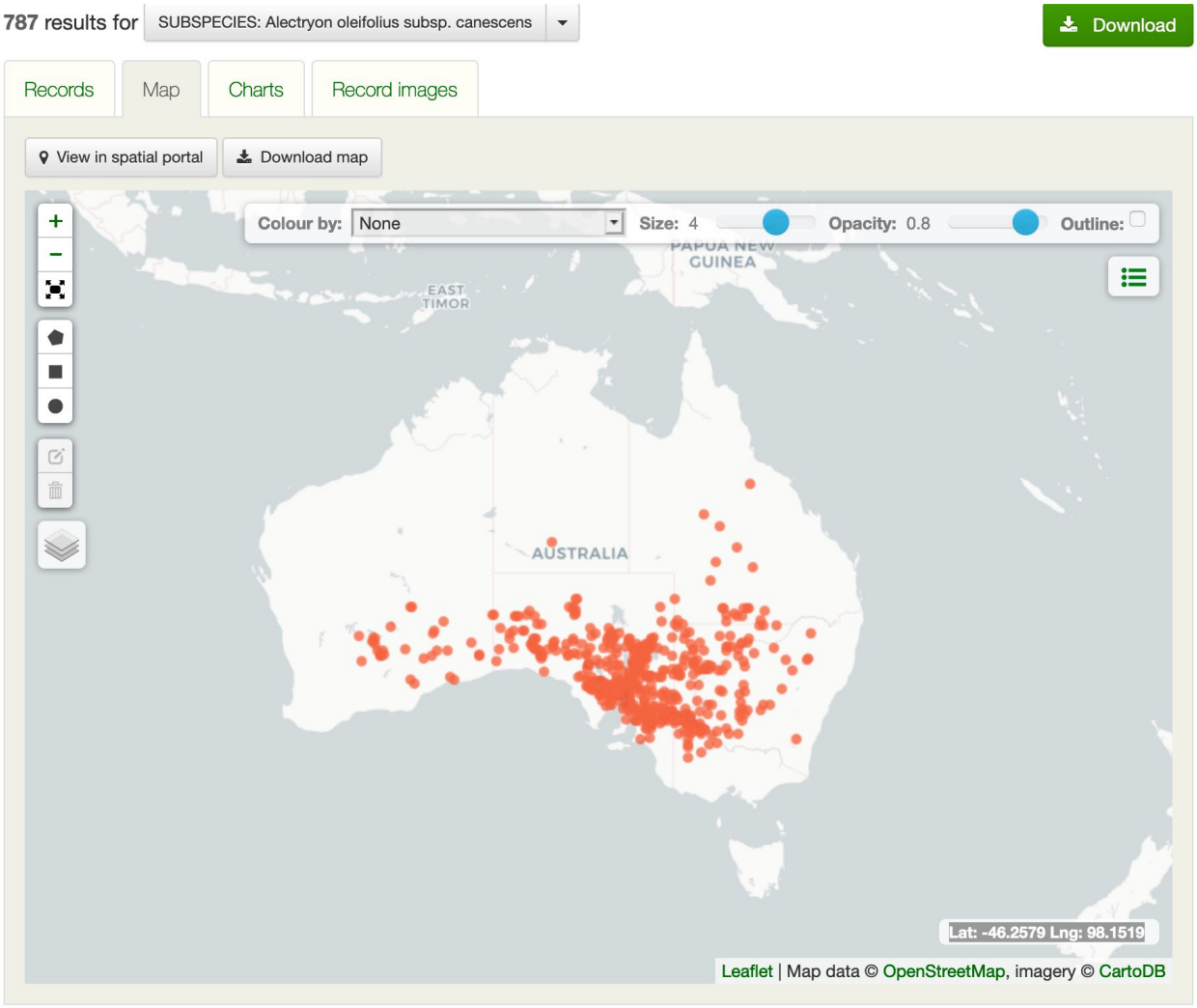
One species *Alectryon oleifolius* subsp. *canescens*, represents a record near the northern known limit of range for the species in W.A. One record on the western side of Lake Carey and two records near Cosmo-Newberry mission are housed at the WA Herbarium, Figure 11. It has also been recorded by Western Botanical between Laverton and Leonora.

Figure 11. Distribution of *Alectryon oleifolius* subsp. *canescens* nearby the Study Area



This species is more commonly recorded southwards of the Study Area towards Norseman and eastwards to South Australia and beyond, Figure 12.

Figure 12. Distribution of *Alectryon oleifolius* subsp. *canescens* in Australia



4.6.2.3 Species not fully identified

Five species, excluding the Mulga complex, remain not fully identified due to dry seasonal conditions and insufficient material being available. Two of these are *Eremophila* species which are tentatively named at present, Appendix 1.

4.6.2.4 Mallee Fowl Mounds

Several Mallee Fowl mounds were observed during the field survey, the majority being old and long unused with vegetation re-established within the mounds. However, one of these located at the extreme northern limit of the Study Area (51J 503640 mE, 6778991 mN) within the SIMS community was active with fresh tracks, fresh leaf litter and mallee fowl scats present. It was described as follows:

Active mound 8m diameter with dry vegetation within the stony mound, to 0.8m deep, centrally excavated. Fresh Mallee Fowl tracks observed and photographed adjacent. The mound is some 10 m south of an old exploration track, within the SIMS community: *Acacia aneura* sens. lat. to 4m, *A. ramulosa* subsp. *ramulosa* 3m, PFC 50% over *Eremophila latrobei* subsp. *filiformis* 1.5m, *Scaevola spinescens* (narrow leaf spiny form) 1.5m, PFC 20%. Soil is red silty sandy lateritic gravel. Site is on the upper slope of a broad gravely rise, near the crest and at least 750m north-east of the Lord Byron explosives magazine Plate 18.

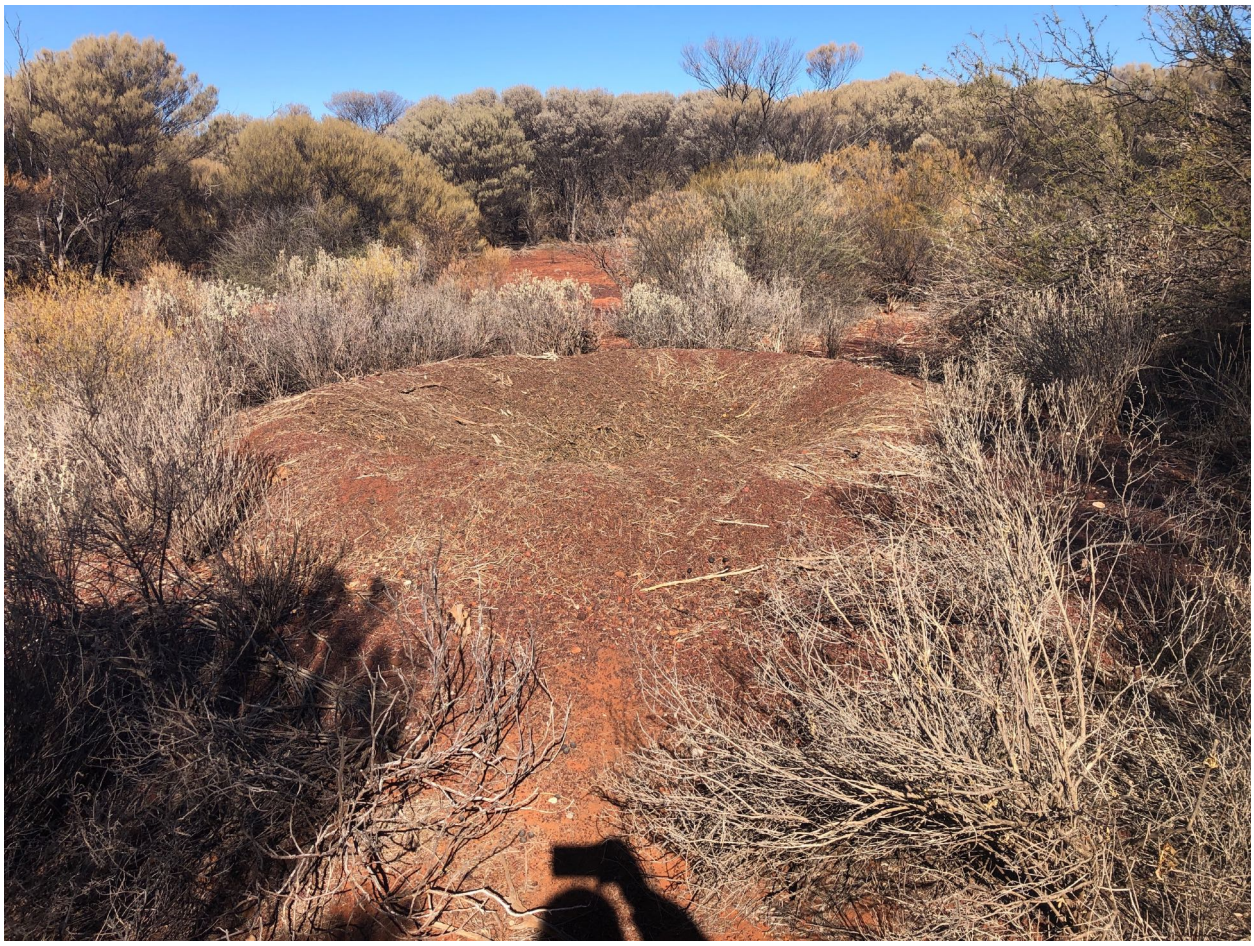


Plate 18. Active Mallee Fowl mound at 51J 503640 mE, 6778991 mN within the SIMS community

4.7. Weeds

No weeds were observed during the 2020 field survey. Climatic conditions were not amenable to annual weeds being recognisable and no perennial weeds were recorded. No weeds were reported in either Western Botanical 2007 or MBS Environmental 2009.

4.8. Vegetation Condition

Vegetation outside the areas of direct historical disturbance were regarded as being in Excellent to Pristine condition using the Vegetation Condition Scale presented in EPA (2016). The previous mining activities at the Study Area have been carefully managed to limit disturbance to areas of direct clearing.

5. Assessment Against the 10 Clearing Principles

The findings of the survey work have been assessed against the clearing principles.

Principle (a)..... Native vegetation should not be cleared if it comprises a high level of biological diversity.

A total of 124 plant taxa (species, subspecies and varieties) representing 21 families and 49 genera were recorded within the Lord Byron tenement.

No Threatened or Priority Flora were recorded.

One species is regarded a new species, *Acacia murrayana* narrow phyllode form (G. & S. Cockerton WB40247). This is a common and widespread species within the *A. murrayana* complex and does not warrant conservation listing (Bruce Maslin pers. comm.).

One species may represent a new taxon, *Eucalyptus lesouefii* pruinose adult leaf form (G & S Cockerton WB40262), however, taxonomic review of the material collected to date has not been completed. Potential hybridity with *E. gypsophila* located regionally may be a factor is this entity (Malcolm French pers. comm.)

Sixteen vegetation units were described for the project area.

Much of the central area of Lord Byron has been cleared in the past for access roads and/or drill lines. No introduced species were found around these disturbed areas.

The field survey was completed following little seasonal rain at a time of year when few ephemeral species were apparent. It was also observed that parts of the project area had been burnt in parts. Acknowledging that this report does not consider the fauna values in addressing this Principle, and taking the above criteria into account, it is not considered that the proposed clearing comprises a high level of biological diversity.

One active Mallee Fowl mound was recorded at the extreme northern limit of the Study Area, some 750 m from the nearest mining infrastructure. Given the distance to mining infrastructure, indirect impacts on this site are unlikely (Dr. Mike Bamford pers. comm.)

The project is not at variance with this principle.

Principle (b) ***.....Native vegetation should not be cleared if it comprised the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia.***

While an active Mallee Fowl Mound was noted north of the Lord Byron pit area, the mound is located some 1.2 km north of the current pit area and 760m north-west of the Lord Byron magazine area, in an area that is not frequented by mining personnel. It is unlikely that mining activities would influence the birds in this area given the distance to operations (Dr. Mike Bamford pers. comm.).

The project is not at variance with this principle.

Principle (c) ***.....Native vegetation should not be cleared if it includes, or is necessary for the continued existence of rare flora.***

No species gazetted as Declared Rare Flora under the *Wildlife Conservation Act 1950*, or Priority Flora was recorded in the project area. The vegetation of the project area is unlikely to support any DRF known from the region.

The project is not at variance with this principle.

Principle (d) ***.....Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community.***

No known Threatened Ecological Communities were recorded from the project area. None of the vegetation types recorded was considered to fit the criteria to be considered a Threatened Ecological Community.

The project is not at variance with this principle.

Principle (e) ***.....Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared.***

The vegetation of the project area is not considered remnant in either a local or bioregion context.

The project is not at variance with this principle.

Principle (f) ..... Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.

There are no major watercourses or wetlands within the project area. Therefore, the proposed clearing will not impact upon any watercourse or wetland.

The project is not at variance with this principle.

Principle (g)..... Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.

Some of the communities represented within the project area are already disturbed with grids of cleared areas for drill lines and/or access roads. It is considered unlikely that any further appreciable land degradation would occur as a result of the clearing.

The project is not at variance with this principle.

Principle (h) ..... Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.

The project area is not adjacent to, or nearby any conservation areas. The proposed clearing will not affect any conservation estate.

The project is not at variance with this principle.

Principle (i)..... Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.

The proposed clearing is unlikely to result in a deterioration of groundwater and there was no surface water observed around the site.

The project is not at variance with this principle.

Principle (j) ***Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence of flooding.***

No surface water was observed and no major drainage areas were noted. Native vegetation clearing is highly unlikely to cause, or exacerbate the incidence of flooding.

The project is not at variance with this principle.

6. Limitations

Limitation	Discussion
Available sources of contextual information	• Adequate contextual information was available in the form of DBCA database records and previous reports. No regional Land System mapping is available for this region. This is not considered a limitation.
The Scope of the survey	• The project was adequately scoped and funded with sufficient time allowed for a thorough field investigation, building on previous works conducted in the Study Area. This is not considered a limitation.
Proportion of flora collected and identified	Two limitations apply here: • The dry seasonal conditions at the time of the 2020 survey meant that annuals could not be assessed. Annuals were also not well assessed during the 2007 and 2009 surveys previously reported. Annuals can therefore not be regarded as well assessed. • Two Priority Flora noted in the DBCA database search are annuals; (*Goodenia lyrata* P3 and *Calandrinia* sp. Menzies (F. Hort et al. FH 4100) P3, and therefore have not been assessed. • Much of the Fish deposit was recently burnt with little or no regeneration observed. The flora of the vegetation associations in this area (SAWS, SAGS) could therefore not be assessed. These are considered limitations to the completeness of the species list.
Completeness and further work which may be needed	• The Fish deposit was largely burnt and has not therefore been assessed in any detail. The vegetation associations have been mapped reasonably accurately, however, no species profiles were able to be compiled. The Fish deposit area can not therefore be considered well assessed. • The dry seasonal conditions preclude the assessment of annuals and geophytes and hamper the post-fire

Limitation	Discussion
	regeneration of recently burnt areas. Annuals are not well assessed within the Fish Study Area. • It is possible that populations of *Bossiaea eremaea* P3 may occur within the Fish deposit area (a small population of 4 plants was recorded outside the Study Area), but the dry seasonal conditions means this could not be assessed. • The Lord Byron and Gilt Key deposit areas are well assessed, with the limitation of annuals not being present. This is not considered a limitation for the Lord Byron and Gilt Key deposit areas but is considered a limitation for the Fish deposit area.
Mapping reliability	• Mapping was conducted at 1:10,000 scale on good quality high resolution aerial imagery and is considered reliable. This is not considered a limitation.
Timing: weather, season	• Dry seasonal conditions throughout central Western Australia contributed to annuals not being present during the July 2020 studies. This also contributed significantly to the lack of regeneration post-fire at the Fish deposit area. This is considered a limitation for the entire Study Area.
Disturbances	• Outside areas of direct clearing for mining, no disturbances were observed. This is not considered a limitation.
Intensity	• The proposed cutback at the Lord Byron deposit area has not been defined at the time of reporting. However, if a minor cutback is planned, the proposed impacts would involve a minor amount of clearing within the Study Area. Similarly, developments at Fish and Gilt Key have not been defined but are also likely to be small in area. Consequently, the survey was planned and implemented as a Targeted Survey using traverses and relevés. This is considered adequate given the relatively small impacts likely, and the risk of impacts to conservation-significant flora species. This is not considered a limitation.
Resources	• Adequate resources of time and materials were made available for the assessment. This is not considered a limitation.
Access	• Access throughout the Study Area was good to excellent. This is not considered a limitation.
Experience levels	• Field surveys and reporting was undertaken by Geoff Cockerton with over 30 years experience in the flora of the Goldfields region of W.A. This is not considered a limitation.

7. List of Participants

Staff Member	Field Surveys	Specimen Identification	Data Analysis	Report Preparation
Geoff Cockerton B.Sc. (Biology) Senior Botanist *Flora Taking (Biological Assessment) License No. –FB62000046*	**1**	**1**	**1**	**1**
Steven Cockerton, Field Assistant	**1**			

8. Acknowledgements

- Accommodation and meals were provided by the Bluecap Mining Ltd mine camp south-west of the Fish Deposit.
- Dr. Mike Bamford, Bamford Consulting Ecologists, is thanked for his commentary on the likely impact of mining operations on the activities of nesting Mallee Fowl at the observed active mound site.
- Mr. Bruce Maslin, WA Herbarium, for advice and commentary on the taxonomic and conservation status of *Acacia murrayana* narrow phyllode form (G. & S. Cockerton WB40247).
- Mr. Malcolm French, eucalypt specialist, for commentary on *Eucalyptus lesouefii* pruinose adult leaf form (G & S Cockerton WB40262) and related taxa in the region.

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Appendix 1. Systematic Species List

Family	Species	Western Botanical 2007 (Lord Byron)	Current Survey 2020 (Lord Byron, Fish and Haul Road)	MBS Environmental 2009 (portion of Lord Byron)	Comment
Adiantaceae	Cheilanthes distans	1			
Amaranthaceae	Ptilotus obovatus (typical form)	1	1	1	
Amaranthaceae	Ptilotus obovatus upright form (G. Cockerton & G O'Keefe 12281)	1	1		
Asclepiadaceae	Marsdenia australis	1	1		
Asclepiadaceae	Sarcostemma viminale subsp. australe	1			
Asteraceae	Chrysocephalum aff. apiculatum	1		1	
Asteraceae	Olearia ?stuartii	1			
Asteraceae	Olearia humilis	1	1		
Asteraceae	Olearia muelleri	1	1	1	
Asteraceae	Podolepis capillaris	1			
Casuarinaceae	Allocasuarina acutivalvis subsp. acutivalvis			1*	mis-identification of Casuarina pauper
Casuarinaceae	Casuarina pauper	1	1		
Chenopodiaceae	Atriplex bunburyana	1	1		
Chenopodiaceae	Atriplex nummularia	1	1	1	
Chenopodiaceae	Enchylaena tomentosa	1			
Chenopodiaceae	Maireana georgei	1	1		
Chenopodiaceae	Maireana pentatropis	1	1	1	
Chenopodiaceae	Maireana sedifolia	1	1	1	
Chenopodiaceae	Maireana sp. Indet	1			

Family	Species	Western Botanical 2007 (Lord Byron)	Current Survey 2020 (Lord Byron, Fish and Haul Road)	MBS Environmental 2009 (portion of Lord Byron)	Comment
Chenopodiaceae	Maireana trichoptera	1	1		
Chenopodiaceae	Maireana triptera		1		
Chenopodiaceae	Rhagodia drummondii	1	1		
Chenopodiaceae	Sclerolaena obliquicuspis	1			
Chenopodiaceae	Sclerolaena sp. Indet	1			
Euphorbiaceae	Euphorbia aff. tannensis subsp. tannensis		1		post fire
Fabaceae	Acacia aneura (yellow-green)	1			
Fabaceae	Acacia aneura 2 x 70 mm	1			
Fabaceae	Acacia aneura 5 x 50 falcate	1			
Fabaceae	Acacia aneura lanceolate silver grey 5 x 20 mm, slightly twisted	1			
Fabaceae	Acacia aneura linear flat silver grey 2 x 100 mm	1			
Fabaceae	Acacia aneura sens. lat.		1		not taken to species level
Fabaceae	Acacia aneura sens. str.		1	1	
Fabaceae	Acacia aneura silver grey terete	1			
Fabaceae	Acacia burkittii	1	1	1	
Fabaceae	Acacia caesaneura	1	1		reported in WB2007 as A. aneura narrow lanceolate silver grey 4 x 50mm
Fabaceae	Acacia colletioides		1		
Fabaceae	Acacia craspedocarpa			1	
Fabaceae	Acacia craspedocarpa (ovate phyllode form)		1		

Family	Species	Western Botanical 2007 (Lord Byron)	Current Survey 2020 (Lord Byron, Fish and Haul Road)	MBS Environmental 2009 (portion of Lord Byron)	Comment
Fabaceae	Acacia heteroneura		1		
Fabaceae	Acacia kempeana	1	1	1	
Fabaceae	Acacia ligulata		1		
Fabaceae	Acacia mulganeura	1	1		reported in WB2007 as A. aneura (twisted ironstone variant) (GC & GOK 11005)
Fabaceae	Acacia murrayana narrow phyllode form (G. & S. Cockerton WB40247)		1		new species, widespread
Fabaceae	Acacia oswaldii	1	1		
Fabaceae	Acacia prainii		1		
Fabaceae	Acacia ?pteraneura		1		need fruits for full ID
Fabaceae	Acacia quadrimarginea		1		
Fabaceae	Acacia ramulosa subsp. ramulosa	1	1	1	
Fabaceae	Acacia sibirica	1	1		
Fabaceae	Acacia sp. Indet	1			
Fabaceae	Acacia tetragonophylla	1	1		
Fabaceae	Indigofera georgei		1		
Fabaceae	Senna artemisioides subsp. artemisioides	1	1		
Fabaceae	Senna artemisioides subsp. filifolia	1	1	1	
Fabaceae	Senna artemisioides subsp. helmsii			1	
Fabaceae	Senna artemisioides subsp. sturtii	1	1		
Fabaceae	Senna cardiosperma	1	1		

Family	Species	Western Botanical 2007 (Lord Byron)	Current Survey 2020 (Lord Byron, Fish and Haul Road)	MBS Environmental 2009 (portion of Lord Byron)	Comment
Fabaceae	Senna pleurocarpa subsp. angustifolia		1		
Fabaceae	Swainsona canescens		1		
Fabaceae	Templetonia incrassata		1		
Goodeniaceae	Scaevola spinescens (broad leaf form)	1	1		
Goodeniaceae	Scaevola spinescens (compact form)		1		
Goodeniaceae	Scaevola spinescens (narrow leaf form)	1	1		
Goodeniaceae	Scaevola spinescens (unspecified form)			1	
Gyrostemonaceae	Codonocarpus cotiniifolius		1		
Lamiaceae	Physopsis viscida		1		
Lamiaceae	Prostanthera althoferi subsp. althoferi	1	1	1	
Lamiaceae	Teucrium teucriiflora	1	1		
Malvaceae	Abutilon cryptopetalum	1			
Malvaceae	Alyogyne pinoniana		1		
Malvaceae	Androcalva loxophylla		1		
Malvaceae	Seringia velutina subsp. ?velutina		1		
Malvaceae	Sida calyxhymenia		1		
Malvaceae	Sida ectogama	1	1		
Malvaceae	Sida sp. Golden calyces glabrous (H.N. Foote 32)	1			

Family	Species	Western Botanical 2007 (Lord Byron)	Current Survey 2020 (Lord Byron, Fish and Haul Road)	MBS Environmental 2009 (portion of Lord Byron)	Comment
Myrtaceae	Eucalyptus concinna	1	1		
Myrtaceae	Eucalyptus gongylocarpa		1		
Myrtaceae	Eucalyptus kingsmillii			1*	likely misidentified E. youngiana
Myrtaceae	Eucalyptus lesouefii pruinose adult leaf form (G & S Cockerton WB40262)	1	1	1	possible new species or hybrid, locally common
Myrtaceae	Eucalyptus longissima	1	1		
Myrtaceae	Eucalyptus oleosa			1*	likely E. longissima
Myrtaceae	Eucalyptus youngiana		1		
Poaceae	Aristida contorta	1			
Poaceae	Austrostipa aff. platychaeta		1		
Poaceae	Austrostipa elegantissima	1		1	
Poaceae	Cymbopogon ambiguus	1			
Poaceae	Enneapogon caerulescens	1			
Poaceae	Eragrostis eriopoda	1	1		
Poaceae	Eriachne helmsii	1		1	
Poaceae	Eriachne mucronata desert form glabrous (G & S Cockerton WB40048)	1	1		erroneously reported in WB2007 as Eragrostis desertorum
Poaceae	Eriachne pulchella	1			
Poaceae	Monachather paradoxus	1			
Poaceae	Paspalidium basicladum	1			
Poaceae	Poaceae sp. Indet. (Annual)	1			
Poaceae	Triodia basedowii	1	1	1	

Family	Species	Western Botanical 2007 (Lord Byron)	Current Survey 2020 (Lord Byron, Fish and Haul Road)	MBS Environmental 2009 (portion of Lord Byron)	Comment
Proteaceae	Grevillea aff. excelsior			1	
Proteaceae	Grevillea berryana	1	1		
Proteaceae	Hakea recurva subsp. arida	1	1		
Rubiaceae	Psydrax latifolia	1	1	1	
Rubiaceae	Psydrax suaveolens	1	1	1	
Rutaceae	Philotheca brucei	1			
Santalaceae	Santalum spicatum	1	1	1	
Sapindaceae	Alectryon oleifolius	1	1	1	
Sapindaceae	Dodonaea lobulata	1	1		
Sapindaceae	Dodonaea rigida	1	1	1	
Scrophulariaceae	Eremophila aff. metallicorum #17		1		insufficient material for definite identification
Scrophulariaceae	Eremophila alternifolia	1	1	1	
Scrophulariaceae	Eremophila arachnoides subsp. tenera (Priority 1)			1*	unlikely this species, possibly Eremophila scoparia
Scrophulariaceae	Eremophila clarkei	1	1		
Scrophulariaceae	Eremophila georgei			1*	may be E. clarkei, the two are very similar
Scrophulariaceae	Eremophila glabra subsp. glabra	1	1		
Scrophulariaceae	Eremophila latrobei subsp. filiformis	1	1	1	
Scrophulariaceae	Eremophila latrobei subsp. glabra	1	1		
Scrophulariaceae	Eremophila latrobei subsp. latrobei	1	1	1	
Scrophulariaceae	Eremophila longifolia (green leaf form)		1		informal form, widespread

Family	Species	Western Botanical 2007 (Lord Byron)	Current Survey 2020 (Lord Byron, Fish and Haul Road)	MBS Environmental 2009 (portion of Lord Byron)	Comment
Scrophulariaceae	Eremophila margarethae	1	1	1	Reported in WB2007 as Eremophila sp. aff. margarethae (very narrow triangular calyx lobes)
Scrophulariaceae	Eremophila oldfieldii subsp. angustifolia	1	1		
Scrophulariaceae	Eremophila oppositifolia subsp. angustifolia		1		
Scrophulariaceae	Eremophila punctata	1	1	1	
Scrophulariaceae	Eremophila scoparia	1	1		
Scrophulariaceae	Eremophila serrulata	1	1		
Scrophulariaceae	Eremophila sp. yellow crispy #8		1		insufficient material for identification
Solanaceae	Solanum ferocissimum		1		post fire
Solanaceae	Solanum orbiculatum		1		
Solanaceae	Solanum plicatile		1		post fire
Solanaceae	Solanum lasiophyllum	1	1		
Sterculiaceae	Brachychiton gregorii	1	1		
Thymelaeaceae	Pimelea microcephala	1	1		
	TOALS	**86**	**91**	**30**	

Appendix 2. Locations of Selected Significant Flora Species

Eucalyptus lesouefii pruinose adult leaf form (G & S Cockerton WB40262)

Within Study Area							
Wpt	Count Mature Trees	Count Juvenile Saplings	Comment	Zone	Zone	Easting	Northing
663-29		60	juveniles 1 to 5m high	51	J	503957	6777950
663-30		24	juveniles 1 to 5m high	51	J	504001	6777935
663-31		3	juveniles 1 to 5m high	51	J	503935	6777967
663-32		55	juveniles 1 to 5m high	51	J	503899	6777975
663-33	1			51	J	503872	6777971
663-34	1			51	J	503860	6777957
663-35	1			51	J	503872	6777949
663-36	1			51	J	503859	6777936
663-37	1			51	J	503858	6777934
663-38	1			51	J	503855	6777933
663-39	1			51	J	503851	6777922
663-40	1			51	J	503834	6777922
663-41		5	juveniles 1 to 5m high	51	J	503828	6777927
663-42	1			51	J	503814	6777881
663-43	1			51	J	503806	6777860
663-44		7	juveniles 1 to 5m high	51	J	503800	6777865
663-45	1			51	J	503806	6777850
663-46	1			51	J	503806	6777840
663-47	1			51	J	503814	6777849
663-48	1			51	J	503806	6777809
663-49		3	juveniles 1.5 to 2m high	51	J	503825	6777822
663-50	1			51	J	503828	6777760
663-51	1			51	J	503839	6777760
663-52	1			51	J	503849	6777772
663-53		2	juveniles 1.5 to 2m high	51	J	503894	6777751
663-54		26	juveniles 1.5 to 2m high	51	J	503878	6777782
663-55		50	juveniles 1 to 5m high	51	J	503854	6777843
663-56		4	juveniles 1.5 to 2.4m high	51	J	504153	6777447
660-8	1			51	J	504014	6777941
660-9	1			51	J	504025	6777930
660-10	1			51	J	504039	6777931
660-11	1			51	J	504077	6777897
660-12	1			51	J	503985	6777959
660-13	1			51	J	503940	6777944
660-14	1			51	J	503880	6777921
660-15	1			51	J	503871	6777924

Within Study Area							
Wpt	Count Mature Trees	Count Juvenile Saplings	Comment	Zone	Zone	Easting	Northing
660-16	1			51	J	503843	6777891
660-17	12		group of trees, approx. 20 x 30m	51	J	503827	6777880
660-18	1			51	J	503836	6777865
660-19	1			51	J	503839	6777864
660-20	1			51	J	503841	6777859
660-21	1			51	J	503837	6777856
660-22	1			51	J	503822	6777859
660-23	1			51	J	503840	6777833
660-24	1			51	J	503832	6777834
660-25	1			51	J	503828	6777831
660-26	1			51	J	503839	6777800
660-27	1			51	J	503844	6777798
660-28	1			51	J	503847	6777803
660-29	1			51	J	503859	6777808
660-30	1			51	J	503865	6777797
660-31	1			51	J	503854	6777788
660-32	1			51	J	503858	6777775
660-33	1			51	J	503861	6777781
660-34	1			51	J	503866	6777785
660-35	1			51	J	503864	6777779
660-36	1			51	J	503862	6777778
660-37	1			51	J	504109	6777750
660-38	1			51	J	504098	6777433
Total	**59**	**239**					
Count	**48**	**11**					

Acacia murrayana narrow phyllode form WB40247

Within Study Area							
Wpt	Count Mature Trees	Count Juvenile Saplings	Comment	Zone	Zone	Easting	Northing
663-100	1		minimum number	51	J	511177	6781010
663-115	20		minimum number	51	J	508576	6781000
663-101		10	minimum number	51	J	510980	6781449
663-101	30		minimum number	51	J	510980	6781449
Totals	**51**	**10**	**Minimum number**				

Alectryon oleifolius* subsp. *canescens

Within Study Area						
Wpt	**Count Mature Trees**	**Count Juvenile Saplings**	**Zone**	**Zone**	**Easting**	**Northing**
663-62	3		51	J	504169	6775411
663-63	1		51	J	503977	6775405
663-118	1		51	J	504714	6775711
663-119	1		51	J	504664	6778755
Totals	**6**	**0**				

Appendix 3. Species vs Vegetation Associations Matrix

	Landform	Low Hills				Rocky Outcrops			Sandplains				Drainage & Hardpan Plains			
	Dominant Geology or Soil Type	Ironstone	Gabbro, Calcrete			Ironstone & Chert			Orange Silty Sand				Red clayey sand			Red clayey sand over Calcrete
Family	Species	SIMS	CpW	CpW/MsS	EIWEs	BIF	BIF DS	ChO	SAMU	SAGS	SAWS	LMWS	HPMS	DRMS	GRMU	MsS
Adiantaceae	*Cheilanthes distans*					1		1								
Amaranthaceae	*Ptilotus obovatus* (typical form)	1				1	1	1					1	1		
Amaranthaceae	*Ptilotus obovatus* (upright form) (G. Cockerton & G. O'Keefe WB12281)		1	1	1		1	1			1			1		
Asclepiadaceae	*Marsdenia australis*					1							1	1		
Asclepiadaceae	*Sarcostemma viminale subsp. australe*					1										
Asteraceae	*Chrysocephalum aff. apiculatum*					1										
Asteraceae	*Olearia ?stuartii*								1							
Asteraceae	*Olearia humilis*					1										
Asteraceae	*Olearia muelleri*		1	1	1											
Asteraceae	*Podolepis capillaris*												1			
Casuarinaceae	*Casuarina pauper*		1	1		1	1									
Chenopodiaceae	*Atriplex bunburyana*			1	1			1								1
Chenopodiaceae	*Atriplex nummularia*			1	1											1
Chenopodiaceae	*Enchylaena tomentosa*				1											
Chenopodiaceae	*Maireana georgei*		1								1					1
Chenopodiaceae	*Maireana pentatropis*										1					
Chenopodiaceae	*Maireana sedifolia*		1	1			1									1
Chenopodiaceae	*Maireana sp.* Indet												1	1		
Chenopodiaceae	*Maireana trichoptera*		1		1									1		1
Chenopodiaceae	*Rhagodia drummondii*													1		1
Chenopodiaceae	*Sclerolaena obliquicuspis*		1													
Chenopodiaceae	*Sclerolaena sp.* Indet												1			
Euphorbiaceae	*Euphorbia tannensis* subsp. *tannensis*									1	1					
Fabaceae	*Acacia aneura* (yellow-green)			1												
Fabaceae	*Acacia aneura* 2 x 70 mm					1	1		1		1	1	1	1	1	
Fabaceae	*Acacia aneura* 5 x 50 falcate	1							1		1			1		
Fabaceae	*Acacia aneura* lanceolate silver grey 5 x 20 mm, slightly twisted	1				1							1		1	

Western Botanical

	Landform	Low Hills				Rocky Outcrops			Sandplains				Drainage & Hardpan Plains			
	Dominant Geology or Soil Type	Ironstone	Gabbro, Calcrete			Ironstone & Chert			Orange Silty Sand				Red clayey sand			Red clayey sand over Calcrete
Family	Species	SIMS	CpW	CpW/MsS	EIWEs	BIF	BIF DS	ChO	SAMU	SAGS	SAWS	LMWS	HPMS	DRMS	GRMU	MsS
Fabaceae	*Acacia aneura* linear flat silver grey 2 x 100 mm	1							1		1	1		1		
Fabaceae	*Acacia aneura sens. str.*								1			1	1	1		
Fabaceae	*Acacia aneura* silver grey terete						1						1			
Fabaceae	*Acacia burkittii*										1			1		1
Fabaceae	*Acacia caesaneura*		1			1	1		1		1					
Fabaceae	*Acacia kempeana*				1		1									
Fabaceae	*Acacia mulganeura*					1										
Fabaceae	*Acacia murrayana* narrow phyllode form (G & S Cockerton WB40247)										1					
Fabaceae	*Acacia oswaldii*		1													
Fabaceae	*Acacia quadrimarginea sens. str.*												1			
Fabaceae	*Acacia ramulosa*	1				1			1			1				
Fabaceae	*Acacia sibirica*		1	1	1		1				1		1	1		
Fabaceae	*Acacia sp.* Indet															
Fabaceae	*Acacia tetragonophylla*	1	1			1	1				1			1		1
Fabaceae	*Indigofera georgei*															
Fabaceae	*Senna artemisioides subsp. artemisioides*												1	1		
Fabaceae	*Senna artemisioides subsp. filifolia*		1	1							1			1		1
Fabaceae	*Senna artemisioides subsp. sturtii*					1	1									1
Fabaceae	*Senna cardiosperma*	1				1	1	1					1	1		
Fabaceae	*Swainsona canescens*									1	1					
Fabaceae	*Templetonia incrassata*		1													
Goodeniaceae	*Scaevola spinescens* (broad leaf form)			1												1
Goodeniaceae	*Scaevola spinescens* (narrow leaf form)	1	1			1	1	1						1		
Goodeniaceae	*Scaevola spinescens* compact form		1													
Lamiaceae	*Physopsis viscida*										1					
Lamiaceae	*Prostanthera althoferi subsp. althoferi*	1				1	1	1	1			1		1		
Lamiaceae	*Spartothamnella teucriiflora*					1			1			1				
Malvaceae	*Abutilon cryptopetalum*					1										

	Landform	Low Hills				Rocky Outcrops			Sandplains				Drainage & Hardpan Plains			
	Dominant Geology or Soil Type	Ironstone	Gabbro, Calcrete			Ironstone & Chert			Orange Silty Sand				Red clayey sand			Red clayey sand over Calcrete
Family	Species	SIMS	CpW	CpW/MsS	EIWEs	BIF	BIF DS	ChO	SAMU	SAGS	SAWS	LMWS	HPMS	DRMS	GRMU	MsS
Malvaceae	*Sida calyxhymenia*										1					1
Malvaceae	*Sida ectogama*		1				1	1								
Malvaceae	*Sida sp. Golden calyces glabrous* (H.N. Foote 32)	1				1	1		1			1				
Myrtaceae	*Eucalyptus concinna*										1					
Myrtaceae	*Eucalyptus gongylocarpa*									1						
Myrtaceae	*Eucalyptus lesouefii* pruinose adult leaf form (G & S Cockerton WB40262)			1	1			1								
Myrtaceae	*Eucalyptus longissima*								1		1			1		
Myrtaceae	*Eucalyptus youngiana*									1	1					
Poaceae	*Aristida contorta*												1			
Poaceae	*Austrostipa elegantissima*		1				1									
Poaceae	*Austrostipa platychaeta*		1	1												
Poaceae	*Cymbopogon ambiguus*					1		1								
Poaceae	*Enneapogon caerulescens*							1			1			1		
Poaceae	*Eragrostis eriopoda*	1							1		1	1				
Poaceae	*Eriachne helmsii*					1										
Poaceae	*Eriachne mucronata* desert form glabrous (WB40048)	1							1				1			
Poaceae	*Eriachne pulchella*					1										
Poaceae	*Monachather paradoxus*								1							
Poaceae	*Paspalidium basicladum*								1							
Poaceae	*Poaceae sp.* Indet. (Annual)	1														
Poaceae	*Triodia basedowii*								1	1	1					
Proteaceae	*Grevillea berryana*	1				1										
Proteaceae	*Hakea recurva subsp. arida*					1		1								
Rubiaceae	*Psydrax latifolia*					1		1								
Rubiaceae	*Psydrax suaveolens*	1				1	1	1				1				
Rutaceae	*Philotheca brucei*					1										
Santalaceae	*Santalum spicatum*		1		1	1	1				1	1	1			

Western Botanical

	Landform	Low Hills				Rocky Outcrops			Sandplains				Drainage & Hardpan Plains			
	Dominant Geology or Soil Type	Ironstone	Gabbro, Calcrete			Ironstone & Chert			Orange Silty Sand				Red clayey sand			Red clayey sand over Calcrete
Family	Species	SIMS	CpW	CpW/MsS	EIWEs	BIF	BIF DS	ChO	SAMU	SAGS	SAWS	LMWS	HPMS	DRMS	GRMU	MsS
Sapindaceae	*Alectryon oleifolius*			1									1			
Sapindaceae	*Dodonaea lobulata*	1		1		1	1	1			1					
Sapindaceae	*Dodonaea rigida*		1			1	1	1								
Scrophulariaceae	*Eremophila aff. gilesii subsp. variabilis*													1		
Scrophulariaceae	*Eremophila aff. metallicorum*													1		
Scrophulariaceae	*Eremophila alternifolia*		1										1			1
Scrophulariaceae	*Eremophila clarkei*											1				
Scrophulariaceae	*Eremophila glabra subsp. glabra*		1													
Scrophulariaceae	*Eremophila latrobei (*filiform leaf form)					1	1									
Scrophulariaceae	*Eremophila latrobei subsp. glabra*	1					1					1				
Scrophulariaceae	*Eremophila latrobei subsp. latrobei*	1	1			1	1									
Scrophulariaceae	*Eremophila margarethae*						1		1			1	1			
Scrophulariaceae	*Eremophila oldfieldii subsp. angustifolia*					1	1				1					
Scrophulariaceae	*Eremophila punctata*	1														
Scrophulariaceae	*Eremophila scoparia*		1	1	1						1			1		
Scrophulariaceae	*Eremophila serrulata*													1		
Solanaceae	*Solanum lasiophyllum*	1								1	1	1		1		
Solanaceae	*Solanum nummularium*								1			1	1			
Solanaceae	*Solanum orbiculatum*									1	1					
Solanaceae	*Solanum plicatile*									1	1					
Sterculiaceae	*Brachychiton gregorii*	1				1	1									
Thymelaeaceae	*Pimelea microcephala*			1												
* This BIF site was sampled east of the Lord Byron project area, 150 m east of the sampled debris slope vegetation unit.																
	Shading Indicates dominant species															

Appendix 4. Conservation Codes and Their Meanings

Department of **Biodiversity, Conservation and Attractions**

GOVERNMENT OF WESTERN AUSTRALIA

CONSERVATION CODES

For Western Australian Flora and Fauna

Threatened, Extinct and Specially Protected fauna or flora[1] are species[2] which have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such.

The *Wildlife Conservation (Specially Protected Fauna) Notice 2018* and the *Wildlife Conservation (Rare Flora) Notice 2018* have been transitioned under regulations 170, 171 and 172 of the *Biodiversity Conservation Regulations 2018* to be the lists of Threatened, Extinct and Specially Protected species under Part 2 of the *Biodiversity Conservation Act 2016.*

Categories of Threatened, Extinct and Specially Protected fauna and flora are:

T **Threatened species**

Listed by order of the Minister as Threatened in the category of critically endangered, endangered or vulnerable under section 19(1), or is a rediscovered species to be regarded as threatened species under section 26(2) of the *Biodiversity Conservation Act 2016* (BC Act).

Threatened fauna is that subset of 'Specially Protected Fauna' listed under schedules 1 to 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for Threatened Fauna.

Threatened flora is that subset of 'Rare Flora' listed under schedules 1 to 3 of the *Wildlife Conservation (Rare Flora) Notice 2018* for Threatened Flora.

The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

CR **Critically endangered species**

Threatened species considered to be "*facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as critically endangered under section 19(1)(a) of the BC Act in accordance with the criteria set out in section 20 and the ministerial guidelines. Published under schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for critically endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for critically endangered flora.

EN **Endangered species**

Threatened species considered to be "*facing a very high risk of extinction in the wild in the near future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as endangered under section 19(1)(b) of the BC Act in accordance with the criteria set out in section 21 and the ministerial guidelines. Published under schedule 2 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for endangered fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for endangered flora.

VU **Vulnerable species**

Threatened species considered to be "*facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with criteria set out in the ministerial guidelines*".

Listed as vulnerable under section 19(1)(c) of the BC Act in accordance with the criteria set out in section 22 and the ministerial guidelines. Published under schedule 3 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for vulnerable fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for vulnerable flora.

Extinct species

Listed by order of the Minister as extinct under section 23(1) of the BC Act as extinct or extinct in the wild.

EX Extinct species

Species where "*there is no reasonable doubt that the last member of the species has died*", and listing is otherwise in accordance with the ministerial guidelines (section 24 of the BC Act).

Published as presumed extinct under schedule 4 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018* for extinct fauna or the *Wildlife Conservation (Rare Flora) Notice 2018* for extinct flora.

EW Extinct in the wild species

Species that *"is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; and it has not been recorded in its known habitat or expected habitat, at appropriate seasons, anywhere in its past range, despite surveys over a time frame appropriate to its life cycle and form*", and listing is otherwise in accordance with the ministerial guidelines (section 25 of the BC Act).

Currently there are no threatened fauna or threatened flora species listed as extinct in the wild. If listing of a species as extinct in the wild occurs, then a schedule will be added to the applicable notice.

Specially protected species

Listed by order of the Minister as specially protected under section 13(1) of the BC Act. Meeting one or more of the following categories: species of special conservation interest; migratory species; cetaceans; species subject to international agreement; or species otherwise in need of special protection.

Species that are listed as threatened species (critically endangered, endangered or vulnerable) or extinct species under the BC Act cannot also be listed as Specially Protected species.

MI Migratory species

Fauna that periodically or occasionally visit Australia or an external Territory or the exclusive economic zone; or the species is subject of an international agreement that relates to the protection of migratory species and that binds the Commonwealth; and listing is otherwise in accordance with the ministerial guidelines (section 15 of the BC Act).

Includes birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and fauna subject to the *Convention on the Conservation of Migratory Species of Wild Animals* (Bonn Convention), an environmental treaty under the United Nations Environment Program. Migratory species listed under the BC Act are a subset of the migratory animals, that are known to visit Western Australia, protected under the international agreements or treaties, excluding species that are listed as Threatened species.

Published as migratory birds protected under an international agreement under schedule 5 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

CD Species of special conservation interest (conservation dependent fauna)

Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened, and listing is otherwise in accordance with the ministerial guidelines (section 14 of the BC Act).

Published as conservation dependent fauna under schedule 6 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

OS Other specially protected species

Fauna otherwise in need of special protection to ensure their conservation, and listing is otherwise in accordance with the ministerial guidelines (section 18 of the BC Act).

Published as other specially protected fauna under schedule 7 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2018*.

P Priority species

Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened fauna or flora.

Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened species or other specially protected fauna lists for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring.

Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.

1 Priority 1: Poorly-known species

Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road and rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.

2 Priority 2: Poorly-known species

Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more locations but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.

3 Priority 3: Poorly-known species

Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread locations with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several locations but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.

4 Priority 4: Rare, Near Threatened and other species in need of monitoring

(a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection but could be if present circumstances change. These species are usually represented on conservation lands.
(b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for vulnerable but are not listed as Conservation Dependent.
(c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.

[1] The definition of flora includes algae, fungi and lichens
[2]Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).

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