Mt Brown Reserve
Reconnaissance Survey
2019

Prepared for: Shire of York

Prepared by: **Del Botanics**
PO Box 119, Mt Helena WA 6082
Mobile 0427700496
Email delbotanics@bigpond.com

November 2019

EXECUTIVE SUMMARY

This report has been prepared by Del Botanics on behalf of the Shire of York to undertake a reconnaissance survey to review remnant flora, fauna and vegetation at Mt Brown Reserve, York. A site survey was undertaken in September 2019. The site is approximately 107 kilometres east of the Perth central area, in the Shire of York.

The site visit in September 2019 recorded a majority of the vegetation within Mt Brown Reserve as "Degraded" condition. Vegetation communities were broadly mapped and described by recording the dominant tree species and upper level flora species. The vegetation described on site can be categorised into three broad vegetation communities, York Gum Woodland, Sheoak Woodland and Granite Outcrops. The Granite Outcrops are valuable habitats for Flora and Fauna and should be protected on this reserve.

Adjustment to some of the current tracks, by potentially increasing the width and the number of tracks may increase the use from walkers and reduce the conflict between different user groups of the reserve. Increasing the width of some of the tracks and applying additional tracks will also aid in immediate weed control by removing the current weeds directly, these areas can then be used to as buffers for future weed control. The retention of the current narrow tracks can be utilised for mountain bikes.

Immediate weed control is recommended and should be undertaken over multiple years starting with small manageable areas. This will need to be followed through with a rehabilitation plan that uses local endemic species. To aid in weed control it is suggested to limit fire use and use fire as an opportunity to undertake weed control.

Due to the site being dominated by weed species with a very low diversity of native understorey, its recommended that a Level 2 Flora and Vegetation Assessment is not necessary, however there are number of recommendations that should be considered for future planning.

STATEMENT OF LIMITATIONS

This environmental report has been prepared in accordance with the scope of services set out in the original quotation. In preparing the report, Del Botanics has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report. Del Botanics has not verified the accuracy or completeness of the data to the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Del Botanics will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed.

In accordance with the scope of services, Del Botanics has have relied on publically available data and information supplied by DBCA and have conducted environmental field monitoring in the preparation of the report. The nature and extent of monitoring conducted is described in the report. Within the limitations imposed by the scope of services, the monitoring and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care. No other warranty, express or implied, is made.

The report has been prepared for the benefit of the Client and for no other party. Del Botanics assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report. Other parties should not rely upon the report or the accuracy or completeness of any conclusions, and should make their own enquiries and obtain independent advice in relation to such matters.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

1. INTRODUCTION

1.1 BACKGROUND

This report has been prepared by Del Botanics on behalf of the Shire of York to review remnant flora, fauna and vegetation on Mt Brown Reserve, (further referred to as MBR) York. A site survey was undertaken in September 2019. The site is approximately 107 kilometres south east of the Perth central area, in the Shire of York. The location of the site is shown on **Figure 1** below.

The Shire of York covers an area of 215,963 hectares. It is located in the Avon River Basin which includes the Lockhart and Avon Catchments. The Avon River runs through the centre of the shire. The State forest covers the western part of the shire, occupying nearly quarter of the total shire.

Figure 1: Mt Brown Reserve Location

1.2 HISTORY

The first European farmers settled in the Avon Valley in 1831 and established themselves as pastoralists, grazing sheep on native herbage and cropping small areas of the better soil types. In 1880 the railway came to the Avon Valley and large advances to agriculture were made in the early 1900's.

Native vegetation in the Shire of York has been significantly cleared for agricultural purposes. The district was first settled in the mid 1800's and the best country for agriculture, being the woodlands on heavy soils in the valleys, was cleared by hand. The remaining areas of native vegetation are mostly the areas unsuitable for agriculture, such as granite outcrops, breakaway country and saline areas. Woodland and sandplain country are very poorly represented in reserves and much of the woodlands that do remain on private land have been degraded by grazing, weed invasion and inappropriate fire regimes (Safstrom, 1997).

1.3 MT BROWN NATURE RESERVE

Mount Brown Reserve (**Figure 2**) is vested within the Shire of York as a gazetted Class A Reserve no. 6915, for the purpose of "Parkland" within the York town site. The reserve covers a total area of 138.80 hectares and its highest point is 342.52 metres above sea level. MBR was originally natural bushland with no cultivated parkland areas but has a network of tracks and firebreaks running through it. MBR has a look out area which appears to be a popular spot for tourists.

The boundary of MBR can be broadly described as Attfield Road to the east, the fence lines of the private properties to the south, Chandos Road to the north and west, the eastern fence line of the cemetery and the eastern fence lines of the properties lining the western boundary of the reserve. The lookout platform and adjacent picnic area are accessed via Steere Road and its continuation, known as Pioneer Drive.

There is a long history of unofficial recreational use of this area for walking, horse riding and more recently for mountain biking. Formal cycling events and the unofficial use of MBR for mountain biking have created conflict between cyclists and walkers and a demand and pressure for public access to trails, especially for mountain bike trails, as identified in the recent Trails Master Plan 2019 for the Shire of York.

Many areas of MBR are degraded or weed infested but it is believed that there are still areas which may contain significant or priority flora. Before applying to vary the vesting order to Parklands and Recreation, the Shire Council has determined to commission a flora and fauna survey to identify and locate vulnerable species or habitats, to protect these areas and guide future recreational use of MBR (Shire of York, 2019). A previous inspection has revealed a number of narrow paths of compacted soil, devoid of native vegetation. These paths are the results of the trail bike activity and off road vehicles.

Mt Brown Reserve currently has a medium to heavy density cover of York Gum (*Eucalyptus loxophleba*) and Jam trees (*Acacia acuminata*), fairly evenly distributed over the whole area, with the odd tree of a different species. However the condition of the understorey across the entire area is in a very degraded condition, with exotic grasses dominating the understorey. In a previous Environmental Field Assessment undertaken in 2008 (Burbidge, 2018), it was noted that there were copious amounts of Lupin, Cape Tulip and Patterson's Curse that dominated the landscape. It further describes that there is very little native understorey vegetation on MBR. Some Granite Outcrops had moss, lichen and fungi present. It also states that without a defined plan for MBR its chances of recovery and re-establishment of native plants will be minimal and it will be left to languish and degrade even further until the reserve is left with nothing more than a few stands of York Gum and Jam trees with the remainder of the parkland covered in weeds, almost as it is now (Burbidge, 2018).

Figure 2: Mt Brown Reserve

2. METHODOLOGY

Del Botanics completed a Reconnaissance (Level 1) spring flora, fauna and vegetation survey at Mt Brown Reserve, York in accordance with EPA Guidance Statement No. 51, Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia (EPA 2004) and EPA Guidance Statement No. 56 Technical Guidance for Terrestrial Fauna Surveys (EPA 2004).

This involved recording dominant flora and fauna species and vegetation communities and condition throughout the reserve. Targeted searches for Threatened and Priority flora listed as occurring or likely to occur at MBR were conducted in likely habitat areas on foot. Vegetation communities and condition of vegetation were recorded and mapped using the Keighery (1994) scale.

2.1 DESKTOP ASSESSMENT

Prior to the commencement of the field survey, a desktop assessment was undertaken to identify relevant environmental information pertaining to both the survey area and to assist in survey design. The desktop assessment involved a review of the following documents:

- Threatened Flora listed under the Commonwealth *Environmental Protection and* Biodiversity Conservation Act 1999 (EPBC Act);
- Declared Rare and Threatened Flora listed under WA *Environmental Protection Act 2016*;
- Priority Flora recognised by the Department of Biodiversity, Conservation and Attractions (DBCA);
- Threatened Ecological Communities (TECs) listed under State and Federal legislation;
- Priority Ecological Communities (PECs) recognised by DBCA;
- Environmentally Sensitive Areas (ESAs) recognised by DBCA;
- Threatened Fauna listed under the Commonwealth *Environmental Protection and* Biodiversity Conservation Act 1999 (EPBC Act);
- Priority Fauna recognised by the Department of Biodiversity, Conservation and Attractions (DBCA);
- Environmental Field Assessment – Mt Brown, York WAGE event 26 August, 2018 (T.Burbidge, 2018);
- York Trails Master Plan, Shire of York (2019-2028) (Common ground Trails, 2018);
- Mt Brown Reserve Management Plan (Terri Watson 2008); and
- Liaison with available local environmental groups (River Conservation Society, Wildflower Society).

3. EXISTING ENVIRONMENT

3.1 SOILS AND LANDFORMS

The Shire of York area is underlain by granitic rocks, and migmatites and acidic gneisses. Most of the shire is underlain by granites of the Yilgran Block. The Shire of York contains two broad regions, each containing characteristic landforms, soil landscapes and vegetation (Weaving, 1994).

- **The Zone of Rejuvenated Drainage**

This zone is defined by the Meckering Line to the east and the Darling Range Zone to the west.

- **The Darling Range Zone**

This Zone is found in the west of the Shire.

3.2 VEGETATION

The Shire of York covers an area of 215,963 hectares. It is located in the Avon River Basin which includes the Lockhart and Avon Catchments. The Avon River runs through the centre of the shire. The State forest covers the western part of the shire, occupying nearly quarter of the total shire.

The South west of Western Australia has been divided into districts based on their vegetation type, drainage system and rainfall. The Shire York contains four Natural Resource Zones as shown below in **Table 1** (Weaving, 1994).

Table 1: The Natural Resources Zones in the Shire of York

NRZ Number	NRZ Code	Beard's Natural Region	Drainage Division	Rainfall (mm)
30	DlAvR3ii	Dale Sub-district (Northern Jarrah Forest)	Avon River	500-700
32	DLSwR3i	Dale Sub-district (Northern Jarrah Forest)	Swan Coast	500-700
34	DlSwR2	Dale Sub-district (Northern Jarrah Forest)	Swan Coast	700-1100
62	AvAvR4	Avon Botanical District (Wheatbelt)	Avon River	less than 500

The Shire is found within two botanical districts: The Darling Botanical District and the Avon Botanical District. These Botanical Districts are divided into two drainage divisions, the Avon River and the Swan Coastal Plain.

The forested areas west of the shire are dominated by the Darling Plateau. These areas consist of Jarrah (*Eucalyptus marginata*), Banksia's and grasstree's (*Xanthorrhoea* spp.). Marri (*Corymbia calophylla)* are predominately found on the loamy soils of the valley slopes, often with Wandoo (*Eucalyptus wandoo).* Flooded Gums (*Eucalyptus rudis*) and Paperbarks (*Melaleuca* spp.) are dominant along the Avon River.

The eastern side is dominated by agricultural land uses and a large portion of the native vegetation has been cleared. Remnant vegetation is common along the water courses, which includes York Gum (*Eucalyptus loxophelba*) and Jam Wattle (*Acacia acuminata*). Wandoo occurs on the mid slopes and along roadsides. Salmon gum (*Eucalyptus salmonophloia*) appears as a dominant tree in remnant vegetation on loamy clay soils. Granite Outcrops are dominated by Lichens (Weaving, 1994).

A major portion of the shire falls within the York Vegetation System. This vegetation is characterised by underlying gneissic rocks which have been eroded so that almost the entire laterite crusted surface has degraded revealing the fertile red loams. There is a gentle relief with occasional local outcrops of metamorphic rocks forming hills. York Gum Woodland covers the whole area with Wandoo confined to the less basic rocks, in areas such as MBR. Flooded Gum and Swamp Sheoak (*Casuarina obesa*) grow along the Avon River and its tributaries (Weaving, 1994).

Photo 1: Jam tree (*Acacia acuminata*) Woodland with weed dominated understorey

Photo 2: Sheoak (*Allocasuarina huegeliana*) Woodland with degraded understorey.

Photo 3: Granite outcrops.

3.3 CLIMATE

The Shire's climate consists of a warm Mediterranean climate with hot dry summers and mild wet winters. Annual rainfall ranges from 1100mm in the west of the Shire to less than 451mm to the east of the Shire. The average maximum temperature range from 34.3°C in January to 15.6°C in July, while the corresponding average minimum temperature's range from 16.8°C in January to 5.3°C in July, when frost are common.

4. FLORA, FAUNA AND VEGETATION

The survey area lies in the Drummond Botanical Subdistrict within the Southwest Botanical Province as described by Beard (1990). Flora composition has been described by Beard (1990) as predominantly consisting of *Banksia* Low Woodlands on leached sands with *Melaleuca* swamps where ill drained and Woodlands of *Eucalyptus* spp. on less leached soils. This area has been described by Beard (1990) as the Avon Botanical District.

The updated mapping system IBRA (*Interim Biogeographic Regionalisation for Australia*) was developed in 1993-94 and is endorsed by all levels of government as a key tool for identifying land for conservation under *Australia's Strategy for the National Reserve System 2009-2030.*

The nationally agreed regionalisation was published in Thackway and Cresswell (1995), *An Interim Biogeographic Regionalisation for Australia: a framework for establishing the national system of reserves.*

The latest version, IBRA7, classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information. The IBRA description of vegetation for this area is best categorised as the Avon Wheatbelt Region.

4.1 FLORA

The site is dominated by York Gum (*Eucalyptus loxophleba)* and Jam Wattle (*Acacia acuminata*) Woodland with various weed species dominating the understorey. There is a low diversity of native understorey species, which are scattered amongst the site. A species list is available in **Appendix A,** this provides a list of flora species identified during the field survey.

Photo 4: York Gum (*Eucalyptus loxophleba*) Woodland with Degraded understory

Photo 5: York Gum (*Eucalyptus loxophleba*) with Jam Wattle (*Acacia acuminata*) woodland with everlasting understorey.

4.1.1 Threatened flora

A search of the Department of Biodiversity, Conservation and Attractions (DBCA) NatureMap database identified three Threatened (T), one Priority 1 (P1), one Priority 2 (P2), eleven Priority 3 (P3), and eight Priority 4 (P4), species within a 10 km radius, that are likely to occur within the area. These species are listed in **Table 2** below.

Table 2: NatureMap listed flora species

Species Name	Common Name	Conservation Code	Likely to occur onsite	Flowering time during survey
Acacia cuneifolia		P4	Yes	Yes
Allocasuarina fibrosa	Woolly Sheoak	T	No	No
Anigozanthos bicolor subsp.*exstans*		P3	No	Yes
Asterolasia grandiflora		P4	Yes	Yes
Beaufortia eriocephala	Woolly Bottlebrush, Woolly Beaufortia	P3	No	Yes
Caladenia integra	Mantis Orchid, Smooth-lipped Spider Orchid	P4	Yes	Yes
Cryptandra beverleyensis		P3	No	unknown
Drosera albonotata		P2	unknown	unknown
Eucalyptus exilis	Boyagin Mallee	P4	Yes	No
Eucalyptus x carnabyi		P4	Yes	Yes
Hemigenia platyphylla		P4	Yes	Yes
Hibbertia montana		P4	Yes	Yes
Placynthium nigrum		P3	unknown	unknown
Pterostylis echinulata		P3	unknown	unknown
Senecio gilbertii		P1	Yes	No
Stackhousia sp. Red-blotched corolla (A. Markey 911)		P3	unknown	unknown
Stylidium scabridum	Moth Triggerplant	P4	No	Yes
Stylidium uniflorum subsp. *extensum*	Red-stemmed Triggerplant	P3	unknown	unknown
Thomasia glabripetala		T	No	Yes
Thomasia montana	Hill Thomasia	T	No	Yes
Thysanotus cymosus		P3	No	Yes
Thysanotus tenuis		P3	No	Yes
Xanthoparmelia hypoleiella		P3	Yes	unknown
Xanthoparmelia subimitatrix		P3	Yes	unknown

A search of the Department of Environment and Energy (DEE) Protected Matters database identified fourteen flora species of significance within a 10 km radius, which are likely to occur within the area.

Three flora species have been listed as Vulnerable and ten species are listed as Endangered and 1 species is listed as Critically Endangered. These species are listed in **Table 3** below.

Table 3: DEE Protected Matters listed flora species

Species Name	Common Name	Conservation Code	Likely to occur onsite	Flowering time during survey
Acacia ataxiphylla subsp. *magna*	Large-fruited Tammin Wattle	Endangered	No	No
Banksia oligantha	Wagin Banksia	Endangered	No	Yes
Dasymalla axillaris	Native Foxglove	Critically Endangered	Yes	Yes
Eleocharis keigheryi	Keighery's Eleocharis	Vulnerable	No	Yes
Gastrolobium hamulosum	Hook-point Poison	Endangered	Yes	Yes
Grevillea christineae	Christine's Grevillea	Endangered	No	No
Melaleuca sciotostyla	Wongan Melaleuca	Endangered	No	No
Roycea pycnophylloides	Saltmat	Endangered	No	No
Symonanthus bancroftii	Bancrofts Symonanthus	Endangered	unknown	No
Thelymitra dedmaniarum	Cinnamon Sun Orchid	Endangered	Yes	No
Thelymitra stellata	Star Sun-orchid	Endangered	Yes	Yes
Thomasia glabripetala	Sandplain Thomasia	Vulnerable	No	Yes
Thomasia montana	Hill Thomasia	Vulnerable	No	Yes
Verticordia staminosa subsp. *staminosa*	Wongan Featherflower	Endangered	Yes	Yes

4.1.2 Department of Biodiversity, Conservation and Attractions (DBCA) Database Search

In addition to the background searches undertaken through the DBCA Naturemap and the DEE Protected Matters, a Threatened and Priority flora search was undertaken through the DBCA. The search is undertaken on records from the Threatened and Priority Flora Database (TPFL) and the WA Herbarium database (WAHerb), which provides known locations of each species. The search was conducted within a 10km radial area from the central coordinate. One Priority 3 (P3) species *Xanthoparmelia hypoleiella,* has been previously recorded from MBR. This lichen is likely to occur on the Granite Outcrops throughout the site.

4.1.3 Weeds

Invasive plants are widespread in fragmented landscapes that have been highly modified, and where nutrient enrichment of soils and frequent disturbance encourages the establishment of weeds over native vegetation. Established weeds compete with native plants, affecting their recruitment and survival,

therefore reducing the habitat quality for native fauna. Grassy weeds can also increase the flammability of the vegetation, increasing fire frequency and intensity. Once established, weeds become a long-term and potentially costly management issue.

There are a very high number of weed species and densities on average across the entire site at MBR. Weeds are dominant throughout the reserve. Intensive weed control is recommended for this site. It will be beneficial to undertake weed control in sections to ensure adequate management is achieved, which can be followed up with planting and rehabilitation. During the survey a majority of the dominant weed species recorded were grasses.

It is important to plan weed control efforts and work from areas in best condition to worst condition. Consider the use of prescribed burns or wildfires as an opportunity to undertake weed control. Insist on using a suitably qualified and experienced environmental professional to undertake weed control (ie. ensure the contractor or staff have knowledge of local native species, ensure weed control is undertaken in a targeted manner). Have a plan in place to follow up weed control efforts and invest in rehabilitation of the area to re-introduce native flora species.

Photo 6: Tracks and weeds within the MBR

4.2 FAUNA

Due to the location of the reserve and the reduced areas of other natural bushland in the area, this reserve is an important refuge for native animals and is a valuable stepping stone of native vegetation in this landscape. A species list of Fauna identified during the field survey is available in **Table 4** below. This is not a complete list as more reptile, bird, insect and mammal species potentially utilise the site; this species list is just a record of those noted during the site visit.

MBR offers a number of valuable fauna habitats. There are numerous trees containing hollows and forage opportunities for birds, there are several granite outcrops which are provide valuable habitat for reptiles and the site provides food and shelter for a number of mammal species.

Table 4: Fauna species identified at MBR

Family	Genus/Species	Common Name
Accipitridae	*Aquila audax*	Wedge-tailed eagle
Apidae	*Apis mellifera*	Honey bee
Apidae		Native Bee's
Campephagidae	*Coracina novaehollandiae*	Black-faced cuckooshrike
Canidae	*Vulpes sp*	Fox
Cercopidae		Spittlebugs
Leporidae	*Oryctolagus cuniculus*	Rabbit
Macropodidae	*Macropus fuliginosus*	Western grey kangaroo
Podargidae	*Podargus strigoides*	Tawny frogmouth
Psittaculidae	*Barnardius zonarius,*	Australian ringneck
Strigidae	*Ninox boobook*	Australian boobook
Tachyglossidae	*Tachyglossus aculeatus*	Short-beaked echidna
Varanidae	*Varanus gouldii*	Sand goanna

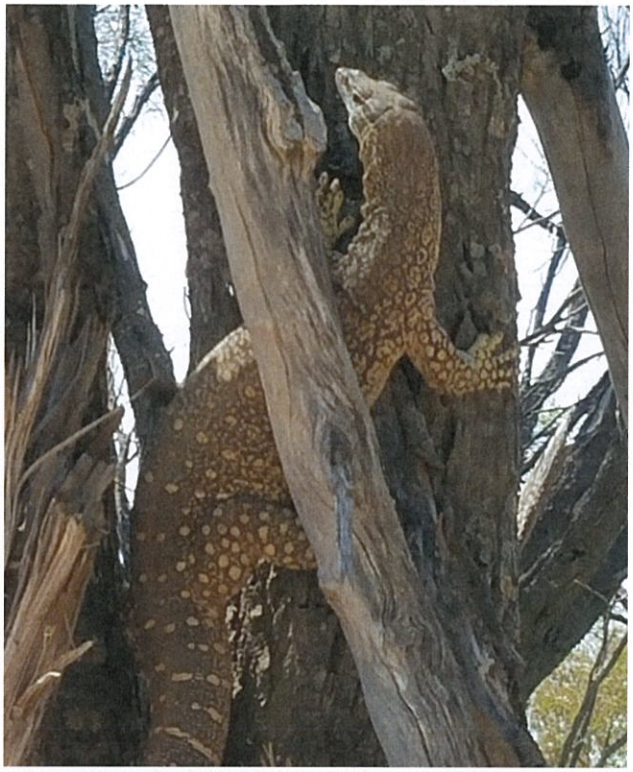


Photo7: Sand goanna *(Varanus gouldii)* located at MBR

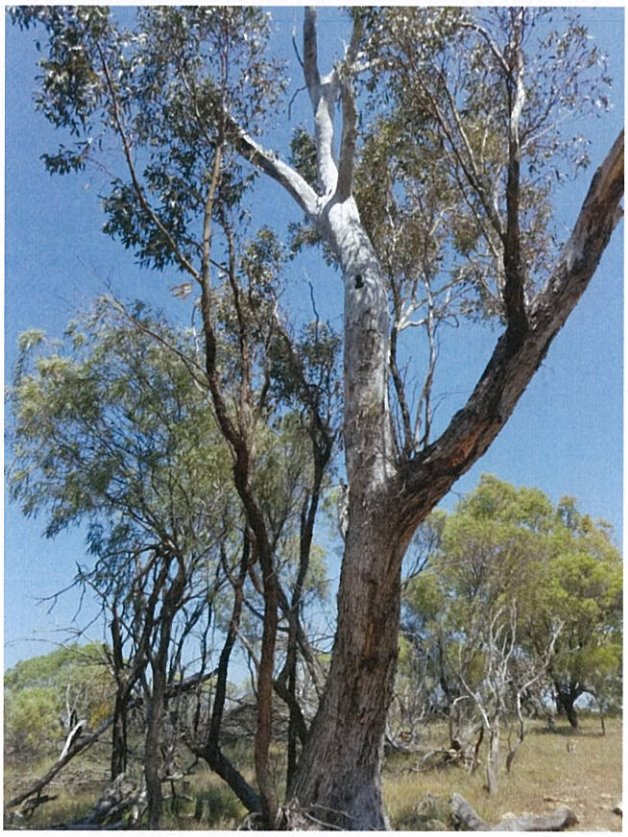


Photo 8: Habitat Tree within MBR

Photo 9: Spittlebugs frothy mass produced while feeding on plants.

4.2.1 Threatened Fauna

A search of the Department of Biodiversity, Conservation and Attractions (DBCA) NatureMap database, identified eight priority species within a 10 km radius, which are likely to occur within the area. Of these, five are listed as Threatened (T) and one as Priority 3 (P3) and two as Priority 4 (P4) species. The list is provided in **Table 5** below.

Table 5: NatureMap listed fauna species

Species Name	Common Name	Conservation Code
Calyptorhynchus baudinii	Baudin's Cockatoo, White-tailed Long-billed Black	T
Calyptorhynchus latirostris	Carnaby's Cockatoo, White-tailed Short-billed Black	T
Hydromys chrysogaster	Water-rat, Rakali	P4
Idiosoma nigrum	Shield-backed Trapdoor Spider	T
Lagostrophus fasciatus subsp. fasciatus	Banded hare-wallaby, Mernine	T
Leipoa ocellata	Malleefowl	T
Neelaps calonotos	Black-striped Snake, black-striped burrowing snake	P3

A search of the Department of Environment and Energy (DEE) Protected Matters database identified eight fauna species of significance likely to occur within a 10km radius of the reserve. One fauna species is listed as Critically Endangered, five species have been listed as Endangered and two species are listed as Vulnerable. These species are listed in **Table 6** below.

Table 6: DEE Protected Matters listed fauna species

Species Name	Common Name	Conservation Code
Calidris ferruginea	Curlew Sandpiper	Critically Endangered
Calyptorhynchus banksii naso	Forest Red-tailed Black-Cockatoo, Karrak	Vulnerable
Calyptorhynchus latirostris	Carnaby's Cockatoo, Short-billed Black-Cockatoo	Endangered
Dasyurus geoffroii	Chuditch, Western Quoll	Vulnerable
Idiosoma nigrum	Shield-backed Trapdoor Spider, Black Rugose, Trapdoor Spider	Vulnerable
Leipoa ocellata	Malleefowl	Vulnerable
Phascogale calura	Red-tailed Phascogale, Red-tailed Wambenger,Kenngoor	Vulnerable
Rostratula australis	Australian Painted-snipe, Australian Painted Snipe	Endangered

4.2.2 Department of Biodiversity, Conservation and Attractions (DBCA) Database Search

In addition to the background searches undertaken through the DBCA Naturemap and the DEE Protected Matters, a Threatened and Priority fauna search was undertaken through the DBCA. The search is undertaken on records from the Threatened and Priority Fauna Database, which provides known locations of each species. The search was conducted within a 10km radial area from the central coordinate. There is currently no priority fauna species recorded as occurring onsite; however the site is listed as a location utilised by the Endangered Carnaby Cockatoo (*Calyptorhynchus latirostris*).

4.2.3 Feral Animals

Several species of invasive animals have established in the Wheatbelt region which have impacted upon native vegetation and fauna. Feral cats (*Felis catus*) and the European fox (*Vulpes vulpes*) are key predators that prey upon ground-dwelling native fauna. The European rabbit (*Oryctolagus cuniculus*) causes direct loss of plant species, and indirect loss of native plant and animal species through changes to soil structure and nutrient dynamics by their digging, burrowing and grazing activities. Feral cats have been noted as using the reserve. There is also evidence rabbits on the reserve.

4.3 VEGETATION

The original vegetation of the region has been mapped and described by Beard (1979, 1980). A majority of the Shire of York's vegetation falls into the Avon Botanical District (Safstrom, 1997). MBR is part of the York Vegetation System. The York Vegetation system is characterised by York Gum (*Eucalyptus loxophleba)* Woodland covering a majority of the area, with Wandoo (*Eucalyptus wandoo*) confined to the less basic rocks. Flooded Gum *(Eucalyptus rudis)* and Swamp Sheoak (*Casuarina obesa*) grow along the Avon River and its major tributaries. Jam (*Acacia acuminata*) and Rock Sheoak (*Allocasuarina*

huegeliana) are common in most areas of the woodland but most of the understory species have disappeared.

4.3.1 Vegetation complexes found within Mt Brown Reserve

MBR falls within the Michibin vegetation complex. The Michibin complex consists of Open woodland of *Eucalyptus wandoo* over *Acacia acuminata* with some *Eucalyptus loxophleba* on valley slopes, with low woodland of *Allocasuarina huegeliana* on or near shallow Granite Outcrops in arid and perarid zones (WALGA, 2019).

Photo 10: York Gum with weed dominated understorey at MBR

Photo 11: York Gum at MBR from the Lookout

4.3.2 Local Vegetation Communities

During the site visit, vegetation communities were broadly mapped and described by recording the dominant tree species and upper level flora species. The vegetation described on site can be categorised into three broad vegetation communities, which are described below. These communities are described in **Table 7** and shown on **Figure 3.**

- **York Gum with Jam**

This vegetation is dominated by York Gum (*Eucalyptus loxophleba*) and Jam (*Acacia acuminata*) over a low understorey of various grass weed species and sparse native species. This vegetation community is the dominant vegetation occurring at MBR. There are significant York Gum's with hollows found in this reserve that provide valuable fauna habitat.

- **Sheoak woodland**

This vegetation is dominated by Sheoak (*Allocasuarina huegeliana*) with an understorey of various grass weed species and sparse native species. This vegetation community occurs predominately around the Granite Outcrops.

- **Granite oucrops**

There are multiple areas of Granite outcrops at MBR. These areas are highly valued habitat areas for various flora and fauna.

Granite Outcrops in WA have a likely-hood of containing rare species of both Flora and Fauna. It is generally agreed amongst those who manage lands of conservation value that Granite Outcrops require individual and careful management if their local plant and animals species are to survive into the future (Watson, 2008).

In the Wheatbelt particularly (mainly because of the loss of habitat due to clearing) more and more Granite Outcrops are used as a source of water and food by many species of animals, birds and insects, some of which are endemic only to rocky outcrops, these include reptiles such as dragon lizards and gecko's. There are also some species of moths and spiders that are thought to be totally reliant on the granite hills of the wheatbelt (Watson, 2008).

Much of the south west of Western Australia is underlain by the Yilgarn Block which is one of the oldest land masses in the world. The Yilgran Block is principally granite that has eroded in to an almost flat surface, most of the surface is covered by soil but occasionally Granite Outcrops occur at the surface. The topography of the outcrop determines the types of plants and animals that can survive on and around it (Weaving, 1994).

Different vegetation structures form around the Granite Outcrops making them a more valuable natural habitat. This occurs at Mt Brown Reserve, Sheoak Woodland forms around the Granite Outcrop, the Sheoak contains nitrogen fixing miro organisms around the rock edge and the dense woodland and mulch from the Sheoak provides various fauna habitats. Beyond the Sheoak Woodlands is Eucalyptus Woodlands creating more valuable flora and fauna habitats (Weaving, 1994).

It is recommended that MBR installs interpretive signage around the reserve to help educate the community about the importance of the vegetation communities, in particular the Granite Outcrops as an important habitat feature of Wheatbelt Woodlands. During the site visit flora species were recorded from three Releves in each of the vegetation communities. Data recorded from Releves on site are provided in **Appendix B**.

Table 8: Vegetation Communities

Mapping Code	Community Descriptions
Vegetation Community 1 – York Gum with Jam open Woodland	
1	Open woodland of *(Eucalyptus loxophleba)* and Jam *(Acacia acuminata),* over grassland of *Neurachne alopecuroide* and **Avena barbata,* and *herbland* of **Lupinus cosentinii* and **Arctotheca calendula* and *Rhodanthe manglesii*
Mapping Code	**Community Descriptions**
Vegetation Community 2 – Sheoak Woodland	
2	Low woodland of *Allocauarina huegeliana,* over grassland of *Neurachne alopecuroide* and **Avena barbata and *Aira caryophyllea*
Mapping Code	**Community Descriptions**
Vegetation Community 3 – Granite outcrop	
3	Exposed Granite outcrops with lichens and mosses

4.3.3 Threatened Ecological Communities

The EPBC Act provides for the strong protection of TEC's, which are listed under section 181 of the Act and are described as 'Critically Endangered', 'Endangered' or 'Vulnerable' under section 182. Schedules of protected TECs maintained pursuant to the EPBC Act are based on the same Floristic Community Type's (FCT's) as adopted by DBCA, however not all TEC's listed by the DBCA are scheduled under the EPBC Act. A DEE Protected Matters Report indicated there is one known Threatened Ecological Community (TEC) likely to occur in the area, this is listed in **Table 8.**

Table 8: EPBC listed Threatened Ecological Communities

Threatened Ecological Community	Conservation Code	Comments
Eucalypt Woodlands of the Western Australian Wheatbelt	Critically Endangered	Community likely to occur in the area

In addition to the background search undertaken through the DEE Protected Matters database, a Threatened Ecological Community search was undertaken through the DBCA. The search is undertaken on records from the Threatened Ecological Community Database which provides known locations of each community. The search was conducted within a 10km radial area from the central coordinate. The TEC *Eucalypt Woodlands of the Western Australian Wheatbelt* is recorded as occurring on site, however due to

the vegetation condition of the site it is unlikely that this TEC is evident. It is recommended that a TEC assessment is undertaken.

4.3.4 Vegetation Condition

Many bushland remnants have been historically subject to ongoing degradation and are especially susceptible to disturbances arising as a result of indirect impacts from surrounding developments and human activity. Degradation is caused by a wide range of factors, including isolation and edge effects, weed invasion, plant diseases, changes in fire frequency and behaviour, landscape fragmentation, illegal firewood cutting, rubbish/refuse dumping, off-road motorbikes and 4WD's, increased predation on native fauna by feral animals, decrease in species richness and general modification of ecological function.

The Vegetation Condition was rated according to the Vegetation Condition Scale commonly used in the Perth Metropolitan Region (Government of WA 2000). The definitions are described in **Table 9**.

Table 9: Vegetation Condition Scale (Taken from Bush Forever (Government of WA 2000))

Vegetation Condition	Definition
Pristine (1)	Pristine or nearly so, no obvious signs of disturbance.
Excellent (2)	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good (3)	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing
Good (4)	Vegetation structure significantly altered by very obvious signs of multiple disturbances. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded (5)	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded (6)	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

In general, the vegetation condition ranged from "Degraded" to "Completely Degraded" in the study area. Vegetation condition mapping is provided on **Figure 4.** The site lacks understorey structure and diversity and is dominated by various weed species. Significant weed control over numerous years is recommended to reduce the amount of weeds and aid in future flora rehabilitation with local endemic species.

4.4 HABITAT TREES

There are a number of Eucalyptus trees on MBR that are suitable habitat trees with formed hollows. Tree hollows are essential to provide shelter and breeding sites for many native animals. Australia-wide, it is estimated that around 300 species of vertebrates use hollows at some time and many of these are now endangered, in part because of the removal of hollow-bearing trees. The hollows provide refuge from the weather and predators, and safe sites for roosting and breeding. In order to maintain this essential wildlife habitat, it is important to retain both living and dead hollow-bearing trees (CALM, 2005).

Hollows form as a trees age, over time, the trees are subject to various natural forces such as fire or storm that cause injury to the protective bark. While the living, outer sapwood may remain healthy, wood-rotting fungi and termites gain access to the heartwood, beginning the decay process. In Western Australia, fire often contributes to the initial cause of injury, as well as, by burning decayed wood, enlarging existing hollows. Wildlife can also renovate hollows using beaks, teeth or claws. Only old trees have hollows. Research has shown that Jarrah, Wandoo and Salmon Gum rarely form hollows before they are 120-150 years of age. A hollow large enough for a black cockatoo (which requires an entrance hole 25cm in diameter) will only be found in a tree that is even older than that (CALM, 2005).

Tree locations are listed below on **Table 10** and shown on **Figure 4**.

Table 10: Habitat Tree Locations

Tree Species	GPS Location	Comments
Eucalyptus loxophleba	50 479395 6472127	Small hollows
Eucalyptus loxophleba	50 479374 6472149	Multiple branches
Eucalyptus loxophleba	50 479723 6472131	
Eucalyptus loxophleba	50 479382 6471793	

Photo 12: Hollow in a habitat tree

5. TRACKS, SIGNAGE AND RECREATIONAL ACTIVITIES

5.1 TRACKS

There are numerous tracks throughout MBR. Most tracks are narrow and well defined which appear to be primarily used for mountain bike riding. It is recommended that some of the current tracks are widened and additional wider tracks are introduced to the reserve. This may increase the use from walkers and reduce the conflict between different user groups of the reserve. Increasing the width of some of the tracks and applying additional tracks will also aid in immediate weed control by removing the current weeds directly, these areas can then be used as buffers for future weed control. The retention of the current narrow tracks can be utilised for mountain bikes. The wider tracks created for walkers could provide self-guided interpretive walk trails around the reserve, which will promote the existing flora, fauna and vegetation communities.

Fire breaks are currently around the boundary of MBR can be broadly described as Attfield Road to the east, the fence lines of the private properties to the south, Chandos Road to the north and west, the eastern fence line of the cemetery and the eastern fence lines of the properties lining the western boundary of the reserve.

Photo 13: Well formed tracks

5.2 SIGNAGE

During the site visit it was noted that there were limited signs to describe the site. It is suggested that numerous interpretive signs are used on the site to describe the vegetation, flora and fauna, the history and Aboriginal stories. It is also important to promote the protection of the site. It is recommended that areas such as the Granite Outcrops would benefit from interpretive signs promoting their importance and encouraging people to stay off these areas to protect the habitats. Signs should be used to encourage people to stay on tracks, to promote weed control and rehabilitation and provide information on flora and fauna species that are found on the reserve.

Photo 14: *Ptilotus* at MBR

5.3 RECREATIONAL ACTIVITY

Mt Brown Reserve appears to be popular for a number of recreational activities. The site is used for bush walking, bike riding, horse riding and 4WD driving. There are historic signs of wood cutting and rubbish dumping, including garden waste, however these areas are limited. Due to the site not being fenced it will be hard to control these activities. However it is important to promote the right activities in the right areas. To limit further degradation to the site it is suggested that current tracks are utilised as much as possible, as well as adding new tracks were necessary. Some of the current track could be widened to cater for bush walking while the narrow tracks can be maintained for mountain bikes.

6. FIRE

Prior to European settlement, fires occurred through lightning strikes and Indigenous burning of the landscape. Indigenous burning practices had been adopted for up to 60 000 years and likely comprised a mosaic of frequent, small-scale fires, often during summer months in the more mesic woodlands of the western Wheatbelt. Since European settlement, fires still occur through lightning strikes. However, they now also originate from prescribed burning operations (including escapes from planned fires), arson or accidental ignition due to a range of sources. The nature and impacts of fire is influenced by other threats in the landscape. Fragmentation into small remnants and the surrounding modified land use can affect the intensity and impact of fires across a patch. The type of understorey may promote or suppress fire spread. Frequency of fire is one important consideration in addition to fire intensity and season. Too frequent fires may eliminate sensitive species (Watson, 2008).

The main concern for natural remnants in the Wheatbelt is a lack of fire or much longer intervals between fire events. The lack of fire limits recruitment of plant species, especially those that require heat, smoke or other features of a fire to stimulate germination and establishment of seedlings. It also impacts on fauna by limiting the development of habitat diversity, especially opportunities for new tree hollows and logs, or not allowing the regeneration of dense thickets of trees and shrubs, that give shelter to many kinds of fauna. It is important to develop appropriate fire management, such as the use of mosaic burning to maintain the diversity of habitats for flora and fauna (Weaving, 1994).

One of the prerequisites for burning is the need for a sufficient amount of seed on the ground or on surrounding vegetation for the fire to aid in germination. In the case of Mt Brown, Watson's report suggests it is highly unlikely that any seed remains on the reserve except for that of weeds. Of the two remaining common native species on the reserve *Acacia acuminata* and *Eucalyptus loxophleba* neither require smoke to aid in germination, although York Gums do benefit from occasional burns which encourage growth of lignotubers, but fires kill off new plants if they are not protected. *Acacia acuminata* seed will remain viable in the soil for up to 25 years, and it will germinate with or without fire (Watson, 2008).

Fires that are too frequent or not frequent enough will not produce the effects we as land managers are looking for. If fires are used as a management tool then it must be realised that many native plants need to have reached maturity and have set seed before a burn could help with re-establishment of local native species, in some cases this could take up to 8 to 10 yrs. Fires that are too frequent also add to the degradation of soils, poor growth of annuals and a poorly formulated fire regime will completely devastate stands of *Allocasuarina*, Wandoo and other fire susceptible species. This could explain to some degree why only fire tolerant native species have continued to spread and survive at Mt Brown Reserve,

while others no longer exist in the reserve or are few in number. While *Allocasuarina* will germinate easily after fire, any subsequent fires, too soon, will wipe out any new seedlings (Watson, 2008).

To date the fire regime at MBR has done little to control weeds, it has just intensified the situation and stimulated even more weed growth. It is important that future management is put in place after a fire to ensure weed control and rehabilitation measures are properly achieved.

It is important to maintain firebreaks around the reserve and enable access throughout the reserve, however any burn offs require immediate and follow up weed control to prevent the forecast of additional weeds. Due to the size and intensity of weeds at MBR it is recommended that fire and weed control are undertaken together in small selected areas to ensure weed control across the site is successfully achieved.

Photo 15: High density of weed species at MBR

7. MEMORIAL GROVE

There appears to be some inappropriate use of the memorial grove which needs to be tackled as soon as possible. The original plan for the memorial grove was the Men of the Trees planting a variety of species in the allocated site and local residents were invited to adopt a tree in memory of family members. However local residents have include small plaques and crosses next to some of the trees which eventually has led to a large number of commemorative signs and other personal items being placed at the base of the trees (Watson, 2008).

The Shire of York has now installed a sign to inform people that all memorial plaques and signs are to be removed and guidelines have been formulated to prevent any other misconceptions about the uses of the memorial grove. The Shire of York will now attempt to make it clear that only previously planted trees will be offered to the public for memorial purposes and no personal effects will be permitted (Watson, 2008).

Photo 16: Memorial site at Mt Brown Reserve

It is important to provide residents of the shire with appropriate guidelines and flora species suggestions. It is recommended that an appropriate list of trees and shrubs that are locally endemic to the area are provided to residents prior to planting. A suggested planting list will offer residents local flora species options which will benefit the reserve by rehabilitating with local endemic flora species and aid in reducing the potential of adding more weeds species into the reserve. It is recommended that a list is developed as part of a management plan for the reserve.

8. CONCLUSION

A site survey at Mt Brown Reserve was undertaken in September 2019. During the site visit a majority of the vegetation within Mt Brown Reserve has been described as "Degraded" condition. Vegetation communities were broadly mapped and described by recording the dominant tree species and upper level flora species. The vegetation described on site can be categorised into three broad vegetation communities. The Granite Outcrops should be protected as important habitats on this reserve.

An adjustment on some of the current tracks, possibly increasing the width and the number of tracks may increase the use from walkers and reduce the conflict between different user groups of the reserve. Increasing the width of some of the tracks and applying additional tracks will also aid in immediate weed control by removing weeds, while the retention of the current narrow tracks can be utilised for mountain bikes.

Immediate weed control is recommended and undertaken over multiple years starting with small manageable areas. This will need to be followed through with a rehabilitation plan that uses local endemic species. To aid in weed control it is suggested to limit fire use and use fire as an opportunity to undertake weed control. A recommended species list must be provided to shire residents for the Tree Memorial area; to establish the local endemic species to be used on the site.

Due to the site being dominated by weed species with a very low diversity of native understorey, its recommended that a Level 2 Flora and Vegetation Assessment is not necessary, however there are number of recommendations that should be considered for future planning.

9. RECOMMENDATIONS

Based on the results of this assessment, Del Botanics proposes the following management recommendations:

- Implement a weed management plan;
- Prepare a rehabilitation plan;
- Prepare guidelines and flora species lists for the memorial planting area;
- Prepare a fire action plan and undertake a fire break maintenance program;
- Design a bush walk interpretive trail and add signage around the lookout and across the site;
- Upgrade of walking trails to better suit bush walkers;
- Retain current tracks as bike trails and promote events;
- Create protection zones for the Granite Outcrops; and
- Undertake a Threatened Ecological Community Assessment for *Eucalypt Woodlands of the Western Australian Wheatbelt*;

10. REFERENCES

Beard J. S. (1990). *Plant life of Western Australia.* Kangaroo Press, Perth.

Beecham, B (2001), *Avon Wheatbelt 2 (AW2 - Re-juvenated Drainage subregion*, Department of Conservation and Land Management

Burbidge, T (2018) *Environmental Field Assessment – Mt Brown*, unpublished.

Common Ground Trails (2018) *Trails Master Plan, Shire of York* 2019-2028, unpublished

Department of the Environment and Energy, (2019) Protected Matters Search Tool. https://www.environment.gov.au/epbc/protected-matters-search-tool

Department of the Environment (2017). Eucalypt Woodlands of the Western Australian Wheatbelt in Community and Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat. Accessed 2017-04-05T15:02:15AEST.

English, V. and Blyth, J. (1997). *Identifying and conserving Threatened Ecological Communities in the South West Botanical Province.* ANCA National Reserves System Cooperative Program, Project Number N702.

Heddle, E.M., Loneragan,, O.W. and Havel, J.J. (1980). *Darling Systems – Vegetation Complexes.* In: Atlas of Natural Resources Darling System, Western Australia. Department of Conservation and Environment, Perth.

NatureMap (2019) *Mapping Western Australia's Biodiversity* Department of Parks and Wildlife and the Western Australian Museum.

WALGA (2019) Environmental Planning Tool, http://walga.asn.au/Subscription-Services/Environmental-Planning-Tool.aspx.

Watson, T (2008), *Mt Brown Reserve Management Plan*, unpublished.

Weaving, S J. (1994), Native Vegetation Handbook for the Shire of York. Department of Agriculture and Food, Western Australia, Perth. Report.

Western Australian Herbarium (2019). *FloraBase - The Western Australian Flora.* Department of Parks and Wildlife

FIGURES

Figure 3: Mt Brown Reserve Vegetation Communities

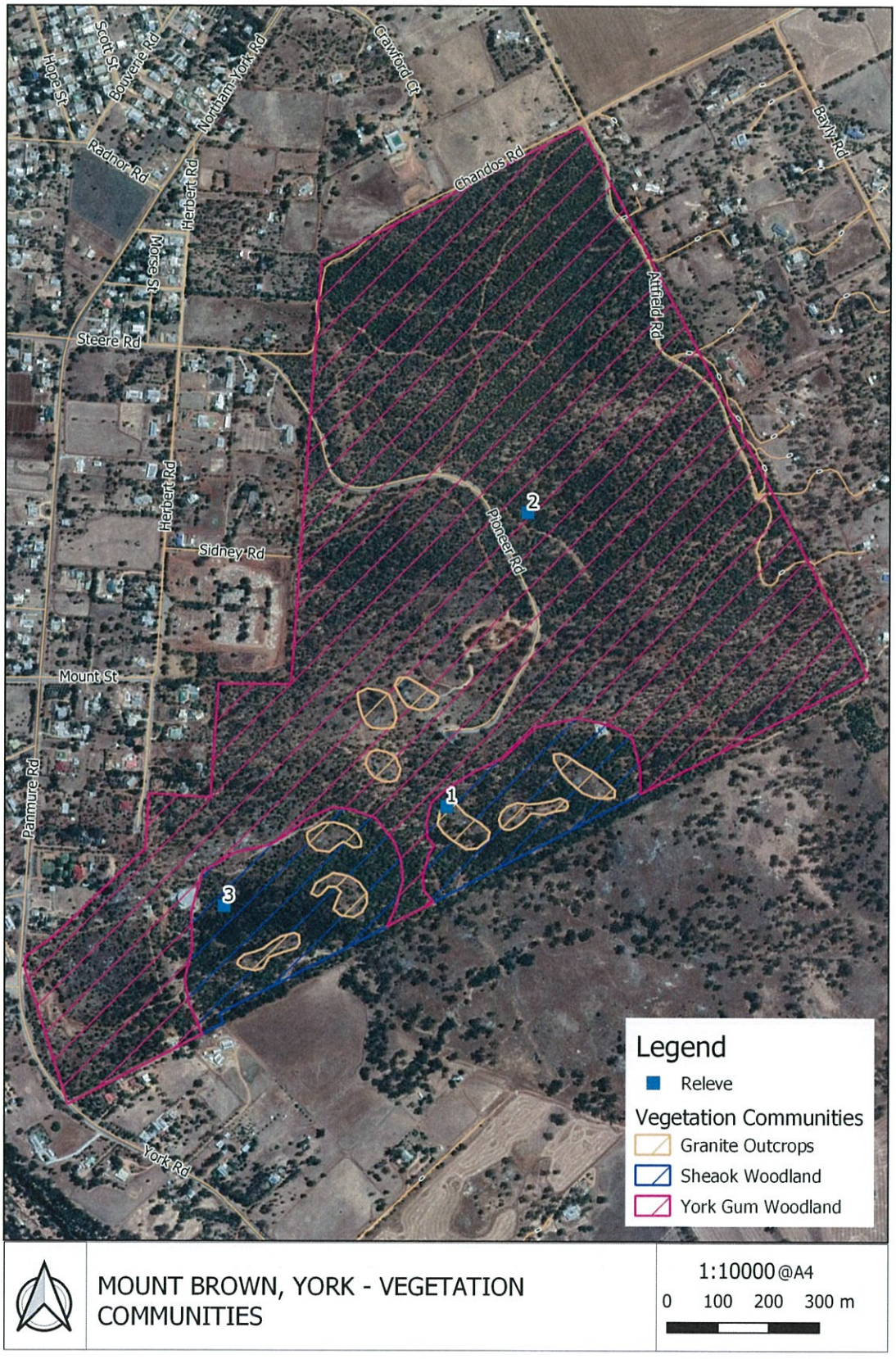
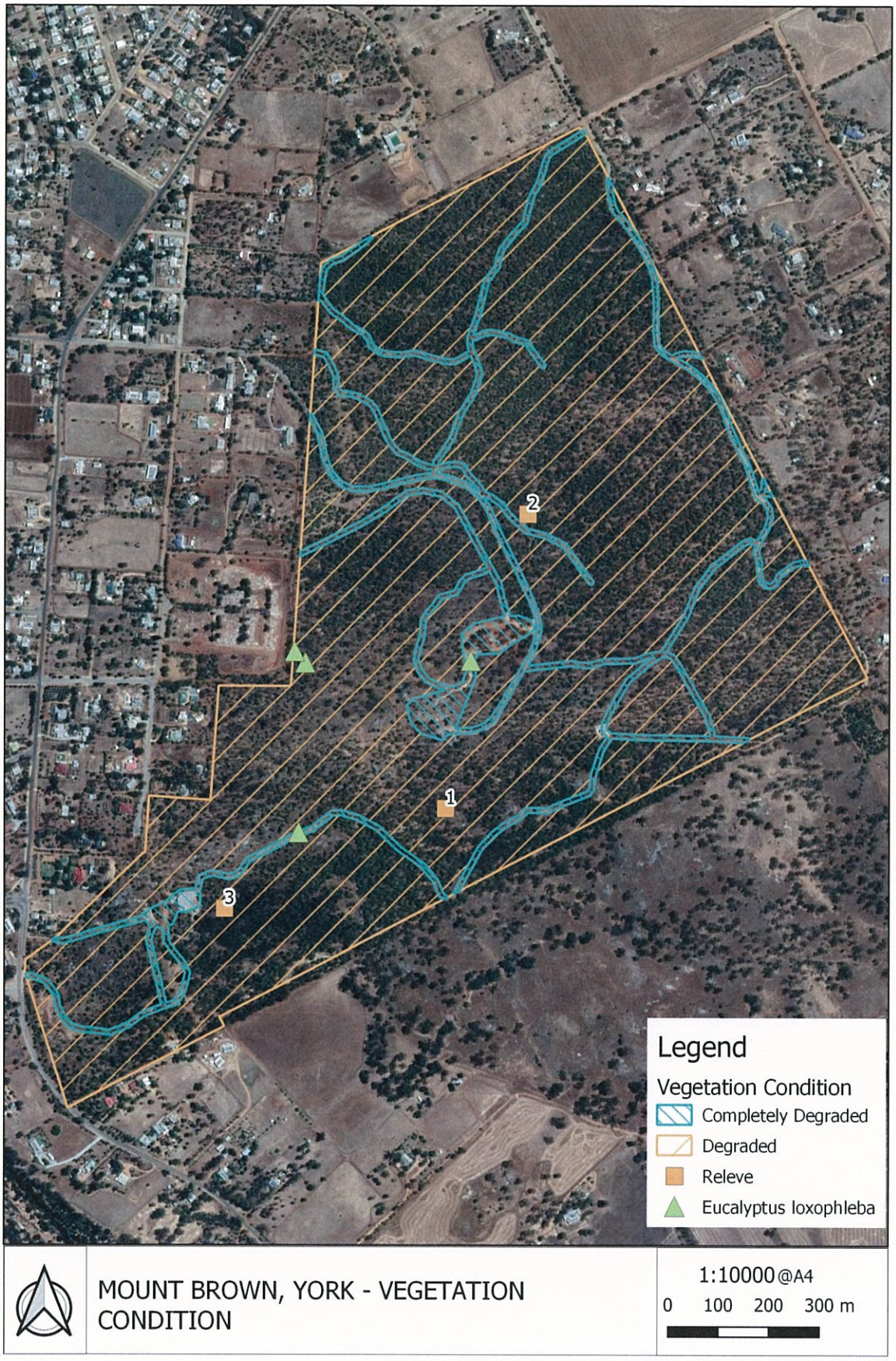


Figure 4: Mt Brown Reserve Vegetation Condition



APPENDIX A
FLORA SPECIES RECORDED

Appendix A: Flora species recorded at Mt Brown Reserve October 2019

Family	Genus/Species
Amaranthaceae	*Ptilotus sp*
Anacardiaceae	**Schinus molle*
Asparagaceae	*Dichopogon sp*
Asteraceae	**Arctotheca calendula*
	**Ursinia anthemoides*
	Podolepis lessonii
	Rhodanthe manglesii
	Waitzia ?nitida
Boraginaceae	**Echium plantagineum*
Boryaceae	*Borya* sp
Brassicaceae	**Raphanus raphanistrum*
Casuarinaceae	*Allocasuarina campestris*
	Allocasuarina huegeliana
Colchicaceae	*Burchardia congesta*
Dennstaedtiaceae	*Pteridium esculentum*
Droseraceae	*Drosera glanduligera*
	Drosera ?menziesii
Fabaceae	**Lupinus cosentinii*
	**Lupinus angustifolius*
	**Trifolium sp (pink)*
	Acacia acuminata
	Acacia microbotrya
Geraniaceae	**Erodium sp*
Hemerocallidaceae	*Caesia micrantha*
	Dianella revoluta
Iridaceae	**Homeria miniata*
	**Romulea rosea*
Malvaceae	**Brachychiton populneus*
Myrtaceae	*Eucalyptus loxophelba*
Oleaceae	**Olea europaea*
Orchidiaceae	*Caladenia flava*
Oxalidaceae	**Oxalis pes-caprae*
Poaceae	**Aira caryophyllea*
	**Avena barbata*
	**Briza maxima*
	**Bromus diandrus*
	**Ehrharta calycina*
	**Lolium sp*
	Austrostip sp
	Austrostipa elegnatissima
	Neurachne alopecuroidea
Pteridaceae	*Cheilanthes austrotenuifolia*
Solanaceae	**Lycium ferocissimum*

APPENDIX B
RELEVE DATA

Appendix A: Releve data recorded at Mt Brown Reserve October 2019

Del Botanics

FIELD SHEET – FLORA AND VEGETATION SURVEY
Level 1 Assessment

Job Code: Shire of York	**Date:** 30/09/2019	**Site:** Mt Brown Reserve

Location: 50 478674 6479674

Vegetation Description: York Gum Woodland

Vegetation Condition: Degraded

Observations: High weed cover, low species diversity, lack of structure

Taxon	Ht (cm)	% Alive	% Dead	% Cover
**Lupinus cosentinii*	30	100		20
**Avena barbata*	50	100		90
Acacia acuminata	600	100		10
Eucalyptus loxophelba	800	100		10
**Arctotheca calendula*	20	100		5

Del Botanics

FIELD SHEET – FLORA AND VEGETATION SURVEY
Level 1 Assessment

Job Code: Shire of York	**Date:** 30/09/2019	**Site:** Mt Brown Reserve

Location: 50 479237 6471643

Vegetation Description: Sheoak Woodland

Vegetation Condition: Degraded

Observations: High weed cover, low species diversity, lack of structure

Taxon	Ht (cm)	% Alive	% Dead	% Cover
Allocasuarina huegeliana	600	100		30
**Lolium sp*	50	100		80
**Avena barbata*	50	100		50

Del Botanics

FIELD SHEET – FLORA AND VEGETATION SURVEY
Level 1 Assessment

Job Code: Shire of York	**Date:** 30/09/2019	**Site:** Mt Brown Reserve

Location: 50 479674 6471840

Vegetation Description: Granite outcrop

Vegetation Condition: Degraded

Observations: High weed cover, low species diversity, lack of structure

Taxon	Ht (cm)	% Alive	% Dead	% Cover
Rhodanthe manglesii	20	100		10
Lichens		100		20
**Avena barbata*	50	100		20
Mosses		100		10
Borya sp	15	100		15