EPA REFERRAL
NOVA NICKEL PROJECT
SUPPORTING DOCUMENT 2014

PREPARED FOR:

SIRIUS GOLD PTY LTD

JUNE 2014

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NOVA NICKEL PROJECT
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1. INTRODUCTION

1.1 BACKGROUND

The Nova Project is a greenfields high grade nickel-copper deposit in the Fraser Range of Western Australia and is owned by Sirius Gold Pty Ltd (Sirius). Sirius aims to develop an underground mine to extract and process nickel and copper from two deposits, Nova and Bollinger.

This document has been prepared to support referral of the proposal to the Western Australian Environmental Protection Authority (EPA). The document is intended to inform and assist in determining the appropriate environmental assessment and approval pathway for the proposed project under Part IV of the *Environmental Protection Act 1986* (*EP Act*). The document describes the proposed project and the environmental setting, aspects and factors associated with the proposal.

The proposed project comprises:

- Underground mining of two deposits; Nova and Bollinger.
- Processing of ore.
- Construction of infrastructure necessary to allow development and operation of the project.

Sirius makes this referral recognising the potential for public interest in the proposal and to establish the requirements for environmental assessment and approval.

1.2 PROPONENT DETAILS

The manager and proponent of the Nova Project is Sirius Gold Pty Ltd (Sirius). Sirius is incorporated in Australia and has shares listed on the ASX. Sirius is the owner of all tenements associated with the Nova Nickel Project.

All compliance and regulatory requirements regarding this assessment document should be forwarded by email, fax, post or courier to the following address:

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1.3 LOCATION AND LAND TENURE

The Nova Project is located approximately 700 km southeast of Perth, 110 km east of Norseman and approximately 40 km north of the Eyre Highway (Figure 1). The site is currently accessed using a pastoral station track located adjacent to fence lines. This track will be utilised during construction. To enable operation of the project, a private road will be constructed from the Eyre Highway to the project area.

The project is predominantly located on Unallocated Crown Land, with about a third of the Mining Lease Application (MLA 28/376) located within the boundary of the Fraser Range Station Pastoral Lease and approximately 8 km of the access road corridor located on the Southern Hills Pastoral Lease (Figure 2).

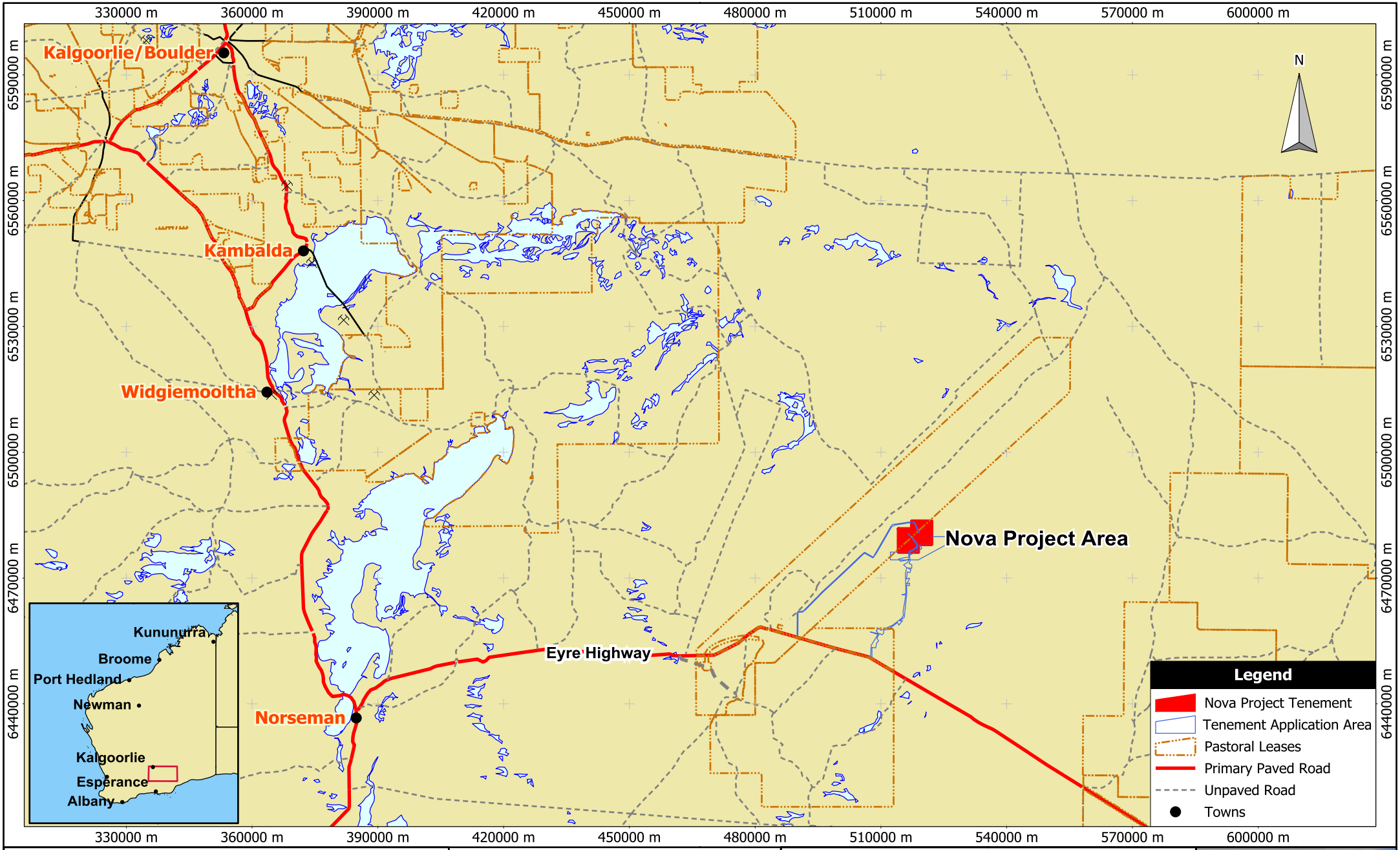
The Nova Project consists of one MLA 28/376 totalling 4,666 ha which has yet to be granted. Applications will be made for Miscellaneous Licences for the access road corridors, borrow pits, the accommodation village and the airstrip. In mid-May 2014, the Goldfields Land and Sea Council advised that the Ngadju claim group, who are the traditional custodians of the land covering the Nova Project, have agreed to provide the necessary consent for the grant of Mining Lease M28/376 subject to Sirius and the Ngadju Group entering into a binding and definitive agreement on the material terms proposed by Sirius in April 2014. It is anticipated that the definitive agreement will be finalised by mid-2014. Grant of tenure for the Mining Lease and Miscellaneous Licences cannot occur until Native Title Agreement is finalised.

1.4 PROJECT SCHEDULE

The proposed schedule for the Nova Project is described in Table 1.

Table 1: Proposed Project Schedule

Description	Scheduled Start Time
Obtain Mining Lease	Pending Native Title
Undertake Definitive Feasibility Study	Q1-Q2 2014
Undertake Permitting	Q2-Q3 2014
Commence Construction	Q4 2014
Underground Mine Development	2015
Production Ramp Up and Infrastructure	Q3 2016
Plant Construction	2015
Stoping	2016
Processing	2016



Scale: 1:1200000
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0 30 km

Sirius Gold Pty Ltd
Nova Project

Figure 1

Location Plan

4 Cook St
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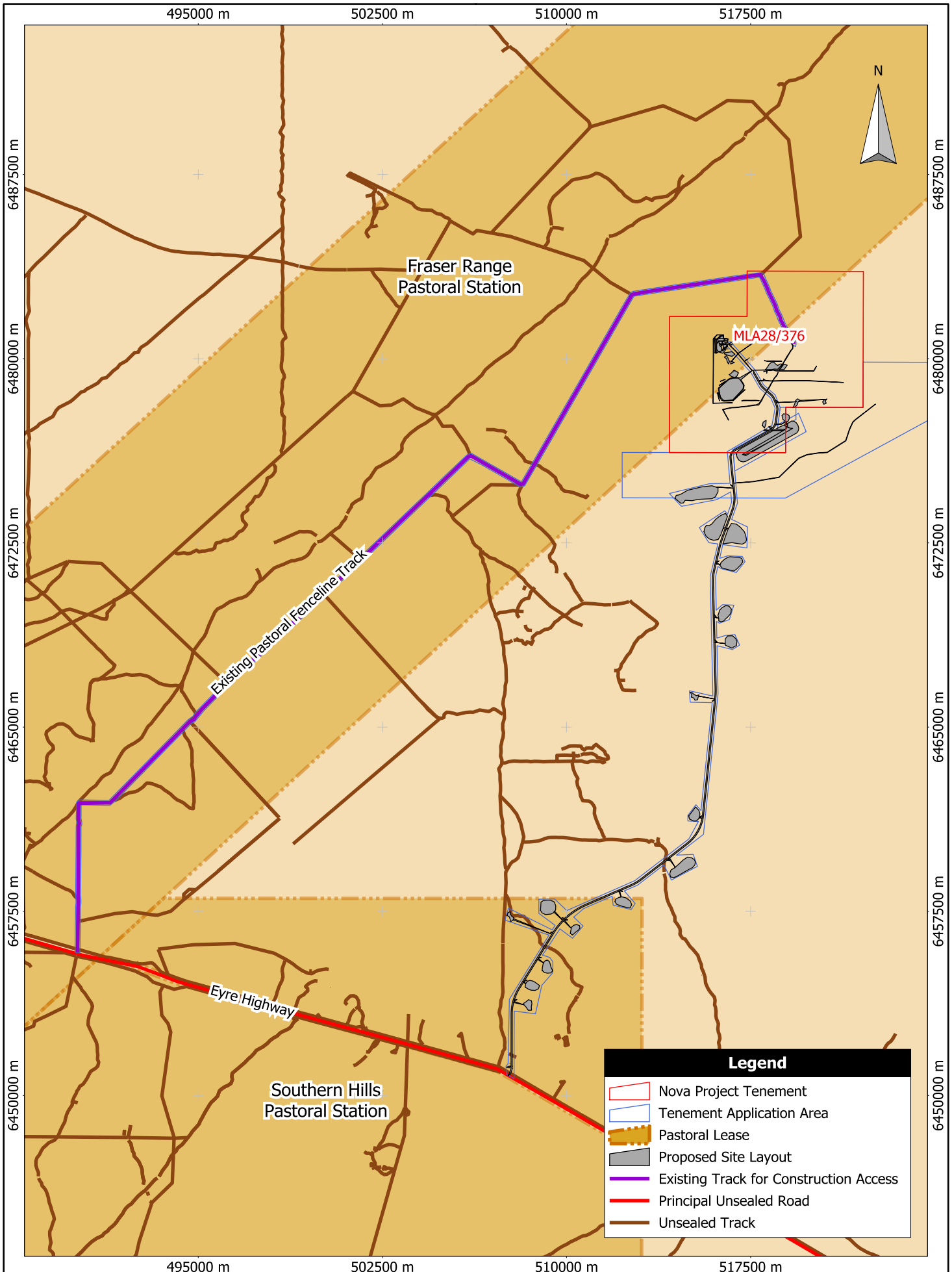
W:\Sirius Resources\Drawings\LocationPlan.map 19/06/2014 F1 Location Plan



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0 4 km

Sirius Gold Pty Ltd
Nova Project

Figure 2

Land Tenure for Nova Project

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2. PROJECT DESCRIPTION

2.1 PROJECT OVERVIEW

The Nova Project is a deposit of high grade nickel and copper in the Fraser Range area of Western Australia. A Scoping Study was completed in September 2013 to consider a number of alternatives for development of the project. The outcomes of the Scoping Study are being further examined with a Definitive Feasibility Study (DFS) due for completion in mid-2014.

Sirius aims to develop an underground mine to extract and process nickel and copper from two deposits, Nova and Bollinger, with access to the deposits via a single decline. Ore will be processed using conventional flotation techniques to produce two concentrates (nickel sulfide and copper sulfide).

In addition, the project will involve the construction and use of:

- A borefield for water supply.
- Access road.
- Support infrastructure, including an accommodation village, workshops and laydown areas, offices, stormwater management infrastructure (bunds and drains), water storage and evaporation ponds, telecommunications infrastructure, diesel power supply and an airstrip.

Mineral concentrates will be trucked along a private access road to the Eyre Highway, and then along public roads to the Port of Esperance.

The conceptual site layout is shown in Figure 3, with Figure 4 showing detail around the mining infrastructure area.

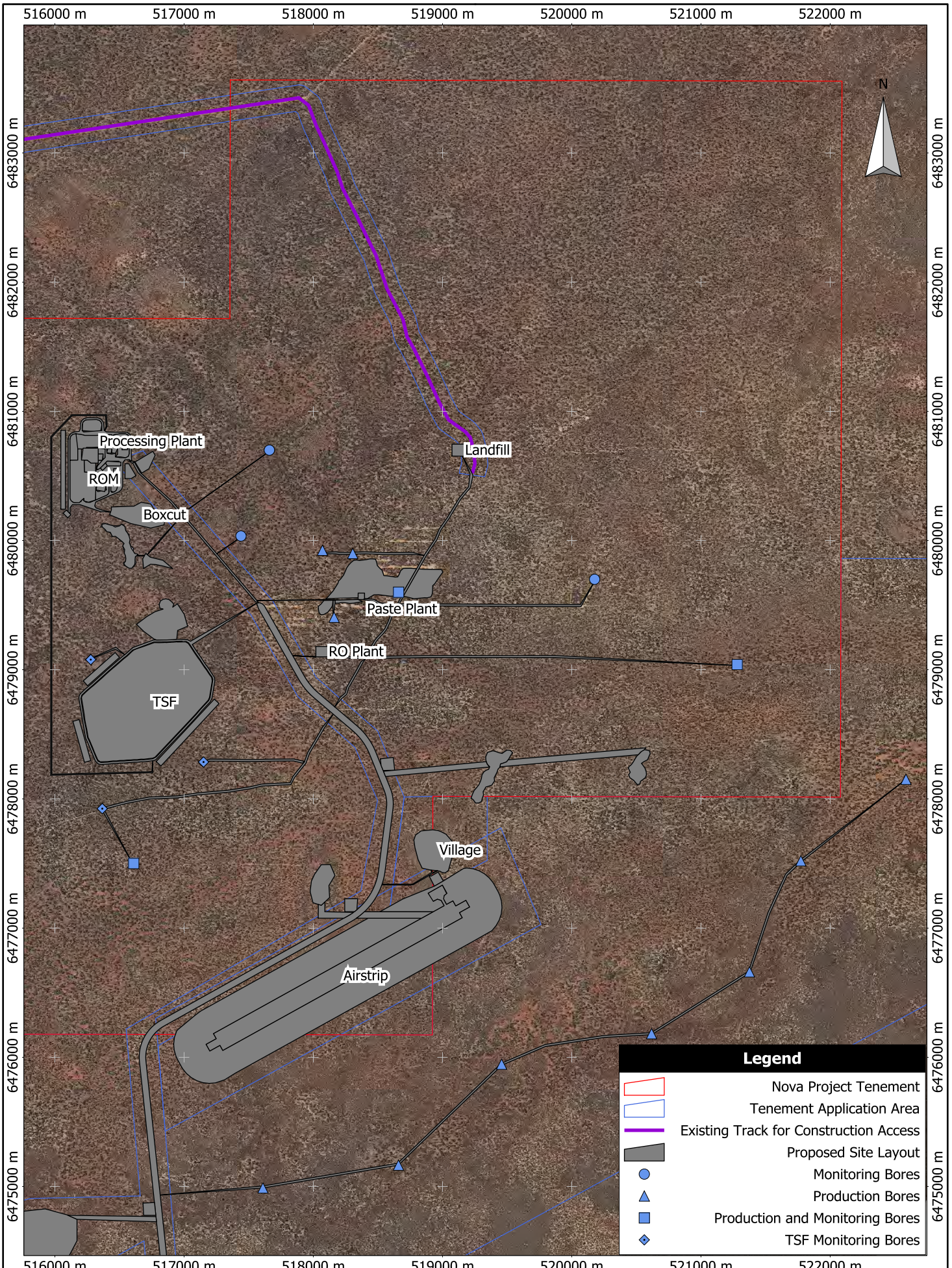
The project life is estimated to be 12 years from the commencement of construction; however exploration is ongoing and extension of the project life is considered highly probable.

Key characteristics of the project are provided in Table 2.

Table 2: Nova Project Key Characteristics

Characteristic	Description
Life of Project	12 years: 2 years construction and 10 years operations
Project Footprint	~ 1,100 ha
Mining Method	Underground – open stoping
Extraction quantities: • Ore • Underground Waste Rock • Total	 15 Mt over 10 years 2 Mt over 12 years 17 Mt over 12 years
Ore Processing	Flotation – 1.5 Mt/a (nominal) 431,500 dry metric tonnes (dmt) copper concentrate total mine life 1,750,000 dmt nickel concentrate total mine life
Operation Time	24 hours, 7 days a week.

Characteristic	Description
Tailings	Total Volume Produced = 11.7 Mt Pastefill = 5.2 Mt (44.4 %) Tailings Storage Facility (TSF) = 6.5 Mt (55.6%)
TSF	Engineered lined TSF, Sub-aerial deposition Volume = 6.5 Mt Footprint = 66 ha Height = 13.5 m
Access Road	40 km at 50 m wide corridor
Water Balance *Construction Phase:* • Mine Dewatering Input Year 1 • Mine Dewatering Input Year 2 *Production Phase:* • Annual Average Demand • Mine Dewatering Input • External Borefield Input	 3,784,320 t/a (average 120 L/s) 2,838,240 t/a (average 90 L/s) 1,892,160 t/a (maximum 60 L/s) 1,576,800 t/a (on average 50 L/s) 315,360 t/a (maximum 10 L/s)
Power Supply: • Unit Type • Quantity • Output • Fuel Consumption	 Diesel generator sets Approximately 10 units 12 MW (each 1,500 KW continuous) running at 1,500 RPM. Approx. 250 L diesel fuel per unit per hour.
Accommodation Requirements • Construction Peak • Construction Average • Operations	 500 people 400 people 400 people



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Sirius Gold Pty Ltd
Nova Project

Figure 3

Conceptual Site Layout

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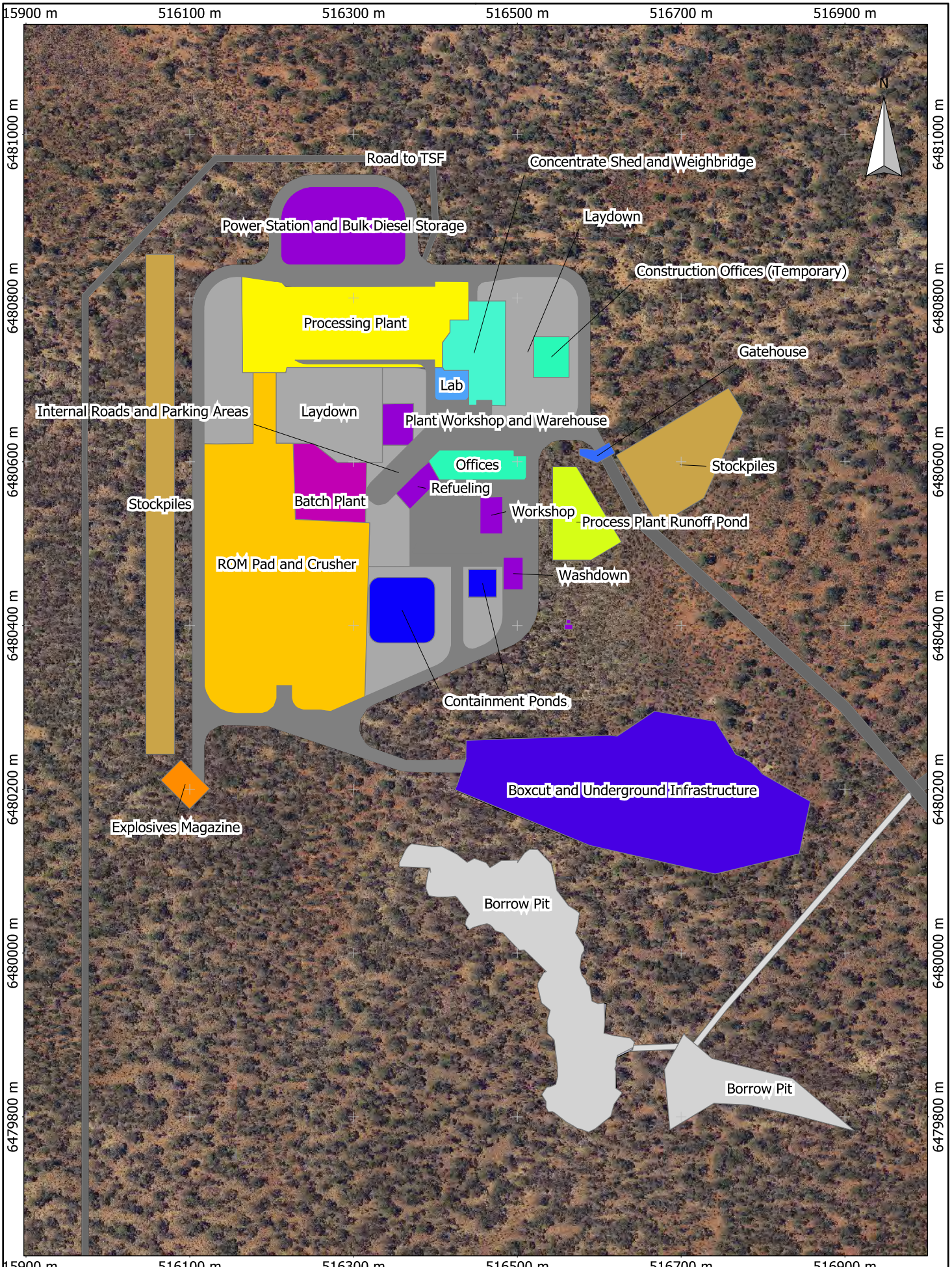


Scale: 1:6000 Original Size: A4 Air Photo Date: 2012 Grid: Australia MGA94 (51) 0 200 m	Sirius Gold Pty Ltd Nova Project	**Figure 4** **Site Layout** **Mining Infrastructure Area**	Martinick Bosch Sell Pty Ltd 4 Cook St West Perth WA 6005 Ph: (08) 9226 3166 Fax: (08) 9226 3177 info@mbsenvironmental.com.au www.mbsenvironmental.com.au MBS ENVIRONMENTAL

W:\Sirius Resources\Drawings\EPA Referral\Site Layout (EPA).map 19/06/2014 Conceptual Site Layout (Processing area) Layout

2.2 PROPOSED LAND DISTURBANCE

Land disturbance required for implementation of the project will be located in the MLA and miscellaneous licences to be obtained for the access road and borefield. Estimated total land disturbance is 400 ha for the project and 700 ha for the access road and borrow pits. About 560 ha will be short term disturbance only for borrow materials for the project. Indicative land disturbance for key components of the project are shown in Table 3.

Table 3: Estimated Land Disturbance for Key Project Components

Component	Estimated Disturbance Area (ha)
Airstrip	34.0
Boxcut and Underground Infrastructure	5.4
Clearing Associated with Airstrip	111.5
Clearing Associated with Borrow Pits	552.2
Containment Ponds	0.7
Explosives Magazine	0.2
Gatehouse and Office	0.1
Landfill	1.0
Laydown Areas	6.0
Concentrate Shed and Weighbridge	0.7
Offices and Laboratory	0.8
Paste Plant and Batch Plant	1.0
Processing Plant	2.6
Processing Plant Runoff Pond	0.7
RO Plant	0.9
Roads	213
Roads and Parking Areas around infrastructure	7.6
Rom Pad, Crushing Area and Access Ramp	5.5
Stockpiles	10.0
TSF	65.6
Village	8.0
Workshops, Fuel Infrastructure, Power Infrastructure and Washdown Area	2.0
Total	**1,029.5**

2.3 MINING

The Nova-Bollinger orebody is located about 450 m below ground level dipping to the southeast. Nova is a polymetallic nickel copper cobalt deposit with all ore planned to be extracted contained in fresh rock. Ore will be accessed via a single boxcut and decline. Ore will be mined using conventional long hole open stoping techniques. Stopes will be backfilled with waste rock and paste fill produced from tailings.

Ore production will be 1.5 Mt/a. This is anticipated to be achieved by Year 3 after completion of decline development and will continue to Year 12 where production will drop to about 900,000 t/a unless further resources are identified.

Ore will be mined to a depth of approximately 450 m. A cross section of the Nova and Bollinger orebodies and underground mine is shown in Figure 5.

The mine will be accessed by a decline portal located in a purpose built boxcut. The boxcut will be developed to a depth of approximately 45 m. The location of the boxcut is significantly constrained by the need to locate it within material of sufficient geotechnical stability and limit exposure to cross cutting faults and fractures and minimise groundwater inflows.

The decline will be 5.5 m wide with a height of 5.8 m with a gradient of 1 in 7. Ore will be brought to the surface by truck and transferred to the Run-Of-Mine (ROM) Pad.

Underground areas will be ventilated via a dual intake and single exhaust system. Ventilation exhaust fans will be located on the surface.

Water inflows to the Nova underground mine will include groundwater and mine service water used in various mining activities such as drilling, washing down and dust suppression. A dewatering system will be installed underground to transfer water to the surface to allow safe mining operations.

Small volumes of sulfidic ore the decline development and from Nova will be stored in temporary stockpiles on the ROM pad prior to completion of the Processing Plant.

2.4 ORE PROCESSING

Ore will be processed using conventional flotation technology to produce both a nickel and copper sulfide concentrate. The Processing Plant will be located onsite in close proximity to the boxcut and ROM Pad.

The onsite Processing Plant will treat approximately 1.5 Mt/a of ore to produce two final products (nickel and copper concentrates) and a tailings stream. Tailings will be thickened and either used for paste fill of underground mine voids or disposed of to an above ground Tailings Storage Facility (TSF).

The ore processing circuit will comprise the following unit processes:

- Primary crushing.
- Coarse ore stockpile.
- SAG and Ball Mill comminution circuit.
- Flotation circuit consisting of three stages:
    - Copper rougher flotation cells.
    - Nickel rougher flotation cells.
    - Pyrrhotite scavenging cells.
    - Nickel scavenging cells.
- Nickel and copper concentrate thickeners, filters and storage shed.
- Flotation tailings thickener and disposal pumps.
- Services and reagents.

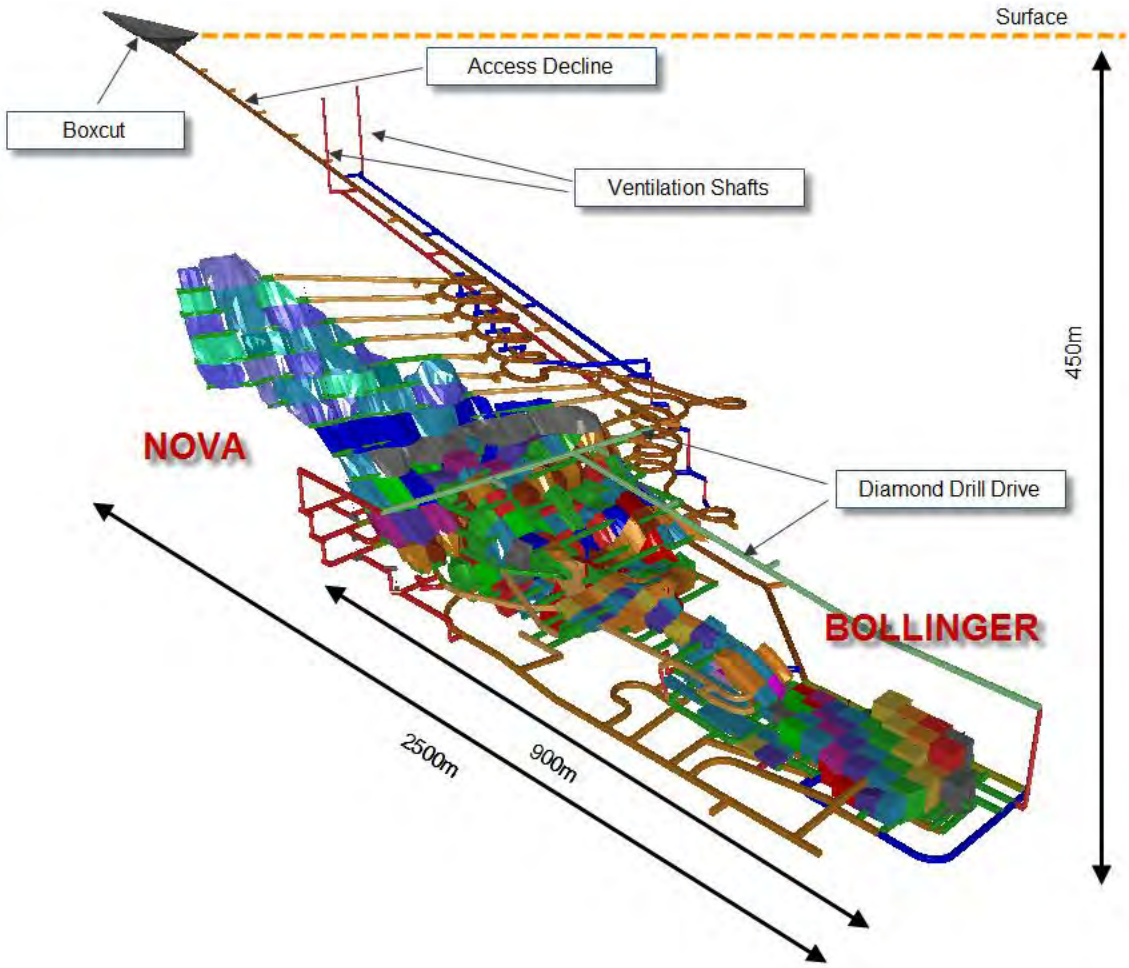


Figure 5: Cross Section of Underground Mine

Reagents likely to be used during ore processing include lime (hydrated), sodium sulfite, sodium silicate, PAX (Potassium Amyl Xanthate), flocculent, TETA (Triethylene tetramine), MIBC (Methyl isobutyl carbinol – frother), Aerophine and Aeropromoter. All reagents will be sourced under bulk supply agreements with vendors who have a proven track record of supply to the mining industry.

Copper concentrate will contain about 22-25% copper with production of about 45,000 t/a anticipated. Nickel concentrate will contain about 13-15% nickel with production of about 180,000 t/a anticipated. Concentrate will be stored onsite in an enclosed shed prior to placement in sealed sea containers and transport off site.

2.5 PROJECT DERIVED WASTE MATERIALS

Waste products from the mining and mineral processing operations would include waste rock and tailings. Relatively small volumes of sewerage will also be generated in the accommodation village and office/workshop areas.

2.5.1 Waste Rock

Development of underground mining operations at Nova-Bollinger deposits is expected to provide significant amounts of waste rock in the following sequence:

- Excavation of a boxcut in mainly oxide waste rock. The proposed boxcut will extend to a depth of 45 m, requiring approximately 800,000 bank cubic metres (BCM) of material to be excavated.

- Development of the decline, generating relatively small volumes of oxide and transition zone waste and larger volumes of low sulfide hanging wall granulites, metasediments and gabbro.
- Development of the Nova orebody, generating relatively small amounts of slightly to moderately sulfidic wastes from both the hanging wall gabbro and footwall metasediments.
- Development of the decline between the Nova and Bollinger orebodies.
- Development of the Bollinger orebody, generating relatively small amounts of slightly to moderately sulfidic wastes from both the hanging wall gabbro and footwall metasediments.

Waste rock would be used in project construction (e.g. TSF embankments, ROM Pad base) and for stope fill. Results of waste characterisation will be used to determine the most appropriate use of waste rock (see Section 3.8). Potentially Acid Forming (PAF) materials will not be used for construction of the ROM Pad or external sections of TSF embankments.

2.5.2 Tailings

Studies indicate 11.7 Mt (dry) of flotation tailings will be produced over the life of the project. Tailings disposal options are likely to include a combination of the following:

- Formation of a paste from a portion of the flotation tailings for disposal into mined stopes underground. Approximately 57% of the flotation tailings mass (5.2 Mt) is likely to be disposed in this manner over the life of the project.
- Disposal of remaining flotation tailings (6.5 Mt) in a conventional surface TSF.

2.5.3 Sewage

Package sewage treatment plants will be installed at the accommodation village and office/workshop areas. Waste water from these systems will either be recycled or disposed of via evaporation or discharge to land.

2.6 TAILINGS STORAGE FACILITY (TSF)

A purpose built engineered TSF will be constructed for long term disposal of about 6.5 Mt of tails. The TSF will have a composite liner system incorporating a clay liner overlain by a synthetic liner. The footprint of the TSF will be about 66 ha and will be 13.5 m high for operational requirements.

The TSF will be designed and constructed under the supervision of a suitably accredited engineer and in accordance with industry standards and guidelines.

The design of the TSF considered a number of alternative locations. This took into consideration such aspects as:

- Avoiding geological faults and fractures.
- Suitable geotechnical conditions.
- Avoiding potential mineralised areas.
- Minimising total land and thus vegetation disturbance for the TSF footprint and associated pipelines.
- Proximity to the Processing Plant.
- Avoiding Priority Ecological Communities (PEC).
- Avoiding watercourses and areas of potential flooding.
- Avoiding heritage sites or areas of cultural importance to the Ngadju people.
- Avoiding impact on conservation significant flora and fauna.

- Minimising disruption to pastoral activities undertaken by the Fraser Range Station.
- Proximity to construction materials for use in embankments.

2.7 PASTE PLANT

A Paste Plant will be constructed to produce paste for backfill of underground voids. This will receive 5.2 Mt of flotation tailings from the Process Plant over the life of the project. Tailings will be mixed with other binding agents to form a stabilised backfill material. It will be located above the orebody to allow paste to gravity flow into mined stopes.

The Paste Plant will comprise of agitated storage tanks, slurry filters, binder storage and addition systems, a continuous paste mixer and independent water and air services. Binder will be brought to site in bulk, pneumatically transferred and stored in a purpose built silo.

2.8 WATER SUPPLY AND BALANCE

2.8.1 Water Source

Raw water will be supplied from underground dewatering from a botryoidal aquifer that overlies the main area of mineralisation (Figure 6). As a fractured rock aquifer, it is likely that large initial dewatering rates of around 90 L/s will be required, but these are expected to decline to 20 L/s by Year 10. Other fractured rock aquifers have been identified within MLA 28/376 with airlift yields in the order of about 5 to 20 L/s. To provide certainty of supply, additional make-up water will be sourced from a palaeochannel aquifer (southern borefield) immediately to the south of the MLA within a proposed Miscellaneous Licence application area.

Raw water typically has a Total Dissolved Solids (TDS) of 40,000 mg/L. A Reverse Osmosis Plant will be used to treat some of the raw water where higher quality water supplies are required (i.e. production of potable water supplies for the accommodation village and offices and for concentrate washing).

Recycling of water will be maximised to minimise the need for abstraction of raw water. Water will primarily be recycled from the TSF and thickeners.

2.8.2 Water Transfer Infrastructure and Storages

Water sourced from mine dewatering and the borefield will be pumped via dedicated pumps and pipes to a centralised water transfer station for distribution for the Reverse Osmosis Plant, the ore processing circuit and other points of use across the project.

Water storages for the project are likely to include a small Raw Water, Process Water and Fire Water storage within the Processing Plant area.

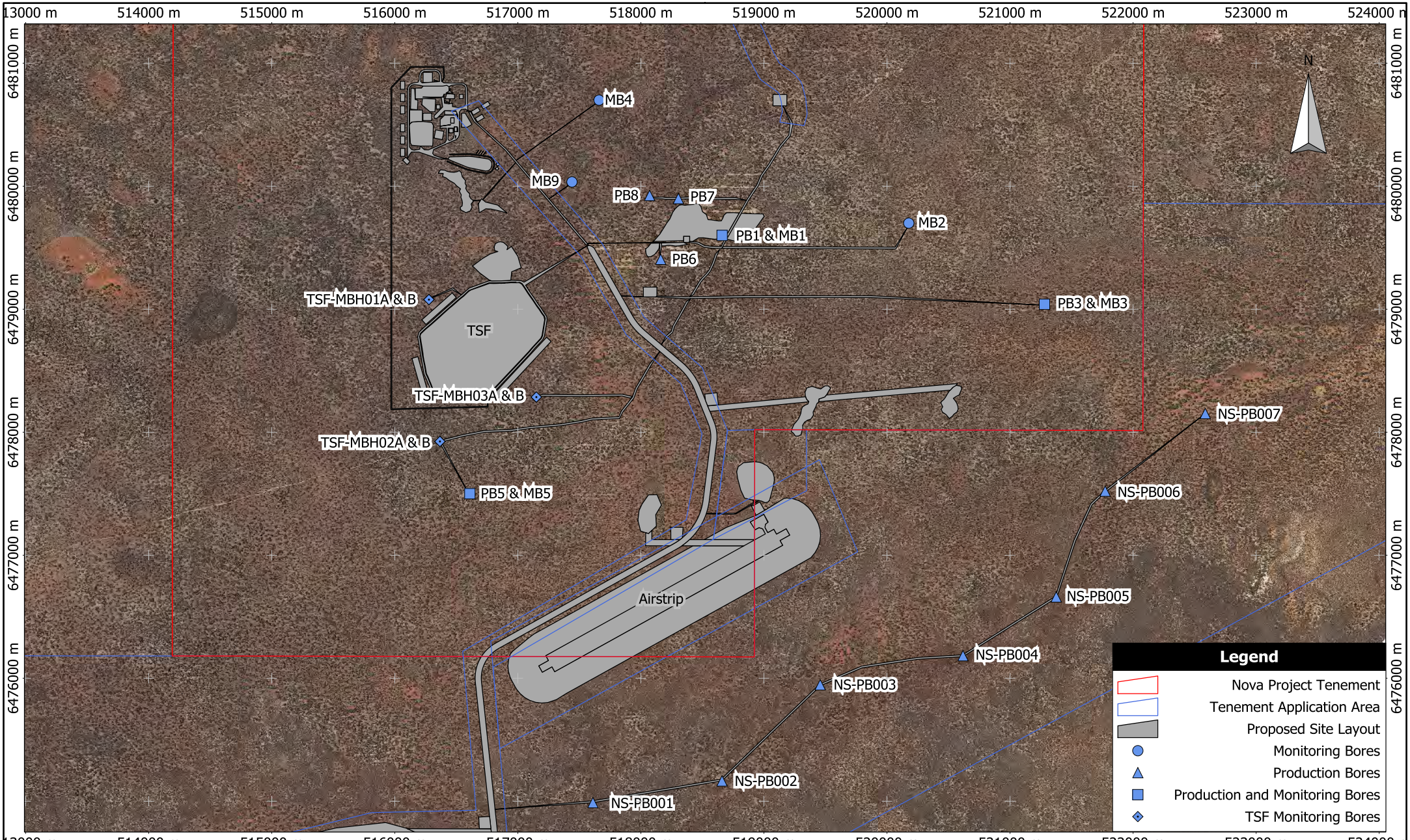
2.8.3 Water Balance

Water supply needs have been estimated to be about 50 to 70 L/s during operations. Construction water demand is estimated to be about 15 L/s. The water balance does not take into account return water pumping from the TSF as hydrological studies indicate that sufficient water will be supplied to the project by dewatering and borefield supplies.

The project is likely to have periods of excess water with a positive balance. Hydrogeological studies indicate excess water is likely in Year 1 when dewatering will occur to allow development of the boxcut, decline and initial open stopes. At this time during construction, water demand will be less than supply. Commissioning and steady

state operation of the Processing Plant will see a change to a negative water balance after the first year of operations. Excess water stored in the TSF will be consumed.

The water balance model considers all water sources and uses and evaluated the stored volume in the TSF. The water balance shows a net inflow for the first year of operations, then a net outflow for the remaining life of mine.



Scale: 1:40000
Original Size: A4
Air Photo Date: 2012
Grid: Australia MGA94 (51)

0 1000 m

Sirius Gold Pty Ltd
Nova Project

Figure 6

Location of Proposed Bores

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W:\Sirius Resources\Drawings\EPA Referral\Site Layout (EPA).map 19/06/2014 Location of Proposed Bores Layout

2.9 POWER SUPPLY

Power will be generated on site using diesel fuelled generators. The anticipated power station load is 12 to 14 MW. Overhead power lines will be installed to distribute 11 kV power to the:

- Paste Plant.
- Accommodation Village.
- Airstrip.
- Above ground transformers for underground electrical supplies.
- Office and workshop area.

Power line corridors will typically align roads and alongside established pipeline corridors to minimise vegetation disturbance.

2.10 SUPPORT FACILITIES

The support facilities that will be developed at the Nova Project are as follows:

- Offices.
- Laboratory.
- Equipment and vehicle maintenance facilities.
- Airstrip including fuel storage and terminal facilities. This will be constructed so it can be licensed by the Civil Aviation Safety Authority (CASA).
- Accommodation village (to support up to 400 workers).
- Communications infrastructure.
- Concrete batch plant for construction and ongoing underground ground support.

The location of support facilities has considered factors such as:

- Avoiding potential mineralised areas.
- Presence of PECs.
- Presence of conservation significant flora and fauna species.
- Watercourses and associated flood zones.
- Heritage sites.
- Prevailing wind directions (airstrip).
- Distances to other associated project items.
- Separation distances to protect human health.

2.11 SITE ACCESS AND MATERIALS TRANSPORT

2.11.1 Site Access

An access haul road will be constructed to connect the project to the Eyre Highway. Scoping Study investigations considered 11 potential routes prior to selection of the current proposed route. This took into consideration aspects such as:

- Minimising total land and thus vegetation disturbance.
- Minimising the number of watercourse crossings.
- Minimising road presence within areas of likely inundation during significant rainfall events.
- Avoiding heritage sites or areas of cultural importance to the Ngadju people.
- Avoiding impact on conservation significant flora. The route was amended to avoid Priority flora species identified during the Level 2 flora survey.
- Avoiding impact on conservation significant fauna. The route was amended to avoid Malleefowl mounds and to provide adequate buffer to these following the Level 2 fauna and Targeted Malleefowl surveys.
- Minimising land disturbance within the PECs. The existing Fraser Range Station Fenceline track currently used to access the exploration camp is located within the Fraser Range PEC. Upgrading this track to the level required for operations was not favoured after discussions with the Pastoral Station owner and Department of Parks and Wildlife (DPaW).
- Proximity to potential water resources to allow use of a single corridor for vehicle access, service access and water transport to the project area.
- Minimising disruption to pastoral activities undertaken by the Fraser Range and Southern Hills Stations.
- Locating the road nearby to where suitable construction materials were identified.
- Road user safety factors. This included such things as maximising line of sight, minimising blind corners or traversing difficult terrain.
- Safe intersection with the Eyre Highway.
- Land access agreements necessary to secure tenure for the corridor.

The proposed access corridor is the most direct access to the project area and minimises vegetation clearance. It does not directly impact on conservation significant flora or fauna species.

The access corridor will be used by all project traffic, importing supplies to the site and exporting concentrate. The current Fenceline track will be used for construction purposes and emergency access during operations only once the permanent access corridor has been constructed (Figure 2).

2.11.2 Concentrate Transport

Sirius has examined a number of product export options including export through the Ports of Esperance, Geraldton, Adelaide, Darwin and Kwinana. It has also considered sale of concentrate to the Nickel West concentrator in Kambalda for drying and blending with materials sent to the Kalgoorlie Nickel Smelter. At this point, export via Esperance Port is the preferred option due to proximity to the project and costs.

Concentrate will be transported in sealed top opening, half height sea containers (1.5 m height). These have been selected considering product loss, product handling, occupational hygiene and environmental issues associated with bulk transport of concentrates.

It is estimated that 12 road trains with double trailers will transport concentrate to Esperance Port daily. Concentrate will be trucked from the project along the access corridor. From here, concentrate will be transported on the following public roads:

- Approximately 135 km along the Eyre Highway to the intersection with the Coolgardie Esperance Highway.
- Approximately 200 km along the Coolgardie Esperance Highway to Esperance.
- Along the Port Access Corridor to the Port of Esperance.

All public roads from the point of exit of the project are classified primary distributors by Main Roads Western Australia with a Restricted Access Vehicles classification of Category 7 (triple road trains).

On arrival at the port or dedicated container storage area, truck drivers will unload the full containers and then load empty containers for the return trip to Nova.

Full containers will be trucked to the berth when a ship is present for loading. Ship loading will be undertaken using ship's cranes and a rotating container tipper within the ship's hold to minimise dust emissions.

2.12 FIRE MANAGEMENT

Sirius is working with the Department of Fire and Emergency Services (DFES) to conduct fuel sampling and develop fuel measurement techniques for the project area. This will involve sampling vegetation and converting that to an over dried weight fuel load. With this information and from research and prescribed burning recently conducted at the Tropicana Gold Mine, DFES will undertake prescribed burns on the site so that potential environmental damage from extreme and out of control wildfires is minimised and community and infrastructure is protected during the life of the project. There is a narrow window of opportunity to conduct prescribed burns of about two to three weeks per year on the average weather conditions. The first burns are proposed for July 2014.

3. EXISTING ENVIRONMENT

3.1 STUDIES AND INVESTIGATIONS

The following environmental studies have been undertaken at and around the Nova Project area:

- Hydrogeology (Groundwater Resource Management).
- Hydrology (JDA Consultants).
- Geochemistry:
  - Landform and Soils Characterisation (MBS Environmental).
  - Waste Rock Characterisation (MBS Environmental).
  - Tailings Characterisation (MBS Environmental).
- Ecological Studies:
  - Level 1 Flora Survey (Armstrong and Associates).
  - Level 1 Fauna Survey (Terrestrial Ecosystems).
  - Level 2 Flora Survey (Mattiske Consulting Pty Ltd).
  - Level 2 Fauna Survey (Rapallo Environmental).
  - Targeted Malleefowl Surveys (Rapallo Environmental).
  - Subterranean Fauna Survey (MBS Environmental).

3.2 REGIONAL SETTING

The Nova Project is located in the Goldfields-Esperance region of Western Australia. Unallocated Crown Land, reserves, grazing, tourism, exploration and mining are the major land uses of the region. Mining of gold and nickel is the most common activity in the area.

The Nova Project lies approximately 8 km to the east of the main Fraser Range ridge, which extends from approximately 130 km in a southwest to northeast direction with a maximum elevation of 570 m (Mt Pleasant). Topography within the Nova Project is almost flat to gently undulating, with elevations ranging from 290 to 310 mAHD.

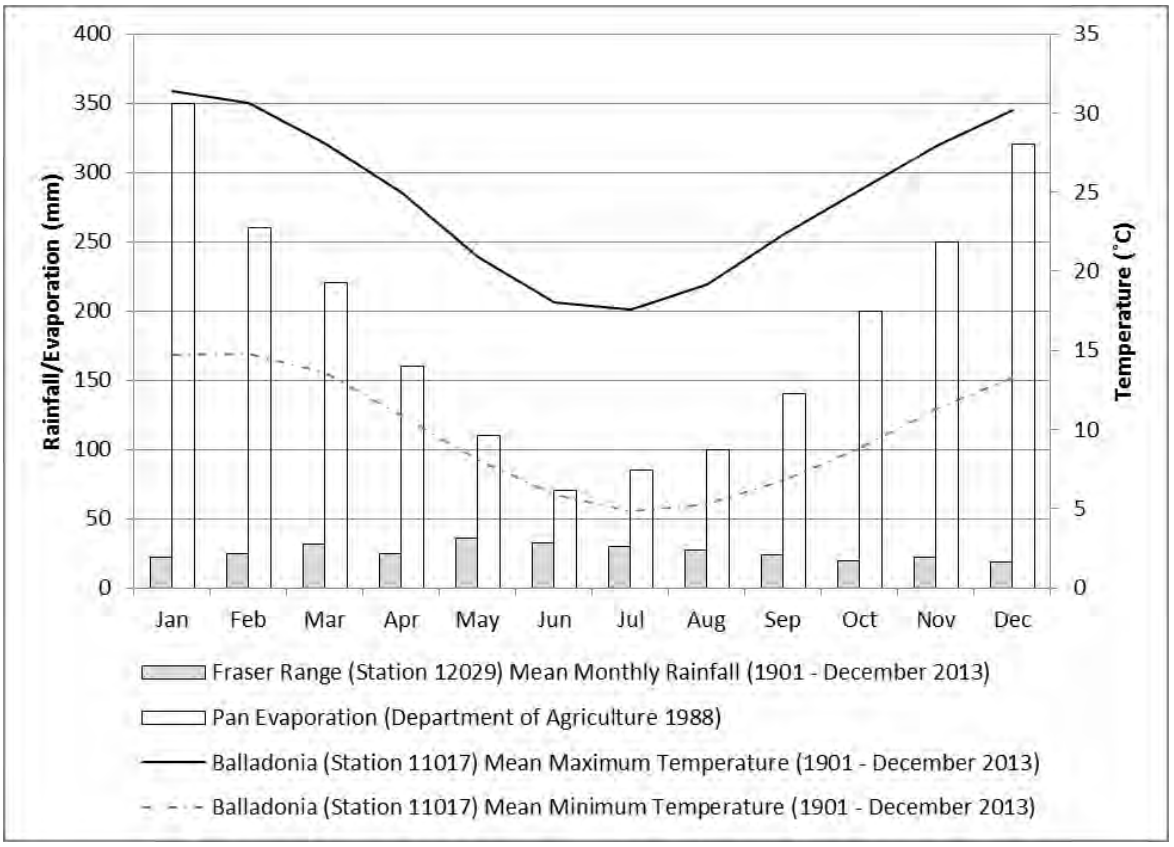
The Nova Project is located in the subregion of Coolgardie 1 Mardabilla of the Coolgardie Interim Biogeographical Regionalisation of Australia region. This subregion is a limestone plain over a granite basement, with red-brown loams and aeolian sands. The main vegetation in this subregion is Eucalypt woodlands over broom bush/greybush, blue bush and salt bush (Grant *et al*. 2002). To the immediate east of the project lies the Coolgardie 3 Eastern Goldfields subregion (Cowan 2001). The relief is subdued and comprises gently undulating plains with low hills and ridges of Archaean greenstones in the west and in the east by Proterozoic basic granulite. The underlying gneisses and granites have been eroded into a flat plain covered with tertiary soils and with scattered exposures of bedrock. Calcareous earths are the dominant soil group. A series of large playa lakes in the west are remnants of an ancient major drainage line.

3.3 CLIMATE

The climate of the Fraser Range area is semi-arid to arid with annual rainfall estimated to be about 315 mm (BOM 2014) and annual pan evaporation rates estimated to be above 2,000 mm based on the Department of Agriculture

(1988) as cited in JDA (2013). The average monthly evaporation is highest in the summer months from November to March. The maximum pan evaporation of 350 mm occurs in January. Erratic but intense rainfall periods can occur during the summer months of January to April due to the inland migration of tropical cyclones and low depression systems, although typically the highest average rainfall reports are in the winter months of May to July. Rainfall data has been collected at Fraser Range Station since 1901 and has been recorded up to December 2013 (BOM 2014) (Chart 1).

The hottest months are December through to February with the coolest months in June to August. Temperature data has been collected from the Balladonia Weather station, about 110 km east of the Fraser Range. Climatic data is shown in Chart 1.



Source: BOM (2014)

Chart 1: Climate at the Nova Project

3.4 GEOLOGY

3.4.1 Regional Geology

The Albany-Fraser province extends along the southern and southwestern margin of the Yilgarn Craton. It consists mainly of orthogneiss and granite but also includes large sheets of metagabbro (including the Fraser Complex), remnants of mafic dykes and widespread metasedimentary rocks. The orthogneisses are derived from Late Archaean and Palaeo- and Mesoproterozoic granitic rocks that were deformed and metamorphosed during Mesoproterozoic orogenic activity (Geoscience Australia 2001).

The province is composed of Archaean and Proterozoic rocks. Proterozoic intrusive activity was accompanied by metamorphism and deformation, and occurred in at least two events. The Biranup Supersuite probably intruded at around 1,700 to 1,600 million years ago, and is mostly composed of heterogeneous orthogneiss. The Nornalup

Supersuite appears to include granites intruded at two ages, approximately 1,300 and 1,190 million years ago. It is dominated by heterogeneous ortho- and paragneisses. There is insufficient detailed information to divide the Nornalup Supersuite into two suites as is indicated by these two distinct ages (Geoscience Australia 2001).

The Fraser Zone is dominated by metamorphosed mafic rocks, but also includes metamorphosed granitic and sedimentary rocks termed the Fraser Range Metamorphics. Much of the northern part of the Fraser Zone is obscured by overlying younger rocks of the Eucla Basin, but geophysical data shows that it is an approximately 425 km long, northeast trending, fault-bounded domain that is up to 50 km wide.

3.4.2 Local Geology

The Nova Project consists of two deposits, Nova and Bollinger. The project site is overlain with a thin (between 0 and 35 m) cover of surficial materials ranging from clay to sands. A sequence of saprolite clay lies under this layer and is less than 50 m in depth. Meta-sedimentary units intruded by a sequence of mafic (trending to ultramafic) gabbro composes the basement geology. This gabbro hosts the mineralisation of the Nova and Bollinger deposits; however, there are large areas of un-mineralised gabbro that form sections of the hanging wall units at the east of the deposits.

Surface outcrop at Nova is limited, but not completely absent. Much of the gabbroic sequence within a feature described as the "Eye" is effectively subcropping beneath a thin (less than 2 m) surficial cover of silty calcareous soil and the Nova orebody has a small outcrop of weathered, gossanous gabbro.

There is also a system of palaeochannels that become extensive to the south and southwest of Nova, which can be up to 90 m thick.

The host rocks of the Nova deposit consist of a suite of meta-gabbroic to meta-picrite cumulates that have been metamorphosed to a high metamorphic grade. These units are interpreted to have been emplaced as layered sills in an extensional sedimentary basin during the late stages of breakup of continental crust and formation of a volcanic passive margin, akin to the modern East Greenland margin. Several discrete lithological units can be distinguished in drill core samples.

The deposit is situated on the northwestern side of the 'Eye'. The strike of the "Eye" is approximately 50º, which corresponds with the regional strike of the Fraser Range Metamorphics. Some areas of the basal mineralisation (Lower Breccia) at Nova have been subject to significant strain. Some transposition is evident and is interpreted to be a north northwest verging thrust fault environment with evidence of drag folding observed within the core.

The Nova deposit steeply dips (-65º to -80º) to the southeast at the southwestern margin, but further to the northeast and east the dip shallows considerably to less than -20º. Bollinger abuts Nova to the immediate east and is generally shallow to flatly dipping. Dimensions of the Nova-Bollinger deposit are approximately 450 m (north) by 900 m (east) and it is located approximately 450 m below topography at its deepest point.

Nickel-copper mineralisation at Nova consists of a primary assemblage of pyrrhotite (FeS), pentlandite ((Ni, Fe)S) and chalcopyrite ($CuFeS_2$), with small amounts of magnetite (Fe_3O_4) and garnet. Pyrrhotite is the dominant sulfide mineral, often forming a mosaic of interlocking crystals. Pentlandite stringers often separate and cross cut pyrrhotite crystals, and are usually 1 to 20 mm wide and relatively short in length (5 to 30 cm). Chalcopyrite mineralisation can form either in patches or be hosted in veins segregated within and peripheral to massive and disseminated ores.

Several styles of mineralisation have been identified at Nova within a variety of host lithologies and structural positions. A schematic cross section of the Nova-Bollinger Deposit is shown in Figure 7.

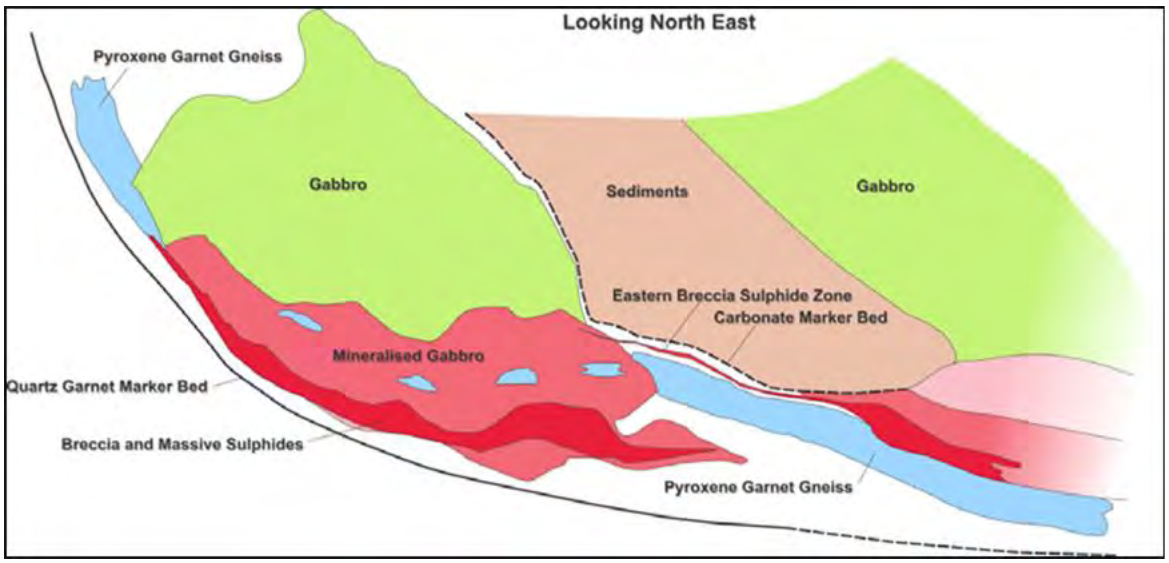


Figure 7: Cross Section of Nova-Bollinger Deposit

3.5 HYDROGEOLOGY

The project area is characterised by low relief and east to southeast draining palaeodrainage systems, underlain by deeply weathered Archaean sequences. Groundwater typically occurs in surficial aquifers forming part of the palaeochannel sequence and in fresh and weathered fractured rock aquifers.

Groundwater is recharged by direct rainfall infiltration or by stream flow during episodic rainfall events. Recharge occurs mainly on or adjacent to the catchment divides, beneath which there are corresponding subdued groundwater divides. Groundwater moves from these divides to discharge into salt lakes along the palaeodrainage in the region. In the salt lakes the groundwater is evaporated and concentrated to brine, which then descends and moves downstream in the palaeochannel sand to eventually discharge into the Eucla Basin (GRM 2013).

Large, fresh groundwater supplies are rare, but larger supplies of brackish to hypersaline groundwater are obtainable from the palaeochannel sequences, calcrete and within the Nova area from site specific shear zones or deeply oxidised zones in the fractured rocks (Sirius Resources NL 2013).

Initial drilling and testing indicated the presence of two primary aquifers within the Nova Project lease area (Figure 8). These are identified as:

- Botryoidal aquifer.
- Discrete fractured rock aquifer.

The Botryoidal aquifer is a fractured rock aquifer that overlies the main area of mineralisation and was initially considered to be laterally extensive with its base at around 200 m below surface. Two dewatering bores have been installed within this aquifer (PB1 and PB6).

Cross-cutting this aquifer and extending potentially across the entire Nova lease area are sub-vertical discrete fractured rock aquifers. These aquifers have been intersected at a range of locations both some distance from the mineralised area and along the proposed decline route.

Groundwater salinities in the province typically range from about 1,000 to 300,000 mg/L TDS. Salinity is lowest along the groundwater divides and increases towards the salt lakes (GRM 2013). Groundwater investigations are still ongoing; however salinity from samples within the project area range from 37,000 to 42,000 mg/L TDS, meaning the groundwater is hypersaline.

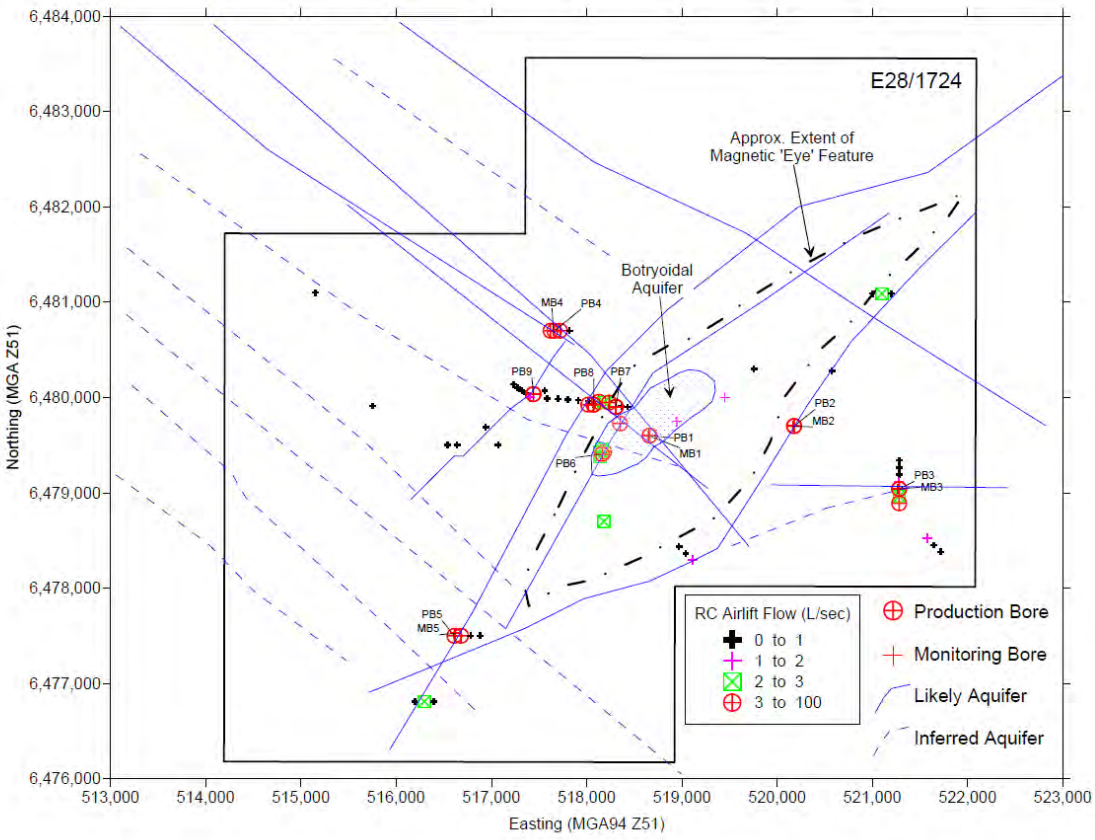


Figure 8: Groundwater Aquifers

3.6 HYDROLOGY

JDA Consultant Hydrologists were commissioned by Sirius to assess the hydrology and flood characteristics of the Nova Project and surrounds to assist with planning of mine infrastructure. There are no defined rivers, creeks or watercourse within the Nova Project area.

Modelling shows that runoff from the Fraser Range drains in a northeast direction, flowing to the south of the Nova Project. Runoff from the Nova Project joins this channel adjacent to the eastern boundary of the project area. In the central eastern section of the study area there are a number of small depressions which drain local catchments. In the southeast of the project area are a number of large catchments which drain to a series of depressions (probably salt lakes) (JDA 2013). The location of ephemeral watercourses in and adjacent to the project area is shown in Figure 9.

The catchment hydrology and runoff hydraulics were assessed for the 10, 20, 50, 100 and 500 year Average Recurrence Interval (ARI) events. Modelling results were used to map the flood extent, depth, peak levels and flows across the Nova site.

At 20 year ARI events, the drainage system is discontinuous with many separate ephemeral drainage lines which only become continuous in higher rainfall events. There are many areas where water ponds and these become trapped low points in the catchment. In these areas water will be trapped and will eventually evaporate or infiltrate.

The 100 year ARI flood mapping shows that flow is maintained within flow channels and there is little breakout of flows. Large sections of the wider regional study area are unaffected by flood flows, other than shallow, localised overland runoff, which can be managed. This applies within the project area also.

For more frequent events, the rainfall loss model recommended by Australian Rainfall and Runoff for this region results in no runoff for all events up to the 10 year ARI event. This loss model was been confirmed against regional stream gauged catchments. Based on rainfall records for the study area, runoff will only have occurred once every 2.5 years since 1995, though most of these events have been less than the 20 year ARI event, where peak flows are generally less than 5 m^3/s. When JDA had compiled this report, only one event, in 2011, exceeded the 50 year ARI event (JDA 2013). Since this time, the Balladonia Station (approximately 110 km from the Nova Project) received 128 mm of rain in January, when the mean rainfall for January is 19.7 mm (BOM 2014).

Scale: 1:130000
Original Size: A4
Air Photo Date: 2005
Grid: Australia MGA94 (51)
0 5000 m

Sirius Gold Pty Ltd
Nova Project

Figure 9

Location of Ephemeral Watercourses for the Nova Project Area

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MBS ENVIRONMENTAL

W:\Sirius Resources\Drawings\EPA Referral\Sirius Resource Baseline.map 19/06/2014 F9. Ephemeral Streams Layout

3.7 LANDFORM AND SOILS CHARACTERISATION

MBS Environmental (MBS) was commissioned by Sirius to undertake a landform and soil characterisation. This study included the description of soil profiles from 15 unused exploration drillhole sumps within 2 km of the centre of the project area. Both topsoil and subsoil samples underwent a series of physical and geochemical tests.

According to Department of Food and Agriculture (DAFWA 2006) soil and landscape mapping, the project is located within the Kambalda Zone of the Kalgoorlie Province. The Kambalda Zone is characterised by flat to undulating plains, with hills, ranges, salt lakes and stony plains, on mafic (greenstone) and granitic rocks of the Yilgarn Craton. Soil types comprise calcareous loamy earths and red loamy earths with associated salt lake soils, red-brown hardpan, shallow loams and red sandy duplex soils.

Low resolution soil mapping by the Australian Soil Resource Information System (ASRIS 2014) identifies the main soil types belonging to the Australian Soil Classification order of calcarosols. As the name suggests, calcarosols are calcareous throughout the profile, typically with high contents of pedogenic carbonates in the subsoil.

Test results showed that the soil in the project area is associated with two soil groups according to the DAFWA (2006) categorisation:

- Alkaline red shallow loamy duplex. Red surface layer over alkaline subsoil. Texture contrast at less than 300 mm depth.
- Calcareous shallow loam which is calcareous throughout the profile (MBS 2014a).

Alkaline red shallow loamy duplex soils are present as alluvial deposits within broad valleys of the project area. They are characterised by red-brown friable clay-loam topsoil with very little gravel overlying sub-plastic to plastic red clays. Soil pH values are alkaline throughout the profile. The shallow topsoil is generally friable, non-saline and has a low to moderate nutrient status. The underlying red clay subsoil is saline and sodic.

Calcareous shallow loam soils occur mainly on gentle slopes and crests of low hills within the project area. Topsoils are typically shallow silty to clayey loams and have a higher gravel content, mainly as calcrete pebbles, than the alkaline red shallow loamy duplex topsoils. Calcrete is common throughout the sandy clay matrix subsoil, in both nodular and sheet (kankar) forms. Soil pH values are alkaline throughout the profile. The shallow topsoil is generally friable, non-saline and has a low to moderate nutrient status. Subsoils are saline and sodic.

Most locations contained significant amounts of coarse organic matter, particularly woody debris associated mainly with eucalypt species and partly decomposed leaf litter, especially beneath *Melaleuca*, *Allocasuarina*, *Acacia* and *Verticordia* shrub species. Relatively little surficial coarse organic matter was recorded at locations where spinifex was the dominant plant species.

There was little evidence of the presence of sandy soil profiles within the project area. Sandier soils are more likely to be encountered on spinifex plains and low hills closer to the Fraser Range.

3.8 WASTE ROCK CHARACTERISATION

MBS was commissioned to undertake waste rock characterisation studies (2014b). A total of 37 samples of waste rock and ore grade materials were sourced from recent drilling programs across the Nova and Bollinger deposits. These were subjected to a standard set of static acid base accounting geochemical tests as well as analysis for elemental, water leachate and dilute acid leachate composition.

Four primary waste lithologies were sampled namely oxide (10 samples), transitional (four samples), fresh (20 samples) and ore (three samples). Overall, 29 of the 37 samples were classified as Non Acid Forming (NAF), four as Potentially Acid Forming (PAF) and four as uncertain.

The oxide waste generally has a low sulfur content and a low Acid Neutralisation Capacity (ANC). Nine of the ten samples were classified as NAF. This waste is predicted to form a circum-neutral, moderately saline and sodic leachate. This waste has generally very low concentrations of metals and metalloids.

Three of the four transition zone samples were classified as NAF and one as 'uncertain'. The transitional waste has properties very similar to the underlying fresh rock, which was found to be variable in terms in mineralogy, sulfur content, ANC and concentrations of heavy metals and metalloids. All samples have a low risk of acid production, with 17 of the 20 fresh rock samples classified as NAF, two as PAF and one as uncertain. Seepage from fresh waste rock is predicted to initially be moderately alkaline and have low salinity. Oxidation of sulfide minerals is expected to increase salinity in response to formation of sulfate salts and decrease the pH values to circum-neutrality. Concentrations of soluble metals and metalloids are predicted to be very low.

Two of the three ore samples were classified as PAF, and the third as uncertain. The ore appears to be very reactive. Oxidation of reactive pyrrhotite is expected to produce acidity within a short period and any subsequent seepage from oxidised ore is predicted to be saline and contain high concentrations of nickel and other base metals.

3.9 TAILINGS CHARACTERISATION

MBS was commissioned to undertake tailings characterisation studies (2014c). Stage 1 of this work which comprised static testing of tailings materials has been completed. Stage 2 which involves kinetic testing of selected tailings materials commenced in January 2014 and is ongoing.

Four samples of tailings produced from metallurgical studies were provided for the static assessment. These compromised flotation tailings and pyrrhotite 'concentrates' from each ore body (Nova and Bollinger). No tailings porewater samples were included in this investigation. Porewater quality will be largely determined by the quality of raw water used in the Processing Plant and at the time of tailings production, sources of raw water were not available.

Geochemical characterisation was carried out on individual tailings samples and a blend, for each orebody recognising that tailings to be disposed of in the TSF would be a blend of flotation and pyrrhotite tailings.

Results of the static testing indicate:

- Pyrrhotite is the dominant sulfide mineral, especially in the pyrrhotite tailings and blended tailings streams. High pyrrhotite tailings will have different geochemical characteristics to pyrite-rich tailings.
- Nova flotation tailings were characterised by very low sulfur content and moderately high ANC provided by reactive magnesium silicate minerals. This material was classified as NAF. Seepage is predicted to be circum-neutral, brackish and contain very low concentrations of soluble metals and metalloids.
- The Bollinger sample assessed in this study had a higher sulfur content, lower ANC and was classified as PAF. Further resource drilling since the time of sample selection has indicated that average sulfur grades for the Bollinger resource (12.25%) will be substantially lower than for materials assessed in this study (27.4%) and similar to Nova (11.75%).
- Both pyrrhotite tailings samples contained very high sulfur concentrations. Although measured ANC values were significant, this is considered an artefact from the test procedure. These samples and the corresponding blended samples were classified as PAF based on their Net Acid Production Potential (NAPP) and Net Acid Generation (NAG) pH values.
- Porewater and seepage from fresh pyrrhotite tailings is predicted to be circum-neutral to moderately alkaline, brackish to slightly saline and contain very low concentrations of soluble metals and metalloids.

The high pyrrhotite tailings are expected to oxidise rapidly when exposed to air and water. Unlike pyrite, which oxidises to form sulfuric acid, oxidation of pyrrhotite can potentially form a wide range of sulfide oxidation products

dependant on the oxygen availability. The amount of acid generated as a result of oxidation (if any) will depend on the reaction pathway. As oxidation pathways for pyrrhotite are more difficult to predict than pyrite, static waste characterisation methods employed by the MBS (2014c) investigation can often provide a worst-case scenario, rather than the 'most probable' scenario.

The only practical means of determining the extent of acid formation for high pyrrhotite tailings and the blended tailings is by undertaking kinetic column tests. Kinetic column tests using samples of the blended Nova and Bollinger tailings under unsaturated (high oxygen availability) and saturated (low oxygen availability) commenced in December 2013. Results obtained to date for the first five of the proposed six monthly leachate samples indicate:

- Bollinger tailings are more reactive than Nova tailings.
- Under saturated (low oxygen availability conditions), Nova and Bollinger tailings oxidise to produce circum-neutral leachates which are characterised by moderate salinity and low concentrations of dissolved metals.
- Under unsaturated (high oxygen availability), Bollinger tailings oxidise rapidly to produce acidic leachates with moderate salinity levels and elevated concentrations of metals including iron, manganese and nickel.
- Under unsaturated (high oxygen availability), Nova tailings oxidised rapidly to initially form an acidic leachate with slightly elevated concentrations of metals, but after several months produced circum-neutral leachates with low concentrations of dissolved metals.

These results demonstrate that sulfides in these tailings oxidise by at least two competing reaction pathways, some of which do not result in acid production or release of elevated concentrations of dissolved metals. The primary potential issue for long term management of tailings is expected to be highly saline seepage from use of hypersaline process water rather than acid and metalliferous drainage from tailings oxidation.

3.10 FLORA AND VEGETATION

Mattiske Consulting Pty Ltd (Mattiske) completed a Level 2 flora and vegetation survey of MLA28/376, the proposed access corridor and potential borefield areas.

A total of 369 vascular plant taxa from 63 families and 145 genera were recorded. Mattiske (2013) mapped 35 vegetation communities in the study area. These comprise 21 Eucalypt woodland communities, 10 mixed shrublands and scrub communities and four hummock grasslands communities. The most restricted vegetation community defined was the S16 community (0.38 ha), which was recorded in only one location on a massive granite outcrop, at the northern end of a borrow pit. The borrow pit has been reduced and at least a 50 m buffer has been provided for this community. These communities are shown in Figure 10. The areas of each of the communities and the proposed percentage of impact according to known distributions by the Mattiske Mapping are shown in Table 4.

The vegetation in the study area was considered to be mostly in very good to excellent condition. It is noted that significant sections have been recently burnt with a local and intense fire. The full report is provided in Appendix 1.

Table 4: Vegetation Communities within the Nova Survey Area

Vegetation Community (Code)	Vegetation Community Description	Mapped Areas (ha) (% of total area surveyed)	Proposed Clearing Area (% of community)
Eucalypt Woodlands			
W1	Woodland of mixed Eucalypts including *Eucalyptus salubris*, *Eucalyptus celastroides*, *Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* over *Cratystylis conocephala*, *Exocarpos aphyllus*, *Diocirea ternata*, *Eremophila alternifolia*, *Eremophila interstans*, *Eremophila ionantha*, *Eremophila scoparia* and *Geijera linearifolia* over *Olearia muelleri*, *Atriplex vesicaria* and *Scaevola spinescens* over mixed shrubs, herbs and grasses on orange-brown sandy clay-loams on flats.	1,207.25 (6.54%)	68.42 (5.67%)
W2	Woodland of *Eucalyptus salubris* and *Eucalyptus oleosa* subsp. *oleosa* with patches of mixed Eucalyptus species over *Melaleuca quadrifaria*, *Acacia hemiteles*, Cratystylis conocephala over *Diocirea ternata*, *Eremophila ionantha*, Atriplex vesicaria, *Eremophila decipiens* subsp. *decipiens*, *Eremophila scoparia*, *Geijera linearifolia*, *Senna artemisioides* subsp. *filifolia* and *Exocarpos aphyllus* over *Vittadinia dissecta* var. *hirta*, *Olearia muelleri*, *Sclerolaena diacantha*, *Ptilotus holosericeus* and *Zygophyllum ovatum* over herbs and grasses on red-orange clayloams on flats and lower slopes.	3,681.76 (19.93%)	143.35 (3.89%)
W3	Woodland of *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* with occasional *Eucalyptus celastroides* and *Eucalyptus salubris* over *Cratystylis conocephala* over *Olearia muelleri*, *Atriplex vesicaria* and *Santalum acuminatum* over *Rhagodia crassifolia*, *Zygophyllum apiculatum* and *Sclerolaena diacantha* over other mixed shrubs and herbs on orange-brown clay-loams on flats and slopes.	3,180.50 (17.22%)	163.31 (5.13%)
W4	Woodland to open woodland of mixed Eucalyptus species over *Eremophila scoparia*, *Cratystylis conocephala* and *Atriplex vesicaria* over *Sclerolaena diacantha*, *Olearia muelleri*, Zygophyllum species and *Rhagodia crassifolia* over herbs on orange clay-loams and sandy-loams on flats.	356.41 (1.93%)	34.86 (9.78%)
W5	Woodland of *Eucalyptus clelandii*, *Eucalyptus urna*, *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii over Melaleuca sheathiana* over *Olearia muelleri*, *Eremophila scoparia* and *Alyxia buxifolia* over *Zygophyllum glaucum* and Maireana species on orange-brown sandy-loams on flats and lower slopes.	1,704.99 (9.23%)	73.42 (4.31%)

Vegetation Community (Code)	Vegetation Community Description	Mapped Areas (ha) (% of total area surveyed)	Proposed Clearing Area (% of community)
W6	Open woodland of mixed Eucalyptus species over *Eremophila dempsteri*, *Melaleuca halmaturorum* and *Melaleuca sheathiana* over *Cratystylis conocephala* and *Eremophila scoparia* over *Olearia muelleri* and mixed shrubs and herbs on orange clay-loams on flats and slopes.	216.99 (1.17%)	39.96 (18.42%)
W7	Open woodland of *Eucalyptus incrassata*, *Eucalyptus rigidula* and *Eucalyptus oleosa* subsp. *oleosa* over *Westringia rigida*, *Daviesia benthamii* subsp. *acanthoclona*, *Acacia erinacea*, *Santalum acuminatum*, *Eremophila scoparia* and *Acacia merrallii* over *Triodia scariosa* and herbs on orange-red clay-loams and sandy-loams on flats and lower slopes.	122.12 (0.66%)	0.54 (0.44%)
W8	Low open woodland of *Eucalyptus oleosa* subsp. *oleosa*, *Eucalyptus spreta* and *Eucalyptus lesouefii* over *Melaleuca sheathiana*, *Eremophila ionantha*, *Acacia hemiteles*, *Eremophila scoparia*, *Cratystylis conocephala* and *Melaleuca halmaturorum* over mixed shrubs and herbs on orange-brown clay-loams and sandy-loams on lower to mid slopes.	2,176.88 (11.78%)	167.96 (7.72%)
W9	Low open woodland of *Eucalyptus gracilis* and *Eucalyptus salubris* over *Eremophila scoparia*, *Eremophila ionantha*, *Melaleuca halmaturorum*, *Diocirea ternata*, *Cratystylis conocephala*, *Olearia muelleri*, *Melaleuca sheathiana* and *Dodonaea stenozyga* over low shrubs and herbs on red-brown sandy-loams and clay-loams on flats.	317.17 (1.72%)	80.31 (25.32%)
W10	Open woodland of *Eucalyptus oleosa* subsp. *oleosa* over *Melaleuca halmaturorum* over *Acacia hemiteles* and *Eremophila alternifolia* over *Olearia muelleri* and *Zygophyllum glaucum* on pale orange clay-loams and sandy-loam gravels on flats.	1,067.02 (5.78%)	3.89 (0.36%)
W11	Open woodland of *Eucalyptus salubris*, *Eucalyptus fraseri* subsp. *fraseri*, *Eucalyptus celastroides* and *Eucalyptus prolixa* over *Diocirea ternata*, *Eremophila ionantha*, *Eremophila scoparia* and *Olearia muelleri* over mixed low Chenopods on orange to red clay-loams on flats.	218.29 (1.18%)	19.79 (9.07%)
W12	Open woodland of *Eucalyptus oleosa* subsp. *oleosa*, *Eucalyptus polita* and *Eucalyptus prolixa* over *Diocirea ternata*, *Dodonaea stenozyga*, Eremophila species, *Daviesia benthamii* subsp. *acanthoclona* and *Olearia muelleri* over mixed low Chenopods and localised patches of *Triodia ?scariosa* on orange to red clays and clay loams on flats.	316.03 (1.95%)	29.08 (8.05%)

Vegetation Community (Code)	Vegetation Community Description	Mapped Areas (ha) (% of total area surveyed)	Proposed Clearing Area (% of community)
W13	Open woodland of *Eucalyptus flocktoniae* and *Eucalyptus celastroides* subsp. *virella* over *Melaleuca sheathiana*, *Diocirea ternata*, *Dodonaea stenozyga*, *Eremophila scoparia*, *Daviesia benthamii* subsp. *acanthoclona*, *Acacia erinacea* and *Olearia muelleri* over herbs and grasses on orange to red clays on flats.	160.45 (0.87%)	8.06 (5.02%)
W14	Open woodland of *Eucalyptus salubris*, *Eucalyptus calycogona* subsp. *calycogona* and Eucalyptus spreta over *Melaleuca halmaturorum*, *Diocirea ternata*, *Eremophila decipiens* subsp. *decipiens*, *Eremophila scoparia*, *Atriplex vesicaria* and *Olearia muelleri* over herbs and grasses on cracking clays on flats.	40.42 (0.22%)	2.76 (6.83%)
W15	Open woodland of *Eucalyptus oleosa* subsp. *oleosa*, *Eucalyptus prolix* and *Eucalyptus protensa* over *Cratystylis conocephala*, *Eremophila decipiens* subsp. *decipiens*, *Eremophila dempsteri*, *Rhagodia eremaea*, *Senna artemisioides* subsp. *filifolia* over herbs and grasses on orange clay-loams and sandy-loams on flats.	56.57 (0.31%)	0 (0%)
W16	Open woodland of mixed Eucalypts including *Eucalyptus transcontinentalis*, *Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus eremophila* subsp. *eremophila*, *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus urna* over *Cratystylis conocephala*, *Commersonia craurophylla*, Eremophila species, *Melaleuca sheathiana*, *Olearia muelleri* and *Scaevola spinescens* over herbs and grasses on orange clay-loams and sandy-loams on flats and slopes of undulating rises.	223.32 (1.21%)	44.57 (19.96%)
W17	Open woodland of *Eucalyptus cylindrocarpa*, *Eucalyptus salubris* and *Eucalyptus oleosa* subsp. *oleosa* over *Cratystylis conocephala*, *Eremophila ionantha* and mixed Chenopod species over herbs and grasses on orange to red-brown sandy-loams and clay-loams with gravel on flats.	27.47 (0.15%)	0 (0%)
W18	Open woodland of *Eucalyptus laevis*, *Eucalyptus moderata*, *Eucalyptus salubris* and *Eucalyptus spreta* over *Acacia hemiteles*, *Acacia merrallii*, *Cratystylis conocephala*, *Eremophila dempsteri*, *Eremophila ionantha*, *Eremophila scoparia*, *Melaleuca halmaturorum* and mixed Chenopod species over patches of *Triodia irritans* on orange to red-brown clay-loams and sandy-loams on flats.	459.61 (2.49%)	46.26 (10.07%)
W19	Open woodland of *Eucalyptus ?loxophleba* subsp. *lissophloia*, *Eucalyptus oleosa* subsp. *oleosa*, *Eucalyptus u*rna and *Eucalyptus spreta* over *Acacia hemiteles*, *Acacia merrallii*, *Cratystylis conocephala*, *Dodonaea stenozyga*, *Eremophila ionantha*, *Eremophila scoparia* and *Exocarpos aphyllus* over herbs and grasses on orange to red-brown clay-loams and sandy-loams on flats.	221.30 (1.20%)	6.43 (2.91%)

Vegetation Community (Code)	Vegetation Community Description	Mapped Areas (ha) (% of total area surveyed)	Proposed Clearing Area (% of community)
W20	Open woodland of *Eucalyptus salubris* with local patches of *Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus spreta*, *Eucalyptus fraseri* subsp. *fraseri* and *Eucalyptus oleosa* subsp. *oleosa* over *Melaleuca sheathiana*, *Acacia hemiteles*, *Cratystylis conocephala*, *Eremophila scoparia* and *Olearia muelleri* over localised patches of *Triodia irritans* on orange to red-brown clay-loams and sandy-loams on flats and lower slopes.	966.20 (5.23%)	16.26 (1.68%)
W21	Open woodland of *Eucalyptus polita* with local patches of *Eucalyptus flocktoniae* and *Eucalyptus lesouefii* over *Melaleuca sheathiana*, *Melaleuca halmaturorum*, *Acacia hemiteles*, *Acacia merrallii*, *Eremophila ionantha*, *Eremophila scoparia* and *Olearia muelleri* over herbs on orange to red-brown clay-loams and sandy-loams on flats and lower slopes.	199.85 (1.08%)	28.68 (14.35%)
Mixed Shrublands and Scrubs			
S1	Open scrub of *Melaleuca halmaturorum*, *Atriplex vesicaria*, *Cratystylis conocephala* and *Eremophila scoparia* with occasional *Eucalyptus lesouefii* and *Eucalyptus salubris* over *Zygophyllum ovatum*, *Scaevola spinescens*, *Olearia muelleri* and *Sclerolaena diacantha* over other low shrubs and herbs on orange clay-loams on flats and slopes.	52.89 (0.29%)	0.26 (0.49%)
S2	Open scrub of *Logania* sp. and *Eremophila ionantha* with occasional emergent *Eucalyptus salubris* and Eucalyptus spreta over Atriplex species, *Ptilotus holosericeus*, *Vittadinia dissecta* var. *hirta* and Chenopod species on orange cracking clays on flats and low lying areas.	9.68 (0.05%)	0.36 (3.72%)
S3	Low open shrubland of *Acacia acuminata* (narrow phyllode variant) over *Eremophila decipiens* subsp. *decipiens*, *Dodonaea lobulata*, *Olearia pimeleoides* and *Eremophila deserti* over *Rhagodia ulicina*, *Enchylaena tomentosa* var. *tomentosa* and *Sclerolaena diacantha* and other mixed shrubs on red-brown clays on flats.	14.37 (0.08%)	0 (0%)
S4	Open scrub of *Allocasuarina helmsii* and *Melaleuca uncinata* with occasional *Eucalyptus rigidula* and *Eucalyptus salubris* over *Acacia hemiteles*, *Alyxia buxifolia*, *Dodonaea microzyga* var. *acrolobata*, *Grevillea acuaria*, *Scaevola spinescens* and *Olearia muelleri* over patches of *Triodia ?scariosa* and herbs on orange to red clay loam and clays on flats and slopes.	163.68 (0.89%)	0.23 (0.14%)
S5	Low open shrubland of *Acacia hemiteles*, *Eremophila decipiens* subsp. *decipiens*, *Rhodanthe chlorocephala* subsp. *rosea*, *Atriplex vesicaria* and *Vittadinia dissecta* var. *hirta* over mixed low shrubs and herbs on red clays on flats.	11.55 (0.06%)	0 (0%)

Vegetation Community (Code)	Vegetation Community Description	Mapped Areas (ha) (% of total area surveyed)	Proposed Clearing Area (% of community)
S6	Open scrub of *Melaleuca hamata*, *Allocasuarina* sp. over *Vittadinia dissecta* var. *hirta*, *Acacia acanthoclada* subsp. *acanthoclada*, *Grevillea huegelii*, *Hannafordia bissillii* subsp. *latifolia* and *Melaleuca fulgens* subsp. *fulgens* over herbs and grasses on red-orange sandy-loams on flats.	101.02 (0.55%)	0.05 (0.05%)
S7	Low open shrubland of *Tecticornia* sp. over *Eragrostis australasica*, *Eragrostis dielsii*, *Austrostipa mollis*, *Sclerolaena cuneata* and *Sclerolaena obliquicuspis* on orange clays on flats.	8.04 (0.04%)	0 (0%)
S8	Low open shrubland of *Acacia assimilis* subsp. *assimilis* and *Melaleuca uncinata* over *Eremophila decipiens* subsp. *decipiens*, *Cryptandra aridicola*, *Dodonaea microzyga* var. *acrolobata*, *Acacia acanthoclada* subsp. *acanthoclada* and *Westringia cephalantha* over *Triodia ?scariosa* and herbs on red-brown clays on lower slopes.	16.91 (0.09%)	0 (0%)
S9	Open scrub of *Allocasuarina campestris*, *Eremophila alternifolia*, *Eremophila decipiens* subsp. *decipiens*, *Geijera linearifolia*, *Melaleuca uncinata* and *Melaleuca fulgens* subsp. *fulgens* over *Trymalium myrtillus* subsp. *myrtillus*, *Senna artemisioides* subsp. *filifolia* over herbs and patches of *Triodia ?scariosa* on red-brown clays on flats and lower slopes.	93.23 (0.50%)	3.70 (3.97%)
S16	Very open scrub of *Beyeria lechenaultii*, *Eremophila alternifolia* and *Vittadinia dissecta* var. *hirta* over mixed shrubs and herbs on red-brown clays on massive granite outcrop.	0.38 (0.00%)	0 (0%)
Hummock Grasslands			
G1	Open hummock grassland of mixed *Triodia* sp. with emergent *Eucalyptus griffithsii*, *Eucalyptus oleosa* subsp. *oleosa*, *Eucalyptus rigidula* and *Eucalyptus ?kumarlensis* over *Acacia erinacea*, *Acacia burkittii* and *Acacia hemiteles* over *Cryptandra aridicola*, *Westringia rigida*, *Senna artemisioides* subsp. *filifolia*, *Eremophila decipiens* subsp. *decipiens*, *Alyxia buxifolia* and *Grevillea acuaria* over herbs on orange-red clay-loams and sandy-loams on flats and slopes.	512.89 (2.77%)	15.18 (2.96%)
G2	Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus horistes* and *Eucalyptus websteriana* subsp. *norsemanica* over *Acacia assimilis* subsp. *atroviridis*, *Allocasuarina helmsii*, *Cryptandra leucopogon*, *Grevillea plurijuga* subsp. *plurijuga*, *Halgania erecta* and *Scaevola amblyanthera* var. *centralis* over herbs on orange-yellow clay-loams and sandy-loams on slopes.	161.53 (0.87%)	12.65 (7.83%)

Vegetation Community (Code)	Vegetation Community Description	Mapped Areas (ha) (% of total area surveyed)	Proposed Clearing Area (% of community)
G3	Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus salubris* and *Eucalyptus griffithsii* over *Acacia hemiteles*, *Eremophila alternifolia*, *Eremophila decipiens* subsp. *decipiens*, *Grevillea acuaria* and *Senna artemisioides* subsp. *filifolia* over herbs on red-brown clays and clay-loams on flats.	65.45 (0.35%)	3.22 (4.92%)
G4	Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus griffithsii* over *Acacia hemiteles*, *Allocasuarina* species, *Pultenaea elachista*, *Scaevola spinescens* and *Westringia rigida* over herbs on red-brown clay-loams on flats and lower slopes.	287.88 (1.56%)	14.87 (5.17%)
Total		**18,473.14 ha**	**1028.55 ha**

3.10.1 Conservation Significant Species

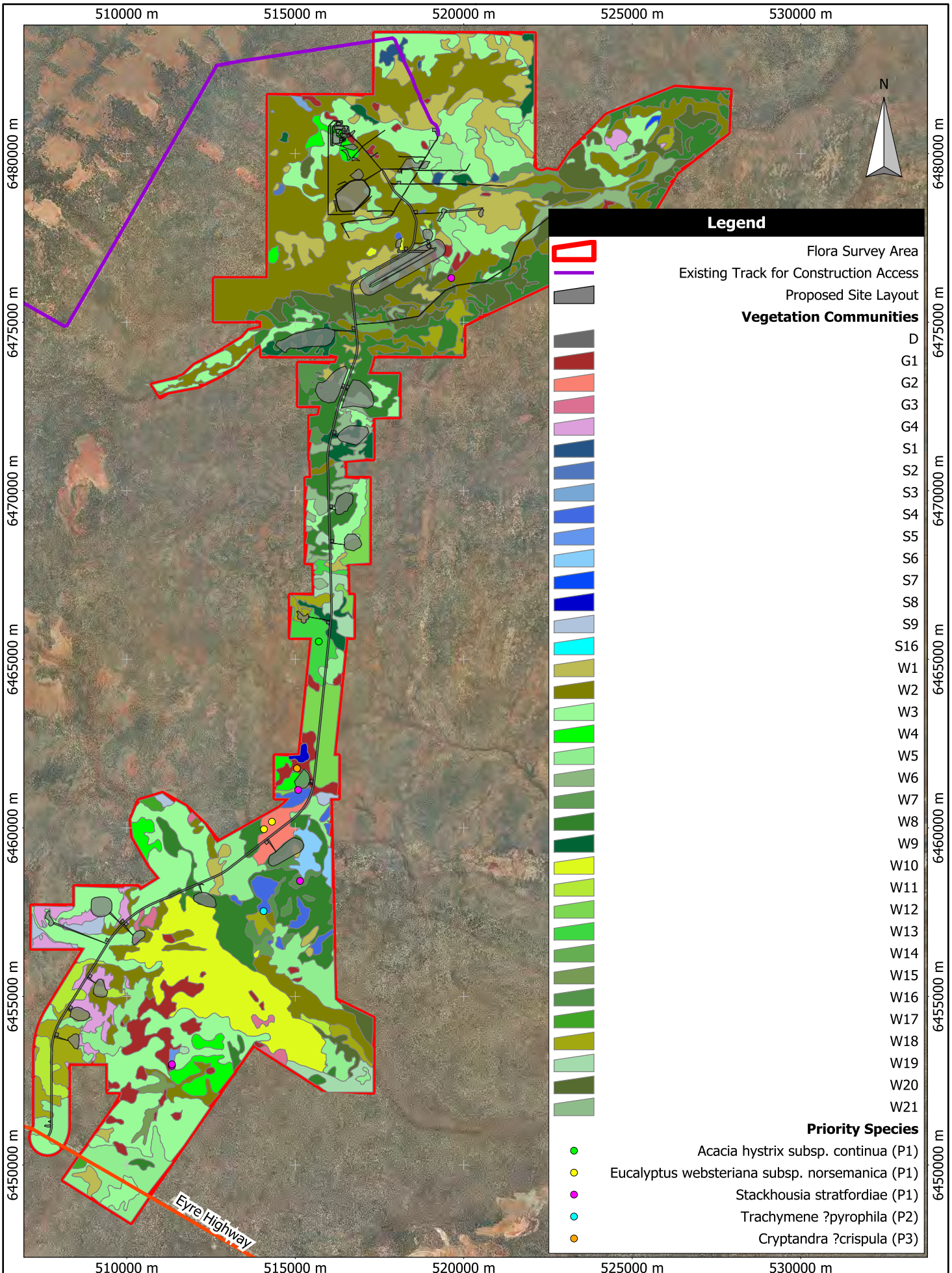
Database searches indicate no Threatened flora species have potential to occur in the project area and none were recorded during the 2012 and 2013 surveys.

Twelve Priority species (as listed by DPaW) have potential to occur in the Nova Project area. During the survey, five Priority flora species were identified (Table 5). Locations of these are shown in Figure 10. None of the identified populations are located within the proposed project footprint.

Table 5: Priority Flora at Nova Project

Species	Conservation Category	Habitat Preference	Recorded in Study Area	Within Project Footprint
Acacia hystrix subsp. *continua*	Priority 1	Clay loam	Yes	No
Eucalyptus websteriana subsp. *norsemanica*	Priority 1	Rocky rises	Yes	No
Stackhousia stratfordiae	Priority 1	Clay loam	Yes	No
Trachymene ?pyrophila	Priority 2	Yellow or orange sand.	Yes	No
Cryptandra ?crispula	Priority 3	Brown sandy clay, yellow loamy sand, red soil and dune ridges, hills and near salt lakes.	Yes	No

A further 14 species recorded in the project area were noted to be range extensions from currently known populations, most likely due to the lack of flora studies in the area.



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Original Size: A4
Air Photo Date: 2005
Grid: Australia MGA94 (51)
0 5000 m

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Nova Project

Figure 10

Priority Flora and Vegetation Communities

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3.10.2 Threatened and Priority Ecological Communities

No Threatened Ecological communities are recorded within the Nova Project area.

The project layout will overlap with two Priority 1 PECs (Figure 11). The northwestern corner of the MLA intersects with the Fraser Range Vegetation Complex PEC and the southern part of the access corridor where it meets the Eyre Highway intersects the Plant Assemblages of the Southern Hills Vegetation Complex PEC. The proposed site layout will not disturb any land in the Fraser Range PEC, and will disturb approximately 62 ha of the Southern Hills PEC. Of this 62 ha, 47 ha will be for short term disturbance for the borrow pits with 15 ha for the main access road.

The Fraser Range Vegetation Complex PEC is described as:

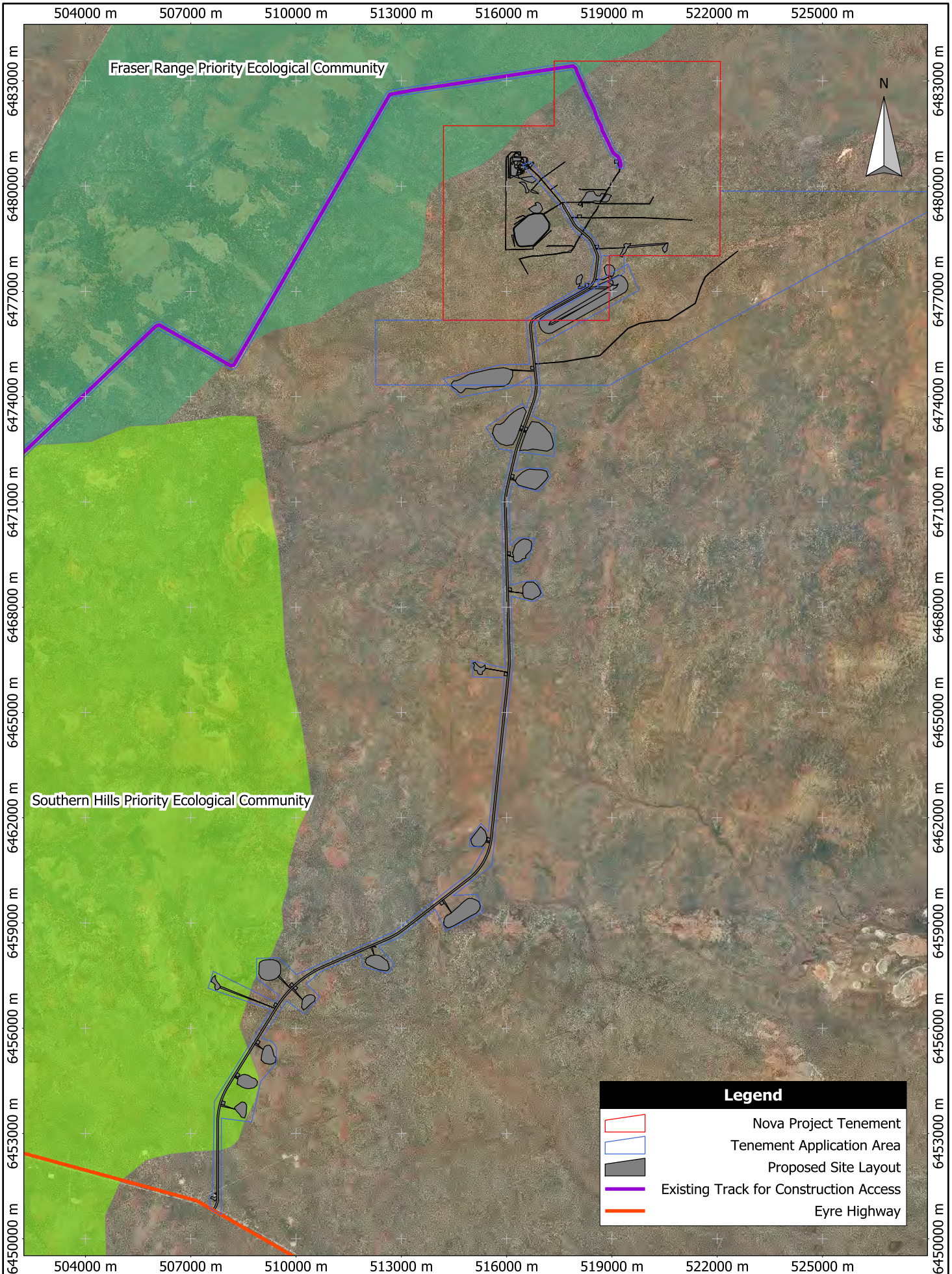
- *Allocasuarina huegeliana* and *Pittosporum phylliraeoides* (note that *P. phillyreoides* var. *macrocarpa* is now recognised as *P. angustifolium* according to Cayzer, Crisp & Telfora 2000) open woodland over *Beyeria lechenaultia* (assumed to be referring to *B. lechenaultii*) and *Dodonaea microzyga* scrub and *Aristida contorta* bunch grasses (granite complex), on the slopes and summits of hills;
- *Acacia acuminata* tall shrubland dominated by *Melaleuca uncinata* and *Triodia scariosa* on uplands with shallow loamy sands;
- *Eucalyptus* aff. *uncinata* (KRN 7854) over *Senna artemisioides* subsp. *helmsii*, *Cryptandra miliaris* (now an excluded name, was reduced to C. arbutiflora var. tubulosa, which has a coastal distribution from Perth to Northcliffe (Rye 1998) – not sure to which Cryptandra species this now refers), *Dodonaea boroniifolia* (now *D. adenophora*), *Dodonaea stenozyga* and *Triodia scariosa* (*Eucalyptus effusa* mallee) on colluvial flats with loamy clay sands; and
- *Eucalyptus oleosa*, *Eucalyptus transcontinentalis*, *Eucalyptus flocktoniae* woodland on flats.

Threatening processes to this vegetation complex, as noted in Cowan (2001) include grazing, exotic weeds, changed fire regimes and mining.

The Plant Assemblages of the Southern Hills Vegetation Complex PEC is described as a complex of woodland (*Eucalyptus oleosa*, *Eucalyptus transcontinentalis*, *Eucalyptus flocktoniae*) on flats with open stony ridges carrying mainly mallee and spinifex (*Eucalyptus effusa* mallee: *Eucalyptus* aff. *uncinata* (KRN 7854) over *Cassia helmsii* (now *Senna artemisioides* subsp. *helmsii*), *Cryptandra miliaris*, *Dodonaea boroniifolia* (now *D. adenophora*), *Dodonaea stenozyga* and *Triodia scariosa*). It also includes patches of grassland, wattle thicket and mallee.

The two PECs overlap considerably in species description leading to difficulties in clarifying their extent and overlap with vegetation communities as defined in the Nova survey area.

Mattiske (2013) reviewed previous work on the PECs and determined that the Eucalypt woodlands exist as a continuum on the slopes away from a series of ranges and hills in the area. By comparing species listed in the original definition of the PECs, it seems that a range of species do not extend into the Nova Project area, while others occur in various numbers of communities.



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Original Size: A4
Air Photo Date: 2005
Grid: Australia MGA94 (51)
0 3000 m

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Figure 11

Priority Ecological Communities

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Meetings with DPaW to discuss PEC issues were held on 6 February 2014 and on 4 June 2014. Outcomes of these discussions were:

- PEC mapping has been based on pre European vegetation mapping completed by Beard (1975) and listing in relation to comments made by Beard (1975) that the vegetation in the Fraser Range area is unique.
- Review of aerial photographs indicates boundaries Beard (1975) has mapped may not have fully captured the entire Fraser Range.
- Quadrat data is not available for either PEC.
- Discrepancies appear to exist between PEC boundaries and Beard (1975) mapping when these are overlain.
- Mapping of the PECs as currently provided by DPaW is coarse and there is potential for PEC boundaries to be refined based on better quality data.
- DPaW invited Mattiske on behalf of Sirius to recommend updated PEC boundaries based on site based work. Mattiske recommended changes to PEC boundaries based on the Mattiske (2014) Level 2 report and Digital Terrain Model.
- DPaW advised that the methodology for the proposed new PEC boundaries was not clear and in the absence of more extensive and detailed ground truthing that the boundaries will remain as they occur on the TEC/PEC database.
- DPaW has advised that project impact assessment should focus on the impacts at a vegetation/floristic community level.

3.10.3 Weeds

Ten plants recorded in the study area are introduced species (weeds). None of these are declared organisms under Section 22 of the *Biosecurity and Agriculture Management Act 2007*. Three of the weeds recorded *Centaurea melitensis, Cucumis myriocarpis* and *Salvia verbenaca* are listed as low status environmental weeds by DPaW (2014). An environmental weed is an introduced species that establishes itself into a natural ecosystem and modifies natural processes (usually adversely) and results in the decline of the communities they invade (DEC 1999).

3.11 TERRESTRIAL FAUNA AND HABITAT

A Level 1 survey of E28/1724 was conducted in December 2012 by Terrestrial Ecosystems.

Sirius commissioned Rapallo Environmental to conduct a Level 2 fauna survey of the project area and access road corridor in November 2013 over a 15 day period (Rapallo 2014a). Additionally, Targeted Malleefowl Surveys of the access road corridor and a borrow pit areas were undertaken by Rapallo Environmental in January, February and May 2014 (Rapallo 2014b; e). The full reports are provided in Appendix 2, Appendix 3 and Appendix 4 respectively. Additional trapping was conducting during the February 2014 Malleefowl Survey and these results are reported separately (Rapallo 2014d) and presented in Appendix 5.

A desktop search completed by Rapallo (2014a) determined that there is potential for 76 reptile, 125 bird, 31 mammal and 5 frog species to occur in the area.

A total of 137 vertebrate fauna species including 40 reptile, 77 bird and 20 mammal species were recorded during the Rapallo survey. Analyses of acoustic recordings made during the survey identified six different bat species in the area. An additional two species of bats may also be present; however this could not be confirmed as calls could only be reliably confirmed to genus level.

Targeted Malleefowl Surveys determined that there are 29 inactive Malleefowl mounds in the survey area (Rapallo 2014b; e). Of these, 11 are classed as dormant Profile 1 (dormant) mounds. The remaining 18 are classed as

extinct Profile 6 (extinct) mounds. Of the 11 dormant mounds recorded, six mounds are within or close to project infrastructure. Where possible, borrow pits will be moved around dormant mounds. One mound within the MLA is within the footprint of the ROM pad. The ROM pad needs to be in this location for geotechnical reasons.

3.11.1 Habitat

There are eight habitats and one micro habitat present in the Nova Project area and access road corridor. These are shown in Figure 12.

The areas of each of these habitats, excluding the sub-type (Creek line, as it has not been mapped) are shown in Table 6.

Table 6: Habitats in the Nova Project Area

Habitat	Description	Survey Area (ha)		Percentage Likely to be Disturbed
		MLA	Access Corridor	
Acacia Shrubland	*Acacia* shrubland to 4 m over mixed low shrubs. Emergent *Eucalyptus* to 8 m.	14.37	-	0.00%
Woodland	Open *Eucalyptus* woodland to 15 m often over *Cratystylis concephala* dominated shrubland with scattered *Santalum, Eremophila*, *Atriplex* and *Olearia*.	4319.37	186.57	7.52%
Melaleuca	Open *Eucalyptus* woodland over *Melaleuca* thicket over mixed shrubs.	173.47	28.83	16.08%
Woodland/ Triodia	Open *Eucalyptus* woodland over *Triodia* grassland with occasional *Eremophila*, *Dodonaea*, *Exocarpos* and *Allocasuarina* that can form groves.	128.90		.2.38%
Regenerating Woodland	Very dense, regenerating *Eucalyptus* woodland with emergent dead tree trunks.	-	222.95	36.02%
Burnt Plain	Regenerating low shrubland/herbland of mixed *Allocasuarina*, *Triodia* and ephemeral herbs. Regeneration in early stage, with 80% bare soil.	-	43.81	28.74%
Mallee/Triodia	*Triodia* plain under sparse straggly mallees to 3 m. Occasional *Allocasuarin*a that can form groves. Mallee/Triodia habitat lower than the surrounding woodland habitat.	-	14.54	43.11%
Woodland Dominated Inundation Zones	*Eucalyptus* woodland such as gimlet over mixed low shrubland such as *Eremophila*, *Diocirea ternata.*	26.18	-	11.79%
Grand Total		**4662.29**	**496.70**	**9.24%**

3.11.2 Species of Conservation Significance

A database search showed that 22 vertebrate species of conservation significance have potential to occur in the project area. Ten were recorded within the habitats of the project area. These comprised:

- Malleefowl (Schedule 1 of the *WC Act* and Vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)).

- Rainbow Bee-eater (Schedule 3 of the *WC Act* and Migratory under the *EPBC Act*).
- Fork Tailed Swift (Schedule 3 of the *WC Act* and Marine and Migratory under the *EPBC Act*).
- Crested Bellbird (Priority 4).
- Crested Shrike-tit (Priority 4).
- White-browed Babbler (Priority 4).
- Rufous Fieldwren (Priority 4).
- Shy Heathwren (Priority 4).
- Australian Bustard (Priority 4).
- Greater Long-eared Bat (Priority 4; potentially recorded onsite.)

Sirius exploration personnel recently recorded the presence of the South-west Carpet Python (protected as a Schedule 4 species under the *WC Act*) in the MLA.

One bat species of conservation significance may also be present however analysis of bat calls was unable to confirm reliably whether calls of long-eared bats *Nyctophilus* spp were the lesser long-eared bat *Nyctophilus geoffroyi* or the central subspecies of the Greater Long-eared Bat *Nyctophilus major tor*. The Greater Long-eared Bat *Nyctophilus major tor* is listed as Priority 4 species by DPaW.

Potential is also considered to exist for the presence the Bush Stone Curlew (Priority 4) as it has been seen in nearby areas by Traditional Owners.

Table 7 provides further detail on species of conservation significance in the project area.

Table 7: Conservation Significant Species at Nova Project

Species	Conservation Status	Observation in Project Area
Malleefowl (*Leipoa ocellata*)	*WC Act* – Schedule 1 *EPBC Act* – Vulnerable	Old and inactive Mounds observed in survey area.
South-west Carpet Python (*Morelia spilota imbricata*)	*WC Act* -Schedule 4	Observed by Sirius staff close to survey area. Photographs verified by Rapallo.
Australian Bustard (*Ardeotis australis*)	Priority 4	Observed by Rapallo during survey.
Crested Shrike-tit (southwestern spp.) (*Falcunculus frontatus leucogaster*)	Priority 4	Observed by Rapallo during survey.
Shy Heathwren (western spp.) (*Calamanthus (Hylocola) cauta whitlocki*)	Priority 4	Observed by Rapallo during survey.
Rainbow Bee-eater (*Merops ornatus*)	EPBC Migratory Species *WC Act* – Schedule 3	Observed by Rapallo during survey.
Fork-tailed Swift (*Apus pacificus*)	EPBC Marine and Migratory *WC Act* – Schedule 3	Observed by Rapallo during survey.
White-browed Babbler (western wheatbelt ssp) (*Pomatostomus superciliosus ashbyi*)	Priority 4	Observed by Rapallo during survey.

Species	Conservation Status	Observation in Project Area
Crested Bellbird (southern) (*Oreoica gutturalis gutturalis*)	Priority 4	Observed by Rapallo during survey.
Bush Stone-Curlew (*Burhinus grallarius*)	Priority 4	Observed by Traditional Owners close to survey area.
Rufous Fieldwren (*Calamanthus campestris montanellus*)	Priority 4	Observed by Rapallo during survey.
Greater Long-eared Bat (Central Form) (*Nyctophilus major tor)*	Priority 4	Calls which may belong to this species were recorded in the project area.

As the majority of the conservation significant species are birds of flight, the development of the project is considered unlikely to significantly impact them.

Additional information is provided on fauna species of conservation significance listed as Scheduled species under the *WC Act* or listed under the *EPBC Act* that were observed within the project area.

3.11.2.1 Malleefowl (Leipoa ocellata)

The Malleefowl is listed as Vulnerable under the *EPBC Act* and under Schedule 1 (rare or likely to become extinct) under the *WC Act*.

In Western Australia, Malleefowl occur mainly in scrubs and thickets of Mallee (*Eucalyptus spp*.), Boree (*Melaleuca lanceolata*) and Bowgada (*Acacia linophylla*), and also other dense, litter-forming shrublands including Mulga (*Acacia aneura*) Shrublands (Johnstone and Storr 1998). Nesting is typically restricted to dense shrublands (which provide protection and nesting material) on a range of substrates (such as sand, loam and gravel) while heavy (clay) soils are avoided (Bamford Consulting Ecologists 2012). Due to a paucity of data, little information is known about the Malleefowl habitats and ecological drivers at the southeastern edge of its Western Australian distribution. It is well documented that across its core distribution, woodland represents poor habitat for the species therefore habitat suitability relates to a probability of occurrence for the species rather than an indication of population density.

Malleefowl are reported as occurring on Ngadju country which covers a significant portion of the Western Woodland (Prober *et al.* 2013). Locally, records for Malleefowl are scarce; this likely reflects a combination of poor survey effort and low densities due to suboptimal habitats at the edge of the Malleefowl's Western Australian range.

The main threat to the Malleefowl is habitat destruction and clearance for agriculture and grazing. Malleefowl are also affected by fire. Malleefowl will feed in recently burnt areas, but they require unburnt areas for breeding and shelter. It appears that Malleefowl may be able to re-occupy key habitats 15 years post-fire (Short and Parsons 2008). Fox predation is the second greatest threat to the Malleefowl, with low survival rate of juveniles in areas with high fox populations (Priddel & Wheeler 1997).

In the fauna survey and a targeted search of the Nova Project area and access road corridor, 29 inactive Malleefowl mounds were recorded. The locations of the Malleefowl mounds are shown in Figure 12. A total of 11 mounds are classified as dormant (Profile 1) and 18 as extinct (Profile 6). One dormant Malleefowl mound is located within MLA 28/376, and the others are located south of MLA 28/376 with two mounds located approximately 4 km to the west of the corridor (outside of the Nova Project area). Of these dormant mounds, six may be impacted by the project.

The habitat quality for supporting Malleefowl within the access road corridor was classified by Rapallo as high, medium and low based on general known habitat requirements of fire history, leaf litter, soil suitability and presence/absence of mounds. The assessment is shown in Appendix 2. Rapallo concluded:

- The long unburnt habitats of the access road corridor (Eucalypt Woodland and Melaleuca habitats) are considered as having the highest relative habitat suitability for Malleefowl due to age post fire and relative abundance of litter.
- The Mallee/Triodia and Woodland Inundation zone habitats were considered to have medium to high habitat suitability due to the litter being low or patchily distributed especially in the larger *Triodia* patches.
- The recently burnt areas were considered be of low suitability as a recent hot burn had resulted in low litter, cover and food resources.
- Regenerating Woodland habitat can be considered to be of medium habitat suitability. This was typically burnt between 5 and 10 years ago. Malleefowl will feed in recently burnt areas, but they require unburnt areas for breeding and shelter (Marchant & Higgins 1993; Benshemesh 2000).
- The burnt plain was considered to have a low suitability for Malleefowl because of the low leaf litter, cover and food resources.

3.11.2.2 South-west Carpet Python (Morelia spilota imbricata)

The South-west Carpet Python is classified under the *WC Act* as a Schedule 4 – Other Specially Protected Fauna. This python has a broad range in a variety of habitats from Northampton in the north, throughout the southwest to Kalgoorlie in the east. Mammal species and birds form the python's diet. Female South-west Carpet Pythons can weigh up to 4.5 kg and can reach 4 m in length, whereas the males are much smaller and rarely weigh more than 1.1 kg. This species is vulnerable to habitat destruction and altered fire regimes.

An opportunistic record of the species was made by Sirius exploration personnel on the road into site during 2013 (photographs were taken and identification confirmed).

Western Australian Museum specimens of this species are listed for Kambalda, Kalgoorlie, Coolgardie, Parker Range, Fraser Range and Norseman and observations of the species have been recorded from the Salmon Gums area and Peak Charles National Park (Brad Maryan Technical Officer (former), *pers. comm,* 2008).

3.11.2.3 Rainbow Bee Eater (Merops ornatus)

The Rainbow Bee-eater is listed under the *WC Act* as Schedule 3 – Migratory birds protected under an international agreement. It is protected under Japan-Australia Migratory Bird Agreement (JAMBA). Under the *EPBC Act* the species is listed as Migratory.

The Rainbow Bee-eater prefers open or lightly timbered areas, often near water. This species has been recorded in dry open sclerophyll forest, open woodlands and shrublands, including mallee, spinifex tussock grassland with scattered trees, chenopod shrubland with scattered trees and riparian or littoral assemblages. It is often seen around disturbed areas such as quarries, road cuttings and mines where exposed bare soil provides suitable breeding sites (Marchant and Higgins 1993).

The Rainbow Bee-eater is a migratory bird and will move north from the southern areas of Australia during winter (Johnstone and Storr 1998). This species is common throughout the region and was recorded in the survey area.

3.11.2.4 Fork-tailed Swift (Apus pacificus)

The Fork-tailed Swift is listed under the *WC Act* as Schedule 3 – Migratory birds protected under an international agreement. It is protected under China-Australia Migratory Bird Agreement (CAMBA), JAMBA, and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA). Under the *EPBC Act* the species is listed as Marine and as Migratory.

This species breeds in the northeast and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, arriving in the Kimberley in late September, in the Pilbara and Eucla by November and in the southwest land division by mid-December. The species generally returns to its breeding grounds by April. It ranges from common in the Kimberley; uncommon to moderately common in the northwest, west and southeastern coasts and rare or scarce elsewhere (Johnstone and Storr 2004).

The Fork-tailed Swift was recorded during the survey in the woodland habitat and the post fire regenerating habitat.

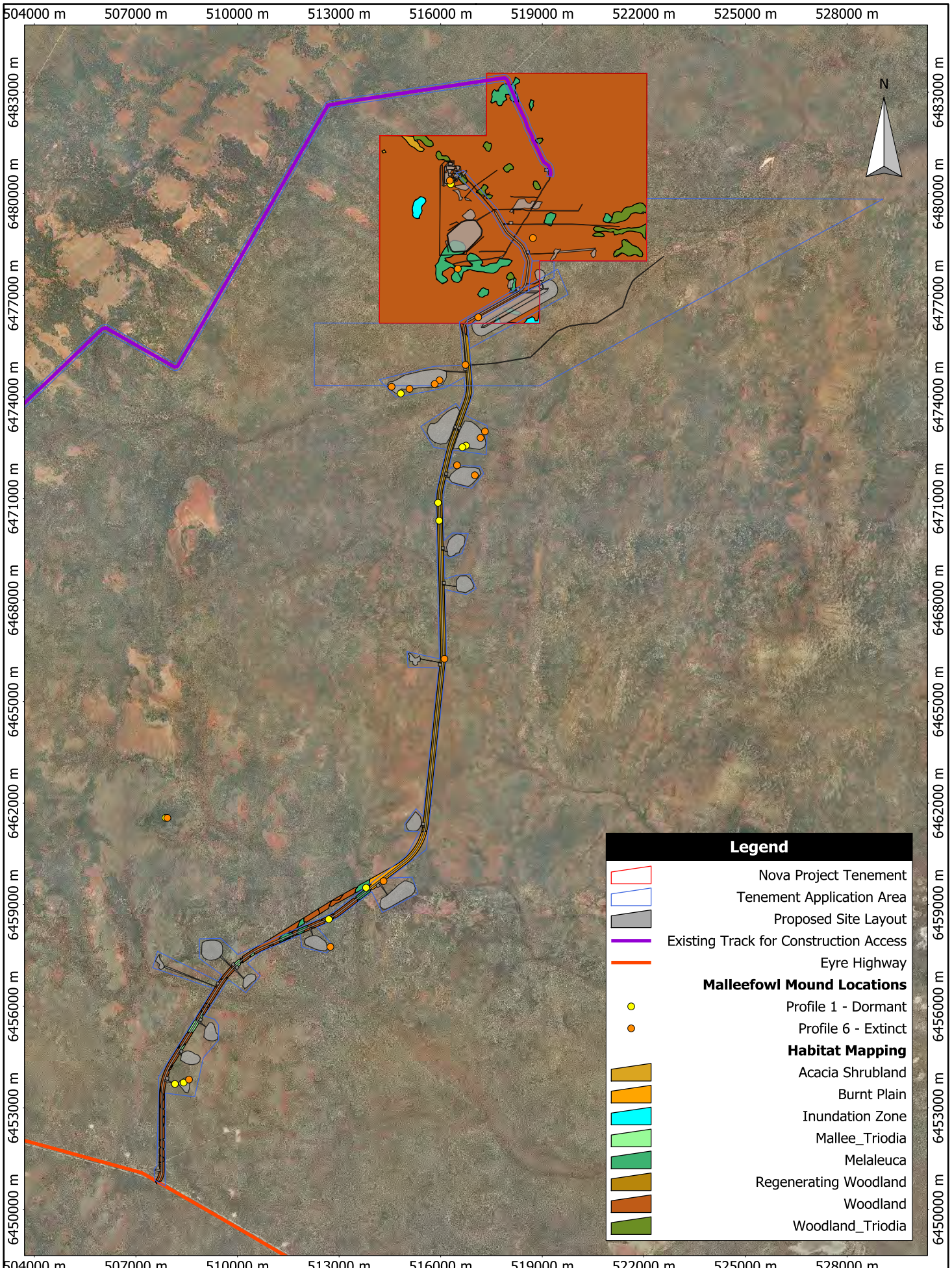

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Figure 12

Habitats and Location of Malleefowl Mounds

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3.11.3 Short Range Endemic Species

Putative Short Range Endemic (SRE) taxa were collected during fauna surveys conducted in and adjacent to the project area in 2013 and 2014 (Rapallo 2014d). This report is provided as Appendix 6. The mollusc (land snail) specimens collected were found to be of the widespread species *Bothriembryon dux* and are not an SRE. Three morphospecies of scorpions were also collected. None are considered to be SREs.

Specialist identification of specimens determined that ten taxa that are potentially SRE were collected. Of these, eight are myglomorph spiders and two are pseudoscorpions. The myglomorph spiders collected considered potential SREs contained a number of female and juvenile specimens. The few male specimens collected were insufficient to allow further classification. The pseudoscorpions collected included a single female for one morphospecies and juveniles for the other morphospecies.

The potential SRE were collected from six different habitats. Review of the number of specimens collected and the distribution of the habitat the specimens were collected from indicates that four morphospecies were collected from multiple locations and six morphospecies were collected from common habitat types.

Confirmation of the actual SRE status of the 10 collected morphospecies can only be obtained if additional specimens are collected that contain sufficient taxonomic information. Typically this requires collection of adult males. In the absence of this, the 10 morphospecies are considered to be classified as *Potential SRE – Data Deficient* (Rapallo 2014b).

3.12 SUBTERRANEAN FAUNA

The potential presence of subterranean fauna was investigated by MBS in October 2013. A desktop review showed that the geology and hydrogeology of the Nova Project area was suitable to support stygofauna. Sampling was undertaken in accordance with the Guidance Statement 54 (for consideration of subterranean fauna), and Draft Guidance Statement 54a (for sampling of subterranean fauna (EPA) 2003, EPA 2007.)

No stygofauna were collected from 13 sample sites. Although troglofauna were not considered as part of this assessment, it was noted that none were collected as by-catch during the stygofauna survey (MBS 2013).

3.13 SOCIAL ENVIRONMENT

3.13.1 Social Setting

The project is in the Goldfields-Esperance region of Western Australia. This area contains Unallocated Crown Land and reserves and is used for grazing, fishing, tourism, exploration and mining.

The project is located within the Shire of Dundas and the nearest permanent town is Norseman which is approximately 140 km to the west. There are small retail shops in Norseman to support the local population in addition to tourists passing through the town. Other nearby features to the Nova Project are Balladonia, a small roadhouse community (110 km southeast along the Eyre Highway) and the Fraser Range Caravan Park (approximately 40 km to the southwest).

Existing facilities at the Nova Project include an accommodation camp that can cater to a maximum of 32 exploration personnel, a core yard, a storage/laydown area and a number of portable equipment items. Access is via an unsealed Fraser Range Station track known as the 'Fenceline track' and a Department of Fire and Emergency Services (DFES) track known as the 'south track'. Both tracks are vulnerable to weather.

3.13.2 Great Western Woodlands

The project area is located within the Great Western Woodlands, an area of high biological richness almost 16 million hectares in size, extending from the edge of the wheatbelt to Kalgoorlie-Boulder in the north, to the inland deserts and the Nullarbor Plain to the east (DEC 2010). This area is mainly composed of woodland, shrubland and mallee communities and has a high diversity of *Eucalyptus* species with as many as 170 occurring in the bioregion. The Great Western Woodlands also have a high diversity in *Acacia* species, and high species and ecosystem diversity in ephemeral (short-lived) flora communities of tertiary sandplain shrublands and of valley floor woodlands. The Great Western Woodlands Strategy (DEC 2010) aims to provide an approach to management and protection that will allow long term conservation of this area's unique natural and cultural values through coordination and integration of many planning and management elements in the area.

The Great Western Woodlands is still relatively intact, however is under increasing pressure from introduced fauna, weeds and bushfires. Land clearing for residential, mining, industrial and infrastructure purposes is an ongoing issue, and leads to loss of biodiversity and increased dry land salinity (DEC 2010).

The Nova Project is situated approximately 80 km from the eastern edge of the Great Western Woodlands, and the project area represents 0.03% of its total area. Sirius has initiated consultation with Gondwanalink, which has taken great interest in the Great Western Woodlands conservation and rehabilitation. Sirius continues to consult to align project development to regional objectives.

3.13.3 Reserves

The project does not occur within any gazetted reserve. Crown Reserve 36957 (Dundas Nature Reserve), reserved under Part 4 of the *Land Administration Act 1997* for the Conservation of Flora and Fauna is located approximately 70 km to the southwest of the project area. A proposed nature reserve (Lake Harris Nature Reserve) is located 50 km northeast of the project area.

3.13.4 Mining History

The Nova deposit was discovered in July 2012 as part of the Fraser Range Exploration Project. Excluding the disturbance caused from exploration activities, there are no current mining related disturbances or historic disturbances in the project area.

3.13.5 Pastoral

The western side of MLA28/376 (1,845 ha) occurs on the Fraser Range Pastoral Lease. The southern 8 km and associated borrow pits (178 ha) of the proposed access road are within the Southern Hills Pastoral Lease.

Fraser Range Station is used for grazing sheep, and plans to introduce grazing of cattle. This station owns and operates a caravan park adjacent to the Eyre Highway. This park caters for tourists driving between Norseman and Adelaide. The Southern Hills Pastoral Station is also used for grazing sheep.

3.13.6 Native Title

The Native Title claimants for this area are the Ngadju people (Ngadju Native Title Claim WC99/002). Sirius is negotiating Land Access Agreements that provide for employment, contracting and cultural awareness programs as well as payments based on production.

3.13.7 Heritage

A search of the Department of Aboriginal Affairs' (DAA) website was conducted on 18 February 2014 to determine the presence of items or sites of State, National or Aboriginal heritage. No registered Aboriginal heritage sites are

located within MLA28/376 or near the proposed access road. The database search identified two sites nearby to the project area:

- Symons Hill (Site ID 1396) is an artefact / scatter site that is also a camp, and is classified as insufficient information by the DAA. It is located to the southwest (approximately 8 km) of the western portion of the MLA.
- Fraser Range 2 (Site ID 1338) is an artefact / scatter site, classified by DAA as insufficient information is located approximately 7 km to the west of the access road.

Sirius has commissioned a number of heritage surveys within the exploration area during the period 2009-2010. These surveys were conducted by archaeologists and anthropologists expert in the area being surveyed. Traditional Owners actively participated in these surveys.

SJC Heritage Consultants Pty Ltd (SJC) conducted an archaeological survey over MLA28/376 in October 2013. During the six day survey, SJC recorded 19 isolated artefacts, six potential snail-shell middens and three potential quartz quarries. This survey also determined that there are no known sacred, ritual, ceremonial or burial sites within the project area. Additionally, there are no prominent rocky outcrops or water sources within the project area that may have been sacred, ritual or ceremonial sites.

Adele Millard Consultancy Services (Adele) completed an ethnographic survey with members of the Ngadju Native Title Claim Group in 2013. The survey covered the proposed access road, borrow pits and water exploration areas. Adele recorded a gnamma hole with three associated rock holes in the vicinity, located approximately 550 m to the west of the access road corridor. This gnamma hole is also associated with the restricted s16 vegetation community. A minimum 50 m buffer from the gnamma hole and the s16 vegetation community will ensure this site is not disturbed.

The location of DAA registered sites, as well as recorded calcrete deposits, stone artefacts, quarries and potential quarries, snail shell middens and potential snail shell middens, rockholes and water sources is shown in Figure 13.

3.14 FIRE REGIMES

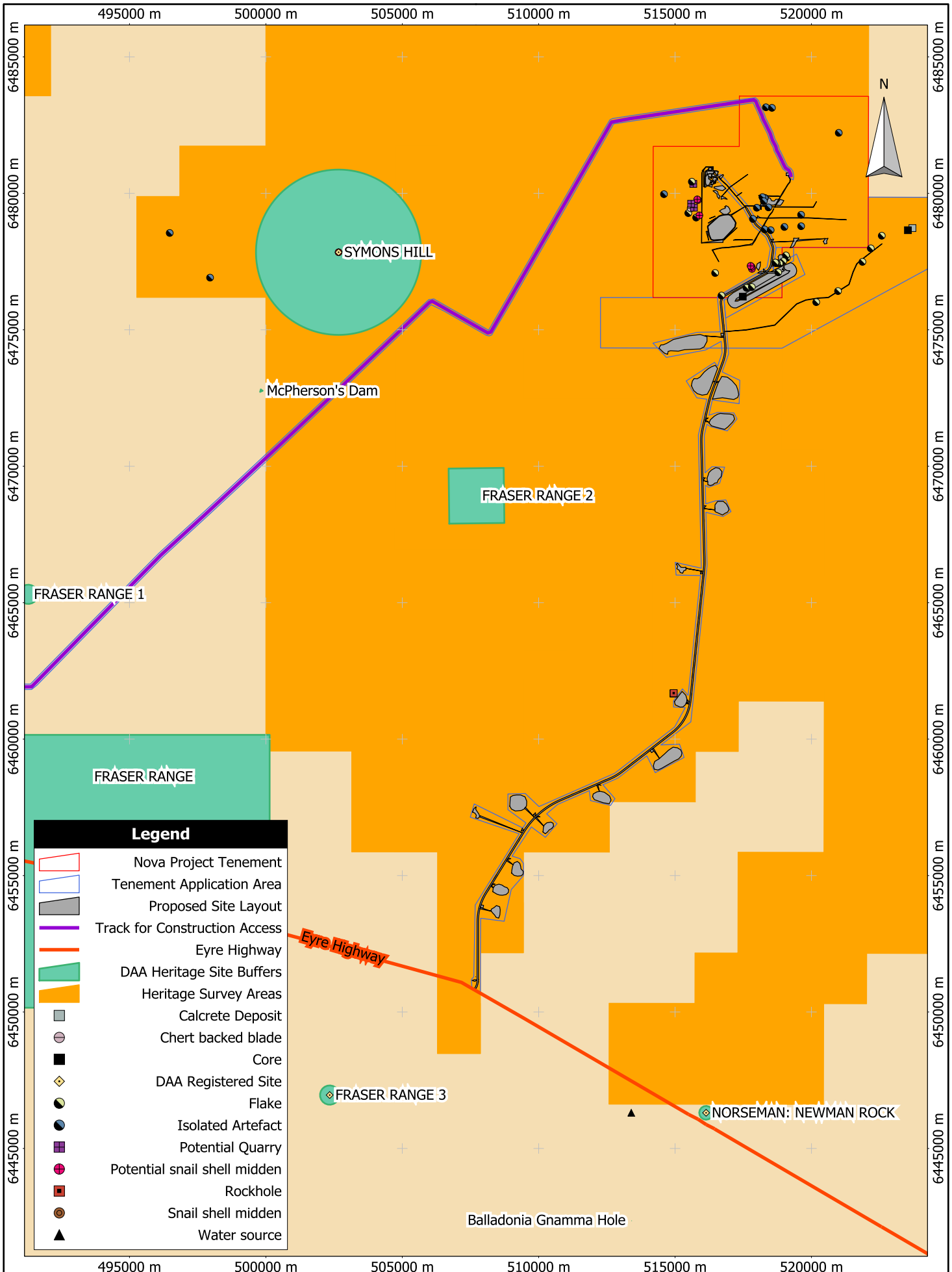
Several recent (5-10 years old) fires have burnt large tracts of woodlands along the proposed access road corridor. During the fauna survey, Rapallo (2014a) observed that a fire occurred about 5-10 years ago through a large portion of the proposed access road corridor. Rapallo (2014a) suggests that the fire was a patchy cool to medium burn. Rapallo (2014a) also noted a smaller area was burnt in a fire less than five years ago. Vegetation within MLA28/376 seems to be largely unburnt by recent fires. Fires in this region are likely due to lightning strikes and they usually burn until they naturally extinguish.

3.15 AIR QUALITY AND NOISE

The closest occupied residential area to the project is the Fraser Range Caravan Park, which is located approximately 40 km to the southwest, across the Eyre Highway. This is used by tourists on a short term basis.

Both Fraser Range Station (located approximately 40 km southwest) and Southern Hills Station (located approximately 50 km southwest have occupied homesteads.

As such, the receptors of air quality and noise issues associated with the project will only be the employees of the Nova Project.



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Original Size: A4
Grid: Australia MGA94 (51)

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Figure 13

Location of Heritage Sites

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4. IDENTIFICATION OF ENVIRONMENTAL FACTORS AND ASSESSMENT OF POTENTIAL IMPACTS

Based on a preliminary assessment, the following is a summary of the key environmental factors identified as being relevant to the proposal:

- Flora and vegetation.
- Terrestrial fauna.
- Terrestrial environmental quality.

Secondary factors that are considered less likely to be impacted by the project include:

- Subterranean fauna.
- Inland waters environmental quality.
- Hydrological processes.
- Heritage.
- Landform.
- Mine closure and rehabilitation.

Other factors considered clearly unlikely to be impacted by the project include:

- Air quality.
- Amenity.
- Human health.
- Offsets.

Information regarding each of the environmental factors including a description of the potential environmental impact and preliminary management and mitigation actions is contained in Table 8.

Table 8: Assessment of Likely Impact on Environmental Factors by the Nova Project

Environmental Factor	EPA Objectives	Potential Impacts of Nova Project	Preliminary Mitigation and Management Actions
Land			
Flora and Vegetation	To maintain representation, diversity, viability and ecological function at the species, population and community level.	• Localised loss of vegetation from clearing. • Loss of biological diversity and reduced regional representation of flora and vegetation communities. • Disturbance to Priority flora. • Fragmentation of land within and near to PECs. • Spread of existing weed species and the introduction of new weed species due to increased vehicle movement in the local area. • Vegetation damage due to increased fire risk. • Death of vegetation due to saline water and tailings spills/leaks. • Alteration to vegetation communities resulting from changed drainage patterns. • Reduction in vegetation condition due to dust emissions. • Loss of riparian vegetation where the access road crosses ephemeral watercourses.	• Clearing activities will be managed to ensure clearing is strictly limited to that necessary for the operations. • Disturbed areas will be rehabilitated as they become available. • Site layout will ensure avoidance of Priority flora. • Direct disturbance of PECs will be minimised through careful design of site layout. • Vehicle and equipment hygiene procedures will be implemented to minimise entry of weed and soil borne diseases. • Fire breaks will be installed to protect key infrastructure where required and mosaic burns will be conducted to assist with minimising spread of fire and reducing the severity of fire when it does occur. • Firefighting equipment will be located on site and personnel trained in fire response. • Lightening protection equipment will be installed as part of project design where necessary. • Project design has considered location of drainage lines and flood levels with the aim of minimising disturbance of these areas. • Pipes transferring saline water and tailings will be located within bunds. • Dust control measures will be implemented. • Speed limits will be implemented to minimise dust emissions. • Dust suppression agents will be used as needed to minimise dust emissions from roads and other disturbed areas. • A Mine Closure Plan will be developed and implemented. Closure criteria will consider EPA objectives for this factor.

Environmental Factor	EPA Objectives	Potential Impacts of Nova Project	Preliminary Mitigation and Management Actions
Landforms	To maintain the variety, integrity, ecological functions and environmental values of landforms and soils.	• Permanent changes to the landform as a result of development of an underground mine and construction of a TSF. • Short term changes to landform for construction of project infrastructure. Impacts on landform are only for the life of the project (10 – 12 years). • Increased erosion within disturbed areas.	• Project design has considered minimising landform disturbance. • Clearing activities will be managed to ensure clearing is strictly limited to that necessary for the operations. • Disturbed areas will be rehabilitated as they become available. • A Mine Closure Plan will be developed and implemented. Closure criteria will consider EPA objectives for this factor. • Topsoil will be stripped and stockpiled for later use in rehabilitation activities. • Woody vegetation cleared for the project will be stockpiled and retained for use in rehabilitation. • Topsoil stockpiles will be seeded if required to minimise erosion. • Borrow pits will be rehabilitated with slopes battered to a 1:3 slope to reduce water erosion and ponding and blend with the surrounding environment. • Consultation will be undertaken with stakeholders regarding the future use of the access road and airstrip post project.
Subterranean Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	Baseline studies did not identify subterranean fauna within the fractured rock aquifer above the orebody. Additional hydrological studies are required for the southern borefield area to determine if sufficient water is present to develop a borefield. Subterranean fauna investigations will be undertaken if hydrological investigations yield positive results. If subterranean fauna is present in the southern borefield area, potential impacts may include: • Direct disturbance of potential subterranean fauna habitat due to dewatering activities. • Alteration of groundwater tables i.e. drawdown associated with dewatering.	If subterranean fauna is found to be present within the southern borefield, management actions to minimise impacts will include: • Designing the water abstraction network to minimise localised groundwater drawdown. • Implementing groundwater level monitoring programs to determine if levels are changing significantly and the spatial extent of these. • Implementing subterranean fauna monitoring programs to determine if population numbers and species diversity are being adversely impacted.

Environmental Factor	EPA Objectives	Potential Impacts of Nova Project	Preliminary Mitigation and Management Actions
Terrestrial Environmental Quality	To maintain the quality of land and soils so that the environment values, both ecological and social, are protected.	• Contamination of soils through spillage of reagents, mineral concentrates, petroleum hydrocarbons, tailings or saline water. • Disruption of pastoral activities on Fraser Range and Southern Hills Stations.	• Pipelines will be located within bunds to prevent uncontrolled discharge of saline water and tailings to the environment. • Tailings and return water pipelines will be fitted with leak detection sensors. • Reagents and hydrocarbons will be stored within bunded areas. • Spill kits will be located at strategic locations throughout the project area and employees trained in their use. • Water storages potentially storing saline or poor quality water will be lined to prevent or minimise seepage. • Project design has minimised location of mining infrastructure on pastoral land. • Concentrate will be loaded within a fully enclosed shed and transported in sealed containers.
Terrestrial Fauna	To maintain representation, diversity, viability and ecological function at the species, population and assemblage level.	• Removal and fragmentation of fauna habitat. • Reduction in connectivity of fauna habitat. • Disturbance of conservation significant fauna species by clearing of habitat. • Increased risk of fauna mortality from vehicle strikes. • Potential increase in pest species (populations and number of species) through establishment of domestic waste disposal and permanent water storage facilities. • Death of fauna due to bogging in the TSF or drowning in water storages. • Isolation of local habitats for terrestrial invertebrate SRE species.	• Clearing activities will be managed to ensure clearing is strictly limited to that necessary for operations. • Project design has considered location of fauna species and habitat of significance. • Disturbed areas will be rehabilitated as they become available. • Buffer areas will be implemented around Malleefowl mounds where possible. • Speed limits will be implemented to minimise fauna mortality due to vehicle strike. • Open holes, trenches, the refuse impoundment and any water holding facilities will be inspected regularly for fauna. • The site induction program will provide information on fauna of conservation significance including their appearance and habitats. • Domestic waste facilities will be fenced and putrescible wastes will be regularly covered.

Environmental Factor	EPA Objectives	Potential Impacts of Nova Project	Preliminary Mitigation and Management Actions
Water			
Hydrological Processes	To maintain the hydrological regimes of groundwater and surface water so that existing and potential uses, including ecosystem maintenance, are protected.	• Flooding of the project area and associated infrastructure. • Ponding of water in infrastructure areas. • Localised lowering of groundwater levels. • Over abstraction of aquifers. • Localised reduction in surface water volumes.	• Project design has considered locations of ephemeral drainages and minimised disturbance of these. • Culverts or floodways will be installed where necessary to prevent blockage of ephemeral drainages. • A surface water management plan will be implemented. • A detailed hydrological review and on-going monitoring will be conducted to ensure sustainable abstraction of groundwater.
Inland Waters Environmental Quality	To maintain the quality of groundwater and surface water, sediment and biota so that the environmental values, both ecological and social, are protected.	• Contamination of underlying groundwater from seepage. • Contaminated of ephemeral drainage lines from saline water, tailings or hydrocarbon spills. • Increased sediment entering ephemeral drainage lines during construction.	• Project design has considered locations of ephemeral drainages and minimised disturbance of these. • Potentially contaminated water will be captured and either re-used or treated before discharge. • Diversion bunds will be constructed to separate clean and potentially contaminated water. • Pipelines will be located within bunds to prevent uncontrolled discharge of saline water and tailings to the environment. • Tailings and return water pipelines will be fitted with leak detection sensors. • Reagents and hydrocarbons will be stored within bunded areas. • Spill kits will be located at strategic locations throughout the project area and employees trained in their use. • Water storages potentially storing saline or poor quality water will be lined to prevent or minimise seepage. • Sediment control measures will be implemented during construction.
Air			

Air Quality	To maintain air quality for the protection of the environment and human health and amenity.	The project is remote and it is greater than 40 km to potential sensitive receptors. The project has potential to affect air quality through:
		• Generation of dust via:
		  • Land clearing during construction.
		  • Blasting during boxcut construction.
			• The project access road will be sealed.
			• Vehicle traffic will be confined to defined roads and tracks.
			• Dust suppression measures will be implemented using water sprays and other means, as necessary.
			• Vehicles and power generation equipment will be maintained to minimise emissions.

Environmental Factor	EPA Objectives	Potential Impacts of Nova Project	Preliminary Mitigation and Management Actions

		• Erosion from topsoil and ore stockpiles.
		• Vehicle movement on unsealed roads within the project area.
		• Emissions from ore crushing and grinding and material transfer during ore processing.
		• Wind erosion of TSF surfaces.
		• Generation of greenhouse gas emissions via:
		  • Engine exhaust emissions from construction equipment, underground mining equipment and light vehicles.
		  • Generation of power using diesel fuel.
		  • Transport of copper and nickel concentrate offsite.
		  • Transport of materials and reagents tor the project area and removal of packaging wastes.
		• Generation of wet saline aerosol emissions from ventilation fans.
			• Disturbed areas will be rehabilitated as they become available.
			• Energy efficiency and greenhouse gas emissions will be considered as part of equipment selection and purchase.
			• Vent fans design will consider the need for capture of saline mists.

People			
Amenity	To ensure that historical and cultural associations are not adversely affected.	The project area is remote and is not visited by people other than those involved in station activities or Traditional Owners. There are no sensitive receptors given the remoteness of the project area. Potential Impacts of the Nova Project are: • Disruption to traditional use of the land by the Ngadju people. • Visual scar on the landscape if rehabilitation of disturbed areas is ineffective.	• Sirius will enter into a Native Title Agreement with the Ngadju people. • Stakeholder consultation will continue to be undertaken. • A Mine Closure Plan will be developed and implemented. • Monitoring will be implemented once areas are rehabilitated to ensure progression towards completion criteria.

Environmental Factor	EPA Objectives	Potential Impacts of Nova Project	Preliminary Mitigation and Management Actions
Heritage	To ensure that historical and cultural associations are not adversely affected.	• Disruption in access to sites of cultural significance. • Direct disturbance of archaeological sites.	• Project design has considered the results of the archaeological and ethnographic surveys. • Project inductions will include information on heritage aspects of the project area.
Human Health	To ensure that human health is not adversely affected.	The project area is remote and is not visited by people other than those involved in station activities or Traditional Owners. Potential impacts on health of employees relevant to the *EP Act* include: • Noise. • Air quality (particulates). • Chemical exposure.	• Project design has considered exposure to noise and dust emissions. The accommodation village has adequate separation to minimise adverse impacts. • Compliance with occupational hygiene requirements for noise and dust in operational areas.
Integrating Factors			
Offsets	To counterbalance any significant residual environmental impacts or uncertainty through the application of offsets.	No critical or high value environment assets will be affected by this project. Offsets are not anticipated to be required.	Project design has considered critical and high value environmental assets and prevented impact on them.
Rehabilitation and Closure	To ensure that premises are closed, decommissioned and rehabilitated in an ecologically sustainable manner, consistent with agreed outcomes and land uses, and without unacceptable liability to the State.	• Wind and water erosion of disturbed areas. • Off-site discharge of potential pollutants from unrehabilitated land. • Ineffective establishment of vegetation and habitat. • Disruption to or poor re-establishment of local drainage paths. • Safety risks associated with infrastructure and the mine workings.	• A Mine Closure Plan will be developed and implemented. • Monitoring will be implemented once areas are rehabilitated to ensure progression towards completion criteria. • Annual payments will be made to the States Mine Rehabilitation Fund.

5. STAKEHOLDER CONSULTATION

Sirius is working to establish responsible mining development at the Nova Project. The company has engaged the following key stakeholders in this project:

- State Government.
- Federal Government.
- Aboriginal groups.
- Non-government organisation and Special Interest Groups.
- Pastoral Stations.

Since the discovery of the nickel-copper deposit and the decision by Sirius to develop the deposit into the Nova Project, a comprehensive consultation program has been implemented to ensure all relevant stakeholders have been identified and effectively consulted with regards to the project. The stakeholder consultation program was aimed at identifying any environmental issues as early as possible during the planning phase of the project to ensure sufficient information was obtained in a timely manner to address significant stakeholder concerns.

Table 9 lists the stakeholders that were identified for the Nova Project.

Table 9: Stakeholders for the Nova Project

Stakeholder Sector	Organisation	Interest
State Government	Office of the Environmental Protection Authority	Administer *EP Act*. Part 4 (*EP Act*) Environmental Impact Assessments.
	Department of Mines and Petroleum (DMP)	Administer *Mining Act 1978* and Regulations. Tenement conditions. Mining Proposal commitments. Environmental Performance Bonds. Rehabilitation standards. Relinquishment criteria. Environmental management.
	Department of Water (DoW)	Surface and groundwater resource protection. Provision of Licences to Take Water.
	Department of Environment Regulation (DER)	Administer *EP Act.* *Contaminated Sites Act 2003*. Contaminated Sites Remediation. Part 5 (*EP Act*) Industry Regulation and Licensing.
	DPaW	*WC Act*. Part 4 (*EP Act*) Environmental Impact Assessments. Flora & Fauna Conservation. Habitat Preservation.
	Department of Commerce	Health and Safety aspects of mining operations.
	Main Roads Western Australia	Public roads.
	Esperance Ports Sea and Land	Shipping concentrate through the Port of Esperance.

Stakeholder Sector	Organisation	Interest
Federal Government	Civil Aviation Safety Authority Department of Transport	Nova Airstrip.
Local Government	Shire of Dundas	Environmental health, building and planning compliance.
Aboriginal groups	Ngadji Representatives Goldfields Land and Sea Council	Access to Ngadju lands. Indigenous issues.
Non-government organisations and Special Interest Groups	Gondwana Link Wilderness Society Goldfields Esperance Development Commission Port Consultative Committee	Location within Great Western Woodlands. Location within Great Western Woodlands. General opportunities within the region. Esperance Port activities.
Pastoral Stations	Fraser Range and Southern Hills Pastoral Stations	Maintaining pastoral activities within exploration and mining tenements.

During the implementation of the stakeholder consultation program during 2013 and 2014, DPaW, DER, DMP and DoW have been consulted in relation to the Nova Project on several occasions. Detail of consultation outcomes with various agencies are provided in the Stakeholder Consultation Register located in Appendix 5.

Specific concerns for DPaW related to the potential environmental impacts that the Nova Project may have on conservation values within the Fraser Range and Southern Hills PECs. DPaW is also concerned about impacts to Priority flora. These concerns have been subsequently investigated during baseline environmental surveys resulting in the proposed mitigation and/or reduction of environmental impacts through strategic mine planning.

Specific items raised by DMP were in regards to safety, waste and tailings management and mine closure. Specific items raised by DER were in regards to saline water and tailings management. These items are being addressed as part of the DFS and potential impacts will be managed through implementation of best practice environmental management measures.

Discussions have been held with all regulators regarding the likelihood that the project will not be formally assessed. Concerns and specific items that have been raised by regulators will be addressed in approval documentation.

Sirius will continue to genuinely engage with relevant stakeholders on the management of matters associated with weed control, feral animal control, bushfire prevention and management, and closure planning to enable compatible management with adjacent lands.

6. EPA PRINCIPLES

The EPA has identified a set of principles for environmental management. Sirius has considered these in relation to the proposed project. Details of how these have been considered in project design and will be considered during project implementation are provided in Table 10.

Table 10: Nova Project – Principles of Environmental Management

Principle	Application
Precautionary Principle Where there are threats of serious irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: • Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and • An assessment of the risk-weighted consequences of various options.	Sirius will make use of the results of baseline environmental investigations to identify potential impacts and assess the environmental risk of the project's implementation on these aspects. Environmental risks will be considered when finalising options for key project design choices. Sirius commits to develop and implement measures to avoid serious or irreversible damage to the environment.
Intergenerational Equity The present generation should ensure that the health, diversity, and productivity of the environment is maintained or enhanced for the benefit of future generations.	Sirius commits to managing those environmental factors within its control such that future adverse impacts are minimised and that, wherever possible, the quality of the environment is maintained or enhanced. A Mine Closure Plan will be prepared for the project to ensure that post mining land use is consistent with agreed stakeholder objectives and so that can be progressively implemented.
Conservation of Biological Diversity and Ecological Integrity Conservation of biological diversity and ecological integration should be a fundamental consideration	The project design, including site layout has taken into account conservation of biological diversity. Direct impacts on conservation significant flora and fauna species have been avoided. Biological studies undertaken as part of collation of baseline information for the project will aid in the understanding of the biological diversity of this previously poorly studied area. Sirius undertakes to fully assess the effects of its operations, both direct and indirect, on the biological environment and to implement measures to protect biodiversity. This assessment will be documented in the final impact assessment document provided to regulatory authorities.
Improved Valuation, Pricing and Incentive Mechanisms • Environmental factors should be included in the valuation of assets and services. • The polluter pays principle – those who	Costs associated with power generation and energy use have been considered as part of the Scoping study and are being refined as part of the DFS. Costs associated with waste generation and disposal have been

Principle	Application
generate pollution and waste should bear the cost of containment, avoidance or abatement. • The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste. • Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, which benefit and/or minimise costs to develop their own solutions and responses to environmental problems.	considered as part of the Scoping Study and are being refined as part of the DFS. This includes the TSF, underground void backfilling, package sewerage treatment plants and disposal of brine from Reverse Osmosis Plants. Costs associated with project closure have been considered as part of the Scoping study and are being refined as part of the DFS. Costs associated with life cycle of reagents and other major project consumables have been considered as part of the Scoping Study.
Waste Minimisation All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment. Wastes should be managed in accordance with the following order of preference: • Avoidance. • Re-use. • Recycling. • Recovery. • Treatment. • Containment. • Disposal.	Waste minimisation principles have been considered in project design. This includes: • Avoiding the need for a permanent waste rock dump on the surface. • Reuse of waste rock and tailings for filling of underground voids. • Re-use of topsoil and cleared vegetation in rehabilitation of areas post mining. • Recycling of waste water from the TSF and within the ore Processing Plant. • Recovery of ROM Pad and Processing Plant footings as part of mine closure. • Treatment of waste water to allow re-use. • Containment of tailings in underground voids as a cemented paste product or containment in a lined, engineered TSF which will be safe, stable and non-polluting in the long term. • Disposal of putrescible wastes on a purpose built onsite landfill. • Minimising packaging wastes associated with reagents by importing in bulk and requiring return of packaging to suppliers.

7. PROJECT ENVIRONMENTAL ASSESSMENT REQUIREMENTS

The Nova Project area is remote and is a new mining area and as such there was limited environmental data available for the surrounding region. Baseline environmental studies undertaken by Sirius have largely been completed and have significantly contributed to the scientific knowledge of the area and have given Sirius a well-developed understanding of the project area, the surrounding environmental aspects and potential impacts.

Sirius has engaged key stakeholders since early 2013 and intends to continue its engagement with interested persons and organisations as it completes environmental investigations and refines project design details.

Sirius considers the significant environmental issues associated with the Nova Project are limited in nature and extent. Environmental issues can be managed effectively within other regulatory frameworks such as:

- **Native Vegetation Clearing Permit**: This is a well-documented assessment process with opportunity for public comment. Impacts of land clearing can be adequately assessed by DMP using this process.
- **Mining Proposal**: This is a well-documented assessment process managed by DMP Environmental Officers with strong technical understanding of the potential impacts of mining and appropriate management measures to safeguard the environment. Requirements for lodgement of an annual Mining Rehabilitation Fund fee will assist in minimising environmental liabilities to the State in the case of unplanned closure.
- **Works Approval**: This is a well-documented assessment process with opportunity for public comment. Design of equipment and infrastructure associated with pollution management specifically discharges to air, land and water can be adequately assessed by DER using this process.
- **Environmental Licence**: This is a well-documented assessment process with opportunity for public comment. Impacts of discharges to air, land and water can be adequately assessed by DER using this process. Conditions can be placed on the licence requiring environmental monitoring, reporting of incidents and provision of monitoring data. DER has powers to assess and ensure compliance with licence conditions.
- **Water Licence**: Sirius holds a licence to abstract water (GWL 176816(1)) for the purposes of dust suppression for mining and mining camp purposes. The current annual allocation is 1,500 kL. This will be increased on an as demands basis subject to 26D licences to explore for water. These are a well-documented assessment process. Impacts on aquifers can be adequately assessed by DoW using this process.

8. CONCLUSION

The project area is remote and is located in a new mining area. Limited baseline environmental information was available prior to Sirius engaging a wide range of specialists to conduct baseline studies. The information obtained from these studies has contributed significantly to the scientific understanding of the area as well as allowing Sirius to develop project plans that prevent or minimise adverse environmental impacts.

Sirius has engaged stakeholders throughout the exploration and project design process and aims to continue to engage effectively with stakeholders throughout the life of the project.

Sirius believes that as a result of project design, potential adverse environmental impacts associated with construction and implementation of the Nova Project are limited and able to be effectively managed using standard industry practices. Key aspects that have potential to be impacted have been identified to be flora and vegetation, terrestrial fauna and terrestrial environmental quality. All other aspects are considered secondary or unlikely to be impacted.

Sirius believes that the project does not warrant formal assessment under Part IV of the *EP Act* as it can be adequately assessed and implementation monitored through provisions of the *Mining Act 1978* and Part V provisions of the *EP Act.*

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APPENDICES

APPENDIX 1: FLORA AND VEGETATION SURVEY OF THE NOVA PROJECT, FRASER RANGE (MATTISKE 2014)

FLORA AND VEGETATION SURVEY OF THE

NOVA PROJECT, FRASER RANGE

Prepared for

SIRIUS GOLD PTY LTD

May 2014

SRL1403/015/2014

Mattiske Consulting Pty Ltd

Disclaimer and Limitations

This report has been prepared on behalf of and for the exclusive use of Sirius Gold Pty Ltd, and is subject to and issued in accordance with the agreement between Sirius Gold Pty Ltd and Mattiske Consulting Pty Ltd. Mattiske Consulting Pty Ltd accepts no liability or responsibility whatsoever for it with respect to any use of, or reliance upon, this report by any third party.

This report is based on the scope of services defined by Sirius Gold Pty Ltd, budgetary and time constraints imposed by Sirius Gold Pty Ltd, the information supplied by Sirius Gold Pty Ltd (and its agents), and the method consistent with the preceding.

DOCUMENT HISTORY

REPORT	VERSION	PREPARED BY	REVIEWED BY	SUBMITTED	
				DATE	COPIES
Internal review	V1	EM	EM	-	-
Draft report for client review	V2	-	EM	3/02/2014	Emailed
Final report	V3	DA/EM	EM	25/02/14	Emailed
Report updated to incorporate additional survey areas	V4	FH/RD/DA	EM	17/06/14	Emailed

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E: Summary of Vascular Plant Species recorded at each Survey Sampling Site within the Nova Survey Area, 2013

F: Summary of Vascular Plant Species recorded in each Vegetation Community in the Nova Survey Area, 2013

G: Vegetation Community Descriptions for the Nova Survey Area, 2013

H: Non-metric Multidimensional Scaling Ordination Plot (MDS) of Survey Sites based on fourth root transformed Abundance Data using Bray Curtis Similarity (Primer V6, Clarke and Gorley 2006)

I1-I2: Hierarchical Clustering of Survey Sites based on fourth root transformed Abundance Data using Bray Curtis Similarity (Primer V6, Clarke and Gorley 2006)

ABBREVIATIONS

BAM Act:	Biosecurity and Agriculture Management Act 2007
BOM:	Bureau of Meteorology
DAF:	Department of Agriculture and Food
DEC:	Department of Environment and Conservation
DPaW:	Department of Parks and Wildlife
DotE:	Department of the Environment
EPA:	Environmental Protection Authority
EPBC Act:	Environment Protection and Biodiversity Conservation Act 1999
EP Act:	Environmental Protection Act 1986
IBRA:	Interim Biogeographical Regionalisation for Australia
MCPL:	Mattiske Consulting Pty Ltd
PEC:	Priority Ecological Community
TEC:	Threatened Ecological Community
TSSC:	Threatened Species Scientific Committee
WC Act:	Wildlife Conservation Act 1950

1. SUMMARY

Mattiske Consulting Pty Ltd (MCPL) was commissioned in 2013 by Sirius Resources NL to undertake a Level 2 flora and vegetation survey of the Sirius Gold Pty Ltd's proposed Nova mine and the associated infrastructure areas.

The Nova Project area is located approximately 100 km east of Norseman, and 30 km north of the Eyre Highway, adjacent to the Fraser Range, Western Australia (Figure 1).

The studies undertaken in 2013 and 2014 over the course of four field surveys, which included different seasons, were considered more than adequate for a Level 2 assessment. Although the survey effort was considered more than adequate, there were two potential constraints on the assessment, the first related to the difficulty of identifying some of the Eucalypts in the recently burnt areas and the second was the difficulty of comparing the vegetation communities as defined with the Priority Ecological Communities (PECs) as defined by DPaW for the 'Fraser Range vegetation complex' and the 'Plant assemblages of the Southern Hills Vegetation Complex'.

Flora

A total of 369 vascular plant taxa, representative of 145 genera and 63 families, were recorded on the Nova Project area. In terms of the coverage of species, as indicated in Section 6.5, based on the Incident Coverage Estimator (ICE) of species richness approximately 83.93% of the flora species potentially present within the Nova Project area were recorded. Further, twenty-two per cent of the vascular plant species recorded were annual or annual/perennial species and the remainder were perennial. The latter findings support the adequacy of the survey effort and coverage over several seasons in 2013 and 2014.

A total of ten introduced (weed) species were recorded within the Nova Project area in 2013 and 2014. None of these species are declared pest organisms pursuant to Section 22 of the BAM Act 1979. Three of the introduced species (**Centaurea melitensis*, **Cucumis myriocarpus* and **Salvia verbenaca*) are listed by the DPaW (2014f) as environmental weeds, although all currently have a low status.

No threatened flora species pursuant to Subsection (2) of Section 23F of the WC Act and as listed by the DPaW (2014b), or pursuant to Section 179 of the EPBC Act or listed by the DotE (2014a) were recorded within the Nova Project area. Four priority flora species, as listed by the DPaW (2014f), were recorded within the Nova Project area. It is apparent that many of the previous collections as extracted from the DPaW (2014b) database have been collected near access tracks and main roads and the scattered distribution may reflect a lack of sampling of these priority species and as more studies are undertaken in the region the status of many of these species may be reviewed.

An additional thirteen species were highlighted as other species of interest. Largely these latter species reflect the lack of detailed botanical studies near the Nova Project area. In addition several groups such as the *Lepidosperma* species are currently undergoing a taxonomic revision and therefore it is difficult to clearly assess their current nomenclature or status.

Vegetation

Thirty-five vegetation communities were defined and mapped on the basis of the analyses within the Nova Project area. These thirty-five vegetation communities consisted of twenty-one Eucalypt woodlands, ten shrublands and open scrubs and four hummock grasslands. One highly restricted vegetation community (S16), which was recorded on one occasion, was associated with a massive granite outcropping. The structural and floristic composition of the shrublands, open scrub and hummock grasslands were particularly evident and the boundaries tended to be clear and usually associated with underlying site conditions. In contrast the woodlands formed a continuum with some species occurring within a range of communities, whilst others were quite specific and localized. As some of the woodland areas had been burnt recently the delineation of some of the boundaries may shift as more information becomes available on the Eucalypts within these burnt areas. Nevertheless the associated species enabled the definition of twenty-one woodlands. The vegetation maps reflect this complexity of the area with subtle changes in dominance and associations influencing the resulting outcome.

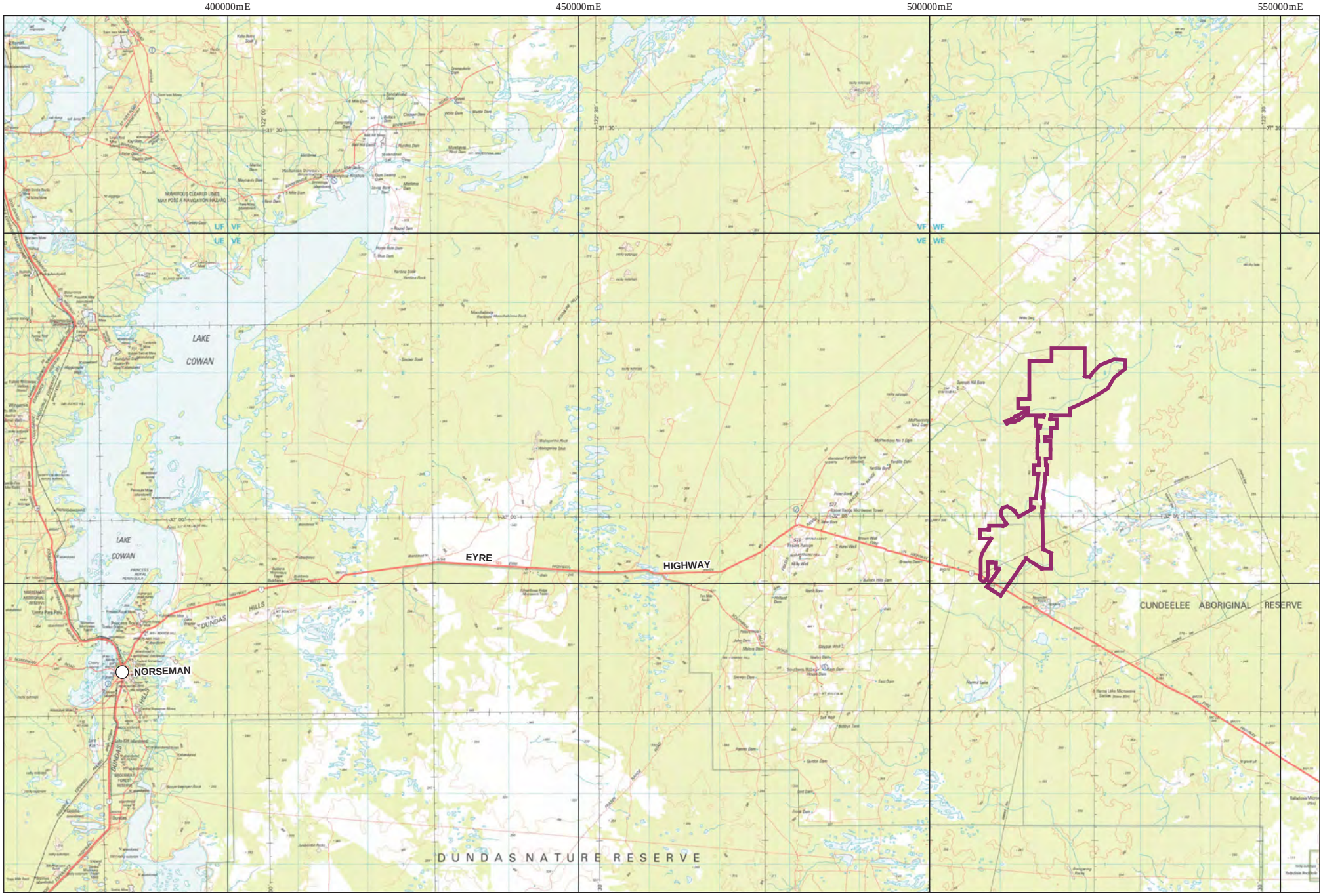
No Threatened Ecological Communities (TECs) as listed by the DPaW (2014b) or by the DotE (2014a) were recorded within the Nova Project area.

Two Priority 1 Ecological Communities, the 'Fraser Range vegetation complex' and the 'Plant assemblages of the Southern Hills Vegetation Complex' overlap with several western sections of the Nova Project area. The proportion of the 'Fraser Range vegetation complex' and 'Southern Hills vegetation complex' intersected by the Nova Project area is 0.98% and 0.83% respectively.

As no detailed data from DPaW was available for the PECs any detailed and comparative statistical analyses with survey quadrats established within the Nova Project area was difficult. In essence it appears that the two PECs rely mainly on the earlier work by Beard (1975) and the updated work of Hopkins, Beeston and Shepherd (2001). In reviewing the overlap with the communities it appears that the Eucalypt woodlands exist as a continuum on the slopes away from a series of ranges and hills in the areas, as a result the species shift across the landscape. In comparing the species highlighted in the original definition of the PECs it appears that a range of species do not extend into the Nova Project area; whilst others occur in various numbers of communities.

As indicated earlier the two PECs overlap in spatial extent and in their definitions. Consequently, there remain questions about the floristic composition and spatial extent of the communities that are associated with these communities.

At the time of compiling this report, details of the location of infrastructure within the Nova Project area were not available. Consequently no calculations related to the potential impacts to mapped vegetation have been supplied.



Legend

Nova Project Area

Client:
SIRIUS GOLD PTY LTD
P.O. Box 1011, Balcatta WA 6914
Tel: +61 8 6241 4200
www.siriusresources.com.au

0 8km
Scale 1:500,000
MGA94 (Zone 51)
CAD Ref: g2125_Nova_f01_01.dgn
Date: Jan 2014 | Rev: B | A3

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
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Nova Project
Locality

Figure:
1

2. INTRODUCTION

Mattiske Consulting Pty Ltd (MCPL) was commissioned in June 2013 by Sirius Resources NL to undertake a Level 2 flora and vegetation survey of Sirius Gold Pty Ltd's proposed Nova mine and the associated infrastructure areas.

The Nova Project area is located approximately 100 km east of Norseman, and 30 km north of the Eyre Highway, adjacent to the Fraser Range, Western Australia (Figure 1). The Nova Project area refers to the proposed mine and infrastructure areas, access road alignment options, borefield and borrow pit areas, see Figure 1.

This survey was carried out over four separate trips, the first focusing on the mine and infrastructure areas (E28/2177), the second focusing on a proposed access road alignment to the Eyre Highway (with additional sampling to complement the first trip), the third focusing on a realignment of the southern section of the proposed access road (E69/3074) (also including additional sampling for the previously surveyed areas) together with proposed bore field areas, and the fourth was focussed on additional areas. All areas surveyed are outlined in Figure 1.

2.1 Western Australia's Flora – A Legislative Perspective

Western Australia has a unique and diverse flora, and is recognised as one of the world's 34 biodiversity hotspots (Myers *et al*. 2000). In this context, Western Australia possesses a high degree of species richness and endemism. This is particularly pronounced in the south-west region of the State. There are currently over 12,000 plant species known to occur within Western Australia (Department of Parks and Wildlife, formerly Department of Environment and Conservation - DPaW 2014a), and scientific knowledge of many of these species is limited.

The legislative protection of flora within Western Australia is principally governed by three Acts. These are:

- The *Wildlife Conservation Act 1950* (WC Act);
- The *Environmental Protection Act 1986* (EP Act); and
- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

The unique flora of Western Australia is potentially under threat due to historical clearing practices associated with agricultural, mining and human habitation activities. As a consequence of these historical clearing practices a number of flora species have become threatened or have the potential to become threatened as their habitat is impacted by human activity. In addition, some areas of the State have been affected by past clearing practices such that entire ecological communities are under threat. The following sections describe these threatened and priority flora and ecological communities, and outline the legislative protection afforded to them.

At the State level, the WC Act provides for taxa of native flora (and fauna) to be specially protected because they are subject to identifiable threats. Protection of these taxa has been identified as being warranted because they may become extinct, are threatened, or are otherwise in need of special protection. Ecological communities that are deemed to be threatened are afforded protection under the EP Act. Listings of threatened species and communities are reviewed annually by the Western Australian

Threatened Species Scientific Committee (TSSC), which is a body appointed by the Minister for the Environment and supported by the DPaW. The TSSC reviews threatened and specially protected flora (and fauna) listings on an annual basis. Recommendation for additions or deletions to the listings of specially protected flora (and fauna) is made to the Minister for the Environment by the TSSC, via the Director General of the DPaW, and the WA Conservation Commission. Under Schedule 1 of the WC Act, the Minister for the Environment may declare that a class or description of flora to be threatened flora throughout the State, by notice published in the Government Gazette (DPaW 2014b).

At the Commonwealth level, under the EPBC Act, a nomination process exists to list a threatened species or ecological community. Additions or deletions to the lists of threatened species and communities are made by the Federal Minister for the Environment, on advice from the Federal TSSC. EPBC Act lists of threatened flora and ecological communities are published on the Department of the Environment (DotE) websites (2014a; 2014b).

2.2 Threatened and Priority Flora

Flora within Western Australia that is considered to be under threat may be classed as either threatened flora or priority flora. Where flora has been gazetted as threatened flora under the WC Act, it is an offence "to take" such flora without the written consent of the Minister. The WC Act states that "to take" flora includes to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means.

Priority flora constitute species which are considered to be under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Such species are considered to potentially be under threat, but do not have legislative protection afforded under the WC Act. The DPaW categorises priority flora according to their conservation priority, using five categories, P1 to P5, to denote the conservation priority status of such species, with P1 listed species being the most threatened, and P5 the least. Priority flora species are regularly reviewed, and may have their priority status changed when more information on the species becomes available. Appendix A1 sets out definitions of both threatened and priority flora (DPaW 2014c).

At the Commonwealth level, under the EPBC Act, threatened species can be listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent, by the Federal Minister for the Environment. A description of each of these categories of threatened species is set out in Appendix A2. Under the EPBC Act, a person must not take an action that has or will have a significant impact on a listed threatened species without approval from the Federal Minister for the Environment, unless those actions are not prohibited under the Act. The current EPBC Act list of threatened flora may be found on the DotE (2014a) website.

2.3 Declared Pest (plant) Organisms

The *Biosecurity and Agriculture Management Act 2007* (BAM Act), Section 22, makes provision for a plant taxa to be listed as a declared pest organism in respect of parts of, or the entire State. According to the BAM Act, a declared pest is defined as a prohibited organism (Section 12), or an organism for which a declaration under section 22 (2) of the Act is in force. As of May 31st, 2013, this act replaced the Agriculture and Related Resources Protection Act 1976.

Under section 26 (1) of the BAM Act, a person who finds a declared plant pest must report, in accordance with subsection (2), the presence or suspected presence of the declared pest to the Director General or an inspector of the Department of Agriculture and Food (DAF) Western Australia.

Under the *Biosecurity and Agriculture Management Regulations 2013*, declared pest plants are placed in one of three control categories, C1 (exclusion), C2 (eradication) or C3 (management), which determines the measures of control which apply to the declared pest (Appendix A6). According to section 30 (3) of the BAM Act, the owner or occupier of land, or a person who is conducting an activity on the land, must take the prescribed control measures to control the declared pest if it is present on the land.

The current listing of declared pest organisms and their control category is available on the Western Australian Organism List (WAOL), at the Biosecurity and Agriculture Management website of the Department of Agriculture and Food (2014).

2.4 Threatened and Priority Ecological Communities

An ecological community is defined as a naturally occurring biological assemblage that occurs in a particular type of habitat composed of specific abiotic and biotic factors. At the State level, ecological communities may be considered as threatened once they have been identified as such by the Western Australian Threatened Ecological Communities Scientific Advisory Committee. A threatened ecological community (TEC) is defined, under the EP Act, as an ecological community listed, designated or declared under a written law or a law of the Commonwealth as threatened, endangered or vulnerable. There are four State categories of TECs: presumed totally destroyed; critically endangered; endangered; and vulnerable (DPaW 2014c). A description of each of these categories is presented in Appendix A3. Threatened ecological communities are gazetted as such (DPaW 2014d).

At the Commonwealth level, some Western Australian TECs are listed as threatened, under the EPBC Act. Under the EPBC Act, a person must not take an action that has or will have a significant impact on a listed threatened ecological community without approval from the Federal Minister for the Environment, unless those actions are not prohibited under the Act. A description of each of these Federal categories of TECs is presented in Appendix A4. The current EPBC Act list of threatened ecological communities can be located on the DotE (2014b) website.

Ecological communities identified as under threat, but not listed as threatened ecological communities, can be classified as priority ecological communities (PECs). These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status. The DPaW categorises priority ecological communities according to their conservation priority, using five categories, P1 to P5, to denote the conservation priority status of such

ecological communities, with P1 communities being the most threatened and P5 the least. Appendix A5 sets out definitions of priority ecological communities (DPaW 2014b). A list of current priority ecological communities can be viewed at the DPaW (2014e) website.

2.5 Clearing of Native Vegetation

Under the EP Act, the clearing of native vegetation requires a permit to do so, from the DER or the Department of Mines and Petroleum, unless that clearing is exempted under specific provisions listed in Schedule 6 of the Act, or are prescribed in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004. Under the EP Act, "native vegetation" means indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation. Under the EP Act, section 51A, "clearing" means the killing or destruction of, the removal of, the severing or ringbarking of trunks or stems of, or the doing of any other substantial damage to, some or all of the native vegetation in an area, and includes the draining or flooding of land, the burning of vegetation, the grazing of stock, or any other act or activity, that causes any of the aforementioned consequences or results.

Under the EP Act, ten principles are set out, under which native vegetation should not be cleared. These principles state that native vegetation should not be cleared, if:

- it comprises a high level of biological diversity;
- it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia;
- it includes, or is necessary for the continued existence of, threatened flora;
- it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community;
- it is significant as a remnant of native vegetation in an area that has been extensively cleared;
- it is growing in, or in association with, an environment associated with a watercourse or wetland;
- the clearing of the vegetation is likely to cause appreciable land degradation;
- the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area;
- the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water; or
- the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

The Environmental Protection (Clearing of Native Vegetation) Regulations 2004, under Regulation 5, sets out prescribed clearing actions that do not require a clearing permit, as defined in section 51C of the EP Act.

Under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, under Regulation 6 –"environmentally sensitive areas" are defined as "the area covered by vegetation within 50 m of threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the threatened flora is located".

Under the Environmental Protection (Clearing of Native Vegetation) Regulations 2004 - Regulation 6 (environmentally sensitive areas), the area covered by a threatened ecological community, is similarly considered an environmentally sensitive area and therefore non-permitted, unless Ministerial approval is granted.

2.6 Local and Regional Significance

Flora or vegetation may be locally or regionally significant in addition to statutory listings by the State or Federal Government. Species, subspecies, varieties, hybrids and ecotypes of flora may be significant for a variety of reasons other than as threatened or priority flora, including:

- a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species;
- relic status;
- anomalous features that indicate a potential new discovery;
- being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- the presence of restricted subspecies, varieties, or naturally occurring hybrids;
- local endemism/a restricted distribution; and
- being poorly reserved (Environmental Protection Authority - EPA 2004).

Vegetation may be significant because the extent is below a threshold level and a range of other reasons, including:

- scarcity;
- unusual species;
- novel combinations of species;
- a role as a refuge;
- a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species;
- being representative of the range of a unit (particularly, a good local and/or regional example of a unit in "prime" habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range); and
- a restricted distribution (EPA 2004).

Vegetation communities are locally significant if they contain priority flora species or contain a range extension of a particular taxon outside of the normal distribution. They may also be locally significant if they are very restricted to one or two locations or occur as small isolated communities. In addition, vegetation communities that exhibit unusually high structural and species diversity are also locally significant.

Vegetation communities are regionally significant where they are limited to specific landform types, are uncommon or restricted plant community types within the regional context, or support populations of threatened flora.

Determining the significance of flora and vegetation may be applied at various scales, for example, a vegetation community may be nationally significant and governed by statutory protection as well as being locally and regionally significant.

3. OBJECTIVES

The aim of this survey was to assess the flora and vegetation values of the proposed mine and infrastructure areas, access road alignment options, borefield sites and borrow pits, encompassing the Nova Project area. Specifically, the objectives included:

- undertake a desktop study of the flora and vegetation of the Fraser Range area (including the Nova Project area), with an emphasis on threatened and priority flora, and threatened and priority ecological communities;
- undertake a Level 2 survey of the Nova Project area, and collect and identify the vascular plant species present;
- collecting data from plots, representative of vegetation communities with replicates wherever possible, allowing for appropriate statistical analyses to meet DPaW and EPA standards, and collect observations at sites on fire regimes, grazing pressures and overall health of the vegetation to allow a determination of the condition of the vegetation in the Nova Project area;
- review the conservation status of the vascular plant species recorded by reference to current literature and current listings by the DPaW and plant collections held at the Western Australian State Herbarium, and listed by the DotE under the EPBC Act;
- define and map the vegetation communities in the survey area;
- define and map the location of any threatened and priority flora located within the survey area;
- define any management issues related to flora and vegetation values;
- provide recommendations on the local and regional significance of the vegetation communities; and
- prepare a report summarising the findings.

4. METHODS

4.1 Desktop Assessment

A desktop assessment was conducted using the FloraBase (DPaW 2014f) and NatureMap (DPaW 2014g) databases, to identify the possible occurrence of threatened and priority flora and threatened and priority ecological communities within the Nova Project area. The NatureMap search parameters used were a 40 km radius 'by circle' at 31° 48′ 55″ S, 123° 12′ 39″ E.

In addition, historical documentation and vegetation mapping of the region, principally that of Beard (1975; 1990) and Paul Armstrong and Associates (2013), that provide extensive resource material for the floristics and vegetation of the Nova Project area and surrounds, was reviewed.

4.2 Field Survey

The Level 2 field assessment of the flora and vegetation of the Nova Project areas was undertaken by a total of ten botanists from MCPL, over four surveys from June 2013 to May 2014 (Table 1), in accordance with methods outlined in Guidance Statement 51 (EPA 2004). All botanists held valid collection licences to collect flora for scientific purposes, issued under the WC Act.

Table 1: Survey Timing and Personnel

SURVEY DATE	NO. SURVEY DAYS	NO. MCPL PERSONNEL
24/06/13 – 28/06/13	5	4
02/09/13 – 07/09/13	6	6
28/10/13 – 01/11/13	5	4
28/04/14 – 02/05/14	5	4

The geographic coordinates defining the mine and infrastructure areas, access road options and borefields were supplied by Sirius Gold Pty Ltd. Aerial photographic maps of this proposed Nova Project area were prepared and supplied by CAD Resources, Western Australia. Survey sites within the areas of interest were selected using aerial photographic maps and field observations. A total of 383 survey sites were selected to sample all vegetation types, with replication, within the survey area, see Appendix B. (Note - the occasional number was allocated to an opportunistic collecting site and is therefore not included in Appendix B).

The flora and vegetation was described and sampled systematically at each survey site, and additional opportunistic collecting was undertaken wherever previously unrecorded plants were observed. At each survey site the following floristic and environmental parameters were noted:

- GPS location (based on GDA94 datum);
- topography;
- soil type and colour;
- outcropping rocks and their type;

- percentage litter cover and percentage bare ground;
- time since fire; and
- for each vascular plant species, the average height and percentage cover (both alive and dead material) was recorded.

The GPS location of species known to be of conservation significance, as well as plant species which could not be identified in the field was recorded, together with their populations.

All plant specimens collected during the field surveys were dried and processed in accordance with the requirements of the Western Australian Herbarium. The plant species were identified through comparisons with pressed specimens housed at the Western Australian Herbarium. Where appropriate, plant taxonomists with specialist skills were consulted. Nomenclature of the species recorded is in accordance with the DPaW (2014f).

4.3 Data Analysis

A species accumulation curve, based on accumulated species versus sites surveyed was prepared, using the data from the first three surveys to provide a measure of the level of adequacy of the survey effort (Estimate S - Colwell 2006). As the number of survey sites increases, and correspondingly the size of the area surveyed increases, there should be a diminishing number of new species recorded. At some point, the number of new species recorded becomes essentially asymptotic. The asymptotic value was determined using Michaelis-Menten modelling and provides an incidence based coverage estimator of species richness (ICE - Chao 2004). When the number of new species being recorded for survey effort expended approaches this asymptotic value, the survey effort can be considered to be adequate.

PRIMER v6 (Plymouth Routines in Multivariate Ecological Research) statistical analysis software was used to analyse species-by-site data and discriminate sites on the basis of their species composition (Clarke and Gorley 2006). To down weight the relative contributions of quantitatively dominant species a presence/absence transformation was applied to the data set. Transformed data were analysed using a series of multivariate analysis routines including Hierarchical Clustering (CLUSTER), Non-metric Multidimensional Scaling (MDS) and Similarity Percentages (SIMPER). Results were used to inform and support interpretation of aerial photography and delineation of individual plant communities. The descriptions of plant communities within the survey area are based on the structural forms of Australian vegetation developed by Beard (1990).

5. DESKTOP ASSESSMENT RESULTS

The proposed Nova Project area lies within the Coolgardie Botanical District of the Southwestern Interzone (Beard 1990). More recently, the vegetation of Western Australia has been assigned to bioregions and subregions under the Interim Biogeographical Regionalisation for Australia (IBRA), with the survey area lying across the Coolgardie 1 (COO1 – Mardabilla subregion) and Coolgardie 3 (COO3 – Eastern Goldfields subregion) subregions of the Coolgardie bioregion.

5.1 Climate

Beard (1990) described the climate of the Coolgardie Botanical District as arid non-seasonal to semi-arid Mediterranean, receiving approximately 200 – 300 mm of rainfall annually. Fraser Range is the closest active Bureau of Meteorology (BoM) weather station to the survey area, however is lacking data for most of 2012 and part of 2013. Rainfall and temperature data for Norseman Aero (BoM 2014), which has the most complete data for the area, is therefore displayed in Figure 2.

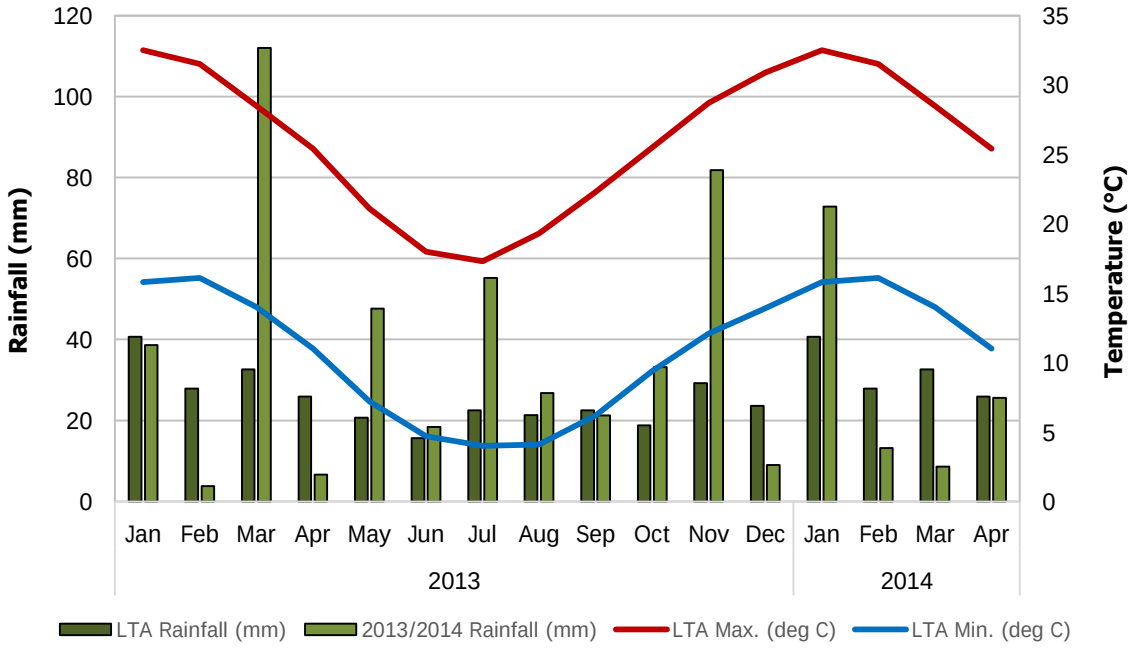

Figure 2: Climatic data for Norseman Aero (BoM 2014)

Note: Long term average rainfall data (1999 – 2014), together with monthly rainfall and average maximum and minimum temperature data for the period May 2013 to April 2014 are shown (BoM 2014).

The heaviest rainfall in the area was received in May, July and November 2013 and January 2014 (Figure 2). This also corresponded to heavy rainfalls recorded at Fraser Range, 154 mm in March 2013 and 93 mm in May 2013, equating to more than four times the average rainfall received in the wider area. Higher than average rainfall was therefore received approximately 12 and then again at four weeks prior to the June 2013 survey, 8 – 12 weeks prior to the September and October 2013 surveys and April 2014 survey (Figure 2).

5.2 Geology, Topography and Soils

The Nova Project lies in the COO1 – Mardabilla subregion which is described as an Eocene marine limestone plain, on a granite basement in the western parts. The Mardabilla subregion is comprised mostly of red-brown loams and aeolian sands (Grant *et al*. 2002).

The Nova Project area also lies adjacent to the COO3 – Eastern goldfields subregion on the edge of the Yilgarn Craton. This subregion is composed of a subdued relief with gently undulating plains, interrupted in the east with a horst of Proterozoic basic granite. The underlying geology is of gneiss and granites eroded into a flat plane covered with tertiary soils and scattered exposures of bedrock. Calcareous earths are dominant on the plains and greenstone areas (Cowan 2001).

The landform and soil data illustrated in Figure 3 was extracted from the soil datasets managed by the Department of Agriculture and Food (2012). The Nova Project area is located within the Atlas landform and soil system. The majority of the Nova Project area is located within the mapping code 266DD14 and a small section of the western sections of the Nova Project area occur within the mapping code 264DD14, Figure 3 and Table 2.

T**able 2: Summary of Landform and Soils** (based on data supplied by DaFA 2012)

Landform and Soil System	**Mapping Code** (see Figure 3)	**Description** (based on data supplied by DAFA (2012)
Atlas	264DD14	Flat to undulating land with small valleys occasionally broken by low narrow rocky hills and ridges, or tors and bosses
Atlas	266DD14	'Flat to undulating land with small valleys occasionally broken by low narrow rocky hills and ridges, or tors and bosses

475000mE 500000mE 525000mE 550000mE

6525000mN

6500000mN

6475000mN

6450000mN

6425000mN

6400000mN

266Mx43
265AC1
266SV3
265DD14
265BA54
265SV3
265DD14
265DD14
265BA1
266DD14
264DD14
264SV3
264Bd
266SV3
264SV3
Eyre Highway
264Bd
264Gb
264Wr
264Bd
264DD14
246DD14
264SV3
557Bd
557Ca
557Wr
557Bd
264SV3
557Lf
557Bd
557Wr

475000mE 500000mE 525000mE 550000mE

Legend

- Nova Project Area
- Roads - Major
- Roads - Minor

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0 8km

Scale 1:400,000
MGA94 (Zone 51)

CAD Ref: g2125_Nova_f02_01.dgn
Date: Jun 2014 | Rev: C | A3

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Nova Project

Soils

Figure: **3**

5.3 Potential Flora

A total of 238 vascular plant taxa, representative of 133 genera and 51 families, have the potential to occur within the Nova Project area (based on the NatureMap, DPaW 2014g), see Appendix C.

5.4 Potential Threatened and Priority Flora

No threatened flora species pursuant to subsection (2) of section 23F of the WC Act and as listed by the DPaW (2014b), or pursuant to section 179 of the EPBC Act or listed by the DotE (2014a), have the potential to occur within the Nova Project area, Appendix C .

A total of 12 priority flora species as listed by the DPaW (2014f) have the potential to occur within the Nova Project area (Table 3).

Table 3: Potential Priority Flora Species within the Nova Project Area

(Based on data from NatureMap database search and Herbarium database searches)

SPECIES	FAMILY	CONSERVATION STATUS	HABITAT PREFERENCES
Bossiaea simulata	FABACEAE	P1	Well-drained sites, raised areas in salt lakes or sand dunes above the samphire zone.
Angianthus newbeyi	ASTERACEAE	P2	Sub-saline sand on salt lake margins.
Astartea sp. Jyndabinbin Rocks (K.R. Newbey 7689)	MYRTACEAE	P2	Grey sand, granitic sandy loam, Aeolian dunes or flat planes.
Chthonocephalus multiceps	ASTERACEAE	P2	Sand or clay on granite outcrops.
Eucalyptus fraseri subsp. *melanobasis*	MYRTACEAE	P2	Red calcareous loam.
Acacia eremophila numerous-nerved variant (A.S. George 11924)	FABACEAE	P3	Sandy flats.
Acacia eremophila var. *variabilis*	FABACEAE	P3	Sand or sandy loam.
Cryptandra crispula	RHAMNACEAE	P3	Brown sandy clay, yellow loamy sand, red soil on dune ridges, hills and near salt lakes.
Eucalyptus histophylla	MYRTACEAE	P3	Sandy loam on laterite or granite outcrops.
Microseris scapigera	ASTERACEAE	P3	Sandy soils on salt lake margins, near granite rocks or samphire flats.
Phlegmatospermum eremaeum	BRASSICACEAE	P3	Stony loam.
Myriophyllum balladoniense	HALORAGACEAE	P4	Semi-permanent rock pools on granite outcrops.

5.5 Introduced (Weed) Species and Declared Pest (Plant) Organisms

Seventeen introduced species have been recorded within the wider Nova Project area (based on NatureMap 2014f, see Appendix B). One of the vascular plant species (**Emex australis*) is a declared pest organism pursuant to Section 33 of the BAM Act 1979 (DAFA 2014). Four of the species (**Pentameris airoides* subsp. *airoides*, **Emex australis*, **Malva parviflora* and **Salvia verbenaca*) are listed by the DPaW (2014f) as environmental weeds, although all currently have a low status.

5.6 Regional Vegetation

The COO1 subregion is comprised of *Eucalyptus* woodland over broomebush or greybush, bluebush and saltbush (Grant et al. 2002). The COO3 subregion is comprised of diverse eucalypt woodlands (part of the Great Western Woodlands) that occur on the ranges and in valleys, with mallees, *Acacia* thickets and shrub-heath on the sandplains (Cowan 2001). Woodlands and *Dodonaea* shrublands occur on the Fraser Range, whilst the wider area is rich in endemic *Acacia* species (Cowan 2001).

According to Beard (1990), the Nova Project area lies within the Coolgardie Botanical District of the Southwestern Interzone and is predominantly comprised of *Eucalyptus* woodlands. In areas with more calcareous soils the woodland becomes more open and has an understorey of saltbush-bluebush. Scrub heath and *Casuarina* thickets are also known to occur on the sandplains. Vegetation to the east of Fraser Range (adjacent to the Nova Project area) is mostly an intricate mosaic of woodland and mallee (*Eucalyptus oleosa* and *Eucalyptus transcontinentalis*) – woodland on a pink loam with calcareous nodules and a greybush understorey; mallee on a red sandy soils overlying a calcareous hardpan, with a spinifex (*Triodia scariosa*) understorey. Woodlands of salmon gum, gimlet and goldfields blackbutt (*Eucalyptus lesouefii*) occur locally in heavy loam soils (Beard 1990).

Beard (1975) defined the Fraser Range System and the Harms System (of the Coolgardie Botanical District), Figure 4.

The **Fraser Range System** were defined as distinctive chain of exposed bosses of granulite gneiss of Proterozoic age – low hills with excessively rocky nature that rise abruptly out of the surrounding woodlands and flats. The rockiest hills carried rare, scattered trees of *Casuarina huegeliana* (now *Allocasuarina huegeliana*) and *Pittosporum phillyraeoides* (*P. phillyreoides* var. *microcarpa* now *P. angustifolium* according to Cayzer, Crisp & Telfora 2000) to 6 m tall with *Dodonaea microzyga* scrub to 1 – 2 m tall. Beard (1975) lists the associated species as:

- Large shrubs – *Acacia acuminata*, *Eucalyptus* sp. inedit. aff. *salubris*, *Eremophila alternifolia*, *Beyeria drummondii* (now *Beyeria lechenaultii*), *Trymalium* aff. *ledifolium*, *Melaleuca uncinata*;
- Small shrubs – *Acacia erinacea*, *Boronia caerulescens* (now *Boronia coerulescens*), *Boronia inornata*, *Indigofera* sp., *Mirbelia microphylla*, *Pimelea spiculigera*, *Scaevola oxyclada* [sic] (assumed to be referring to *S. oxyclona*), *Thryptomene australis*; and
- Herbaceous – *Aristida arenaria* (now *Aristida contorta*), *Microseris scapigera* (now Priority 3), *Ptilotus obovatus*, *Ptilotus spathulatus* and *Stipa elegantissima* (now *Austrostipa elegantissima*).

The **Harms System** according to Beard (1975) lies between the Fraser Range and the Nullarbor Plain. Beard (1975) describes this system as gently undulating, with a sequence of low ridges and depressions, with occasional granite outcrops. A pattern of overstorey sequence from ridge to flat is usually evident in the woodlands of this system (and others within the Great Western Woodlands).

- Ridges – *Eucalyptus transcontinentalis*;
- Middle slopes – less tall and more open, consisting of *Eucalyptus oleosa*, *Eucalyptus flocktoniae* with *Eucalyptus gracilis*; and
- Lower slopes and flats – *Eucalyptus salubris*.

Typical for surrounding woodlands, the understorey is generally either semi-succulent (greybush – *Cratystylis conocephala*, *Atriplex vesicaria*, with *Eremophila dempsteri*, *Olearia muelleri*, *Westringia rigida*) or sclerophyll (small sclerophyll shrubs such as *Eremophila* spp., *Acacia merrallii*, *Boronia leptophylla* (now *B. inornata* subsp. *leptophylla*) and *Olearia muelleri*) (Beard 1975).

In more recent years Hopkins, Beeston and Shepherd (2001) delineated a series of vegetation maps based primarily in this region on the previous work of Beard (1975). The following detail has been extracted from the DAF (2012) database and summarized in Table 4 and on Figure 4.

Table 4: Summary of Pre-European Vegetation Mapping Codes

(Note: common names were used in their description and the scientific names were added in the following table to assist in the interpretation)

System-Association Code	Original Association Description	Original Mapping Code
488	Mosaic: Medium woodland; gimlet (*Eucalyptus salubris*) / Shrublands; mallee scrub, *Eucalyptus eremophila*	e34Mi/e15Si
489.1	Mosaic: Medium woodland; goldfields blackbutt (*Eucalyptus lesouefii*) & Dundas blackbutt (*Eucalyptus dundasii*) / Shrublands; Dodonaea scrub	e13,14Mi/dSi
500.1	Mosaic: Medium woodland; merrit (*Eucalyptus flocktoniae*) & red mallee (*Eucalyptus oleosa*)/ Shrublands; Dodonaea scrub	e11,22Mi/dSi
482	Medium woodland; merrit (*Eucalyptus flocktoniae*) & red mallee (*Eucalyptus oleosa*)	e11,22Mi
487	Medium woodland; redwood (*Eucalyptus transcontinentalis*) & red mallee (*Eucalyptus oleosa*)	e10,22Mi

475000mE 500000mE 525000mE 550000mE

6525000mN 6500000mN 6475000mN 6450000mN 6425000mN 6400000mN

ZANTHUS SYSTEM
DUNDAS SYSTEM
HARMS SYSTEM
FRASER RANGE SYSTEM
CLEAR STREAK SYSTEM

125 128 481.2 482 486 487 488 489 489.1 500.1 509.2 513 519.5 520 524 524.1 525 676

475000mE 500000mE 525000mE 550000mE

Legend

- Nova Project Area
- Roads - Major
- Roads - Minor

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MGA94 (Zone 51)
CAD Ref: g2125_Nova_f03_01.dgn
Date: Jun 2014 | Rev: C | A3

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Nova Project

Pre-European Vegetation

Figure: 4

5.7 Level 1 Assessment by Armstrong

A Level 1 reconnaissance survey of the Nova Project area, tenement E28/1724, was conducted in October 2012 by Paul Armstrong and Associates (2013). The survey noted that the preferred habitat for ephemeral priority species (*Angianthus newbeyi*, *Chthonocephalus multiceps*, *Microseris scapigera*, *Myriophyllum balladoniense* and *Phlegmatospermum eremaeum*) recorded nearby the survey area were not encountered during the field survey. Soils within the Nova Project area were typically red-brown sandy loam to sandy clay with calcrete or lateritic gravel, with no granite outcrops, rocky areas or saline depressions (Paul Armstrong and Associates 2013). No threatened or priority flora were recorded in this particular survey.

Paul Armstrong and Associates (2013) described and mapped five vegetation associations (based on the Muir 1977 vegetation classification system) for the Nova Project area:

- *Eucalyptus* ?*brachycalyx* low forest – with other mixed eucalypts over dwarf scrub dominated by *Atriplex vesicaria* or *Dodonaea stenozyga* on orange-brown to red sandy clay loam with calcareous nodules.
- *Eucalyptus lesouefii* low forest – with other mixed eucalypts over dwarf scrub dominated by *Atriplex vesicaria* or *Cratystylis conocephala* on orange to red to brown-red sandy clay loam.
- *Eucalyptus salubris* low forest – with patches of *Melaleuca lanceolata* or *Eremophila scoparia* thicket over heath of *Eremophila ionantha* over *Cratystylis conocephala* or *Olearia muelleri* on orange to red sandy clay loam.
- *Eucalyptus* ?*transcendentals* [sic] (assumed to be referring to *E.* ?*transcontinentalis*) – over *Allocasuarina helmsii* scrub over *Daviesia benthamii* subsp. *acanthoclada* [sic] (assumed to be referring to *D. benthamii* subsp. *acanthoclona*) and *Dodonaea stenozyga* over open *Triodia scariosa* hummock grassland on pink-red loamy sand.
- *Eucalyptus oleosa* open tree mallee – over open scrub of *Allocasuarina helmsii* over dwarf scrub of *Acacia acanthoclada* subsp. *acanthoclada* over *Triodia scariosa* hummock grass restricted to a few small areas on red loamy sand.

5.8 Threatened and Priority Ecological Communities

No Threatened Ecological Communities as listed by the Department of Parks and Wildlife (2014a) or by the Department of the Environment (2014a) were inferred to occur within or in close proximity to the mine tenement of the Nova Project area or wider Fraser Range area.

Two Priority 1 Ecological Communities, the 'Fraser Range vegetation complex' and the 'Plant assemblages of the Southern Hills Vegetation Complex' are known from the immediate area surrounding the Nova Project area (Figure 5).

475000mE 500000mE 525000mE 550000mE

6525000mN

6500000mN

6475000mN

6450000mN

6425000mN

6400000mN

FRASER RANGE PRIORITY 1

FRASER RANGE PRIORITY 1

SOUTHERN HILLS PRIORITY 1

Eyre Highway

475000mE 500000mE 525000mE 550000mE

Legend

- Nova Project Area
- Roads - Major
- Roads - Minor

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CAD Ref: g2125_Nova_f04_01.dgn

Date: Jun 2014 | Rev: D | A3

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Nova Project

Priority Ecological Communities

Figure: 5

The plant assemblages of the **Fraser Range vegetation complex** are described as:

- *Allocasuarina huegeliana* and *Pittosporum phylliraeoides* (*P. phillyreoides* var. *microcarpa* now *P. angustifolium* according to Cayzer, Crisp & Telfora 2000) open woodland over *Beyeria lechenaultia* [sic] (assumed to be referring to *B. lechenaultii*) and *Dodonaea microzyga* scrub and *Aristida contorta* bunch grasses (granite complex), on the slopes and summits of hills;
- *Acacia acuminata* tall shrubland dominated by *Melaleuca uncinata* and *Triodia scariosa* on uplands with shallow loamy sands;
- *Eucalyptus* aff. *uncinata* (KRN 7854) over *Senna artemisioides* subsp. *helmsii*, *Cryptandra miliaris* (now an excluded name, was reduced to *C. arbutiflora* var. *tubulosa*, which has a coastal distribution from Perth to Northcliffe (Rye 1998), hence unsure which *Cryptandra* species this now refers to), *Dodonaea boroniifolia* (now *D. adenophora*), *Dodonaea stenozyga* and *Triodia scariosa* (*Eucalyptus effusa* mallee) on colluvial flats with loamy clay sands; and
- *Eucalyptus oleosa*, *Eucalyptus transcontinentalis*, *Eucalyptus flocktoniae* woodland on flats.

The plant assemblages of the **Southern Hills complex vegetation** is described as a mixture of woodland (*Eucalyptus oleosa*, *Eucalyptus transcontinentalis*, *Eucalyptus flocktoniae*) on flats with open stony ridges carrying mainly mallee and spinifex (*Eucalyptus effusa* mallee: *Eucalyptus* aff. *uncinata* (KRN 7854) over *Cassia helmsii* (now *Senna artemisioides* subsp. *helmsii*), *Cryptandra miliaris* (now excluded), *Dodonaea boroniifolia* (now *D. adenophora*), *Dodonaea stenozyga* and *Triodia scariosa*). It also includes patches of grassland, wattle thicket and mallee.

The two PECs overlap in spatial extent and in the definitions. Consequently, there remain questions about the floristic composition and spatial extent of the communities that are associated with these communities.

Threatening processes to this vegetation complex, as noted in Cowan (2001) include grazing, exotic weeds, changed fire regimes and mining.

5.9 Great Western Woodlands

The Great Western Woodlands Strategy (DEC 2010b) outlines issues and current management responses for this internationally significant area. The strategy aims to provide an approach to management and protection that will allow long term conservation of this area's unique natural and cultural values through coordination and integration of many planning and management elements in the area. It is an area of high biological richness, almost 16 million hectares in size, extending from the edge of the wheatbelt to Kalgoorlie-Boulder in the north, to the inland deserts and the Nullarbor Plain to the east (DEC 2010b), including the Nova Project area and surrounding areas. This area is mainly composed of woodland, shrubland and mallee communities and has an exceptionally high diversity of *Eucalyptus* species with as many as 170 occurring in the bioregion (Cowan 2001). The Great Western Woodlands also have a high diversity in *Acacia* species, and high species and ecosystem diversity in ephemeral (short-lived) flora communities of tertiary sandplain shrublands and of valley floor woodlands.

6. FIELD SURVEY RESULTS

6.1 Flora

A total of 369 vascular plant taxa, representative of 145 genera and 63 families, were recorded in the Nova Project area, Appendix D. The majority of taxa recorded were representative of the Fabaceae (50 taxa), Myrtaceae (49 taxa), Asteraceae (36 taxa), Chenopodiaceae (36 taxa) and Poaceae (24 taxa) families.

6.2 Introduced (weed) Species and Declared Pest (plant) Organisms

A total of ten introduced (weed) species were recorded within the Nova Project area in 2013 (Appendix D). None of these species are declared pest organisms pursuant to Section 22 of the BAM Act 1979. Three of the introduced species (**Centaurea melitensis*, **Cucumis myriocarpis* and **Salvia verbenaca*) are listed by the DEC (2009) as environmental weeds, although all currently have a low status.

6.3 Threatened and Priority Flora

No threatened flora species pursuant to Subsection (2) of Section 23F of the WC Act and as listed by the DPaW (2014b), or pursuant to Section 179 of the EPBC Act or listed by the DotE (2014a), were recorded within the Nova Project area.

Five priority flora species, as listed by the DPaW (2014f), were recorded within the Nova Project area, Table 5, Appendices D, E and F and Figure 6. It is apparent that many of the previous collections as extracted from the DPaW (2014b) database have been collected near access tracks and main roads. A brief description of the priority flora species collected and recorded during the field studies in 2013 and 2014 is provided below:

Acacia hystrix subsp. *continua* (P1) FABACEAE

One *Acacia hystrix* subsp. *continua* (P1) population was recorded within the Nova Project area (Figure 6). The specimen was recorded on bright orange clay flats along the proposed access road alignment to the Eyre Highway at Mattiske vegetation survey site REYN027. Known from three WA Herbarium records from a single location, north of Salmon Gums. This Nova Project record represents an approximate 200 km range extension east-north-east of the known distribution.

The location of *Acacia hystrix* subsp. *continua* (P1) recorded during the survey of the Nova Project area is summarized in Table 5.

Cryptandra ?crispula (P3) RHAMNACEAE

One *Cryptandra ?crispula* (P3) population was recorded within the Nova Project area (Figure 6). The specimen was recorded on red-brown clay flats at the Mattiske vegetation survey site ANGUS003. Known from eight WA Herbarium records (scattered from west of Kalgoorlie to Norseman).

The location of *Cryptandra ?crispula* (P3) recorded during the survey of the Nova Project area is summarized in Table 5. The specimen was identified from a sterile collection.

***Eucalyptus websteriana* subsp. *norsemanica* (P1) MYRTACEAE**

Two *Eucalyptus websteriana* subsp. *norsemanica* (P1) populations were recorded within the Nova Project area (Figure 6). *Eucalyptus websteriana* subsp. *norsemanica* (P1) was recorded on clay loam slopes in two nearby locations along the proposed realignment corridor of the southern section of the proposed access road (E69/3074). Known from 13 WA Herbarium records (scattered from Kalgoorlie to Norseman), the occurrence in the Nova Project area represents a new population, approximately 200 km east of the known distribution.

The locations of *Eucalyptus websteriana* subsp. *norsemanica* (P1) recorded during the survey of the Nova Project area are summarized in Table 5.

***Stackhousia stratfordiae* (P1) CELASTRACEAE**

Four *Stackhousia stratfordiae* (P1) populations were recorded within the Nova Project area (Figure 6), noting that two occurrences were located near each other during the assessment. *Stackhousia stratfordiae* (P1) was recorded growing on red/orange clay loam flats in four scattered locations along the proposed access road alignment to the Eyre Highway.

The locations of *Stackhousia stratfordiae* (P1) recorded during the survey of the Nova Project area are summarized in Table 5.

***Trachymene ?pyrophila* (P2) ARALIACEAE**

One *Trachymene* ?*pyrophila* (P2) population was recorded within the Nova Project area (Figure 6). *Trachymene* ?*pyrophila* (P2) was recorded on orange clay flats along the proposed access road alignment to the Eyre Highway at Mattiske vegetation survey site HR085. Due to the lack of fruiting material available at the time of survey, a confirmed species name could not be given.

The location of *Trachymene* ?*pyrophila* (P2) recorded during the survey of the Nova Project area is summarized in Table 5.

Table 5: Summary of Location of Priority Species recorded on the Nova Survey Area, 2013

(Note – several locations for *Stackhousia stratfordiae* are very close to each other on the map and therefore do not show up separately on Figure 6)

Species or Taxa	Easting (GDA94-Zone 51)	Northing (GDA94-Zone 51)
Acacia hystrix subsp. *continua* (P1)	515697	6465527
Cryptandra ?crispula (P3)	515052	6461765
Eucalyptus websteriana subsp. *norsemanica* (P1)	514308	6460182
Eucalyptus websteriana subsp. *norsemanica* (P1)	514071	6459961
Stackhousia stratfordiae (P1)	519629	6476309
Stackhousia stratfordiae (P1)	511340	6452946
Stackhousia stratfordiae (P1)	515139	6458426
Stackhousia stratfordiae (P1)	511340	6452989
Stackhousia stratfordiae (P1)	515087	6461125
Trachymene ?pyrophila (P2)	514059	6457531

500000mE

525000mE

6500000mN

6475000mN

6450000mN

6425000mN

Abbrev	Species	Priority
Ae	*Acacia eremophila* var. *variabilis*	P3
Ah	*Acacia hystrix* subsp. *continua*	P1
Bs	*Bossiaea simulata*	P1
Ef	*Eucalyptus fraseri* subsp. *melanobasis*	P2
Eh	*Eucalyptus histophylla*	P3
Ew	*Eucalyptus websteriana* subsp. *norsemanica*	P1
Mb	*Myriophyllum balladoniense*	P4
Ms	*Microseris scapigera*	P3
Ss	*Stackhousia stratfordiae*	P1
T?p	*Trachymene ?pyrophila*	P2

THREATENED AND PRIORITY SPECIES

Priority	TPFL	Herbarium	MCPL
Threatened	●	■	▲
1	●	■	▲
2	●	■	▲
3	●	■	▲
4	●	■	▲

Ms Ef Ef Ef Ef Ef Ef Eyre Highway Ss Ah Ss Ew Ew Ss T?p Ss Mb Mb Ae Eh Ae, Eh Ms Ms Ef Ms Bs Eh Eh Eh Eh Eh Ae Eh Ae

Legend

- Nova Project Area
- Roads - Major
- Roads - Minor

Client:
SIRIUS GOLD PTY LTD
P.O. Box 1011, Balcatta WA 6914
Tel: +61 8 6241 4200
www.siriusresources.com.au

0 5km

Scale 1:250,000
MGA94 (Zone 51)

CAD Ref: g2125_Nova_f05_01.dgn
Date: Jan 2014 | Rev: B | A3

Mattiske Consulting Pty Ltd
28 Central Road, Kalamunda WA 6076 ~ Tel: 9257 1625 ~ Fax: 9257 1640
Author: E M Mattiske | MCPL Ref: SRL1303 / 002 / 04
Drawn: CAD Resources ~ www.cadresources.com.au
Tel: (08) 9246 3242 ~ Fax: (08) 9246 3202

Nova Project

Threatened and Priority Flora

Figure: **6**

6.4 Other Species of Interest

Fourteen species were highlighted as other species of interest. These latter species reflect the lack of detailed botanical studies near and within the Nova Project area. In addition several groups such as the *Lepidosperma* species are currently undergoing a taxonomic revision and therefore it is difficult to clearly assess their current nomenclature or status.

Table 6 provides a summary of the recorded flora species that reflect significant (>200 km) range extensions from currently known populations. Several additional flora species were recorded 100 km from previous collections that are recorded at the WA Herbarium (DPaW 2014a).

Table 6: Summary of Flora Species reflecting Range Extensions to Known Distribution Patterns

Species	Family	Summary of Information on Distribution Patterns
Acacia assimilis subsp. *atroviridis*	FABACEAE	WA Herbarium records are confined mostly to the Mallee and Esperance Plains IBRA bioregions. The occurrence in the Nova Project area represents an approximate 200 km range extension east of the known distribution.
Acacia enervia subsp. *explicata*	FABACEAE	WA Herbarium records are confined mostly to the Avon Wheatbelt, Coolgardie and Mallee IBRA bioregions. The occurrence in the Nova Project area represents an approximate 200 km range extension to the east of the known distribution.
Acacia hystrix subsp. *hystrix*	FABACEAE	WA Herbarium records are confined mostly to Mallee, and the border of Mallee and Coolgardie IBRA bioregions. Collections in the Nova Project area represent an approximate 300 km range extension to the east of the known distribution.
Alyogyne sp. Shark Bay (D.J. Edinger 6212)	MALVACEAE	Known from five WA Herbarium records (scattered east of Kalgoorlie and west of Esperance). The occurrence in the Nova Project area represents a new population, approximately 200 km from the nearest record (but within the range of known records).
* *Cucumis myriocarpus*	CUCURBITACEAE	Within the known range however the occurrence in the Nova Project area represents a new population approximately 200 km from the nearest WA Herbarium record.
Juncus pallidus	JUNCACEAE	WA Herbarium records are confined to the south-west botanical province. The occurrence in the Nova Project area represents an approximate 200 km range extension north-east of the nearest WA Herbarium record.
Lepidosperma aff. *diurnum*	CYPERACEAE	WA Herbarium records are confined mostly to the Esperance Plains, Mallee and Coolgardie IBRA bioregions. The *Lepidosperma* genus is also undergoing a revision currently, and as such, the status of these species may change. The occurrence in the Nova survey area represents an approximate 300 km range extension east of the known distribution.

Table 6: Summary of Flora Species reflecting Range Extensions to Known Distribution Patterns (continued)

Species	Family	Summary of Information on Distribution Patterns
Lepidosperma sp. Norseman	CYPERACEAE	The specimen collected is referrable to a species that will soon be added to a census. On the basis of current knowledge, this taxon is likely to be assessed as having conservation significance (M. Hislop 2014 pers. comm.).
Maireana ?*marginata*	CHENOPODIACEAE	WA Herbarium records are confined mostly to the Avon Wheatbelt IBRA bioregion. The occurrence in the Nova Project area represents an approximate 150 km range extension, east of the known distribution.
Melaleuca ?*zeteticorum*	MYRTACEAE	Within the known range however the occurrence in the Nova Project area represents a new population approximately 200 km from the nearest WA Herbarium record.
Minuria leptophylla	ASTERACEAE	Within the known range however the occurrence in the Nova Project area represents a new population approximately 200 km from the nearest WA Herbarium record.
Poranthera microphylla	PHYLLANTHACEAE	Within the known range however the occurrence in the Nova Project area represents a new population approximately 200 km from the nearest WA Herbarium record.
Rhagodia eremaea	CHENOPODIACEAE	WA Herbarium records are scattered throughout central and central-coastal WA. The occurrence in the Nova Project area represents an approximate 200 km range extension south of the known distribution.
Stackhousia monogyna	CELASTRACEAE	WA Herbarium records are scattered mostly within the south-western botanical province. The occurrence in the Nova Project area represents an approximate 250 km range extension north-east of the nearest WA Herbarium record.

6.5 Coverage of Flora

A species accumulation curve was used to evaluate the sampling adequacy and is presented in Figure 7. The Incidence based Coverage Estimator (ICE) of species richness was 438.45. Based on this value and the total of 369 species recorded in the sampling sites (note – does not include the opportunistic collections) and as such was approximately 83.93% of the flora species potentially present within the Nova Project area. Twenty-two per cent of the vascular plant species recorded were annual or annual/perennial species and the remainder are perennial.

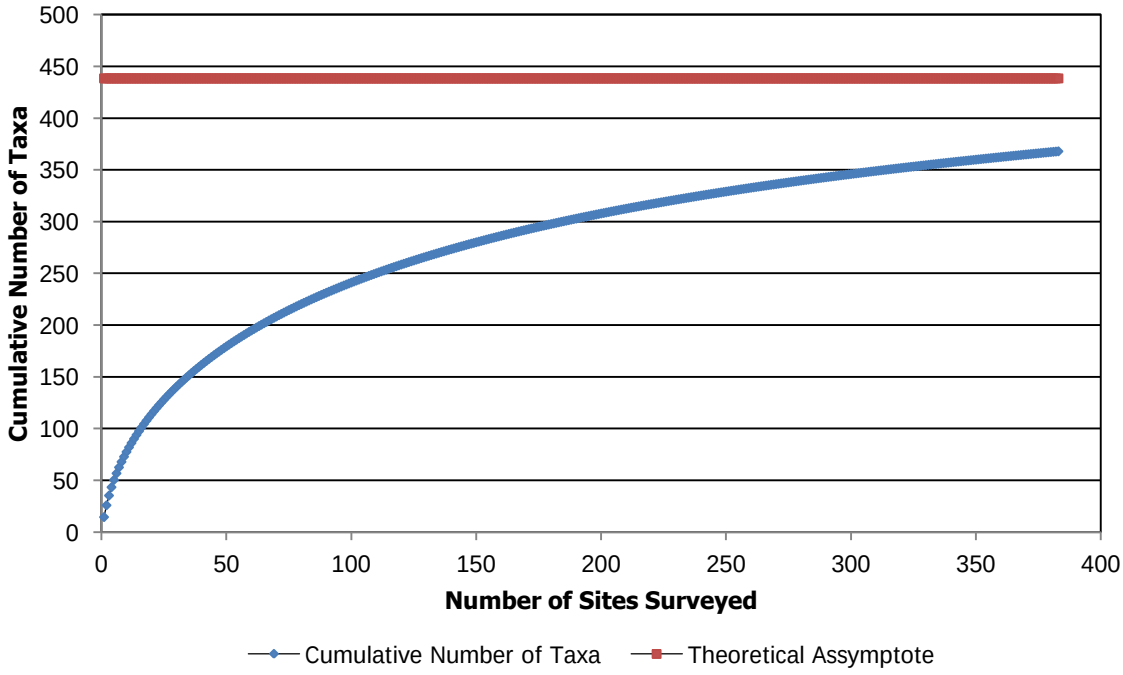


Figure 7: Average Randomised Species Accumulation Curve

Note: Only data from sampling sites was used to calculate both a species accumulation curve and a theoretical maximum number of species (asymptotic value) within the survey area.

6.6 Vegetation

A total of thirty-five vegetation communities were defined and mapped on the basis of the analyses (see Appendices H and I) described within the Nova Project area, and are illustrated in Figure 8, with representative photos of the communities provided in Appendix G. A description of each vegetation community is set out below. The total areas mapped for each of the vegetation communities across the Nova Project area is set out in Table 7. Woodland communities dominated the survey area, accounting for 91.83% of the Nova Project area. Grasslands and shrublands constituted 5.56% and 2.55% respectively of the Nova Project area. The most restricted vegetation community defined was the S16 community (0.38 ha), which was recorded in only one location on a massive granite outcrop (refer to Table 7. The latter S16 community is not evident on Figure 8.2 at the scale presented.

Eucalypt Woodlands

W1: Woodland of mixed Eucalypts including *Eucalyptus salubris*, *Eucalyptus celastroides*, *Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* over *Cratystylis conocephala*, *Exocarpos aphyllus*, *Diocirea ternata*, *Eremophila alternifolia*, *Eremophila interstans*, *Eremophila ionantha*, *Eremophila scoparia* and *Geijera linearifolia* over *Olearia muelleri*, *Atriplex vesicaria* and *Scaevola spinescens* over mixed shrubs, herbs and grasses on orange-brown sandy clay-loams on flats.

W2: Woodland of *Eucalyptus salubris* and *Eucalyptus oleosa* subsp. *oleosa* with patches of mixed *Eucalyptus* species over *Melaleuca quadrifaria*, *Acacia hemiteles*, *Cratystylis conocephala* over *Diocirea ternata*, *Eremophila ionantha*, *Atriplex vesicaria*, *Eremophila decipiens* subsp. *decipiens*, *Eremophila scoparia*, *Geijera linearifolia*, *Senna artemisioides* subsp. *filifolia* and *Exocarpos aphyllus* over *Vittadinia dissecta* var. *hirta*, *Olearia muelleri*, *Sclerolaena diacantha*, *Ptilotus holosericeus* and *Zygophyllum ovatum* over herbs and grasses on red-orange clay-loams on flats and lower slopes.

W3: Woodland of *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* with occasional *Eucalyptus celastroides* and *Eucalyptus salubris* over *Cratystylis conocephala* over *Olearia muelleri*, *Atriplex vesicaria* and *Santalum acuminatum* over *Rhagodia crassifolia*, *Zygophyllum apiculatum* and *Sclerolaena diacantha* over other mixed shrubs and herbs on orange-brown clay-loams on flats and slopes.

W4: Woodland to open woodland of mixed *Eucalyptus* species over *Eremophila scoparia*, *Cratystylis conocephala* and *Atriplex vesicaria* over *Sclerolaena diacantha*, *Olearia muelleri*, *Zygophyllum* species and *Rhagodia crassifolia* over herbs on orange clay-loams and sandy-loams on flats.

W5: Woodland of *Eucalyptus clelandii*, *Eucalyptus urna*, *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* over *Melaleuca sheathiana* over *Olearia muelleri*, *Eremophila scoparia* and *Alyxia buxifolia* over *Zygophyllum glaucum* and *Maireana* species on orange-brown sandy-loams on flats and lower slopes.

W6: Open woodland of mixed *Eucalyptus* species over *Eremophila dempsteri*, *Melaleuca halmaturorum* and *Melaleuca sheathiana* over *Cratystylis conocephala* and *Eremophila scoparia* over *Olearia muelleri* and mixed shrubs and herbs on orange clay-loams on flats and slopes.

W7: Open woodland of *Eucalyptus incrassata*, *Eucalyptus rigidula* and *Eucalyptus oleosa* subsp. *oleosa* over *Westringia rigida, Daviesia benthamii* subsp. *acanthoclona*, *Acacia erinacea*, *Santalum acuminatum*, *Eremophila scoparia* and *Acacia merrallii* over *Triodia scariosa* and herbs on orange-red clay-loams and sandy-loams on flats and lower slopes.

W8: Low open woodland of *Eucalyptus oleosa* subsp. *oleosa*, *Eucalyptus spreta* and *Eucalyptus lesouefii* over *Melaleuca sheathiana*, *Eremophila ionantha*, *Acacia hemiteles*, *Eremophila scoparia*, *Cratystylis conocephala* and *Melaleuca halmaturorum* over mixed shrubs and herbs on orange-brown clay-loams and sandy-loams on lower to mid slopes.

W9: Low open woodland of *Eucalyptus gracilis* and *Eucalyptus salubris* over *Eremophila scoparia*, *Eremophila ionantha*, *Melaleuca halmaturorum*, *Diocirea ternata*, *Cratystylis conocephala*, *Olearia muelleri*, *Melaleuca sheathiana* and *Dodonaea stenozyga* over low shrubs and herbs on red-brown sandy-loams and clay-loams on flats.

W10: Open woodland of *Eucalyptus oleosa* subsp. *oleosa* over *Melaleuca halmaturorum* over *Acacia hemiteles* and *Eremophila alternifolia* over *Olearia muelleri* and *Zygophyllum glaucum* on pale orange clay-loams and sandy-loam gravels on flats.

W11: Open woodland of *Eucalyptus salubris*, *Eucalyptus fraseri* subsp. *fraseri*, *Eucalyptus celastroides* and *Eucalyptus prolixa* over *Diocirea ternata*, *Eremophila ionantha*, *Eremophila scoparia* and *Olearia muelleri* over mixed low Chenopods on orange to red clay-loams on flats.

W12: Open woodland of *Eucalyptus oleosa* subsp. *oleosa, Eucalyptus polita* and *Eucalyptus prolixa* over *Diocirea ternata, Dodonaea stenozyga*, *Eremophila* species, *Daviesia benthamii* subsp. *acanthoclona* and *Olearia muelleri* over mixed low Chenopods and localized patches of *Triodia* ?*scariosa* on orange to red clays and clay loams on flats.

W13: Open woodland of *Eucalyptus flocktoniae* and *Eucalyptus celastroides* subsp. *virella* over *Melaleuca sheathiana*, *Diocirea ternata*, *Dodonaea stenozyga*, *Eremophila scoparia*, *Daviesia benthamii* subsp. *acanthoclona*, *Acacia erinacea* and *Olearia muelleri* over herbs and grasses on orange to red clays on flats.

W14: Open woodland of *Eucalyptus salubris*, *Eucalyptus calycogona* subsp. *calycogona* and *Eucalyptus spreta* over *Melaleuca halmaturorum*, *Diocirea ternata*, *Eremophila decipiens* subsp. *decipiens*, *Eremophila* scoparia, *Atriplex vesicaria* and *Olearia muelleri* over herbs and grasses on cracking clays on flats.

W15: Open woodland of *Eucalyptus oleosa* subsp. *oleosa*, *Eucalyptus prolix* and *Eucalyptus protensa* over *Cratystylis conocephala*, *Eremophila decipiens* subsp. *decipiens*, *Eremophila dempsteri*, *Rhagodia eremaea*, *Senna artemisioides* subsp. *filifolia* over herbs and grasses on orange clay-loams and sandy-loams on flats.

W16: Open woodland of mixed Eucalypts including *Eucalyptus transcontinentalis*, *Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus eremophila* subsp. *eremophila*, *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus urna* over *Cratystylis conocephala*, *Commersonia craurophylla*, *Eremophila* species, *Melaleuca sheathiana*, *Olearia muelleri* and *Scaevola spinescens* over herbs and grasses on orange clay-loams and sandy-loams on flats and slopes of undulating rises.

W17: Open woodland of *Eucalyptus cylindrocarpa*, *Eucalyptus salubris* and *Eucalyptus oleosa* subsp. *oleosa* over *Cratystylis conocephala*, *Eremophila ionantha* and mixed Chenopod species over herbs and grasses on orange to red-brown sandy-loams and clay-loams with gravel on flats.

W18: Open woodland of *Eucalyptus laevis*, *Eucalyptus moderata*, *Eucalyptus salubris* and *Eucalyptus spreta* over *Acacia hemiteles*, *Acacia merrallii*, *Cratystylis conocephala*, *Eremophila dempsteri*, *Eremophila ionantha*, *Eremophila scoparia*, *Melaleuca halmaturorum* and mixed Chenopod species over patches of *Triodia irritans* on orange to red-brown clay-loams and sandy-loams on flats.

W19: Open woodland of *Eucalyptus* ?*loxophleba* subsp. *lissophloia*, *Eucalyptus oleosa* subsp. *oleosa* *Eucalyptus urna* and *Eucalyptus spreta* over *Acacia hemiteles*, *Acacia merrallii*, *Cratystylis conocephala*, *Dodonaea stenozyga*, *Eremophila ionantha*, *Eremophila scoparia* and *Exocarpos aphyllus* over herbs and grasses on orange to red-brown clay-loams and sandy-loams on flats.

W20: Open woodland of *Eucalyptus salubris* with local patches of *Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus spreta*, *Eucalyptus fraseri* subsp. *fraseri* and *Eucalyptus oleosa* subsp. *oleosa* over *Melaleuca sheathiana*, *Acacia hemiteles*, *Cratystylis conocephala*, *Eremophila scoparia* and *Olearia muelleri* over localized patches of *Triodia irritans* on orange to red-brown clay-loams and sandy-loams on flats and lower slopes.

W21: Open woodland of *Eucalyptus polita* with local patches of *Eucalyptus flocktoniae* and *Eucalyptus lesouefii* over *Melaleuca sheathiana*, *Melaleuca halmaturorum*, *Acacia hemiteles*, *Acacia merrallii*, *Eremophila ionantha*, *Eremophila scoparia* and *Olearia muelleri* over herbs on orange to red-brown clay-loams and sandy-loams on flats and lower slopes.

Mixed Shrublands and Scrubs

S1: Open scrub of *Melaleuca halmaturorum*, *Atriplex vesicaria*, *Cratystylis conocephala* and *Eremophila scoparia* with occasional *Eucalyptus lesouefii* and *Eucalyptus salubris* over *Zygophyllum ovatum*, *Scaevola spinescens*, *Olearia muelleri* and *Sclerolaena diacantha* over other low shrubs and herbs on orange clay-loams on flats and slopes.

S2: Open scrub of *Logania* sp. and *Eremophila ionantha* with occasional emergent *Eucalyptus salubris* and *Eucalyptus spreta* over *Atriplex* species, *Ptilotus holosericeus*, *Vittadinia dissecta* var. *hirta* and Chenopod species on orange cracking clays on flats and low lying areas.

S3: Low open shrubland of *Acacia acuminata* (narrow phyllode variant) over *Eremophila decipiens* subsp. *decipiens*, *Dodonaea lobulata*, *Olearia pimeleoides* and *Eremophila deserti* over *Rhagodia ulicina*, *Enchylaena tomentosa* var. *tomentosa* and *Sclerolaena diacantha* and other mixed shrubs on red-brown clays on flats.

S4: Open scrub of *Allocasuarina helmsii* and *Melaleuca uncinata* with occasional *Eucalyptus rigidula* and *Eucalyptus salubris* over *Acacia hemiteles*, *Alyxia buxifolia*, *Dodonaea microzyga* var. *acrolobata*, *Grevillea acuaria*, *Scaevola spinescens* and *Olearia muelleri* over patches of *Triodia* ?*scariosa* and herbs on orange to red clay loam and clays on flats and slopes.

S5: Low open shrubland of *Acacia hemiteles*, *Eremophila decipiens* subsp. *decipiens*, *Rhodanthe chlorocephala* subsp. *rosea*, *Atriplex vesicaria* and *Vittadinia dissecta* var. *hirta* over mixed low shrubs and herbs on red clays on flats.

S6: Open scrub of *Melaleuca hamata*, *Allocasuarina* sp. over *Vittadinia dissecta* var. *hirta*, *Acacia acanthoclada* subsp. *acanthoclada*, *Grevillea huegelii*, *Hannafordia bissillii* subsp. *latifolia* and *Melaleuca fulgens* subsp. *fulgens* over herbs and grasses on red-orange sandy-loams on flats.

S7: Low open shrubland of *Tecticornia* sp. over *Eragrostis australasica*, *Eragrostis dielsii*, *Austrostipa mollis*, *Sclerolaena cuneata* and *Sclerolaena obliquicuspis* on orange clays on flats.

S8: Low open shrubland of *Acacia assimilis* subsp. *assimilis* and *Melaleuca uncinata* over *Eremophila decipiens* subsp. *decipiens*, *Cryptandra aridicola*, *Dodonaea microzyga* var. *acrolobata*, *Acacia acanthoclada* subsp. *acanthoclada* and *Westringia cephalantha* over *Triodia* ?*scariosa* and herbs on red-brown clays on lower slopes.

S9: Open scrub of *Allocasuarina campestris*, *Eremophila alternifolia*, *Eremophila decipiens* subsp. *decipiens*, *Geijera linearifolia*, *Melaleuca uncinata* and *Melaleuca fulgens* subsp. *fulgens* over *Trymalium myrtillus* subsp. *myrtillus*, *Senna artemisioides* subsp. *filifolia* over herbs and patches of *Triodia* ?*scariosa* on red-brown clays on flats and lower slopes.

S16: Very open scrub of *Beyeria lechenaultii*, *Eremophila alternifolia* and *Vittadinia dissecta* var. *hirta* over mixed shrubs and herbs on red-brown clays on massive granite outcrop.

Hummock Grasslands

G1: Open hummock grassland of mixed *Triodia* sp. with emergent *Eucalyptus griffithsii*, *Eucalyptus oleosa* subsp. *oleosa*, *Eucalyptus rigidula* and *Eucalyptus* ?*kumarlensis* over *Acacia erinacea*, *Acacia burkittii* and *Acacia hemiteles* over *Cryptandra aridicola*, *Westringia rigida*, *Senna artemisioides* subsp. *filifolia*, *Eremophila decipiens* subsp. *decipiens*, *Alyxia buxifolia* and *Grevillea acuaria* over herbs on orange-red clay-loams and sandy-loams on flats and slopes.

G2: Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus horistes* and *Eucalyptus websteriana* subsp. *norsemanica* over *Acacia assimilis* subsp. *atroviridis*, *Allocasuarina helmsii*, *Cryptandra leucopogon*, *Grevillea plurijuga* subsp. *plurijuga*, *Halgania erecta* and *Scaevola amblyanthera* var. *centralis* over herbs on orange-yellow clay-loams and sandy-loams on slopes.

G3: Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus salubris* and *Eucalyptus griffithsii* over *Acacia hemiteles*, *Eremophila alternifolia*, *Eremophila decipiens* subsp. *decipiens*, *Grevillea acuaria* and *Senna artemisioides* subsp. *filifolia* over herbs on red-brown clays and clay-loams on flats.

G4: Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus griffithsii* over *Acacia hemiteles*, *Allocasuarina species*, *Pultenaea elachista*, *Scaevola spinescens and Westringia rigida* over herbs on red-brown clay-loams on flats and lower slopes.

Table 7: Area coverage of each vegetation community defined within the Nova Project area

Vegetation Community	Area (ha)	Percentage of total area mapped
D	8.42	0.046
G1	512.51	2.774
G2	161.53	0.874
G3	65.45	0.354
G4	287.88	1.558
S1	52.89	0.286
S2	9.68	0.052
S3	14.37	0.078
S4	163.68	0.886
S5	11.55	0.063
S6	101.02	0.547
S7	8.04	0.044
S8	16.91	0.092
S9	93.23	0.505
S16	0.38	0.002
W1	1,207.25	6.535
W2	3,681.76	19.930
W3	3,180.50	17.217
W4	356.41	1.929
W5	1,704.99	9.230
W6	216.99	1.175
W7	122.12	0.661
W8	2,176.88	11.784
W9	317.17	1.717
W10	1,067.02	5.776
W11	218.29	1.182
W12	361.03	1.954
W13	160.45	0.869
W14	40.42	0.219
W15	56.57	0.306
W16	223.32	1.209
W17	27.47	0.149
W18	459.61	2.488
W19	221.30	1.198
W20	966.20	5.230
W21	199.85	1.081
Total Area	**18,473.14**	**100.000**

6.7 Vegetation Condition

The vegetation of the Nova Project area was largely considered to be in Very Good to Excellent condition; although significant sections had been burnt with a local and intense fire. The latter led to some difficulties in collecting appropriate plant material required to identify some Eucalypts in the central part of the proposed haul roads.

LEGEND

Eucalypt Woodlands

W1: Woodland of mixed Eucalypts including *Eucalyptus salubris*, *Eucalyptus celastroides, Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* over *Cratystylis conocephala*, *Exocarpos aphyllus, Diocirea ternata*, *Eremophila alternifolia*, *Eremophila interstans, Eremophila ionantha, Eremophila scoparia* and *Geijera linearifolia* over *Olearia muelleri*, *Atriplex vesicaria* and *Scaevola spinescens* over mixed shrubs, herbs and grasses on orange-brown sandy clay-loams on flats .

W2: Woodland of *Eucalyptus salubris* and *Eucalyptus oleosa* subsp. *oleosa* with patches of mixed *Eucalyptus* species over *Melaleuca quadrifaria, Acacia hemiteles, Cratystylis conocephala* over *Diocirea ternata, Eremophila ionantha*, *Atriplex vesicaria*, *Eremophila decipiens* subsp. *decipiens*, *Eremophila scoparia, Geijera linearifoilia, Senna artemisioides* subsp. *filifolia* and *Exocarpos aphyllus* over *Vittadinia dissecta* var. *hirta*, *Olearia muelleri*, *Sclerolaena diacantha*, *Ptilotus holosericeus* and *Zygophyllum ovatum* over herbs and grasses on red-orange clay-loams on flats and lower slopes.

W3: Woodland of *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* with occasional *Eucalyptus celastroides* and *Eucalyptus salubris* over *Cratystylis conocephala* over *Olearia muelleri*, *Atriplex vesicaria* and *Santalum acuminatum* over *Rhagodia crassifolia*, *Zygophyllum apiculatum* and *Sclerolaena diacantha* over other mixed shrubs and herbs on orange-brown clay-loams on flats and slopes.

W4: Woodland to open woodland of mixed *Eucalyptus* species over *Eremophila scoparia*, *Cratystylis conocephala* and *Atriplex vesicaria* over *Sclerolaena diacantha*, *Olearia muelleri*, *Zygophyllum* species and *Rhagodia crassifolia* over herbs on orange clay-loams and sandy-loams on flats.

W5: Woodland of *Eucalyptus clelandii*, *Eucalyptus urna*, *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* over *Melaleuca sheathiana* over *Olearia muelleri*, *Eremophila scoparia* and *Alyxia buxifolia* over *Zygophyllum glaucum* and *Maireana* species on orange-brown sandy-loams on flats and lower slopes.

W6: Open woodland of mixed *Eucalyptus* species over *Eremophila dempsteri*, *Melaleuca halmaturorum* and *Melaleuca sheathiana* over *Cratystylis conocephala* and *Eremophila scoparia* over *Olearia muelleri* and mixed shrubs and herbs on orange clay-loams on flats and slopes.

W7: Open woodland of *Eucalyptus incrassata*, *Eucalyptus rigidula* and *Eucalyptus oleosa* subsp. *oleosa* over *Westringia rigida, Daviesia benthamii* subsp. *acanthoclona*, *Acacia erinacea*, *Santalum acuminatum*, *Eremophila scoparia* and *Acacia merrallii* over *Triodia scariosa* and herbs on orange-red clay-loams and sandy-loams on flats and lower slopes.

W8: Low open woodland of *Eucalyptus oleosa* subsp. *oleosa, Eucalyptus spreta* and *Eucalyptus lesouefii* over *Melaleuca sheathiana*, *Eremophila ionantha*, *Acacia hemiteles*, *Eremophila scoparia, Cratystylis conocephala* and *Melaleuca halmaturorum* over mixed shrubs and herbs on orange-brown clay-loams and sandy-loams on lower to mid slopes.

W9: Low open woodland of *Eucalyptus gracilis* and *Eucalyptus salubris* over *Eremophila scoparia*, *Eremophila ionantha, Melaleuca halmaturorum*, *Diocirea ternata, Cratystylis conocephala, Olearia muelleri, Melaleuca sheathiana* and *Dodonaea stenozyga* over low shrubs and herbs on red-brown sandy-loams and clay-loams on flats.

W10: Open woodland of *Eucalyptus oleosa* subsp. *oleosa* over *Melaleuca halmaturorum* over *Acacia hemiteles* and *Eremophila alternifolia* over *Olearia muelleri* and *Zygophyllum glaucum* on pale orange clay-loams and sandy-loam gravels on flats.

W11: Open woodland of *Eucalyptus salubris, Eucalyptus fraseri* subsp. *fraseri, Eucalyptus celastroides* and *Eucalyptus prolixa* over *Diocirea ternata, Eremophila ionantha, Eremophila scoparia* and *Olearia muelleri* over mixed low Chenopods on orange to red clay-loams on flats.

W12: Open woodland of *Eucalyptus oleosa* subsp. *oleosa, Eucalyptus polita* and *Eucalyptus prolixa* over *Diocirea ternata, Dodonaea stenozyga, Eremophila* species, *Daviesia benthamii* subsp. *acanthoclona* and *Olearia muelleri* over mixed low Chenopods and localized patches of *Triodia ?scariosa* on orange to red clays and clay loams on flats.

W13: Open woodland of *Eucalyptus flocktoniae* and *Eucalyptus celastroides* subsp. *virella* over *Melaleuca sheathiana, Diocirea ternata, Dodonaea stenozyga, Eremophila scoparia, Daviesia benthamii* subsp. *acanthoclona, Acacia erinacea* and *Olearia muelleri* over herbs and grasses on orange to red clays on flats.

W14: Open woodland of *Eucalyptus salubris, Eucalyptus calycogona* subsp. *calycogona* and *Eucalyptus spreta* over *Melaleuca halmaturorum, Diocirea ternata, Eremohila decipiens* subsp. *decipiens, Eremophila* scoparia, *Atriplex vesicaria* and *Olearia muelleri* over herbs and grasses on cracking clays on flats.

W15: Open woodland of *Eucalyptus oleosa* subsp. *oleosa, Eucalyptus prolix* and *Eucalyptus protensa* over *Cratystylis conocephala, Eremophila decipiens* subsp. *decipiens, Eremophila dempsteri, Rhagodia eremaea, Senna artemisioides* subsp. *filifolia* over herbs and grasses on orange clay-loams and sandy-loams on flats.

W16: Open woodland of mixed Eucalypts including *Eucalyptus transcontinentalis, Eucalyptus calycogona* subsp. *calycogona, Eucalyptus eremophila* subsp. *eremophila, Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus urna* over *Cratystylis conocephala, Commersonia craurophylla, Eremophila* species, *Melaleuca sheathiana, Olearia muelleri* and *Scaevola spinescens* over herbs and grasses on orange clay-loams and sandy-loams on flats and slopes of undulating rises.

W17: Open woodland of *Eucalyptus cylindrocarpa, Eucalyptus salubris* and *Eucalyptus oleosa* subsp. *oleosa* over *Cratystylis conocephala, Eremophila ionantha* and mixed Chenopod species over herbs and grasses on orange to red-brown sandy-loams and clay-loams with gravel on flats.

W18: Open woodland of *Eucalyptus laevis, Eucalyptus moderata, Eucalyptus salubris* and *Eucalyptus spreta* over *Acacia hemiteles, Acacia merrallii, Cratystylis conocephala, Eremophila dempsteri, Eremophila ionantha, Eremophila scoparia, Melaleuca halmaturorum* and mixed Chenopod species over patches of *Triodia irritans* on orange to red-brown clay-loams and sandy-loams on flats.

W19: Open woodland of *Eucalyptus ?loxophleba* subsp. *lissophloia, Eucalyptus oleosa* subsp. *oleosa Eucalyptus urna* and *Eucalyptus spreta* over *Acacia hemiteles, Acacia merrallii, Cratystylis conocephala, Dodonaea stenozyga, Eremophila ionantha, Eremophila scoparia* and *Exocarpos aphyllus* over herbs and grasses on orange to red-brown clay-loams and sandy-loams on flats.

W20: Open woodland of *Eucalyptus salubris* with local patches of *Eucalyptus calycogona* subsp. *calycogona, Eucalyptus spreta, Eucalyptus fraseri* subsp. *fraseri* and *Eucalyptus oleosa* subsp. *oleosa* over *Melaleuca sheathiana, Acacia hemiteles, Cratystylis conocepahala, Eremophila scoparia* and *Olearia muelleri* over localized patches of *Triodia irritans* on orange to red-brown clay-loams and sandy-loams on flats and lower slopes.

W21: Open woodland of *Eucalyptus polita* with local patches of *Eucalyptus flocktoniae* and *Eucalyptus lesouefii* over *Melaleuca sheathiana, Melaleuca halmaturorum, Acacia hemiteles, Accaia merrallii, Eremophila ionantha, Eremophila scoparia* and *Olearia muelleri* over herbs on orange to red-brown clay-loams and sandy-loams on flats and lower slopes.

Mixed Shrublands and Scrubs

S1: Open scrub of *Melaleuca halmaturorum*, *Atriplex vesicaria*, *Cratystylis conocephala* and *Eremophila scoparia* with occasional *Eucalyptus lesouefii* and *Eucalyptus salubris* over *Zygophyllum ovatum*, *Scaevola spinescens*, *Olearia muelleri* and *Sclerolaena diacantha* over other low shrubs and herbs on orange clay-loams on flats and slopes.

S2: Open scrub of *Logania* sp. and *Eremophila ionantha* with occasional emergent *Eucalyptus salubris* and *Eucalyptus spreta* over *Atriplex* species, *Ptilotus holosericeus, Vittadinia dissecta* var. *hirta* and Chenopod species on orange cracking clays on flats and low lying areas.

S3: Low open shrubland of *Acacia acuminata* (narrow phyllode variant) over *Eremophila decipiens* subsp. *decipiens, Dodonaea lobulata, Olearia pimeleoides* and *Eremophila deserti* over *Rhagodia ulicina*, *Enchylaena tomentosa* var. *tomentosa* and *Sclerolaena diacantha* and other mixed shrubs on red-brown clays on flats.

S4: Open scrub of *Allocasuarina helmsii* and *Melaleuca uncinata* with occasional *Eucalyptus rigidula* and *Eucalyptus salubris* over *Acacia hemiteles*, *Alyxia buxifolia, Dodonaea microzyga* var. *acrolobata, Grevillea acuaria, Scaevola spinescens* and *Olearia muelleri* over patches of *Triodia ?scariosa* and herbs on orange to red clay loam and clays on flats and slopes.

S5: Low open shrubland of *Acacia hemiteles, Eremophila decipiens* subsp. *decipiens, Rhodanthe chlorocephala* subsp. *rosea, Atriplex vesicaria* and *Vittadinia dissecta* var. *hirta* over mixed low shrubs and herbs on red clays on flats.

S6: Open scrub of *Melaleuca hamata*, *Allocasuarina* sp. over *Vittadinia dissecta* var. *hirta, Acacia acanthoclada* subsp. *acanthoclada, Grevillea huegelii, Hannafordia bissillii* subsp. *latifolia* and *Melaleuca fulgens* subsp. *fulgens* over herbs and grasses on red-orange sandy-loams on flats.

S7: Low open shrubland of *Tecticornia* sp. over *Eragrostis australasica, Eragrostis dielsii, Austrostipa mollis, Sclerolaena cuneata* and *Sclerolaena obliquicuspis* on orange clays on flats.

S8: Low open shrubland of *Acacia assimilis* subsp. *assimilis* and *Melaleuca uncinata* over *Eremophila decipiens* subsp. *decipiens, Cryptandra aridicola, Dodonaea microzyga* var. *acrolobata, Acacia acanthoclada* subsp. *acanthoclada* and *Westringia cephalantha* over *Triodia ?scariosa* and herbs on red-brown clays on lower slopes.

S9: Open scrub of *Allocasuarina campestris, Eremophila alternifolia, Eremophila decipiens* subsp. *decipiens, Geijera linearifolia, Melaleuca uncinata* and *Melaleuca fulgens* subsp. *fulgens* over *Trymalium myrtillus* subsp. *myrtillus, Senna artemisioides* subsp. *filifolia* over herbs and patches of *Triodia ?scariosa* on red-brown clays on flats and lower slopes.

S16: Very open scrub of *Beyeria lechenaultii, Eremophila alternifolia* and *Vittadinia dissecta* var. *hirta* over mixed shrubs and herbs on red-brown clays on massive granite outcropping.

Hummock Grasslands

G1: Open hummock grassland of mixed *Triodia* sp. with emergent *Eucalyptus griffithsii*, *Eucalyptus oleosa* subsp. *oleosa, Eucalyptus rigidula* and *Eucalyptus ?kumarlensis* over *Acacia erinacea*, *Acacia burkittii* and *Acacia hemiteles* over *Cryptandra aridicola*, *Westringia rigida*, *Senna artemisioides* subsp. *filifolia*, *Eremophila decipiens* subsp. *decipiens*, *Alyxia buxifolia* and *Grevillea acuaria* over herbs on orange-red clay-loams and sandy-loams on flats and slopes.

G2: Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus horistes* and *Eucalyptus websteriana* subsp. *norsemanica* over *Acacia assimilis* subsp. *atroviridis, Allocasuarina helmsii, Cryptandra leucopogon, Grevillea plurijuga* subsp. *plurijuga, Halgania erecta* and *Scaevola amblyanthera* var. *centralis* over herbs on orange-yellow clay-loams and sandy-loams on slopes.

G3: Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus salubris* and *Eucalyptus griffithsii* over *Acacia hemiteles, Eremophila alternifolia, Eremophila decipiens* subsp. *decipiens, Grevillea acuaria* and *Senna artemisioides* subsp. *filifolia* over herbs on red-brown clays and clay-loams on flats.

G4: Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus griffithsii* over *Acacia hemiteles, Allocasuarina species, Pultenaea elachista, Scaevola spinescens and Westringia rigida* over herbs on red-brown clay-loams on flats and lower slopes.

Miscellaneous

D: Disturbed land.

Regional Species

Ac: *Aristida contorta*

Bl: *Beyeria lechenaultii*

Ds: *Dodonaea stenozyga*

Threatened and Ecological Communities

Fraser Range (P1)

Southern Hills (P1)

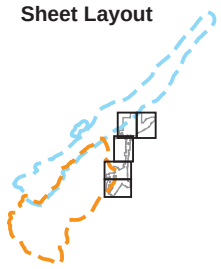
THREATENED AND PRIORITY SPECIES

Priority	DEC	Herbarium	MCPL
Threatened	●	■	▲
1	●	■	▲
2	●	■	▲
3	●	■	▲
4	●	■	▲

Priority Species

Abbrev	Species	Priority
Ah	*Acacia hystrix* subsp. *continua*	P1
Ew	*Eucalyptus websteriana* subsp. *norsemanica*	P1
Ss	*Stackhousia stratfordiae*	P1
T?p	*Trachymene ?pyrophila*	P2

Sheet Layout



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CAD Ref: g2125_Nova_f15_00.dgn
Date: Jun 2014 | Rev: C | A3

Nova Project

Legend

Figure: **8.0**

507500mE 510000mE 512500mE 515000mE 517500mE

6455000mN

6452500mN

6450000mN

SOUTHERN HILLS PRIORITY 1

E 69/3074

G4 W2 W2 W2 W11 W2 W11 G4 W3 W18 W5 W18 W18 G4 W11 G4 W18 W5 D W3 G1 W3 G1 W3 G1 W4 W19 S5 W3 Ss Ss W3 G1 G1 G1 W15 W2 G1 G1 W3 W15 G1 W3 W1 G1 W5 W5 W17 W8 D W1 W5 W3 W3 W5 G1 W10 G1 G1 W3 G3 W3 G1 W4 W3 G1 W8 G3 W5 W8 W5 W19 G1 W5 W2 W11 W20 W18 W20 W5 W8 W8 W5 W19

507500mE 510000mE 512500mE 515000mE 517500mE

Notes:
Refer to figure 8.0 for legend

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0 500m
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Nova Project

Vegetation

Sheet 1 of 5 sheets

Figure:
8.1

507500mE 510000mE 512500mE 515000mE 517500mE

6462500mN

6460000mN

6457500mN

SOUTHERN HILLS
PRIORITY 1

E 69/3074

W12 S8 W4 G1 S16 W4 Ss W12 S4 S9 W5 S4 S4 S4 W8 Ew Ew G2 W8 S6 W1 W8 W8 W5 W16 S6 W16 Ss S4 W8 W16 W16 W16 W16 W2 T?p W8 S4 W18 W16 W5 W16 W1 S4 S4 S4 W7 W1 W10 W5 W8 W2 G1

S9 W17 G3 W3 W2 W4 W8 W2 W3 W3 W1 W10 W2 W2 W2 W2 W10 G1

W3 G4 G4 G4 S9 S9 W2 G3 G3 W3 G3 G4 W3 W2 W11 W2 G4 W2 G1

507500mE 510000mE 512500mE 515000mE 517500mE

Notes:
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N

0 500m
Scale 1:30,000
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Nova Project

Vegetation

Sheet 2 of 5 sheets

Figure:
8.2

512500mE 515000mE 517500mE

6472500mN 6470000mN 6467500mN 6465000mN

W3 W3 W3 W2 W3 W3

W1 W1 W3 W16 W1 W8 W8 W3 W3 W16 W8 W3 W3 W8 W8 W3 W21 W21 W9 W16 W21 W21 W21 W9 W8 W2 W9 W21 W8 W21 W3 W21 W3 W8 W21 W19 W3 W21 W12 W6 W1 W21 W13 W19 W21 W18 W12 W9 W9 W19 W13 W5 G1 G1 W12

512500mE 515000mE 517500mE

Notes:
Refer to figure 8.0 for legend

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Nova Project

Vegetation

Sheet 3 of 5 sheets

Figure:
8.3

512500mE 515000mE 517500mE

6482500mN 6480000mN 6477500mN 6475000mN

FRASER RANGE PRIORITY 1

E 28/1724

Ss

Notes:
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Nova Project

Vegetation

Sheet 4 of 5 sheets

Figure: **8.4**

520000mE 522500mE 525000mE 527500mE

6482500mN 6480000mN 6477500mN 6475000mN

W9 W1 W3 W1 W3 W1 W2 W3 W1 W9 W3 W1 W5 W5 W3 W5 W5 W3 W3 W3 W7 W9 S1 W1 W2 W7 G1 W5 W1 W2 E 28/1724 W6 W3 W3 W7 W2 G1 W2 W8 W2 W8 W2 S7 W3 W20 G4 W20 W5 W2 W5 W20 W8 W6 W8 W8 W8 W20 W8 W20 W2 W6 W2 S9 G1 W20 W8 W20 W2 W8 W8 G2 W2 W2 W8 W2 W3 W20 W20 W8 W8 W20 W18

Notes:
Refer to figure 8.0 for legend

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0 500m
Scale 1:30,000
MGA94 (Zone 51)
CAD Ref: g2125_Nova_f15_05.dgn
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Nova Project

Vegetation

Sheet 5 of 5 sheets

Figure:
8.5

6.8 Threatened and Priority Ecological Communities

No Threatened Ecological Communities as listed by the Department of Parks and Wildlife (2014d) or by the Department of the Environment (2014b) were recorded within the Nova Project area.

Two Priority 1 Ecological Communities, the 'Fraser Range vegetation complex' and the 'Plant assemblages of the Southern Hills Vegetation Complex' overlap with several western sections of the Nova Project area. The areas of intersection of the Nova Project area, together with the mapped vegetation communities, for both the Fraser Range and Southern Hills Vegetation Complexes are set out in Table 8. The proportion of the 'Fraser Range vegetation complex' intersected by the Nova Project area was 0.98%. The proportion of the 'Southern Hills vegetation complex' intersected by the Nova project area was 1.58%.

Table 8: Area of intersection between the Fraser Range vegetation complex (P1), Southern Hills vegetation complex (P1) and vegetation communities mapped within the Nova Project area

Vegetation Complex	Mattiske Vegetation Community	Total Area (ha)	Area of Intersection with PEC (ha)	Percentage of Total Area Mapped
Fraser Range vegetation complex (P1) Total Area = 79,603.97 (unbuffered)	G1	512.51	18.51	3.61
	S1	52.89	38.35	72.51
	S3	14.37	14.37	100.00
	W1	1,207.25	64.47	5.34
	W2	3,681.76	360.26	9.78
	W3	3,180.50	222.09	6.98
	W4	356.41	37.96	10.65
	W9	317.17	17.05	5.38
	W14	40.42	2.42	5.99
	W20	966.20	0.71	0.07
	Total area / % of PEC		776.19	0.98
Southern Hills vegetation complex (P1) Total Area = 96,157.71 ha	D	8.42	0.35	4.16
	G3	65.45	27.25	41.63
	G4	287.88	255.53	88.76
	S9	93.23	61.96	66.46
	W2	3,681.76	197.55	5.37
	W3	3,180.50	422.00	13.27
	W4	356.41	0.56	0.16
	W5	1,704.99	102.12	5.99
	W8	2,176.88	0.05	0.002
	W10	1,067.02	39.39	3.69
	W11	218.29	191.34	87.65
	W18	459.61	221.11	48.11
	Total area / % of PEC		1,519.21	1.58

As no detailed data was available for the PECs any detailed statistical analyses was difficult. Consequently there was a need to rely on the definitions as summarized in Section 5.8.

In essence it appears that the two PECs rely mainly on the earlier work by Beard (1975) and the updated work of Hopkins, Beeston and Shepherd (2001). In reviewing the overlap with the communities it appears that the Eucalypt woodlands exist as a continuum on the slopes away from a series of ranges and hills in the areas, and as a result the species shift across the landscape. In comparing the species highlighted in the original definition of the PECs it appears that a range of species do not extend into the Nova project area; whilst others occur in various numbers of communities (see Table 9).

As indicated earlier the two PECs overlap in spatial extent and in their definitions. Consequently, there remain questions about the floristic composition and spatial extent of the communities that are associated with these communities.

Table 9: Comparison between species that occur within the Fraser Range and Southern Hills PECs and Nova Project Area (including Mine and associated Infrastructure areas)

Species Listed in Fraser Range and Southern Hill PECs (DPaW)	Review of Species within the Nova Survey Area	Representation in Vegetation Communities in the Nova Survey Area
Acacia acuminata (only recorded *Acacia acuminata* (narrow phyllode variant) in 2013)	Yes if assume narrow phyllode variant the same	G1, S3, S4
Allocasuarina huegeliana	No	-
Aristida contorta	Yes	G1, G3, S3, S9, W2, W3, W13
Beyeria lechenaultii	Yes	G1, S8
Cryptandra arbutiflora var. *tubulosa*	No	-
Dodonaea adenophora	No	G2
Dodonaea microzyga (recorded as *Dodonaea microzyga* var. *acrolobata* in 2013)	Yes if assume variety the same	G1, S4, S8, S9, W1, W8
Dodonaea stenozyga	Yes	G1, G4, S1, W1, W2, W5, W6, W9, W12, W13, W16, W18, W19, W21
Eucalyptus aff. *uncinata*	No	-
Eucalyptus effusa	No	-
Eucalyptus flocktoniae (including *Eucalyptus flocktoniae* subsp. *hebes* also in comparison from 2013 data)	Yes	W7, W13, W21
Eucalyptus oleosa (including *Eucalyptus oleosa* subsp. *oleosa* also in comparison from 2013 data)	Yes	G1, S1, W1, W2, W3, W4, W5, W6, W7, W8, W10, W12, W15, W16, W17, W19, W20
Eucalyptus transcontinentalis	Yes	W16
Melaleuca uncinata	Yes	G2, S4, S8, S9
Pittosporum angustifolium (*P. phillyreoides* var. *microcarpa* now *P. angustifolium* according to Cayzer, Crisp & Telfora 2000)	Yes	W1
Senna artemisioides subsp. helmsii	No	-

7. DISCUSSION

7.1 Survey Constraints and Limitations

An assessment of the survey against a range of factors which may have had an impact on the outcomes of the survey is summarized in Table 10.

Based on this assessment, the main constraint was associated with the lack of detail on the Fraser Range Hill and Southern Hill PECs that overlap western sections of the Nova Project area. The studies undertaken in 2013 on several occasions were considered more than adequate for a Level 2 assessment.

Table 10: Potential Flora and Vegetation Survey Limitations for the Mine Tenement Nova Project

Potential Survey Limitation	Impact on Survey
Sources of information and availability of contextual information (i.e. pre-existing background versus new material).	**Constraint**: Background information was sourced to provide contextual information for the current project. The PEC's are inadequately defined and some constraints were encountered in comparing data collected in the Mine Tenement with the PECs as defined by Department of Parks and Wildlife 2014a). Other previous work in the locality including the Rangeland Land System surveys, Beard (1975) mapping, DPaW databases and previous work undertaken by Paul Armstrong (2013).
Scope (i.e. what life forms, etc., were sampled).	**Not a constraint**: Vascular flora was the focus of the survey. These were thoroughly sampled. Twenty-two per cent of the vascular plant species recorded are annual or annual/perennial species and the remainder are perennial.
Proportion of flora collected and identified (based on sampling, timing and intensity).	**Not a constraint:** The proportion of flora collected and identified was considered adequate. It was estimated that approximately 83.93% of the flora potentially present within the survey area were recorded at sampling sites (via species accumulation plot).
Completeness and further work which might be needed (i.e. was the relevant survey area fully surveyed).	**Not a constraint:** Sites were pre-selected using high resolution aerial photography to ensure all vegetation communities subjectively identified were sampled, with multiple replications. Where necessary, additional sites were chosen in the field. Site selection and replication was considered adequate to accurately analyse and discriminate sites based on species composition and subsequently delineate vegetation community boundaries.
Mapping reliability.	**Not a constraint:** More than adequate coverage of the survey area was achieved. High quality aerial maps (Scale: 1:10,000) were used for both the survey work and subsequent vegetation community mapping. Vegetation community boundaries were often discontinuous with interfaces resembling admixtures of one or more communities. This is a recognised and unavoidable limitation of vegetation mapping, particularly across mosaic *Eucalyptus* / *Melaleuca* and other shrubs associations and open woodland associations.

Table 10: Potential Flora and Vegetation Survey Limitations for the Mine Tenement Nova Project (continued)

Potential Survey Limitation	Impact on Survey
Disturbances (fire, flood, accidental human intervention, etc.).	**Potential Constraint**: Areas in the southern east corner of Mine Tenement and in sections of the proposed Haul Road options have been subject to recent fire events (<5 years). The vigorous re-growth of key species in some of these recently burnt areas led to restrictions on the ability to identify some species and in particular a few of the Eucalypts.
Intensity (in retrospect, was the intensity adequate).	**Not a constraint:** Survey intensity was considered to have been thorough in throughout the project area with more than adequate replication being achieved via pre-planned sites, opportunistic field selection and relevé sites. Survey area was easily accessible by car and on foot.
Resources (i.e. were there adequate resources to complete the survey to the required standard).	**Not a constraint:** Resources, in terms of time, equipment, support and personnel were adequate to undertake and complete the survey.
Access problems (i.e. ability to access survey area).	**Not a constraint**: Access in to the survey area was good, with foot traverses of the area achieved to ensure adequate survey coverage of the Mine Tenement.
Experience levels (e.g. degree of expertise in plant identification to taxon level).	**Not a constraint:** Ecologists and botanists have undertaken previous surveys in the wider area and were familiar with the flora and vegetation. Collected specimens that were unable to be identified in the Mattiske herbarium were taken to the Western Australian Herbarium for positive identification.

7.2 Review of Flora Values

A total of 369 vascular plant taxa, representative of 145 genera and 63 families, were recorded in the Nova Project area. A total of ten introduced (weed) species were recorded within the Nova Project area in 2013 and 2014 (Appendix D). None of these species are declared pest organisms pursuant to Section 22 of the BAM Act 1979. Three of the introduced species (**Centaurea melitensis,* **Cucumis myriocarpis* and **Salvia verbenaca*) are listed by the DEC (2009) as environmental weeds, although all have a low status currently.

No threatened flora species pursuant to Subsection (2) of Section 23F of the WC Act and as listed by the DPaW (2014b), or pursuant to Section 179 of the EPBC Act or listed by the DotE (2014a), were recorded within the Nova Project area. Five priority flora species, as listed by the DPaW (2014f), were recorded within the Nova Project area. It is apparent that many of the previous collections, as extracted from the DPaW (2014b) database, have been collected near access tracks and main roads and the scattered distribution may reflect a lack of sampling of these priority species and as more studies are undertaken in the region the status of many of these species may be reviewed.

In terms of the coverage of species, as indicated in Section 6.5, based on the Incident Coverage Estimator (ICE) of species richness approximately 83.93% of the flora species potentially present within the Nova Project area were recorded. Further, twenty-two per cent of the vascular plant species recorded were annual or annual/perennial species and the remainder were perennial. The latter findings support the adequacy of the survey effort and coverage over several seasons in 2013 and 2014.

7.3 Review of Vegetation Values

A total of 35 vegetation communities were defined and mapped on the basis of the analyses within the Nova Project area. These thirty-five vegetation communities consisted of twenty-one Eucalypt woodlands, ten shrublands and open scrubs and four hummock grasslands. In determining these numbers there was a reliance on the abundance data collected on the foliage cover for the respective species in the different areas. The structural and floristic composition of the shrublands, open scrub and hummock grasslands were particularly evident and the boundaries tended to be clear and usually associated with underlying site conditions. In contrast, the woodlands formed a continuum with some species occurring within a range of communities, whilst others were quite specific and localized. As some of the woodland areas had been burnt recently the delineation of some of the boundaries may shift as more information becomes available on the Eucalypts within these burnt areas. Nevertheless the associated species enabled the definition of twenty-one woodlands. The vegetation maps reflect this complexity of the area with subtle changes in dominance and associations influencing the resulting outcome. One vegetation community, the S16 community, was recorded at a single location and is so small that it is not apparent on Figure 8.2. This community consisted of a sparse shrubland occurring on a massive granite outcrop.

No Threatened Ecological Communities as listed by the Department of Parks and Wildlife (2014d) or by the Department of the Environment (2014b) were recorded within the Nova Project area.

Two Priority 1 Ecological Communities, the 'Fraser Range vegetation complex' and the 'Plant assemblages of the Southern Hills Vegetation Complex' overlap with several western sections of the Nova project area. The proportion of the 'Fraser Range vegetation complex' and 'Southern Hills vegetation complex' intersected by the mapped Nova Project area are 0.98% and 1.58% respectively. This represents a very small proportion of the respective vegetation complexes, and given the peripheral nature of the areas of intersection, could be considered to be low impact. At the time of compiling this report, details of the location of infrastructure within the Nova Project area were not finalised. Consequently no calculations related to the potential impacts to mapped vegetation have been made.

As no detailed data was available for the PECs any detailed statistical analyses was difficult. In essence it appears that the two PECs rely mainly on the earlier work by Beard (1975) and the updated work of Hopkins, Beeston and Shepherd (2001). In reviewing the overlap with the communities it appears that the Eucalypt woodlands exist as a continuum on the slopes away from a series of ranges and hills in the areas. As a result the species shift across the landscape. In comparing the species highlighted in the original definition of the PECs it appears that a range of species do not extend into the Nova Project area; whilst others occur in various numbers of communities.

As indicated earlier the two PECs overlap in spatial extent and in their definitions. Consequently, there remain questions about the floristic composition and spatial extent of the communities that are associated with these communities.

8. PERSONNEL

The following MCPL personnel were involved in this project:

NAME	POSITION	PROJECT INVOLVEMENT	FLORA COLLECTION PERMIT
Dr E.M. Mattiske	Managing Director & Principal Ecologist	Planning, fieldwork, data interpretation, report preparation, management	SL010847
Mrs B. Koch	Senior Botanist	Plant identification	N/A
Mr R. Dharmarajan	Experienced Botanist & Project Leader	Planning, fieldwork, data interpretation, assisting in report preparation	SL010838
Mr D. Angus	Experienced Botanist	Fieldwork, assisting in report preparation	SL010859; DRF 11-1314
Mr C. Blackburn	Experienced Botanist	Fieldwork	SL010835; DRF 12-1314
Ms F. Hart	Experienced Ecologist	Fieldwork, assisting in report preparation	SL010844
Ms N. Murdock	Experienced Botanist	Fieldwork, assisting in report preparation and plant identification	SL010848; DRF 10-1314
Ms C. Reynolds	Experienced Botanist	Fieldwork, plant identification	SL010849
Mr D. Marsh	Experienced Botanist (contracted)	Fieldwork	N/A
Mr A. Barrett	Botanist	Fieldwork	SL010860
Mr J. Freeman	Botanist	Fieldwork, assisting in report preparation	SL010841
Ms C. Sands	Botanist	Fieldwork	SL010853
Mr B. Ellery	Taxonomist	Plant identification	N/A
Ms K. Tippur	Taxonomist	Plant identification	N/A
Mrs F. Gambie	Taxonomist	Plant identification	N/A
Ms R Jones	Botanist	Assisting in data collation	N/A

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APPENDIX A: LEGISLATIVE PROTECTION FOR WESTERN AUSTRALIA'S ENVIRONMENT

A.1. Overview of Western Australia's Flora

Western Australia has a unique and diverse flora, and is recognised as one of the world's 34 biodiversity hotspots (Myers *et al*. 2000). In this context, Western Australia possesses a high degree of species richness and endemism. This is particularly pronounced in the south-west region of the State. There are currently over 10,000 plant species known to occur within Western Australia (DPaW 2014c), and scientific knowledge of many of these species is limited.

The unique flora of Western Australia is potentially under threat due to historical clearing practices associated with agricultural, mining and human habitation activities. As a consequence of these historical clearing practices a number of flora species have become threatened or have the potential to become threatened as their habitat is impacted by human activity. In addition, some areas of the State have been affected by past clearing practices such that entire ecological communities are under threat.

At the Commonwealth level, under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), a nomination process exists to list a threatened species or ecological community. Additions or deletions to the lists of threatened species and communities are made by the Minister for Sustainability, Environment, Water, Populations and Communities on advice from the Federal Threatened Species Scientific Committee. The *EPBC Act* lists of threatened flora and ecological communities are published on the Department of Sustainability, Environment, Water, Populations and Communities (DSEWPC) website (DSEWPC 2014a; 2014b).

Ecological communities that are deemed to be threatened are also afforded protection under the *Environmental Protection Act 1986* (EP Act). Listings of threatened species and communities are reviewed annually by the Western Australian Threatened Species Scientific Committee (TSSC), which is a body appointed by the Minister for the Environment and supported by the DPaW.

The TSSC reviews threatened and specially protected flora (and fauna) listings on an annual basis. Recommendation for additions or deletions to the listings of specially protected flora (and fauna) are made to the Minister for the Environment by the TSSC, via the Director General of the DPaW and the WA Conservation Commission. Under Schedule 1 of the *Wildlife Conservation Act 1950*, the Minister for the Environment may declare that a class or description of flora to be threatened flora throughout the State, by notice published in the *Government Gazette* (DPaW 2014d).

The following sections describe these threatened and priority flora and ecological communities, and outline the legislative protection afforded to them.

A.2. Threatened and Priority Flora

Flora within Western Australia that is considered to be under threat may be classed as either threatened or priority flora. At the Commonwealth level, under the *EPBC Act*, threatened species can be listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable, or conservation dependent, by the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities. Under the *EPBC Act*, a person must not take an action that has, or will have, a significant impact on a listed threatened species without approval from the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities, unless those actions are not prohibited under the Act. Table I sets out definitions of threatened flora under federal legislation. The current *EPBC Act* list of threatened flora may be found on the DSEWPC (2014a) website.

At the State level, the *Wildlife Conservation Act 1950* provides for taxa of native flora (and fauna) to be specially protected because they are subject to identifiable threats. Protection of these taxa has been identified as being warranted because they may become extinct, are threatened, or are otherwise in need of special protection. Where flora has been gazetted as threatened flora under the *Wildlife Conservation Act 1950*, it is an offence "to take" such flora without the written consent of the Minister. The WC Act states that "to take" flora includes to gather, pluck, cut, pull up, destroy, dig up, remove or injure the flora or to cause or permit the same to be done by any means.

Priority flora constitute species which are considered to be under threat, but for which there is insufficient information available concerning their distribution and/or populations to make a proper evaluation of their conservation status. Such species are considered to potentially be under threat, but do not have legislative protection afforded under the Wildlife Conservation Act.

The DPaW (2014b) categorises priority flora according to their conservation priority, using five categories, P1 to P5, to denote the status of such species, with P1 listed species being the most threatened and P5 the least. Priority flora species are regularly reviewed, and may have their status changed when more information on the species becomes available. Table II sets out State definitions of both threatened and priority flora.

Table I: Federal Definition of Threatened Flora Species

Note: Adapted from the EPBC Act.

CODE	CATEGORY
Ex	**Extinct** Taxa which at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the immediate or near future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

APPENDIX A: LEGISLATIVE PROTECTION FOR WESTERN AUSTRALIA'S ENVIRONMENT

Table II: State Definition of Threatened and Priority Flora Species

Note: Adapted from DPaW (2014b).

CODE	CATEGORY
T	**Threatened Flora (Declared Rare Flora – Extant)** Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such (Schedule 1 under the WC Act). Threatened flora (Schedule 1) are further ranked by DPaW according to their level of threat using IUCN Red List criteria: • **CR:** Critically Endangered – considered to be facing an extremely high risk of extinction in the wild; • **EN:** Endangered – considered to be facing a very high risk of extinction in the wild; or • **VU:** Vulnerable – considered to be facing a high risk of extinction in the wild.
P1	**Priority One – Poorly Known Species** Taxa that are known from one or a few collections or sight records (generally less than five), all on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, Shire, Westrail and Main Roads WA road, gravel and soil reserves, and active mineral leases and under threat of habitat destruction or degradation. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes.
P2	**Priority Two – Poorly Known Species** Taxa that are known from one or a few collections or sight records, some of which are on lands not under imminent threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown land, water reserves, etc. Taxa may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes.
P3	**Priority Three – Poorly Known Species** Taxa that are known from collections or sight records from several localities not under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Taxa may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them.
P4	**Priority Four – Rare Threatened and other species in need of monitoring** (i) **Rare** - Taxa 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 taxa are usually represented on conservation lands. (ii) **Near Threatened** - Taxa that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable. (iii) Taxa that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
P5	**Priority Five – Conservation Dependent Species** Taxa that are not threatened but are subject to a specific conservation program, the cessation of which would result in the taxon becoming threatened within five years.

A.3. Threatened and Priority Ecological Communities

An ecological community is defined as a naturally occurring biological assemblage that occurs in a particular type of habitat composed of specific abiotic and biotic factors. Under the EPBC Act, a person must not take an action that has or will have a significant impact on a listed threatened ecological community without approval from the Commonwealth Minister for the Sustainability, Environment, Water, Population and Communities, unless those actions are not prohibited under the Act. A description of each of these categories of TECs is presented in Table III. The current EPBC Act list of threatened ecological communities can be located on the DSEWPC (2014b) website.

At the State level, ecological communities may be considered as threatened once they have been identified as such by the Western Australian Threatened Ecological Communities Scientific Advisory Committee. A threatened ecological community is defined, under the EPBC Act, as an ecological community listed, designated or declared under a written law or a law of the Commonwealth as threatened, endangered or vulnerable. There are four State categories of threatened ecological communities, or TECs; a description of each of these categories of TECs is presented in Table IV. Some, but not all, Western Australian TECs are also listed as threatened under the EPBC Act. A list of current TEC's can be viewed at the DPaW (2014e) website.

Ecological communities identified as threatened, but not listed as threatened ecological communities, can be classified as priority ecological communities (PECs). These communities are under threat, but there is insufficient information available concerning their distribution to make a proper evaluation of their conservation status.

The DPaW (2014b) categorises PECs according to their conservation priority, using five categories, P1 to P5, to denote the conservation priority status of such ecological communities; these categories are defined in Table V. A list of current PECs can be viewed at the DPaW (2014f) website.

Table III: Federal Definition of Threatened Ecological Communities

Note: Adapted from DSEWPC (2014b).

CATEGORY	DEFINITION
Critically endangered	If, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future.
Endangered	If, at that time, it is not critically endangered and is facing a very high risk of extinction in the wild in the near future.
Vulnerable	If, at that time, it is not critically endangered or endangered, and is facing a high risk of extinction in the wild in the medium-term future.

APPENDIX A: LEGISLATIVE PROTECTION FOR WESTERN AUSTRALIA'S ENVIRONMENT

Table IV: State Definition of Threatened Ecological Communities

Note: Adapted from DPaW (2014b).

CODE	CATEGORY
PTD	**Presumed Totally Destroyed** An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extant and either of the following applies: (i) records within the last 50 years have not been confirmed despite thorough searches or known likely habitats or; (ii) all occurrences recorded within the last 50 years have since been destroyed.
CE	**Critically Endangered** An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria: (iv) The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be substantially rehabilitated in the immediate future due to modification; (v) The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; (vi) The ecological community is highly modified with potential of being rehabilitated in the immediate future.
E	**Endangered** An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria: (i) The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification; (ii) The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; (iii) The ecological community is highly modified with potential of being rehabilitated in the short term future.
V	**Vulnerable** An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria: (i) The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated; (ii) The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; (iii) The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.

APPENDIX A: LEGISLATIVE PROTECTION FOR WESTERN AUSTRALIA'S ENVIRONMENT

Table V: State Definition of Priority Ecological Communities

Note: Adapted from DPaW (2014b).

CODE	CATEGORY
P1	**Poorly-known ecological communities** Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.
P2	**Poorly-known ecological communities** Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.
P3	**Poorly known ecological communities** (i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or: (ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or; (iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.
P4	Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.
P5	**Conservation Dependent ecological communities** Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

A.4. Clearing of Native Vegetation

Under the EP Act, the clearing of native vegetation requires a permit to do so, from the Department of Environment Regulation (DER) or the Department of Mines and Petroleum (DMP), unless that clearing is exempted under specific provisions listed in Schedule 6 of the Act, or are prescribed in the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*.

Under the EP Act, "native vegetation" means indigenous aquatic or terrestrial vegetation, and includes dead vegetation unless that dead vegetation is of a class declared by regulation to be excluded from this definition but does not include vegetation in a plantation.

Under Section 51A of the EP Act, "clearing" means the killing or destruction of, the removal of, the severing or ringbarking of trunks or stems of, or the doing of any other substantial damage to, some or all of the native vegetation in an area, and includes the draining or flooding of land, the burning of vegetation, the grazing of stock, or any other act or activity, that causes any of the aforementioned consequences or results.

Under the EP Act, ten principles are set out, under which native vegetation should not be cleared. These principles state that native vegetation should not be cleared, if:

a. it comprises a high level of biological diversity;

b. it comprises the whole or a part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous to Western Australia;

c. it includes, or is necessary for the continued existence of, threatened flora;

d. it comprises the whole or a part of, or is necessary for the maintenance of, a threatened ecological community;

e. it is significant as a remnant of native vegetation in an area that has been extensively cleared;

f. it is growing in, or in association with, an environment associated with a watercourse or wetland;

g. the clearing of the vegetation is likely to cause appreciable land degradation;

h. the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area;

i. the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water; or

j. the clearing of the vegetation is likely to cause, or exacerbate, the incidence or intensity of flooding.

The *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, under Regulation 5, sets out prescribed clearing actions that do not require a clearing permit, as defined in Section 51C of the EP Act.

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*, under Regulation 6 – "environmentally sensitive areas" are defined as "the area covered by vegetation within 50 m of threatened flora, to the extent to which the vegetation is continuous with the vegetation in which the threatened flora is located".

Under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* - Regulation 6 (environmentally sensitive areas), the area covered by a threatened ecological community, is similarly considered an environmentally sensitive area and therefore non-permitted, unless Ministerial approval is granted.

A.5. Local and Regional Significance

Flora or vegetation may be locally or regionally significant in addition to statutory listings by the State or Federal Government. Whilst not legislatively protected, these factors are taken into consideration during the assessment of mining proposals, clearing proposals and other proposed development; Guidance Statement 51 specifically states:

> *"A broad consideration of the ecological processes that influence sites and their ecological functions is required; statutory lists of Declared Rare and Priority Flora are only a small subset of biodiversity. Proponents should ensure that flora and vegetation surveys provide sufficient information to address both biodiversity conservation and ecological function values within the context of the type of proposal being considered and the relevant EPA objectives for protection of the environment"* (EPA 2004).

In regards to flora; species, subspecies, varieties, hybrids and ecotypes may be significant other than as threatened flora or priority flora, for a variety of reasons, including:

- a keystone role in a particular habitat for threatened species, or supporting large populations representing a significant proportion of the local regional population of a species;
- relic status;
- anomalous features that indicate a potential new discovery;
- being representative of the range of a species (particularly, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range);
- the presence of restricted subspecies, varieties, or naturally occurring hybrids;
- local endemism/a restricted distribution; and
- being poorly reserved (EPA 2004).

Vegetation may be significant because the extent is below a threshold level and a range of other reasons, including:

- scarcity;
- unusual species;
- novel combinations of species;
- a role as a refuge;
- a role as a key habitat for threatened species or large populations representing a significant proportion of the local to regional total population of a species;
- being representative of the range of a unit (particularly, a good local and/or regional example of a unit in "prime" habitat, at the extremes of range, recently discovered range extensions, or isolated outliers of the main range); and
- a restricted distribution (EPA 2004).

Vegetation communities are locally significant if they contain priority flora species or contain a range extension of a particular taxon outside of the normal distribution. They may also be locally significant if they are very restricted to one or two locations or occur as small isolated communities. In addition, vegetation communities that exhibit unusually high structural and species diversity are also locally significant. Vegetation communities are regionally significant where they are limited to specific landform types, are uncommon or restricted plant community types within the regional context, or support populations of threatened flora. Determining the significance of flora and vegetation may be applied at various scales, for example, a vegetation community may be nationally significant and governed by statutory protection as well as being locally and regionally significant.

A.6. Declared Organisms (including Introduced Plant Species)

The *Biosecurity and Agriculture Management Act 2007* (BAM Act) replaced the *Agriculture and Related Resources Protection Act 1976.* Organisms are grouped into four main classifications;

- Declared pests (section 22)
- Permitted (section 11)
- Prohibited (section 12)
- Permitted Requiring a permit (73, *BAM Regulations 2013*)

The Western Australian Organism List (WAOL) has been created to summarize the declared status of organisms that have been classified as part of the enactment of the BAM Act.

Under the BAM Act, all declared pests are assigned to one of three categories, namely C1 (exclusion), C2 (eradication) or C3 (management), as described below:

C1 category (Exclusion) – Pests will be assigned to this category if they are not established in Western Australia and control measures are to be taken, including border checks, in order to prevent them entering and establishing in the State.

C2 category (Eradication) – Pests will be assigned to this category if they are present in Western Australia in low enough numbers or in sufficiently limited areas that their eradication is still a possibility.

C3 category (Management) – Pests will be assigned to this category if they are established in Western Australia but it is feasible, or desirable, to manage them in order to limit their damage. Control measures can prevent a C3 pest from increasing in population size or density or moving from an area in which it is established into an area which currently is free of that pest.

Organisms that are unlisted are those that have not been declared by the Minister for Agriculture and Food as permitted, prohibited or declared pests, and therefore are not included on the WAOL. Section 15 (2) states unlisted organisms cannot be imported, except with a permit. This provision requires therefore that people must seek permission to bring undeclared organisms across the border into Western Australia so that an assessment can be made about any biosecurity threats they may pose to the State.

A7. Environmental Weeds

The Department of Parks and Wildlife have prepared a series of lists of environmental weeds with associated rankings for the respective regions (http://florabase.dpaw.wa.gov.au/weeds/). In addition, the Department of Environment and Conservation (former name of DPaW) have published an "Environmental Weed Strategy for Western Australia (http://www.dec.wa.gov.au/pdf/plants_animals/environmental_weed_strategy_wa.pdf). Both of these documents provide guidance on the weed species and potentially how environmental weeds could be prioritized and managed.

APPENDIX B: SUMMARY OF RECORDING SITES ON NOVA SURVEY AREA, 2013 - 2014

Site No	Location (GDA94, Zone 51)	
	Easting (mE)	Northing (mN)
S001	507302	6452512
S002	507406	6451997
S003	507500	6450630
S004	507520	6451131
S005	507555	6451813
S006	507557	6452901
S007	507703	6454443
S008	507870	6451842
S009	508100	6454433
S010	508148	6451498
S011	508237	6452962
S012	508328	6455179
S013	508522	6454821
S014	508610	6450024
S015	508711	6456223
S016	508760	6455337
S017	508809	6449742
S018	509245	6456967
S019	509409	6456426
S020	509440	6455785
S021	509451	6450908
S022	509539	6451311
S023	509619	6456370
S024	509656	6450369
S025	509713	6449292
S026	509768	6450459
S027	509851	6457648
S028	509924	6450941
S029	510005	6457161
S030	510212	6460085
S031	510367	6450111
S032	510450	6451910
S033	510506	6449698
S034	510661	6457381
S035	510682	6452228
S036	510744	6451629
S037	510747	6451040
S038	510783	6460571
S039	511106	6453166
S040	511129	6460797
S041	511319	6451162
S042	511340	6452946
S043	511340	6452989

Site No	Location (GDA94, Zone 51)	
	Easting (mE)	Northing (mN)
S044	511436	6452593
S045	511477	6458472
S046	511550	6452183
S047	511642	6453778
S048	511681	6453454
S049	511876	6454112
S050	511970	6460363
S051	511989	6452204
S052	512026	6460226
S053	512435	6453312
S054	512446	6453852
S055	512461	6452776
S056	512565	6453587
S057	512646	6459132
S058	512670	6458717
S059	512950	6453936
S060	513125	6453342
S061	513128	6458979
S062	513609	6459904
S063	513627	6455951
S064	513911	6456327
S065	513933	6457104
S066	513975	6455498
S067	513980	6456357
S068	514008	6454668
S069	514059	6457531
S070	514071	6459961
S071	514244	6456428
S072	514308	6460182
S073	514309	6474885
S074	514326	6477134
S075	514327	6454336
S076	514329	6478038
S077	514332	6481261
S078	514360	6474793
S079	514412	6480100
S080	514448	6478994
S081	514467	6458075
S082	514488	6456493
S083	514541	6455606
S084	514545	6479458
S085	514561	6478942
S086	514562	6477576

APPENDIX B: SUMMARY OF RECORDING SITES ON NOVA SURVEY AREA, 2013 - 2014

Site No	Location (GDA94, Zone 51)	
	Easting (mE)	Northing (mN)
S087	514585	6456480
S088	514634	6456490
S089	514658	6480589
S090	514716	6459621
S091	514739	6457519
S092	514755	6477218
S093	514776	6479487
S094	514839	6456739
S095	514869	6454589
S096	514892	6480206
S097	514896	6455796
S098	514919	6476782
S099	514949	6479548
S100	514978	6475562
S101	515023	6481422
S102	515035	6457113
S103	515101	6459197
S104	515131	6474479
S105	515138	6461186
S106	515139	6458426
S107	515146	6460919
S108	515153	6461251
S109	515182	6459156
S110	515189	6454841
S111	515195	6460170
S112	515203	6474892
S113	515213	6481507
S114	515249	6477959
S115	515292	6456662
S116	515295	6462154
S117	515316	6457247
S118	515317	6457577
S119	515323	6456456
S120	515339	6479566
S121	515346	6475165
S122	515354	6456351
S123	515363	6474599
S125	515393	6455369
S126	515397	6480869
S127	515401	6480092
S128	515407	6481531
S129	515409	6457908
S130	515417	6463247

Site No	Location (GDA94, Zone 51)	
	Easting (mE)	Northing (mN)
S131	515418	6476778
S132	515429	6462682
S133	515430	6477435
S134	515431	6463753
S135	515460	6462179
S136	515466	6464047
S137	515466	6480348
S138	515496	6480067
S139	515498	6464195
S140	515501	6478450
S141	515512	6458885
S142	515534	6459702
S143	515541	6462659
S144	515552	6481588
S145	515564	6460626
S146	515564	6480006
S147	515571	6459378
S148	515583	6474835
S149	515608	6468944
S150	515649	6471528
S151	515670	6460997
S152	515674	6461060
S153	515677	6460421
S154	515683	6461747
S155	515690	6467186
S156	515696	6475478
S157	515696	6480481
S158	515697	6465527
S159	515711	6461224
S160	515719	6471116
S161	515725	6466663
S162	515730	6466260
S163	515746	6468462
S164	515748	6467668
S165	515756	6469567
S166	515777	6467984
S167	515804	6462523
S168	515813	6470705
S169	515827	6470026
S170	515858	6460312
S171	515867	6460768
S172	515893	6463041
S173	515897	6480479

APPENDIX B: SUMMARY OF RECORDING SITES ON NOVA SURVEY AREA, 2013 - 2014

Site No	Location (GDA94, Zone 51)	
	Easting (mE)	Northing (mN)
S174	515929	6453977
S175	515936	6477635
S176	515938	6481103
S177	515944	6464481
S178	515947	6479010
S179	515980	6452906
S180	516037	6478260
S181	516103	6463944
S182	516107	6472814
S183	516116	6465910
S184	516123	6463383
S185	516124	6480202
S186	516145	6481396
S187	516150	6452878
S188	516170	6464274
S189	516179	6481001
S190	516180	6467661
S191	516183	6468330
S192	516188	6470217
S193	516209	6473319
S194	516217	6467105
S195	516218	6471422
S196	516225	6469075
S197	516237	6470953
S198	516241	6464197
S199	516273	6452310
S200	516282	6465808
S201	516286	6466796
S202	516297	6469595
S203	516326	6468579
S204	516336	6466308
S205	516370	6471675
S206	516378	6474981
S207	516412	6477225
S208	516435	6477469
S209	516448	6479858
S210	516452	6474547
S211	516499	6472073
S212	516565	6472709
S213	516569	6453456
S214	516622	6481507
S215	516631	6472493
S216	516643	6453592

Site No	Location (GDA94, Zone 51)	
	Easting (mE)	Northing (mN)
S217	516663	6479518
S218	516668	6476090
S219	516717	6481056
S220	516735	6478175
S221	516752	6474085
S222	516848	6472984
S223	516879	6475874
S224	516895	6474859
S225	516943	6473807
S226	516947	6481557
S227	516975	6479772
S228	517030	6477859
S229	517042	6477852
S230	517047	6481122
S231	517127	6481126
S232	517151	6474452
S233	517171	6479174
S234	517201	6480084
S235	517211	6476362
S236	517222	6479979
S237	517238	6477092
S238	517344	6481420
S240	517423	6481380
S241	517446	6476712
S242	517721	6482574
S243	517747	6453508
S244	517749	6482681
S245	517786	6482742
S246	517799	6482275
S247	517808	6483088
S248	517839	6482726
S249	517853	6477349
S250	517891	6481085
S251	517942	6482173
S252	517993	6480776
S253	518007	6477552
S254	518010	6476721
S255	518086	6482700
S256	518110	6477382
S257	518164	6480431
S258	518246	6480728
S259	518390	6482953
S260	518438	6476480

APPENDIX B: SUMMARY OF RECORDING SITES ON NOVA SURVEY AREA, 2013 - 2014

Site No	Location (GDA94, Zone 51)	
	Easting (mE)	Northing (mN)
S261	518584	6476804
S262	518592	6482270
S263	518675	6483110
S264	518706	6479202
S265	518786	6480321
S266	518818	6475739
S267	518821	6480246
S268	518832	6477084
S269	518847	6478329
S270	518883	6481591
S271	518912	6482664
S272	518938	6477923
S273	518994	6477941
S274	518999	6475485
S275	519024	6477431
S276	519027	6477891
S277	519055	6477534
S278	519066	6476720
S279	519121	6476948
S280	519124	6478996
S281	519162	6475531
S282	519189	6477411
S283	519190	6475193
S284	519197	6480999
S285	519200	6479622
S286	519208	6479270
S287	519255	6477610
S288	519339	6482783
S289	519352	6483315
S290	519361	6477447
S291	519417	6478341
S292	519466	6480414
S293	519487	6478574
S294	519555	6479925
S295	519594	6481807
S296	519611	6475186
S297	519629	6476309
S298	519706	6479228
S299	519720	6482513
S300	519754	6477859
S301	519877	6481318
S302	519896	6478158
S303	519953	6483286

Site No	Location (GDA94, Zone 51)	
	Easting (mE)	Northing (mN)
S304	520017	6482887
S305	520018	6483102
S306	520071	6477018
S307	520132	6480491
S308	520203	6481591
S309	520233	6481730
S310	520276	6477468
S311	520353	6481056
S312	520473	6483309
S313	520488	6479088
S314	520571	6481945
S315	520593	6478803
S316	520659	6483159
S317	520695	6482459
S318	520736	6483218
S319	520793	6476544
S320	520826	6481258
S321	520869	6479264
S322	520956	6480512
S323	521020	6481940
S324	521105	6482973
S325	521122	6479397
S326	521134	6483065
S327	521179	6478892
S328	521193	6476803
S329	521197	6477831
S330	521296	6476989
S331	521339	6481157
S332	521373	6477208
S333	521405	6483049
S334	521438	6476636
S335	521459	6479106
S336	521521	6479475
S339	521529	6480705
S340	521532	6482624
S341	521590	6482194
S342	521697	6481762
S343	521726	6477317
S344	521825	6479264
S345	521875	6481164
S346	521889	6480857
S347	521897	6481595
S348	521910	6476398

APPENDIX B: SUMMARY OF RECORDING SITES ON NOVA SURVEY AREA, 2013 - 2014

Site No	Location (GDA94, Zone 51)	
	Easting (mE)	Northing (mN)
S349	522682	6477497
S350	522832	6478661
S351	522925	6478527
S352	523317	6477228
S353	523359	6477909
S354	523497	6478350
S355	523882	6479839
S356	523924	6478946
S357	524152	6478173
S358	524501	6478760
S359	524504	6478453
S360	524528	6479170
S361	524590	6479939
S362	524618	6480493
S363	525100	6480994
S364	525149	6480690
S365	525561	6480987
S366	525809	6480385
S367	525888	6480222
S368	516408	6470214

Site No	Location (GDA94, Zone 51)	
	Easting (mE)	Northing (mN)
S369	513777	6474553
S370	509407	6457665
S371	516791	6468673
S372	515052	6461765
S373	508123	6456932
S374	513512	6474523
S375	513180	6474281
S376	516531	6469834
S377	515125	6466377
S378	514982	6461600
S379	514951	6461661
S380	507698	6457373
S381	513317	6475995
S382	516039	6473223
S383	508516	6453627
S384	508746	6454401
S385	509187	6455137
S386	516658	6471627
S387	510185	6456671

APPENDIX C: POTENTIAL VASCULAR PLANT SPECIES NEAR THE NOVA SURVEY AREA, BASED ON NATURMAP (DPaW 2014g)

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 201

FAMILY	Species
PTERIDACEAE	*Cheilanthes distans*
	Cheilanthes lasiophylla
ASPLENIACEAE	*Pleurosorus rutifolius*
MARSILEACEAE	*Marsilea drummondii*
POTAMOGETONACEAE	*Lepilaena australis*
JUNCAGINACEAE	*Triglochin* sp. A Flora of Australia (G.J. Keighery 2477)
POACEAE	**Pentameris airoides* subsp. *airoides*
	**Rostraria pumila*
	**Schismus arabicus*
	Amphipogon caricinus var. *caricinus*
	Aristida contorta
	Austrostipa elegantissima
	Austrostipa platychaeta
	Digitaria brownii
	Enneapogon caerulescens
	Eragrostis australasica
	Eragrostis dielsii
	Panicum effusum
	Paspalidium constrictum
	Triodia irritans
	Triodia scariosa
	Tripogon loliiformis
CYPERACEAE	*Isolepis cernua* var. *cernua*
JUNCACEAE	**Juncus hybridus*
	Juncus aridicola
COLCHICACEAE	*Wurmbea tenella*
HEMEROCALLIDACEAE	*Stypandra glauca*
ORCHIDACEAE	*Microtis eremicola*
	Prasophyllum gracile
	Pterostylis picta
	Pterostylis roensis
	Thelymitra petrophila
CASUARINACEAE	*Allocasuarina huegeliana*
URTICACEAE	*Parietaria cardiostegia*
PROTEACEAE	*Grevillea anethifolia*
	Grevillea oligantha
	Grevillea sarissa subsp. *anfractifolia*

APPENDIX C: POTENTIAL VASCULAR PLANT SPECIES NEAR THE NOVA SURVEY AREA, BASED ON NATURMAP (DPaW 2014g)

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 201

FAMILY	Species
SANTALACEAE	*Exocarpos sparteus*
POLYGONACEAE	**Emex australis*
	Muehlenbeckia florulenta
CHENOPODIACEAE	*Atriplex vesicaria*
	Dissocarpus paradoxus
	Dysphania cristata
	Einadia nutans subsp. *eremaea*
	Einadia nutans subsp. *nutans*
	Maireana glomerifolia
	Maireana pentatropis
	Maireana trichoptera
	Rhagodia crassifolia
	Sclerolaena brevifolia
	Sclerolaena diacantha
	Sclerolaena parviflora
	Tecticornia lylei
	Tecticornia pergranulata subsp. *pergranulata*
AMARANTHACEAE	*Ptilotus carlsonii*
	Ptilotus divaricatus
	Ptilotus obovatus
	Ptilotus spathulatus
GYROSTEMONACEAE	*Codonocarpus cotinifolius*
AIZOACEAE	**Cleretum papulosum* subsp. *papulosum*
	**Mesembryanthemum nodiflorum*
CARYOPHYLLACEAE	**Herniaria cinerea*
	**Silene nocturna*
BRASSICACEAE	**Alyssum linifolium*
	Geococcus pusillus
	Harmsiodoxa brevipes var. *brevipes*
	Stenopetalum lineare var. *lineare*
DROSERACEAE	*Drosera macrantha*
CRASSULACEAE	*Crassula colligata* subsp. *lamprosperma*
PITTOSPORACEAE	*Pittosporum angustifolium*
FABACEAE	**Medicago minima*
	Acacia acanthoclada subsp. *acanthoclada*
	Acacia camptoclada
	Acacia colletioides
	Acacia eremophila var. *variabilis* (P3)
	Acacia erinacea

APPENDIX C: POTENTIAL VASCULAR PLANT SPECIES NEAR THE NOVA SURVEY AREA, BASED ON NATURMAP (DPaW 2014g)

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 201

FAMILY	Species
FABACEAE (continued)	*Acacia hemiteles*
	Acacia inamabilis
	Acacia jennerae
	Acacia merrallii
	Acacia sp. narrow phyllode (B.R. Maslin 7831)
	Acacia uncinella
	Acacia verricula
	Acacia warramaba
	Aotus sp. Tortile (G.J. Keighery 3767)
	Bossiaea leptacantha
	Cullen discolor
	Daviesia pachyloma
	Dillwynia sp. Coolgardie (V.E. Sands 637.3. 1)
	Glycine peratosa
	Indigofera australis subsp. *hesperia*
	Leptosema daviesioides
	Mirbelia depressa
	Senna artemisioides
	Senna artemisioides subsp. x *artemisioides*
	Senna pleurocarpa var. *angustifolia*
	Senna pleurocarpa var. *pleurocarpa*
	Swainsona disjuncta
	Swainsona formosa
	Swainsona rostellata
GERANIACEAE	**Erodium aureum*
	**Erodium cicutarium*
	Erodium cygnorum
OXALIDACEAE	**Oxalis corniculata*
	Oxalis exilis
	Oxalis perennans
RUTACEAE	*Boronia fabianoides* subsp. *fabianoides*
	Geijera linearifolia
	Phebalium elegans
	Phebalium lepidotum
EUPHORBIACEAE	**Ricinus communis*
	Beyeria lechenaultii
CELASTRACEAE	*Stackhousia* sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)
SAPINDACEAE	*Dodonaea adenophora*
	Dodonaea lobulata
	Dodonaea microzyga var. *acrolobata*
	Dodonaea stenozyga
	Dodonaea viscosa subsp. *angustissima*
RHAMNACEAE	*Cryptandra aridicola*

APPENDIX C: POTENTIAL VASCULAR PLANT SPECIES NEAR THE NOVA SURVEY AREA, BASED ON NATURMAP (DPaW 2014g)

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 201

FAMILY	Species
MALVACEAE	**Malva parviflora*
	Lasiopetalum behrii
	Radyera farragei
	Sida calyxhymenia
VIOLACEAE	*Hybanthus epacroides*
	Hybanthus floribundus subsp. *curvifolius*
THYMELAEACEAE	*Pimelea microcephala*
	Pimelea spiculigera var. *spiculigera*
	Pimelea spiculigera var. *thesioides*
MYRTACEAE	*Calothamnus gilesii*
	Eucalyptus assimilans
	Eucalyptus calycogona subsp. *calycogona*
	Eucalyptus comitae-vallis
	Eucalyptus cyclostoma
	Eucalyptus cylindriflora
	Eucalyptus cylindrocarpa
	Eucalyptus effusa subsp. *effusa*
	Eucalyptus eremophila subsp. *eremophila*
	Eucalyptus flocktoniae
	Eucalyptus fraseri subsp. *fraseri*
	Eucalyptus fraseri subsp. *melanobasis* (P2)
	Eucalyptus gracilis
	Eucalyptus grossa
	Eucalyptus histophylla (P3)
	Eucalyptus incrassata
	Eucalyptus laevis
	Eucalyptus leptophylla
	Eucalyptus lesouefii
	Eucalyptus melanoxylon
	Eucalyptus oleosa
	Eucalyptus optima
	Eucalyptus platycorys
	Eucalyptus protensa
	Eucalyptus quadrans
	Eucalyptus rigidula
	Eucalyptus salubris
	Eucalyptus sp. Fraser Range (D. Nicolle 2157)
	Eucalyptus spreta
	Eucalyptus terebra
	Eucalyptus tortilis
	Eucalyptus urna
	Eucalyptus vittata
	Eucalyptus youngiana
	Melaleuca acuminata subsp. *acuminata*
	Melaleuca elliptica
	Melaleuca halmaturorum
	Melaleuca lanceolata

APPENDIX C: POTENTIAL VASCULAR PLANT SPECIES NEAR THE NOVA SURVEY AREA, BASED ON NATURMAP (DPaW 2014g)

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 201

FAMILY	Species
MYRTACEAE (continued)	*Melaleuca sheathiana*
	Thryptomene australis subsp. *brachyandra*
HALORAGACEAE	*Glischrocaryon angustifolium*
	Haloragis dura
	Myriophyllum balladoniense (P4)
ARALIACEAE	*Trachymene cyanopetala*
APIACEAE	*Daucus glochidiatus*
GENTIANACEAE	*Schenkia australis*
APOCYNACEAE	*Marsdenia australis*
CONVOLVULACEAE	*Convolvulus remotus*
	Wilsonia humilis
BORAGINACEAE	*Halgania andromedifolia*
	Halgania cyanea var. Charleville (R.W. Purdie +111)
	Halgania integerrima
	Heliotropium asperrimum
	Omphalolappula concava
LAMIACEAE	**Salvia verbenaca*
	Prostanthera campbellii
	Prostanthera laricoides
	Prostanthera serpyllifolia subsp. *serpyllifolia*
	Teucrium eremaeum
	Teucrium sessiliflorum
	Teucrium sp. Balladonia (K.R. Newbey 7380)
	Westringia rigida
SOLANACEAE	*Lycium australe*
	Nicotiana goodspeedii
	Solanum hoplopetalum
	Solanum lasiophyllum
	Solanum nummularium
	Solanum plicatile
SCROPHULARIACEAE	*Diocirea ternata*
	Eremophila alternifolia
	Eremophila decipiens subsp. *decipiens*
	Eremophila dempsteri
	Eremophila ionantha
	Eremophila oblonga
	Eremophila psilocalyx
	Myoporum platycarpum subsp. *platycarpum*
RUBIACEAE	*Opercularia spermacocea*

APPENDIX C: POTENTIAL VASCULAR PLANT SPECIES NEAR THE NOVA SURVEY AREA, BASED ON NATURMAP (DPaW 2014g)

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 201

FAMILY	Species
CAMPANULACEAE	*Wahlenbergia communis*
	Wahlenbergia tumidifructa
GOODENICAEAE	*Dampiera tenuicaulis* var. *tenuicaulis*
	Goodenia pinnatifida
	Goodenia quasilibera
	Scaevola oxyclona
ASTERACEAE	*Actinobole uliginosum*
	Angianthus tomentosus
	Brachyscome ciliaris
	Brachyscome iberidifolia
	Brachyscome lineariloba
	Centipeda crateriformis subsp. *compacta*
	Cephalipterum drummondii
	Ceratogyne obionoides
	Chrysocephalum apiculatum
	Cratystylis conocephala
	Euchiton sphaericus
	Hyalosperma glutinosum subsp. *glutinosum*
	Leiocarpa semicalva subsp. *semicalva*
	Leiocarpa websteri
	Lemooria burkittii
	Microseris scapigera (P3)
	Millotia myosotidifolia
	Millotia tenuifolia var. *tenuifolia*
	Olearia dampieri subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628)
	Olearia sp. Kennedy Range (G. Byrne 66)
	Ozothamnus blackallii
	Podolepis capillaris
	Podolepis rugata
	Rhodanthe pygmaea
	Rhodanthe stricta
	Schoenia cassiniana
	Triptilodiscus pygmaeus

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED ON THE NOVA SURVEY AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 2014a).

FAMILY	SPECIES
PTERIDACEAE	*Cheilanthes sieberi* subsp. *sieberi*
MARSILEACEAE	*Marsilea hirsuta*
POACEAE	*Amphipogon caricinus* var. *caricinus* *Amphipogon* sp. *Aristida contorta* *Aristida ?holathera* *Austrostipa elegantissima* *Austrostipa hemipogon* *Austrostipa mollis* *Austrostipa nitida* *Austrostipa platychaeta* *Austrostipa scabra* subsp. *scabra* *Austrostipa* sp. *Enneapogon avenaceus* *Enneapogon caerulescens* *Enneapogon* sp. *Eragrostis australasica* *Eragrostis dielsii* *Panicum effusum* *Rytidosperma caespitosum* * *Schismus arabicus* *Triodia irritans* *Triodia scariosa* *Triodia ?tomentosa* *Triodia* sp. Poaceae sp.
CYPERACEAE	*Gahnia* sp. South West (K.L. Wilson & K. Frank KLW 9266) *Lepidosperma* aff. *diurnum* *Lepidosperma* sp.
RESTIONACEAE	*Lepidobolus deserti*
CENTROLEPIDACEAE	*Centrolepis polygyna*
JUNCACEAE	*Juncus pallidus*
ASPARAGACEAE	*Lomandra collina* *Lomandra effusa* *Thysanotus manglesianus* *Thysanotus* sp.
HEMEROCALLIDACEAE	*Dianella revoluta*

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED ON THE NOVA SURVEY AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 2014a).

FAMILY	SPECIES
ORCHIDACEAE	*Pterostylis* sp.
CASUARINACEAE	*Allocasuarina campestris* *Allocasuarina helmsii* *Allocasuarina* sp.
PROTEACEAE	*Grevillea acuaria* *Grevillea anethifolia* *Grevillea huegelii* *Grevillea plurijuga* subsp. *plurijuga* *Grevillea teretifolia* *Grevillea* sp.
SANTALACEAE	*Exocarpos aphyllus* *Santalum acuminatum* *Santalum spicatum* *Santalum* sp.
CHENOPODIACEAE	*Atriplex acutibractea subsp. karoniensis* *Atriplex nummularia* *Atriplex vesicaria* *Atriplex* sp. *Chenopodium curvispicatum* *Chenopodium* sp. *Enchylaena tomentosa* *Enchylaena tomentosa* var. *tomentosa* *Eriochiton sclerolaenoides* *Maireana ?appressa* *Maireana carnosa* *Maireana erioclada* *Maireana ?eriosphaera* *Maireana georgei* *Maireana ?marginata* *Maireana pentatropis* *Maireana radiata* *Maireana sedifolia* *Maireana suaedifolia* *Maireana trichoptera* *Maireana triptera* *Maireana* sp. *Rhagodia crassifolia* *Rhagodia drummondii* *Rhagodia eremaea* *Rhagodia ulicina* *Rhagodia* sp. *Salsola australis*

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED ON THE NOVA SURVEY AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 2014a).

FAMILY	SPECIES
CHENOPODIACEAE (continued)	*Sclerolaena cuneata* *Sclerolaena diacantha* *Sclerolaena drummondii* *Sclerolaena obliquicuspis* *Sclerolaena parviflora* *Sclerolaena uniflora* *Tecticornia* sp. Chenopodiaceae sp.
AMARANTHACEAE	*Ptilotus carlsonii* *Ptilotus drummondii* *Ptilotus drummondii* var. *minor* *Ptilotus drummondii* ?var. *scaposus* *Ptilotus holosericeus* *Ptilotus nobilis* *Ptilotus obovatus* *Ptilotus spathulatus* *Ptilotus* sp. Goldfields (R. Davis 10796) *Ptilotus* sp.
GYROSTEMONACEAE	*Codonocarpus cotinifolius* *Gyrostemon racemiger*
PORTULACACEAE	*Calandrinia eremaea* *Calandrinia porifera* *Calandrinia* sp.
BRASSICACEAE	*Arabidella chrysodema* *Arabidella trisecta* *Arabidella* sp. **Brassica* sp. *Lepidium* sp. *Menkea australis*
CRASSULACEAE	*Crassula colorata* var. *colorata*
PITTOSPORACEAE	*Pittosporum ?angustifolium*
FABACEAE	*Acacia acanthoclada* subsp. *acanthoclada* *Acacia acoma* *Acacia acuminata* (narrow phyllode variant) *Acacia andrewsii* *Acacia assimilis* *Acacia assimilis* subsp. *assimilis* *Acacia assimilis* subsp. *atroviridis* *Acacia burkittii*

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED ON THE NOVA SURVEY AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 2014a).

FAMILY	SPECIES
FABACEAE (continued)	*Acacia camptoclada* *Acacia colletioides* *Acacia densiflora* *Acacia enervia* subsp. *explicata* *Acacia eremophila* var. *eremophila* *Acacia erinacea* *Acacia evenulosa* *Acacia hemiteles* *Acacia hystrix* subsp. *continua* (P1) *Acacia hystrix* subsp. *hystrix* *Acacia merrallii* *Acacia oswaldii* *Acacia rigens* *Acacia tetragonophylla* *Acacia uncinella* *Acacia verricula* *Acacia* sp. *Aotus* sp. Tortile (G.J. Keighery 3767) *Aotus* sp. *Bossiaea leptacantha* *Bossiaea* sp. *Cullen discolor* *Daviesia benthamii* *Daviesia benthamii* subsp. *acanthoclona* *Daviesia* sp. *Dillwynia* sp. Coolgardie (V.E. Sands 637.3. 1) *Dillwynia* sp. *Indigofera australis* *Leptosema daviesioides* *Lotus cruentus* * *Medicago ? sativa* *Mirbelia depressa* *Pultenaea elachista* *Pultenaea purpurea* *Senna artemisioides* subsp. x *artemisioides* *Senna artemisioides* subsp. *filifolia* *Senna ?cardiosperma* *Senna pleurocarpa* var. *pleurocarpa* *Senna stowardii* *Swainsona* sp. *Templetonia ceracea* *Templetonia* sp.
GERANIACEAE	* *Erodium aureum* *Pelargonium australe*

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED ON THE NOVA SURVEY AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 2014a).

FAMILY	SPECIES
ZYGOPHYLLACEAE	*Zygophyllum apiculatum* *Zygophyllum aurantiacum* *Zygophyllum eremaeum* *Zygophyllum glaucum* *Zygophyllum ovatum* *Zygophyllum reticulatum* *Zygophyllum tesquorum* *Zygophyllum* sp.
RUTACEAE	*Boronia fabianoides* subsp. *fabianoides* *Geijera linearifolia* *Microcybe multiflora* subsp. *baccharoides* *Microcybe multiflora* subsp. *multiflora* *Phebalium canaliculatum* *Phebalium lepidotum*
POLYGALACEAE	*Comesperma polygaloides*
EUPHORBIACEAE	*Beyeria lechenaultii* *Beyeria* sp. *Euphorbia drummondii*
PHYLLANTHACEAE	*Poranthera microphylla* *Poranthera triandra*
CELASTRACEAE	*Stackhousia monogyna* *Stackhousia muricata* *Stackhousia stratfordiae* (P1) *Stackhousia* sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)
SAPINDACEAE	*Dodonaea adenophora* *Dodonaea lobulata* *Dodonaea microzyga* var. *acrolobata* *Dodonaea stenozyga* *Dodonaea viscosa* subsp. *angustissima* *Dodonaea* sp.
RHAMNACEAE	*Cryptandra aridicola* *Cryptandra* ?*crispula* (P3) *Cryptandra minutifolia* subsp. *brevistyla* *Cryptandra recurva* *Trymalium myrtillus* subsp. *myrtillus*
ELAEOCARPACEAE	*Tetratheca efoliata*

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED ON THE NOVA SURVEY AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 2014a).

FAMILY	SPECIES
MALVACEAE	*Alyogyne* sp. Shark Bay (D.J. Edinger 6212)
	Commersonia craurophylla
	Hannafordia bissillii subsp. *latifolia*
	Lawrencia repens
	Lawrencia ?squamata
	Radyera farragei
	Sida sp.
	Malvaceae sp.
FRANKENIACEAE	*Frankenia desertorum*
	Frankenia sp.
VIOLACEAE	*Hybanthus epacroides*
	Hybanthus floribundus
THYMELAEACEAE	*Pimelea microcephala* subsp. *microcephala*
	Pimelea trichostachya
	Pimelea sp.
MYRTACEAE	*Calothamnus gilesii*
	Eucalyptus calycogona subsp. *calycogona*
	Eucalyptus celastroides
	Eucalyptus celastroides subsp. *celastroides*
	Eucalyptus celastroides subsp. *virella*
	Eucalyptus clelandii
	Eucalyptus concinna
	Eucalyptus cylindrocarpa
	Eucalyptus eremophila subsp. *eremophila*
	Eucalyptus flocktoniae
	Eucalyptus flocktoniae subsp. *hebes*
	Eucalyptus fraseri subsp. *fraseri*
	Eucalyptus gracilis
	Eucalyptus griffithsii
	Eucalyptus horistes
	Eucalyptus incrassata
	Eucalyptus ?kumarlensis
	Eucalyptus laevis
	Eucalyptus lesouefii
	Eucalyptus ?longissima
	Eucalyptus ?loxophleba subsp. *lissophloia*
	Eucalyptus moderata
	Eucalyptus oleosa subsp. *oleosa*
	Eucalyptus optima
	Eucalyptus polita
	Eucalyptus prolixa
	Eucalyptus protensa

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED ON THE NOVA SURVEY AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 2014a).

FAMILY	SPECIES
MYRTACEAE (continued)	*Eucalyptus rigidula* *Eucalyptus salubris* *Eucalyptus sheathiana* *Eucalyptus spreta* *Eucalyptus transcontinentalis* *Eucalyptus urna* *Eucalyptus websteriana* subsp. *norsemanica* (P1) *Eucalyptus* sp. *Leptospermum* sp. *Melaleuca acuminata* subsp. *acuminata* *Melaleuca eleuterostachya* *Melaleuca fulgens* subsp. *fulgens* *Melaleuca halmaturorum* *Melaleuca hamata* *Melaleuca lanceolata* *Melaleuca ?lateriflora* *Melaleuca quadrifaria* *Melaleuca sheathiana* *Melaleuca uncinata* *Melaleuca ?zeteticorum* *Melaleuca* sp. Myrtaceae sp.
HALORAGACEAE	*Glischrocaryon angustifolium* *Glischrocaryon aureum* *Haloragis dura* *Haloragis gossei* *Haloragis trigonocarpa*
ARALIACEAE	*Trachymene pilosa* *Trachymene ?pyrophila* (P2)
APIACEAE	*Platysace trachymenioides*
LOGANIACEAE	*Logania* sp.
GENTIANACEAE	*Schenkia australis*
APOCYNACEAE	*Alyxia buxifolia* *Marsdenia australis* *Rhyncharrhena linearis*
CONVOLVULACEAE	*Convolvulus angustissimus* subsp. *angustissimus* Convolvulaceae sp.

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED ON THE NOVA SURVEY AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 2014a).

FAMILY	SPECIES
BORAGINACEAE	*Halgania anagalloides*
	Halgania andromedifolia
	Halgania cyanea
	Halgania erecta
	Halgania integerrima
	Halgania sp.
LAMIACEAE	*Prostanthera althoferi subsp. althoferi*
	* *Salvia verbenaca*
	Teucrium sessiliflorum
	Westringia cephalantha
	Westringia rigida
SOLANACEAE	*Lycium* sp.
	Nicotiana goodspeedii
	Nicotiana rotundifolia
	Solanum hoplopetalum
	Solanum lasiophyllum
	* *Solanum nigrum*
	Solanum nummularium
	Solanum plicatile
	Solanum sp.
SCROPHULARIACEAE	*Diocirea ternata*
	Eremophila alternifolia
	Eremophila caperata
	Eremophila decipiens subsp. *decipiens*
	Eremophila dempsteri
	Eremophila deserti
	Eremophila gibbosa
	Eremophila interstans
	Eremophila ionantha
	Eremophila oblonga
	Eremophila psilocalyx
	Eremophila rugosa
	Eremophila saligna
	Eremophila scoparia
	Eremophila sp.
	Myoporum montanum
	Myoporum platycarpum subsp. *platycarpum*
	Scrophulariaceae sp.
CUCURBITACEAE	* *Cucumis myriocarpus*
CAMPANULACEAE	*Wahlenbergia preissii*
	Wahlenbergia tumidifructa

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED ON THE NOVA SURVEY AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 2014a).

FAMILY	SPECIES
GOODENIACEAE	*Coopernookia strophiolata* *Dampiera lavandulacea* *Dampiera tenuicaulis* *Goodenia berardiana* *Goodenia concinna* *Goodenia ?havilandii* *Goodenia pinnatifida* *Goodenia quasilibera* *Goodenia* sp. *Scaevola amblyanthera* var. *centralis* *Scaevola bursariifolia* *Scaevola restiacea* subsp. *divaricata* *Scaevola spinescens* *Scaevola* sp. *Velleia daviesii*
ASTERACEAE	*Actinobole uliginosum* *Angianthus tomentosus* *Asteridea athrixioides* *Brachyscome ciliaris* var. *ciliaris* *Brachyscome iberidifolia* *Calotis hispidula* ** Centaurea melitensis* *Centipeda crateriformis* *Chrysocephalum apiculatum* *Cratystylis conocephala* *Helichrysum luteoalbum* *Hyalosperma demissum* *Leucochrysum fitzgibbonii* *Minuria leptophylla* *Olearia dampieri* subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628) *Olearia exiguifolia* *Olearia muelleri* *Olearia pimeleoides* *Podolepis canescens* *Podolepis capillaris* *Pogonolepis* sp. *Rhodanthe chlorocephala* subsp. *rosea* *Rhodanthe floribunda* *Senecio lacustrinus* *Senecio quadridentatus* *Senecio* sp. ** Sonchus oleraceus* ** Sonchus sp.* *Streptoglossa* sp.

APPENDIX D: SUMMARY OF VASCULAR PLANT SPECIES RECORDED ON THE NOVA SURVEY AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DPaW 2014a).

FAMILY	SPECIES
ASTERACEAE (continued)	*Vittadinia dissecta* var. *hirta* *Vittadinia humerata* *Waitzia acuminata* var. *acuminata* *Waitzia suaveolens* var. *flava* *Waitzia suaveolens* var. *suaveolens* *Westringia rigida* Asteraceae sp.

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S001	**S002**	**S003**	**S004**	**S005**	**S006**	**S007**	**S008**	**S009**	**S010**	**S011**	**S012**	**S013**	**S014**	**S015**	**S016**	**S017**	**S018**	**S019**	**S020**	**S021**	**S022**	**S023**	**S024**	**S025**	**S026**	**S027**	**S028**	**S029**	**S030**	**S031**	**S032**	**S033**	**S034**	**S035**	**S036**	**S037**	**S038**	**S039**	**S040**	**S041**	**S042**	**S043**	**S044**	**S045**	**S046**	**S047**	**S048**	**S049**	**S050**
Acacia acanthoclada subsp. *acanthoclada*																																																		
Acacia acoma								x																																										
Acacia acuminata (narrow phyllode variant)																																																		
Acacia andrewsii																																																		
Acacia assimilis																																																		
Acacia assimilis subsp. *assimilis*																																																		
Acacia assimilis subsp. *atroviridis*																																																		
Acacia burkittii																																																		
Acacia camptoclada																																																		
Acacia colletioides																																																		
Acacia densiflora																																																		
Acacia enervia subsp. *explicata*																																																		
Acacia eremophila var. *eremophila*																																																		
Acacia erinacea																						x				x											x													
Acacia evenulosa																																																		
Acacia hemiteles											x		x	x		x	x	x				x				x					x			x					x	x		x	x			x			x	x
Acacia hystrix subsp. *continua* (P1)																																																		
Acacia hystrix subsp. *hystrix*																																																		
Acacia merrallii	x																x							x																					x			x		
Acacia oswaldii																																																		
Acacia rigens																																																		x
Acacia tetragonophylla																																																		
Acacia sp.																																																		
Acacia uncinella																																							x										x	
Acacia verricula																																																		
Actinobole uliginosum																																														x				
Allocasuarina campestris																																																		
Allocasuarina helmsii																																																		
Allocasuarina sp.																x											x		x																					
Alyogyne sp. Shark Bay (D.J. Edinger 6212)																																																		
Alyxia buxifolia																						x				x			x			x					x	x	x									x		
Amphipogon caricinus var. *caricinus*																																																		
Amphipogon sp.																																																		
Angianthus tomentosus																																														x				
Aotus sp. Tortile (G.J. Keighery 3767)																																																		
Aotus sp.																																																		
Arabidella chrysodema																																														x				
Arabidella trisecta																																																		
Arabidella sp.																																																		
Aristida contorta																				x			x																	x										
Aristida ?*holathera*																																																		
Asteraceae sp.																																																		
Asteridea athrixioides																																										x	x			x				
Atriplex acutibractea subsp. *karoniensis*																																																		
Atriplex nummularia							x		x						x				x	x			x															x										x		
Atriplex vesicaria					x	x																	x																											
Atriplex sp.	x		x				x		x			x		x	x				x	x	x							x		x		x				x					x	x	x	x		x	x	x		
Austrostipa elegantissima														x																		x				x										x		x		
Austrostipa hemipogon																	x								x											x	x													
Austrostipa mollis				x																																														
Austrostipa nitida																																																		
Austrostipa platychaeta	x		x						x		x										x				x			x			x							x							x					
Austrostipa scabra subsp. *scabra*																																																		
Austrostipa sp.																																																		
Beyeria lechenaultii																																																		
Beyeria sp.																																																		
Boronia fabianoides subsp. *fabianoides*																																																		
Bossiaea leptacantha																																																		
Bossiaea sp.																																																		
Brachyscome ciliaris var. *ciliaris*																																														x				

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S021	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S049	S050
Brachyscome iberidifolia																																																		
**Brassica* sp.																																																		
Calandrinia eremaea																																																		
Calandrinia porifera																																																		
Calandrinia sp.																																																		
Calothamnus gilesii																																																		
Calotis hispidula																						x																								x				
**Centaurea melitensis*																		x		x			x											x						x			x							
Centipeda crateriformis																																																		
Centrolepis polygyna																																																		
Cheilanthes sieberi subsp. *sieberi*																																																		
Chenopodiaceae sp.							x								x				x	x			x																											
Chenopodium curvispicatum														x								x																				x				x				
Chenopodium sp.																																																		
Chrysocephalum apiculatum																											x																							
Codonocarpus cotinifolius																																																		
Comesperma polygaloides																																																		
Commersonia craurophylla																																																		
Convolvulaceae sp.																																																		
Convolvulus angustissimus subsp. *angustissimus*																																																		x
Coopernookia strophiolata																																																		
Crassula colorata var. *colorata*																																														x				
Cratystylis conocephala	x		x	x		x	x	x	x					x	x		x		x	x			x		x			x		x	x	x			x	x		x	x		x			x	x	x	x	x		
Cryptandra aridicola																					x	x				x	x												x										x	
Cryptandra ?crispula (P3)																																																		
Cryptandra minutifolia subsp. *brevistyla*																																																		
Cryptandra recurva																																																		
**Cucumis myriocarpus*																																											x							
Cullen discolor																																																			
Dampiera lavandulacea																																																		
Dampiera tenuicaulis																																																		
Daviesia benthamii					x																																													
Daviesia benthamii subsp. *acanthoclona*																												x		x																				
Daviesia sp.																																																		
Dianella revoluta																																																		
Dillwynia sp. Coolgardie (V.E. Sands 637.3. 1)																																										x								
Dillwynia sp.																																																		
Diocirea ternata						x			x			x					x																												x					
Dodonaea adenophora																																																		
Dodonaea lobulata																																																		
Dodonaea microzyga var. *acrolobata*																																																		
Dodonaea stenozyga		x									x																																							
Dodonaea viscosa subsp. *angustissima*																																																		
Dodonaea sp.																																																		
Enchylaena tomentosa			x					x						x								x								x					x											x				
Enchylaena tomentosa var. *tomentosa*																																																		
Enneapogon avenaceus																																																		
Enneapogon caerulescens																																										x								
Enneapogon sp.																																																		
Eragrostis australasica																																																		
Eragrostis dielsii																																								x			x							
Eremophila alternifolia																		x		x														x						x										x
Eremophila caperata																																																		
Eremophila decipiens subsp. *decipiens*													x		x	x		x	x			x	x						x					x	x	x			x	x		x	x	x		x		x	x	x
Eremophila dempsteri	x			x	x			x	x						x					x			x									x			x	x	x	x			x						x			
Eremophila deserti																																												x						
Eremophila gibbosa																																																		
Eremophila interstans																																																		
Eremophila ionantha		x												x				x			x		x								x			x			x	x						x	x	x		x		
Eremophila oblonga																																																		

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Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S021	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S049	S050
Eremophila psilocalyx																																																		
Eremophila rugosa			x	x																																														
Eremophila saligna																																																		
Eremophila scoparia	x	x	x				x	x						x	x		x				x		x	x	x			x		x	x	x				x					x			x	x		x			
Eremophila sp.																																																		
Eriochiton sclerolaenoides																	x								x																			x				x		
**Erodium aureum*																																																		
Eucalyptus calycogona subsp. *calycogona*																					x																									x				
Eucalyptus celastroides																																																		
Eucalyptus celastroides subsp. *celastroides*																																																		
Eucalyptus celastroides subsp. *virella*																																																		
Eucalyptus clelandii																																																		
Eucalyptus concinna											x															x																								
Eucalyptus cylindrocarpa														x																								x												
Eucalyptus eremophila subsp. *eremophila*																																	x																	
Eucalyptus flocktoniae																																																		
Eucalyptus flocktoniae subsp. *hebes*																																																		
Eucalyptus fraseri subsp. *fraseri*						x						x																																						
Eucalyptus gracilis																										x																								
Eucalyptus griffithsii													x			x						x					x		x					x					x											
Eucalyptus horistes																																																		
Eucalyptus incrassata																																																		
Eucalyptus ?kumarlensis																																																		
Eucalyptus laevis	x	x						x	x															x																										
Eucalyptus lesouefii																																																		
Eucalyptus ?longissima																																																		
Eucalyptus ?loxophleba subsp. *lissophloia*																																																		
Eucalyptus moderata																																																		
Eucalyptus oleosa subsp. *oleosa*			x	x			x			x				x	x		x		x		x				x			x		x	x	x	x		x	x	x	x			x				x		x			
Eucalyptus optima																																																		
Eucalyptus polita																																																		
Eucalyptus prolixa						x											x																		x															
Eucalyptus protensa												x																							x	x														
Eucalyptus rigidula																									x																								x	
Eucalyptus salubris								x				x							x				x															x							x					
Eucalyptus sheathiana																																																		
Eucalyptus spreta					x					x														x																								x		
Eucalyptus transcontinentalis																																																		
Eucalyptus urna				x	x					x														x																										
Eucalyptus websteriana subsp. *norsemanica* (P1)																																																		
Eucalyptus sp.					x	x								x																x														x						
Euphorbia drummondii																																																		
Exocarpos aphyllus	x				x	x		x						x			x	x		x	x	x	x		x			x	x		x	x		x		x		x	x	x					x	x		x	x	
Frankenia desertorum																																																		
Frankenia sp.																																														x				
Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)													x													x	x		x																					
Geijera linearifolia															x			x		x	x		x					x						x		x				x				x	x	x	x	x		
Glischrocaryon angustifolium																																																		
Glischrocaryon aureum																																																		
Goodenia berardiana													x			x				x							x		x																					
Goodenia concinna																																																		
Goodenia ?havilandii																																																		
Goodenia pinnatifida																																																		
Goodenia quasilibera																																																			
Goodenia sp.																										x													x											
Grevillea acuaria																													x					x																x
Grevillea anethifolia																																																		
Grevillea huegelii																	x																																	
Grevillea plurijuga subsp. *plurijuga*																																																		
Grevillea teretifolia																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																
	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S021	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S049	S050
Grevillea sp.																																																		
Gyrostemon racemiger																																																		
Halgania anagalloides																																																		
Halgania andromedifolia																						x																												
Halgania cyanea																																																		
Halgania erecta																																																		
Halgania integerrima																																																		
Halgania sp.																																								x										
Haloragis dura																																																	x	x
Haloragis gossei																										x																								
Haloragis trigonocarpa																																																		
Hannafordia bissillii subsp. *latifolia*																																																		
Helichrysum luteoalbum																																																	x	
Hyalosperma demissum																																																		
Hybanthus epacroides																													x																					
Hybanthus floribundus																																																x		
Indigofera australis																																																		
Juncus pallidus																																																		
Lawrencia repens																																														x				
Lawrencia ?squamata																																																		
Lepidium sp.																																																		
Lepidobolus deserti																																																		
Lepidosperma aff. *diurnum*																																																		
Lepidosperma sp.																																																		
Leptosema daviesioides																																																		
Leptospermum sp.																																																		
Leucochrysum fitzgibbonii																																																		
Logania sp.																																																		
Lomandra collina																																																		
Lomandra effusa																																																		
Lotus cruentus																																																		
Lycium sp.																																																x		
Maireana ?appressa																																																		
Maireana carnosa																												x																						
Maireana erioclada	x														x															x														x						
Maireana ?eriosphaera																																																		
Maireana georgei																																			x															
Maireana ?marginata																							x															x												
Maireana pentatropis	x				x	x		x	x																x			x				x			x												x			
Maireana radiata																														x																				
Maireana sedifolia										x									x											x					x															
Maireana suaedifolia																																																		
Maireana trichoptera						x								x			x				x							x																						
Maireana triptera																																													x					
Maireana sp.																																																		
Malvaceae sp.																																																		
Marsdenia australis																																																		
Marsilea hirsuta																																																		
* *Medicago ?sativa*																																																		
Melaleuca acuminata subsp. *acuminata*																																																		
Melaleuca eleuterostachya																										x																								
Melaleuca fulgens subsp. *fulgens*																																																		
Melaleuca halmaturorum																															x																			
Melaleuca hamata																																																		
Melaleuca lanceolata																																																		
Melaleuca ?lateriflora																																																		
Melaleuca quadrifaria			x							x																		x		x																				
Melaleuca sheathiana			x		x					x														x	x								x				x										x			
Melaleuca uncinata																																																		
Melaleuca ?zeteticorum																																																		

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Species	Site																																																	
	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S021	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S049	S050
Melaleuca sp.																																																		
Menkea australis																																																		
Microcybe multiflora subsp. *baccharoides*																																																		
Microcybe multiflora subsp. *multiflora*																																																		
Minuria leptophylla																																							x									x	x	
Mirbelia depressa																																																		
Myoporum montanum																			x																															
Myoporum platycarpum subsp. *platycarpum*																																																		
Myrtaceae sp.																																																		
Nicotiana goodspeedii																																																		
Nicotiana rotundifolia																																																		
Olearia dampieri subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628)																																																		
Olearia exiguifolia																																																		
Olearia muelleri		x	x		x		x	x			x			x	x	x	x		x		x	x	x		x	x		x			x	x	x			x	x	x			x			x	x		x	x	x	
Olearia pimeleoides																																																		
Panicum effusum																																																		
Pelargonium australe																																																		
Phebalium canaliculatum																																																		
Phebalium lepidotum																																																		
Pimelea microcephala subsp. *microcephala*																																																		
Pimelea trichostachya																										x													x											
Pimelea sp.																																						x		x										
Pittosporum ?*angustifolium*																																																		
Platysace trachymenioides																																																		
Poaceae sp.								x																															x									x		
Podolepis canescens											x		x													x													x											
Podolepis capillaris																																							x											
Pogonolepis sp.																																																		
Poranthera microphylla																										x																								
Poranthera triandra																																																		
Prostanthera althoferi subsp. *althoferi*																																																		
Pterostylis sp.																																																		
Ptilotus carlsonii																		x																								x	x			x		x		
Ptilotus drummondii																																																		
Ptilotus drummondii var. *minor*																																																		
Ptilotus drummondii ?var. *scaposus*																																																		
Ptilotus holosericeus	x													x			x				x	x						x														x	x			x				
Ptilotus nobilis																																								x										
Ptilotus obovatus														x																																				
Ptilotus spathulatus								x												x			x											x				x		x										x
Ptilotus sp. Goldfields (R. Davis 10796)																																																		
Ptilotus sp.																																																		
Pultenaea elachista											x		x			x										x	x		x										x				x						x	
Pultenaea purpurea																																																		
Radyera farragei																																																		
Rhagodia crassifolia	x			x			x					x			x				x		x							x																x						
Rhagodia drummondii			x																	x																														
Rhagodia eremaea																																				x														
Rhagodia ulicina																				x																														
Rhagodia sp.																																			x															
Rhodanthe chlorocephala subsp. *rosea*																																										x	x			x				
Rhodanthe floribunda																		x		x							x													x										
Rhyncharrhena linearis																																																		
Rytidosperma caespitosum																																											x							
Salsola australis																																										x								
* *Salvia verbenaca*																																										x								
Santalum acuminatum		x	x																													x						x						x						
Santalum spicatum																						x														x														
Santalum sp.																															x																			
Scaevola amblyanthera var. *centralis*											x																							x																x

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Species	Site																																																	
	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S021	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S049	S050
Scaevola bursariifolia				x	x																																													
Scaevola restiacea subsp. *divaricata*																																																		
Scaevola spinescens	x	x						x	x		x		x	x		x					x	x			x				x			x								x					x			x	x	
Scaevola sp.				x																																														
Schenkia australis																																																		
* *Schismus arabicus*																																																		
Sclerolaena cuneata																																								x										
Sclerolaena diacantha	x				x	x			x					x			x			x		x	x		x			x			x	x			x			x			x		x	x	x	x				
Sclerolaena drummondii																																														x				
Sclerolaena obliquicuspis	x																																																	
Sclerolaena parviflora					x																																													
Sclerolaena uniflora							x	x							x				x											x																				
Scrophulariaceae sp.																																																		
Senecio lacustrinus																																											x							
Senecio quadridentatus																																														x				
Senecio sp.																																																		
Senna artemisioides subsp. *filifolia*	x	x	x											x							x	x							x					x		x	x	x	x	x	x	x		x		x	x	x	x	x
Senna artemisioides subsp. x *artemisioides*				x											x			x																																
Senna ?cardiosperma																																																		
Senna pleurocarpa var. *pleurocarpa*																																																		
Senna stowardii																																																		
Sida sp.																																				x														
Solanum hoplopetalum																																																		
Solanum lasiophyllum																																																		
* *Solanum nigrum*																																																		
Solanum nummularium	x																																							x										
Solanum plicatile																																																		
Solanum sp.																																																		
* *Sonchus oleraceus*																																											x							
* *Sonchus sp.*																																																		
Stackhousia monogyna																		x																																
Stackhousia muricata																																																		
Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)																																																		
Stackhousia stratfordiae (P1)																																										x	x							
Streptoglossa sp.																																																		
Swainsona sp.																																																		
Tecticornia sp.																																																		
Templetonia ceracea																																																		
Templetonia sp.				x	x																																													
Tetratheca efoliata																																																		
Teucrium sessiliflorum																		x																																
Thysanotus manglesianus											x					x			x																															x
Thysanotus sp.																																																		
Trachymene pilosa																																																		
Trachymene ?pyrophila (P2)																																																		
Triodia irritans											x		x			x											x		x					x																x
Triodia scariosa																						x				x													x									x	x	
Triodia ?tomentosa																																																		
Triodia sp.																																																		
Trymalium myrtillus subsp. *myrtillus*																																																		
Velleia daviesii																																																		
Vittadinia dissecta var. *hirta*																				x																				x		x	x							
Vittadinia humerata																																																		
Wahlenbergia preissii																																																		
Wahlenbergia tumidifructa																																																		
Waitzia acuminata var. *acuminata*																																							x			x								
Waitzia suaveolens var. *flava*																																																		
Waitzia suaveolens var. *suaveolens*																																																		
Westringia cephalantha																																																		
Westringia rigida		x		x							x											x				x	x		x										x										x	

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S001	S002	S003	S004	S005	S006	S007	S008	S009	S010	S011	S012	S013	S014	S015	S016	S017	S018	S019	S020	S021	S022	S023	S024	S025	S026	S027	S028	S029	S030	S031	S032	S033	S034	S035	S036	S037	S038	S039	S040	S041	S042	S043	S044	S045	S046	S047	S048	S049	S050
Zygophyllum apiculatum	x	x	x	x	x			x			x			x			x																				x				x									
Zygophyllum aurantiacum																																																		
Zygophyllum eremaeum	x																																	x																
Zygophyllum glaucum					x					x							x							x				x		x	x	x							x					x	x		x			
Zygophyllum ovatum	x																									x						x			x	x	x				x			x			x	x		
Zygophyllum reticulatum																												x																						
Zygophyllum tesquorum																																							x									x	x	
Zygophyllum sp.																																																		

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Species	Site																																																	
	S051	S052	S053	S054	S055	S056	S057	S058	S059	S060	S061	S062	S063	S064	S065	S066	S067	S068	S069	S070	S071	S072	S073	S074	S075	S076	S077	S078	S079	S080	S081	S082	S083	S084	S085	S086	S087	S088	S089	S090	S091	S092	S093	S094	S095	S096	S097	S098	S099	S100
Acacia acanthoclada subsp. *acanthoclada*		x																				x			x															x							x			x
Acacia acoma																																																		
Acacia acuminata (narrow phyllode variant)																											x																							
Acacia andrewsii																																																		
Acacia assimilis																																																		
Acacia assimilis subsp. *assimilis*																																																		
Acacia assimilis subsp. *atroviridis*																				x		x																												
Acacia burkittii																																																		
Acacia camptoclada																																																		
Acacia colletioides																																																		
Acacia densiflora																																																		
Acacia enervia subsp. *explicata*																																																		
Acacia eremophila var. *eremophila*																																																		
Acacia erinacea								x										x																			x										x			
Acacia evenulosa																																																		
Acacia hemiteles				x	x			x			x	x	x	x	x	x		x					x		x		x																		x		x			x
Acacia hystrix subsp. *continua* (P1)																																																		
Acacia hystrix subsp. *hystrix*																																																		
Acacia merrallii												x	x				x																											x						
Acacia oswaldii																																																		
Acacia rigens																																																		
Acacia tetragonophylla																																																		
Acacia sp.																																																		
Acacia uncinella					x																																													
Acacia verricula																			x																															
Actinobole uliginosum																																																		
Allocasuarina campestris																																																		
Allocasuarina helmsii																		x	x	x		x									x						x													
Allocasuarina sp.																																												x						
Alyogyne sp. Shark Bay (D.J. Edinger 6212)																				x																				x										
Alyxia buxifolia					x		x				x			x			x																								x			x			x			
Amphipogon caricinus var. *caricinus*																						x																		x										
Amphipogon sp.																																																		
Angianthus tomentosus										x																																								
Aotus sp. Tortile (G.J. Keighery 3767)																																																		
Aotus sp.																																																		
Arabidella chrysodema																																																		
Arabidella trisecta																												x																						
Arabidella sp.																																																		
Aristida contorta																									x		x																							
Aristida ?*holathera*																																																		
Asteraceae sp.																																			x															
Asteridea athrixioides																																			x															
Atriplex acutibractea subsp. *karoniensis*																																			x															
Atriplex nummularia		x																										x																						
Atriplex vesicaria		x									x																	x	x																	x				
Atriplex sp.	x		x	x					x	x													x	x	x	x				x			x		x	x			x			x	x					x	x	
Austrostipa elegantissima			x	x	x																					x							x			x										x				
Austrostipa hemipogon	x																							x		x			x							x						x						x		
Austrostipa mollis																																																		
Austrostipa nitida									x											x																								x			x			
Austrostipa platychaeta		x						x			x												x		x			x	x												x				x					x
Austrostipa scabra subsp. *scabra*																																																		
Austrostipa sp.																																		x																
Beyeria lechenaultii																																																		
Beyeria sp.																																																		
Boronia fabianoides subsp. *fabianoides*																																																		
Bossiaea leptacantha																	x																					x												
Bossiaea sp.																																																		
Brachyscome ciliaris var. *ciliaris*																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

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Species	Site																																																	
	S051	S052	S053	S054	S055	S056	S057	S058	S059	S060	S061	S062	S063	S064	S065	S066	S067	S068	S069	S070	S071	S072	S073	S074	S075	S076	S077	S078	S079	S080	S081	S082	S083	S084	S085	S086	S087	S088	S089	S090	S091	S092	S093	S094	S095	S096	S097	S098	S099	S100
Brachyscome iberidifolia																																									x									
* *Brassica* sp.																														x					x															
Calandrinia eremaea																			x									x			x										x									
Calandrinia porifera																																																		
Calandrinia sp.																																																		
Calothamnus gilesii																						x																												
Calotis hispidula																															x		x																	
* *Centaurea melitensis*																									x																									
Centipeda crateriformis																																																		
Centrolepis polygyna																																																		
Cheilanthes sieberi subsp. *sieberi*																																																		
Chenopodiaceae sp.																																																		
Chenopodium curvispicatum				x						x													x																			x				x				
Chenopodium sp.																																																		
Chrysocephalum apiculatum																				x																														
Codonocarpus cotinifolius																			x												x																			
Comesperma polygaloides																																								x										
Commersonia craurophylla																															x										x									
Convolvulaceae sp.																				x																														
Convolvulus angustissimus subsp. *angustissimus*																				x																														
Coopernookia strophiolata																							x																											
Crassula colorata var. *colorata*										x																																								
Cratystylis conocephala	x	x	x	x					x	x	x		x										x	x	x	x		x	x				x	x		x			x			x	x		x		x	x	x	
Cryptandra aridicola																		x				x															x										x			
Cryptandra ?crispula (P3)																																																		
Cryptandra minutifolia subsp. *brevistyla*																																																		
Cryptandra recurva																																																		
* *Cucumis myriocarpus*																																																		
Cullen discolor																				x																														
Dampiera lavandulacea																			x																															
Dampiera tenuicaulis																				x		x																		x										
Daviesia benthamii								x			x																																							
Daviesia benthamii subsp. *acanthoclona*			x									x		x			x						x																					x						
Daviesia sp.																																															x			
Dianella revoluta																				x		x									x									x										
Dillwynia sp. Coolgardie (V.E. Sands 637.3. 1)																																																		
Dillwynia sp.																																																		
Diocirea ternata		x						x																									x																	
Dodonaea adenophora																						x																												
Dodonaea lobulata																											x																							
Dodonaea microzyga var. *acrolobata*																			x																															
Dodonaea stenozyga								x																							x								x					x			x			
Dodonaea viscosa subsp. *angustissima*																																																		
Dodonaea sp.																																																		
Enchylaena tomentosa										x																							x									x						x		
Enchylaena tomentosa var. *tomentosa*																											x								x				x											
Enneapogon avenaceus																																																		
Enneapogon caerulescens																																																		
Enneapogon sp.																																																		
Eragrostis australasica																																																		
Eragrostis dielsii		x																																																
Eremophila alternifolia									x	x			x																				x														x			
Eremophila caperata																							x	x																										
Eremophila decipiens subsp. *decipiens*		x					x		x	x	x					x							x				x	x					x		x							x					x			
Eremophila dempsteri	x										x															x										x												x		
Eremophila deserti																											x																							
Eremophila gibbosa																																																		
Eremophila interstans																											x																							
Eremophila ionantha			x					x				x						x					x		x	x		x		x				x	x	x									x	x		x	x	x
Eremophila oblonga			x		x																																													

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Species	Site																																																	
	S051	S052	S053	S054	S055	S056	S057	S058	S059	S060	S061	S062	S063	S064	S065	S066	S067	S068	S069	S070	S071	S072	S073	S074	S075	S076	S077	S078	S079	S080	S081	S082	S083	S084	S085	S086	S087	S088	S089	S090	S091	S092	S093	S094	S095	S096	S097	S098	S099	S100
Eremophila psilocalyx								x																																				x						
Eremophila rugosa																																																		
Eremophila saligna																																																		
Eremophila scoparia	x		x	x			x		x			x	x	x	x		x						x	x					x	x				x		x						x	x		x			x	x	x
Eremophila sp.	x				x																														x														
Eriochiton sclerolaenoides																									x																x								
* *Erodium aureum*																																																		
Eucalyptus calycogona subsp. *calycogona*																													x																				
Eucalyptus celastroides																																																		
Eucalyptus celastroides subsp. *celastroides*																																																		
Eucalyptus celastroides subsp. *virella*																																			x														
Eucalyptus clelandii																																																		
Eucalyptus concinna																x																																		
Eucalyptus cylindrocarpa										x		x																																			x			
Eucalyptus eremophila subsp. *eremophila*																																											x						
Eucalyptus flocktoniae																																																		
Eucalyptus flocktoniae subsp. *hebes*																x																																		
Eucalyptus fraseri subsp. *fraseri*							x									x				x											x																			
Eucalyptus gracilis				x																																		x											
Eucalyptus griffithsii					x																																													
Eucalyptus horistes		x																		x		x																		x										
Eucalyptus incrassata																																																		
Eucalyptus ?*kumarlensis*																																																		
Eucalyptus laevis															x														x																					
Eucalyptus lesouefii								x			x																																							
Eucalyptus ?*longissima*																																																		
Eucalyptus ?*loxophleba* subsp. *lissophloia*																																																		
Eucalyptus moderata																																																		
Eucalyptus oleosa subsp. *oleosa*			x	x					x			x	x	x		x	x				x								x														x		x			x	x	
Eucalyptus optima																																																		
Eucalyptus polita																																																		
Eucalyptus prolixa						x																													x														
Eucalyptus protensa																																																		
Eucalyptus rigidula					x													x																		x										x			
Eucalyptus salubris								x	x					x		x					x		x	x	x	x		x	x	x			x	x	x	x						x	x		x	x		x	x	x
Eucalyptus sheathiana																																																		
Eucalyptus spreta				x									x																					x				x											
Eucalyptus transcontinentalis																														x										x									
Eucalyptus urna								x			x				x																									x			x						
Eucalyptus websteriana subsp. *norsemanica* (P1)																			x		x																											
Eucalyptus sp.	x																		x				x	x							x					x				x		x						x		
Euphorbia drummondii																										x																						
Exocarpos aphyllus	x	x			x			x	x	x	x				x	x		x					x		x	x		x	x				x	x	x										x	x	x	x		
Frankenia desertorum		x																																															
Frankenia sp.																																																		
Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)																																							x										
Geijera linearifolia		x						x			x														x		x					x	x			x					x	x		x					
Glischrocaryon angustifolium																																																		
Glischrocaryon aureum																			x											x									x	x									
Goodenia berardiana																			x																														
Goodenia concinna																																																		
Goodenia ?*havilandii*																																																		
Goodenia pinnatifida																																																		
Goodenia quasilibera																																																		
Goodenia sp.																																	x		x													
Grevillea acuaria		x															x							x																					x			
Grevillea anethifolia																			x		x																		x							x			
Grevillea huegelii											x			x																																			
Grevillea plurijuga subsp. *plurijuga*																																																		
Grevillea teretifolia																																																		

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Species	Site																																																	
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Grevillea sp.																																					x													
Gyrostemon racemiger																				x											x									x										
Halgania anagalloides																																																		
Halgania andromedifolia																																												x						
Halgania cyanea																																																		
Halgania erecta																				x		x																		x										
Halgania integerrima												x															x				x																			
Halgania sp.																																																		
Haloragis dura																																																		
Haloragis gossei																															x										x									
Haloragis trigonocarpa																				x																														
Hannafordia bissillii subsp. *latifolia*																																																		
Helichrysum luteoalbum																																																		
Hyalosperma demissum																																																		
Hybanthus epacroides																																																		
Hybanthus floribundus																																																		
Indigofera australis																																																		
Juncus pallidus																																																		
Lawrencia repens		x								x																																								
Lawrencia ?squamata																																																		
Lepidium sp.																																																		
Lepidobolus deserti																																																		
Lepidosperma aff. *diurnum*																																																		
Lepidosperma sp.																				x		x																		x										
Leptosema daviesioides																			x																															
Leptospermum sp.																			x												x										x									
Leucochrysum fitzgibbonii																																																		
Logania sp.																																			x															
Lomandra collina																																								x										
Lomandra effusa																																																		
Lotus cruentus																																																		
Lycium sp.																																																		
Maireana ?appressa																																																		
Maireana carnosa																																																		
Maireana erioclada	x																									x																								
Maireana ?eriosphaera																																																		
Maireana georgei																																																		
Maireana ?marginata		x									x																	x																	x					
Maireana pentatropis											x	x	x								x			x																		x	x					x		x
Maireana radiata		x		x																			x																											
Maireana sedifolia																																																		
Maireana suaedifolia																																																		
Maireana trichoptera										x																x							x			x						x						x		
Maireana triptera										x																		x	x																	x				
Maireana sp.																																		x	x														x	
Malvaceae sp.																																																		
Marsdenia australis																																																		
Marsilea hirsuta																																																		
* *Medicago ?sativa*																																			x															
Melaleuca acuminata subsp. *acuminata*																																																		
Melaleuca eleuterostachya																															x																			
Melaleuca fulgens subsp. *fulgens*																																																		
Melaleuca halmaturorum														x	x	x	x																						x					x						
Melaleuca hamata																			x																															
Melaleuca lanceolata																							x																											
Melaleuca ?lateriflora																					x																													
Melaleuca quadrifaria							x														x																						x		x			x		
Melaleuca sheathiana											x												x								x										x	x								x
Melaleuca uncinata																						x																												
Melaleuca ?zeteticorum																																																		

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Species	Site																																																	
	S051	S052	S053	S054	S055	S056	S057	S058	S059	S060	S061	S062	S063	S064	S065	S066	S067	S068	S069	S070	S071	S072	S073	S074	S075	S076	S077	S078	S079	S080	S081	S082	S083	S084	S085	S086	S087	S088	S089	S090	S091	S092	S093	S094	S095	S096	S097	S098	S099	S100
Melaleuca sp.																																																		
Menkea australis																																																		
Microcybe multiflora subsp. *baccharoides*																																																		
Microcybe multiflora subsp. *multiflora*																																												x						
Minuria leptophylla																																																		
Mirbelia depressa																				x		x																		x										
Myoporum montanum																																																		
Myoporum platycarpum subsp. *platycarpum*																																			x															
Myrtaceae sp.																																																		
Nicotiana goodspeedii																																																		
Nicotiana rotundifolia																																																			
Olearia dampieri subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628)																																																		
Olearia exiguifolia																																																			
Olearia muelleri	x	x	x	x	x				x		x	x	x	x	x		x						x	x		x			x				x	x		x			x		x	x	x	x	x	x	x	x	x	x
Olearia pimeleoides																											x																							
Panicum effusum																																																		
Pelargonium australe																																																		
Phebalium canaliculatum																																																		
Phebalium lepidotum																																									x									
Pimelea microcephala subsp. *microcephala*																																																		
Pimelea trichostachya																				x											x									x										
Pimelea sp.																																																		
Pittosporum ?*angustifolium*																																																		
Platysace trachymenioides																				x																				x										
Poaceae sp.																																																		
Podolepis canescens					x															x											x										x						x			
Podolepis capillaris																																																		
Pogonolepis sp.																																																		
Poranthera microphylla																			x																															
Poranthera triandra																															x																			
Prostanthera althoferi subsp. *althoferi*																																																		
Pterostylis sp.																																																		
Ptilotus carlsonii																									x																									
Ptilotus drummondii																																																		
Ptilotus drummondii var. *minor*																				x																														
Ptilotus drummondii ?var. *scaposus*																																																		
Ptilotus holosericeus									x	x																x				x			x		x	x					x	x				x		x	x	
Ptilotus nobilis																																			x															
Ptilotus obovatus										x																																								
Ptilotus spathulatus		x																		x			x		x			x																						
Ptilotus sp. Goldfields (R. Davis 10796)		x																																																
Ptilotus sp.																																																		
Pultenaea elachista																		x																			x													
Pultenaea purpurea																																																		
Radyera farragei																																																		
Rhagodia crassifolia	x			x					x															x					x	x												x			x					
Rhagodia drummondii		x																										x																						
Rhagodia eremaea																																																		
Rhagodia ulicina																											x																							
Rhagodia sp.																																																		
Rhodanthe chlorocephala subsp. *rosea*																																																		
Rhodanthe floribunda																																																		
Rhyncharrhena linearis																																																		
Rytidosperma caespitosum		x																										x																						
Salsola australis																																																		
* *Salvia verbenaca*																																																		
Santalum acuminatum			x	x				x				x					x	x								x								x		x	x					x	x		x		x			
Santalum spicatum																																																		
Santalum sp.																																																		
Scaevola amblyanthera var. *centralis*																				x																				x										

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Species	Site																																																	
	S051	S052	S053	S054	S055	S056	S057	S058	S059	S060	S061	S062	S063	S064	S065	S066	S067	S068	S069	S070	S071	S072	S073	S074	S075	S076	S077	S078	S079	S080	S081	S082	S083	S084	S085	S086	S087	S088	S089	S090	S091	S092	S093	S094	S095	S096	S097	S098	S099	S100
Scaevola bursariifolia													x		x																																			
Scaevola restiacea subsp. *divaricata*																				x																				x										
Scaevola spinescens					x				x	x	x		x		x			x					x		x			x									x				x				x		x		x	
Scaevola sp.																																																		
Schenkia australis																																																		
* *Schismus arabicus*																																																		
Sclerolaena cuneata		x																										x																						
Sclerolaena diacantha	x			x				x	x	x						x								x	x		x	x	x	x			x		x	x						x			x	x			x	x
Sclerolaena drummondii										x																							x										x							
Sclerolaena obliquicuspis																												x							x															
Sclerolaena parviflora	x																																								x									
Sclerolaena uniflora																							x																									x		
Scrophulariaceae sp.																			x																															
Senecio lacustrinus																																									x									
Senecio quadridentatus																																																		
Senecio sp.																																			x															
Senna artemisioides subsp. *filifolia*			x		x			x	x	x	x		x	x	x		x	x							x	x			x				x										x	x	x	x	x			x
Senna artemisioides subsp. x *artemisioides*																																																		
Senna ?*cardiosperma*																																																		
Senna pleurocarpa var. *pleurocarpa*																				x																														
Senna stowardii																																																		
Sida sp.																																																		
Solanum hoplopetalum																																									x									
Solanum lasiophyllum																																																		
* *Solanum nigrum*																																																		
Solanum nummularium																																																		
Solanum plicatile																			x	x											x									x	x									
Solanum sp.																																																		
* *Sonchus oleraceus*																																																		
* *Sonchus sp.*																																																		
Stackhousia monogyna																																																		
Stackhousia muricata																						x																												
Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)																																																		
Stackhousia stratfordiae (P1)																																																		
Streptoglossa sp.																																																		
Swainsona sp.																											x																							
Tecticornia sp.																																																		
Templetonia ceracea																																																		
Templetonia sp.																							x																											
Tetratheca efoliata																															x																			
Teucrium sessiliflorum																																																		
Thysanotus manglesianus		x						x												x		x						x												x										
Thysanotus sp.																																					x													
Trachymene pilosa																																																		
Trachymene ?*pyrophila* (P2)																			x																															
Triodia irritans																				x		x			x															x										x
Triodia scariosa					x												x	x													x						x			x							x			
Triodia ?*tomentosa*																																																		
Triodia sp.																			x																															
Trymalium myrtillus subsp. *myrtillus*																																																		
Velleia daviesii																																								x	x									
Vittadinia dissecta var. *hirta*																											x	x		x	x				x						x					x	x			
Vittadinia humerata																																																		
Wahlenbergia preissii																																																		
Wahlenbergia tumidifructa																																																		
Waitzia acuminata var. *acuminata*																																																		
Waitzia suaveolens var. *flava*																																																		
Waitzia suaveolens var. *suaveolens*																			x																						x									
Westringia cephalantha																																																		
Westringia rigida					x											x	x	x																			x			x				x						x

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Species	**Site**																																																	
	S051	**S052**	**S053**	**S054**	**S055**	**S056**	**S057**	**S058**	**S059**	**S060**	**S061**	**S062**	**S063**	**S064**	**S065**	**S066**	**S067**	**S068**	**S069**	**S070**	**S071**	**S072**	**S073**	**S074**	**S075**	**S076**	**S077**	**S078**	**S079**	**S080**	**S081**	**S082**	**S083**	**S084**	**S085**	**S086**	**S087**	**S088**	**S089**	**S090**	**S091**	**S092**	**S093**	**S094**	**S095**	**S096**	**S097**	**S098**	**S099**	**S100**
Zygophyllum apiculatum									x		x			x		x	x						x	x										x		x							x		x		x	x	x	
Zygophyllum aurantiacum																																																	x	
Zygophyllum eremaeum																																																		
Zygophyllum glaucum	x		x	x	x						x	x	x	x	x						x		x	x					x																x					x
Zygophyllum ovatum	x			x																	x					x				x					x							x				x				
Zygophyllum reticulatum	x										x																																							
Zygophyllum tesquorum																				x																														
Zygophyllum sp.																																																		

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Species	Site																																																
	S101	S102	S103	S104	S105	S106	S107	S108	S109	S110	S111	S112	S113	S114	S115	S116	S117	S118	S119	S120	S121	S122	S123	S125	S126	S127	S128	S129	S130	S131	S132	S133	S134	S135	S136	S137	S138	S139	S140	S141	S142	S143	S144	S145	S146	S147	S148	S149	S150	S151
Acacia acanthoclada subsp. *acanthoclada*																x																								x										
Acacia acoma																																																		
Acacia acuminata (narrow phyllode variant)		x											x																									x												
Acacia andrewsii																																																		
Acacia assimilis																																																		
Acacia assimilis subsp. *assimilis*																x																		x																x
Acacia assimilis subsp. *atroviridis*																																																		
Acacia burkittii																																																		
Acacia camptoclada																																																		
Acacia colletioides																																																		
Acacia densiflora																																																		
Acacia enervia subsp. *explicata*																																																		
Acacia eremophila var. *eremophila*																																																		
Acacia erinacea			x		x												x	x											x		x		x	x	x			x				x	x							
Acacia evenulosa																																																		
Acacia hemiteles		x	x	x	x	x				x					x		x	x			x		x				x		x		x		x	x	x			x				x		x						
Acacia hystrix subsp. *continua* (P1)																																																		
Acacia hystrix subsp. *hystrix*																		x											x																					
Acacia merrallii				x																			x																									x		
Acacia oswaldii																																																		
Acacia rigens																																																		
Acacia tetragonophylla																																																		
Acacia sp.																																											x							
Acacia uncinella																																																		
Acacia verricula											x																																							
Actinobole uliginosum									x																																									
Allocasuarina campestris																																																		x
Allocasuarina helmsii		x			x												x	x																x								x	x							x
Allocasuarina sp.							x		x																																					x				
Alyogyne sp. Shark Bay (D.J. Edinger 6212)																																																		
Alyxia buxifolia		x	x			x									x		x	x										x																					x	
Amphipogon caricinus var. *caricinus*																																																		
Amphipogon sp.																																																		
Angianthus tomentosus																																																	x	
Aotus sp. Tortile (G.J. Keighery 3767)																																																		
Aotus sp.																																																		
Arabidella chrysodema																																																		
Arabidella trisecta																																																		
Arabidella sp.																																																		
Aristida contorta																																																		
Aristida ?*holathera*																																																		
Asteraceae sp.																																																		
Asteridea athrixioides																																	x																	
Atriplex acutibractea subsp. *karoniensis*																																																		
Atriplex nummularia																																																		
Atriplex vesicaria												x														x																								
Atriplex sp.	x													x											x	x	x			x		x				x	x		x								x	x	x	
Austrostipa elegantissima						x						x		x	x							x								x		x							x											
Austrostipa hemipogon			x			x			x		x			x														x	x		x	x												x						
Austrostipa mollis										x																																								
Austrostipa nitida		x													x						x																													
Austrostipa platychaeta						x				x		x																x																				x		
Austrostipa scabra subsp. *scabra*																																					x								x					
Austrostipa sp.			x										x														x																x							
Beyeria lechenaultii																x																		x																
Beyeria sp.																																																		
Boronia fabianoides subsp. *fabianoides*																																																		
Bossiaea leptacantha				x																																														
Bossiaea sp.																																																		
Brachyscome ciliaris var. *ciliaris*																																																		

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Species	Site																																																	
	S101	S102	S103	S104	S105	S106	S107	S108	S109	S110	S111	S112	S113	S114	S115	S116	S117	S118	S119	S120	S121	S122	S123	S125	S126	S127	S128	S129	S130	S131	S132	S133	S134	S135	S136	S137	S138	S139	S140	S141	S142	S143	S144	S145	S146	S147	S148	S149	S150	S151
Brachyscome iberidifolia																																																		
*Brassica sp.																																																		
Calandrinia eremaea						x			x		x																						x							x	x			x		x			x	
Calandrinia porifera							x																																											
Calandrinia sp.																																																		
Calothamnus gilesii																																		x																
Calotis hispidula						x			x		x																												x										x	
*Centaurea melitensis																																																		
Centipeda crateriformis																																																		
Centrolepis polygyna																																																		
Cheilanthes sieberi subsp. *sieberi*													x																																					
Chenopodiaceae sp.																																																		
Chenopodium curvispicatum																																																		
Chenopodium sp.																																																		
Chrysocephalum apiculatum																																																		
Codonocarpus cotinifolius																																																		
Comesperma polygaloides																																										x								x
Commersonia craurophylla						x																						x																						
Convolvulaceae sp.																																																		
Convolvulus angustissimus subsp. *angustissimus*																																																		
Coopernookia strophiolata																					x																													
Crassula colorata var. *colorata*									x		x						x												x												x			x		x			x	
Cratystylis conocephala						x		x			x	x		x	x							x								x		x			x	x	x		x					x	x			x	x	
Cryptandra aridicola		x														x															x			x				x				x								x
Cryptandra ?crispula (P3)																																																		
Cryptandra minutifolia subsp. *brevistyla*																																																		
Cryptandra recurva																																																		
*Cucumis myriocarpus																																																		
Cullen discolor																																																		
Dampiera lavandulacea							x																																	x										
Dampiera tenuicaulis																																																		
Daviesia benthamii																																																		
Daviesia benthamii subsp. *acanthoclona*				x																		x									x													x						
Daviesia sp.																																																		
Dianella revoluta		x					x		x		x						x	x																				x		x		x				x				
Dillwynia sp. Coolgardie (V.E. Sands 637.3. 1)																		x																								x								
Dillwynia sp.																																																		
Diocirea ternata			x		x	x						x		x				x				x		x					x	x	x		x		x							x								
Dodonaea adenophora																																																		
Dodonaea lobulata																																																		
Dodonaea microzyga var. *acrolobata*			x								x					x	x	x																																x
Dodonaea stenozyga					x										x														x		x			x								x								
Dodonaea viscosa subsp. *angustissima*																																																		
Dodonaea sp.									x																															x						x				
Enchylaena tomentosa														x																		x							x										x	
Enchylaena tomentosa var. *tomentosa*	x												x													x	x																							
Enneapogon avenaceus																											x																							
Enneapogon caerulescens						x																																												
Enneapogon sp.																																																		
Eragrostis australasica																																																		
Eragrostis dielsii																									x																								x	
Eremophila alternifolia																											x											x					x							
Eremophila caperata																					x		x																								x			
Eremophila decipiens subsp. *decipiens*		x						x				x	x			x	x					x	x			x	x			x					x				x				x	x						
Eremophila dempsteri														x										x						x		x			x				x											
Eremophila deserti								x																		x						x																	x	
Eremophila gibbosa							x																																											
Eremophila interstans																									x																									
Eremophila ionantha					x			x		x		x		x							x		x							x		x							x								x	x		
Eremophila oblonga																																																		

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Eremophila psilocalyx																															x													x						
Eremophila rugosa																																																		
Eremophila saligna																																																		
Eremophila scoparia				x	x			x							x					x	x			x	x	x			x	x		x										x		x	x		x		x	
Eremophila sp.						x																						x				x																		
Eriochiton sclerolaenoides			x			x								x																																				
**Erodium aureum*													x																																					
Eucalyptus calycogona subsp. *calycogona*						x																x				x											x								x					
Eucalyptus celastroides																																																		
Eucalyptus celastroides subsp. *celastroides*																																																		
Eucalyptus celastroides subsp. *virella*																								x																										
Eucalyptus clelandii	x																																																	
Eucalyptus concinna																																																		
Eucalyptus cylindrocarpa																						x																												
Eucalyptus eremophila subsp. *eremophila*																																																		
Eucalyptus flocktoniae																																																		
Eucalyptus flocktoniae subsp. *hebes*																																																		
Eucalyptus fraseri subsp. *fraseri*																			x																															
Eucalyptus gracilis				x																			x																				x	x						
Eucalyptus griffithsii																																											x							
Eucalyptus horistes																																																		
Eucalyptus incrassata																																																		
Eucalyptus ?*kumarlensis*																																											x							
Eucalyptus laevis				x																																														
Eucalyptus lesouefii																																		x																
Eucalyptus ?*longissima*																																				x														
Eucalyptus ?*loxophleba* subsp. *lissophloia*																																																		
Eucalyptus moderata																																																		
Eucalyptus oleosa subsp. *oleosa*			x			x									x				x		x			x				x		x	x						x					x			x			x		
Eucalyptus optima																																																		
Eucalyptus polita																																																		
Eucalyptus prolixa																													x																					
Eucalyptus protensa																																																		
Eucalyptus rigidula		x															x	x																x																
Eucalyptus salubris	x									x		x		x						x			x		x	x	x			x		x					x		x									x		
Eucalyptus sheathiana																																																		
Eucalyptus spreta																																															x			
Eucalyptus transcontinentalis																												x																					x	
Eucalyptus urna																			x									x																						
Eucalyptus websteriana subsp. *norsemanica* (P1)																																																		
Eucalyptus sp.					x	x	x	x	x		x									x						x		x				x	x		x	x		x												
Euphorbia drummondii																									x																									
Exocarpos aphyllus			x							x				x			x	x	x				x				x			x		x							x									x	x	
Frankenia desertorum																																																		
Frankenia sp.																																																		
Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)																																		x								x								
Geijera linearifolia										x		x		x	x																	x																x	x	
Glischrocaryon angustifolium							x		x		x																													x	x					x				
Glischrocaryon aureum						x																						x																						
Goodenia berardiana																																																		
Goodenia concinna																																											x							
Goodenia ?*havilandii*																																																		
Goodenia pinnatifida						x																											x																	
Goodenia quasilibera																																																		
Goodenia sp.																																																		
Grevillea acuaria			x	x													x	x				x											x					x				x								
Grevillea anethifolia							x																											x																x
Grevillea huegelii				x																																										x				
Grevillea plurijuga subsp. *plurijuga*																																																		
Grevillea teretifolia																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S101	S102	S103	S104	S105	S106	S107	S108	S109	S110	S111	S112	S113	S114	S115	S116	S117	S118	S119	S120	S121	S122	S123	S125	S126	S127	S128	S129	S130	S131	S132	S133	S134	S135	S136	S137	S138	S139	S140	S141	S142	S143	S144	S145	S146	S147	S148	S149	S150	S151
Grevillea sp.																																																		
Gyrostemon racemiger																																									x									
Halgania anagalloides																																																		
Halgania andromedifolia																															x			x								x		x						x
Halgania cyanea																																																		
Halgania erecta																																																		
Halgania integerrima							x																															x												
Halgania sp.																																																		
Haloragis dura																																																		
Haloragis gossei						x	x																					x																						
Haloragis trigonocarpa																																																		
Hannafordia bissillii subsp. *latifolia*																																									x					x				
Helichrysum luteoalbum									x		x																	x													x									
Hyalosperma demissum									x																																x					x				
Hybanthus epacroides																																																		
Hybanthus floribundus																																																		
Indigofera australis													x																																					
Juncus pallidus																																																		
Lawrencia repens						x																x											x																	
Lawrencia ?squamata																																																		
Lepidium sp.																																																		
Lepidobolus deserti																																																		
Lepidosperma aff. *diurnum*																																		x																x
Lepidosperma sp.							x																																											
Leptosema daviesioides							x																					x												x										
Leptospermum sp.																																																		
Leucochrysum fitzgibbonii																															x																			
Logania sp.																																																		
Lomandra collina																																																		
Lomandra effusa																																																		
Lotus cruentus						x																																												
Lycium sp.																																																		
Maireana ?appressa																									x																									
Maireana carnosa																																																		
Maireana erioclada																																																		
Maireana ?eriosphaera																										x											x								x					
Maireana georgei																																																		
Maireana ?marginata										x																																								
Maireana pentatropis								x				x																		x							x							x	x				x	
Maireana radiata																																																		
Maireana sedifolia																																																		
Maireana suaedifolia																																																		
Maireana trichoptera			x			x						x		x	x							x				x				x			x		x				x											
Maireana triptera												x																																					x	
Maireana sp.																				x																	x								x					
Malvaceae sp.																									x																									
Marsdenia australis																																																		
Marsilea hirsuta																																																		
* *Medicago ?sativa*																																																		
Melaleuca acuminata subsp. *acuminata*					x											x																												x						
Melaleuca eleuterostachya																																						x												
Melaleuca fulgens subsp. *fulgens*																																								x										x
Melaleuca halmaturorum																				x															x								x							
Melaleuca hamata							x		x																													x		x	x					x				
Melaleuca lanceolata				x																																											x			
Melaleuca ?lateriflora																																																		
Melaleuca quadrifaria	x							x																						x																				
Melaleuca sheathiana																			x	x	x		x	x				x		x	x													x				x	x	
Melaleuca uncinata		x														x	x																																	x
Melaleuca ?zeteticorum																																																		

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Species	Site																																																	
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Melaleuca sp.									x		x																														x									
Menkea australis																																																		
Microcybe multiflora subsp. *baccharoides*																																																		
Microcybe multiflora subsp. *multiflora*																																																		
Minuria leptophylla																																																		
Mirbelia depressa																																																		
Myoporum montanum																																																		
Myoporum platycarpum subsp. *platycarpum*																																																		
Myrtaceae sp.									x																															x	x									
Nicotiana goodspeedii						x																						x																						
Nicotiana rotundifolia		x															x																																	
Olearia dampieri subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628)																																																		
Olearia exiguifolia																																																			
Olearia muelleri			x	x		x		x		x				x	x		x	x		x			x	x	x	x	x		x	x	x	x	x		x		x						x	x	x		x	x	x	
Olearia pimeleoides													x																																					
Panicum effusum																																																		
Pelargonium australe																																																		
Phebalium canaliculatum																																																		
Phebalium lepidotum		x													x		x																																	
Pimelea microcephala subsp. *microcephala*																										x																								
Pimelea trichostachya							x																																											
Pimelea sp.																																																		
Pittosporum ?*angustifolium*																																																		
Platysace trachymenioides																																																			
Poaceae sp.									x																															x										
Podolepis canescens																																																		
Podolepis capillaris											x																														x								x	
Pogonolepis sp.																																																		
Poranthera microphylla																																																		
Poranthera triandra																																																		
Prostanthera althoferi subsp. *althoferi*																																																		
Pterostylis sp.																																																		
Ptilotus carlsonii						x																																												
Ptilotus drummondii									x								x																					x			x					x				
Ptilotus drummondii var. *minor*																																																		
Ptilotus drummondii ?var. *scaposus*																x																																		
Ptilotus holosericeus			x			x					x			x												x			x	x		x	x				x		x		x			x	x					
Ptilotus nobilis																																	x																	
Ptilotus obovatus																																																		
Ptilotus spathulatus							x				x																																							
Ptilotus sp. Goldfields (R. Davis 10796)																																																		
Ptilotus sp.																																																		
Pultenaea elachista																																		x								x								
Pultenaea purpurea																																																		
Radyera farragei						x					x																																							
Rhagodia crassifolia	x													x						x																	x							x	x			x		
Rhagodia drummondii												x																																						
Rhagodia eremaea																																																		
Rhagodia ulicina													x														x																							
Rhagodia sp.																																																		
Rhodanthe chlorocephala subsp. *rosea*																																																		
Rhodanthe floribunda																																																		
Rhyncharrhena linearis																																																		
Rytidosperma caespitosum																																																		
Salsola australis																																																		
* *Salvia verbenaca*																																																		
Santalum acuminatum					x	x				x				x	x			x							x				x		x								x			x						x		
Santalum spicatum																																		x																
Santalum sp.																																																		
Scaevola amblyanthera var. *centralis*							x																																	x										

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Scaevola bursariifolia				x																																								x						
Scaevola restiacea subsp. *divaricata*																																																		
Scaevola spinescens			x			x		x		x		x			x			x										x			x												x	x					x	
Scaevola sp.																																																		
Schenkia australis																																																		
* *Schismus arabicus*																																																		
Sclerolaena cuneata												x																																						
Sclerolaena diacantha	x		x			x						x	x	x	x					x		x	x		x	x			x		x		x		x		x		x				x	x	x		x			
Sclerolaena drummondii																																																		
Sclerolaena obliquicuspis																																																		
Sclerolaena parviflora						x					x																	x	x																					
Sclerolaena uniflora																														x		x																		
Scrophulariaceae sp.									x																															x										
Senecio lacustrinus																												x																						
Senecio quadridentatus																																																		
Senecio sp.																																																		
Senna artemisioides subsp. *filifolia*						x				x		x	x		x		x				x	x					x	x					x		x		x		x				x	x	x			x		
Senna artemisioides subsp. x *artemisioides*																																																		
Senna ?*cardiosperma*																																																		
Senna pleurocarpa var. *pleurocarpa*											x																	x																						
Senna stowardii										x																																								
Sida sp.																																																		
Solanum hoplopetalum						x					x																														x					x				
Solanum lasiophyllum													x																																					
* *Solanum nigrum*																																																		
Solanum nummularium																																																			
Solanum plicatile						x	x		x		x																	x												x	x					x				
Solanum sp.											x																																							
* *Sonchus oleraceus*																																																		
* *Sonchus sp.*																																																		
Stackhousia monogyna																																																			
Stackhousia muricata		x																																						x	x									
Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)							x									x																								x						x				x
Stackhousia stratfordiae (P1)						x																																												
Streptoglossa sp.																																																		
Swainsona sp.																																																		
Tecticornia sp.																																																		
Templetonia ceracea																																																		
Templetonia sp.																																																		
Tetratheca efoliata																																																		
Teucrium sessiliflorum																																																		
Thysanotus manglesianus																																																		
Thysanotus sp.																																																		
Trachymene pilosa									x								x																													x				
Trachymene ?*pyrophila* (P2)																																																		
Triodia irritans																																																		
Triodia scariosa		x														x	x	x													x		x	x	x			x				x								x
Triodia ?*tomentosa*																																											x							
Triodia sp.							x																																	x						x				
Trymalium myrtillus subsp. *myrtillus*																																		x																x
Velleia daviesii																																								x	x					x				
Vittadinia dissecta var. *hirta*						x			x		x		x	x											x		x	x												x	x					x			x	
Vittadinia humerata											x																																							
Wahlenbergia preissii																																																			
Wahlenbergia tumidifructa									x																															x	x					x				
Waitzia acuminata var. *acuminata*																																																		
Waitzia suaveolens var. *flava*																																																		
Waitzia suaveolens var. *suaveolens*						x											x											x																						
Westringia cephalantha																x	x																																	
Westringia rigida				x						x																					x			x								x	x							

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Species	Site																																																	
	S101	**S102**	**S103**	**S104**	**S105**	**S106**	**S107**	**S108**	**S109**	**S110**	**S111**	**S112**	**S113**	**S114**	**S115**	**S116**	**S117**	**S118**	**S119**	**S120**	**S121**	**S122**	**S123**	**S125**	**S126**	**S127**	**S128**	**S129**	**S130**	**S131**	**S132**	**S133**	**S134**	**S135**	**S136**	**S137**	**S138**	**S139**	**S140**	**S141**	**S142**	**S143**	**S144**	**S145**	**S146**	**S147**	**S148**	**S149**	**S150**	**S151**
Zygophyllum apiculatum	x																							x		x										x	x						x		x		x	x		
Zygophyllum aurantiacum																										x																								
Zygophyllum eremaeum	x													x																																				
Zygophyllum glaucum								x			x								x									x		x	x	x			x							x								
Zygophyllum ovatum	x					x		x						x											x	x				x	x	x	x		x															
Zygophyllum reticulatum																																																		
Zygophyllum tesquorum																																										x								
Zygophyllum sp.																																																		

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Species	Site																																																	
	S152	S153	S154	S155	S156	S157	S158	S159	S160	S161	S162	S163	S164	S165	S166	S167	S168	S169	S170	S171	S172	S173	S174	S175	S176	S177	S178	S179	S180	S181	S182	S183	S184	S185	S186	S187	S188	S189	S190	S191	S192	S193	S194	S195	S196	S197	S198	S199	S200	S201
Acacia acanthoclada subsp. *acanthoclada*																																																		
Acacia acoma																																				x														
Acacia acuminata (narrow phyllode variant)																																																		
Acacia andrewsii																																																		
Acacia assimilis																																																		
Acacia assimilis subsp. *assimilis*																			x	x																														
Acacia assimilis subsp. *atroviridis*																																																		
Acacia burkittii																																																		
Acacia camptoclada																																																		
Acacia colletioides		x																																																
Acacia densiflora																																																		
Acacia enervia subsp. *explicata*																																																	
Acacia eremophila var. *eremophila*																																																		
Acacia erinacea	x		x	x				x					x		x						x				x					x			x					x	x				x				x			
Acacia evenulosa																																					x										x			
Acacia hemiteles	x	x	x					x			x						x	x			x				x		x					x				x		x	x	x	x		x					x	x	x
Acacia hystrix subsp. *continua* (P1)							x																																											
Acacia hystrix subsp. *hystrix*																x																																		
Acacia merrallii										x	x	x		x			x	x								x				x		x									x				x	x		x		
Acacia oswaldii																																			x															
Acacia rigens																																																		
Acacia tetragonophylla																																																		
Acacia sp.																									x																									
Acacia uncinella																																																		
Acacia verricula																																																		
Actinobole uliginosum																																																		
Allocasuarina campestris																				x																														
Allocasuarina helmsii	x							x											x													x																		
Allocasuarina sp.																																																		
Alyogyne sp. Shark Bay (D.J. Edinger 6212)																																																		
Alyxia buxifolia													x																										x	x										
Amphipogon caricinus var. *caricinus*																																																		
Amphipogon sp.																																																		
Angianthus tomentosus								x																																										
Aotus sp. Tortile (G.J. Keighery 3767)																																																		
Aotus sp.																									x																									
Arabidella chrysodema																																																		
Arabidella trisecta																																																		
Arabidella sp.																																																		
Aristida contorta							x																																											
Aristida ?*holathera*																																																		
Asteraceae sp.																																																		
Asteridea athrixioides																											x																							
Atriplex acutibractea subsp. *karoniensis*																																																		
Atriplex nummularia																																																		
Atriplex vesicaria																							x																											
Atriplex sp.						x																x		x			x		x		x				x	x														x
Austrostipa elegantissima																															x																			
Austrostipa hemipogon																x					x			x			x																						
Austrostipa mollis																																																		
Austrostipa nitida																															x																x	x		
Austrostipa platychaeta									x						x		x		x											x		x				x			x	x								x	x	
Austrostipa scabra subsp. *scabra*																																																		
Austrostipa sp.													x																						x															
Beyeria lechenaultii																																																		
Beyeria sp.																																																			
Boronia fabianoides subsp. *fabianoides*																																																		
Bossiaea leptacantha																																																		
Bossiaea sp.																																																		
Brachyscome ciliaris var. *ciliaris*																																																		

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Species	Site																																																	
	S152	S153	S154	S155	S156	S157	S158	S159	S160	S161	S162	S163	S164	S165	S166	S167	S168	S169	S170	S171	S172	S173	S174	S175	S176	S177	S178	S179	S180	S181	S182	S183	S184	S185	S186	S187	S188	S189	S190	S191	S192	S193	S194	S195	S196	S197	S198	S199	S200	S201
Brachyscome iberidifolia																																																		
**Brassica* sp.																																																		
Calandrinia eremaea							x												x																															
Calandrinia porifera																															x																			
Calandrinia sp.																																																		
Calothamnus gilesii																																																		
Calotis hispidula							x	x								x			x					x																										
**Centaurea melitensis*																																																		
Centipeda crateriformis																																																		
Centrolepis polygyna																															x																			
Cheilanthes sieberi subsp. *sieberi*																																																		
Chenopodiaceae sp.																								x																										
Chenopodium curvispicatum																																						x											x	
Chenopodium sp.																																																		
Chrysocephalum apiculatum																																																		
Codonocarpus cotinifolius																																																		
Comesperma polygaloides																			x																															
Commersonia craurophylla																								x																										
Convolvulaceae sp.																																																		
Convolvulus angustissimus subsp. *angustissimus*																																																		
Coopernookia strophiolata																																																		
Crassula colorata var. *colorata*								x											x												x																			
Cratystylis conocephala		x			x	x		x	x	x	x	x			x		x					x	x						x		x			x	x	x				x						x		x	x	
Cryptandra aridicola																				x					x																									x
Cryptandra ?crispula (P3)																																																		
Cryptandra minutifolia subsp. *brevistyla*																																																		
Cryptandra recurva																																																		
**Cucumis myriocarpus*																																																		
Cullen discolor																			x																															
Dampiera lavandulacea																																																		
Dampiera tenuicaulis																																																		
Daviesia benthamii																																																		
Daviesia benthamii subsp. *acanthoclona*	x	x	x				x		x	x		x		x				x								x				x		x	x								x	x	x		x		x	x		
Daviesia sp.																																																		
Dianella revoluta	x																		x																															
Dillwynia sp. Coolgardie (V.E. Sands 637.3. 1)																																																		
Dillwynia sp.																																																		
Diocirea ternata	x		x				x	x			x		x			x					x		x							x		x	x						x				x			x	x			
Dodonaea adenophora																																																		
Dodonaea lobulata																																																		
Dodonaea microzyga var. *acrolobata*	x																		x	x																														
Dodonaea stenozyga	x	x	x	x			x	x		x	x	x	x		x	x					x									x			x						x				x				x			x
Dodonaea viscosa subsp. *angustissima*																																																		
Dodonaea sp.																																																		
Enchylaena tomentosa																																																		x
Enchylaena tomentosa var. *tomentosa*																																																		
Enneapogon avenaceus																																						x												
Enneapogon caerulescens																																																		
Enneapogon sp.																																																		
Eragrostis australasica																																																		
Eragrostis dielsii																															x																			
Eremophila alternifolia																									x										x			x												
Eremophila caperata											x						x	x																												x				
Eremophila decipiens subsp. *decipiens*		x															x	x								x				x								x						x		x			x	
Eremophila dempsteri			x	x			x			x	x		x		x									x		x	x		x	x	x		x									x								
Eremophila deserti																																								x										
Eremophila gibbosa																			x	x																														
Eremophila interstans																																																		
Eremophila ionantha		x		x						x	x						x	x									x		x												x		x					x	x	
Eremophila oblonga																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S152	S153	S154	S155	S156	S157	S158	S159	S160	S161	S162	S163	S164	S165	S166	S167	S168	S169	S170	S171	S172	S173	S174	S175	S176	S177	S178	S179	S180	S181	S182	S183	S184	S185	S186	S187	S188	S189	S190	S191	S192	S193	S194	S195	S196	S197	S198	S199	S200	S201
Eremophila psilocalyx		x																												x																				
Eremophila rugosa																																				x														
Eremophila saligna																																																		
Eremophila scoparia		x			x	x	x	x	x	x	x	x	x		x	x	x	x								x	x		x			x		x	x	x				x	x	x			x	x	x	x	x	x
Eremophila sp.																																																		
Eriochiton sclerolaenoides				x																				x			x																							
**Erodium aureum*																																																		
Eucalyptus calycogona subsp. *calycogona*																																	x						x											
Eucalyptus celastroides																							x																											
Eucalyptus celastroides subsp. *celastroides*																																																		
Eucalyptus celastroides subsp. *virella*													x																x																					
Eucalyptus clelandii																																																		
Eucalyptus concinna																																																		
Eucalyptus cylindrocarpa															x													x																						
Eucalyptus eremophila subsp. *eremophila*																															x																			
Eucalyptus flocktoniae							x																																											
Eucalyptus flocktoniae subsp. *hebes*																																																		
Eucalyptus fraseri subsp. *fraseri*																																																		
Eucalyptus gracilis		x									x						x															x														x				
Eucalyptus griffithsii																									x													x												
Eucalyptus horistes																																																		
Eucalyptus incrassata																																																		
Eucalyptus ?*kumarlensis*																																						x												
Eucalyptus laevis										x																																								
Eucalyptus lesouefii														x	x														x					x																
Eucalyptus ?*longissima*																																																		
Eucalyptus ?*loxophleba* subsp. *lissophloia*	x								x			x																																					x	x
Eucalyptus moderata																																																		
Eucalyptus oleosa subsp. *oleosa*									x			x					x	x			x	x								x			x		x	x			x	x		x					x			
Eucalyptus optima																																																		
Eucalyptus polita			x	x				x																																	x			x						
Eucalyptus prolixa																					x																													
Eucalyptus protensa																																																		
Eucalyptus rigidula																																																		
Eucalyptus salubris					x												x						x				x		x										x											
Eucalyptus sheathiana																																																		
Eucalyptus spreta																														x			x												x					x
Eucalyptus transcontinentalis																																																		
Eucalyptus urna																								x		x		x																				x		
Eucalyptus websteriana subsp. *norsemanica* (P1)																																																		
Eucalyptus sp.					x	x				x	x				x	x							x	x			x		x	x			x									x	x				x			
Euphorbia drummondii																																																		
Exocarpos aphyllus		x			x					x	x	x					x					x		x	x		x		x		x	x		x				x	x			x		x		x		x	x	
Frankenia desertorum																																																		
Frankenia sp.																																																		
Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)																																						x												
Geijera linearifolia																	x												x						x					x										
Glischrocaryon angustifolium																			x																															
Glischrocaryon aureum																																																		
Goodenia berardiana																																																		
Goodenia concinna																									x																									
Goodenia ?*havilandii*																																																		
Goodenia pinnatifida																			x								x																							
Goodenia quasilibera																																						x												
Goodenia sp.																																																		
Grevillea acuaria	x																								x													x												
Grevillea anethifolia																																																		
Grevillea huegelii																		x												x																		x		
Grevillea plurijuga subsp. *plurijuga*																																																		
Grevillea teretifolia																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																
	S152	S153	S154	S155	S156	S157	S158	S159	S160	S161	S162	S163	S164	S165	S166	S167	S168	S169	S170	S171	S172	S173	S174	S175	S176	S177	S178	S179	S180	S181	S182	S183	S184	S185	S186	S187	S188	S189	S190	S191	S192	S193	S194	S195	S196	S197	S198	S199	S200	S201
Grevillea sp.											x																																						
Gyrostemon racemiger																																																	
Halgania anagalloides																									x																								
Halgania andromedifolia	x		x						x										x	x	x						x																							
Halgania cyanea																																														x				
Halgania erecta																																																	
Halgania integerrima																														x																	x			
Halgania sp.																																																	
Haloragis dura																																																	
Haloragis gossei								x											x																														
Haloragis trigonocarpa																																																	
Hannafordia bissillii subsp. *latifolia*																																																	
Helichrysum luteoalbum																																																	
Hyalosperma demissum																																																	
Hybanthus epacroides																																																	
Hybanthus floribundus																																																	
Indigofera australis																																																	
Juncus pallidus																																																	
Lawrencia repens																																																	
Lawrencia ?squamata																																																	
Lepidium sp.																																																	
Lepidobolus deserti																																																	
Lepidosperma aff. *diurnum*	x																				x																													
Lepidosperma sp.																																																	
Leptosema daviesioides																			x																														
Leptospermum sp.																																																	
Leucochrysum fitzgibbonii																																																	
Logania sp.																																																	
Lomandra collina																																																	
Lomandra effusa																																																	
Lotus cruentus																			x																														
Lycium sp.																																																	
Maireana ?appressa																																			x														
Maireana carnosa																																								x									
Maireana erioclada																																																	
Maireana ?eriosphaera						x																	x																											
Maireana georgei																																																	
Maireana ?marginata					x																															x													
Maireana pentatropis					x																			x	x			x										x				x											x
Maireana radiata																																																	
Maireana sedifolia																																																	
Maireana suaedifolia																																						x											
Maireana trichoptera			x	x																					x			x				x																						
Maireana triptera																x																																		
Maireana sp.						x																												x			x											
Malvaceae sp.																																																	
Marsdenia australis		x																																															
Marsilea hirsuta																																																	
* *Medicago ?sativa*																																																	
Melaleuca acuminata subsp. *acuminata*																																																	
Melaleuca eleuterostachya																																																	
Melaleuca fulgens subsp. *fulgens*																			x	x																														
Melaleuca halmaturorum				x											x	x		x								x															x		x				x	x				
Melaleuca hamata																																																	
Melaleuca lanceolata																																																	
Melaleuca ?lateriflora																																																	
Melaleuca quadrifaria																												x													x			x						
Melaleuca sheathiana			x		x		x		x				x	x	x								x		x		x			x									x	x	x		x	x	x		x		
Melaleuca uncinata																			x	x																														
Melaleuca ?zeteticorum																																																	

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Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S152	S153	S154	S155	S156	S157	S158	S159	S160	S161	S162	S163	S164	S165	S166	S167	S168	S169	S170	S171	S172	S173	S174	S175	S176	S177	S178	S179	S180	S181	S182	S183	S184	S185	S186	S187	S188	S189	S190	S191	S192	S193	S194	S195	S196	S197	S198	S199	S200	S201
Melaleuca sp.																																																		
Menkea australis								x																																										
Microcybe multiflora subsp. *baccharoides*																																														x				
Microcybe multiflora subsp. *multiflora*				x																																														
Minuria leptophylla																																																		
Mirbelia depressa																																																		
Myoporum montanum																																																		
Myoporum platycarpum subsp. *platycarpum*																																																		
Myrtaceae sp.																																																		
Nicotiana goodspeedii																			x																															
Nicotiana rotundifolia																																																		
Olearia dampieri subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628)																																																		
Olearia exiguifolia																															x																			
Olearia muelleri		x	x	x	x	x		x	x	x	x	x	x		x	x	x	x			x	x				x	x		x	x	x		x	x		x			x	x	x	x	x	x	x	x		x	x	x
Olearia pimeleoides																																																		
Panicum effusum																																																		
Pelargonium australe																			x																															
Phebalium canaliculatum																																																		
Phebalium lepidotum		x																		x																														
Pimelea microcephala subsp. *microcephala*																																																		
Pimelea trichostachya																																																		
Pimelea sp.																																																		
Pittosporum ?angustifolium																																																		
Platysace trachymenioides																																																		
Poaceae sp.																																																		
Podolepis canescens																																																		
Podolepis capillaris																															x																			
Pogonolepis sp.								x																																										
Poranthera microphylla																																																		
Poranthera triandra																																																		
Prostanthera althoferi subsp. *althoferi*																																																		
Pterostylis sp.																																																		
Ptilotus carlsonii																											x																							
Ptilotus drummondii																			x	x											x																			
Ptilotus drummondii var. *minor*																																																		
Ptilotus drummondii ?var. *scaposus*																																																		
Ptilotus holosericeus			x						x							x					x			x			x				x							x					x							x
Ptilotus nobilis																																																		
Ptilotus obovatus			x																																															
Ptilotus spathulatus																							x																											
Ptilotus sp. Goldfields (R. Davis 10796)																																																		
Ptilotus sp.																																																		
Pultenaea elachista																																																		
Pultenaea purpurea																																																		
Radyera farragei																																																		
Rhagodia crassifolia														x								x													x					x										x
Rhagodia drummondii																																																		
Rhagodia eremaea																																																		
Rhagodia ulicina																																																		
Rhagodia sp.																																																		
Rhodanthe chlorocephala subsp. *rosea*																																																		
Rhodanthe floribunda																																																		
Rhyncharrhena linearis																																																		
Rytidosperma caespitosum																																																		
Salsola australis																																																		
* *Salvia verbenaca*																																																		
Santalum acuminatum	x	x					x				x	x			x						x	x				x	x			x		x	x		x				x	x							x	x	x	x
Santalum spicatum										x			x																x																					
Santalum sp.			x					x																																										
Scaevola amblyantha var. *centralis*																			x																															

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Species	Site																																																	
	S152	S153	S154	S155	S156	S157	S158	S159	S160	S161	S162	S163	S164	S165	S166	S167	S168	S169	S170	S171	S172	S173	S174	S175	S176	S177	S178	S179	S180	S181	S182	S183	S184	S185	S186	S187	S188	S189	S190	S191	S192	S193	S194	S195	S196	S197	S198	S199	S200	S201
Scaevola bursariifolia	x								x																							x																		
Scaevola restiacea subsp. *divaricata*																																																		
Scaevola spinescens	x	x		x				x	x		x	x	x		x		x	x	x						x	x	x			x	x					x		x	x	x		x				x	x	x	x	x
Scaevola sp.																																																		
Schenkia australis																																																		
* *Schismus arabicus*								x																																										
Sclerolaena cuneata																																																		
Sclerolaena diacantha		x	x	x	x	x		x	x							x					x	x	x	x			x				x				x			x		x			x					x		x
Sclerolaena drummondii																																						x	x											
Sclerolaena obliquicuspis																																																x		
Sclerolaena parviflora																								x						x																				
Sclerolaena uniflora																																																		
Scrophulariaceae sp.																																																		
Senecio lacustrinus																																																		
Senecio quadridentatus																																																		
Senecio sp.																																																		
Senna artemisioides subsp. *filifolia*	x	x		x		x				x	x					x			x	x					x	x	x								x			x				x						x		
Senna artemisioides subsp. x *artemisioides*																																																		
Senna ?cardiosperma																																																		
Senna pleurocarpa var. *pleurocarpa*																			x																															
Senna stowardii																																																		
Sida sp.																																																		
Solanum hoplopetalum								x																																										
Solanum lasiophyllum																																																		
* *Solanum nigrum*																																																		
Solanum nummularium																																																		
Solanum plicatile																			x																															
Solanum sp.																																																		
* *Sonchus oleraceus*																																																		
* *Sonchus sp.*																																																		
Stackhousia monogyna																																																		
Stackhousia muricata																																																		
Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)																			x	x																														
Stackhousia stratfordiae (P1)																																																		
Streptoglossa sp.																									x																									
Swainsona sp.																																																		
Tecticornia sp.																																																		
Templetonia ceracea																										x																								
Templetonia sp.																																																		
Tetratheca efoliata																																																		
Teucrium sessiliflorum																																																		
Thysanotus manglesianus							x																																											
Thysanotus sp.																																																		
Trachymene pilosa																																																		
Trachymene ?pyrophila (P2)																																																		
Triodia irritans																																x																x		
Triodia scariosa	x							x											x	x										x																				
Triodia ?tomentosa																									x													x												
Triodia sp.											x																																							
Trymalium myrtillus subsp. *myrtillus*								x												x																														
Velleia daviesii																																																		
Vittadinia dissecta var. *hirta*								x																x																										
Vittadinia humerata																																																		
Wahlenbergia preissii																																																		
Wahlenbergia tumidifructa																																																		
Waitzia acuminata var. *acuminata*																																																		
Waitzia suaveolens var. *flava*																								x																										
Waitzia suaveolens var. *suaveolens*																																																		
Westringia cephalantha	x																																																	
Westringia rigida	x			x							x			x				x						x	x			x										x						x						

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Species	**Site**																																																	
	S152	**S153**	**S154**	**S155**	**S156**	**S157**	**S158**	**S159**	**S160**	**S161**	**S162**	**S163**	**S164**	**S165**	**S166**	**S167**	**S168**	**S169**	**S170**	**S171**	**S172**	**S173**	**S174**	**S175**	**S176**	**S177**	**S178**	**S179**	**S180**	**S181**	**S182**	**S183**	**S184**	**S185**	**S186**	**S187**	**S188**	**S189**	**S190**	**S191**	**S192**	**S193**	**S194**	**S195**	**S196**	**S197**	**S198**	**S199**	**S200**	**S201**
Zygophyllum apiculatum										x							x					x							x					x	x							x								x
Zygophyllum aurantiacum						x																																												
Zygophyllum eremaeum																																				x														
Zygophyllum glaucum		x			x				x		x	x					x	x						x					x											x				x		x		x	x	
Zygophyllum ovatum			x			x				x						x					x						x											x												
Zygophyllum reticulatum																																																		
Zygophyllum tesquorum																																																		
Zygophyllum sp.																																																		

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Species	Site																																																	
	S202	S203	S204	S205	S206	S207	S208	S209	S210	S205	S206	S207	S208	S209	S210	S211	S212	S213	S214	S215	S216	S217	S218	S219	S220	S221	S222	S223	S224	S225	S226	S227	S228	S229	S230	S231	S232	S233	S234	S235	S236	S237	S238	S240	S241	S242	S243	S244	S245	S246
Acacia acanthoclada subsp. *acanthoclada*																																																		
Acacia acoma																																																		
Acacia acuminata (narrow phyllode variant)																																											x							
Acacia andrewsii																																																		
Acacia assimilis																																																		
Acacia assimilis subsp. *assimilis*																																																		
Acacia assimilis subsp. *atroviridis*																																																		
Acacia burkittii																																																		
Acacia camptoclada																																																		
Acacia colletioides																																																		
Acacia densiflora																																																		
Acacia enervia subsp. *explicata*																																																		
Acacia eremophila var. *eremophila*																									x																								
Acacia erinacea																																								x		x	x						
Acacia evenulosa																																																		
Acacia hemiteles	x		x	x	x				x	x	x				x	x		x			x	x		x		x		x		x		x									x	x	x				x			
Acacia hystrix subsp. *continua* (P1)																																																		
Acacia hystrix subsp. *hystrix*																																																		
Acacia merrallii	x			x						x						x				x							x										x										x			
Acacia oswaldii																															x																			
Acacia rigens																																							x		x									
Acacia tetragonophylla																																																		
Acacia sp.																																											x							
Acacia uncinella																																																		
Acacia verricula																																																		
Actinobole uliginosum																																																		
Allocasuarina campestris																																																		
Allocasuarina helmsii																																											x							
Allocasuarina sp.																																																		
Alyogyne sp. Shark Bay (D.J. Edinger 6212)																																																		
Alyxia buxifolia		x																								x		x					x	x					x	x										
Amphipogon caricinus var. *caricinus*																																																		
Amphipogon sp.																																																		
Angianthus tomentosus																																																		
Aotus sp. Tortile (G.J. Keighery 3767)																																																		
Aotus sp.																						x																												
Arabidella chrysodema																																																		
Arabidella trisecta																																																		
Arabidella sp.																																																x		
Aristida contorta																																											x							
Aristida ?*holathera*																																																		
Asteraceae sp.																																							x											
Asteridea athrixioides																																x																x		
Atriplex acutibractea subsp. *karoniensis*																																																		
Atriplex nummularia																																																		
Atriplex vesicaria																																														x			x	
Atriplex sp.					x	x	x	x			x	x	x	x			x		x			x			x			x	x	x	x		x			x		x							x	x		x	x	x
Austrostipa elegantissima					x	x	x				x	x	x				x						x			x																x			x					
Austrostipa hemipogon							x						x												x								x	x				x												
Austrostipa mollis																																																		
Austrostipa nitida																	x						x					x																			x			
Austrostipa platychaeta		x																x			x							x																			x			
Austrostipa scabra subsp. *scabra*																																														x		x	x	x
Austrostipa sp.								x						x					x					x							x					x					x									
Beyeria lechenaultii																																																		
Beyeria sp.																																									x									
Boronia fabianoides subsp. *fabianoides*																																																		
Bossiaea leptacantha																																																		
Bossiaea sp.																																																		
Brachyscome ciliaris var. *ciliaris*																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

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Brachyscome iberidifolia																																																		
* *Brassica* sp.																																																		
Calandrinia eremaea					x						x												x																											
Calandrinia porifera																																																		
Calandrinia sp.																																																		
Calothamnus gilesii																																																		
Calotis hispidula					x						x																											x												
* *Centaurea melitensis*																																																		
Centipeda crateriformis																																																		
Centrolepis polygyna																																																		
Cheilanthes sieberi subsp. *sieberi*																																																		
Chenopodiaceae sp.																																																		
Chenopodium curvispicatum					x	x					x	x												x					x			x									x							x		
Chenopodium sp.																																																		
Chrysocephalum apiculatum																																																		
Codonocarpus cotinifolius																																																		
Comesperma polygaloides																																																		
Commersonia craurophylla																							x																											
Convolvulaceae sp.																																																		
Convolvulus angustissimus subsp. *angustissimus*																																																		
Coopernookia strophiolata																				x							x																							
Crassula colorata var. *colorata*																																																		
Cratystylis conocephala		x	x	x	x	x	x	x		x	x	x	x	x			x		x						x		x	x		x	x				x	x		x							x	x	x			x
Cryptandra aridicola																										x													x		x		x	x						
Cryptandra ?crispula (P3)																																																		
Cryptandra minutifolia subsp. *brevistyla*																																																		
Cryptandra recurva																																																		
* *Cucumis myriocarpus*																																																		
Cullen discolor																																																		
Dampiera lavandulacea																																																		
Dampiera tenuicaulis																																																		
Daviesia benthamii																																																		
Daviesia benthamii subsp. *acanthoclona*				x					x	x					x	x											x			x							x													
Daviesia sp.																																																		
Dianella revoluta																																							x				x	x						
Dillwynia sp. Coolgardie (V.E. Sands 637.3. 1)																																																		
Dillwynia sp.																																																		
Diocirea ternata						x						x														x		x	x																					
Dodonaea adenophora																																																		
Dodonaea lobulata																																																		
Dodonaea microzyga var. *acrolobata*																																																		
Dodonaea stenozyga																																																x		
Dodonaea viscosa subsp. *angustissima*																																																		
Dodonaea sp.																																																		
Enchylaena tomentosa						x	x					x	x																									x												
Enchylaena tomentosa var. *tomentosa*					x						x													x																										x
Enneapogon avenaceus																								x																										
Enneapogon caerulescens																																																		
Enneapogon sp.																																x																		
Eragrostis australasica																																																		
Eragrostis dielsii																						x																												
Eremophila alternifolia					x				x		x				x				x					x		x			x		x				x	x						x								
Eremophila caperata																					x																			x										
Eremophila decipiens subsp. *decipiens*				x	x	x				x	x	x							x			x				x		x	x		x							x	x				x							
Eremophila dempsteri																											x	x	x	x															x					
Eremophila deserti								x						x																		x				x		x			x									
Eremophila gibbosa																																																		
Eremophila interstans																																			x	x														x
Eremophila ionantha	x		x			x						x				x					x				x							x						x			x									
Eremophila oblonga																		x			x																										x			

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Eremophila psilocalyx																																																		
Eremophila rugosa																																																		
Eremophila saligna						x						x																						x				x												
Eremophila scoparia	x	x	x	x		x	x	x	x	x		x	x	x	x	x	x		x		x				x		x	x	x	x	x	x		x	x		x			x					x		x			x
Eremophila sp.																										x		x	x	x							x													
Eriochiton sclerolaenoides						x	x					x	x											x	x						x				x			x												
* *Erodium aureum*																																																		
Eucalyptus calycogona subsp. *calycogona*																																													x					
Eucalyptus celastroides																																																		
Eucalyptus celastroides subsp. *celastroides*																																																		
Eucalyptus celastroides subsp. *virella*																									x																									
Eucalyptus clelandii																																								x										
Eucalyptus concinna																																																		
Eucalyptus cylindrocarpa																										x																								
Eucalyptus eremophila subsp. *eremophila*																																																		
Eucalyptus flocktoniae																x																																		
Eucalyptus flocktoniae subsp. *hebes*																																																		
Eucalyptus fraseri subsp. *fraseri*																		x																																
Eucalyptus gracilis			x	x						x																																								
Eucalyptus griffithsii																																							x				x	x		x				
Eucalyptus horistes																																																		
Eucalyptus incrassata																																																		
Eucalyptus ?*kumarlensis*																																											x	x						
Eucalyptus laevis																					x		x																											
Eucalyptus lesouefii																				x																										x		x		
Eucalyptus ?*longissima*																																																		
Eucalyptus ?*loxophleba* subsp. *lissophloia*																																																		
Eucalyptus moderata																																																		
Eucalyptus oleosa subsp. *oleosa*	x	x							x						x		x							x			x	x		x							x		x			x			x					
Eucalyptus optima																																																		
Eucalyptus polita																																																		
Eucalyptus prolixa																										x		x																						
Eucalyptus protensa								x						x																																				
Eucalyptus rigidula																															x																			
Eucalyptus salubris					x	x	x				x	x	x						x			x			x	x			x			x				x		x				x			x	x				x
Eucalyptus sheathiana																																																		
Eucalyptus spreta																							x	x					x						x															x
Eucalyptus transcontinentalis																																																		
Eucalyptus urna				x						x							x			x													x	x																
Eucalyptus websteriana subsp. *norsemanica* (P1)																																																		
Eucalyptus sp.	x						x	x	x				x	x	x			x									x		x	x							x										x			
Euphorbia drummondii								x						x								x														x														
Exocarpos aphyllus		x		x	x	x				x	x	x					x		x		x	x		x		x		x		x	x	x				x					x				x		x			
Frankenia desertorum																																																		
Frankenia sp.																																																		
Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)																																											x	x						
Geijera linearifolia		x		x	x	x	x	x		x	x	x	x	x			x		x			x		x	x			x			x	x				x								x	x			x		
Glischrocaryon angustifolium																																																		
Glischrocaryon aureum																																																		
Goodenia berardiana																																																		
Goodenia concinna																																																		
Goodenia ?*havilandii*																																																		
Goodenia pinnatifida																																																		
Goodenia quasilibera																																											x	x						
Goodenia sp.																																																x		
Grevillea acuaria																								x		x													x		x		x	x						
Grevillea anethifolia																																																		
Grevillea huegelii	x																				x																													
Grevillea plurijuga subsp. *plurijuga*																																																		
Grevillea teretifolia																																																		

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Grevillea sp.																																																		
Gyrostemon racemiger																																																		
Halgania anagalloides																																											x							
Halgania andromedifolia	x																																																	
Halgania cyanea																																																		
Halgania erecta																																																		
Halgania integerrima																																									x		x							
Halgania sp.																																																		
Haloragis dura																																																		
Haloragis gossei																																																		
Haloragis trigonocarpa																																																		
Hannafordia bissillii subsp. *latifolia*																																																		
Helichrysum luteoalbum																																																		
Hyalosperma demissum																																																		
Hybanthus epacroides																																																		
Hybanthus floribundus																																																		
Indigofera australis																																																		
Juncus pallidus																																																		
Lawrencia repens																																																		
Lawrencia ?squamata																																																		
Lepidium sp.																																																		
Lepidobolus deserti																																																		
Lepidosperma aff. *diurnum*																																																		
Lepidosperma sp.																																																		
Leptosema daviesioides																																																		
Leptospermum sp.																																																		
Leucochrysum fitzgibbonii																							x																											
Logania sp.																																																		
Lomandra collina																																																		
Lomandra effusa																																																		
Lotus cruentus																																																		
Lycium sp.																																																		
Maireana ?appressa																			x																	x														
Maireana carnosa																																																		
Maireana erioclada																									x																									
Maireana ?eriosphaera																																																		
Maireana georgei																																																		
Maireana ?marginata																																																		
Maireana pentatropis					x						x						x																								x				x					
Maireana radiata																											x			x															x					
Maireana sedifolia																																																		
Maireana suaedifolia																																																		
Maireana trichoptera					x	x					x	x											x		x	x																							x	
Maireana triptera					x						x															x																								
Maireana sp.																															x										x					x		x	x	x
Malvaceae sp.																			x																															
Marsdenia australis																																		x																
Marsilea hirsuta																																																		
* *Medicago ?sativa*																																																		
Melaleuca acuminata subsp. *acuminata*																																																		
Melaleuca eleuterostachya																																																		
Melaleuca fulgens subsp. *fulgens*																																																		
Melaleuca halmaturorum									x						x								x						x							x						x								
Melaleuca hamata																																																		
Melaleuca lanceolata																																																		
Melaleuca ?lateriflora																																																		
Melaleuca quadrifaria				x			x			x			x												x																									
Melaleuca sheathiana		x		x			x		x	x			x		x	x	x	x		x	x				x		x			x			x	x						x		x					x	x		
Melaleuca uncinata																																																		
Melaleuca ?zeteticorum																																																		

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Melaleuca sp.																																																		
Menkea australis																																																		
Microcybe multiflora subsp. *baccharoides*																x																																		
Microcybe multiflora subsp. *multiflora*																										x																								
Minuria leptophylla																																																		
Mirbelia depressa																																																		
Myoporum montanum																																																		
Myoporum platycarpum subsp. *platycarpum*																																																		
Myrtaceae sp.																																																		
Nicotiana goodspeedii																																																		
Nicotiana rotundifolia																																																		
Olearia dampieri subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628)																																																		
Olearia exiguifolia																																																		
Olearia muelleri	x	x	x	x	x		x		x	x	x		x		x	x	x		x	x	x		x	x	x	x	x	x	x	x		x	x	x	x	x	x	x		x	x	x			x	x	x	x	x	x
Olearia pimeleoides																								x																										
Panicum effusum																						x																												
Pelargonium australe																																																		
Phebalium canaliculatum																																																		
Phebalium lepidotum																																																		
Pimelea microcephala subsp. *microcephala*																						x																												
Pimelea trichostachya																																																		
Pimelea sp.																																																		
Pittosporum ?angustifolium																																																		
Platysace trachymenioides																																																		
Poaceae sp.																																																		
Podolepis canescens																																																		
Podolepis capillaris																																																		
Pogonolepis sp.																																																		
Poranthera microphylla																																																		
Poranthera triandra																																																		
Prostanthera althoferi subsp. *althoferi*																																																		
Pterostylis sp.																																							x									x		
Ptilotus carlsonii																																																		
Ptilotus drummondii																																											x	x						
Ptilotus drummondii var. *minor*																																																		
Ptilotus drummondii ?var. *scaposus*																																																		
Ptilotus holosericeus					x	x	x	x			x	x	x	x			x		x				x	x					x		x	x	x		x	x		x			x	x				x		x	x	x
Ptilotus nobilis						x						x																																						
Ptilotus obovatus					x						x																					x																		
Ptilotus spathulatus																						x																												
Ptilotus sp. Goldfields (R. Davis 10796)																																																		
Ptilotus sp.																																																		
Pultenaea elachista																					x																							x						
Pultenaea purpurea																																																		
Radyera farragei																																																		
Rhagodia crassifolia								x						x			x		x					x															x							x		x	x	
Rhagodia drummondii																																																		
Rhagodia eremaea																																																		
Rhagodia ulicina																						x																												
Rhagodia sp.																																																		
Rhodanthe chlorocephala subsp. *rosea*																																																		
Rhodanthe floribunda																																																		
Rhyncharrhena linearis																								x																										
Rytidosperma caespitosum																																																		
Salsola australis																																																		
* *Salvia verbenaca*																																																		
Santalum acuminatum		x						x						x					x		x	x	x		x			x				x				x		x			x	x			x	x				x
Santalum spicatum																																																		
Santalum sp.																																																		
Scaevola amblyanthera var. *centralis*																																																		

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Scaevola bursariifolia																x				x	x																													
Scaevola restiacea subsp. *divaricata*																																																		
Scaevola spinescens	x	x		x						x							x		x		x	x		x		x	x			x	x	x								x				x			x	x	x	
Scaevola sp.																																																		
Schenkia australis																																																		
* *Schismus arabicus*																																																		
Sclerolaena cuneata																																																		
Sclerolaena diacantha			x		x	x	x	x			x	x	x	x			x		x	x			x	x			x		x		x	x	x	x		x		x			x					x		x	x	x
Sclerolaena drummondii						x						x																													x									
Sclerolaena obliquicuspis																																																		
Sclerolaena parviflora																				x			x																											
Sclerolaena uniflora																																																		
Scrophulariaceae sp.																																																		
Senecio lacustrinus					x						x																																							
Senecio quadridentatus																																																		
Senecio sp.																																																		
Senna artemisioides subsp. *filifolia*	x		x			x		x				x		x				x	x			x		x		x					x	x						x			x		x	x	x		x			x
Senna artemisioides subsp. x *artemisioides*																																																		
Senna ?*cardiosperma*																																																		
Senna pleurocarpa var. *pleurocarpa*																																																		
Senna stowardii																																																		
Sida sp.																																																		
Solanum hoplopetalum																																																		
Solanum lasiophyllum																																																		
* *Solanum nigrum*																																																		
Solanum nummularium																																																		
Solanum plicatile																																																			
Solanum sp.																																																		
* *Sonchus oleraceus*																																																		
* *Sonchus sp.*																							x																											
Stackhousia monogyna																																																		
Stackhousia muricata																																																		
Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)																																																		
Stackhousia stratfordiae (P1)																																																		
Streptoglossa sp.																																																		
Swainsona sp.																																																		
Tecticornia sp.																																																		
Templetonia ceracea	x																																																	
Templetonia sp.																																																		
Tetratheca efoliata																																																		
Teucrium sessiliflorum																																																		
Thysanotus manglesianus																																																		
Thysanotus sp.																																x							x		x									
Trachymene pilosa																																																		
Trachymene ?*pyrophila* (P2)																																																		
Triodia irritans																					x																													
Triodia scariosa																										x													x											
Triodia ?*tomentosa*																																											x	x						
Triodia sp.																																																		
Trymalium myrtillus subsp. *myrtillus*																																																		
Velleia daviesii																																																		
Vittadinia dissecta var. *hirta*					x			x			x			x			x					x	x									x																		x
Vittadinia humerata																																																		
Wahlenbergia preissii																																																		
Wahlenbergia tumidifructa																																																		
Waitzia acuminata var. *acuminata*																	x																																	
Waitzia suaveolens var. *flava*																																																		
Waitzia suaveolens var. *suaveolens*																																																		
Westringia cephalantha																																																		
Westringia rigida									x						x	x		x			x													x			x				x		x	x						

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																
	S202	S203	S204	S205	S206	S207	S208	S209	S210	S205	S206	S207	S208	S209	S210	S211	S212	S213	S214	S215	S216	S217	S218	S219	S220	S221	S222	S223	S224	S225	S226	S227	S228	S229	S230	S231	S232	S233	S234	S235	S236	S237	S238	S240	S241	S242	S243	S244	S245	S246
Zygophyllum apiculatum																		x											x						x											x	x	x		
Zygophyllum aurantiacum								x						x								x																								x			x	
Zygophyllum eremaeum																															x																			
Zygophyllum glaucum	x		x	x			x		x	x			x		x	x	x			x	x		x		x					x			x	x						x		x			x					
Zygophyllum ovatum						x		x				x		x					x			x			x			x			x	x	x	x		x		x				x						x	x	x
Zygophyllum reticulatum																																																		
Zygophyllum tesquorum																																																		
Zygophyllum sp.																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S247	S248	S249	S250	S251	S252	S253	S254	S255	S256	S257	S258	S259	S260	S261	S262	S263	S264	S265	S266	S267	S268	S269	S270	S271	S272	S273	S274	S275	S276	S277	S278	S279	S280	S281	S282	S283	S284	S285	S286	S287	S288	S289	S290	S291	S292	S293	S294	S295	S296
Acacia acanthoclada subsp. *acanthoclada*																																																		
Acacia acoma																																																		x
Acacia acuminata (narrow phyllode variant)																																																		
Acacia andrewsii						x																																												
Acacia assimilis																																																		
Acacia assimilis subsp. *assimilis*																																																		
Acacia assimilis subsp. *atroviridis*																																																		
Acacia burkittii																			x		x																													
Acacia camptoclada																																																		
Acacia colletioides																														x																				
Acacia densiflora																																																		
Acacia enervia subsp. *explicata*																																																		
Acacia eremophila var. *eremophila*																																																		
Acacia erinacea						x													x		x			x												x														
Acacia evenulosa																																																		
Acacia hemiteles							x	x	x	x						x			x		x			x					x	x	x	x				x	x				x			x		x				x
Acacia hystrix subsp. *continua* (P1)																																																		
Acacia hystrix subsp. *hystrix*																																																		
Acacia merrallii																																																		
Acacia oswaldii						x																																												
Acacia rigens																																																		
Acacia tetragonophylla																																																		
Acacia sp.																																																		
Acacia uncinella																																																		
Acacia verricula																																																		
Actinobole uliginosum																																																		
Allocasuarina campestris																																																		
Allocasuarina helmsii							x												x		x																													
Allocasuarina sp.																																																		
Alyogyne sp. Shark Bay (D.J. Edinger 6212)																																																		
Alyxia buxifolia			x				x												x		x					x	x		x		x					x			x		x				x	x	x			
Amphipogon caricinus var. *caricinus*																																																		
Amphipogon sp.							x																																											
Angianthus tomentosus			x																																															
Aotus sp. Tortile (G.J. Keighery 3767)																																																		
Aotus sp.																																																		
Arabidella chrysodema																							x																											
Arabidella trisecta																																																		
Arabidella sp.																																																		
Aristida contorta																								x																										
Aristida ?*holathera*																																																		
Asteraceae sp.																																																		
Asteridea athrixioides																									x																									
Atriplex acutibractea subsp. *karoniensis*																																																		
Atriplex nummularia																		x																																
Atriplex vesicaria				x							x						x								x																	x	x							
Atriplex sp.	x		x	x	x				x		x	x	x	x		x	x	x				x			x									x				x								x	x		x	
Austrostipa elegantissima		x	x										x	x																																	x			
Austrostipa hemipogon																													x		x												x			x	x			
Austrostipa mollis																																																		
Austrostipa nitida																						x																												
Austrostipa platychaeta								x							x													x	x			x									x	x	x	x						
Austrostipa scabra subsp. *scabra*					x				x				x			x																																		
Austrostipa sp.				x	x				x		x	x				x								x										x				x		x									x	
Beyeria lechenaultii																																																		
Beyeria sp.							x																																											
Boronia fabianoides subsp. *fabianoides*																																																		
Bossiaea leptacantha																																																		
Bossiaea sp.																																																		
Brachyscome ciliaris var. *ciliaris*																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S247	S248	S249	S250	S251	S252	S253	S254	S255	S256	S257	S258	S259	S260	S261	S262	S263	S264	S265	S266	S267	S268	S269	S270	S271	S272	S273	S274	S275	S276	S277	S278	S279	S280	S281	S282	S283	S284	S285	S286	S287	S288	S289	S290	S291	S292	S293	S294	S295	S296
Brachyscome iberidifolia																																																		
* *Brassica* sp.																																																		
Calandrinia eremaea														x																																				
Calandrinia porifera																																																			
Calandrinia sp.																																																		
Calothamnus gilesii																																																		
Calotis hispidula																																															x			
* *Centaurea melitensis*																																																		
Centipeda crateriformis																																																		
Centrolepis polygyna																																																		
Cheilanthes sieberi subsp. *sieberi*																																																		
Chenopodiaceae sp.																																														x	x			
Chenopodium curvispicatum											x																															x							x	
Chenopodium sp.																																																		
Chrysocephalum apiculatum																																																		
Codonocarpus cotinifolius																																																		
Comesperma polygaloides																																																		
Commersonia craurophylla																																																		
Convolvulaceae sp.																																																		
Convolvulus angustissimus subsp. *angustissimus*																																																		
Coopernookia strophiolata																																					x													x
Crassula colorata var. *colorata*																																																		
Cratystylis conocephala	x	x	x	x				x	x		x	x	x	x	x		x			x		x			x				x		x	x		x				x		x			x			x	x		x	
Cryptandra aridicola						x	x												x		x			x									x									x								
Cryptandra ?*crispula* (P3)																																																		
Cryptandra minutifolia subsp. *brevistyla*																																																		
Cryptandra recurva																																																		
* *Cucumis myriocarpus*																																																		
Cullen discolor																																																		
Dampiera lavandulacea																																																		
Dampiera tenuicaulis																																																		
Daviesia benthamii																																																		
Daviesia benthamii subsp. *acanthoclona*										x					x															x		x	x																	x
Daviesia sp.																																																		
Dianella revoluta						x	x																																											
Dillwynia sp. Coolgardie (V.E. Sands 637.3. 1)																																																		
Dillwynia sp.																																																		
Diocirea ternata														x						x						x	x			x											x			x						
Dodonaea adenophora																																																		
Dodonaea lobulata																																																		
Dodonaea microzyga var. *acrolobata*																																																		
Dodonaea stenozyga																					x			x																										
Dodonaea viscosa subsp. *angustissima*																																																		
Dodonaea sp.																																																		
Enchylaena tomentosa																																			x										x					
Enchylaena tomentosa var. *tomentosa*	x								x									x							x									x									x						x	
Enneapogon avenaceus																																																		
Enneapogon caerulescens																																																		
Enneapogon sp.									x																																									
Eragrostis australasica																																																		
Eragrostis dielsii																							x																											
Eremophila alternifolia			x							x				x										x														x												
Eremophila caperata										x																				x										x										
Eremophila decipiens subsp. *decipiens*			x	x	x	x	x		x							x		x	x	x	x					x	x	x		x		x		x	x	x		x									x		x	
Eremophila dempsteri			x					x						x	x							x													x															x
Eremophila deserti																								x																										
Eremophila gibbosa																																																		
Eremophila interstans																	x																					x												
Eremophila ionantha											x					x		x		x			x			x	x	x		x		x		x		x						x					x			
Eremophila oblonga																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S247	S248	S249	S250	S251	S252	S253	S254	S255	S256	S257	S258	S259	S260	S261	S262	S263	S264	S265	S266	S267	S268	S269	S270	S271	S272	S273	S274	S275	S276	S277	S278	S279	S280	S281	S282	S283	S284	S285	S286	S287	S288	S289	S290	S291	S292	S293	S294	S295	S296
Eremophila psilocalyx																																																		
Eremophila rugosa																																																		
Eremophila saligna																																																		
Eremophila scoparia	x	x			x						x		x		x	x				x		x			x	x	x			x		x			x	x		x	x	x		x	x	x		x		x		x
Eremophila sp.																																																		
Eriochiton sclerolaenoides																																				x														
* *Erodium aureum*																																																		
Eucalyptus calycogona subsp. *calycogona*																																			x						x			x						
Eucalyptus celastroides												x																																						
Eucalyptus celastroides subsp. *celastroides*																																																		
Eucalyptus celastroides subsp. *virella*																																														x				
Eucalyptus clelandii								x							x																																	x		
Eucalyptus concinna																																																		
Eucalyptus cylindrocarpa																																																		
Eucalyptus eremophila subsp. *eremophila*																																																		
Eucalyptus flocktoniae																																																		
Eucalyptus flocktoniae subsp. *hebes*																																																		
Eucalyptus fraseri subsp. *fraseri*																																																		
Eucalyptus gracilis																																						x												
Eucalyptus griffithsii						x																		x																										
Eucalyptus horistes																																																		
Eucalyptus incrassata																																																		
Eucalyptus ?*kumarlensis*																																																		
Eucalyptus laevis																						x																				x	x							x
Eucalyptus lesouefii	x	x											x																x	x	x	x				x			x						x	x				
Eucalyptus ?*longissima*																																																		
Eucalyptus ?*loxophleba* subsp. *lissophloia*																																																		
Eucalyptus moderata																																																		
Eucalyptus oleosa subsp. *oleosa*						x				x			x			x	x		x		x	x			x				x		x	x					x					x	x					x		
Eucalyptus optima																																																		
Eucalyptus polita																																																		
Eucalyptus prolixa			x																																															
Eucalyptus protensa																																																		
Eucalyptus rigidula																																																		
Eucalyptus salubris		x		x	x		x		x		x	x		x		x		x				x	x			x	x	x						x	x			x			x	x	x	x	x	x	x		x	
Eucalyptus sheathiana																																																		
Eucalyptus spreta	x																													x																				
Eucalyptus transcontinentalis																																																		
Eucalyptus urna																																x							x						x					
Eucalyptus websteriana subsp. *norsemanica* (P1)																																																		
Eucalyptus sp.								x							x					x																	x													x
Euphorbia drummondii				x	x				x																																									
Exocarpos aphyllus			x	x	x	x			x	x			x	x				x	x		x	x				x	x	x						x	x		x		x		x	x	x			x	x	x	x	
Frankenia desertorum																																																		
Frankenia sp.																																																		
Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)																																																		
Geijera linearifolia				x	x			x	x					x					x		x	x				x	x		x			x						x		x		x	x			x	x			
Glischrocaryon angustifolium																																																		
Glischrocaryon aureum																																																		
Goodenia berardiana																																																		
Goodenia concinna																								x																										
Goodenia ?*havilandii*							x																																											
Goodenia pinnatifida																																																		
Goodenia quasilibera																																																		
Goodenia sp.																									x																									
Grevillea acuaria							x																			x	x																							
Grevillea anethifolia																																																		
Grevillea huegelii																																																		
Grevillea plurijuga subsp. *plurijuga*																																																		
Grevillea teretifolia																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S247	S248	S249	S250	S251	S252	S253	S254	S255	S256	S257	S258	S259	S260	S261	S262	S263	S264	S265	S266	S267	S268	S269	S270	S271	S272	S273	S274	S275	S276	S277	S278	S279	S280	S281	S282	S283	S284	S285	S286	S287	S288	S289	S290	S291	S292	S293	S294	S295	S296
Grevillea sp.																																																		
Gyrostemon racemiger																																																		
Halgania anagalloides																																																		
Halgania andromedifolia																																																		
Halgania cyanea																																																		
Halgania erecta																																																		
Halgania integerrima																								x																										
Halgania sp.																																																		
Haloragis dura																																																		
Haloragis gossei																																																			
Haloragis trigonocarpa																																																		
Hannafordia bissillii subsp. *latifolia*																																																		
Helichrysum luteoalbum																																																		
Hyalosperma demissum																																																		
Hybanthus epacroides																																																		
Hybanthus floribundus																																																		
Indigofera australis																																																		
Juncus pallidus																																																		
Lawrencia repens			x																																															
Lawrencia ?*squamata*																																																		
Lepidium sp.																																																		
Lepidobolus deserti																																																		
Lepidosperma aff. *diurnum*																																																		
Lepidosperma sp.																																																		
Leptosema daviesioides																																																		
Leptospermum sp.																																																		
Leucochrysum fitzgibbonii																																																		
Logania sp.																							x																											
Lomandra collina																																																		
Lomandra effusa																																																		
Lotus cruentus																																																		
Lycium sp.																																																		
Maireana ?*appressa*																																																x		
Maireana carnosa																																																		
Maireana erioclada																																						x											x	
Maireana ?*eriosphaera*													x																																					
Maireana georgei																																												x						
Maireana ?*marginata*																																																		
Maireana pentatropis					x								x	x				x				x																									x			
Maireana radiata			x					x						x															x																					
Maireana sedifolia																																			x															
Maireana suaedifolia																																																		
Maireana trichoptera			x																										x		x																			
Maireana triptera																																									x		x							
Maireana sp.				x	x				x			x						x						x	x	x	x							x				x											x	
Malvaceae sp.				x	x											x																																		
Marsdenia australis																																																		
Marsilea hirsuta																																																		
* *Medicago* ?*sativa*																							x																											
Melaleuca acuminata subsp. *acuminata*																																												x						
Melaleuca eleuterostachya																					x																													
Melaleuca fulgens subsp. *fulgens*																																																		
Melaleuca halmaturorum	x									x																				x		x								x				x						
Melaleuca hamata																																																		
Melaleuca lanceolata																																																		
Melaleuca ?*lateriflora*																																																		
Melaleuca quadrifaria																																													x					
Melaleuca sheathiana								x							x					x									x		x				x		x		x						x			x		
Melaleuca uncinata																																																		
Melaleuca ?*zeteticorum*																																																		

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Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
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Melaleuca sp.																																																		
Menkea australis																																																		
Microcybe multiflora subsp. *baccharoides*																																																		
Microcybe multiflora subsp. *multiflora*																																																		
Minuria leptophylla																																																		
Mirbelia depressa																																																		
Myoporum montanum																																																		
Myoporum platycarpum subsp. *platycarpum*																x																																		
Myrtaceae sp.																																																		
Nicotiana goodspeedii																																																		
Nicotiana rotundifolia																																																		
Olearia dampieri subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628)																																																		
Olearia exiguifolia																																																		
Olearia muelleri	x	x			x			x	x	x	x		x	x	x		x	x		x	x	x			x	x	x	x	x	x	x	x			x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
Olearia pimeleoides																																																		
Panicum effusum																																																		
Pelargonium australe																																																		
Phebalium canaliculatum							x																																											
Phebalium lepidotum																																																		
Pimelea microcephala subsp. *microcephala*																																																		
Pimelea trichostachya																																																		
Pimelea sp.																																																		
Pittosporum ?angustifolium																																																		
Platysace trachymenioides																																																		
Poaceae sp.																																																		
Podolepis canescens																																																		
Podolepis capillaris																																																		
Pogonolepis sp.																																																		
Poranthera microphylla																																																		
Poranthera triandra																																																		
Prostanthera althoferi subsp. *althoferi*						x	x																																											
Pterostylis sp.																																																		
Ptilotus carlsonii																																																		
Ptilotus drummondii																																																		
Ptilotus drummondii var. *minor*																																																		
Ptilotus drummondii ?var. *scaposus*																																																		
Ptilotus holosericeus	x		x	x					x		x			x			x	x				x	x			x	x							x				x		x	x	x	x	x					x	
Ptilotus nobilis				x																																														
Ptilotus obovatus																x																															x			
Ptilotus spathulatus																		x					x					x						x																
Ptilotus sp. Goldfields (R. Davis 10796)																																																		
Ptilotus sp.					x																																													
Pultenaea elachista						x																																												
Pultenaea purpurea																																																		
Radyera farragei																																																		
Rhagodia crassifolia					x				x			x	x	x			x																					x					x							
Rhagodia drummondii																																																		
Rhagodia eremaea																																																		
Rhagodia ulicina																																																		
Rhagodia sp.																													x																					
Rhodanthe chlorocephala subsp. *rosea*																																																		
Rhodanthe floribunda																																																		
Rhyncharrhena linearis																										x	x																							
Rytidosperma caespitosum																																																		
Salsola australis																																																		
* *Salvia verbenaca*																																																		
Santalum acuminatum								x	x			x		x		x						x				x	x			x		x						x			x			x		x	x			
Santalum spicatum														x																																				
Santalum sp.															x														x		x																		
Scaevola amblyanthera var. *centralis*																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S247	S248	S249	S250	S251	S252	S253	S254	S255	S256	S257	S258	S259	S260	S261	S262	S263	S264	S265	S266	S267	S268	S269	S270	S271	S272	S273	S274	S275	S276	S277	S278	S279	S280	S281	S282	S283	S284	S285	S286	S287	S288	S289	S290	S291	S292	S293	S294	S295	S296
Scaevola bursariifolia																																																		
Scaevola restiacea subsp. *divaricata*																																																		
Scaevola spinescens					x			x					x					x								x	x	x	x	x	x	x				x	x	x			x	x	x			x	x		x	x
Scaevola sp.																																																		
Schenkia australis																																																		
* *Schismus arabicus*																																																		
Sclerolaena cuneata																												x																						
Sclerolaena diacantha	x	x	x	x	x				x		x		x	x		x	x	x							x	x	x	x						x						x		x	x		x	x	x		x	
Sclerolaena drummondii			x						x					x																				x							x						x			
Sclerolaena obliquicuspis				x																																														
Sclerolaena parviflora																																								x										
Sclerolaena uniflora																				x										x					x	x					x			x						
Scrophulariaceae sp.																																																		
Senecio lacustrinus																																																		
Senecio quadridentatus																																																		
Senecio sp.																																																		
Senna artemisioides subsp. *filifolia*		x			x	x			x	x				x	x	x						x		x				x		x		x				x	x					x	x	x			x	x	x	x
Senna artemisioides subsp. x *artemisioides*																																																		
Senna ?cardiosperma																																																		
Senna pleurocarpa var. *pleurocarpa*																																																		
Senna stowardii																																																		
Sida sp.																																																		
Solanum hoplopetalum																													x		x																			
Solanum lasiophyllum																																																		
* *Solanum nigrum*																																																		
Solanum nummularium																																																		
Solanum plicatile																																																		
Solanum sp.																																																		
* *Sonchus oleraceus*																																																		
* *Sonchus sp.*																																																		
Stackhousia monogyna																																																		
Stackhousia muricata																																																		
Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)																																																		
Stackhousia stratfordiae (P1)																																																		
Streptoglossa sp.																																																		
Swainsona sp.																																																			
Tecticornia sp.																																																			
Templetonia ceracea																																																		
Templetonia sp.																																																		
Tetratheca efoliata																																																		
Teucrium sessiliflorum																																																		
Thysanotus manglesianus																																																		
Thysanotus sp.							x																																											
Trachymene pilosa																																																		
Trachymene ?pyrophila (P2)																																																		
Triodia irritans																																																		
Triodia scariosa						x	x												x		x												x			x														
Triodia ?tomentosa																								x																										
Triodia sp.																																																		
Trymalium myrtillus subsp. *myrtillus*							x																																											
Velleia daviesii																																																		
Vittadinia dissecta var. *hirta*					x				x														x		x			x	x		x												x							
Vittadinia humerata																																																		
Wahlenbergia preissii																																																		
Wahlenbergia tumidifructa																																																		
Waitzia acuminata var. *acuminata*																																																		
Waitzia suaveolens var. *flava*																																																		
Waitzia suaveolens var. *suaveolens*																																																		
Westringia cephalantha																																																		
Westringia rigida						x	x			x									x		x			x						x						x														x

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Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S247	**S248**	**S249**	**S250**	**S251**	**S252**	**S253**	**S254**	**S255**	**S256**	**S257**	**S258**	**S259**	**S260**	**S261**	**S262**	**S263**	**S264**	**S265**	**S266**	**S267**	**S268**	**S269**	**S270**	**S271**	**S272**	**S273**	**S274**	**S275**	**S276**	**S277**	**S278**	**S279**	**S280**	**S281**	**S282**	**S283**	**S284**	**S285**	**S286**	**S287**	**S288**	**S289**	**S290**	**S291**	**S292**	**S293**	**S294**	**S295**	**S296**
Zygophyllum apiculatum	x					x					x	x	x	x			x	x						x		x	x	x		x		x		x	x					x					x		x			
Zygophyllum aurantiacum													x																																					
Zygophyllum eremaeum			x																																														x	
Zygophyllum glaucum								x		x					x							x							x		x							x	x						x	x		x		
Zygophyllum ovatum			x	x					x			x	x	x		x								x		x	x											x			x	x	x				x			
Zygophyllum reticulatum																																										x								
Zygophyllum tesquorum																																																		
Zygophyllum sp.																																																		

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Species	Site																																																	
	S297	S298	S299	S300	S301	S302	S303	S304	S305	S306	S307	S308	S309	S310	S311	S312	S313	S314	S315	S316	S317	S318	S319	S320	S321	S322	S323	S324	S325	S326	S327	S328	S329	S330	S331	S332	S333	S334	S335	S336	S339	S340	S341	S342	S343	S344	S345	S346	S347	S348
Acacia acanthoclada subsp. *acanthoclada*																																																		
Acacia acoma																																																		
Acacia acuminata (narrow phyllode variant)																																																		
Acacia andrewsii																																																		
Acacia assimilis																																																		
Acacia assimilis subsp. *assimilis*																																																		
Acacia assimilis subsp. *atroviridis*																																																		
Acacia burkittii																																																		
Acacia camptoclada																																																		
Acacia colletioides																																x																		
Acacia densiflora																																																		
Acacia enervia subsp. *explicata*																		x																																
Acacia eremophila var. *eremophila*																																																		
Acacia erinacea										x					x		x		x										x							x								x						
Acacia evenulosa																																																		
Acacia hemiteles	x									x					x			x			x						x					x						x							x	x			x	
Acacia hystrix subsp. *continua* (P1)																																																		
Acacia hystrix subsp. *hystrix*																																																		
Acacia merrallii														x															x					x		x				x										
Acacia oswaldii																																																		
Acacia rigens																																																		
Acacia tetragonophylla																																																		
Acacia sp.																															x																			
Acacia uncinella																																																		
Acacia verricula																																																		
Actinobole uliginosum	x																																																	
Allocasuarina campestris																																																		
Allocasuarina helmsii										x																																								
Allocasuarina sp.																																																		
Alyogyne sp. Shark Bay (D.J. Edinger 6212)																																																		
Alyxia buxifolia				x			x	x	x				x		x				x					x			x								x						x		x	x				x		
Amphipogon caricinus var. *caricinus*																																																		
Amphipogon sp.																																																		
Angianthus tomentosus	x																																																	
Aotus sp. Tortile (G.J. Keighery 3767)																																																		
Aotus sp.																																																		
Arabidella chrysodema	x																																																	
Arabidella trisecta																																																		
Arabidella sp.																																																		
Aristida contorta																																																		
Aristida ?*holathera*																																																		
Asteraceae sp.																																																		
Asteridea athrixioides																																																		
Atriplex acutibractea subsp. *karoniensis*																																																		
Atriplex nummularia																																																		
Atriplex vesicaria			x				x	x	x							x				x		x						x																						
Atriplex sp.	x				x			x	x				x	x				x			x		x	x			x	x		x			x	x	x		x					x	x	x			x			
Austrostipa elegantissima			x					x	x													x					x																			x				
Austrostipa hemipogon			x				x	x	x					x		x						x																												
Austrostipa mollis																																																		
Austrostipa nitida																																																		
Austrostipa platychaeta			x	x					x					x		x																		x		x									x					
Austrostipa scabra subsp. *scabra*																											x																							
Austrostipa sp.					x										x		x				x			x				x		x					x		x						x					x		
Beyeria lechenaultii																																																		
Beyeria sp.																																																		
Boronia fabianoides subsp. *fabianoides*																																																		
Bossiaea leptacantha																																				x														
Bossiaea sp.																																								x										
Brachyscome ciliaris var. *ciliaris*																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

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Species	Site																																																	
	S297	S298	S299	S300	S301	S302	S303	S304	S305	S306	S307	S308	S309	S310	S311	S312	S313	S314	S315	S316	S317	S318	S319	S320	S321	S322	S323	S324	S325	S326	S327	S328	S329	S330	S331	S332	S333	S334	S335	S336	S339	S340	S341	S342	S343	S344	S345	S346	S347	S348
Brachyscome iberidifolia																																																		
**Brassica* sp.																																																		
Calandrinia eremaea																																																		
Calandrinia porifera																																																		
Calandrinia sp.																																																		
Calothamnus gilesii																																																		
Calotis hispidula	x		x																																															
**Centaurea melitensis*																																																		
Centipeda crateriformis																																																		
Centrolepis polygyna																																																		
Cheilanthes sieberi subsp. *sieberi*																																																		
Chenopodiaceae sp.																																																		
Chenopodium curvispicatum								x					x								x							x																						
Chenopodium sp.																																																		
Chrysocephalum apiculatum																																																		
Codonocarpus cotinifolius																																																		
Comesperma polygaloides																																																		
Commersonia craurophylla																																																		
Convolvulaceae sp.																																																		
Convolvulus angustissimus subsp. *angustissimus*																																																		
Coopernookia strophiolata																																																		
Crassula colorata var. *colorata*																																																		
Cratystylis conocephala	x		x				x	x				x	x	x		x						x	x	x	x	x	x	x		x			x	x	x		x					x	x	x		x		x	x	
Cryptandra aridicola										x																																								
Cryptandra ?*crispula* (P3)																																																		
Cryptandra minutifolia subsp. *brevistyla*																																																		
Cryptandra recurva																																																		
**Cucumis myriocarpus*																																																		
Cullen discolor																																																		
Dampiera lavandulacea																																																		
Dampiera tenuicaulis																																																		
Daviesia benthamii																																																		
Daviesia benthamii subsp. *acanthoclona*		x								x																			x		x	x				x											x			
Daviesia sp.																																																		
Dianella revoluta																																																		
Dillwynia sp. Coolgardie (V.E. Sands 637.3. 1)										x																																								
Dillwynia sp.																																																		
Diocirea ternata										x																						x													x					
Dodonaea adenophora																																																		
Dodonaea lobulata									x													x																												
Dodonaea microzyga var. *acrolobata*																																																		
Dodonaea stenozyga											x				x				x																															
Dodonaea viscosa subsp. *angustissima*																																																		
Dodonaea sp.																																																		
Enchylaena tomentosa			x						x																																									
Enchylaena tomentosa var. *tomentosa*					x		x						x					x									x	x		x												x		x	x					
Enneapogon avenaceus																																																		
Enneapogon caerulescens																																																		
Enneapogon sp.																																																		
Eragrostis australasica																																																		
Eragrostis dielsii	x																																																	
Eremophila alternifolia													x		x									x																		x	x	x					x	
Eremophila caperata		x							x																x						x	x				x														
Eremophila decipiens subsp. *decipiens*	x	x						x	x								x	x		x	x	x		x			x	x		x	x	x				x		x				x		x	x					
Eremophila dempsteri														x									x															x							x					
Eremophila deserti			x																								x			x												x								
Eremophila gibbosa																																																		
Eremophila interstans													x		x																																			
Eremophila ionantha	x									x				x			x		x						x		x				x	x	x	x				x	x						x	x				
Eremophila oblonga																																																		

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Species	Site																																																	
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Eremophila psilocalyx																																																		
Eremophila rugosa																																																		
Eremophila saligna																																																		
Eremophila scoparia		x	x	x		x	x	x	x		x	x				x				x				x	x		x				x	x		x	x	x	x			x	x	x	x	x		x	x		x	x
Eremophila sp.																																																	x	
Eriochiton sclerolaenoides							x																	x																										
**Erodium aureum*																																																		
Eucalyptus calycogona subsp. *calycogona*														x					x															x					x							x				
Eucalyptus celastroides					x							x	x		x									x											x		x							x						
Eucalyptus celastroides subsp. *celastroides*																																																		
Eucalyptus celastroides subsp. *virella*																																																		
Eucalyptus clelandii											x					x										x															x						x	x		
Eucalyptus concinna																																																		
Eucalyptus cylindrocarpa																																					x													
Eucalyptus eremophila subsp. *eremophila*																																																		
Eucalyptus flocktoniae																															x																			
Eucalyptus flocktoniae subsp. *hebes*																																																		
Eucalyptus fraseri subsp. *fraseri*																																																		
Eucalyptus gracilis		x									x																																						x	
Eucalyptus griffithsii																																																		
Eucalyptus horistes																																																		
Eucalyptus incrassata																															x									x										
Eucalyptus ?*kumarlensis*																																																		
Eucalyptus laevis																																																		
Eucalyptus lesouefii				x		x										x				x		x										x	x																	
Eucalyptus ?*longissima*																																																		
Eucalyptus ?*loxophleba* subsp. *lissophloia*																																																		
Eucalyptus moderata																																																		
Eucalyptus oleosa subsp. *oleosa*					x		x			x		x									x				x	x			x				x	x	x	x	x				x						x	x		
Eucalyptus optima																																																		
Eucalyptus polita																																																		
Eucalyptus prolixa																																																		
Eucalyptus protensa																																																		
Eucalyptus rigidula																															x									x										
Eucalyptus salubris	x	x	x			x	x	x	x				x	x	x		x	x			x	x		x			x	x		x				x				x	x			x	x	x	x	x				
Eucalyptus sheathiana																																																		
Eucalyptus spreta							x	x															x									x																		x
Eucalyptus transcontinentalis																																																		
Eucalyptus urna						x																																			x									
Eucalyptus websteriana subsp. *norsemanica* (P1)																																																		
Eucalyptus sp.																																																		
Euphorbia drummondii																												x																						
Exocarpos aphyllus	x						x		x		x			x	x		x		x		x			x			x		x	x	x	x			x				x			x		x		x		x	x	x
Frankenia desertorum																																																		
Frankenia sp.																																																			
Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)																																																		
Geijera linearifolia	x		x				x	x	x				x	x	x				x			x		x				x							x							x		x	x			x		
Glischrocaryon angustifolium																																																		
Glischrocaryon aureum																																																		
Goodenia berardiana																																																		
Goodenia concinna											x																													x										
Goodenia ?*havilandii*																																																		
Goodenia pinnatifida																																																		
Goodenia quasilibera																																																		
Goodenia sp.																																																		
Grevillea acuaria																			x										x																					
Grevillea anethifolia																																																		
Grevillea huegelii																																				x														x
Grevillea plurijuga subsp. *plurijuga*																																																		
Grevillea teretifolia		x																																						x										

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Grevillea sp.																																																		
Gyrostemon racemiger																																																		
Halgania anagalloides																																																		
Halgania andromedifolia																													x																					x
Halgania cyanea																																																		
Halgania erecta																																																		
Halgania integerrima																																																		
Halgania sp.										x																																								
Haloragis dura																																																		
Haloragis gossei																																																		
Haloragis trigonocarpa																																																		
Hannafordia bissillii subsp. *latifolia*																																																		
Helichrysum luteoalbum																																																		
Hyalosperma demissum																																																		
Hybanthus epacroides																																																		
Hybanthus floribundus																																																		
Indigofera australis																																																		
Juncus pallidus																																																		
Lawrencia repens	x																																																	
Lawrencia ?squamata	x																																																	
Lepidium sp.																																																		
Lepidobolus deserti																																																		
Lepidosperma aff. *diurnum*																																																		
Lepidosperma sp.																																																		
Leptosema daviesioides																																																		
Leptospermum sp.																																																		
Leucochrysum fitzgibbonii																																																		
Logania sp.																																																		
Lomandra collina																																																		
Lomandra effusa																																																		
Lotus cruentus																																																		
Lycium sp.																																																		
Maireana ?appressa																					x			x		x																					x			
Maireana carnosa																																																		
Maireana erioclada												x	x																																			x		
Maireana ?eriosphaera																		x											x																					
Maireana georgei																																		x																
Maireana ?marginata																																																		
Maireana pentatropis			x				x	x	x					x			x										x	x					x		x												x			
Maireana radiata																																																		
Maireana sedifolia			x										x																																					
Maireana suaedifolia													x																																					
Maireana trichoptera			x																				x										x												x					
Maireana triptera			x				x		x																																									
Maireana sp.					x								x		x		x		x								x	x									x					x		x		x				
Malvaceae sp.																																																		
Marsdenia australis																																																		
Marsilea hirsuta																																																		
* *Medicago ?sativa*																																																		
Melaleuca acuminata subsp. *acuminata*																																																		
Melaleuca eleuterostachya																																																		
Melaleuca fulgens subsp. *fulgens*																																																		
Melaleuca halmaturorum										x	x														x			x	x			x																		
Melaleuca hamata																																																		
Melaleuca lanceolata																																																		
Melaleuca ?lateriflora																																																		
Melaleuca quadrifaria																																	x																	
Melaleuca sheathiana				x		x					x												x			x			x												x						x	x	x	x
Melaleuca uncinata																																																		
Melaleuca ?zeteticorum																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																																	
	S297	S298	S299	S300	S301	S302	S303	S304	S305	S306	S307	S308	S309	S310	S311	S312	S313	S314	S315	S316	S317	S318	S319	S320	S321	S322	S323	S324	S325	S326	S327	S328	S329	S330	S331	S332	S333	S334	S335	S336	S339	S340	S341	S342	S343	S344	S345	S346	S347	S348
Melaleuca sp.																																																		
Menkea australis																																																		
Microcybe multiflora subsp. *baccharoides*																																																		
Microcybe multiflora subsp. *multiflora*																																																		
Minuria leptophylla																																																		
Mirbelia depressa																																																		
Myoporum montanum																																																		
Myoporum platycarpum subsp. *platycarpum*																		x																																
Myrtaceae sp.																																																		
Nicotiana goodspeedii																																																		
Nicotiana rotundifolia																																																		
Olearia dampieri subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628)																																																		
Olearia exiguifolia																																																		
Olearia muelleri	x		x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x		x		x	x	x	x	x	x			x		x	x	x	x			x	x	x
Olearia pimeleoides																																																		
Panicum effusum																																																		
Pelargonium australe																																																		
Phebalium canaliculatum																																																		
Phebalium lepidotum																																																		
Pimelea microcephala subsp. *microcephala*											x																																							
Pimelea trichostachya																																																		
Pimelea sp.																																																		
Pittosporum ?*angustifolium*																								x																										
Platysace trachymenioides																																																		
Poaceae sp.																		x	x																															
Podolepis canescens																																																		
Podolepis capillaris																																																		
Pogonolepis sp.																																																		
Poranthera microphylla																																																		
Poranthera triandra																																																		
Prostanthera althoferi subsp. *althoferi*																																																		
Pterostylis sp.																																																		
Ptilotus carlsonii																																																		
Ptilotus drummondii																																																		
Ptilotus drummondii var. *minor*																																																		
Ptilotus drummondii ?var. *scaposus*																																																		
Ptilotus holosericeus			x			x	x	x									x		x	x	x	x		x		x	x	x		x				x					x				x		x	x				
Ptilotus nobilis																																							x											
Ptilotus obovatus																		x									x																							
Ptilotus spathulatus																																																		
Ptilotus sp. Goldfields (R. Davis 10796)																																																		
Ptilotus sp.																																																		
Pultenaea elachista																																																		
Pultenaea purpurea																																																		
Radyera farragei																																																		
Rhagodia crassifolia			x		x		x	x	x			x				x		x		x		x		x									x	x			x				x	x	x				x	x		
Rhagodia drummondii	x																																																	
Rhagodia eremaea																																																		
Rhagodia ulicina																																																		
Rhagodia sp.																																																		
Rhodanthe chlorocephala subsp. *rosea*																																																		
Rhodanthe floribunda																																																		
Rhyncharrhena linearis																	x																													x				
Rytidosperma caespitosum																																																		
Salsola australis																																																		
* *Salvia verbenaca*																																																		
Santalum acuminatum					x		x	x	x	x		x		x					x		x	x		x				x	x		x	x		x	x	x	x					x	x		x			x		
Santalum spicatum																				x																														
Santalum sp.																																																			
Scaevola amblyanthera var. *centralis*																																																		

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

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Species	Site																																																	
	S297	S298	S299	S300	S301	S302	S303	S304	S305	S306	S307	S308	S309	S310	S311	S312	S313	S314	S315	S316	S317	S318	S319	S320	S321	S322	S323	S324	S325	S326	S327	S328	S329	S330	S331	S332	S333	S334	S335	S336	S339	S340	S341	S342	S343	S344	S345	S346	S347	S348
Scaevola bursariifolia		x																							x				x											x										
Scaevola restiacea subsp. *divaricata*																																																		
Scaevola spinescens		x	x				x		x						x	x		x		x	x	x	x	x			x		x	x		x	x	x	x				x			x		x	x	x	x	x	x	
Scaevola sp.																																																		
Schenkia australis																																																		
* *Schismus arabicus*																																																		
Sclerolaena cuneata																																																		
Sclerolaena diacantha			x			x	x	x	x				x		x	x	x	x	x		x	x		x	x	x	x	x		x					x		x	x	x				x	x	x	x				
Sclerolaena drummondii																					x						x																		x					
Sclerolaena obliquicuspis																																																		
Sclerolaena parviflora		x																	x												x										x									
Sclerolaena uniflora																																x																		
Scrophulariaceae sp.																																																		
Senecio lacustrinus																																																		
Senecio quadridentatus																																																		
Senecio sp.																																																		
Senna artemisioides subsp. *filifolia*	x			x				x	x							x	x				x						x	x		x		x		x				x		x				x	x	x		x	x	
Senna artemisioides subsp. x *artemisioides*																																																		
Senna ?cardiosperma																																																		
Senna pleurocarpa var. *pleurocarpa*																																																		
Senna stowardii																																										x								
Sida sp.																																																		
Solanum hoplopetalum																																																		
Solanum lasiophyllum																																																		
* *Solanum nigrum*																																																		
Solanum nummularium																												x									x													
Solanum plicatile																																																		
Solanum sp.																																																		
* *Sonchus oleraceus*																																																		
* *Sonchus sp.*																																																		
Stackhousia monogyna																																																		
Stackhousia muricata																																																		
Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)																																																		
Stackhousia stratfordiae (P1)	x																																																	
Streptoglossa sp.																																																		
Swainsona sp.																																																		
Tecticornia sp.																																																		
Templetonia ceracea																																																		
Templetonia sp.																																																		
Tetratheca efoliata																																																		
Teucrium sessiliflorum																																																		
Thysanotus manglesianus																																																		
Thysanotus sp.																			x																															
Trachymene pilosa																																																		
Trachymene ?pyrophila (P2)																																																		
Triodia irritans																																																		
Triodia scariosa										x																			x		x					x				x										
Triodia ?tomentosa											x																																							
Triodia sp.																																																		
Trymalium myrtillus subsp. *myrtillus*																																																		
Velleia daviesii																																																		
Vittadinia dissecta var. *hirta*			x															x			x						x	x																						
Vittadinia humerata																																																		
Wahlenbergia preissii																																																		
Wahlenbergia tumidifructa																																																		
Waitzia acuminata var. *acuminata*																																																		
Waitzia suaveolens var. *flava*																																																		
Waitzia suaveolens var. *suaveolens*																																																		
Westringia cephalantha																																																		
Westringia rigida										x	x																		x		x	x				x														

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Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																								
	S297	S298	S299	S300	S301	S302	S303	S304	S305	S306	S307	S308	S309	S310	S311	S312	S313	S314	S315	S316	S317	S318	S319	S320	S321
Zygophyllum apiculatum		x				x											x				x				x
Zygophyllum aurantiacum																									
Zygophyllum eremaeum	x												x												
Zygophyllum glaucum				x		x	x			x	x	x				x						x			
Zygophyllum ovatum							x	x	x					x					x		x	x			
Zygophyllum reticulatum			x						x							x									
Zygophyllum tesquorum																									
Zygophyllum sp.																									

Species	Site																								
	S322	S323	S324	S325	S326	S327	S328	S329	S330	S331	S332	S333	S334	S335	S336	S339	S340	S341	S342	S343	S344	S345	S346	S347	S348
Zygophyllum apiculatum		x		x			x			x		x			x	x							x		
Zygophyllum aurantiacum																									
Zygophyllum eremaeum												x					x								
Zygophyllum glaucum	x							x																	
Zygophyllum ovatum			x						x					x			x	x	x	x	x				
Zygophyllum reticulatum																									
Zygophyllum tesquorum																									
Zygophyllum sp.																									

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Species	Site																																										
	S349	S350	S351	S352	S353	S354	S355	S356	S357	S358	S359	S360	S361	S362	S363	S364	S365	S366	S367	S368	S369	S370	S371	S372	S373	S374	S375	S376	S377	S378	S379	S380	S381	S382	S383	S384	S385	S386	S387
Acacia acanthoclada subsp. *acanthoclada*									x															x															
Acacia acoma																																							
Acacia acuminata (narrow phyllode variant)																																							
Acacia andrewsii																																							
Acacia assimilis																								x						x									
Acacia assimilis subsp. *assimilis*																																							
Acacia assimilis subsp. *atroviridis*																																							
Acacia burkittii																																							
Acacia camptoclada																												x											
Acacia colletioides																																							
Acacia densiflora									x																														
Acacia enervia subsp. *explicata*																																							
Acacia eremophila var. *eremophila*																																							
Acacia erinacea																																							
Acacia evenulosa																																							
Acacia hemiteles			x		x			x	x	x	x							x		x						x			x	x									
Acacia hystrix subsp. *continua* (P1)																																							
Acacia hystrix subsp. *hystrix*																																							
Acacia merrallii																							x					x	x	x									x
Acacia oswaldii																																							
Acacia rigens																																							
Acacia tetragonophylla																														x									
Acacia sp.																																							
Acacia uncinella																																							
Acacia verricula																																							
Actinobole uliginosum																																							
Allocasuarina campestris																																							
Allocasuarina helmsii																																							
Allocasuarina sp.														x																										
Alyogyne sp. Shark Bay (D.J. Edinger 6212)																																							
Alyxia buxifolia			x									x	x																		x	x				x			
Amphipogon caricinus var. *caricinus*																																							
Amphipogon sp.																																							
Angianthus tomentosus			x					x																															
Aotus sp. Tortile (G.J. Keighery 3767)				x					x																														
Aotus sp.																																							
Arabidella chrysodema																																							
Arabidella trisecta																																							
Arabidella sp.																																							
Aristida contorta			x													x																								
Aristida ?holathera																																	x						
Asteraceae sp.																																							
Asteridea athrixioides																																							
Atriplex acutibractea subsp. *karoniensis*																																							
Atriplex nummularia																					x				x														x
Atriplex vesicaria								x														x			x								x		x		x		x
Atriplex sp.			x					x							x	x					x					x	x				x		x						
Austrostipa elegantissima																																	x						
Austrostipa hemipogon																																		x					
Austrostipa mollis			x				x									x	x	x																					
Austrostipa nitida											x	x																											
Austrostipa platychaeta		x			x																						x										x		
Austrostipa scabra subsp. *scabra*																																							
Austrostipa sp.																					x																		
Beyeria lechenaultii																															x								
Beyeria sp.																																							
Boronia fabianoides subsp. *fabianoides*									x																														
Bossiaea leptacantha									x																														
Bossiaea sp.																																							
Brachyscome ciliaris var. *ciliaris*																																							

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Species	Site																																						
	S349	S350	S351	S352	S353	S354	S355	S356	S357	S358	S359	S360	S361	S362	S363	S364	S365	S366	S367	S368	S369	S370	S371	S372	S373	S374	S375	S376	S377	S378	S379	S380	S381	S382	S383	S384	S385	S386	S387
Brachyscome iberidifolia																	x																						
**Brassica* sp.																																							
Calandrinia eremaea																	x																						
Calandrinia porifera																																							
Calandrinia sp.								x																															
Calothamnus gilesii																								x							x								
Calotis hispidula																																							
**Centaurea melitensis*																																							
Centipeda crateriformis						x																																	
Centrolepis polygyna																																							
Cheilanthes sieberi subsp. *sieberi*																																							
Chenopodiaceae sp.																						x												x	x	x		x	
Chenopodium curvispicatum																																							
Chenopodium sp.																					x																		
Chrysocephalum apiculatum						x																																	
Codonocarpus cotinifolius																																							
Comesperma polygaloides																																							
Commersonia craurophylla																																							
Convolvulaceae sp.																																							
Convolvulus angustissimus subsp. *angustissimus*																																							
Coopernookia strophiolata		x																x	x																				
Crassula colorata var. *colorata*																																							
Cratystylis conocephala							x			x					x	x		x			x	x	x		x		x					x	x	x	x	x		x	x
Cryptandra aridicola									x					x																									
Cryptandra ?crispula (P3)																								x															
Cryptandra minutifolia subsp. *brevistyla*				x																																			
Cryptandra recurva				x																																			
**Cucumis myriocarpus*																																							
Cullen discolor																																							
Dampiera lavandulacea																																							
Dampiera tenuicaulis																																							
Daviesia benthamii																																							
Daviesia benthamii subsp. *acanthoclona*				x					x									x								x		x											
Daviesia sp.														x																									
Dianella revoluta				x					x																														
Dillwynia sp. Coolgardie (V.E. Sands 637.3. 1)																																							
Dillwynia sp.				x																																			
Diocirea ternata								x																			x						x				x		
Dodonaea adenophora																																							
Dodonaea lobulata																																							
Dodonaea microzyga var. *acrolobata*																															x								
Dodonaea stenozyga			x								x			x													x		x	x		x				x			
Dodonaea viscosa subsp. *angustissima*			x																																				
Dodonaea sp.																																							
Enchylaena tomentosa																																							
Enchylaena tomentosa var. *tomentosa*																					x																		
Enneapogon avenaceus																															x								
Enneapogon caerulescens																																							
Enneapogon sp.																																	x						
Eragrostis australasica																	x																						
Eragrostis dielsii			x														x																	x					
Eremophila alternifolia			x																												x								
Eremophila caperata										x	x								x							x								x					
Eremophila decipiens subsp. *decipiens*	x		x			x		x								x					x				x		x			x			x						
Eremophila dempsteri																		x												x		x	x	x		x		x	x
Eremophila deserti																																							
Eremophila gibbosa																																							
Eremophila interstans																																							
Eremophila ionantha	x		x		x		x	x			x				x	x		x	x		x				x		x	x	x				x						
Eremophila oblonga																																							

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Eremophila psilocalyx																														x	x	x							
Eremophila rugosa																																							
Eremophila saligna																																							
Eremophila scoparia					x		x	x			x	x			x			x				x				x		x					x	x	x	x		x	x
Eremophila sp.																																							
Eriochiton sclerolaenoides																																							
* *Erodium aureum*																																							
Eucalyptus calycogona subsp. *calycogona*																																							
Eucalyptus celastroides																						x														x			
Eucalyptus celastroides subsp. *celastroides*							x																																
Eucalyptus celastroides subsp. *virella*										x			x																											
Eucalyptus clelandii									x			x	x																	x										
Eucalyptus concinna								x					x																						x						
Eucalyptus cylindrocarpa																																							
Eucalyptus eremophila subsp. *eremophila*																																							
Eucalyptus flocktoniae																																							
Eucalyptus flocktoniae subsp. *hebes*																																							
Eucalyptus fraseri subsp. *fraseri*																																			x				
Eucalyptus gracilis																												x	x										x
Eucalyptus griffithsii														x					x																					
Eucalyptus horistes																																							
Eucalyptus incrassata																																							
Eucalyptus ?kumarlensis																																							
Eucalyptus laevis															x			x					x									x			x	x		x	
Eucalyptus lesouefii																																							
Eucalyptus ?longissima																																							
Eucalyptus ?loxophleba subsp. *lissophloia*																		x																					
Eucalyptus moderata																																							
Eucalyptus oleosa subsp. *oleosa*													x									x																	
Eucalyptus optima																																		x					
Eucalyptus polita																																							
Eucalyptus prolixa																											x						x						
Eucalyptus protensa																																							
Eucalyptus rigidula																												x											
Eucalyptus salubris	x	x			x		x	x			x				x	x					x				x								x						
Eucalyptus sheathiana				x																x																			
Eucalyptus spreta		x																	x																				
Eucalyptus transcontinentalis																																							
Eucalyptus urna													x										x													x	x		
Eucalyptus websteriana subsp. *norsemanica* (P1)																																							
Eucalyptus sp.										x	x	x														x		x	x							x			x
Euphorbia drummondii																																							
Exocarpos aphyllus	x		x		x	x	x				x				x			x	x		x				x						x			x		x			x
Frankenia desertorum			x			x		x	x																														
Frankenia sp.																																							
Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)																																							
Geijera linearifolia					x		x			x		x	x		x	x		x								x					x				x				x
Glischrocaryon angustifolium																																							
Glischrocaryon aureum																																							
Goodenia berardiana																																							
Goodenia concinna																																							
Goodenia ?havilandii																																							
Goodenia pinnatifida																																							
Goodenia quasilibera																																							
Goodenia sp.																																							
Grevillea acuaria								x	x					x																										
Grevillea anethifolia																																							
Grevillea huegelii									x	x																														
Grevillea plurijuga subsp. *plurijuga*				x																																			
Grevillea teretifolia																																							

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Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																									
	S349	S350	S351	S352	S353	S354	S355	S356	S357	S358	S359	S360	S361	S362	S363	S364	S365	S366	S367	S368	S369	S370	S371	S372	S373	S374	S375	S376	S377	S378	S379	S380	S381	S382	S383	S384	S385	S386	S387
Grevillea sp.																												x	x									x	
Gyrostemon racemiger																																							
Halgania anagalloides																																							
Halgania andromedifolia																				x								x											
Halgania cyanea																				x																			
Halgania erecta																																							
Halgania integerrima																							x						x	x									
Halgania sp.																																							
Haloragis dura																																							
Haloragis gossei																																							
Haloragis trigonocarpa																																							
Hannafordia bissillii subsp. *latifolia*																																							
Helichrysum luteoalbum						x																																	
Hyalosperma demissum																																							
Hybanthus epacroides																																							
Hybanthus floribundus																																							
Indigofera australis																																							
Juncus pallidus						x																																	
Lawrencia repens																																							
Lawrencia ?*squamata*																																							
Lepidium sp.																	x																						
Lepidobolus deserti				x																																			
Lepidosperma aff. *diurnum*																																							
Lepidosperma sp.				x																																			
Leptosema daviesioides				x																																			
Leptospermum sp.																																							
Leucochrysum fitzgibbonii																																							
Logania sp.																																							
Lomandra collina																																							
Lomandra effusa				x																																			
Lotus cruentus																																							
Lycium sp.																																							
Maireana ?*appressa*																																							
Maireana carnosa																																							
Maireana erioclada																																							
Maireana ?*eriosphaera*																																							
Maireana georgei																																							
Maireana ?*marginata*			x																																				
Maireana pentatropis																																							
Maireana radiata																																							
Maireana sedifolia																					x																		
Maireana suaedifolia																																		x					
Maireana trichoptera																																							
Maireana triptera																					x	x																	
Maireana sp.																																						x	
Malvaceae sp.																																							
Marsdenia australis																																							
Marsilea hirsuta						x																																	
** Medicago* ?*sativa*																																							
Melaleuca acuminata subsp. *acuminata*								x																															
Melaleuca eleuterostachya																																							
Melaleuca fulgens subsp. *fulgens*																																							
Melaleuca halmaturorum																				x																			
Melaleuca hamata				x																																			
Melaleuca lanceolata																																							
Melaleuca ?*lateriflora*																																							
Melaleuca quadrifaria												x	x									x																x	
Melaleuca sheathiana		x										x	x							x			x			x		x	x			x		x	x		x	x	
Melaleuca uncinata																																							
Melaleuca ?*zeteticorum*				x																																			

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																						
	S349	S350	S351	S352	S353	S354	S355	S356	S357	S358	S359	S360	S361	S362	S363	S364	S365	S366	S367	S368	S369	S370	S371	S372	S373	S374	S375	S376	S377	S378	S379	S380	S381	S382	S383	S384	S385	S386	S387
Melaleuca sp.																																							
Menkea australis																																							
Microcybe multiflora subsp. *baccharoides*																																							
Microcybe multiflora subsp. *multiflora*																																							
Minuria leptophylla																																							
Mirbelia depressa																																							
Myoporum montanum																																							
Myoporum platycarpum subsp. *platycarpum*																																							
Myrtaceae sp.																																							
Nicotiana goodspeedii																																							
Nicotiana rotundifolia																																							
Olearia dampieri subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628)																																		x					
Olearia exiguifolia																																							
Olearia muelleri	x	x			x		x			x	x		x			x		x	x		x	x	x		x	x			x	x		x	x			x		x	
Olearia pimeleoides																																							
Panicum effusum																																							
Pelargonium australe																																							
Phebalium canaliculatum																														x									
Phebalium lepidotum																																							
Pimelea microcephala subsp. *microcephala*																																							
Pimelea trichostachya																																							
Pimelea sp.																																							
Pittosporum ?*angustifolium*																																							
Platysace trachymenioides																																							
Poaceae sp.																																							
Podolepis canescens																																							
Podolepis capillaris																																							
Pogonolepis sp.																																							
Poranthera microphylla																																							
Poranthera triandra																																							
Prostanthera althoferi subsp. *althoferi*			x																																				
Pterostylis sp.																																							
Ptilotus carlsonii																																							
Ptilotus drummondii																																							
Ptilotus drummondii var. *minor*														x																									
Ptilotus drummondii ?var. *scaposus*																																							
Ptilotus holosericeus																																							
Ptilotus nobilis								x																															
Ptilotus obovatus			x													x															x			x					
Ptilotus spathulatus		x																																					
Ptilotus sp. Goldfields (R. Davis 10796)																																							
Ptilotus sp.																						x											x						
Pultenaea elachista																																							
Pultenaea purpurea									x																														
Radyera farragei																																							
Rhagodia crassifolia		x																				x													x		x		x
Rhagodia drummondii			x												x	x																							
Rhagodia eremaea																																							
Rhagodia ulicina																																							
Rhagodia sp.																									x														
Rhodanthe chlorocephala subsp. *rosea*																																							
Rhodanthe floribunda																																							
Rhyncharrhena linearis																																							
Rytidosperma caespitosum																																							
Salsola australis																																							
* *Salvia verbenaca*																																							
Santalum acuminatum			x		x		x		x	x					x	x			x										x										
Santalum spicatum																																							
Santalum sp.																																							
Scaevola amblyanthera var. *centralis*																																							

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																						
	S349	S350	S351	S352	S353	S354	S355	S356	S357	S358	S359	S360	S361	S362	S363	S364	S365	S366	S367	S368	S369	S370	S371	S372	S373	S374	S375	S376	S377	S378	S379	S380	S381	S382	S383	S384	S385	S386	S387
Scaevola bursariifolia																												x	x										
Scaevola restiacea subsp. *divaricata*																																							
Scaevola spinescens			x				x			x	x				x			x					x		x				x	x				x		x			
Scaevola sp.																																							
Schenkia australis						x																																	
* *Schismus arabicus*																																							
Sclerolaena cuneata						x											x																						
Sclerolaena diacantha			x		x			x			x				x	x					x	x					x					x							
Sclerolaena drummondii																																							
Sclerolaena obliquicuspis					x												x										x												
Sclerolaena parviflora																																							
Sclerolaena uniflora																									x								x	x	x		x	x	x
Scrophulariaceae sp.																																							
Senecio lacustrinus																																							
Senecio quadridentatus																																							
Senecio sp.																																							
Senna artemisioides subsp. *filifolia*		x	x		x			x			x	x											x		x				x	x		x				x			x
Senna artemisioides subsp. x *artemisioides*																															x								
Senna ?*cardiosperma*																																			x				
Senna pleurocarpa var. *pleurocarpa*																																							
Senna stowardii																																							
Sida sp.																																							
Solanum hoplopetalum					x																													x					
Solanum lasiophyllum																																							
* *Solanum nigrum*																															x								
Solanum nummularium																x																							
Solanum plicatile																																							
Solanum sp.																																							
* *Sonchus oleraceus*																																							
* *Sonchus sp.*																																							
Stackhousia monogyna																																							
Stackhousia muricata																																							
Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)																																							
Stackhousia stratfordiae (P1)																																							
Streptoglossa sp.																																							
Swainsona sp.																																							
Tecticornia sp.						x											x																						
Templetonia ceracea																																							
Templetonia sp.																																							
Tetratheca efoliata																																							
Teucrium sessiliflorum																																							
Thysanotus manglesianus																			x																				
Thysanotus sp.																																							
Trachymene pilosa																																							
Trachymene ?*pyrophila* (P2)																																							
Triodia irritans				x						x				x				x	x																				
Triodia scariosa									x															x															
Triodia ?*tomentosa*																																							
Triodia sp.																																							
Trymalium myrtillus subsp. *myrtillus*																																							
Velleia daviesii																																							
Vittadinia dissecta var. *hirta*			x													x					x				x		x	x			x		x	x					
Vittadinia humerata																																							
Wahlenbergia preissii						x																																	
Wahlenbergia tumidifructa																																							
Waitzia acuminata var. *acuminata*																																							
Waitzia suaveolens var. *flava*																																							
Waitzia suaveolens var. *suaveolens*																																							
Westringia cephalantha														x																									
Westringia rigida									x			x		x						x									x			x				x			

APPENDIX E: SUMMARY OF VASCULAR PLANT SPECIES RECORDED AT EACH SURVEY SITE WITHIN THE NOVA SURVEY AREA, 2013 - 2014

Note: * denotes introduced species; T denotesThreatened Flora Species; P1 to P5 denote Priority Flora Species (DPAW, 2014a)

Species	Site																																										
	S349	S350	S351	S352	S353	S354	S355	S356	S357	S358	S359	S360	S361	S362	S363	S364	S365	S366	S367	S368	S369	S370	S371	S372	S373	S374	S375	S376	S377	S378	S379	S380	S381	S382	S383	S384	S385	S386	S387
Zygophyllum apiculatum					x		x						x			x																								
Zygophyllum aurantiacum																																										
Zygophyllum eremaeum															x																										
Zygophyllum glaucum		x										x	x									x	x						x			x			x	x	x		x
Zygophyllum ovatum																																									
Zygophyllum reticulatum																																									
Zygophyllum tesquorum																						x	x									x			x	x				
Zygophyllum sp.																																									

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES IN VEGETATION COMMUNITIES ON TE NOVA AND INFRASTRUCTURE PROJECT AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DEC 2012c).

Species	Vegetation Community																																		
	G1	G2	G3	G4	S1	S2	S3	S4	S5	S6	S7	S8	S9	S16	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21
Acacia acanthoclada subsp. *acanthoclada*	x	x	x							x		x				x																		x	
Acacia acoma																						x										x			
Acacia acuminata (narrow phyllode variant)	x						x	x																											
Acacia andrewsii	x																																		
Acacia assimilis	x																	x																	
Acacia assimilis subsp. *assimilis*	x							x				x	x																						
Acacia assimilis subsp. *atroviridis*		x																																	
Acacia burkittii	x																																		
Acacia camptoclada																						x													
Acacia colletioides																			x			x													
Acacia densiflora	x																																		
Acacia enervia subsp. *explicata*																x																			
Acacia eremophila var. *eremophila*															x																				
Acacia erinacea	x							x							x	x	x			x	x					x	x								x
Acacia evenulosa	x																									x									
Acacia hemiteles	x		x	x			x	x	x				x		x	x	x	x	x	x		x	x	x		x				x	x	x	x	x	x
Acacia hystrix subsp. *continua* (P1)																											x								
Acacia hystrix subsp. *hystrix*								x																		x									
Acacia merrallii			x												x	x	x	x	x		x	x	x			x				x		x	x	x	x
Acacia oswaldii	x															x	x									x									
Acacia rigens	x		x																																
Acacia tetragonophylla																		x																	
Acacia sp.								x														x													
Acacia uncinella	x																				x														
Acacia verricula	x																																		
Actinobole uliginosum										x						x																			
Allocasuarina campestris													x																						
Allocasuarina helmsii	x	x						x					x										x			x				x					
Allocasuarina sp.				x				x		x																				x					
Alyogyne sp. Shark Bay (D.J. Edinger 6212)		x																																	
Alyxia buxifolia	x			x				x						x	x	x	x		x		x			x	x		x			x	x	x	x		
Amphipogon caricinus var. *caricinus*		x																																	
Amphipogon sp.								x																											
Angianthus tomentosus																x										x				x	x				
Aotus sp. Tortile (G.J. Keighery 3767)	x	x																																	
Aotus sp.	x															x																			
Arabidella chrysodema						x										x																			
Arabidella trisecta																	x																		
Arabidella sp.					x																														
Aristida contorta	x		x				x						x			x	x										x								
Aristida ?holathera																x																			

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Species	Vegetation Community																																					
	G1	G2	G3	G4	S1	S2	S3	S4	S5	S6	S7	S8	S9	S16	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21
Asteraceae sp.	x					x																																
Asteridea athrixioides					x	x			x							x	x									x												
Atriplex acutibractea subsp. *karoniensis*						x																																
Atriplex nummularia			x													x	x					x										x	x	x				
Atriplex vesicaria			x	x	x										x	x	x		x				x		x			x					x					
Atriplex sp.			x		x	x			x						x	x	x	x	x			x	x		x			x	x	x	x	x	x					
Austrostipa elegantissima	x				x										x	x	x							x					x	x	x	x	x					
Austrostipa hemipogon	x									x					x	x	x	x	x			x				x			x	x								
Austrostipa mollis											x					x	x		x													x						
Austrostipa nitida	x	x						x							x	x	x		x							x				x		x	x	x				
Austrostipa platychaeta			x	x				x							x	x	x		x	x	x	x	x			x				x	x	x	x	x				
Austrostipa scabra subsp. *scabra*					x										x	x	x																					
Austrostipa sp.	x				x		x								x	x	x	x				x	x				x											
Beyeria lechenaultii	x											x		x																								
Beyeria sp.	x							x																														
Boronia fabianoides subsp. *fabianoides*	x																																					
Bossiaea leptacantha	x							x													x		x															
Bossiaea sp.																					x																	
Brachyscome ciliaris var. *ciliaris*																x																						
Brachyscome iberidifolia											x																			x								
* *Brassica* sp.						x									x																							
Calandrinia eremaea								x		x	x					x	x		x			x				x	x			x		x						
Calandrinia porifera								x																						x								
Calandrinia sp.																x																						
Calothamnus gilesii	x	x												x																								
Calotis hispidula	x							x		x					x	x			x			x				x	x			x								
* *Centaurea melitensis*			x						x				x			x																						
Centipeda crateriformis													x																									
Centrolepis polygyna																														x								
Cheilanthes sieberi subsp. *sieberi*							x																															
Chenopodiaceae sp.				x											x	x	x		x				x									x						
Chenopodium curvispicatum	x				x				x						x	x	x											x			x		x					
Chenopodium sp.																						x																
Chrysocephalum apiculatum		x		x								x																										
Codonocarpus cotinifolius								x																						x								
Comesperma polygaloides	x	x						x				x																										
Commersonia craurophylla																			x											x		x						
Convolvulaceae sp.		x																																				
Convolvulus angustissimus subsp. *angustissimus*		x	x																																			
Coopernookia strophiolata				x												x			x			x										x		x				
Crassula colorata var. *colorata*								x		x						x			x			x				x				x	x							

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES IN VEGETATION COMMUNITIES ON TE NOVA AND INFRASTRUCTURE PROJECT AREA, 2013 AND 2014

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Species	Vegetation Community																																						
	G1	G2	G3	G4	S1	S2	S3	S4	S5	S6	S7	S8	S9	S16	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21
Cratystylis conocephala	x		x	x	x										x	x	x	x	x	x		x	x		x	x			x	x	x	x	x	x	
Cryptandra aridicola	x	x		x				x				x	x		x	x																	x		
Cryptandra ?crispula (P3)	x																																						
Cryptandra minutifolia subsp. *brevistyla*		x																																				
Cryptandra recurva		x																																				
** Cucumis myriocarpus*									x																														
Cullen discolor		x						x																														
Dampiera lavandulacea								x		x																													
Dampiera tenuicaulis		x																																				
Daviesia benthamii															x				x																				
Daviesia benthamii subsp. *acanthoclona*	x	x													x	x	x	x	x	x	x	x	x	x		x	x			x		x	x		x			
Daviesia sp.	x			x																																		
Dianella revoluta	x	x						x		x												x								x								
Dillwynia sp. Coolgardie (V.E. Sands 637.3. 1)	x							x	x																													
Dillwynia sp.		x																																				
Diocirea ternata	x							x							x	x	x		x			x	x		x	x	x	x		x		x						
Dodonaea adenophora		x																																				
Dodonaea lobulata							x								x																								
Dodonaea microzyga var. *acrolobata*	x							x				x	x	x	x							x																	
Dodonaea stenozyga	x			x	x										x	x	x	x	x	x			x			x	x			x		x	x		x			
Dodonaea viscosa subsp. *angustissima*																x																							
Dodonaea sp.										x																													
Enchylaena tomentosa	x														x	x	x	x	x										x	x	x	x	x	x	x			
Enchylaena tomentosa var. *tomentosa*					x	x	x								x	x	x					x	x					x										
Enneapogon avenaceus	x													x	x	x																						
Enneapogon caerulescens									x																					x								
Enneapogon sp.															x	x																						
Eragrostis australasica											x																												
Eragrostis dielsii						x			x		x		x		x	x														x								
Eremophila alternifolia	x		x										x	x	x	x	x					x	x	x				x			x							
Eremophila caperata				x	x										x	x	x	x	x	x	x	x	x	x								x						
Eremophila decipiens subsp. *decipiens*	x		x	x		x	x	x	x			x	x		x	x	x	x	x	x	x	x	x	x	x	x		x	x		x		x	x	x		
Eremophila dempsteri			x												x	x	x	x	x	x		x	x			x	x	x	x	x	x	x		x	x		
Eremophila deserti	x						x								x	x	x	x					x					x		x							
Eremophila gibbosa								x					x																									
Eremophila interstans							x								x	x	x						x															
Eremophila ionantha	x		x	x	x	x							x		x	x	x	x	x	x	x	x	x		x	x					x	x	x	x	x			
Eremophila oblonga	x																x																x		x			
Eremophila psilocalyx	x													x	x		x	x	x							x					x						
Eremophila rugosa																	x		x			x																
Eremophila saligna																x			x																			

APPENDIX F: SUMMARY OF VASCULAR PLANT SPECIES IN VEGETATION COMMUNITIES ON TE NOVA AND INFRASTRUCTURE PROJECT AREA, 2013 AND 2014

Note: * denotes introduced species; T denotes Threatened Flora and P1-P5 denote Priority Flora Species (DEC 2012c).

Species	Vegetation Community																																					
	G1	G2	G3	G4	S1	S2	S3	S4	S5	S6	S7	S8	S9	S16	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21
Eremophila scoparia	x		x	x	x										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Eremophila sp.	x														x			x				x	x					x		x					
Eriochiton sclerolaenoides	x														x	x	x	x	x				x							x			x		x
* *Erodium aureum*							x																												
Eucalyptus calycogona subsp. *calycogona*	x														x	x	x									x		x		x				x	
Eucalyptus celastroides															x		x								x							x			
Eucalyptus celastroides subsp. *celastroides*																x																			
Eucalyptus celastroides subsp. *virella*															x				x								x								
Eucalyptus clelandii																x	x		x	x															
Eucalyptus concinna	x			x											x			x	x		x														
Eucalyptus cylindrocarpa	x														x	x	x		x	x		x									x				
Eucalyptus eremophila subsp. *eremophila*																			x											x					
Eucalyptus flocktoniae																					x						x								x
Eucalyptus flocktoniae subsp. *hebes*																					x														
Eucalyptus fraseri subsp. *fraseri*				x				x								x			x		x				x								x	
Eucalyptus gracilis	x		x												x	x	x		x			x	x												
Eucalyptus griffithsii	x		x	x													x																		
Eucalyptus horistes		x														x																			
Eucalyptus incrassata																					x														
Eucalyptus ?kumarlensis	x																																		
Eucalyptus laevis				x											x	x	x		x				x									x			
Eucalyptus lesouefii	x				x										x		x		x	x		x													x
Eucalyptus ?longissima																		x																	
Eucalyptus ?loxophleba subsp. *lissophloia*	x																					x										x			
Eucalyptus moderata																																x			
Eucalyptus oleosa subsp. *oleosa*	x				x										x	x	x	x	x	x	x	x		x		x				x	x	x		x	x	
Eucalyptus optima															x																				
Eucalyptus polita																										x									x
Eucalyptus prolixa															x	x		x							x	x				x					
Eucalyptus protensa																		x							x					x					
Eucalyptus rigidula	x							x								x	x				x	x													
Eucalyptus salubris			x		x	x		x							x	x	x	x	x			x	x	x	x			x			x	x		x	
Eucalyptus sheathiana		x																																	
Eucalyptus spreta					x	x									x		x		x			x	x			x		x				x	x	x	
Eucalyptus transcontinentalis																														x					
Eucalyptus urna															x		x		x	x			x		x					x		x	x		
Eucalyptus websteriana subsp. *norsemanica* (P1)		x																																	
Eucalyptus sp.	x	x	x					x		x					x	x	x	x	x	x		x	x		x	x		x		x	x	x		x	
Euphorbia drummondii							x								x	x		x					x												
Exocarpos aphyllus	x		x	x		x		x					x	x	x	x	x	x	x		x	x	x	x	x				x	x	x	x	x	x	x
Frankenia desertorum	x												x			x																			

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Species	Vegetation Community																																					
	G1	G2	G3	G4	S1	S2	S3	S4	S5	S6	S7	S8	S9	S16	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21
Frankenia sp.																x																					
Gahnia sp. South West (K.L. Wilson & K. Frank KLW 9266)	x	x		x																																	
Geijera linearifolia	x		x		x								x		x	x	x	x	x	x			x		x				x	x		x	x				
Glischrocaryon angustifolium								x		x												x															
Glischrocaryon aureum		x																												x							
Goodenia berardiana		x		x												x																					
Goodenia concinna	x																		x		x																
Goodenia ?havilandii								x																														
Goodenia pinnatifida								x								x										x				x								
Goodenia quasilibera	x																																				
Goodenia sp.	x				x	x											x																				
Grevillea acuaria	x		x	x				x							x	x					x		x		x	x											
Grevillea anethifolia	x	x						x					x																									
Grevillea huegelii	x									x					x					x	x	x	x		x							x	x				
Grevillea plurijuga subsp. *plurijuga*		x																																			
Grevillea teretifolia																					x		x														
Grevillea sp.	x																					x	x														
Gyrostemon racemiger		x								x																				x							
Halgania anagalloides	x																																				
Halgania andromedifolia	x							x					x						x		x	x				x				x							
Halgania cyanea																						x	x														
Halgania erecta		x																																			
Halgania integerrima	x						x	x									x	x				x	x			x				x							
Halgania sp.	x																																				
Haloragis dura	x		x																																		
Haloragis gossei	x							x																		x				x							
Haloragis trigonocarpa		x																																			
Hannafordia bissillii subsp. *latifolia*										x																											
Helichrysum luteoalbum	x									x			x									x								x							
Hyalosperma demissum										x																											
Hybanthus epacroides				x																																	
Hybanthus floribundus																																	x				
Indigofera australis							x																														
Juncus pallidus													x																								
Lawrencia repens															x	x										x				x	x						
Lawrencia ?squamata																x																					
Lepidium sp.											x																											
Lepidobolus deserti		x																																			
Lepidosperma aff. *diurnum*	x												x																								
Lepidosperma sp.		x						x																													
Leptosema daviesioides		x						x		x																				x							

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Leptospermum sp.								x																						x					
Leucochrysum fitzgibbonii	x																															x			
Logania sp.						x																													
Lomandra collina		x																																	
Lomandra effusa		x																																	
Lotus cruentus								x																						x					
Lycium sp.																																	x		
Maireana ?appressa															x	x	x		x				x												
Maireana carnosa																	x																		
Maireana erioclada															x	x	x	x														x			
Maireana ?eriosphaera																x	x	x			x							x							
Maireana georgei															x		x												x						
Maireana ?marginata																x	x		x			x									x		x		
Maireana pentatropis	x														x	x	x	x	x			x			x				x	x		x	x	x	
Maireana radiata															x	x	x	x		x		x													
Maireana sedifolia															x		x	x	x			x							x				x		
Maireana suaedifolia	x														x																				
Maireana trichoptera					x										x	x	x		x			x			x	x		x		x	x	x			x
Maireana triptera															x	x	x					x				x				x	x				
Maireana sp.	x				x	x									x	x	x	x					x		x									x	
Malvaceae sp.															x	x																			
Marsdenia australis																			x																
Marsilea hirsuta													x																						
** Medicago ?sativa*						x																													
Melaleuca acuminata subsp. *acuminata*												x			x	x			x							x									
Melaleuca eleuterostachya	x																													x					
Melaleuca fulgens subsp. *fulgens*								x		x			x																						
Melaleuca halmaturorum	x				x										x				x	x	x	x	x	x		x		x		x		x		x	x
Melaleuca hamata	x	x						x		x																									
Melaleuca lanceolata																x						x	x												
Melaleuca ?lateriflora																x																			
Melaleuca quadrifaria															x	x	x	x	x				x												x
Melaleuca sheathiana	x			x	x										x	x	x		x	x	x	x	x	x	x	x	x			x		x	x	x	x
Melaleuca uncinata		x						x				x	x				x																		
Melaleuca ?zeteticorum		x																																	
Melaleuca sp.										x												x													
Menkea australis																										x									
Microcybe multiflora subsp. *baccharoides*																							x												x
Microcybe multiflora subsp. *multiflora*															x															x					x
Minuria leptophylla	x																																x		
Mirbelia depressa		x																																	

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Myoporum montanum																	x																		
Myoporum platycarpum subsp. *platycarpum*						x										x																			
Myrtaceae sp.										x																										
Nicotiana goodspeedii								x																						x					
Nicotiana rotundifolia								x																											
Olearia dampieri subsp. *eremicola* (Diels & Pritzel s.n. PERTH 00449628)															x																				
Olearia exiguifolia																														x					
Olearia muelleri	x			x	x			x							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Olearia pimeleoides							x								x																					
Panicum effusum																x																				
Pelargonium australe								x																												
Phebalium canaliculatum								x										x																		
Phebalium lepidotum								x					x		x				x											x						
Pimelea microcephala subsp. *microcephala*																x			x																	
Pimelea trichostachya	x	x						x																						x						
Pimelea sp.													x																		x					
Pittosporum ?*angustifolium*															x																					
Platysace trachymenioides		x																																		
Poaceae sp.	x									x						x																x	x			
Podolepis canescens	x	x		x																										x						
Podolepis capillaris	x									x												x								x						
Pogonolepis sp.																										x										
Poranthera microphylla	x							x																												
Poranthera triandra																														x						
Prostanthera althoferi subsp. *althoferi*	x							x								x																				
Pterostylis sp.	x				x																															
Ptilotus carlsonii			x						x				x			x													x			x			
Ptilotus drummondii	x							x		x			x																x						
Ptilotus drummondii var. *minor*		x		x																																
Ptilotus drummondii ?var. *scaposus*												x																								
Ptilotus holosericeus	x				x	x			x	x					x	x	x	x	x			x	x	x	x	x		x		x	x	x	x			
Ptilotus nobilis						x							x		x	x										x										
Ptilotus obovatus														x	x	x	x									x					x					
Ptilotus spathulatus		x	x			x		x					x			x	x					x			x						x	x		x		
Ptilotus sp. Goldfields (R. Davis 10796)																x																				
Ptilotus sp.															x	x	x																			
Pultenaea elachista	x			x					x																							x				
Pultenaea purpurea	x																																			
Radyera farragei																						x								x						
Rhagodia crassifolia	x		x	x	x										x	x	x	x	x						x							x	x	x	x	
Rhagodia drummondii																x	x																			

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	G1	G2	G3	G4	S1	S2	S3	S4	S5	S6	S7	S8	S9	S16	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	W19	W20	W21
Rhagodia eremaea																													x						
Rhagodia ulicina							x									x																			
Rhagodia sp.																	x												x						
Rhodanthe chlorocephala subsp. *rosea*									x							x																			
Rhodanthe floribunda				x									x			x																			
Rhyncharrhena linearis															x	x									x										
Rytidosperma caespitosum									x							x	x																		
Salsola australis									x																										
* *Salvia verbenaca*									x																										
Santalum acuminatum	x			x				x							x	x	x	x	x	x	x	x	x	x	x	x	x			x	x	x	x		
Santalum spicatum	x														x	x	x										x		x			x			
Santalum sp.																	x			x		x				x									
Scaevola amblyanthera var. *centralis*		x	x	x				x		x																									
Scaevola bursariifolia	x				x														x		x	x	x									x			x
Scaevola restiacea subsp. *divaricata*		x																																	
Scaevola spinescens	x		x	x	x			x					x		x	x	x	x	x	x	x	x	x		x	x	x			x	x	x	x	x	x
Scaevola sp.																			x																
Schenkia australis													x																						
* *Schismus arabicus*																										x									
Sclerolaena cuneata											x		x			x	x																		
Sclerolaena diacantha	x		x		x	x	x		x						x	x	x	x	x			x	x	x	x	x		x	x	x	x	x	x	x	x
Sclerolaena drummondii	x														x	x															x				
Sclerolaena obliquicuspis						x					x				x	x	x															x	x		
Sclerolaena parviflora	x				x													x	x		x	x	x			x					x		x		
Sclerolaena uniflora	x		x	x				x		x					x	x	x	x				x	x		x	x					x		x		
Scrophulariaceae sp.								x		x																									
Senecio lacustrinus									x							x														x					
Senecio quadridentatus																x																			
Senecio sp.						x																													
Senna artemisioides subsp. *filifolia*	x		x	x	x		x	x	x				x		x	x	x	x	x	x	x	x	x	x		x			x	x	x	x	x	x	x
Senna artemisioides subsp. x *artemisioides*													x	x			x		x																
Senna ?*cardiosperma*				x																															
Senna pleurocarpa var. *pleurocarpa*		x						x														x								x					
Senna stowardii															x	x																			
Sida sp.																													x						
Solanum hoplopetalum										x					x	x	x					x				x				x					
Solanum lasiophyllum							x																												
* *Solanum nigrum*														x																					
Solanum nummularium													x		x		x															x			
Solanum plicatile		x						x		x												x								x					
Solanum sp.																						x													

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** Sonchus oleraceus*									x																												
** Sonchus sp.*																																x					
Stackhousia monogyna													x																								
Stackhousia muricata		x						x		x																											
Stackhousia sp. Mt Keith (G. Cockerton & G. O'Keefe 11017)								x		x		x	x																								
Stackhousia stratfordiae (P1)									x							x														x							
Streptoglossa sp.	x																																				
Swainsona sp.							x																														
Tecticornia sp.											x		x																								
Templetonia ceracea																			x			x															
Templetonia sp.																x			x																		
Tetratheca efoliata																														x							
Teucrium sessiliflorum													x																								
Thysanotus manglesianus		x	x	x											x	x	x										x										
Thysanotus sp.	x							x								x																					
Trachymene pilosa								x		x																											
Trachymene ?pyrophila (P2)								x																													
Triodia irritans		x	x	x																x			x									x	x	x		
Triodia scariosa	x							x				x	x		x						x					x			x			x				
Triodia ?tomentosa	x																		x																		
Triodia sp.								x		x													x														
Trymalium myrtillus subsp. *myrtillus*	x							x					x														x										
Velleia daviesii		x								x																				x							
Vittadinia dissecta var. *hirta*	x					x	x		x	x			x	x	x	x	x	x	x			x					x			x		x					
Vittadinia humerata																						x															
Wahlenbergia preissii													x																								
Wahlenbergia tumidifructa										x																											
Waitzia acuminata var. *acuminata*	x								x								x																				
Waitzia suaveolens var. *flava*																			x																		
Waitzia suaveolens var. *suaveolens*								x																						x							
Westringia cephalantha	x			x				x				x																									
Westringia rigida	x	x		x				x								x	x		x		x	x	x	x					x		x		x		x	x
Zygophyllum apiculatum	x			x	x										x	x	x	x	x	x	x	x	x	x	x			x			x	x	x	x		
Zygophyllum aurantiacum					x											x	x	x										x								
Zygophyllum eremaeum			x												x	x	x					x										x				
Zygophyllum glaucum	x		x	x											x	x	x	x	x	x		x	x	x	x	x			x		x	x	x	x		
Zygophyllum ovatum	x				x	x									x	x	x	x	x				x	x	x	x		x	x		x	x				
Zygophyllum reticulatum															x	x	x	x	x																	
Zygophyllum tesquorum	x	x																															x			
Zygophyllum sp.				x													x															x				

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W1	Woodland of mixed Eucalypts including *Eucalyptus salubris*, *Eucalyptus celastroides, Eucalyptus calycogona* subsp. *calycogona*, *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* over *Cratystylis conocephala*, *Exocarpos aphyllus, Diocirea ternata*, *Eremophila alternifolia*, *Eremophila interstans, Eremophila ionantha, Eremophila scoparia* and *Geijera linearifolia* over *Olearia muelleri*, *Atriplex vesicaria* and *Scaevola spinescens* over mixed shrubs, herbs and grasses on orange-brown sandy clay-loams on flats. **No of Quadrats:** 49 **Similarity Percentage:** 36 %	
W2	Woodland of *Eucalyptus salubris* and *Eucalyptus oleosa* subsp. *oleosa* with patches of mixed *Eucalyptus* species over *Melaleuca quadrifaria, Acacia hemiteles, Cratystylis conocephala* over *Diocirea ternata, Eremophila ionantha*, *Atriplex vesicaria*, *Eremophila decipiens* subsp. *decipiens*, *Eremophila scoparia, Geijera linearifolia, Senna artemisioides* subsp. *filifolia* and *Exocarpos aphyllus* over *Vittadinia dissecta* var. *hirta*, *Olearia muelleri*, *Sclerolaena diacantha*, *Ptilotus holosericeus* and *Zygophyllum ovatum* over herbs and grasses on red-orange clay-loams on flats and lower slopes. **No of Quadrats:** 47 **Similarity Percentage:** 36 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W3	Woodland of *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* with occasional *Eucalyptus celastroides* and *Eucalyptus salubris* over *Cratystylis conocephala* over *Olearia muelleri*, *Atriplex vesicaria* and *Santalum acuminatum* over *Rhagodia crassifolia*, *Zygophyllum apiculatum* and *Sclerolaena diacantha* over other mixed shrubs and herbs on orange-brown clay-loams on flats and slopes. **No of Quadrats:** 46 **Similarity Percentage:** 41 %	
W4	Woodland to open woodland of mixed *Eucalyptus* species over *Eremophila scoparia*, *Cratystylis conocephala* and *Atriplex vesicaria* over *Sclerolaena diacantha*, *Olearia muelleri*, *Zygophyllum* species and *Rhagodia crassifolia* over herbs on orange clay-loams and sandy-loams on flats. **No of Quadrats:** 9 **Similarity Percentage:** 49 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W5	Woodland of *Eucalyptus clelandii*, *Eucalyptus urna*, *Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus lesouefii* over *Melaleuca sheathiana* over *Olearia muelleri*, *Eremophila scoparia* and *Alyxia buxifolia* over *Zygophyllum glaucum* and *Maireana* species on orange-brown sandy-loams on flats and lower slopes. **No of Quadrats:** 29 **Similarity Percentage:** 35 %	
W6	Open woodland of mixed *Eucalyptus* species over *Eremophila dempsteri*, *Melaleuca halmaturorum* and *Melaleuca sheathiana* over *Cratystylis conocephala* and *Eremophila scoparia* over *Olearia muelleri* and mixed shrubs and herbs on orange clay-loams on flats and slopes. **No of Quadrats:** 5 **Similarity Percentage:** 41 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W7	Open woodland of *Eucalyptus incrassata*, *Eucalyptus rigidula* and *Eucalyptus oleosa* subsp. *oleosa* over *Westringia rigida, Daviesia benthamii* subsp. *acanthoclona*, *Acacia erinacea*, *Santalum acuminatum*, *Eremophila scoparia* and *Acacia merrallii* over *Triodia scariosa* and herbs on orange-red clay-loams and sandy-loams on flats and lower slopes. **No of Quadrats:** 5 **Similarity Percentage:** 39 %	
W8	Low open woodland of *Eucalyptus oleosa* subsp. *oleosa, Eucalyptus spreta* and *Eucalyptus lesouefii* over *Melaleuca sheathiana*, *Eremophila ionantha*, *Acacia hemiteles*, *Eremophila scoparia, Cratystylis conocephala* and *Melaleuca halmaturorum* over mixed shrubs and herbs on orange-brown clay-loams and sandy-loams on lower to mid slopes. **No of Quadrats:** 20 **Similarity Percentage:** 31 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W9	Low open woodland of *Eucalyptus gracilis* and *Eucalyptus salubris* over *Eremophila scoparia*, *Eremophila ionantha, Melaleuca halmaturorum*, *Diocirea ternata, Cratystylis conocephala, Olearia muelleri, Melaleuca sheathiana* and *Dodonaea stenozyga* over low shrubs and herbs on red-brown sandy-loams and clay-loams on flats. **No of Quadrats:** 12 **Similarity Percentage:** 32 %	
W10	Open woodland of *Eucalyptus oleosa* subsp. *oleosa* over *Melaleuca halmaturorum* over *Acacia hemiteles* and *Eremophila alternifolia* over *Olearia muelleri* and *Zygophyllum glaucum* on pale orange clay-loams and sandy-loam gravels on flats. **No of Quadrats:** 4 **Similarity Percentage:** 53 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W11	Open woodland of *Eucalyptus salubris, Eucalyptus fraseri* subsp. *fraseri, Eucalyptus celastroides* and *Eucalyptus prolixa* over *Diocirea ternata, Eremophila ionantha, Eremophila scoparia* and *Olearia muelleri* over mixed low Chenopods on orange to red clay-loams on flats. **No of Quadrats:** 5 **Similarity Percentage:** 38%	
W12	Open woodland of *Eucalyptus oleosa* subsp. *oleosa, Eucalyptus polita* and *Eucalyptus prolixa* over *Diocirea ternata, Dodonaea stenozyga, Eremophila* species, *Daviesia benthamii* subsp. *acanthoclona* and *Olearia muelleri* over mixed low Chenopods and localized patches of *Triodia ?scariosa* on orange to red clays and clay loams on flats. **No of Quadrats:** 13 **Similarity Percentage:** 45 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W13	Open woodland of *Eucalyptus flocktoniae* and *Eucalyptus celastroides* subsp. *virella* over *Melaleuca sheathiana, Diocirea ternata, Dodonaea stenozyga, Eremophila scoparia, Daviesia benthamii* subsp. *acanthoclona, Acacia erinacea* and *Olearia muelleri* over herbs and grasses on orange to red clays on flats. **No of Quadrats:** 2 **Similarity Percentage:** 40 %	
W14	Open woodland of *Eucalyptus salubris, Eucalyptus calycogona* subsp. *calycogona* and *Eucalyptus spreta* over *Melaleuca halmaturorum, Diocirea ternata, Eremohila decipiens* subsp. *decipiens, Eremophila* scoparia, *Atriplex vesicaria* and *Olearia muelleri* over herbs and grasses on cracking clays on flats. **No of Quadrats:** 2 **Similarity Percentage:** 49 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W15	Open woodland of *Eucalyptus oleosa* subsp. *oleosa, Eucalyptus prolix* and *Eucalyptus protensa* over *Cratystylis conocephala, Eremophila decipiens* subsp. *decipiens, Eremophila dempsteri, Rhagodia eremaea, Senna artemisioides* subsp. *filifolia* over herbs and grasses on orange clay-loams and sandy-loams on flats. **No of Quadrats:** 2 **Similarity Percentage:** 43 %	
W16	Open woodland of mixed Eucalypts including *Eucalyptus transcontinentalis, Eucalyptus calycogona* subsp. *calycogona, Eucalyptus eremophila* subsp. *eremophila, Eucalyptus oleosa* subsp. *oleosa* and *Eucalyptus urna* over *Cratystylis conocephala, Commersonia craurophylla, Eremophila* species, *Melaleuca sheathiana, Olearia muelleri* and *Scaevola spinescens* over herbs and grasses on orange clay-loams and sandy-loams on flats and slopes of undulating rises. **No of Quadrats:** 7 **Similarity Percentage:** 23 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W17	Open woodland of *Eucalyptus cylindrocarpa, Eucalyptus salubris* and *Eucalyptus oleosa* subsp. *oleosa* over *Cratystylis conocephala, Eremophila ionantha* and mixed Chenopod species over herbs and grasses on orange to red-brown sandy-loams and clay-loams with gravel on flats. **No of Quadrats:** 3 **Similarity Percentage:** 44 %	
W18	Open woodland of *Eucalyptus laevis, Eucalyptus moderata, Eucalyptus salubris* and *Eucalyptus spreta* over *Acacia hemiteles, Acacia merrallii, Cratystylis conocephala, Eremophila dempsteri, Eremophila ionantha, Eremophila scoparia, Melaleuca halmaturorum* and mixed Chenopod species over patches of *Triodia irritans* on orange to red-brown clay-loams and sandy-loams on flats. **No of Quadrats:** 10 **Similarity Percentage:** 35 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W19	Open woodland of *Eucalyptus ?loxophleba* subsp. *lissophloia, Eucalyptus oleosa* subsp. *oleosa Eucalyptus urna* and *Eucalyptus spreta* over *Acacia hemiteles, Acacia merrallii, Cratystylis conocephala, Dodonaea stenozyga, Eremophila ionantha, Eremophila scoparia* and *Exocarpos aphyllus* over herbs and grasses on orange to red-brown clay-loams and sandy-loams on flats. **No of Quadrats:** 5 **Similarity Percentage:** 36 %	
W20	Open woodland of *Eucalyptus salubris* with local patches of *Eucalyptus calycogona* subsp. *calycogona, Eucalyptus spreta, Eucalyptus fraseri* subsp. *fraseri* and *Eucalyptus oleosa* subsp. *oleosa* over *Melaleuca sheathiana, Acacia hemiteles, Cratystylis conocepahala, Eremophila scoparia* and *Olearia muelleri* over localized patches of *Triodia irritans* on orange to red-brown clay-loams and sandy-loams on flats and lower slopes. **No of Quadrats:** 8 **Similarity Percentage:** 39 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
W21	Open woodland of *Eucalyptus polita* with local patches of *Eucalyptus flocktoniae* and *Eucalyptus lesouefii* over *Melaleuca sheathiana, Melaleuca halmaturorum, Acacia hemiteles, Accaia merrallii, Eremophila ionantha, Eremophila scoparia* and *Olearia muelleri* over herbs on orange to red-brown clay-loams and sandy-loams on flats and lower slopes. **No of Quadrats:** 46 **Similarity Percentage:** 30 %	
S1	Open scrub of *Melaleuca halmaturorum*, *Atriplex vesicaria*, *Cratystylis conocephala* and *Eremophila scoparia* with occasional *Eucalyptus lesouefii* and *Eucalyptus salubris* over *Zygophyllum ovatum*, *Scaevola spinescens*, *Olearia muelleri* and *Sclerolaena diacantha* over other low shrubs and herbs on orange clay-loams on flats and slopes. **No of Quadrats:** 6 **Similarity Percentage:** 34 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
S2	Open scrub of *Logania* sp. and *Eremophila ionantha* with occasional emergent *Eucalyptus salubris* and *Eucalyptus spreta* over *Atriplex* species, *Ptilotus holosericeus, Vittadinia dissecta* var. *hirta* and Chenopod species on orange cracking clays on flats and low lying areas. **No of Quadrats:** 2 **Similarity Percentage:** 41 %	
S3	Low open shrubland of *Acacia acuminata* (narrow phyllode variant) over *Eremophila decipiens* subsp. *decipiens, Dodonaea lobulata, Olearia pimeleoides* and *Eremophila deserti* over *Rhagodia ulicina*, *Enchylaena tomentosa* var. *tomentosa* and *Sclerolaena diacantha* and other mixed shrubs on red-brown clays on flats. **No of Quadrats:** 2 **Similarity Percentage:** 46 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
S4	Open scrub of *Allocasuarina helmsii* and *Melaleuca uncinata* with occasional *Eucalyptus rigidula* and *Eucalyptus salubris* over *Acacia hemiteles*, *Alyxia buxifolia, Dodonaea microzyga* var. *acrolobata, Grevillea acuaria, Scaevola spinescens* and *Olearia muelleri* over patches of *Triodia ?scariosa* and herbs on orange to red clay loam and clays on flats and slopes. **No of Quadrats:** 9 **Similarity Percentage:** 25 %	
S5	Low open shrubland of *Acacia hemiteles, Eremophila decipiens* subsp. *decipiens, Rhodanthe chlorocephala* subsp. *rosea, Atriplex vesicaria* and *Vittadinia dissecta* var. *hirta* over mixed low shrubs and herbs on red clays on flats. **No of Quadrats:** 2 **Similarity Percentage:** 58 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
S6	Open scrub of *Melaleuca hamata*, *Allocasuarina* sp. over *Vittadinia dissecta* var. *hirta, Acacia acanthoclada* subsp. *acanthoclada, Grevillea huegelii, Hannafordia bissillii* subsp. *latifolia* and *Melaleuca fulgens* subsp. *fulgens* over herbs and grasses on red-orange sandy-loams on flats. **No of Quadrats:** 4 **Similarity Percentage:** 54 %	
S7	Low open shrubland of *Tecticornia* sp. over *Eragrostis australasica, Eragrostis dielsii, Austrostipa mollis, Sclerolaena cuneata* and *Sclerolaena obliquicuspis* on orange clays on flats. **No of Quadrats:** 1 **Similarity Percentage:** N/A	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
S8	Low open shrubland of *Acacia assimilis* subsp. *assimilis* and *Melaleuca uncinata* over *Eremophila decipiens* subsp. *decipiens, Cryptandra aridicola, Dodonaea microzyga* var. *acrolobata, Acacia acanthoclada* subsp. *acanthoclada* and *Westringia cephalantha* over *Triodia ?scariosa* and herbs on red-brown clays on lower slopes. **No of Quadrats:** 1 **Similarity Percentage:** N/A	
S9	Open scrub of *Allocasuarina campestris, Eremophila alternifolia, Eremophila decipiens* subsp. *decipiens, Geijera linearifolia, Melaleuca uncinata* and *Melaleuca fulgens* subsp. *fulgens* over *Trymalium myrtillus* subsp. *myrtillus, Senna artemisioides* subsp. *filifolia* over herbs and patches of *Triodia ?scariosa* on red-brown clays on flats and lower slopes. **No of Quadrats:** 5 **Similarity Percentage:** 17 %	

APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

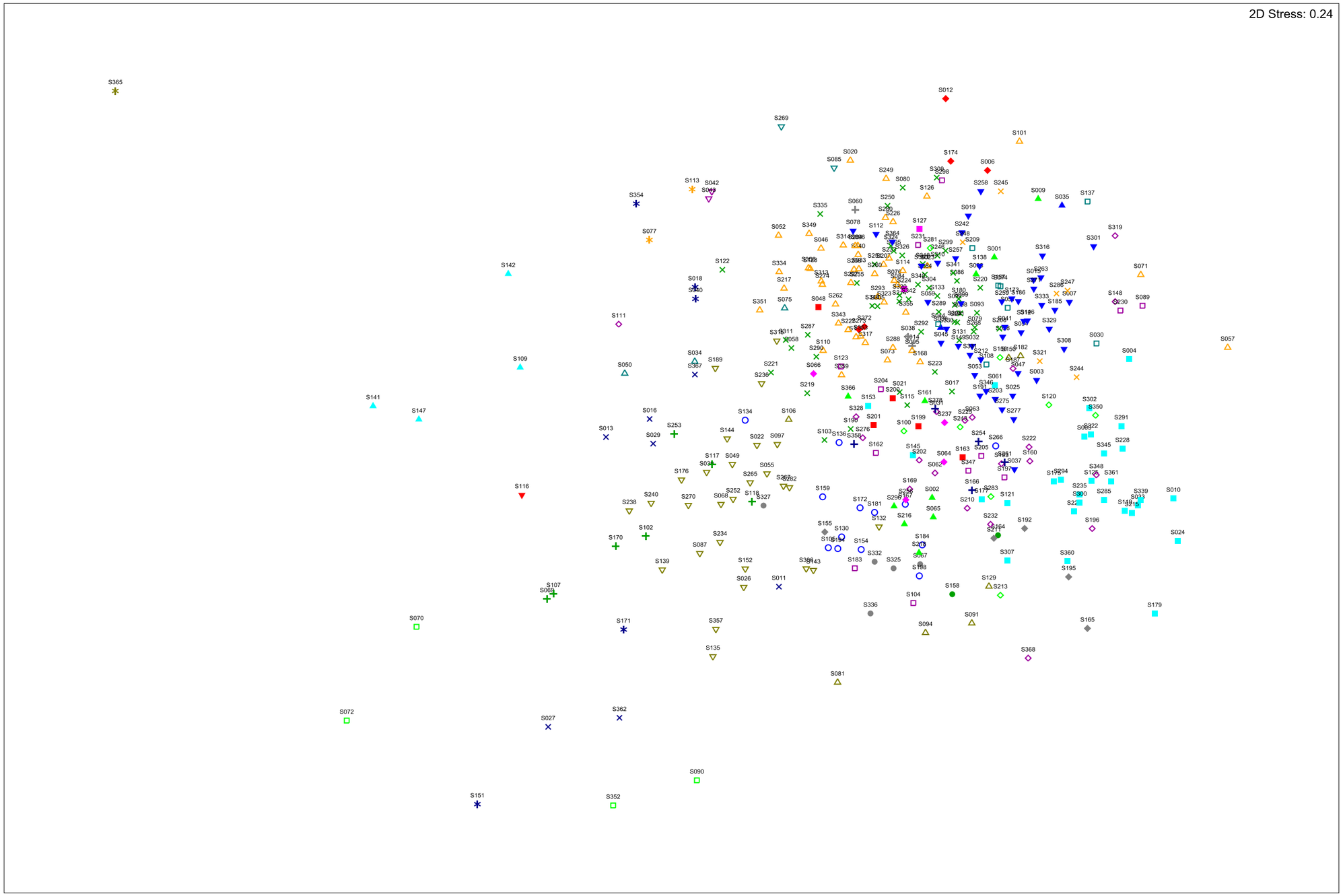
Mapping Code	Vegetation Community Description	Representative Plate of Community
G1	Open hummock grassland of mixed *Triodia* sp. with emergent *Eucalyptus griffithsii*, *Eucalyptus oleosa* subsp. *oleosa, Eucalyptus rigidula* and *Eucalyptus* ?*kumarlensis* over *Acacia erinacea*, *Acacia burkittii* and *Acacia hemiteles* over *Cryptandra aridicola*, *Westringia rigida*, *Senna artemisioides* subsp. *filifolia*, *Eremophila decipiens* subsp. *decipiens*, *Alyxia buxifolia* and *Grevillea acuaria* over herbs on orange-red clay-loams and sandy-loams on flats and slopes. **No of Quadrats:** 30 **Similarity Percentage:** 32 %	
G2	Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus horistes* and *Eucalyptus websteriana* subsp. *norsemanica* over *Acacia assimilis* subsp. *atroviridis, Allocasuarina helmsii, Cryptandra leucopogon, Grevillea plurijuga* subsp. *plurijuga, Halgania erecta* and *Scaevola amblyanthera* var. *centralis* over herbs on orange-yellow clay-loams and sandy-loams on slopes. **No of Quadrats:** 4 **Similarity Percentage:** 31 %	

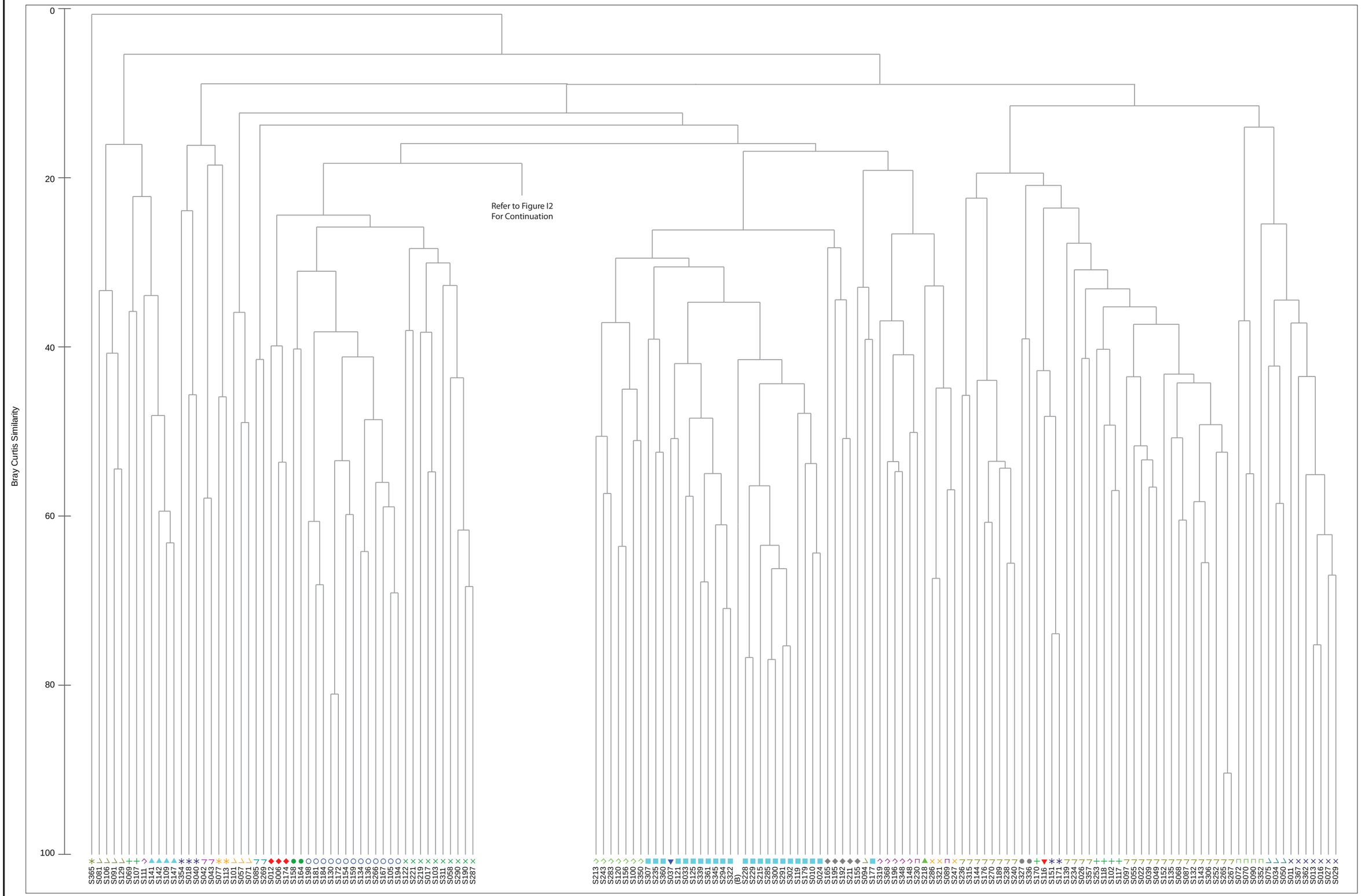
APPENDIX G: VEGETATION COMMUNITY DESCRIPTIONS FOR THE NOVA SURVEY AREA, 2013 – 2014

Mapping Code	Vegetation Community Description	Representative Plate of Community
G3	Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus salubris* and *Eucalyptus griffithsii* over *Acacia hemiteles, Eremophila alternifolia, Eremophila decipiens* subsp. *decipiens, Grevillea acuaria* and *Senna artemisioides* subsp. *filifolia* over herbs on red-brown clays and clay-loams on flats. **No of Quadrats:** 3 **Similarity Percentage:** 48 %	
G4	Open hummock grassland of *Triodia irritans* with emergent *Eucalyptus griffithsii* over *Acacia hemiteles, Allocasuarina species, Pultenaea elachista, Scaevola spinescens and Westringia rigida* over herbs on red-brown clay-loams on flats and lower slopes. **No of Quadrats:** 7 **Similarity Percentage:** 50 %	

APPENDIX H: NON-METRIC MULTIDIMENSIONAL SCALING ORDINATION PLOT (MDS) OF SURVEY SITES BASED ON FOURTH ROOT TRANSFORMED ABUNDANCE DATA USING BRAY CURTIS SIMILARITY (PRIMER V6, CLARKE AND GORLEY 2006)

Transform: Fourth root
Resemblance: S17 Bray Curtis similarity





Vegetation Community Type

Note: (B) is Sites S005 & S175

W18 W3 W5 W11 W17 W1 S9 W2 G1 W4 W8 W15 W19 W10 W7 S4 G4
S3 W16 S2 W9 W20 W12 S6 S8 W14 W21 W13 W6 S1 S7 G3 S5 G2

Client: Sirius Resources

CAD Ref: g2125_Nova_Apnd_I_1.ai
Date: Feb 2014 | Rev: A | A3

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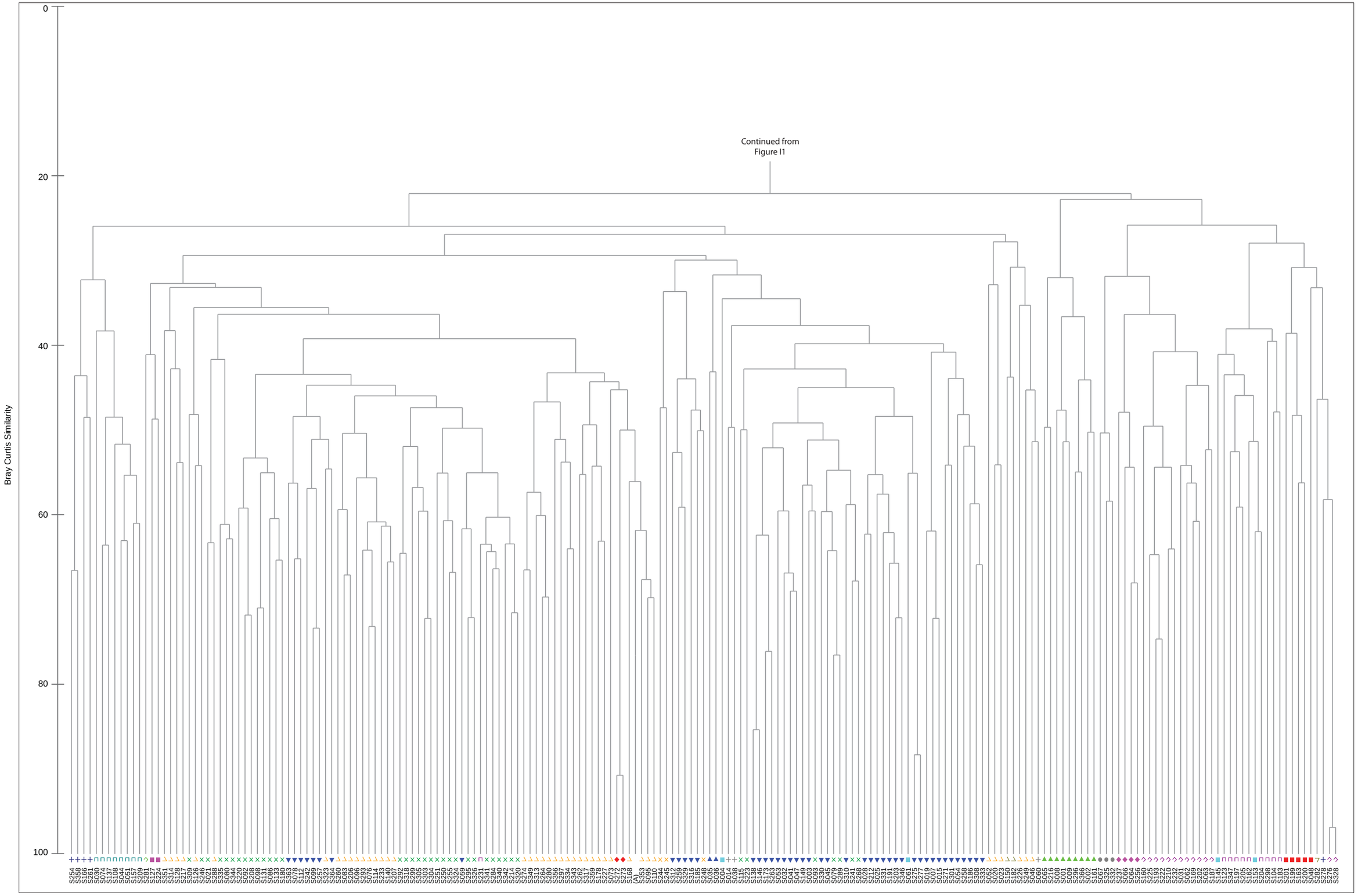
NOVA PROJECT

Hierarchical Cluster of Vegetation Community Types

Appendix:

I1



Vegetation Community Type

Note: (A) is Sites S084 & S355

W18 W3 W5 W11 W17 W1 S9 W2 G1 W4 W8 W15 W19 W10 W7 S4 G4
S3 W16 S2 W9 W20 W12 S6 S8 W14 W21 W13 W6 S1 S7 G3 S5 G2

Client: Sirius Resources

CAD Ref: g2125_Nova_Apnd_I_2.ai
Date: Feb 2014 | Rev: A | A3

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NOVA PROJECT

Hierarchical Cluster of Vegetation Community Types

Subgroup A

Appendix:

I2

APPENDIX 2: FAUNA SURVEY OF THE NOVA PROJECT AREA (RAPALLO 2014A)

REPORT No. 15410

Fauna Survey of the Nova Project Area

Prepared for: Sirius Gold Pty Ltd
Date: March 2014

Rapallo Environmental is a Western Australian consultancy with a strong reputation for technical excellence, client-focus and innovation. We build long-term alliances through outstanding delivery on a range of services to the resource sector, government and associated industries.

ENVIRONMENTAL | ENGINEERING | CONSTRUCTION & OPERATIONS *NDT & Inspections* | MINING | RESOURCE MANAGEMENT

Report No. 15410
Fauna Survey of the Nova Project Area
Prepared for Sirius Gold Pty Ltd
March 2014

Revision	Revision Detail	Date	Prepared	Reviewed	Approved
A	Internal Review	20/12/2013	Chris Cooper Marieke Weerheim Kate George	Kate George	Kate George
B	Issue to Client	10/01/2014	Marieke Weerheim Chris Cooper Kate George	Chris Cooper	Kate George
C	Client Comments Addressed	17/02/2014	Marieke Weerheim Kate George Chris Cooper	Kate George	Kate George
D	Additional Client Comments Addressed	21/03/2014	Marieke Weerheim Chris Cooper	Kate George	Kate George
E	Additional Client Comments Addressed	28/03/2014	Marieke Weerheim	Kate George	Kate George

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EXECUTIVE SUMMARY

Sirius Gold Pty Ltd (Sirius) proposes to develop the Nova Project, comprising a nickel-copper mine in mining lease application MLA28/376 (MLA), and a 40 kilometre (km) access road connecting the MLA with the Eyre Highway.

Rapallo Environmental was commissioned by Sirius to conduct a Level 2 fauna survey of the project area. The survey area comprised the MLA (4,600 hectares [ha]) and the access road corridor (400 ha). The survey included a desktop review of regional data, and a single-phase Level 2 field survey.

The field survey was completed from 5 to 19 November 2013 by a team of six Rapallo ecologists. Survey work included installation and deployment of six systematic trapping grids, bird surveys, bat surveys by means of acoustic recordings, hand foraging, deployment of Motion Detecting Cameras (MDCs), and opportunistic survey records. The survey focused on recording vertebrate fauna, while any putative Short-Range Endemic (SRE) invertebrate fauna were also recorded.

Eight broad fauna habitat types were identified in the project area. The dominant habitat type in the MLA was Woodland, within which the habitats Acacia shrubland, Melaleuca, and Woodland/Triodia were embedded. The dominant habitat type in the road corridor was Regenerating Woodland, within which were smaller patches of the habitats Burnt Plain, Mallee/Triodia, and Woodland dominated inundation zone. In addition, one sub-type was recorded, comprising a narrow creek line within the Regenerating Woodland habitat, considered to be a subset of this habitat.

A total of 136 (potentially 138) vertebrate fauna species were recorded from the project area, comprising 19 (potentially 21) mammals, 40 reptiles and 77 birds.

Nine vertebrate fauna species of conservation significance were identified in the project area, comprising eight bird species, and (potentially) one species of bat. One conservation listed snake was recorded from an unconfirmed location either within or close to the MLA.

- Malleefowl (*Leipoa ocellata*) – *Wildlife Conservation Act 1950* (WC Act) Schedule 1: Fauna that is rare or likely to become extinct, EPBC Act Vulnerable.
- Crested Shrike-Tit (south-western ssp.) (*Falcunculus frontatus leucogaster*) – DPaW Priority 4: Taxa in need of monitoring.
- Shy Heathwren (western ssp.) (*Hylacola cauta whitlocki*) – DPaW Priority 4: Taxa in need of monitoring.
- Rainbow Bee-eater (*Merops ornatus*) – WC Act Schedule 3: Migratory birds protected under an international agreement, EPBC Act Migratory.
- Fork-tailed Swift (*Apus pacificus*) – WC Act Schedule 3: Migratory birds protected under an international agreement, EPBC Act Marine and Migratory.
- White-browed Babbler (Western Wheatbelt) (*Pomatostomus superciliosus ashbyi*) – DPaW Priority 4: Taxa in need of monitoring.
- Crested Bellbird (southern ssp.) (*Oreoica gutturalis gutturalis*) – DPaW Priority 4: Taxa in need of monitoring.
- Rufous Fieldwren (western wheatbelt ssp.) (*Calamanthus campestris montanellus*) – DPaW Priority 4: Taxa in need of monitoring.
- Carpet Python (south-west ssp.) (*Morelia spilota imbricata*) – DPaW Priority 4: Taxa in need of monitoring.
- Greater Long-eared Bat (*Nyctophilus major tor*) – DPaW Priority 4: Taxa in need of monitoring.

All of the bird species were recorded during the survey by Rapallo Staff. The Carpet Python was sighted by Sirius staff prior to the survey, at an unconfirmed location either within or in close proximity to the MLA. The potential presence of the Greater Long-eared Bat was determined from bat call analysis. However, these calls could only be reliably identified to genus level, and the calls may also belong to a closely related non-listed species.

Provided that environmental management measures are implemented, the diversity of vertebrate fauna assemblages within the region is unlikely to be significantly affected by the proposed project.

Targeted Malleefowl surveying has commenced. The results will be reported in a separate document.

Putative Short-Range Endemic (SRE) invertebrates of the orders Mygalomorph spiders, scorpions, pseudo-scorpions, and land snails, were collected from nine locations in the project area. Taxonomic identifications have been completed for the spiders and scorpions, revealing two species of potential SRE. These were the Mygalomorph spiders *Aganippe* sp. indet, and *Aname* sp. indet. Follow-up surveys targeting Mygalomorph spiders has been completed in February 2014. None of the scorpions were found to be SRE. Identifications of pseudo-scorpions and snails will be presented in a separate report.

1 INTRODUCTION

Sirius Gold Pty Ltd (Sirius) proposes to develop the Nova Project (the project), comprising a nickel-copper mine and associated infrastructure. The project is situated in the Shire of Dundas, about 140 (km) north-east of Norseman in Western Australia (Figure 1). The project is located in the Coolgardie Biogeographical region, and forms part of the Great Western Woodlands.

The proposed mining area falls within exploration tenement E28/1724. Sirius has applied for a mining tenement which has provisionally been designated as MLA28/376 (hereafter referred to as the MLA). The mining area will comprise an underground mine, storage and processing facilities, a camp, an air strip and power generation infrastructure, with a combined impact area of approximately 300 (ha).

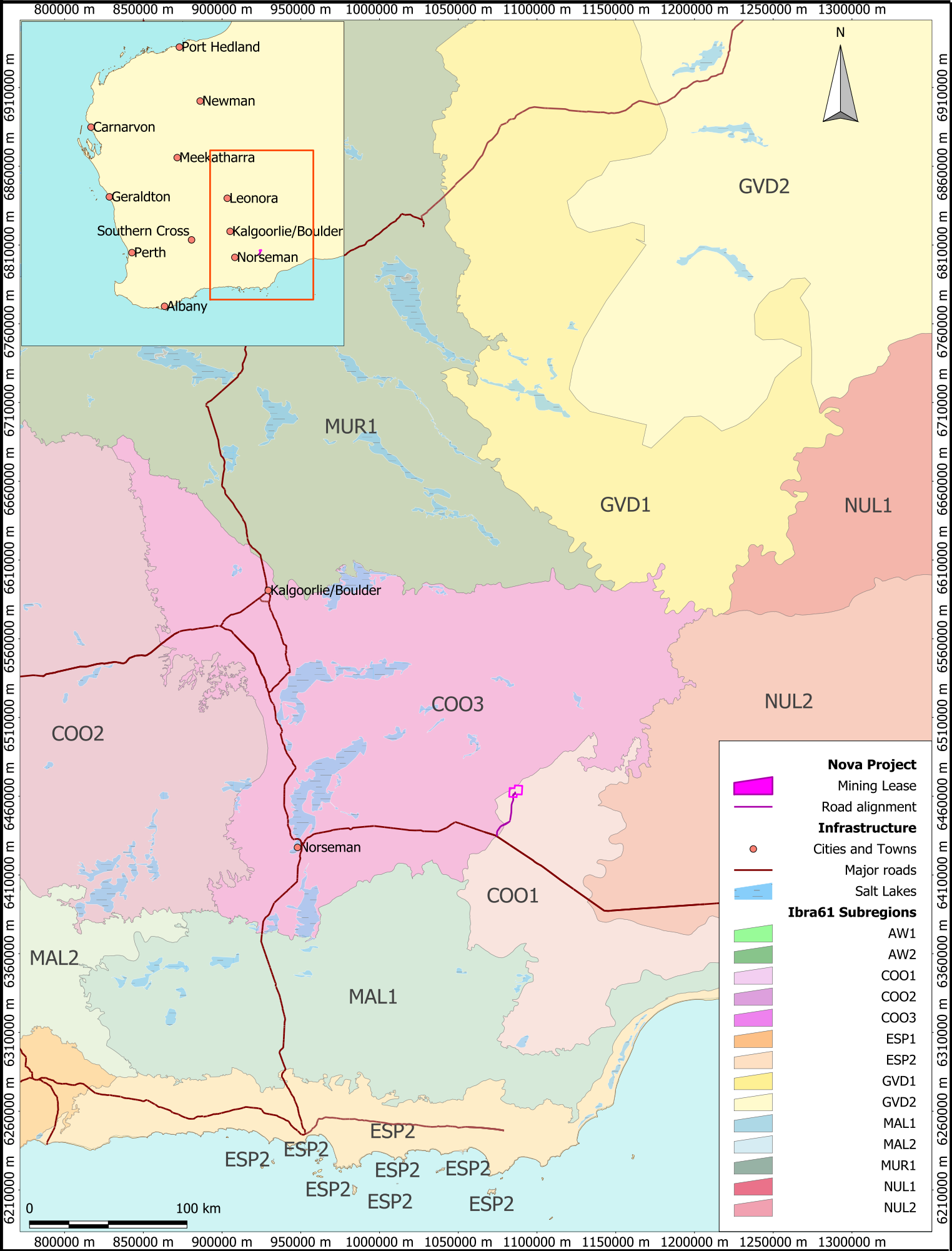
The proposed access road will run north-south from the mining area to the Eyre highway, over a length of approximately 40 km. The road corridor will have a width of approximately 50 metres (m), hence a disturbance area of approximately 200 ha.

1.1 SCOPE AND OBJECTIVES

Rapallo Environmental was commissioned by Sirius to conduct a Level 2 fauna survey of the project area, comprising both the MLA (4,600 ha) and the road corridor (Figure 1). At the time of the survey, the road corridor was proposed to be 100 m wide; hence the survey area for the corridor was 400 ha. The survey was completed over a 15 day period, from 5 to 19 November 2013 by a team of six experienced ecologists. Detailed survey methods are outlined in Section 4.

The objectives of the fauna survey were to:

- Provide an indication of the vertebrate fauna assemblage (reptiles, amphibians, small mammals and birds) on and in the vicinity of the project area, so that potential impacts on the fauna and fauna assemblage may be subsequently assessed.
- Identify the presence and/or potential occurrence of species of conservation significance that are present or likely to be present in the project area.
- Assess the habitat types and values associated with the proposed development.
- Determine if any additional surveys are required to assess the potential impact on fauna assemblages in the project area, in particular, impacts on species of conservation significance.
- Record opportunistic fauna observations.
- Obtain, if possible, living specimens of land snails at the site, in particular those belonging to the genus *Bothriembryon*; the subject of a current research project being undertaken by the Western Australian Museum (WAM). Collected specimens may be required to be submitted to WAM.



Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 3,000,000
Datum: MGA94 (Zone 51)

Figure 1

Location of the Project Area

2 LEGISLATION AND SURVEY GUIDANCE

Legislation relevant to the assessment of impacts on flora and fauna in Western Australia include the Federal *Environment Protection and Biodiversity Conservation Act 1999*, and the State *Environmental Protection Act 1986*, and *Wildlife Conservation Act 1950*.

In addition to species listed under these Acts, the Western Australian Department of Parks and Wildlife (DPaW) also lists fauna species under Priority rankings.

The Western Australian Environmental Protection Authority (EPA) has produced a series of guidance documents to aid in assessing the environmental impacts of developments in Western Australia.

2.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), together with the *Environment Protection and Biodiversity Conservation Regulations 2000*, provides for the protection, identification and listing of nationally and internationally important flora, fauna, ecological communities and heritage, defined as Matters of National Environmental Significance.

The main authority under the EPBC Act is the Federal Department of the Environment (DoE). Actions likely to have a significant impact on Matters of National Environmental Significance need to be referred to the DoE for assessment and approval.

The conservation categories of species listed under the EPBC Act follow recommendations of the International Union for the Conservation of Nature (IUCN 2014). The following categories of threatened fauna are recognised: Extinct (EX), Extinct in the Wild (EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), and Conservation Dependent (CD).

The EPBC Act also provides for protection of migratory species that are covered under the following International Conventions:

- Japan-Australia Migratory Bird Agreement (JAMBA)
- China-Australia Migratory Bird Agreement (CAMBA)
- Republic Of Korea – Australia Migratory Bird Agreement (ROKAMBA)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)

Ecological communities are unique and naturally occurring groups of plants and animals. Their presence can be determined by factors such as plant assemblage, soil type, position in the landscape, climate and water availability. The following categories of Threatened Ecological Communities are recognised: Critically Endangered (CR), Endangered (EN), and Vulnerable (VU).

2.2 ENVIRONMENTAL PROTECTION ACT 1986

The Western Australian *Environmental Protection Act 1986* (EP Act) provides for the protection of the environment from harm and pollution resulting from the development of land or natural resources. The main authority under the Act is the EPA which has statutory obligations under Part III and IV of the Act to undertake environmental impact assessment, protect the environment from harm and to provide advice to the Minister of Environment on matters of environmental importance.

The Act provides for the protection of Environmentally Sensitive Areas (ESA) under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. ESAs are selected for their environmental values at state or national level, and are defined under the *Environmental Protection (Environmentally Sensitive Areas) Notice 2005*.

Environmentally Sensitive Areas include:

- Declared World Heritage properties
- Areas on the Register of the National Estate
- Defined wetlands and riparian vegetation within 50 metres of the wetland
- Area of vegetation within 50 metres of Declared Rare Flora
- Areas covered by Threatened Ecological Communities
- Bush Forever sites

The main protection given to ESAs is that clearing permit exemptions that may exist under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004* do not apply in ESAs.

2.3 WILDLIFE CONSERVATION ACT 1950

In Western Australia, all native fauna is protected under the *Wildlife Conservation Act 1950* and cannot be collected, kept or culled without the appropriate permits. The *Wildlife Conservation Act 1950* uses a set of Schedules to classify the level of protection given to fauna species.

Special protection is given to species that are formally recognised as under threat of extinction, rare, or generally in need of protection. Specially protected fauna are classified under a set of Schedules which outline the level of protection; these are:

- Schedule 1 – Threatened Fauna (T): Fauna that is rare or is likely to become extinct.
- Schedule 2 – Presumed Extinct Fauna (X)
- Schedule 3 – Birds protected under International Agreement (IA): Migratory birds subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and the Republic of Korea (ROKAMBA) relating to the protection of migratory birds.
- Schedule 4 – Other Specially Protected Fauna (S): Fauna that is in need of special protection, for reasons otherwise than for those mentioned under Schedules 1, 2 and 3.

Threatened Fauna (T) are further ranked by the DPaW according to their level of threat, using International Union for Conservation of Nature (IUCN) Red List Criteria. These sub-categories are: Critically Endangered (CR), Endangered (EN) and Vulnerable (VU).

The DPaW regularly reviews and revises the schedule of threatened fauna listings in Western Australia. The list of specially protected fauna is published in the *Western Australian Government Gazette* as Wildlife Conservation (Specially Protected Fauna) Notices, with the most recent dated 17 September 2013 (Government of Western Australia 2013).

2.4 DPAW PRIORITY FAUNA RANKINGS

The Western Australian DPaW (previously Department of Environment and Conservation, DEC) maintains a supplementary list of Priority fauna rankings. Priority fauna are species which are not

considered Threatened under the State and Federal Acts mentioned above, but for which the DPaW considers that there is cause for concern.

Priority fauna are recognised as having conservation significance and are given consideration when developments are proposed within their distribution and/or habitats. There are five levels of Priority ranking. Priority 1, 2 or 3 (not yet adequately surveyed), Priority 4 (rare, near threatened, or in need of monitoring), and Priority 5 (conservation dependent).

The list of Priority Fauna is published on the DPaW website, with the most current list dated 17 September 2013 (DPaW 2013a).

2.5 EPA GUIDANCE STATEMENTS

The EPA of Western Australia is responsible under the WC Act to protect the environment and to prevent environmental harm. Part of its role is to conduct environmental impact assessments (EIA) of major projects. Another part is to develop policy and guidance documents; these documents carry the force of law under both the WC Act and the EP Act.

2.5.1 EPA GUIDANCE FOR TERRESTRIAL FAUNA

The guidance documents relevant to terrestrial vertebrate fauna are:

- *Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002)
- *Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004a)
- *Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010)

Guidance Statement 56 outlines the minimal expectations of the EPA in regards to terrestrial fauna considerations in EIA. It provides a number of general recommendations for consideration before a survey, including the level of survey required, survey design and intensity, survey limitations, and reporting of data. For the Coolgardie Bioregion, Guidance Statement 56 recommends that any proposed project with footprint greater than 50 ha requires a Level 2 survey to adequately assess potential impacts on terrestrial fauna (EPA 2004a).

The Technical Guide provides detailed standards and protocols for fauna surveys, with techniques and methods specific to the different bioregions of Western Australia. The Technical Guide recommends that field surveys should be conducted during the period of maximum activity of the targeted faunal group, which will depend on the region. However, the Technical Guide recognizes that periods of peak activity may differ between species groups, and that for some regions surveying during peak activity is not logistically practical. Repeat surveys over multiple seasons will generally yield higher number of species than single surveys, and will account for temporal difference in activity patterns (EPA 2010).

The project area is located in the South-Western Interzone between the Eremaean and South-West botanical provinces (Beard 1990; Thackway & Cresswell 1995). For this area, the most suitable time to conduct surveys is in November-December, which coincides with peak activity for reptiles, birds, and mammals, and with frog species that breed in summer. This time, however is outside the peak activity period for burrowing frogs and winter breeding frogs (see Table 1 based on EPA 2010).

Table 1 EPA (2010) recommended survey timing for vertebrate fauna in the South-West Interzone

Species Group	Period of recommended survey timing per month											
	J	F	M	A	M	J	J	A	S	O	N	D
Reptiles												
Adults												
Adults and hatchlings												
Amphibians												
Burrowing frogs												
Winter breeders												
Summer breeders												
Birds												
Bush birds												
Migratory waders												
Mammals												

2.5.2 EPA GUIDANCE FOR SHORT-RANGE ENDEMIC FAUNA

Short-range Endemic (SRE) fauna are considered to be invertebrate species with a naturally small range (less than 10,000 square kilometres) (Harvey 2002). SRE species often possess a combination of ecological and life-history traits that make them vulnerable to extinction. These traits include poor powers of dispersal, confinement to isolated habitats, low levels of fecundity, and usually highly seasonal activity patterns (i.e. only active during cooler, wetter periods).

Based on these traits and after reviewing the literature in Australia, Harvey (2002) listed a series of invertebrate groups that either showed high levels of short range endemism or were likely to include SRE species. The list of groups includes Mygalomorph spiders, scorpions, pseudoscorpions, millipedes, and land snails. Taxa from these groups are of particular risk of being SRE, and survey methods should be designed to optimise the chances of recording these groups (EPA 2009).

The following guidance documents outline the minimum expectations of the EPA in regards to consideration of SRE fauna in an environmental impact assessment.

- *Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002).
- *Guidance Statement No. 20: Sampling of Short Range Endemic Invertebrate Fauna for Environmental Impact Assessment in Western Australia* (EPA 2009).

Guidance Statement No. 20 outlines the general standards required for SRE surveys, and presents a common framework by which they should be carried out. It also sets out the expectations in respect of the quality and quantity of data collected during SRE surveys, and how this data should be analysed and reported.

Guidance Statement No. 20 suggests that the optimum time to survey SRE is during seasonally wet conditions. Typically, SRE taxa are easier to collect during wet conditions as they become more active and venture from their hiding places. In addition, for many SREs adults (particularly adult males) are required for identification, and many taxa reach maturity timed to coincide with wet conditions. In the Goldfields and Midwest areas, high rainfall events are scattered and sporadic, with rainfall influenced by south-west fronts in the south, and by cyclone events in the north. This means that for the project

area the optimum SRE survey time will be determined by the rainfall events of that particular year, rather than an annual time period (EPA 2009).

Important in the context of Environmental Impact Assessments, Guidance Statement No. 20 recognises and discusses limitations on current knowledge in respect to SRE fauna. In particular, the limitations encountered after recording rare and cryptic taxa, and the low probability of further survey success. If such rare or cryptic specimens are restricted to impact zones, a risk-based analysis using habitat as a surrogate for distribution can be considered (EPA 2009).

3 REGIONAL CONTEXT OF THE SURVEY AREA

3.1 CLIMATE

The Nova project area has an arid to semi-arid Warm Mediterranean climate (Thackway & Cresswell 1995). The nearest Bureau of Meteorology (BoM) weather station is at Balladonia (Station Number 011017), located approximately 90 km south-east of the project area.

The average annual rainfall for Balladonia is 264 mm, calculated over the years 1891 to 2013. Rainfall occurs throughout the year, with the majority falling in autumn and early winter (Figure 2). Summers are warm, with average maximum temperatures of 30 °C. Temperatures in excess over 40 °C happen on average 8 days each year, mainly in December and January (Bureau of Meteorology 2013).

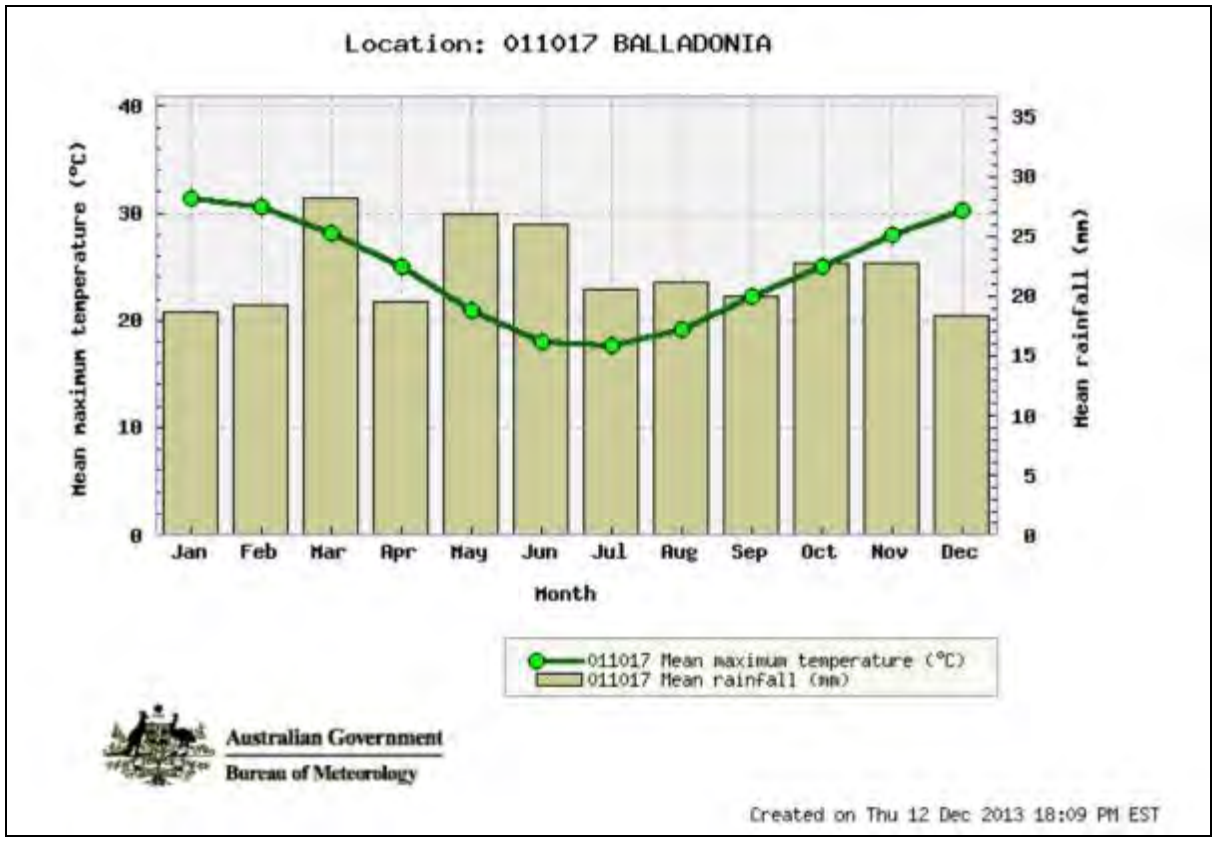


Figure 2 Mean maximum temperatures and rainfall recorded at Balladonia weather station

A small weather station recording only rainfall data is located at Fraser Range (Station Number 012029), approximately 15 km east of the project area. The total amount of rainfall over 2013 from January to October was 412.5 mm, with the majority falling in March (154.1 mm). Over the four months preceding the survey (July to October), Fraser Range received a total of 104.5 mm of rain, spread out evenly over the months. No rainfall data for November was available at the time of writing.

During the survey, from 5 to 19 November 2013, the Balladonia weather station recorded 4.2 mm of rainfall. Most rain fell on Thursday 7 November (3.6 mm). Daytime temperatures during the survey were in the mid to high 20s, with Tuesday 5th (40 °C) and Sunday 17th (33.8 °C) being the hottest days. Night time temperatures fluctuated between 16 °C on the night of the 17th to 5.7 °C on the night of the 10th. Daily temperature and rainfall data from the Balladonia Station during the survey period are shown in Table 2.

Table 2 Daily temperature and rainfall recorded at Balladonia over the period of the survey

Survey day	Maximum temperature (°C)	Minimum temperature (°C)	Rainfall (mm)
Tuesday, 5 November 2013	40	16	
Wednesday, 6 November 2013	21.1	14.3	
Thursday, 7 November 2013	21.2	12.5	3.6
Friday, 8 November 2013	23.7	8	
Saturday, 9 November 2013	24.8	5.7	
Sunday, 10 November 2013	23.5	7.2	
Monday, 11 November 2013	27.4	7.5	
Tuesday, 12 November 2013	30.2	9.5	
Wednesday, 13 November 2013	29.8	11	
Thursday, 14 November 2013	28.5	14.5	
Friday, 15 November 2013	24.9	14.7	
Saturday, 16 November 2013	29.3	9.5	
Sunday, 17 November 2013	33.8	9.4	
Monday, 18 November 2013	21.5	16	
Tuesday, 19 November 2013	18	11.3	0.6

3.2 BIOGEOGRAPHY

The bioregions of Australia are described in the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway & Cresswell 1995). Bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features and plant and animal communities. The latest version, IBRA7, classifies Australia's landscapes into 89 large geographically distinct bioregions and 419 subregions (DoE 2013).

The project area is located in the Coolgardie Bioregion, which is characterised by granite rocky outcrops, low greenstone hills, laterite uplands and broad plains. The bioregion does not have major rivers or creeks and includes numerous salt lakes. The geology consists of greenstone belts and granites of Archaean age (2,400-3000 million years old) (Thackway & Cresswell 1995).

The project area straddles the border of the Mardabilla (COO1) and Eastern Goldfields (COO3) subregions (Figure 1). The majority of the MLA and the road corridor are situated in the Mardabilla subregion, while the north-western corner of the MLA and the southern 9 km of the road corridor fall within the Eastern Goldfields subregion.

The Mardabilla (COO1) subregion comprised of granite strata of the Yilgarn Craton with Archaean Greenstone intrusions in parallel belts. The subregion is an Eocene marine limestone plain, on a granite basement in its western parts. Drainage is occluded. (Grant *et al.* 2002).

The Eastern Goldfields (COO3) subregion lies on the Yilgarn Craton's 'Eastern Goldfields Terrains'. The relief is subdued and comprises of gently undulating plains interrupted in the west with low hills and ridges of Archaean greenstones and in the east by a horst of Proterozoic basic granulite. The underlying geology is of gneisses and granites eroded into a flat plane covered with tertiary soils and with scattered exposures of bedrock. The subregion contains a series of large playa lakes in the western half, which are remnants of an ancient major drainage line (Cowan 2002).

3.3 HYDROLOGY

The Coolgardie bioregion lies on the Southern Cross area of the Yilgarn Craton, which covers half of the total landmass of Australia. The Yilgarn Craton contains a network of ancient palaeodrainage channels of Tertiary origin (Johnson & McQueen 2003). This palaeodrainage network drains from the north and west into the Great Australian bight (Coleman 2003).

The project area is situated on the eastern margin of the palaeodrainage network, but is not located over a palaeochannel. Instead, the geology underlying the project area comprises the matrix of low-productivity aquifers within which the palaeochannels are embedded (Jacobson & Lau 1978).

The project area is traversed by three non-perennial minor watercourses running east-west across the MLA and across the proposed access road alignment (Australian Government 2013).

3.4 SOILS

The project area falls in the Kambalda Zone (zone 265) of the Kalgoorlie Province of the soil-landscape regions of Western Australia (Tille 2006). The Kambalda zone is described as:

> *Flat to undulating plains (with hills, ranges and some salt lakes and stony plains) on greenstone and granitic rocks of the Yilgarn Craton. Calcareous loamy earths and Red loamy earths with Salt lakes soils and some Redbrown hardpan shallow loams and Red sandy duplexes. Red mallee, blackbutt, salmon gum, gimlet woodlands with mulga and halophytic shrublands (and some spinifex grasslands). Located in the south-eastern Goldfields between Menzies, Norseman and the Fraser Range.*

The soils of the project area are mapped as Soil Unit DD14 (Australian Government 2013). This unit is described as follows (CSIRO Australia 2013):

> *Flat to undulating land with small valleys occasionally broken by low narrow rocky hills and ridges, or tors and bosses; some block silcrete and silcrete fragments recorded in the area of Sheet 10; some clay pans and salt lakes with dunes and lunettes; some small dune tracts in the area of Sheet 10: chief soils are brown and grey-brown calcareous earths (Gc1.12) and (Gc1.22), mostly with loamy surface soils, but there are some areas with sandy surface soils and some (Gc2.22) soils and gilgais. Associated are various (Dr) soils such as (Dr1.73, Dr1.83) in valleys and flats; shallow red earths (Gn2.12) often with rock at 3 ft; siliceous sands (Uc1.2) on dunes and lunettes; and areas of undescribed soils. Country rock is present in some areas at depths of 3-5 ft, while in other sites non-calcareous clays occur at similar depths.*

3.5 REGIONAL VEGETATION

The project area is located in the Coolgardie Botanical District of the South-Western Interzone between the South West and the Eremaean Botanical Provinces (Beard 1990). This botanical district is characterised by eucalypt woodlands, becoming open and with saltbush-bluebush understorey on the more calcareous soils. Patches of shrub steppe occur adjoining the Great Victorian Desert.

The Coolgardie botanical district encompasses a variety of vegetation types, defined by geology. The project area is situated in the subset located east of the Goldfields and north-west of the Nullarbor Plain. In this area the soils become steadily more calcareous, but in the north along the transcontinental railway also more sandy. The result in the latter area is an intricate mosaic of eucalypt woodland and shrub steppe consisting of mallee and spinifex. Patches of *Eucalyptus salmonophloia*, *E. lesouefii* and *E.*

salubris occur on the heavier soils. However, most the woodlands consist of *E. oleosa* and *E. transcontinentalis* on a highly calcareous fluffy pink soil. These woodlands usually have a greybush understorey of *Cratystylis conocephala*. The latter two eucalypt species are also those forming the mallee, adopting a mallee form with a ground layer principally of *Triodia scariosa* on red sand, and overlying a calcareous hardpan (Beard 1990).

Digital maps of pre-European vegetation communities, based on state-wide mapping by J.S. Beard at 1:250,000 scale (Beard 2005), show that the project area traverses four vegetation associations. These are listed and described in Table 3 below.

Table 3 Beard vegetation associations of the project area

Vegetation Association	Description	Location in project area	Area
Harms 487	Medium eucalypt woodland comprising *Eucalyptus transcontinentalis* (redwood) and *E. oleosa* (red mallee).	Majority of MLA and northern 20 km of road corridor	4,627 ha
Fraser Range 488	Mosaic: (a) medium Eucalypt woodland of *E. salubris* (gimlet) over shrublands, (b) mallee scrub; (c) *E. eremophila* woodland	Two small sections in north-west corner of MLA	136 ha
Fraser Range 489.1	Mosaic dominated by (a) *Dodonaea* open shrubland, interspersed with; (b) *Allocasuarina* mixed woodland over *Dodonaea* over grasses; (c) *Pittosporum phylliraeoides* over *Acacia acuminata*, (d) medium woodland of *E. lesouefii* (goldfields blackbutt) & *E. dundasii* (Dundas blackbutt)	Small section in western corner of MLA	133 ha
Fraser Range 500.1	Mosaic: (a) medium *Eucalypt* sp. woodland over mallee over *Dodonaea*; (b) *Acacia* over shrubs and *Maireana sedifolia*; (c) *Triodia* over chenopods, over grasses.	Southern 10 km of road corridor	109 ha

3.6 PROTECTED AREAS

3.6.1 ENVIRONMENTALLY SENSITIVE AREAS

The project area does not overlay any Environmentally Sensitive Areas as described by the *Environmental Protection (Clearing of Native Vegetation) Regulation 2004* or Priority Ecological Communities (PECs) as defined by the Department of Environment Regulation (DER) Native Vegetation Map Viewer, there are no ESAs within five kilometers of the project area (DER 2014).

3.6.2 THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

The Coolgardie bioregion does not contain any Threatened Ecological Communities (TECs) (DPaW 2013b). Two Priority Ecological Communities (PECs) have been identified in the vicinity of the project area. These are the Priority 1 Fraser Range Vegetation Complex, and the Priority 1 Plant Assemblages of the Southern Hills Vegetation Complex (DEC 2013e). The boundary of the Fraser Range Complex lies approximately 3 km north-east of the MLA.

The Fraser Range Vegetation Complex comprises four vegetation assemblages associated with the Fraser Range (DPaW 2013e). These are described as:

- *Allocasuarina huegeliana* and *Pittosporum phylliraeoides* open woodland over *Beyeria leschenaultia and Dodonaea microzyga* Scrub and *Aristida contorta* bunch grasses (granite complex), on the slopes and summits of hills;
- *Acacia acuminata* Tall Shrubland dominated by *Melaleuca uncinata* and *Triodia scariosa* on uplands with shallow loamy sands;
- *Eucalyptus* aff. *uncinata* (KRN 7854) over *Senna artemisioides* subsp. *helmsii, Cryptandra miliaris, Dodonaea boroniifolia*, *D. stenozyga* and *Triodia scariosa* (*Eucalyptus effusa* Mallee) on colluvial flats with loamy clay sands, and;
- *E. oleosa*, *E. transcontinentalis*, *E. flocktoniae* Woodland on flats.

The Plant Assemblages of the Southern Hills Vegetation Complex are described as:

- Complex of woodland (*E. oleosa*, *E. transcontinentalis*, *E. flocktoniae*) on flats with open stony ridges carrying mainly mallee and spinifex (*Eucalyptus effusa* Mallee: *Eucalyptus* aff. *uncinata* (KRN 7854) over *Cassia helmsii*, *Cryptandra miliaris*, *Dodonaea boroniifolia*, *D. stenozyga* and *Triodia scariosa*). Includes patches of grassland, wattle thicket and mallee.

3.6.3 GREAT WESTERN WOODLANDS

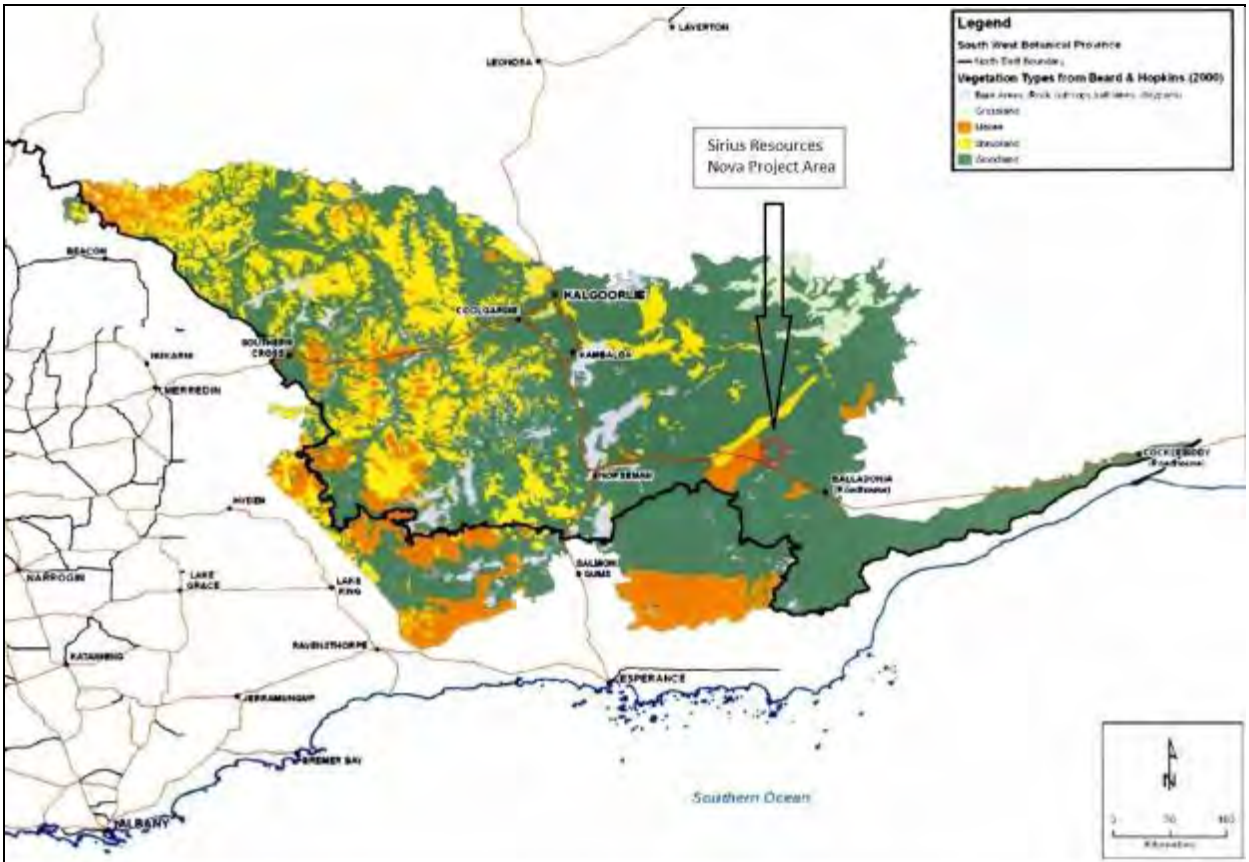
The project area lies within the Great Western Woodlands (Figure 3) an area of great biological richness covering nearly 16 million ha (DEC 2010). The Great Western Woodlands partially overlap with the north-eastern edge of the South West Botanical Province (Beard 1990), an internationally recognised biodiversity hotspot. The Great Western Woodlands includes the entire Coolgardie IBRA Bioregion as well as parts of the Mallee, Avon Wheatbelt, Nullarbor and Murchison Bioregions.

The dominant vegetation type of the Great Western Woodlands is woodland communities, covering 63% of the total area, followed by shrubland (20%), mallee communities (10%) and grasslands (2%). The woodland communities are highly varied, and encompass many different vegetation communities. The Great Western Woodlands is a centre for eucalypt diversity, with 160 species of eucalypts recorded in the area, many of which are endemic. This represents 21% of all known eucalypt species in Australia.

The Great Western Woodlands support more than 3,000 species of flowering plants, which is 20% of Australia's known flora. The area has 38 species of Threatened (Declared Rare) Flora, many of which are endemic, 217 Priority flora species and 15 PECs, many of which are associated with BIF and greenstone ranges.

Although still relatively intact, the Great Western Woodlands are under increasing pressure from introduced fauna, weeds, and bushfires. Land clearing for residential, mining, industrial and infrastructure purposes is an ongoing issue, leading to loss of biodiversity and increased dry land salinity (DEC 2010).

The project area, covering approximately 4,600 ha, represents 0.03 % of the total area of the Great Western Woodlands.



Map reproduced from: *A Biodiversity and Cultural Conservation Strategy for the Great Western Woodlands* (DEC 2010).
Coloured area indicated boundaries of Great Western Woodlands in this document.

Figure 3 Location of the project area in the Great Western Woodlands

4 METHODS

4.1 SCIENTIFIC LICENCE

This survey was licensed under the Western Australian *Wildlife Conservation Act 1950* Regulation 17 "Licence to Take Fauna for Scientific Purposes" licence number: SF009543

4.2 VOUCHERING

Following EPA (2010) recommendations, Rapallo will voucher specimens if:

- They are of a species or species group specifically requested by the WAM;
- They cannot be identified in the field (typically difficult species such as *Ramphotyphlops spp.*);
- They represent a species of taxonomic confusion/interest;
- They exhibit a significant range extension; or
- They are possibly an un-described species.

Rapallo sought advice from the Western Australian Museum (WAM) prior to the field survey in regards to fauna that may be required for vouchering. WAM advised Rapallo that they were conducting a taxonomic review of the snail genus *Bothriembryon* within the region and requested Rapallo Environmental voucher any live snail specimens collected during the survey.

4.3 PERSONNEL

Table 4 outlines the personnel that were involved in the field survey and the preparation of this report.

Table 4 Personnel involved in this survey

Name	Position	Trap Installation	Field Survey	Reporting
Kate George	Principal Scientist	●	●	●
Chris Cooper	Ecologist	●	●	●
Marieke Weerheim	Ecologist	●	●	●
Magnus Peterson	Field Ecologist	●	●	●
Floyd Holmes	Trainee Ecologist		●	
Chris Sanderson	Field Ecologist		●	
Nicholas Thomas	Technical Officer	●		

4.4 DESKTOP SEARCH

Prior to the field survey, database searches were completed to identify whether species of conservation significance had either been recorded within the survey area or had the potential to occur within habitats found on the project area. These databases are listed in Table 5. Results of the database searches are summarised in Appendix I.

Table 5 Database searches completed for the survey area.

Search	Latitude	Longitude	Buffer	Comments
DPaW Threatened Fauna Database (2013c)	31°49'09" S,	123°11'25"E	40 km	Point Search
DoE Protected Matters Search Tool (2013)	31°49'09" S,	123°11'25"E	10 km	Area Search
DPaW NatureMap (2013d)	31°49'09" S,	123°11'25"E	40 km	Point Search
Birdlife Australia BirdData (Birdlife Australia 2013a)	32°05'24"S 32°33'14"S	123°14'42"E 122°57'08"E	1 degree square	Point Search
WAM Mollusc Database (2013a)	32°09'51"S 31°40'04"S	123°27'39"E 122°54'35"E	2800km^2	Area Search
WAM Terrestrial SRE Database (2013b)	32°09'51"S 31°40'04"S	123°27'39"E 122°54'35"E	2800km^2	Area Search

In addition to the above database sources, data from previous fauna surveys in the region were reviewed. Table 6 details which reports were used for the regional literature review and their approximate distances from the project area.

Table 6 Regional literature sources

Report	Author	Approximate Distance from project area (km)
Biological Survey of the Eastern Goldfields of Western Australia. Part 9. Norseman to Balladonia study area. Records of the Western Australian Museum Supplement No. 42.	Hall and Mckenzie (1993)	Camp 1 – 65 km SW Camp 2 – 60 km SE Camp 3 – 110 km S Camp 4 – 100km SW Camp 5 – 120 km S
St Ives Gold Fauna Survey. Spring 2005. Unpublished report for Jim's Seeds Trees and Weeds.	Western Wildlife (2006)	140 km NW
Draft, level two terrestrial fauna survey of the Salmon Gums Project Area. Report for MBS Environmental.	Rapallo (2009)	180 km SW
Biological Survey of the Eastern Goldfields of Western Australia. Part 2. Widgiemootha to Zanthus study area. Records of the Western Australian Museum Supplement No. 18.	Dell and How (1984)	Buningonia – 70 km NE Woodline – 70 km E
The Biological Survey of the Eastern Goldfields of Western Australia. Part 4. Lake Johnston to Hyden Study Area. Records of the Western Australian Museum Supplement No. 30.	How *et al.* (1980)	Mc Dermid Rock – 225 km E Lake Cronin – 320 km WSW Frank Hann NP – 290 km SW Peak Charles – 220 km SW
Vertebrate Fauna of the Honman Ridge - Bremer Range District, Great Western Woodlands, Western Australia. Report by The Wilderness Society.	Duncan *et al.* (2006)	240 km WSW
Biological and Environmental Survey of M63/163 Lease and Surrounding Area: Maggie Hays Project. School of Environmental Biology, Curtin University of Technology.	Brearley *et al*. (1997)	240 km WSW

Report	Author	Approximate Distance from project area (km)
Biological Survey and Environmental Assessment of The Emily Ann Project Area. School of Environmental Biology, Curtin University of Technology.	Brearley *et al.* (1998)	240 km WSW
Environmental Protection Statement for the Spotted Quoll Mine. Summary of Biota Fauna Surveys (2006a, 2006b, 2007a and 2007b) - Tables 19 to 21.	Coffey Environments (2009)	330 km SW
Great Western Woodlands bird list October 2013. Western Australian Bird Notes, No 148	Fox (2013)	Frank Hann NP – 290 km SW Peak Charles – 220 km Lake King Norseman – 340 km SW

4.5 VERTEBRATE FAUNA SURVEY

A single-phase Level 2 fauna survey of the project area was completed from 5 to 19 November 2013 by a team of six Rapallo ecologists. Survey work included installation and deployment of six systematic trapping grids, bird surveys, bat surveys by means of acoustic recordings, hand foraging, spotlighting, deployment of Motion Detecting Cameras (MDCs), and opportunistic survey records.

4.5.1 FAUNA HABITAT MAPPING

Broad-scale fauna habitat mapping of the project area was undertaken using the following information:

- Vegetation maps by Mattiske (2014)
- Habitat assessments of the MLA by Terrestrial Ecosystems (2013)
- Aerial photography as provided by the client (dated August 2005), and available online
- Selective ground-truthing of habitat types and boundaries during site selection and while traversing the survey area.

Rapallo's habitat mapping focussed on broad habitat types as relevant from a terrestrial vertebrate fauna perspective.

4.5.2 SYSTEMATIC TRAPPING

Six systematic trap sites were deployed across the project area with two trap sites along the proposed access road and four trap sites within the mining lease application (MLA). The locations of the six systematic trapping sites across the project area are shown in Figure 4.

Table 7 shows the total number of trap nights by trap site and habitat type. Trap sites were selected within each of the six dominant habitat types present in the project area, as identified from maps and information provided prior to the survey. Fauna habitats are described in section 5.2.

Table 7 Trap night summary and trap configuration per site

Site number and habitat	Pitfall Traps	Elliot Traps	Funnel Traps	Cage Traps	Total Nights
Site 1 – Acacia Shrubland	108	180	90	36	414
Site 2 - Woodland	96	160	80	32	368
Site 3 - Melaleuca	96	160	80	32	368
Site 4 – Woodland/Triodia	96	160	80	32	368
Site 5 - Regenerating	84	140	70	28	322
Site 6 - Burnt	84	140	70	28	322
Total	**564**	**940**	**470**	**188**	**2162**

Rapallo used a nested pitfall trap grid to survey the terrestrial fauna of the survey area. Trap configuration is illustrated in Figure 5. Each systematic trapping site consisted of:

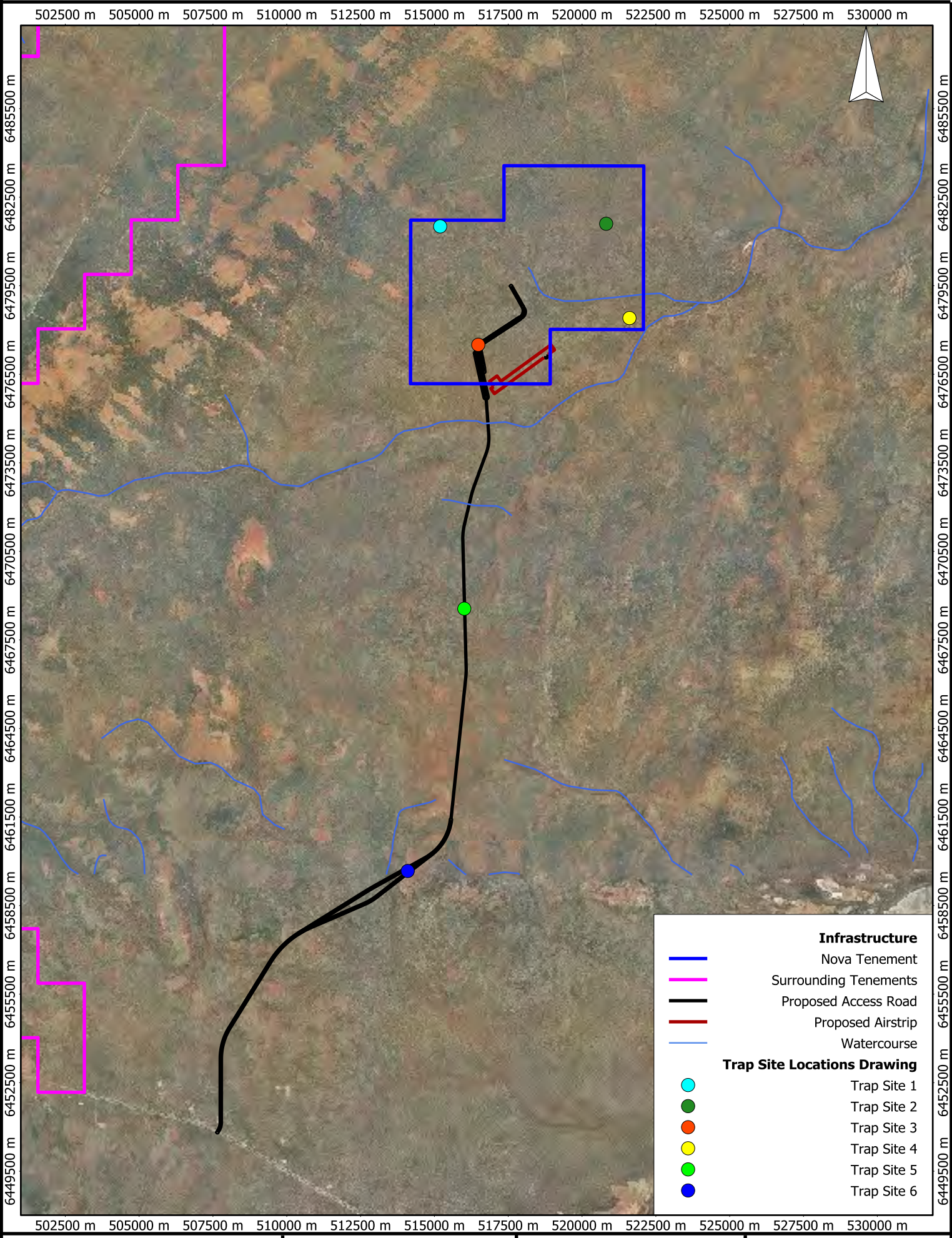
- 20 Elliot traps
- 10 funnel traps (2 lines of 5)

- 12 bucket pitfall traps (2 lines of 6)
- 4 cage traps
- 1 Motion detecting camera

Each pitfall trap had a white polystyrene tray to provide shelter for any captured fauna. Funnel traps and Elliot traps were covered with native vegetation and cage traps were covered with insulation sheeting, to provide shelter for captured fauna. Elliot and cage traps were baited with a mixture of oats, sardines, honey and peanut butter. Baits were replaced every three days.

Vertebrate fauna were identified and released each morning as the trap lines were cleared. Specimens that could not be immediately identified were placed in a calico bag and kept in a cool location until identified at the field camp. After identification the specimens were released near the site of capture when conditions for release were suitable (i.e. early morning or late afternoon). The following data were recorded for each animal captured:

- Trapping site and trap number
- Species
- Sex and reproductive condition (where possible)
- Age class, i.e. whether juvenile or adult (where possible)



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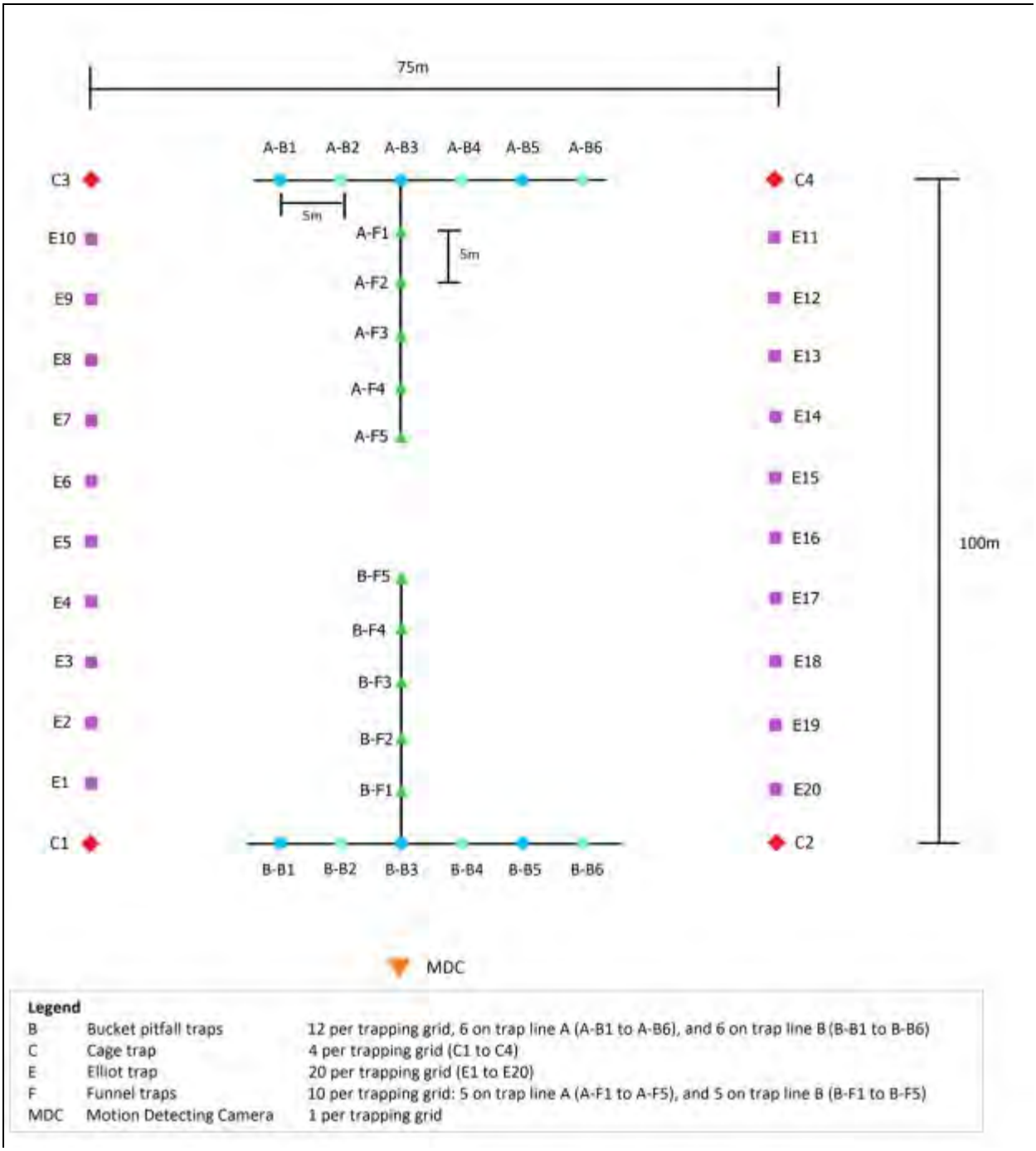
Nova Project

Scale: 1 : 160,000
Datum: MGA94 (51)

0 5 km

Locations of Systematic Trapping Sites

Figure 4



Legend		
B	Bucket pitfall traps	12 per trapping grid, 6 on trap line A (A-B1 to A-B6), and 6 on trap line B (B-B1 to B-B6)
C	Cage trap	4 per trapping grid (C1 to C4)
E	Elliot trap	20 per trapping grid (E1 to E20)
F	Funnel traps	10 per trapping grid: 5 on trap line A (A-F1 to A-F5), and 5 on trap line B (B-F1 to B-F5)
MDC	Motion Detecting Camera	1 per trapping grid

Figure 5 Trap configuration of systematic trapping sites

4.5.3 BIRD SURVEYS

Bird assemblages were through systematic surveys, and opportunistic observations. Systematic twenty minute two-hectare bird surveys, as per Birdlife Australia (2013b) guidelines, were completed at all trapping sites during peak bird activity (6 to 9 am) when cryptic species were most detectable.

Records from each site were supplemented with opportunistic records. These records were collected at trap sites, during travel between trap sites and during day time forage surveys. Data recorded during opportunistic observations included location, date, and habitat where the species was recorded. Birds were identified by direct observation, tracks and scats, and call.

4.5.4 BAT SURVEYS

Bat surveys were conducted by deploying a Songbird SM2BAT+ ultrasonic sound recorder. The Songbird was positioned at six locations in the project area deemed suitable for bats hunting or roosting. These were the four trap sites in the MLA, a creek line along the road alignment, and at the grey water dam near the camp. The Songbird was programmed to activate at 6 pm and record until 6 am. The recordings were stored on SD cards, one per site, which were sent to Dr. Kyle Armstrong of Specialised Zoological for analysis. In addition to the acoustic recordings, Rapallo also collected opportunistic records of all bats seen or heard during spotlight surveys.

4.5.5 SPOTLIGHTING

Spotlight surveys were undertaken in each of the habitat types recorded on the survey area. In order to not disturb nocturnal fauna, spotlight surveys were conducted at a minimum distance of 200 metres from trapping grids. Spotlight surveys were run over 30 minutes and were undertaken by a team of three ecologists. All nocturnal fauna and/or potential SRE's found during spotlighting searches were recorded using a handheld Garmin GPS.

4.5.6 HAND FORAGING AND HABITAT ASSESSMENTS

The project area was traversed opportunistically using a combination of driving, walking, and riding. The aim of the traverses was to ensure that the majority of the survey area was examined including those parts where road access was limited; to ground-truth the extent of fauna habitat interpreted from aerial photography, and to collect additional fauna records.

Foraging surveys were completed at all systematic trapping sites, and at all areas of interest identified during the traverses of the project area. Fauna records collected during foraging surveys have been included in the overall species lists for the survey. Foraging activities included lifting bark and old tin, rolling old logs, and raking through sand and leaf litter. The following data was recorded for each foraging site:

- GPS location
- Soil type and characteristics
- Geology and landform
- Leaf litter depth
- Evidence of disturbance (i.e. fire, grazing)
- Broad vegetation description
- Potential suitability for species of conservation significance including SREs

4.5.7 OPPORTUNISTIC RECORDS

While traversing the survey area, opportunistic records were taken of all fauna and potential SRE invertebrates, as well as secondary evidence such as tracks and burrows. The following data was recorded each time a species of conservation significance, SRE, or secondary evidence was recorded:

- GPS location
- Species and (where possible) sex and maturity
- Habitat type
- Photograph of species, or of secondary evidence (where possible)

Additional records of potential SRE spider burrows were provided by the Traditional Owners present on site at the time of the survey. Data recorded from opportunistic sightings has been included in the overall species lists for the survey.

4.5.8 MOTION DETECTING CAMERAS

Motion detecting cameras (MDCs) of the model Scoutguard SG550 were deployed across the survey area in habitats with the potential to support Chuditch. MDCs were deployed at all systematic trap sites (n=6) and an additional nine opportunistic locations in habitats with the potential to support Chuditch. Cameras were left in situ.

Each camera was programmed to record 30 seconds of video, at one minute intervals with detection sensitivity set to high. Each camera was securely fastened on either a small tripod that was secured to the ground, or a suitable tree trunk. The camera was focused on a bait station, baited with tinned cat food with high sardine content or tinned sardines. Data recorded from the MDCs has been included in the overall species lists for the survey.

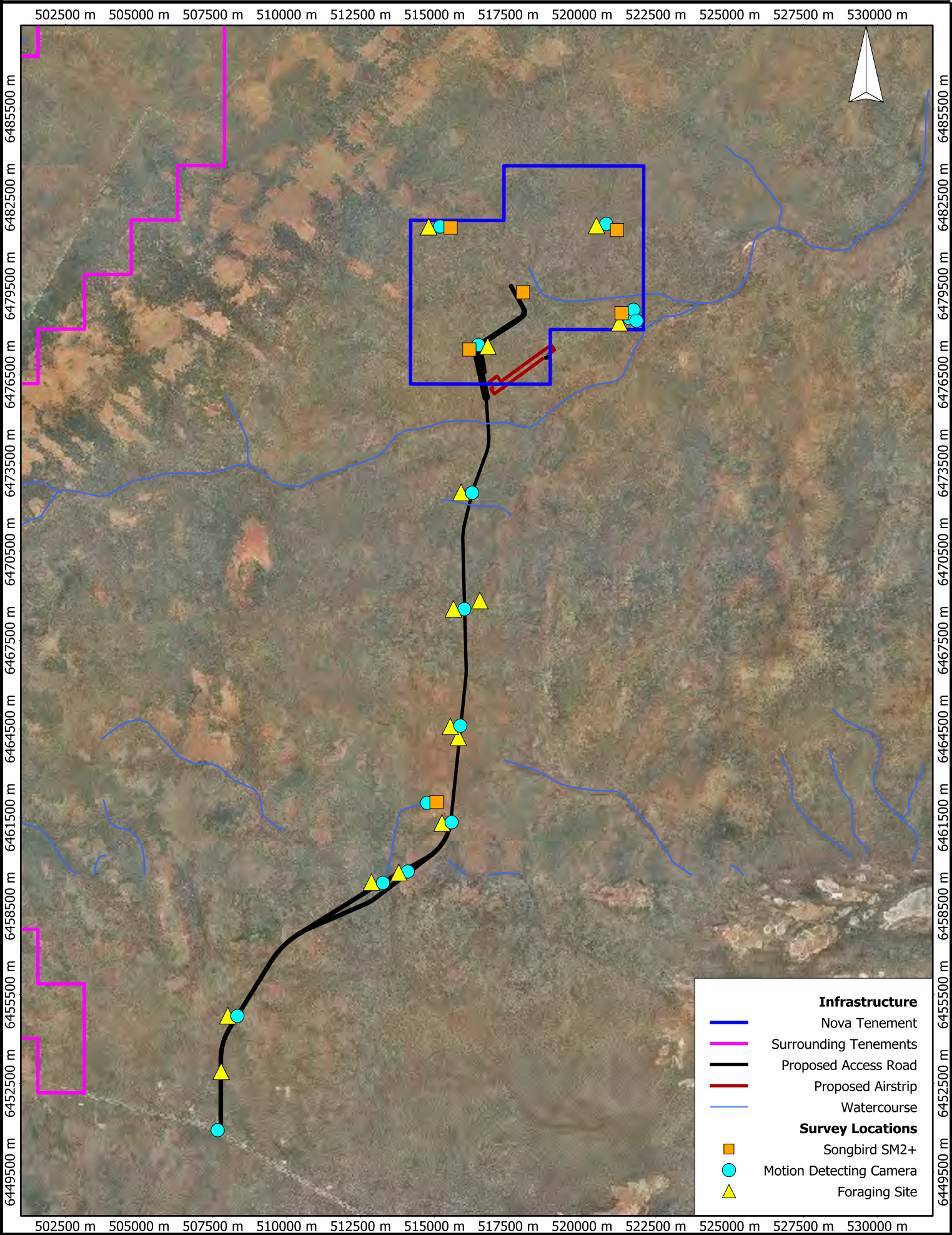
4.6 SRE SURVEY

Surveys for potential SRE specimens were conducted in conjunction the vertebrate fauna surveys from 5 to 19 November 2013. Pitfall traps for vertebrate fauna (as described in section 4.5.2) are also suitable for capturing wandering spiders and scorpions, while SRE were also captured during hand foraging and opportunistic records (sections 4.5.6 and 4.5.7. In addition to these methods, leaf litter samples were collected to specifically survey for SRE.

4.6.1 LEAF LITTER COLLECTION

Leaf litter was collected from all systematic trapping sites and foraging sites Figure 6. Leaf litter was collected in a twenty litre bucket, and the species of tree or shrub yielding the leaf litter was recorded. Samples were sifted in the field using 1.5 millimetre sieves. The final mixture of organic matter was transported back Perth, and run through Tullgren Funnels for a minimum of 48 hours to extract invertebrate specimens.

Specimens collected from the Tullgren Funnels were sorted under a microscope at the Rapallo laboratory. Potential SRE taxa were separated from the bulk samples and vouchered for taxonomic identification according to WAM (2013c) submission guidelines.



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Scale: 1 : 160,000
Datum: MGA94 (51)

0 5 km

Locations of Songbirds, MDCs and Foraging sites

Figure 6

4.6.2 CATEGORIES OF SHORT-RANGE ENDEMISM

Currently, there is no accepted system to determine the likelihood that a species is an SRE. For the purpose of this report, Rapallo has adopted the three-tier likelihood system developed by Phoenix Environmental Sciences, (2012 Appendix 10), wherein species are categorised based on the different probabilities of short-range endemism: 'confirmed', 'likely' or 'potential' SRE. These categories are dynamic and can change as knowledge of SRE status is updated.

Although categorisation of SRE likelihood may help to set conservation priorities, SRE taxa of all categories should be assessed on their merit, in order to determine appropriate conservation measures that adhere to the Precautionary Principle within environmental impact assessments.

The Precautionary Principle, as included in the 2003 amendment of the EP Act, is defined as:

> *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, decisions should be guided by: (a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and (b) an assessment of the risk-weighted consequences of various options* (EPA 2004b).

4.6.3 TAXONOMIC IDENTIFICATION

All potential SRE taxa were sent off to taxonomic experts for identification before being vouchered in the WAM collection. The following taxonomists were involved with specimen identification:

- Dr Volker Framenau (Phoenix) — Millipedes, centipedes, pseudoscorpions, spiders
- Dr Simon Judd (Phoenix) — Slaters
- Dr Corey Whisson (WAM) — Land snails
- Dr Erich Volschenk (Scorpion ID) — Scorpions

4.7 STATISTICAL ESTIMATION OF SPECIES RICHNESS

The software program EstimateS version 9.1.0 (Colwell 2013) was used to estimate survey completeness by generating species accumulation curves and by calculating predicted total species richness. Analyses were conducted on systematic survey data only, i.e. systematic trapping data for mammals and reptiles, and systematic 20-minute bird survey for birds.

Analyses were run on abundance data for mammals and reptiles. Trapping records for both groups were combined to provide a more robust dataset. Bird data was analysed using frequency data, i.e. the number of times a species was recorded at each location, rather than the number of individuals.

EstimateS was run using the default settings, with the following exceptions:

- Accumulations (runs) were randomised 10,000 times without replacement
- Upper abundance limit for rare or infrequent species was set to 2
- Classic formulas were used for Chao 1 and Chao 2

Data was plotted as the number of species recorded (y-axis) against the number of systematic survey sites (x-axis). The program provided seven different species richness predictors, these were: ACE, ICE, Chao 1, Chao 2, Jack 1, Jack 2, and Bootstrap.

Following the analysis, the accumulation curves generated by the various predictors were plotted and those that delivered erratic curves were removed. The predicted (average) species richness was calculated by taking the average of the remaining estimators.

4.8 SURVEY LIMITATIONS AND CONSTRAINTS

An assessment of the limitation of the survey has been displayed in Table 8 in accordance with Guidance Statement No. 56 (EPA 2004a).

Table 8 Discussion of potential limitations and constraints experienced during the survey

Aspect	Constraint	Discussion
Experience of Consultants	No	All members of the survey team have experience in undertaking fauna surveys throughout Western Australia, including the Great Western Woodlands.
Scope	No	Scope and intensity of survey were suitable to achieve the survey aims as outlined in Section 1.1
Proportion of fauna identified, recorded and/or collected	No	Bird abundance and diversity was high, with breeding activity recorded for local bush birds (including honeyeaters and robins), as well as an influx of migratory birds such as Scarlet-chested Parrots from the east, and White-winged Trillers, Crimson Chats and Black Honeyeaters from the north. Conversely, reptile and mammal abundance and diversity were relatively low, which may have been due to low night-time temperatures. There was a notable paucity of snake records, with only one day-time active snake recorded. No amphibians were recorded, which may have been due to the absence of high rainfall events prior to and during the survey.
Information sources e.g. previously available information (whether historic or recent) vs. new data.	No	Sufficient regional information is available; however there are few recent studies in the vicinity of the project area. Birdlife Australia is currently undertaking intense systematic bird surveys of the Great Western Woodlands, the interim results of which have been incorporated in the literature review of this report.
Proportion of task achieved and further work may be required	Yes	All the major fauna habitats of the project area were adequately surveyed through trapping and foraging. Pending taxonomic identifications, further SRE investigations may be required. Based on finding several old mounds, a targeted Malleefowl survey of the road alignment is recommended.
Timing, weather, seasons. Cycle	No	Survey timing conformed with EPA (2010) recommendations, however temperatures were relatively low for the time of year, and there was no recent high rainfall event. These climatic conditions may have subdued amphibian, reptile, mammal, and SRE activity at the time of survey, which may warrant a second survey phase and/or a targeted SRE survey following a significant rainfall event.
Disturbances that affected the survey	Partial	Low night-time temperatures during the survey may have subdued mammal and reptile activity. To compensate for this, trapping was extended for a further two nights.
Survey Intensity	No	Survey intensity was appropriate to survey all the major fauna habitats of the project area.
Completeness of Survey	No	All the major habitats of the project area were surveyed. The survey program was completed as planned.
Resources	No	The survey was adequately resourced.

Aspect	Constraint	Discussion
Access Problems and Remoteness	Partial	Access to the majority of the road corridor was difficult due to denseness of regenerating vegetation and absence of roads. To compensate for this, Rapallo completed foraging surveys at point locations along the corridor where grid lines were present, and traversed the corridor using quad bikes. The habitats that could not be trapped were Mallee/Triodia, Woodland Inundation Zone (WI) and Creek Line (see Table 9) as there was not road access to allow for trap clearance. However, these habitats were covered by foraging surveys, which suggested that from a fauna perspective the Mallee/Triodia WI and Creek Line habitats provided similar resources as those in the adjacent Regenerating woodland, Woodland and Woodland/Triodia habitat. However, the Creek and WI habitats are the most likely area within the project area to support amphibians, and additional survey work following high rainfall might capture these.
Availability of contextual information within the region	No	Sufficient information is available to discuss the fauna assemblages and fauna habitat of the project area in a regional context.

4.9 SOURCES OF INFORMATION

The following literature sources have been used to determine nomenclature, taxonomy and fauna distribution patterns used in this report:

- Mammals — Van Dyck and Strahan (2008), Menkhorst and Knight (2011).
- Bats — Churchill (2008).
- Reptiles — Cogger (2000); Storr et al.(2002); Storr et al.(1999); Wilson and Swan (2013).
- Amphibians — Tyler et al. (2000), Tyler and Doughty (2009)
- Birds — Christidis and Boles (2008), Barrett (2003), Johnstone and Storr (1998 and 2004), Benshemesh (2000), Marchant and Higgins (1993), Higgins (1999).

Nomenclature for herpetofauna and mammals follows that of the Checklist of Terrestrial Vertebrate Fauna of Western Australia, published by the Western Australian Museum (2013d). Nomenclature and taxonomy of birds follows that of Birdlife Australia (Barrett 2003; Birdlife Australia 2013a).

5 RESULTS

5.1 SUMMARY OF RESULTS

During the survey a total of 136 (potentially 138) vertebrate fauna species were recorded from the project area, comprising 19 (potentially 21) mammals, 40 reptiles and 77 birds. Nine species of conservation significance were recorded during the survey, including eight birds, and one bat. Inaddition, a conservation listed snake was recorded by Sirius exploration staff from an unconfirmed locality either within or close to the MLA.

Putative SRE taxa were recorded from nine locations and comprised Mygalomorph spiders, scorpions, pseudoscorpions and snails. Taxonomic examination of collected specimens has identified two species of potential SRE, both Mygalomorph spiders, recorded from two locations in the MLA. In addition, live specimens of *Bothriembryon* land snail, which have potential to be SRE, were recorded from three localities. Identifications of snails and pseudoscorpions are still pending, and will be discussed in a separate report.

Eight fauna habitat types, and one sub-type, were recorded in the project area. The most dominant habitats were Eucalyptus Woodland in the MLA, and Regenerating Woodland in the road corridor.

The desktop search identified an additional 12 mammal species (including 2 of conservation significance), 36 reptiles (2 of conservation significance), and 48 birds (6 of conservation significance), and five species of frog, which could occur in the project area based on distribution and habitat requirements. These are presented in Appendix I. The conservation significant species and their likelihood of occurrence in the project area are further discussed in section 6.

5.2 FAUNA HABITATS RECORDED IN THE PROJECT AREA

Eight broad fauna habitat types, and one sub-type, were identified on the project area. These are listed and described in Table 9 and further detailed in Appendix II.

The dominant fauna habitat found across the survey area was Woodland, comprising mixed *Eucalyptus* woodland over *Cratystylis concephala* shrubland. Within the Woodland habitat, there was subtle variation in denseness and composition of the understorey, which may translated into variation in micro-habitats on a smaller scale. Trap site 2 was established in Woodland, while foraging surveys were completed in other areas of Woodland habitat.

The Woodland habitat formed the main matrix within which three other habitats were embedded, these were Melaleuca, Acacia shrubland, and open Eucalypt woodland over Triodia (Woodland/Triodia), which were recorded in patches throughout the MLA.

The second most extensive habitat in the project area was Regenerating Woodland, which covered the majority of the proposed road corridor. It comprises dense whipstick mallee which has re-sprouted after a fire that occurred approximately five to ten years prior to the survey. The fire appears to have been patchy and cool to medium. Examination of adjacent unburnt vegetation, as well as the dead stag trees and fallen timber, suggests that the habitat prior to the burn comprised a combination of Woodland and Mallee/Triodia. From a fauna perspective, the regenerating mallee that has re-sprouted represents a different habitat type from what was previously present, because it is structurally very different from the unburnt woodland previously existed. Structurally, the Regenerating Woodland resembles heathland rather than woodland. This has provided new habitat patches for species such as

Shy Heathwren and Rufous Fieldwren, which otherwise would not have occurred in the project area. At the same time, the remnants of woodland elements, particularly the stag trees and large amounts of fallen timber, provide habitat that still suits some woodland birds (particularly Brown-headed and Yellow-plumed Honeyeaters, and Black-faced Woodswallows).

Within the road corridor, the Regenerating Woodland was the dominant habitat type, and formed a matrix which was intersected by Creek micro habitat, and interspersed with patches of Mallee eucalypts over Triodia (Mallee/Triodia) occurring low on the landscape and to a lesser extent the Woodland dominated inundation zone habitat.

The Burnt Plain habitat occurred in a small section of the road corridor, at the base of a quartz ridge. The vegetation prior to the fire appears to have been low shrubland over Triodia, as still present in adjacent unburnt areas. This area was burnt more recently, less than five years prior to the survey. The vegetation was very open; with more than 80% bare ground and clear fire scars throughout. From a fauna perspective, this habitat provides very little shelter, and little food as the sparse vegetation is unlikely to support many insects.

Trapping sites (see section 4.5.1) were established in Acacia shrubland, Woodland, Melaleuca, Woodland/Triodia, Regenerating Woodland and Burnt Plain. No traps were established in Mallee/Triodia, Creek or the Woodland dominated inundation zone (WI) habitat due to the absence of road access to allow for trap clearance, and because the patches were relatively small.

Table 9 Fauna habitats identified in the project area

Habitat Name	Habitat Description	Species of Conservation Significance that could use habitat	Photo
Acacia shrubland	**Vegetation** *Acacia* shrubland to 4 m over mixed low shrubs. Emergent *Eucalyptus* to 8 m. **Geology, Soil, Landform** Red loam with isolated protruding calcrete outcropping. **Location** In low-lying area in the north-west of the MLA. Trap site 1 established in this habitat. This habitat was only recorded in the MLA, where it makes up approximately 2% of the total area.	▪ Malleefowl ▪ White-browed Babbler ▪ South-West Carpet Python ▪ Australian Bustard ▪ Rainbow Bee-eater ▪ Fork-tailed Swift ▪ Crested Shrike-tit ▪ Western Rosella ▪ Peregrine Falcon ▪ Greater Long-eared Bat ▪ Crested Bellbird ▪ Bush Stone-curlew	

Habitat Name	Habitat Description	Species of Conservation Significance that could use habitat	Photo
Woodland	**Vegetation** Open *Eucalyptus* woodland to 15m often over *Cratystylis concephala* dominated shrubland with scattered *Santalum, Eremophila*, *Atriplex* and *Olearia*. **Geology, Soil, Landform** Red-brown powdery loam. **Location** Covering majority of the MLA and significant areas of the proposed road corridor. Trap site 2 established in this habitat. This habitat makes up approximately 80% of the MLA, and approximately 37% of the road corridor.	▪ Malleefowl (ormant mounds found in this habitat) ▪ South-West Carpet Python ▪ Rainbow Bee-eater ▪ Fork-tailed Swift ▪ Chuditch ▪ Lake Cronin Snake ▪ Crested Shrike-tit ▪ Western Rosella ▪ Peregrine Falcon ▪ White-browed Babbler ▪ Greater Long-eared Bat ▪ Crested Bellbird ▪ Bush Stone-curlew ▪ Australian Bustard	

Habitat Name	Habitat Description	Species of Conservation Significance that could use habitat	Photo
Melaleuca	**Vegetation** Open *Eucalyptus* woodland over *Melaleuca* thicket over mixed shrubs. **Geology, Soil, Landform** Gently sloping plain of orange clay loam. **Location** Pockets of melaleuca thickets occur scattered throughout the matrix of open Eucalypt woodland over Cratystylis within the MLA. Trap site 3 established in this habitat. This habitat makes up approximately 9% of the MLA, and approximately 6% of the road corridor.	▪ Malleefowl (dormant mounds found in this habitat) ▪ South-West Carpet Python ▪ Rainbow Bee-eater ▪ Fork-tailed Swift ▪ Chuditch ▪ Lake Cronin Snake ▪ Crested Shrike-tit ▪ Western Rosella ▪ Peregrine Falcon ▪ White-browed Babbler ▪ Greater Long-eared Bat ▪ Crested Bellbird ▪ Bush Stone-curlew ▪ Australian Bustard	

Habitat Name	Habitat Description	Species of Conservation Significance that could use habitat	Photo
Woodland/ Triodia	**Vegetation** Open *Eucalyptus* woodland over *Triodia* grassland with occasional *Eremophila*, *Dodonaea*, *Exocarpos* and *Allocasuarina that* can form groves. **Geology, Soil, Landform** Plain of red sandy clay loam. Surface of calcrete pisolith with a calcrete layer at 40 cm. **Location** Small pockets of *Triodia* habitat within the matrix of Woodland habitat in the MLA. Trap site 4 established in this habitat. This habitat type was only recorded in the MLA where it makes up approximately 7% of the total area.	▪ Malleefowl ▪ South-West Carpet Python ▪ Rainbow Bee-eater ▪ Fork-tailed Swift ▪ Chuditch ▪ Crested Shrike-tit ▪ Western Rosella ▪ Peregrine Falcon ▪ White-browed Babbler ▪ Greater Long-eared Bat ▪ Crested Bellbird ▪ Bush Stone-curlew ▪ Australian Bustard	

Habitat Name	Habitat Description	Species of Conservation Significance that could use habitat	Photo
Regenerating woodland	**Vegetation** Very dense, regenerating *Eucalyptus* woodland with emergent dead stag trees. **Geology, Soil, Landform** Brown sandy clay loam. **Location** Along majority of the proposed access corridor, representing likely a combination of burnt Woodland and Mallee vegetation. Trap site 5 established in this habitat. This habitat type only occurs in the road corridor, where it makes up approximately 45% of the total area.	▪ Malleefowl (forage only) ▪ South-West Carpet Python ▪ Rainbow Bee-eater ▪ Fork-tailed Swift ▪ Shy Heathwren ▪ Western Rosella ▪ Peregrine Falcon ▪ Greater Long-eared Bat ▪ Crested Bellbird ▪ Rufous Fieldwren	

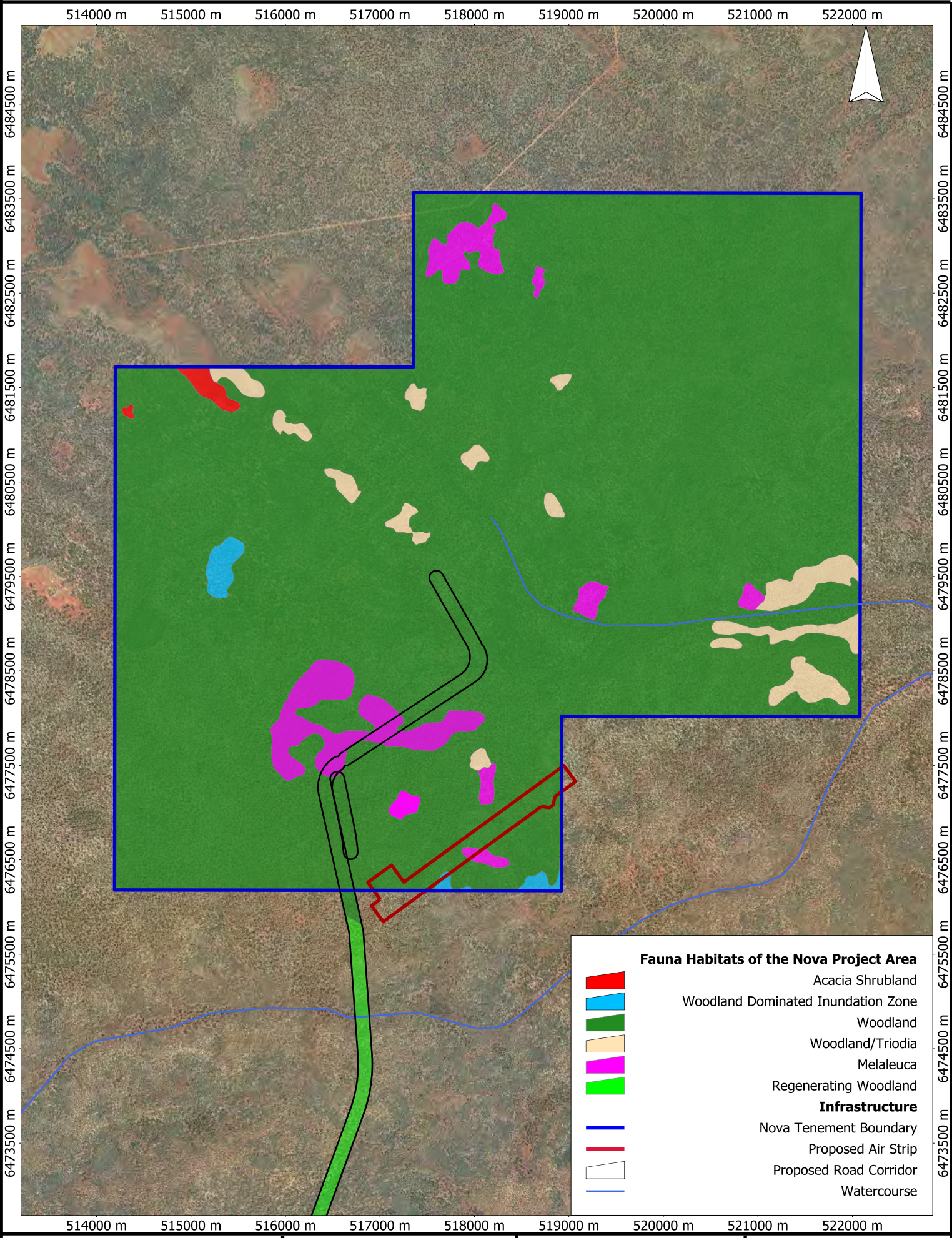
Habitat Name	Habitat Description	Species of Conservation Significance that could use habitat	Photo
Creek*	**Vegetation** Creekline of dense woodland of regenerating eucalypts with emergent dead eucalypt stags, over open mixed shrubs including *Eremophilas*, over grasses, on deep red-brown sand. **Geology, Soil, Landform** **R**ed deep sand, defined creek bed. **Location** To the west of the proposed access corridor, running towards it. ** Creek habitat is regarded as micro-habitat of the Regenerating Woodland Habitat and has been included in the area calculations for this habitat type.*	▪ Malleefowl (forage only) ▪ South-West Carpet Python ▪ Australian Bustard ▪ Rainbow Bee-eater ▪ Fork-tailed Swift ▪ Shy Heathwren ▪ Western Rosella ▪ Peregrine Falcon ▪ Greater Long-eared Bat ▪ Crested Bellbird ▪ Bush Stone-curlew ▪ Rufous Fieldwren	

Habitat Name	Habitat Description	Species of Conservation Significance that could use habitat	Photo
Burnt plain	**Vegetation** Regenerating low shrubland/herbland of mixed *Allocasuarina*, *Triodia* and ephemeral herbs. Regeneration in early stage, with 80% bare soil. **Geology, Soil, Landform** Plain of red brown loam. Low rise of protruding granitic outcrop. **Location** Central area of the proposed access corridor. Trap site 6 established in this habitat. This habitat occurs only in the road corridor, where it makes up approximately 9% of the total area.	▪ Malleefowl (forage only) ▪ Australian Bustard ▪ Rainbow Bee-eater ▪ Fork-tailed Swift ▪ Peregrine Falcon ▪ Crested Bellbird ▪ Bush Stone-curlew	

Habitat Name	Habitat Description	Species of Conservation Significance that could use habitat	Photo
Woodland dominated inundation zones (WI)	**Vegetation** Eucalyptus woodland such as gimlet over mixed low shrubland such as *eremophila, Diocirea ternata*, (not *Cratystylis concephala*). **Geology, Soil, Landform** Red brown loam Inundation zone (water infiltration evident: cracks, but no defined channel). **Location** Proposed access corridorand a small section in the west of the MLA. This habitat was only found in the MLA where it makes up approximately 2% of the total area.	▪ Malleefowl ▪ South-West Carpet Python ▪ Rainbow Bee-eater ▪ Fork-tailed Swift ▪ Chuditch ▪ Crested Shrike-tit ▪ Western Rosella ▪ Peregrine Falcon ▪ White-browed Babbler ▪ Greater Long-eared Bat ▪ Crested Bellbird ▪ Bush Stone-curlew ▪ Australian Bustard	

Habitat Name	Habitat Description	Species of Conservation Significance that could use habitat	Photo
Mallee/Triodia	*Triodia* plain under sparse straggly mallees to 3 metres. Occasional *Allocasuarina* that can form groves. Mallee/Triodia habitat all lower than the surrounding woodland habitat. **Geology, Soil, Landform** Red brown to Light brown loamy soil **Location** Proposed access corridor. This habitat was only recorded in the road corridor, where it makes up approximately 3% of the total area.	▪ Malleefowl ▪ South-West Carpet Python ▪ Rainbow Bee-eater ▪ Fork-tailed Swift ▪ Chuditch ▪ Crested Shrike-tit ▪ Western Rosella ▪ Peregrine Falcon ▪ White-browed Babbler ▪ Greater Long-eared Bat ▪ Crested Bellbird ▪ Bush Stone-curlew	

Footnotes with Table 9:
** Creek is considered to be a micro-habitat within the Regenerating Woodland habitat. It stands apart, however, due to its increased likelihood of supporting frogs.*



Rapallo environmental

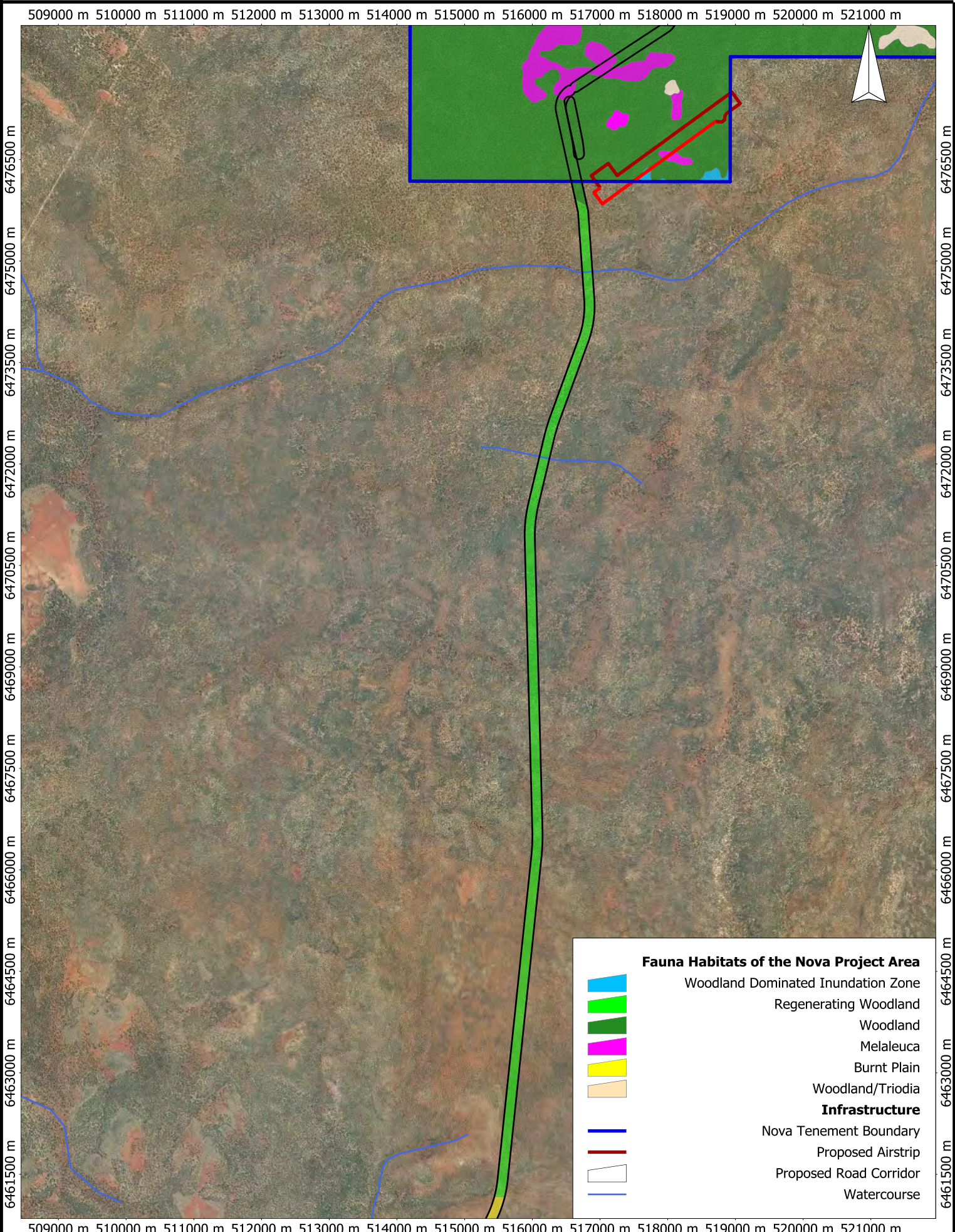
Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 50,000
Datum: MGA94 (51)

0 1 km

Fauna Habitats
Recorded in the MLA

Figure 7



Rapallo environmental

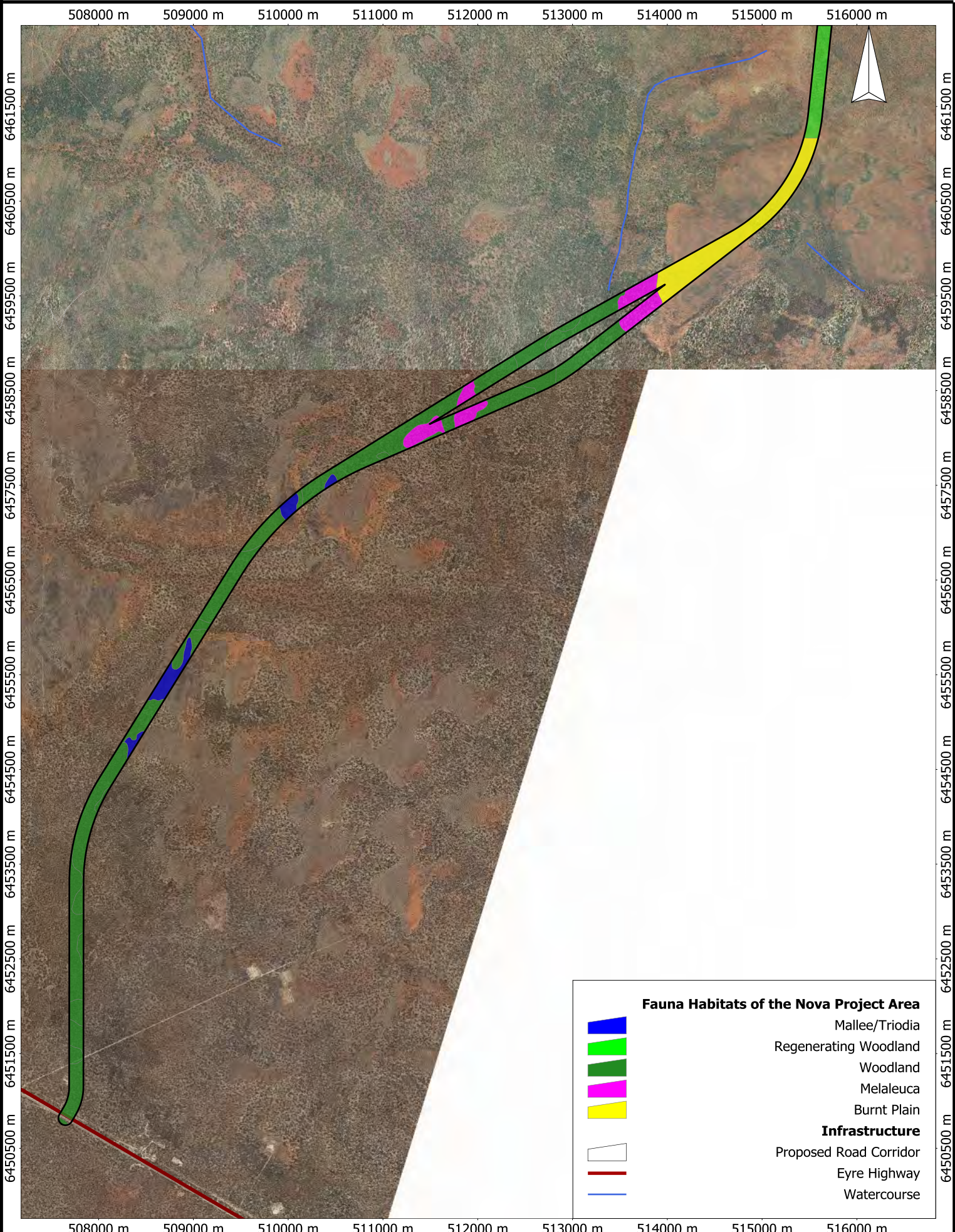
Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 70,000
Datum: MGA94 (51)

0 2 km

Fauna Habitats of the Northern Section of the Proposed Road Corridor

Figure 8



Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 50,000
Datum: MGA94 (51)

0 1 km

Fauna Habitats of the Southern Section of the Proposed Road Corridor

Figure 9

5.3 MAMMALS

Thirteen non-volant (non-flying) mammal species were recorded during the survey, comprising seven native species and six introduced (feral) species. In addition, six (potentially eight) species of bat were identified through analysis of acoustic recordings. Results are summarised in Table 10, and discussed in sections 5.3.1 (non-volant mammals) and 5.3.2 (bats).

5.3.1 NON-VOLANT MAMMALS RECORDED IN THE SURVEY

Eight species of native mammal were recorded in the project area. Four of these were captured in traps, comprising the small predatory marsupials Southern Ningaui (*Ningaui yvonnae*) and Little Long-tailed Dunnart (*Sminthopsis dolichura*), the Western Pygmy Possum (*Cercartetus concinnus*), and the native rodent Sandy Inland Mouse (*Pseudomys hermannsburgensis*). The other four native mammals were recorded either by direct observation (Euro, Western Grey Kangaroo) or by secondary signs (Echidna). Tracks and scats of macropods, which likely represented the Euro or Western Grey, were recorded throughout the survey area.

Six introduced (feral) mammal species were recorded. These were the House Mouse (*Mus musculus*) captured in traps, the European Rabbit (*Oryctolagus cuniculus*) observed at dusk at several locations in the MLA. The introduced carnivores Dingo/Feral Dog (*Canis* sp.) and Cat (*Felis catus*), and the herbivores Cattle (*Bos taurus*) and Dromedary Camel (*Camelus dromedarius*) were all recorded from tracks only.

Trap site 5 in Regenerating Woodland recorded the greatest species richness of native mammals (n=3) from systematic trapping. Woodland/Triodia habitat recorded the greatest trapping success of native mammals, with four records of the Southern Ningaui, and three records of Sandy Inland Mouse (*Pseudomys hermannsburgensis*). Two species of mammal were recorded at Sites 1, 2 and 5 however one species from each site was found to be the introduced House Mouse.

Trap site 1 in Acacia habitat recorded two mammal species, a single record of the Little Long-tailed Dunnart and two records of the introduced House Mouse (*Mus musculus*). Trap site 2 in Woodland recorded one Western Pygmy Possum (*Cercartetus concinnus*) and one House Mouse. Three records of the Western Pygmy Possum were made at trap site 3 in Melaleuca habitat.

No species of native mammal were recorded at the Burnt Plain habitat at site 6 however the tracks of the Dromedary Camel and Dingo/Feral Dog were recorded in the vicinity of this site.

No species of conservation significant non-volant mammals were recorded during the survey.

5.3.2 BATS RECORDED IN THE SURVEY

Acoustic recordings of bat calls were made at trap sites 1, 2, 3, and 4 within the MLA and at the dam near the Nova camp (within Woodland habitat). Analyses of these recordings by Specialised Zoological identified the presence of at least six, and potentially eight species of bat within the project area.

Four of the bat taxa could be identified to species level based on calls. These were the White-striped Freetail Bat *Austronomus australis*, Gould's Wattled Bat *Chalinolobus gouldii*, Chocolate Wattled Bat *Chalinolobus morio*, and Southern Forest Bat *Vespadelus regulus*. Part of the call repertoire of the White-striped Free-tail bat falls within the audible spectrum for humans, and this enabled additional records of this species be made from calls heard by the survey team.

Two of the bat taxa could only be identified to genus level based on calls. These were bats of the genus *Nyctophilus* (long-eared bats), and bats of the genus *Mormopterus* (free-tailed bats).

Call sequences attributed to long-eared bats *Nyctophilus* spp. could not be identified reliably to one species in each case. They may derive from either the lesser long-eared bat *Nyctophilus geoffroyi* or the central subspecies of the Greater Long-eared Bat *Nyctophilus major tor*. The latter species is listed as Priority 4 by DPaW (see section 6.18). Based on distribution, it is possible that either species, or even both, occurs in the project area. Identification can only be confirmed through harp trapping.

Calls of the two free-tailed bats *Mormopterus* sp. 3 and *Mormopterus* sp.4 are similar and can be difficult to distinguish. There were sufficient high quality examples to make identifications at the level of genus based on both pulse shape and sequence patterns; however the two candidate *Mormopterus* species could not be separated from each other. Based on distribution, it is possible that either species, or even both, occurs in the project area. Identification can only be confirmed through harp trapping.

Table 10 Mammals recorded in the Nova project area

Scientific Name	Common Name	Acacia		Woodland		Melaleuca		Woodland/ Triodia		Regen. Woodland		Burnt Plain	Mallee/ Triodia and WI zone	Total[6]
		T[1]	O[2]	T	O	T	O	T	O	T	O	O	O	
Native species														
Cercartetus concinnus	Western Pygmy possum			1		3								**4**
Macropus fuliginosus	Western Grey Kangaroo									12				**12**
Macropus robustus	Euro										3		1	**4**
Macropus sp.	(kangaroo species)		tracks					tracks			tracks	tracks		**present**
Ningaui yvonnae	Southern Ningaui							4						**4**
Pseudomys hermannsburgensis	Sandy Inland Mouse							3						**3**
Sminthopsis dolichura	Little Long-tailed Dunnart	1								1				**2**
Tachyglossus aculeatus	Echidna												2	**2**
Austronomus australis	White-striped Free-tail Bat	AR[5]			calls / AR[5]	AR		AR	calls					**present**
Chalinolobus gouldii	Gould's Wattled Bat	AR		AR	AR	AR		AR						**present**
Chalinolobus morio	Chocolate Wattled Bat	AR			AR	AR		AR						**present**
Vespadelus regulus	Southern Forest Bat	AR		AR	AR	AR		AR						**present**
Nyctophilus geoffroyi **and/or[3]** *Nyctophilus major tor*	Lesser Long-eared Bat **and/or[3]** Greater Long-eared Bat (Listed DPaW Priority 4)				AR	AR								**present**
Mormopterus sp. 3 **and/or[4]** *Mormopterus sp. 4*	Inland Free-tailed Bat **and/or[4]** South-western Free-tailed Bat			AR	AR	AR		AR		AR				**present**

Scientific Name	Common Name	Acacia		Woodland		Melaleuca		Woodland/ Triodia		Regen. Woodland		Burnt Plain	Mallee/ Triodia and WI zone	Total[6)]
Introduced (feral) species														
Camelus dromedarius	Dromedary Camel		tracks			tracks						tracks		**present**
Felis catus	Feral Cat										2 (tracks: adult + kitten)			**2**
Mus musculus	House Mouse	2		1						1				**4**
Oryctolagus cuniculus	European Rabbit		5 + scats											**present**
Bos taurus	Cattle		scats											**present**
Canis sp.	Dingo/Feral Dog											tracks		**1**
Total species per habitat		**10**		**8**		**8**		**8**		**7**		**3**	**2**	**19 (21)**

Footnotes with Table 10:

1) *T = Trapping sites, with: Acacia = Trap Site 1*
   Woodland = Trap site 2
   Melaleuca = Trap site 3
   Woodland/Triodia = Trap site 4
   Regen. Woodland = Trap site 5
   Burnt Plain = Trap site 6
2) *O = Opportunistic sightings, foraging, and spotlighting surveys.*
   Acoustic Recordings (AR) of bat calls listed in the Opportunistic column within the Woodland habitat were made at the dam next to camp.
3) *Call sequences attributed to long-eared bats Nyctophilus spp. could not be identified reliably to one species in each case. They may derive from either the lesser long-eared bat Nyctophilus geoffroyi or the central greater long-eared bat Nyctophilus major tor.*
4) *Calls of Mormopterus sp. 3 and Mormopterus sp.4 are similar and can be difficult to distinguish. There were sufficient high quality examples to make identifications at the level of genus based on both pulse shape and sequence patterns; however the two candidate Mormopterus species could not be separated from each other.*
5) *AR = Acoustic Recordings; while "calls" refers to audible calls that can be detected by the healthy human ear (only relevant to A. australis).*
   Acoustic Recordings (AR) of bat calls listed in the Opportunistic column within the Woodland habitat were made at the dam next to camp.
6) *Bat calls of Nyctophilus and Mormopterus were identified to genus level, with two potential species in each genus. Hence, total species is 19 minimum, but potentially 21.*

5.4 REPTILES AND AMPHIBIANS

Reptile records from the survey were moderately high with a total of 40 reptile species comprising 355 individual records (Table 11). The reptile assemblage recorded in the survey comprised of 11 geckos, four pygopods ("legless lizards"), 17 skinks, four agamids (dragons), one varanid (goannas), and three snakes. No amphibians were recorded during the survey.

A total of 30 species from 189 records were collected during systematic trapping while a further 10 species from 163 records were collected either opportunistically or during foraging/spotlighting surveys.

The most common reptile species recorded during the survey were the Western Stone Gecko (*Diplodactylus granariensis*) (n=50) with the majority recorded during spotlighting and foraging surveys (n=40) and Main's Ground Gecko (*Lucasium maini*) (n=34) with the majority recorded from systematic surveys (n=22) and the remaining from spotlighting and foraging surveys (n=12).

Species richness was generally consistent across five of the six habitat types surveyed with values between 10 and 14 species being recorded at each trapping site. The Regenerating Woodland habitat yielded the highest species richness, with 14 species recorded from trapping site 5. The greatest abundance of individuals were captured at the Acacia shrubland (trapping site 1) (n=42). The Burnt Plain (trapping site 6) recorded the lowest species richness (n=3) and abundance (n=6) during the survey.

No reptile species of conservation significance were recorded during the survey. However, a large python found prior to the survey and matching the description of the South West Carpet Python (*Morelia spilota imbricata*) was reported to Rapallo Environmental staff by Sirius site personnel. This species is listed as Schedule 4 – Other Specially Protected Fauna by the DPaW.

No amphibian species were recorded during the survey despite rain falling in the weeks prior to the survey as well as light overnight showers during the survey period.

Table 11 Reptiles recorded in the Nova project area (total individuals)

Scientific Name	Common Name	Acacia		Woodland		Melaleuca		Woodland /Triodia		Regen. Woodland		Burnt Plain		Creek	Mallee/ Triodia and WI zone	Total
		T[1)]	O[2)]	T	O	T	O	T	O	T	O	T	O	T	O	
Geckoes																
Christinus marmoratus	Marbled Gecko				2											**2**
Diplodactylus calcicolus	South Coast Gecko				1											**1**
Diplodactylus granariensis	Western Stone Gecko			1	28	3	2		6	5			1	4		**50**
Diplodactylus pulcher	Pretty Gecko	13		4		1						2				**20**
Gehyra variegata	Tree Dtella	10		1	5				2	7						**25**
Hesperoedura reticulata	Reticulated Velvet Gecko			1	19		1		4							**25**
Heteronotia binoei	Bynoes Gecko				2											**2**
Lucasium maini	Main's Ground Gecko	14		6	6	1	4			1				2		**34**
Strophurus assimilis	Thorn-tailed Gecko								1					2		**3**
Strophurus elderi	Jewelled Gecko								1							**1**
Underwoodisaurus milii	Thick-tailed Gecko	1			3		1		4							**9**
Pygopods																
Delma australis	Marble-faced Delma							1								**1**
Delma butleri	Spinifex Delma							4								**4**
Lialis burtonis	Burton's Legless Lizard							1								**1**
Pygopus lepidopodus	Common Scaly-foot					2			2	2						**6**
Skinks																
Cryptoblepharus buchanani	Buchanan's Snake-eyed Skink			2		1			1							**4**
Ctenotus atlas	Southern Spinifex Ctenotus							24	4							**28**

Scientific Name	Common Name	Acacia		Woodland		Melaleuca		Woodland /Triodia		Regen. Woodland		Burnt Plain		Creek	Mallee/ Triodia and WI zone	Total
Ctenotus pantherinus	Leopard Ctenotus												1			**1**
Ctenotus schomburgkii	Barred Wedge-snouted Ctenotus			1						9		4				**14**
Ctenotus uber	Western Spotted Ctenotus	3														**3**
Cyclodomorphus melanops elongatus	Spinifex Slender Blue-tongue							1								**1**
Egernia richardi	Richard's Crevice-skink	1			3	2				1	1					**8**
Eremiascincus richardsoni	Broad-banded Sandswimmer	1								1						**2**
Hemiergis initialis brookeri	Western Earless Skink	1		1	3	5		1								**10**
Lerista dorsalis	South Coast Slider									1						**1**
Lerista picturata	Southern Robust Slider			6		2		1		1						**10**
Lerista timida	Dwarf Three-toed Slider	2		2	1	6	1			1						**13**
Menetia greyi	Common Dwarf Skink	3	1	5	2	2		1								**14**
Morethia butleri	Butler's Snake-eyed Skink				3	1				1						**5**
Morethia obscura	Shrubland Snake-eyed Skink					1				2						**3**
Tiliqua occipitalis	Western Blue-tongue	1														**1**
Tiliqua rugosa	Bobtail Skink				1						3					**4**
Dragons																
Ctenophorus chapmani	Eastern Heath Dragon										1					**1**
Ctenophorus cristatus	Crested Dragon			1	8		1		3		8		1			**22**
Moloch horridus	Thorny Devil				3											**3**
Pogona minor	dwarf bearded dragon									1	2					**3**
Varanids																

Scientific Name	Common Name	Acacia		Woodland		Melaleuca		Woodland /Triodia		Regen. Woodland		Burnt Plain		Creek	Mallee/ Triodia and WI zone	Total
Varanus gouldii	Sand Goanna	1	2		5						1				1	**10**
Snakes																
Brachyurophis semifasciatus	Southern Shovel-nosed Snake							1		2		1				**4**
Pseudechis australis	mulga snake														1	**1**
Ramphotyphlops australis	Southern Blind Snake	1		1				2								**4**
Total individuals recorded		**52**	**3**	**32**	**95**	**27**	**10**	**37**	**28**	**35**	**16**	**7**	**3**	**8**	**2**	**355**
Total species per habitat		**13**		**22**		**15**		**19**		**18**		**6**		**3**	**2**	**40**

Footnotes with Table 11:

1) T = Trapping sites, with: Acacia = Trap Site 1
Woodland = Trap site 2
Melaleuca = Trap site 3
Woodland/Triodia = Trap site 4
Regen. Woodland = Trap site 5
Burnt Plain = Trap site 6

2) O = Opportunistic sightings, foraging, and spotlighting surveys

5.5 BIRDS

A total of 77 species of birds were recorded during the survey using a combination of systematic surveys, opportunistic and foraging sightings and spotlighting records. As expected, bird records were dominated by woodland birds with the most common species recorded during the survey being the Weebill and Striated Pardalote, recorded 51 times and 47 times respectively followed by the White-fronted Honeyeater (n=39) and the Inland Thornbill (n=34).

The habitats of the project area varied in bird species richness. A total of 49 species were recorded across the large area of intact old growth woodland found on the project area while the regenerating woodland along the proposed access road was found to support a total of 45 species. Interestingly, the Mallee/Triodia and Woodland Inundation habitat types recorded the third highest species richness (n=34) despite not having daily systematic bird surveys completed within this habitat type. Of the sites where daily systematic surveys were completed, the Woodland/ Triodia habitat type was found to have the lowest species richness with only 23 species present.

Honeyeaters of the family Meliphagidae were the most species rich family with eleven species recorded across the project area followed by the family Acanthizidae (Thornbills) with eight species. These large families contain multiple species of generalist woodland birds as such higher records of these species over others is to be expected.

Eight species of conservation significant birds were recorded across the project area. These were Malleefowl (S1, V), Rainbow Bee-eater (S3), Fork-tailed Swift (S3), Crested Bellbird (P4), Crested Shrike-tit (P4), White-browed Babbler (P4), Rufous Fieldwren (P4) and Shy Heathwren (P4).

The Crested Bellbird and the Rainbow Bee-eater were the most commonly encountered species of conservation significance during the survey with each species recorded in six habitat types. White-browed Babblers were recorded in three habitat types on the project area.

Bird species of conservation significance are discussed further in Section 6.

Table 12 Birds Recorded in the Nova project area (frequency of occurrence data)

Family	Common Name	Scientific Name	Cons. Status[1)]	Acacia		Woodland		Melaleuca		Woodland/Triodia		Regen. Woodland		Burnt Plain		Creek	Mallee/ Triodia /WI zone		Total
				S[2)]	O[3)]	S	O	S	O	S	O	S	O	S	O	O	S	O	
Casuariidae	Emu	*Dromaius novaehollandiae*			1				2						2		1		6
Megapodiidae	Malleefowl	*Leipoa ocellata*	S1, V												2			1	3
Phasianidae	Stubble Quail	*Coturnix pectoralis*															1		1
Columbidae	Common Bronzewing	*Phaps chalcoptera*													2			1	3
Podargidae	Tawny Frogmouth	*Podargus strigoides*					2											1	3
Eurostopodidae	Spotted Nightjar	*Eurostopodus argus*					2												2
Apodidae	Fork-tailed Swift	*Apus pacificus*	S3, M				1						1						2
Accipitridae	Brown Goshawk	*Accipiter fasciatus*			1														1
	Collared Sparrowhawk	*Accipiter cirrocephalus*																1	1
	Square tailed kite	*Lophoictinia isura*		1															1
	Wedge-tailed Eagle	*Aquila audax*											1					1	2
	Whistling Kite	*Haliastur sphenurus*												1					1
Falconidae	Brown Falcon	*Falco berigora*					1		1		3		2	1	2			1	11
Turnicidae	Little Button-quail	*Corvus coronoides*					1												1
Psittacidae	Australian Ringneck	*Barnardius zonarius*		2	5		2		1	3	1							1	15
	Mulga Parrot	*Psephotus varius*					2						3						5
	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*		1	2	4	4		1	1	1							1	15
	Regent Parrot	*Polytelis anthopeplus*							1	1					2				4

Family	Common Name	Scientific Name	Cons. Status[1)]	Acacia		Woodland		Melaleuca		Woodland/Triodia		Regen. Woodland		Burnt Plain		Creek	Mallee/ Triodia /WI zone		Total
	Scarlet-chested Parrot	*Neophema splendida*								2	2		5		1				10
Cuculidae	Black-eared Cuckoo	*Chalcites osculans*				1	2						1						4
	Horsfields Bronze-cuckoo	*Chalcites basalis*				1	4					1		1	1		1		9
	Pallid Cuckoo	*Cacomantis pallidus*				1			1										2
	Shining Bronze-cuckoo	*Chrysococcyx lucidus*			1				2										3
Strigidae	Southern Boobook	*Ninox novaeseelandiae*					3												3
Halcyonidae	Sacred Kingfisher	*Todirhamphus sanctus*					1												1
Meropidae	Rainbow Bee-eater	*Merops ornatus*	S3, M		1	3	4		1			1	1	1	1			1	14
Climacteridae	Rufous Treecreeper	*Climacteris rufa*				6	4			4	1		1						16
	White-browed Treecreeper	*Climateris affinis*											1						1
Maluridae	Blue-breasted Fairy-wren	*Malurus pulcherrimus*							1				3		3	1		1	9
Acanthizidae	Chestnut rumped thornbill	*Acanthiza uropygialis*		1	2		1												4
	Inland Thornbill	*Acanthiza apicalis*		2	5	1	3	1	1		1	4	10	1	1	1	1	2	34
	Redthroat	*Pyrrholaemus brunneus*			3	1	3		2			1	6	2	2		1	2	23
	Rufous Fieldwren	*Calamanthus montanellus*	P4										3						3
	Shy heathwren	*Calamanthus cautus*	P4				1						3					1	5

Family	Common Name	Scientific Name	Cons. Status[1)]	Acacia		Woodland		Melaleuca		Woodland/Triodia		Regen. Woodland		Burnt Plain		Creek	Mallee/ Triodia /WI zone		Total
	Slaty-backed Thornbill	*Acanthiza robustirostris*						2			1								3
	Weebill	*Smicrornis brevirostris*		2	5	6	7	5	3	2	2	4	11	1			1	2	51
	Yellow-rumped thornbill	*Acanthiza chrysorrhoa*			2														2
Pardalotidae	Spotted Pardalote	*Pardalotus punctatus*											1						1
	Striated Pardalote	*Pardalotus striatus*		4	5	5	5	5	3	3	3	4	8		1		1	1	48
Meliphagidae	Black Honeyeater	*Sugomel niger*					1									1		1	3
	Brown-headed Honeyeater	*Melithreptus brevirostris*			1	1	3	1	1	1			4						12
	Crimson Chat	*Epthianura tricolor*											3	1	1				5
	Red Wattlebird	*Anthochaera carunculata*		2	1	6	4	3	1	3	2	2	5		1		1		31
	Singing Honeyeater	*Lichenostomus virescens*											1	1					2
	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*			1		1				2		2		1				7
	White-cheeked Honeyeater	*Phylidonyris niger*													1				1
	White-eared honeyeater	*Lichenostomus leucotis*			5	1	2		1			1	4		1		1	1	17
	White-fronted Honeyeater	*Purnella albifrons*		4	3	4	5	1		3	1	4	8	3	3			1	40
	Yellow-plumed Honeyeater	*Lichenostomus ornatus*			1	6	3	3		4	2	2	4						25
	Yellow-throated Miner	*Manorina flavigula*			1								3						4

Family	Common Name	Scientific Name	Cons. Status[1)]	Acacia		Woodland		Melaleuca		Woodland/Triodia		Regen. Woodland		Burnt Plain		Creek	Mallee/ Triodia /WI zone		Total
Pomatostomidae	White-browed Babbler	*Pomatostomus superciliosus*	P4	3	3						2	1	2						11
Eupetidae	Chestnut Quail-thrush	*Cinclosoma castanotum*				3	7		1			1	2				1	1	16
Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*				1	1	1	2				2					1	8
Campephagidae	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*			1		2	2			1		2	2	1		1	1	13
	White-winged Triller	*Lalage sueurii*									2	2	5				1		10
Pachycephalidae	Crested Bellbird	*Oreoica gutturalis*	P4	2	2	1	2	1	1				6		1			1	17
	Crested Shrike-tit	*Falcunculus frontatus*	P4				1												1
	Gilberts Whistler	*Pachycephala inornata*				2	3		2	4	3								14
	Golden Whistler	*Pachycephala pectoralis*					1	1	2				2						6
	Grey Shrike-thrush	*Colluricincla harmonica*		1	3	2	2	3	3	1	3	2	5		1		1		27
	Rufous Whistler	*Pachycephala rufiventris*			1	1							1						3
Artamidae	Dusky Woodswallow	*Artamus cyanopterus*				4	2			3		1	3						13
	Grey Butcherbird	*Cracticus torquatus*		1		2	1	1	1				2		1			1	10
	Grey Currawong	*Strepera versicolor*		2	3	1	2	2	1									1	12
	Masked Woodswallow	*Artamus personatus*			1								3		1			2	7
	Pied Butcherbird	*Cracticus nigrogularis*					1										1	1	3

Family	Common Name	Scientific Name	Cons. Status[1)]	Acacia		Woodland		Melaleuca		Woodland/Triodia		Regen. Woodland		Burnt Plain		Creek	Mallee/ Triodia /WI zone		Total
Rhipiduridae	Willie Wagtail	*Rhipidura leucophrys*			1	1	3		1	1	1	1	2						11
Corvidae	Australian Raven	*Turnix velox*					1												1
	Little Crow	*Corvus bennetti*					1												1
Petroicidae	Hooded Robin	*Melanodryas cucullata*											2						2
	Jacky Winter	*Microeca fascinans*				2	3		2				2						9
	Red-capped Robin	*Petroica goodenovii*		1	3		2	3				1	3		1			1	15
	Western Yellow Robin	*Eopsaltria griseogularis*				1	1	2	4		2								10
Megaluridae	Brown Songlark	*Cincloramphus cruralis*										1							1
	Rufous Songlark	*Cincloramphus mathewsi*					2							1					3
Hirundinidae	Tree Martin	*Petrochelidon nigricans*					1						1						2
Motacillidae	Australasian Pipit	*Anthus novaeseelandiae*												4	4			2	10
Total species per habitat				**30**		**49**		**32**		**23**		**45**		**29**		**3**	**34**		**77**
Abundance (frequency of occurrence) per habitat				**93**		**179**		**80**		**72**		**174**		**58**		**3**	**47**		**706**

Footnotes with Table 12

1) V = EPBC Act Vulnerable, M = EPBC Act Migratory, S1 = WC Act Schedule 1, S3 = WC Act Schedule 3, P4 = DPaW Priority 4

2) S = Systematic 20-minute surveys of 2-ha area

3) O = Opportunistic sightings, foraging, and spotlighting surveys

5.6 SPECIES ACCUMULATION CURVES

5.6.1 ACTUAL SPECIES ACCUMULATION

During the survey a total of 77 birds, 40 reptiles and 14 non-volant mammal species were recorded. After the survey, an additional six (potentially eight) bat species were identified from acoustic recordings (see section 5.3.2 for details); these have not been included in the day-to-day accumulation curves below.

The accumulation of species with each additional survey day is displayed in Figure 10. On the last survey day, 18 November 2013, only trap site 6 was still open, located in the highly unproductive Burnt Plain habitat, while foraging and systematic bird surveys had ceased.

By the end of the survey, bird records continued to rise, while mammal and reptile records appeared to reach a plateau. This indicates that the majority of reptiles and mammals that were present in the project area, and which were active at the time of the survey, were recorded. However, it is likely that additional bird species would have been recorded if the survey had continued longer.

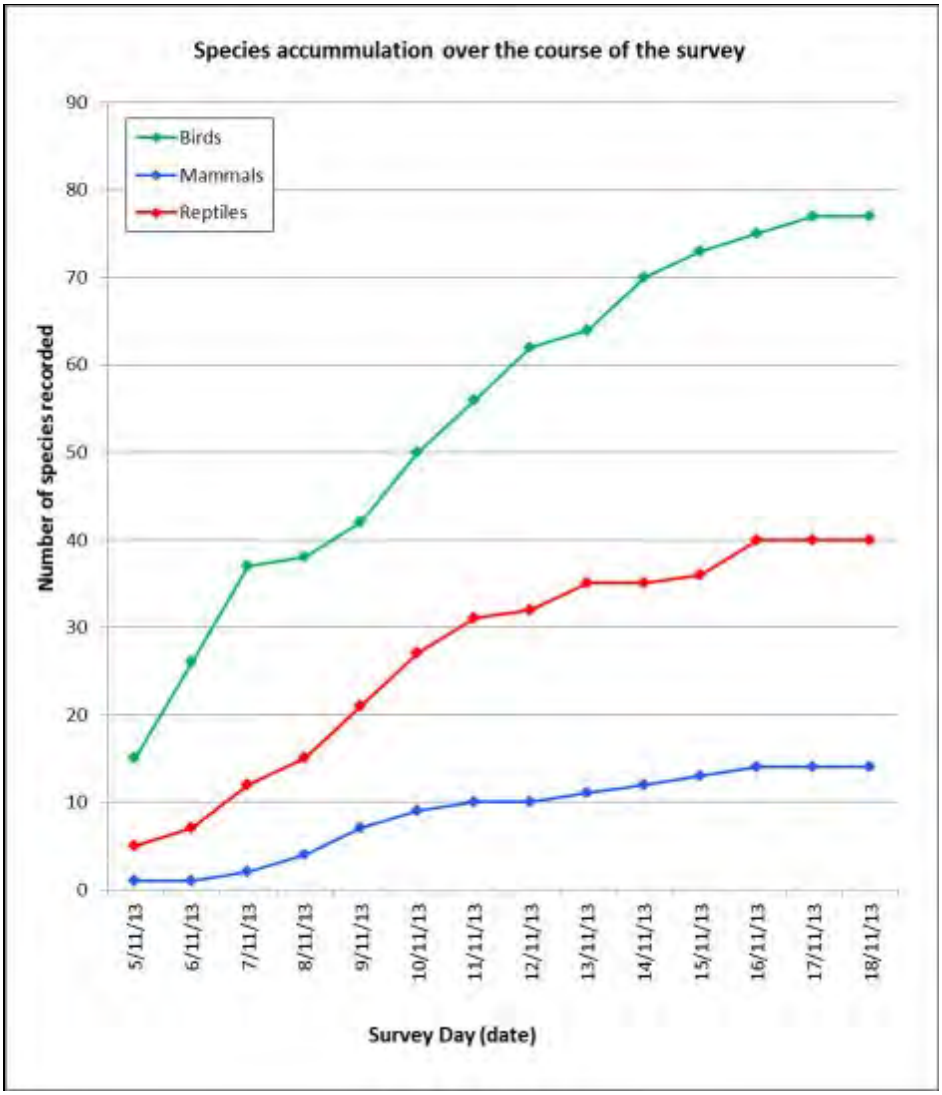


Figure 10 Actual species accumulation over the course of the survey

5.6.2 SPECIES RICHNESS ESTIMATORS: MAMMALS AND REPTILES

During the survey, 40 reptile species and 19 (potentially 21) mammal species were recorded. Of these, 30 reptiles and 5 mammals were recorded in the systematic trapping grids. Species richness estimators were generated over the combined trapping data for mammals and reptiles (i.e. 35 species in total).

The predictors ICE and Chao 2 produced erratic curves and were removed from further analysis. Average predicted species richness was calculated using the mean of the remaining predictors, which are listed in Table 13, and plotted in Figure 11. The species richness estimators indicated that the systematic trapping grids recorded approximately 71% of all trappable mammals and reptiles. This is also reflected in the species accumulation curve which continues to rise at the end of the survey, and does not approach the predicted species richness of 50 species.

Table 13 Predicted species richness and survey completeness for systematic trapping

Predictor	Predicted species richness	Survey completeness estimation based on observed/predicted
ACE	56.7	62 %
Chao 1	51.6	68 %
Jack 1	47.5	74 %
Jack 2	53.8	65 %
Bootstrap	40.8	86 %
Average	**50.1**	**71%**

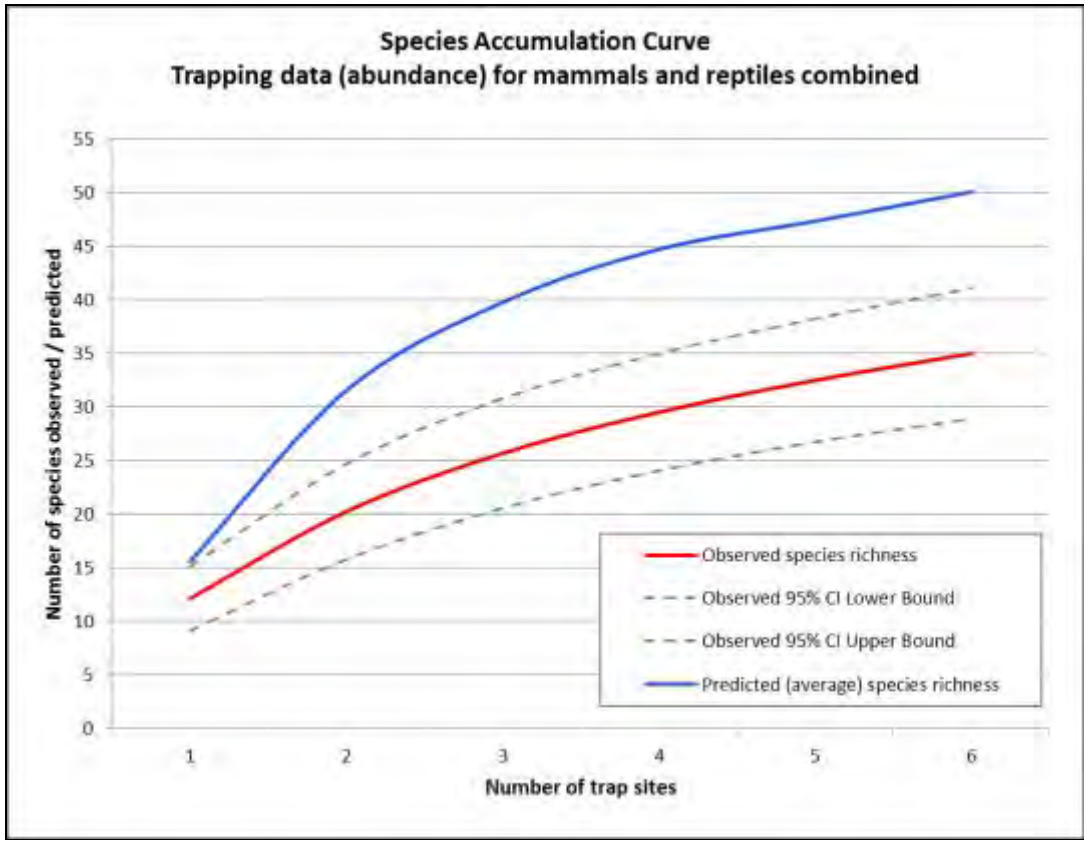


Figure 11 Species accumulation curve for reptiles and mammals (systematic trapping data)

5.6.3 SPECIES RICHNESS ESTIMATORS: SYSTEMATIC BIRD SURVEYS

During the systematic 20-minute bird surveys, a total of 48 bird species were recorded. Species richness estimators were generated over frequency-of-occurrence data for each species.

The predictors ACE, ICE, Chao 1, Chao 2 and Jack 2 produced erratic curves and were removed from further analysis. Average predicted species richness was calculated using the mean of the remaining predictors, listed in Table 14 and plotted in Figure 12. The species richness estimators indicated that approximately 80 % of predicted bird species were recorded during the systematic surveys.

The actual number of species recorded during the survey, based on systematic survey data supplemented by opportunistic records, was 77. This number well exceeds the predicted species richness based on systematic surveys alone. The opportunistic bird surveys covered a much greater area and likely included more micro-habitats, and therefore yielded a significant addition to the number of species recorded from systematic surveys only. Overall, these combined figures indicated that the greater majority of bird species present in the project area were recorded during the survey.

Table 14 Predicted species richness and survey completeness for systematic trapping

Predictor	Predicted species richness	Survey completeness estimation based on observed/predicted
Jack 1	65.5	73 %
Bootstrap	55.9	86 %
Average	**60.7**	**80 %**

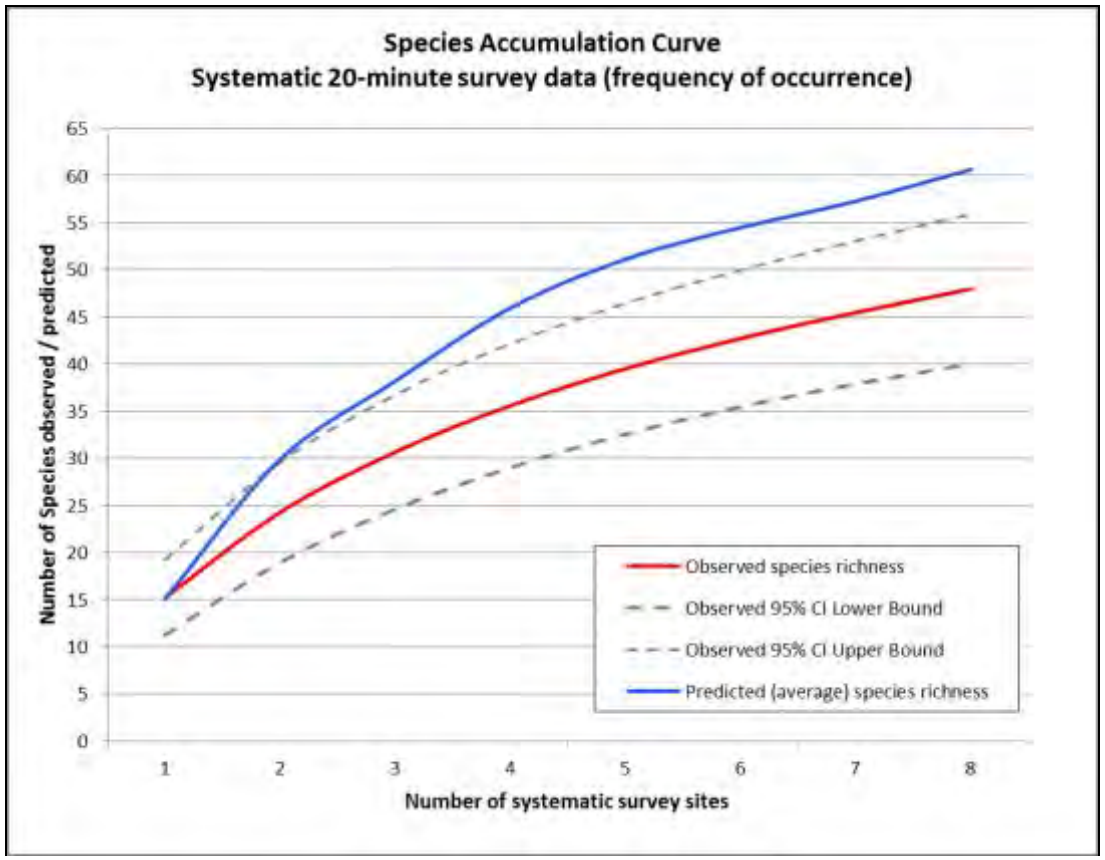


Figure 12 Species accumulation curve for bird species (20-minute survey data)

5.6.4 SURVEY COMPLETENESS

The species richness estimators for mammals and reptiles (section 5.6.2) indicate that the survey recorded 71 % of all trappable species. This is reflected in a predicted species accumulation curve that does not reach a plateau.

However, the actual species accumulation curve for mammals and reptiles, based on species attrition per survey day (section 5.6.1) do reach a plateau, with no new mammal and reptile species recorded in the last two survey days. Regional records do not suggest many additional small mammals that could have been recorded in the habitats available, and those that may have been present are cryptic species and locally uncommon species. This suggests that follow-up survey work, conducted during a second phase may record a couple of additional mammals (e.g. Bollam's Mouse, Ash-grey Mouse).

For the reptiles, the paucity of snake records, and the relatively cool nights at the time of survey, indicates that follow-up surveys conducted over summer may record additional species, especially snakes as several common species expected to occur in the project area were not recorded during the survey.

The species richness estimators for birds (section 5.6.3) indicate that the systematic 20-minute surveys have recorded approximately 80% of bird species. Additional opportunistic records well exceed the predicted species richness, indicating that the survey has recorded most bird species that were present in the project area at the time of survey.

The actual species accumulation curve for birds (section 5.6.1) does not reach a plateau at the end of the survey. The latter suggests that additional species may have been present in the project area. This is corroborated by a review of regional records, which indicates several species that could use the habitats in the project area. Most of these, however are either cryptic species (i.e. owls and nightjars), species that occur in low densities (i.e. raptors such as Australian Kestrel and Australian Hobby), or nomadic species that would only occur in the project area for parts of the year (i.e. Black Honeyeaters, Pied Honeyeaters and Purple-gaped Honeyeaters). Follow-up surveys conducted over a different time of year are likely to record additional bird species for the project area. However, the majority of the local bird population appears to have been recorded during the survey.

No amphibians were recorded during the survey. The latter was likely due to the absence of standing water in the project area, or high rainfall events prior to or during the survey. The presence of creek and floodplain areas in the project area suggest that follow-up surveys completed during wet conditions would yield amphibians.

5.7 SHORT-RANGE ENDEMICS

A total of 28 potential SRE specimens were collected during the survey and submitted for identification, comprising 9 Mygalomorph spiders, 3 scorpions, 5 pseudoscorpions, and 11 live snail specimens. These are presented in Table 15 below. At the time of writing, identifications of Mygalomorph spiders and scorpions had been had been completed (Appendix V), but identifications for pseudoscorpions and snails are still pending. These will be discussed in a separate report.

5.7.1 MYGALOMORPH SPIDERS

Eight specimens of Mygalomorph spiders (trapdoor spiders) were collected during the Level 2 survey. Taxonomic identifications revealed that these specimens comprised five morpho-species from three genera: *Aganippe* (family Idiopidae), *Aname* (family Nemesiidae) and *Cethegus* (family Dipluridae).

The single *Aganippe* specimen was a female, dug up from a burrow near trap site 1 in the MLA (Acacia habitat). The specimen is a potential SRE, but is unidentifiable to species level at this time. The specimen is rated potential SRE based on distribution patterns within the genus *Aganippe*.

Three species of the genus *Aname* were identified from the MLA, one of which, *Aname* sp. indet (not Aname MYG 181) is a potential SRE, collected from Melaleuca habitat. The other two species, *Aname* MYG 181 and *Aname tepperi*, are widespread and not SRE.

The single specimen of *Cethegus ischnotheloides* specimen was a male collected from a pit-bucket at trap site 5 within the road corridor. This is not a SRE species.

The general ecology of the potential SRE species, based on field data, is as follows: the single specimen of *Aganippe sp*. was collected from its burrow in an mature unburnt *Acacia acuminata* community in a large loamy clay depression with the potential for inundation; a total of four specimens of *Aname* sp. A. were collected from two sites during the survey, three specimens from a *Eucalyptus* woodland dominated habitat recently burnt by a cool fire on a yellow-brown sandy clay, and one specimen from a mature unburnt *Eucalyptus* woodland dominated habitat with a *Cratystylis* dominated understorey on an orange-brown loamy clay soil; *Aname* sp. B. was represented by a single specimen from a mature unburnt *Melaleuca pauperiflora* dominated low woodland on a friable brownish clay-loam.

5.7.2 SCORPIONS

Three scorpions were collected during the survey, which were identified as comprising two species from two different genera: *Isometroides* (family Buthidae) and *Lychas* (family Buthidae).

Two specimens of the spider hunting specialist *Isometroides* sp. were collected at trap site 2 within the MLA, which was a mature unburnt tall *Eucalyptus* woodland with a *Cratystylis* understorey on an orange-brown loamy clay soil. The specimens comprise a so far unknown species of *Isometroides*, which was assigned the morpho-species name *Isometroides* 'balladonia'. Based on known distribution patterns of species within the genus, *Isometroides* 'balladonia' is not considered an SRE.

A single specimen of *Lychas* 'adonis' was recorded from trap site 5, located in the road corridor. The habitat comprised a *Eucalyptus* woodland, recently burnt by a cool fire, on a yellow-brown sandy clay. The genus *Lychas* is widespread across the Australian mainland, and most species in this genus appear to have wide distributions. Lychas 'adonis' is widespread across Australia and is not an SRE.

5.7.3 PSEUDOSCORPIONS

Taxonomic identifications for pseudoscorpions are pending, and will be discussed in a separate report.

5.7.4 SNAILS

Live snail specimens of the genus Bothriembryon were collected from three locations, two of these were within the MLA, and one was collected by a Sirius staff member at a waypoint plotting south of the Eyre Highway. In addition, minute live snails were extracted from leaf litter samples collected from two trap sites in the MLA and one foraging site in the road corridor.

The *Bothriembryon* specimens comprised large pale snails, of which empty shells were encountered on the ground across most habitats within the survey area. The nearest locality record for this genus is in the Esperance area. Members of the genus *Bothriembryon* have the potential to be SRE species. Taxonomic identifications for snails are still pending, and will be discussed in a separate report.

Table 15 Potential SRE specimens collected during the survey

Taxonomic Group	Preliminary Identification	SRE	Site	Habitat	Coordinates	Collection Date	Collection Method	Rapallo ID Number	No. specimens
Mygalomorph Spider	*Aganippe* sp.	Potential	Trap site 1	Acacia	31°48'7"S 123°9'38"E	18/11/2013	Forage	RAP-15410-TS1-FACE-MYG-05	1
Mygalomorph Spider	*Aname 'MYG181'*	No	Trap site 2	Woodland	31°48'4"S 123°13'12"E	15/11/2013	Pitfall trap	RAP-15410-TS2-CRATE-MYG-08	1
Mygalomorph Spider	*Aname tepperi*	No	Trap site 3	Melaleuca	31°50'17"S 123°10'27"E	11/11/2013	Pitfall trap	RAP-15410-TS3-MELA-MYG-03	1
Mygalomorph Spider	Aname sp. indet. (not 'MYG181')	Potential	Trap site 3	Melaleuca	31°50'17"S 123°10'27"E	19/11/2013	Elliot trap	RAP-15410-TS3-MELA-MYG-06	1
Mygalomorph Spider	*Cethegus ischnotheloides*	No	Trap site 5	Regenerating woodland	31°55'8"S 123°10'10"E	16/11/2013	Pitfall trap	RAP-15410-TS5-REGEN-MYG-01	1
Mygalomorph Spider	Aname 'MYG181'	No	Trap site 5	Regenerating woodland	31°55'8"S 123°10'10"E	09/11/2013	Pitfall trap	RAP-15410-TS5-REGEN-MYG-02	1
Mygalomorph Spider	Aname 'MYG181'	No	Trap site 5	Regenerating woodland	31°55'8"S 123°10'10"E	17/11/2013	Pitfall trap	RAP-15410-TS5-REGEN-MYG-07	1
Mygalomorph Spider	Aname 'MYG181'	No	Trap site 5	Regenerating woodland	31°55'8"S 123°10'10"E	13/11/2013	Pitfall trap	RAP-15410-TS5-REGEN-MYG-09	1
Scorpion	*Isometroides* 'balladonia'	No	Trap site 2	Woodland	31°48'4"S 123°13'12"E	12/11/2013	Pitfall trap	RAP-15410-TS2-CRATE-SCP-10	1
Scorpion	*Isometroides* 'balladonia'	No	Trap site 2	Woodland	31°48'4"S 123°13'12"E	13/11/2013	Pitfall trap	RAP-15410-TS2-CRATE-SCP-11	1
Scorpion	Lychas 'adonis'	No	Trap site 5	Regenerating woodland	31°55'8"S 123°10'10"E	17/11/2013	Pitfall trap	RAP-15410-TS5-REGEN-SCP-12	1
Pseudoscorpion	Pending		Road corridor (Wpt: HR14B)	Regenerating woodland	32°00'08"S 123°08'25"E	15/11/2013	Forage	RAP-15410-HR14B-PSE-22	1
Pseudoscorpion	Pending		Road corridor (Wpt: HR21)	Regenerating woodland	31°56'17"S 123°10'12"E	16/11/2013	Forage	RAP-15410-HR21-PSE-21	1

Taxonomic Group	Preliminary Identification	SRE	Site	Habitat	Coordinates	Collection Date	Collection Method	Rapallo ID Number	No. specimens
Pseudoscorpion	Pending		Trap site 1	Acacia Shrubland	31°48'7"S 123°9'38''E	11/11/2013	Leaf litter sample	RAP-15410-TS1-FACE-PSE-20	1
Pseudoscorpion	Pending		Trap site 3	Melaleuca	31°50'17"S 123°10'27''E	12/11/2013	Leaf litter sample	RAP-15410-TS3-MELA-PSE-16	1
Pseudoscorpion	Pending		Trap site 4	Woodland/ Triodia	31°49'47"S 123°13'42''E	11/11/2013	Leaf litter sample	RAP-15410-TS4-SPAG-PSE-17	1
Snail	*Bothriembryon* sp.	Possible	MLA (Wpt: FHSNAIL1)	Woodland	31°48'5"S 123°13'8''E	13/11/2013	Forage	RAP-15410-FHSNAIL1-SCP-13	1
Snail	*Bothriembryon* sp.	Possible	MLA (Wpt: CSSNAIL)	Woodland	31°48'5"S 123°13'9"E	13/11/2013	Forage	RAP-15410-CSSNAIL-MOL-14	2
Snail	Pending		Trap site 4	Woodland/ Triodia	31°49'47"S 123°13'42''E	11/11/2013	Leaf litter sample	RAP-15410-TS4-SPAG-MOL-18	1
Snail	Pending		Trap site 2	Woodland	31°48'4"S 123°13'12''E	13/11/2013	Leaf litter sample	RAP-15410-TS2-CRATE-MOL-19	3
Snail	Pending		Road corridor (Wpt: HR14B)	Regenerating woodland	32°00'08"S 123°08'25"E	15/11/2013	Forage	RAP-15410-HR14B-MOL-23	1
Snail	*Bothriembryon* sp.	Possible	South of road corridor (Wpt: SW_Sirius)	Woodland/ Triodia	32°23'60"S 122°17'30"E	19/11/2013	Forage	RAP-15410-SW_Sirius-MOL-24	3
Total Potential SRE Specimens Collected									28
Total Mygalomorph Spiders									9
Total Scorpions									3
Total Pseudoscorpions									5
Total Snails									11

6 SPECIES OF CONSERVATION SIGNIFICANCE

Regional comparisons have identified 22 vertebrate fauna species of conservation significance that have been recorded from the region (Appendix I). Nine of these species were recorded within the habitats of the project area during surveys, comprising eight bird species, and potentially one bat. Their locations are mapped in Figure 13 to Figure 23. In addition, the conservation listed South-West Carpet Python was recorded by Sirius exploration staff from an unconfirmed location either within or outside the project area. This sighting could not be mapped due to lack of information.

Based on distribution maps, presence of suitable habitat in the project area, and/or nearby sightings, an additional three species of conservation significance may occur in the project area. These are the Bush Stone-curlew, the Australian Bustard, and the inland subspecies of the Western Rosella (Table 17).

6.1 SOUTHERN MARSUPIAL MOLE *NOTORYCTES TYPHLOPS*

The Southern Marsupial Mole *Notoryctes typhlops* is listed as Endangered under the *EPBC* and *WC Act*. The Marsupial Mole is sparsely distributed across much of arid Australia (Menkhorst & Knight 2011), Importantly, Benshemesh (2004) notes that Marsupial Moles are not capable of travelling far across hard ground and continuity of suitable habitat (sand dunes, swales, sand plains) is likely to be very important for the occurrence of Marsupial Moles in an area.

The species was not recorded during the survey and suitable habitat does not occur on the survey area. Development on the survey area is highly unlikely to impact on the Southern Marsupial Mole.

6.2 MALLEEFOWL *LEIPOA OCELLATA*

In Western Australia, the Malleefowl is listed under the WC Act as Schedule 1: Fauna that is rare or likely to be extinct (Government of Western Australia 2013). Nationally, the species is listed under the EPBC Act as Vulnerable (Department of the Environment 2013).

The Malleefowl belongs to an ancient family called Megapodiidae whose members all build terrestrial mounds for nesting (Marchant & Higgins 1993). Clearance for agriculture has eliminated and fragmented much of the Malleefowl habitat, resulting in localised extinctions and fragmented populations. The remaining isolated populations are now mostly in suboptimal habitat, since the mallee on the best soil has been cleared, and are vulnerable to catastrophic events, such as bushfires (Garnett *et al.* 2011).

The Malleefowl is found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or Acacia species. A sandy substrate and abundance of leaf litter are required for mound construction and heat regulation (Johnstone & Storr 1998).

Knowledge of the status of the Malleefowl in the woodlands to the east of the Wheatbelt is poor (Short & Parsons 2008). Parsons *et al*. (2008) examined the distribution of Malleefowl in the Western Australian Wheatbelt. Malleefowl distribution was associated with landscapes that had lower rainfall, greater amounts of mallee and shrubland that occur as large remnants and lighter soil surface textures. At a finer scale, Malleefowl occurrence was associated with mallee/shrubland and thicket. Clarke (2005) found that in particular, habitats on sandy substrates that support *Triodia* were of greatest importance. Chenopod mallee, which typically forms on heavy soils, and heath-dominated habitat, which usually forms on nutrient-poor sand were among the least preferred mallee habitats for Malleefowl.

Fire affects Malleefowl breeding. Although Malleefowl will feed in recently burnt areas, they require long unburnt areas for breeding and shelter (Marchant & Higgins 1993; Benshemesh 2000). Short and Parsons (2008) found that in the Western Australian wheatbelt, mallee developed a complex understorey and rich litter layer after about 15 years and maintained these characteristics beyond 45 years. In contrast, Acacia shrubland took somewhat longer to develop a litter layer, and this layer and the shrubby understorey tended to diminish after about 25-30 years. This suggests that in Western Australia Malleefowl may be able to re-occupy and potentially breed in key habitats 15 years post-fire.

Within the Hyden – Lake Johnstone Study Area How *et al*. (1980) recorded Malleefowl at Lake Cronin (old mound), McDermid Rock (actual observation) and Peak Charles (old mound and actual observation). Hall and McKenzie (1993) reported old mounds at Camps One and Four within the Norseman – Balladonia Study Area. Duncan *et al*. (2006) recorded Malleefowl from the Honman Ridge via a dog/fox scat. Rapallo (2009) recorded old mounds near Exclamation Lake, approximately 30 km west of Salmon Gums. Approximate distances of these regional Malleefowl records within the Great Western Woodlands are listed in Table 6.

Based on dominant vegetation and fire history, the habitats of the survey area are not preferred habitat for the species and although mounds were recorded, Malleefowl densities are likely to be low.

Further information on the presence of Malleefowl in the project area, and assessment of potential impacts on the local Malleefowl population is provided in Rapallo (2014 – in prep.) *Targeted Malleefowl Survey of the Nova Project Area*.

Evidence of Malleefowl was recorded at three locations within or close to the survey area in the form of nesting mounds (Table 16). Of these mounds, two were proximal to the proposed access road corridor, and one was on the north-south track less than five kilometres north-west of the survey area.

Plates 1 to 3 show the mounds recorded during the survey. Of the three mounds proximal to the proposed access road corridor, one was assessed as an extinct profile 6 mound and one was assessed as a dormant profile 1 mound (as explained in Appendix III). Figure 18 show the locations of the mounds found within the access road corridor. The North-South track mound, shown in Figure 23, was investigated by Rapallo and found to be a dormant Profile 1 mound. It was recorded in a long unburnt tall mallee habitat.

Table 16 Coordinates and descriptions of Malleefowl mounds recorded in the survey

Photograph	Mound Profile Nr.	Habitat	Easting	Northing
Plate 1	1	Mallee	507873	6461567
Plate 2	1	Melaleuca	513796	6459503
Plate 3	6	Burnt Plain (ridge)	514313	6459699

Terrestrial Ecosystems (2013) located an extinct mound on the MLA, located in Woodland habitat. This mound could not be re-located during the survey, most likely due to extensive movements of vehicles and machinery in the area.

Although present in the survey area, provided clearing, fire and traffic management controls are implemented, development on the survey area is unlikely to impact on the Malleefowl.

Plate 1 **Malleefowl mound (Profile No. 1) recorded five km west of the road corridor**

Plate 2 **Malleefowl (Profile No. 1) mound recorded in the road corridor west of Trapping Site 6**

Plate 3 **Very old Malleefowl mound (Profile No. 6) recorded in the road corridor on burnt quartz ridge east of trapping site 6**

6.3 PEREGRINE FALCON *FALCO PEREGRINUS*

The Peregrine Falcon *Falco peregrinus* is listed under the WC Act as Schedule 4 - Other Specially Protected Fauna (Table 17). The species has experienced a large population decline as a result of reduced breeding success caused by herbicide and pesticide use in the 1950's to the 1970's. Since the banning of such chemicals the species population has stabilised and expanded. In Western Australia, populations are stable in areas with granite outcrops and cliffs (Johnstone & Storr 1998). In the absence of such habitats, the species is known to use nests of species from the family Corvidae and occasionally hollows for nesting (Marchant & Higgins 1993).

Proximal sightings of the species have been recorded with Birdlife Australia Atlas and NatureMap records from close to the survey area (Birdlife Australia 2013a; DPaW 2013d), with the nearest record at the intersection of the road corridor with the Eyre Highway (Birdlife Australia 2013a). Regional sightings include Peak Charles National Park, Honman Ridge, Exclamation Lake (Salmon Gums) and Forrestania (How *et al.* 1980; Duncan *et al.* 2006; Coffey Environments 2009; Rapallo Environmental 2009). The species was not recorded during the survey. The lack of suitable nesting sites (granite outcrops and cliffs) would suggest that the species is likely to be an infrequent visitor to the survey area. Development on the survey area is unlikely to impact on the Peregrine Falcon.

6.4 SOUTH-WEST CARPET PYTHON *MORELIA SPILOTA IMBRICATA*

The south-west subspecies of the Carpet Python *Morelia spilota imbricata* is listed by DPaW as Schedule 4 - Other Specially Protected Fauna Table 17. It has a broad range over a variety of habitats from Northampton in the north, throughout the south-west to Kalgoorlie in the east. It feeds on a variety of small to medium sized mammal species and birds. The sub-species shows extreme sexual dimorphism; females can grow to nearly four metres in length, weighing up to 4.5 kilograms, while males rarely reach more than 1.1 kilograms (Johnstone & Storr 1998). It is particularly vulnerable to habitat destruction and altered fire regimes (Cogger *et al.* 1993).

The South West Carpet Python has been recorded from semi-arid coastal and inland habitats, Banksia woodland, Eucalypt woodlands, and grasslands and is likely to be present within the project area.

Sirius exploration staff recorded a Carpet Python on the road into site during 2013 (photographs were taken and identification confirmed). The exact location of this sighting could not be confirmed with Sirius, and may have been within, or in close proximity to the MLA. It is therefore highly likely that the South-West Carpet Python occurs in the project area.

WAM specimens are listed for Kambalda, Kalgoorlie, Coolgardie, Parker Range, Fraser Range and Norseman and observations of the species have been recorded from the Salmon Gums area and Peak Charles National Park (Brad Maryan Technical Officer (former), *pers. comm,* 2008).

Provided clearing and traffic management controls are implemented, development in the survey area is unlikely to impact on the South-West Carpet Python.

6.5 AUSTRALIAN BUSTARD *ARDEOTIS AUSTRALIS*

The Australian Bustard *Ardeotis australis* is listed by DPaW as Priority 4 – Taxa in Need of Monitoring Table 17. The species did not register in the DPaW Threatened and Priority Fauna Database search, but was recorded by the Traditional Owners during heritage surveys. The Australian Bustard is widely distributed, but has suffered massive historical population declines. It is particularly vulnerable to intensive agricultural practices and fox predation (Garnett & Crowley 2000). The species utilises a wide

variety of grass habitats; including tussock, Triodia and grassy woodlands. They can also utilise chenopod flats and have been reported in lightly modified habitats such as golf courses. The species feeds on a variety of insects (such as stick insects) and fruits (Johnstone & Storr 1998).

Proximal sightings of the species have been recorded with Birdlife Australia Atlas records from close to the survey area (Birdlife Australia 2013a). Regional sightings include the WAM Norseman-Balladonia study areas, Lake Cronin and Frank Hann National Parks (How *et al.* 1980; Hall & McKenzie 1993). Traditional Owners reported seeing this species at an open plain to the north-west of the project area.

Provided clearing and traffic management controls are implemented, development in the survey area is unlikely to impact on the Australian Bustard.

6.6 CRESTED SHRIKE-TIT (SOUTH-WESTERN SSP) *FALCUNCULUS FRONTATUS LEUCOGASTER*

The Crested Shrike-tit (south-western ssp) *Falcunculus frontatus leucogaster* is listed as by DPaW as Priority 4 - Taxa in need of monitoring species (Table 17). The species inhabits woodlands, scrubs and more open forests of Eucalyptus especially Wandoo *E. wandoo*, Flat Topped Yate *E. occidentalis*, Karri *E. diversicolor*, Tingle *E. jacksonii*, Flooded Gum *E. rudis*, Salmon Gum *E. salmonophloia* and Gimlet *E. salubris* (Johnstone & Storr 2004).

Proximal sightings of the species have been recorded with NatureMap records from close to the survey area (DPaW 2013d). Regional sightings include the WAM Norseman-Balladonia study areas and Lake Cronin Nature Reserve (How *et al.* 1980; Hall & McKenzie 1993). A sighting north of Salmon Gums was recorded by Dr Harry Recher in 2003 (Johnstone & Storr 2004; Recher 2006).

The Crested Shrike-tit (south-western ssp) was recorded in Woodland habitat near the Nova exploration camp during the survey.

Provided clearing controls are implemented, development in the survey area is unlikely to impact on the Crested Shrike-tit (south-western ssp).

6.7 SHY HEATHWREN (WESTERN SSP) *HYLACOLA CAUTA WHITLOCKI*

The Shy Heathwren (western ssp) *Calamanthus cautus whitlocki* is listed by DPaW as Priority 4 - Taxa in need of monitoring (Table 17). Shy Heathwren can be found in the south-eastern regions of Western Australia. The species inhabits dense shrublands and heaths including the understorey of eucalyptus woodlands. It is also recorded as utilising post fire regeneration shrubland, uncleared road verges and remnants in farmland. They are generally associated with plant communities on stony soils, though any habitat with dense heaths can be utilised (Johnstone & Storr 2004). The Shy Heathwren was recorded within the post fire regeneration habitats of the survey area.

Proximal sightings of the species have been recorded with Birdlife Australia Atlas and Naturemap records from close to the survey area (Birdlife Australia 2013a; DPaW 2013d). Regional sightings include the WAM Norseman-Balladonia study areas, Great Western Woodland atlas survey sites (Frank Hann, Lake King – Norseman Road), Exclamation Lake (Salmon Gums), WAM Lake Johnston study areas (Lake Cronin, Frank Hann, Peak Charles), Honman Ridge and Forrestania. (Hall & McKenzie 1993; Duncan *et al.* 2006; Coffey Environments 2009; Rapallo Environmental 2009; Birdlife Australia 2013a).

Provided clearing controls are implemented, development on the survey area is unlikely to impact on the Shy Heathwren.

6.8 WESTERN ROSELLA (INLAND SSP) *PLATYCERCUS ICTEROTIS XANTHOGENYS*

The Western Rosella (inland subspecies) *Platycercus icterotis xanthogeny*s is listed under the WC Act as Schedule 1 – Fauna that is rare or likely to become extinct (Table 17). The Western Rosella is endemic to the south of Western Australia. The inland subspecies is found in *Eucalyptus* and *Allocasuarina* woodlands and scrubs, especially those containing Wandoo (*E. wandoo*), Flooded Gum (*E .rudis*), Salmon Gum *(E. salmonophloia*), tall mallee and Rock Sheoak (*Allocasuarina huegeliana*) (Johnstone & Storr 1998; Higgins 1999).

DPaW records include a confirmed sighting from Norseman in 2007 and the survey area lies within the known distribution of the species. Proximal sightings of the species have been recorded with Birdlife Australia Atlas records from close to the survey area (Birdlife Australia 2013). Regional sightings include the Great Western Woodland atlas survey sites, WAM Norseman-Balladonia study areas, Lake Cronin and Frank Hann National Parks (How *et al.* 1980; Dell & How 1984; Brearley *et al.* 1997, 1998; Coffey Environments 2009; Birdlife Australia 2013a).

The Western Rosella was not observed during the survey. However, it is likely that the species could use the survey area as an occasional foraging site, given the proximity of other sightings and the habitats in the project area being suitable for this species. Provided clearing controls are implemented, development on the survey area is unlikely to impact on the Western Rosella.

6.9 RAINBOW BEE-EATER *MEROPS ORNATUS*

The Rainbow Bee-eater *Merops ornatus* is listed under the WC Act as Schedule 3 – Migratory birds protected under an international agreement. It is protected under JAMBA. Under the EPBC Act the species is listed as Migratory (Table 17).

The Rainbow Bee-eater prefers open or lightly timbered areas, often near water. This species has been recorded in dry open sclerophyll forest, open woodlands and shrublands, including mallee, spinifex tussock grassland with scattered trees, chenopod shrubland with scattered trees and riparian or littoral assemblages. It is often seen around disturbed areas such as quarries, road cuttings and mines where exposed bare soil provides suitable breeding sites (Marchant & Higgins 1993). The Rainbow Bee-eater is a migratory bird and will move north from the southern areas of Australia during winter (Johnstone & Storr 1998). This species is common throughout the region and was recorded in the survey area. Development in the survey area is unlikely to impact on the Rainbow Bee-eater.

6.10 RED-NECKED STINT *CALIDRIS RUFICOLLIS*

The Red-necked Stint *Calidris ruficolis* is listed under the WC Act as Schedule 3 – Migratory birds protected under an international agreement. It is protected under CAMBA, JAMBA, ROKAMBA, and the Bonn Convention. Under the EPBC Act the species is listed as Migratory.

The Red-necked Stint breeds in north-eastern Siberia and northern and western Alaska. It follows the East Asian-Australasian Flyway to spend the southern summer months in Australia. In Australia, Red-necked Stints are found on the coast, in sheltered inlets, bays, lagoons, estuaries, intertidal mudflats and protected sandy or coralline shores. They may also be seen in saltworks, sewage farms, saltmarsh, shallow wetlands including lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats, flooded paddocks or damp grasslands. They are often in dense flocks, feeding or roosting (Birdlife Australia 2013). The species was not recorded during the survey and suitable habitat does not

occur on the project area. Development on the survey area is highly unlikely to impact on the Red-necked Stint.

6.11 COMMON GREENSHANK *TRINGA NEBULARIA*

The Common Greenshank *Tringa nebularia* is listed under the WC Act as Schedule 3 – Migratory birds protected under an international agreement. It is protected under CAMBA, JAMBA, ROKAMBA, and the Bonn Convention. Under the EPBC Act the species is listed as Migratory (Table 17).

Common Greenshanks are migratory, breeding in Palaearctic regions and moving south in a broad front, along the coasts and inland to their non-breeding areas. Greenshanks arrive in Australia in August and numbers increase slowly until September, with larger numbers arriving until November. Following arrival, the Common Greenshank remains in the same location with some local movements. Birds move north again in March and April (Birdlife Australia 2014). In Western Australia, the Common Greenshank is generally absent from the Western Deserts although there are a few records from the Great Sandy Desert and the Nullarbor Plain. It occurs around most of the coast from Cape Arid in the south to Carnarvon in the north-west. In the Kimberleys it is recorded in the south-west and the north-east, with isolated records from the Bonaparte Archipelago (Higgins & Davies 1996).

The species was not recorded during the survey and suitable habitat does not occur on the project area. Development on the survey area will not impact on the Common Greenshank.

6.12 FORK-TAILED SWIFT *APUS PACIFICUS*

The Fork-tailed Swift *Apus pacificus* is listed under the WC Act as Schedule 3 – Migratory birds protected under an international agreement. It is protected under CAMBA, JAMBA, and ROKAMBA. Under the EPBC Act the species is listed as Marine and as Migratory (Table 17).

The Fork-tailed Swift breeds in the north-east and central-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, arriving in the Kimberley in late September, in the Pilbara and Eucla by November and in the south-west land division by mid-December. The species generally returns to its breeding grounds by April. It ranges from common in the Kimberley; uncommon to moderately common in the north-west, west and south-eastern coasts and rare or scarce elsewhere (Johnstone & Storr 2004).

The Fork-tailed Swift was recorded during the survey in the woodland habitat and the post fire regenerating habitat. Given the Fork-tailed Swift is an aerial species that rarely comes down to the ground in its non-breeding areas, development on the survey area is unlikely to impact upon it.

6.13 EASTERN GREAT EGRET *ARDEA MODESTA*

The Great Egret (Eastern Great Egret) *Ardea modesta* is listed under the WC Act as Schedule 3 – Migratory birds protected under an international agreement. It is protected under CAMBA (as *Egretta alba*), and JAMBA (as *Egretta alba*). Under the EPBC Act it is listed as Marine and Migratory (Table 17).

The Eastern Great Egret can be found throughout Australia, with the exception of the arid regions. It is listed under the EPBC Act as Migratory – Overfly Marine (Table 17). The Great Egret inhabits terrestrial wetlands, estuarine, littoral habitats and grasslands. It prefers permanent water bodies on floodplains and the shallows of deep permanent lakes (Marchant & Higgins 1993), though it can be seen on any watered area including damp grasslands (Johnstone & Storr 1998).

The species was not recorded during the survey and suitable habitat does not occur in the project area. Development in the survey area will not impact on the Great Egret.

6.14 CATTLE EGRET *ARDEA IBIS*

The Cattle Egret *Ardea ibis* is listed under the EPBC Act as Migratory Wetland species (Table 17). In Western Australia the Cattle Egret is common in areas of medium to high rainfall. The Cattle Egret usess grasslands, woodlands and wetlands, and is not common in arid areas (Johnstone & Storr 1998).

The species was not recorded during the survey. Suitable habitat does not occur on the project area. Development on the survey area will not impact on the Cattle Egret.

6.15 CHUDITCH *DASYURUS GEOFFROYI*

In Western Australia the Chuditch *Dasyurus geoffroyi* is listed under the WC Act as Schedule 1 – Fauna that is rare or likely to become extinct (Table 17). The Chuditch can be found in areas of the south-west of Western Australia, dominated by sclerophyll forest, drier woodlands and mallee shrublands. Male Chuditch have a home range of approximately 15 square kilometres which can overlap with other males and females have a home range of three to four square kilometres (Serena & Soderquist 1989; Soderquist & Serena 2000). The species is carnivorous and will feed on mammals and birds (up to the size of a bandicoot or parrot), reptiles and invertebrates (Van Dyck & Strahan 2008).

The Chuditch has experienced drastic population declines, a result of fox predation and habitat degradation (Serena & Soderquist 1989; Soderquist & Serena 2000). However, over recent years Chuditch populations have increased in response to fox control and translocations programs. There have been translocation programs at Cape Arid National Park, approximately 200 kilometres south of the survey area and Lake Magenta Nature Reserve, 400 kilometres south-west of the survey area (Department of the Environment 2014).

DPaW have two records (1998 and 2008) of Chuditch, from Salmon Gums, 190 kilometres south-west of the project area. Both records were of males. The Chuditch recorded in 1998 was a tagged animal from the releases at Cape Arid. This animal was found in a chicken pen at Salmon Gums and re-released at Cape Arid. The 2008 Chuditch record was found dead south of Salmon Gums on Poverty Lane (Keith Morris *pers. comm.*). It is likely that these records were of dispersing males and to date no females have been recorded from the Salmon Gums region.

In addition, Chuditch were trapped from near Forrestania close to Frank Hann National Park (290 km to the south west of the survey area) in February 2009. These animals were not recaptures from a translocation program (Keith Morris *pers. comm*.).

In older literature, Serena *et al.* (1991) describe the distribution of the Chuditch outside of the south-western Jarrah forest and woodland based on WAM specimens, reliable sightings and road kill records taken from 1975-1991. Records outside the Jarrah Forest closest to the survey area included Frank Hann National Park (1987), Forrestania National Park (1984/1985) and Munglinup (1983).

DPaW's fauna surveys of Dundas Nature Reserve in May 2009 failed to detect the species (Keith Morris pers comm.) The survey was specifically designed to detect medium sized mammal species.

Discussions with Traditional Owners did not yield any information about Chuditch in the area apart from the Salmon gums chicken pen record. Chuditch were not recorded during the survey and are

unlikely to be present based on distribution. Development in the survey area is therefore unlikely to impact on Chuditch.

6.16 LAKE CRONIN SNAKE *PAROPLOCEPHALUS ATRICEPS*

The Lake Cronin Snake *Paroplocephalus atriceps* is listed as by DPaW as Priority 3 – Taxa with several, poorly known populations, some on conservation lands (Table 17). The species is not known to have declined, but is thought to be vulnerable as it has a very restricted range surrounded by unsuitable habitat (Cogger *et al.* 1993; Wilson & Swan 2013). A number of threatening processes affect populations including; clearance of habitat for agriculture and grazing; crop production and disturbance by mining activities (Cogger *et al.* 1993).

The species did not show up in the DPaW Threatened and Priority Species Database Search, however, Lake Cronin snake was recorded from the Exclamation Lake area (Salmon Gums) in 2002 (Rapallo Environmental 2009). Other regional records include a record from Maggie Hays collected from *Eucalyptus longicornis - E. salmonophloia* woodland over *Cratystylis conocephala* dwarf scrub on red-brown clay loam. The cryptic nature of the species and the apparent suitability of the survey area habitat means that Lake Cronin Snake cannot be discounted. Provided clearing controls are implemented, development on the survey area is unlikely to impact on the Lake Cronin Snake.

6.17 WHITE-BROWED BABBLER (WESTERN WHEATBELT SSP) *POMATOSTOMUS SUPERCILIOSUS ASHBYI*

The wheatbelt subspecies of the White-browed Babbler *Pomatostomus superciliosus ashbyi* is listed by DPaW as Priority 4 – Species in need of monitoring, for reasons that it has declined or become locally extinct in several locations along the Western Australian wheatbelt (Table 17).

The species utilises a diverse range of woodland habitats with shrubby understoreys (Johnstone & Storr 2004). The wheatbelt subspecies hybridises with *P. superciliosus superciliosus* (central and southern arid zone and eastern mallee subspecies) between Dongara–Geraldton and Hopetown-Esperance (Schodde & Mason 1999). Subspecies identification of the White-browed Babbler requires either morphological measurements of captured individuals or DNA sequencing. A mist netting survey at Exclamation Lake (Salmon Gums) recorded the subspecies as ashbyi (Rapallo Environmental 2009).

Proximal sightings of White-browed Babbler (subspecies undetermined) have been recorded with Birdlife Australia Atlas and Naturemap records from close to the survey area (Birdlife Australia 2013, DPaW 2013). Regional sightings include the WAM Widgiemooltha to Zanthus study sites, WAM Norseman-Balladonia study areas, Great Western Woodland atlas survey sites (Frank Hann Nature Reserve, Lake King – Norseman Road), Exclamation Lake (Salmon Gums), WAM Lake Johnston study areas (Lake Cronin, Peak Charles), Kambalda, Honman Ridge and Forrestania (Dell & How 1984; Hall & McKenzie 1993; Duncan *et al.* 2006; Western Wildlife 2006; Coffey Environments 2009; Rapallo Environmental 2009).

The White-browed Babbler (subspecies undetermined) was recorded at five sites within the survey area, within Woodland, Acacia, and Regenerating Woodland habitat. The project area is located in an area of overlap between the conservation listed subspecies *P. superciliosus ashbyi* and the non-listed *P. superciliosus superciliosus* subspecies. Therefore, it is not possible to determine on observation alone which subspecies occurs in the project area, because the physical differences between the subspecies are minute. Which subspecies occurs can only be reliably determined through morphological

measurements (from mist-netted birds) or DNA sequencing. Lacking this information, confirmed subspecies identification is not possible at this time.

Provided clearing controls are implemented, development on the survey area is unlikely to impact on the White-browed Babbler.

6.18 GREATER LONG-EARED BAT *NYCTOPHILUS MAJOR TOR*

DPaW currently list *Nyctophilus timoriensis* (central form) as a Priority 4 species occurring in south-west Western Australia. A taxonomic review of *N. timoriensis* was completed by Parnaby (2009). This paper resulted in the splitting of *N. timoriensis* into several new species. The previously listed population of *N. timoriensis* has been renamed as the subspecies *Nyctophilus major tor* and occupies areas of the Great Western Woodlands and Goldfields region of south-west Western Australia. This subspecies has remained as a Priority 4 species and taxonomic changes will be reflected in the next update of the DPaW Threatened Fauna Notice (DPaW pers. comm. February 2014).

This species was potentially recorded at two sites within the project area, within woodland around the Nova camp and from Melaleuca thickets within Eucalypt woodlands at trap site 3. Due to the difficulty in determining the difference in call structure between the relatively common Lesser Long-eared Bat *Nyctophilus geoffroyi* and *N. major tor*, harp trapping would be required to accurately determine which of these species (or both) occur in the project area.

Provided clearing controls are implemented, development on the survey area is unlikely to impact on these species.

6.19 CRESTED BELLBIRD (SOUTHERN SSP) *OREOICA GUTTURALIS GUTTURALIS*

The southern subspecies of the Crested Bellbird *Oreoica gutturalis gutturalis* is listed by DPaW as Priority 4 – Taxa in need of monitoring (Table 17). It did not register on a DEC Threatened and Priority Fauna database search for the survey area.

The Nova project is located close to the overlap area between the conservation listed southern subspecies (*O. gutturalis gutturalis*) and the non-listed northern subspecies (*O. gutturalis pallescens*). Based upon distribution mapping, the records from the Nova survey area are likely to be that of the Priority 4 listed southern subspecies however confirmation of the identification can only be achieved through morphological measurements or DNA sequencing (from mist-netting birds).

Garnett and Crowley (2000) list the Crested Bellbird (southern ssp) as near threatened as it has disappeared from well in excess of 50% of its historical range – particularly along the periphery. Garnett *et al.* (2011), omitted Crested Bellbird (southern ssp) from the Action Plan for Australian Birds. Johnstone and Storr (2004) do not follow the separation of the report by Garnett and Crowley (2000).

In the south-west the Crested Bellbird inhabits wooded country. In the eastern interior the Crested Bellbird inhabits mainly mulga and *Acacia* scrubs, but can also be found in mallee scrubs and some *Eucalyptus* and *Casuarina* woodlands (Johnstone & Storr 2004). The survey area is situated on the northern edge of the subspecies reported distribution.

Proximal sightings of Crested Bellbird (subspecies undetermined) have been recorded with Birdlife Australia Atlas and Naturemap records from close to the survey area (Birdlife Australia 2013, DPaW 2013). Regional sightings include the WAM Widgiemooltha to Zanthus study sites, WAM Norseman-Balladonia study areas, Great Western Woodland atlas survey sites (Peak Charles), WAM Lake Johnston

study areas, Kambalda, Honman Ridge and Forrestania (Dell & How 1984; Hall & McKenzie 1993; Duncan *et al.* 2006; Western Wildlife 2006; Coffey Environments 2009; Rapallo Environmental 2009).

The Crested Bellbird was recorded on woodland and post fire regenerating habitats of the survey area. Provided clearing controls are implemented, development on the survey area is unlikely to impact on the Crested Bellbird.

6.20 BUSH STONE-CURLEW *BURHINUS GRALLARIUS*

The Bush Stone-curlew *Burhinus grallarius* is listed as by DPaW as Priority 4 – Taxa in Need of Monitoring (Table 17). The species did not register in the DPaW Threatened and Priority Fauna Database search.

The Bush Stone-Curlew prefers lightly wooded areas with an abundance of fallen logs and leaf litter. Once distributed in all but the most arid areas of Australia, the Bush Stone-curlew has suffered large range contractions and population declines. It is particularly vulnerable to fox predation, but has also suffered from land clearing and altered fire regimes (Johnstone and Storr, 1998). The survey area falls outside the current distribution of the species (Marchant & Higgins 1993; Barrett 2003). Rapallo did not record Bush Stone-curlew during the survey. However, the species is very cryptic and locally uncommon and may be easily overlooked. Traditional Owners reported recent sightings of this species in the vicinity of the project area.

Provided clearing and traffic management controls are implemented, development on the survey area is unlikely to impact on the Bush Stone-curlew.

6.21 RUFOUS FIELDWREN *CALAMANTHUS CAMPESTRIS MONTANELLUS*

The western wheatbelt subspecies of the Rufous Fieldwren *Calamanthus campestris montanellus* is listed by DPaW as Priority 4 – Taxa in need of monitoring (Table 17). It did not register in the DPaW Threatened and Priority Fauna database search completed as part of the desktop survey.

Garnett and Crowley (2000) list the western wheatbelt subspecies of the Rufous Fieldwren as near threatened because more than half of the habitat of this subspecies has been cleared for agriculture.

The Rufous Fieldwren prefer heaths and other low shrublands (up to 1.5 metres high) on sandplains and lateritic ridges as well as shrub steppe (*Maireana, Atriplex* and samphire - *Halosarcia*) on limestone plains and around salt lakes (Johnstone & Storr 2004). The species has disappeared from areas overgrazed by rabbits and sheep and have sporadic distributions around salt lakes that have retained intact chenopod flats. The Rufous Fieldwren is a ground nesting species making it vulnerable to feral animal predation.

Johnston and Storr (2004) do not recognize separate subspecies of the Rufous Fieldwren, and only refer to the full species. They report that inland from the coastal heaths around Esperance the species is uncommon. This is likely to be related to extensive habitat damage caused by overgrazing.

This species is uncommon throughout the region with sightings recorded at Kambalda, Peak Charles, WAM Widgiemooltha to Zanthus study sites and Forrestania (Hall & McKenzie 1993; Western Wildlife 2006; Coffey Environments 2009; Birdlife Australia 2013a).

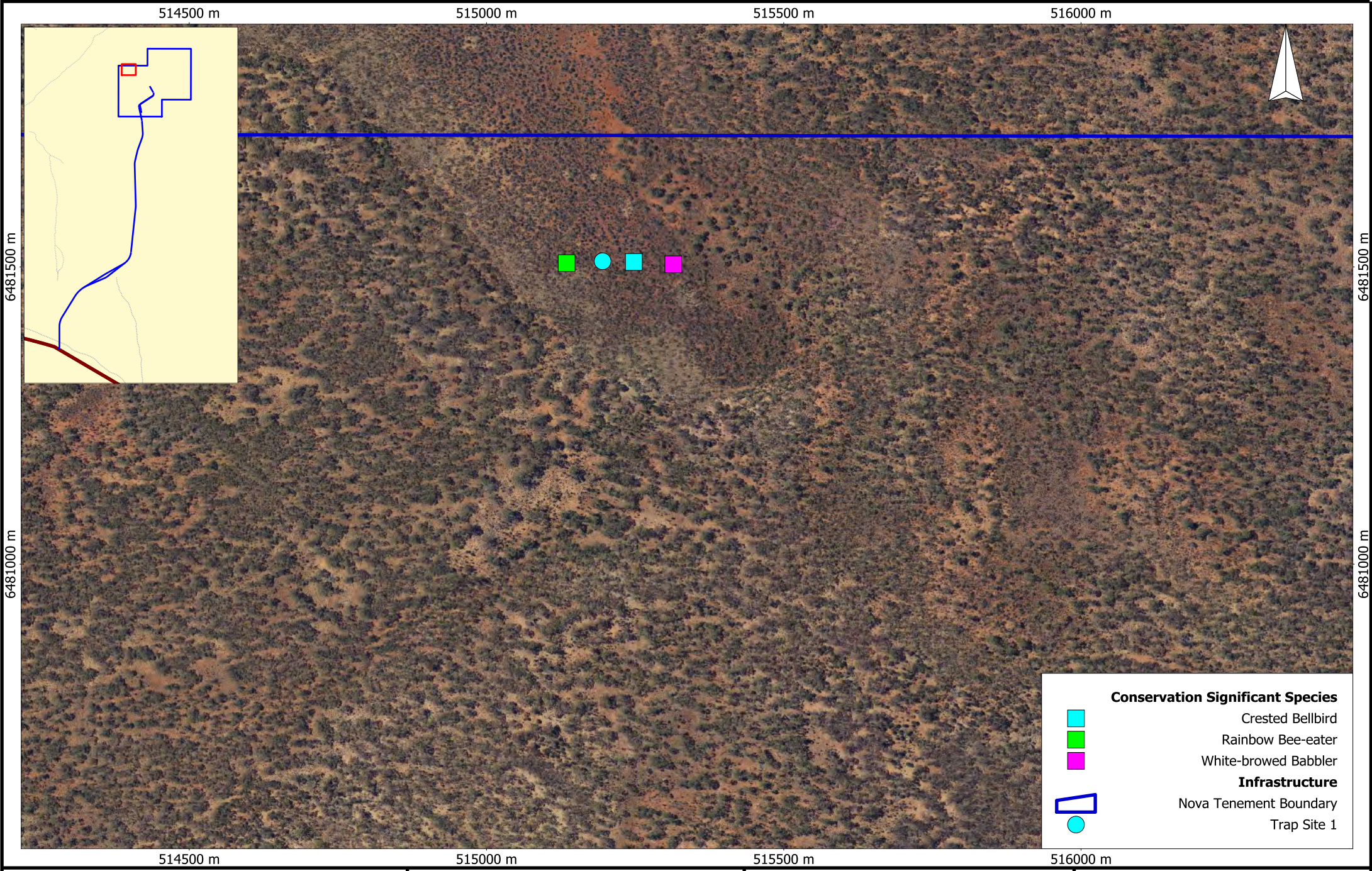
The Rufous Fieldwren was recorded within the post fire regenerating habitats of the survey area. It may be extant on the survey area due to the lack of sheep grazing that has affected most of its prior distribution.

Provided clearing and pest management controls are implemented, development in the survey area is unlikely to impact on the Rufous Fieldwren.

6.22 WOMA *ASPIDITES RAMSAYI*

In Western Australia the Woma is listed by DPaW as Schedule 4 – Other Specially Protected Fauna (Table 17).The Woma python is scarce and infrequently encountered across its entire range. Historically it had a very wide range across the sandier parts (mostly sand-deserts) of inland Australia. Its distribution reaches the coast in the westernmost part of the Great Sandy Desert and Port Hedland districts in Western Australia. In these remote desert areas populations of this species are still relatively secure, but in the south-west of Western Australia populations have declined dramatically because of land clearing for agricultural purposes (Cogger 2000).

Woma are predominately found in sandplain habitat. It is likely that *Triodia* habitats of the survey area are not extensive enough to support Woma. Development in the survey area will not impact on the Woma.



Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 8,000
Datum: MGA94 (51)
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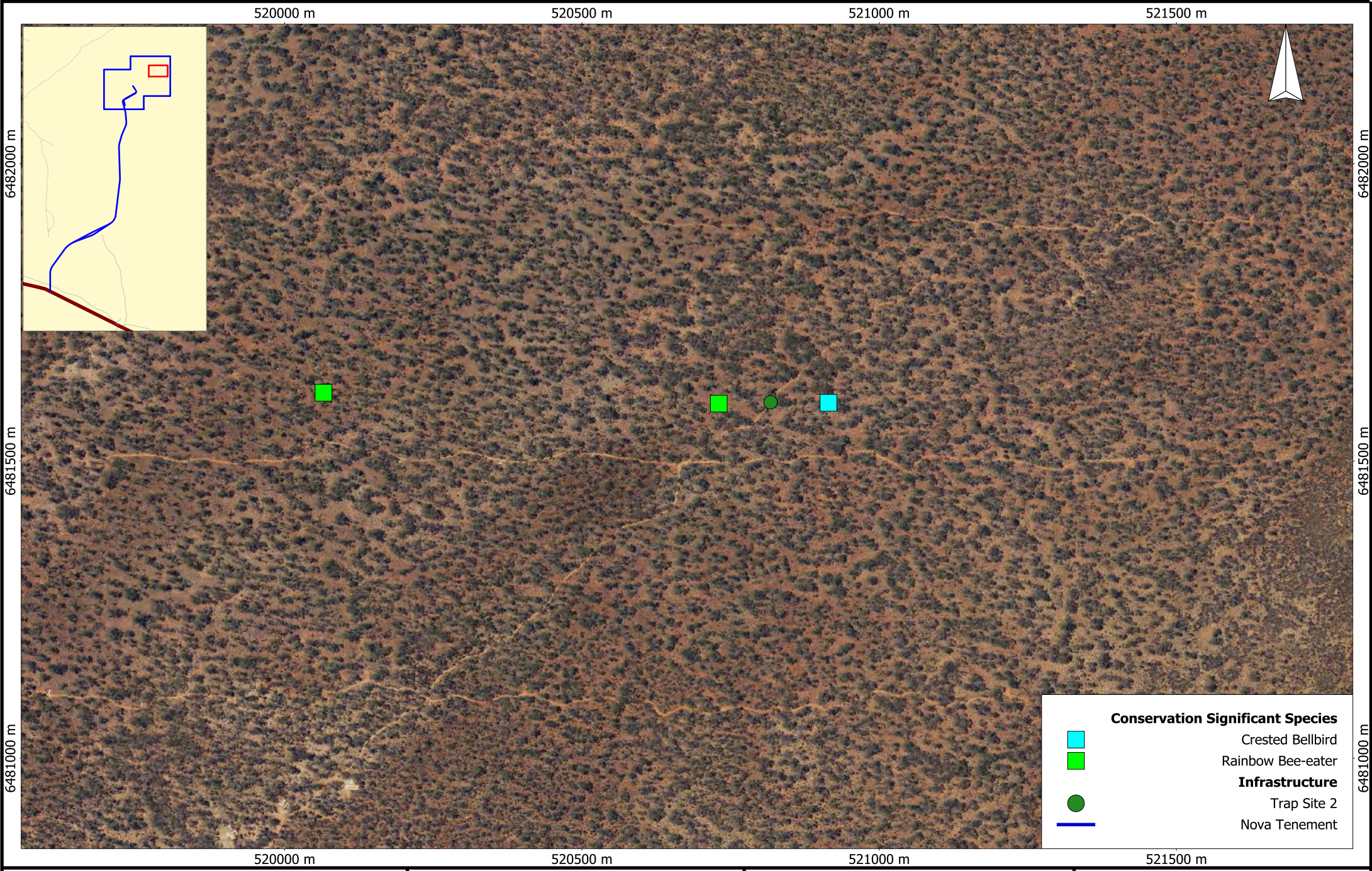
Trap Site 1
Conservation Significant Species

Figure 13



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Nova Project

Scale: 1 : 8,000
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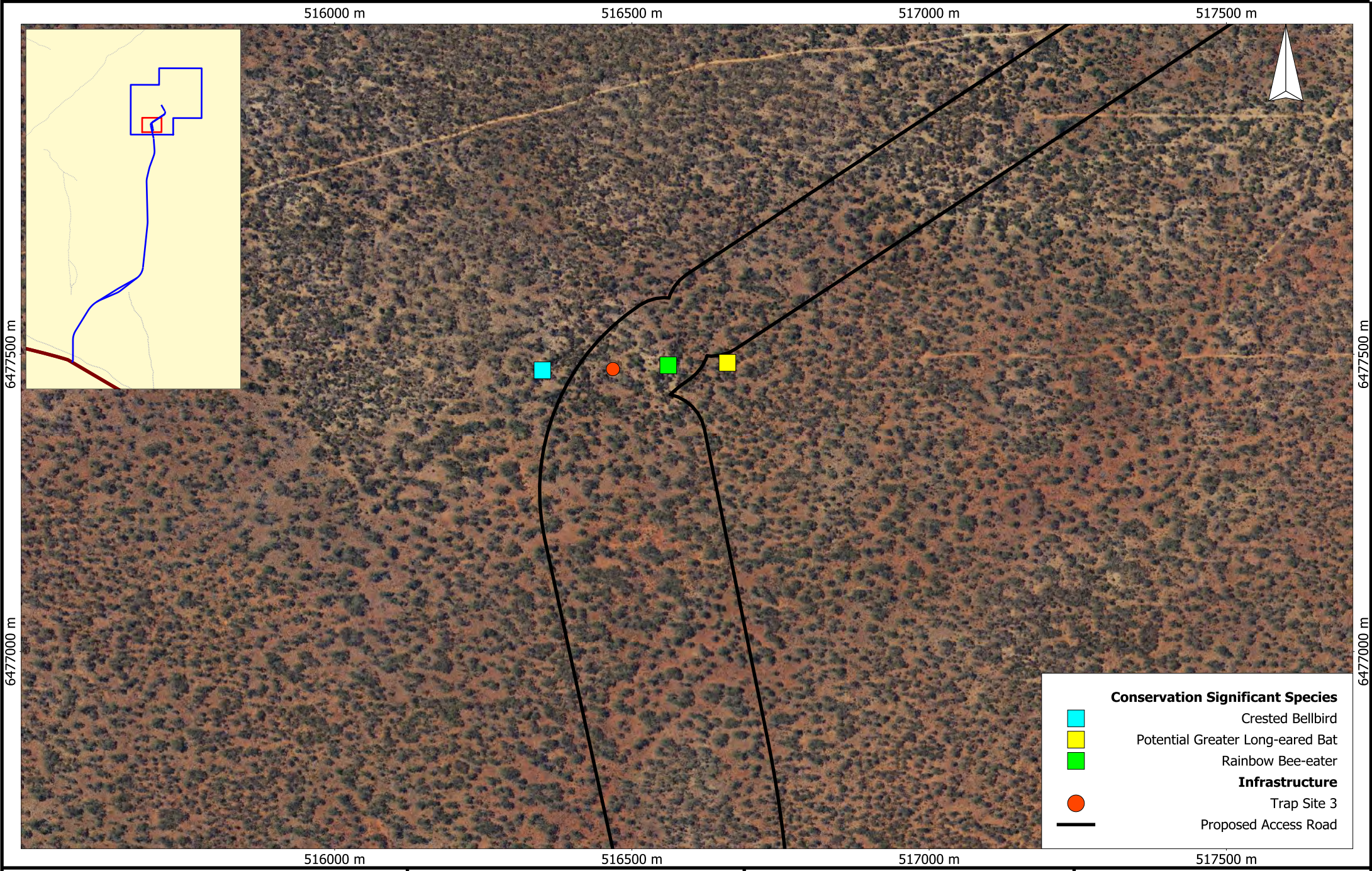
0 250 m

Trap Site 2
Conservation Significant Species

Figure 14



Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 8,000
Datum: MGA94 (51)
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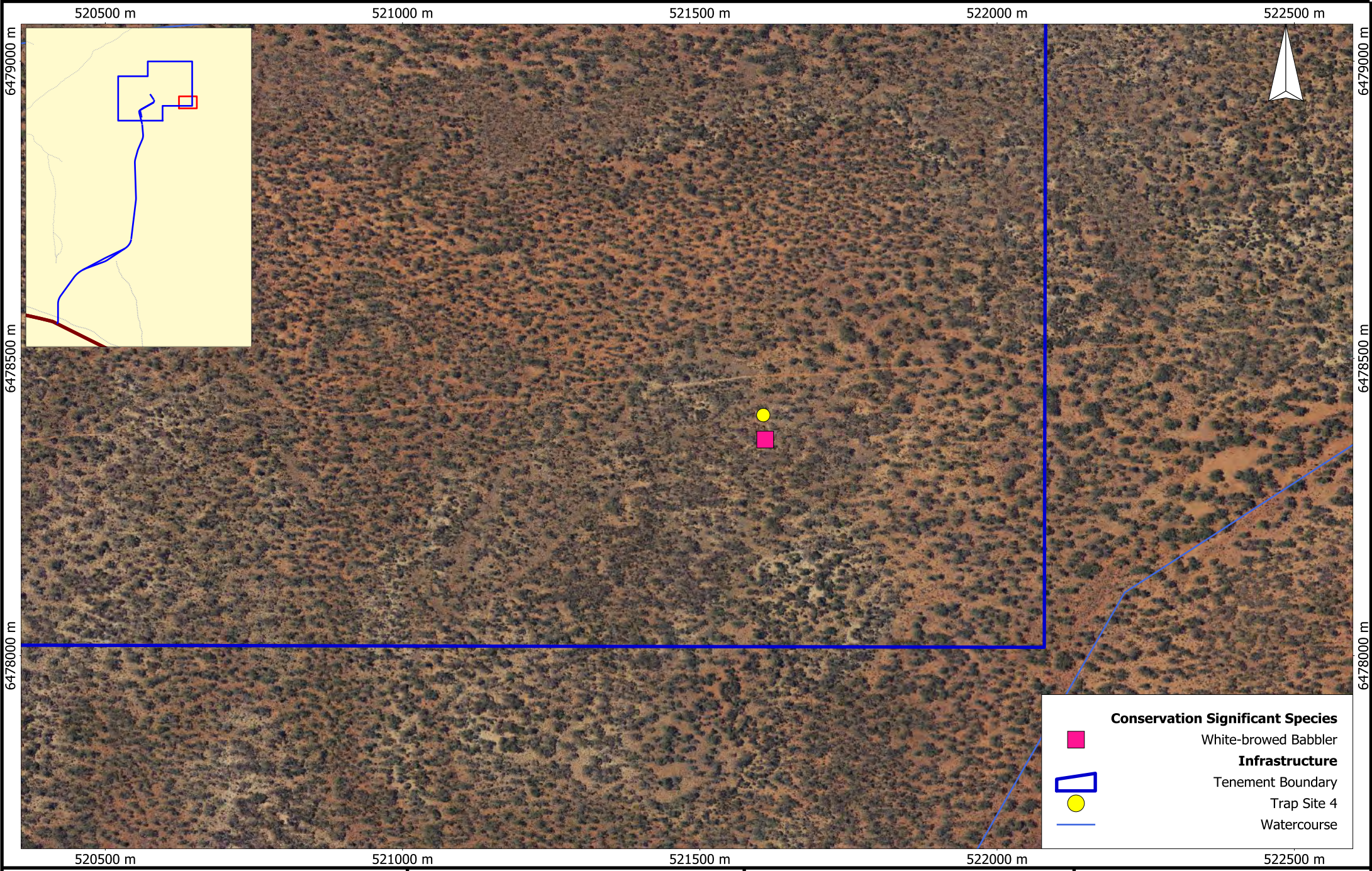
Trap Site 3
Conservation Significant Species

Figure 15



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Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 8,000
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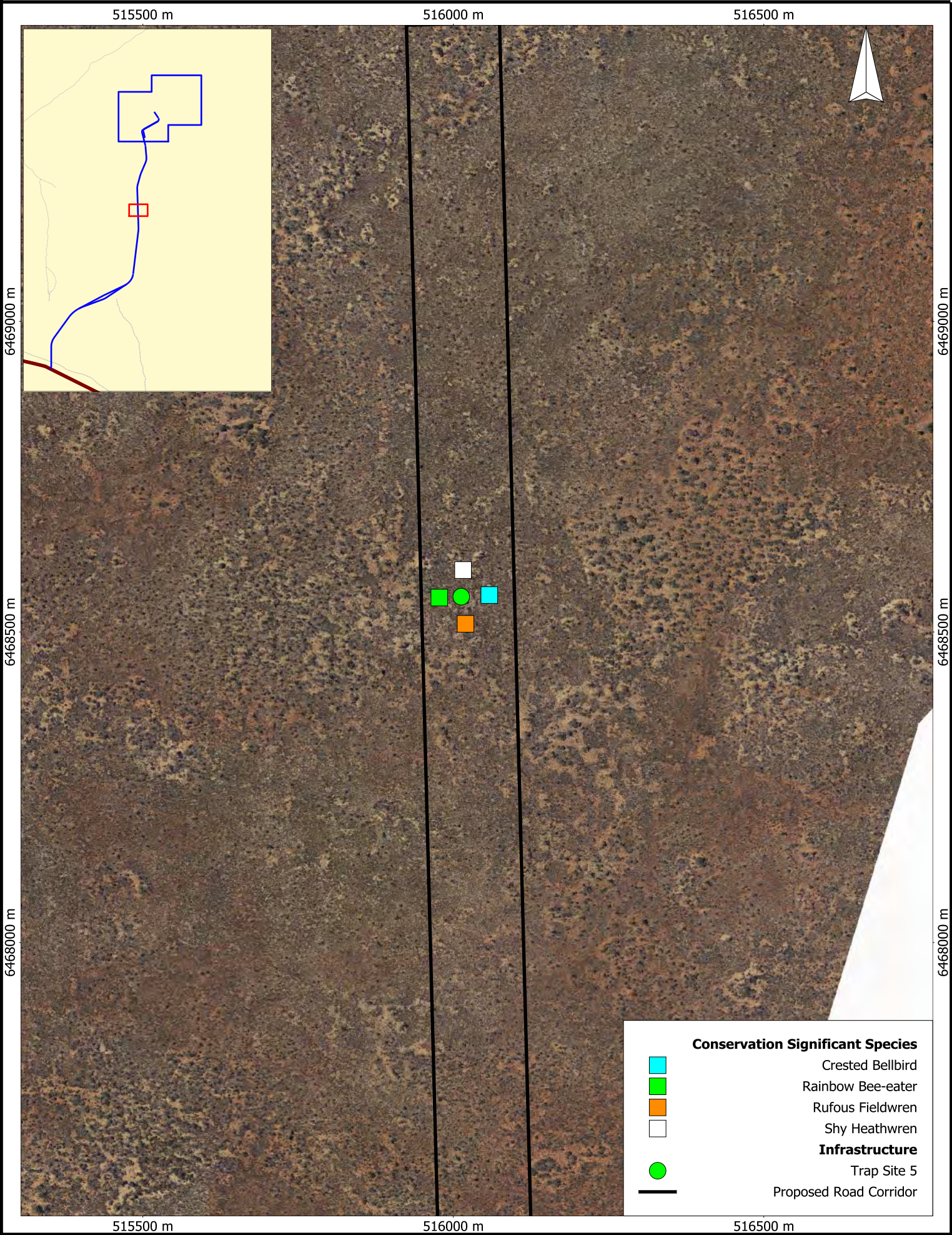
Trap Site 4
Conservation Significant Species

Figure 16



Rapallo environmental

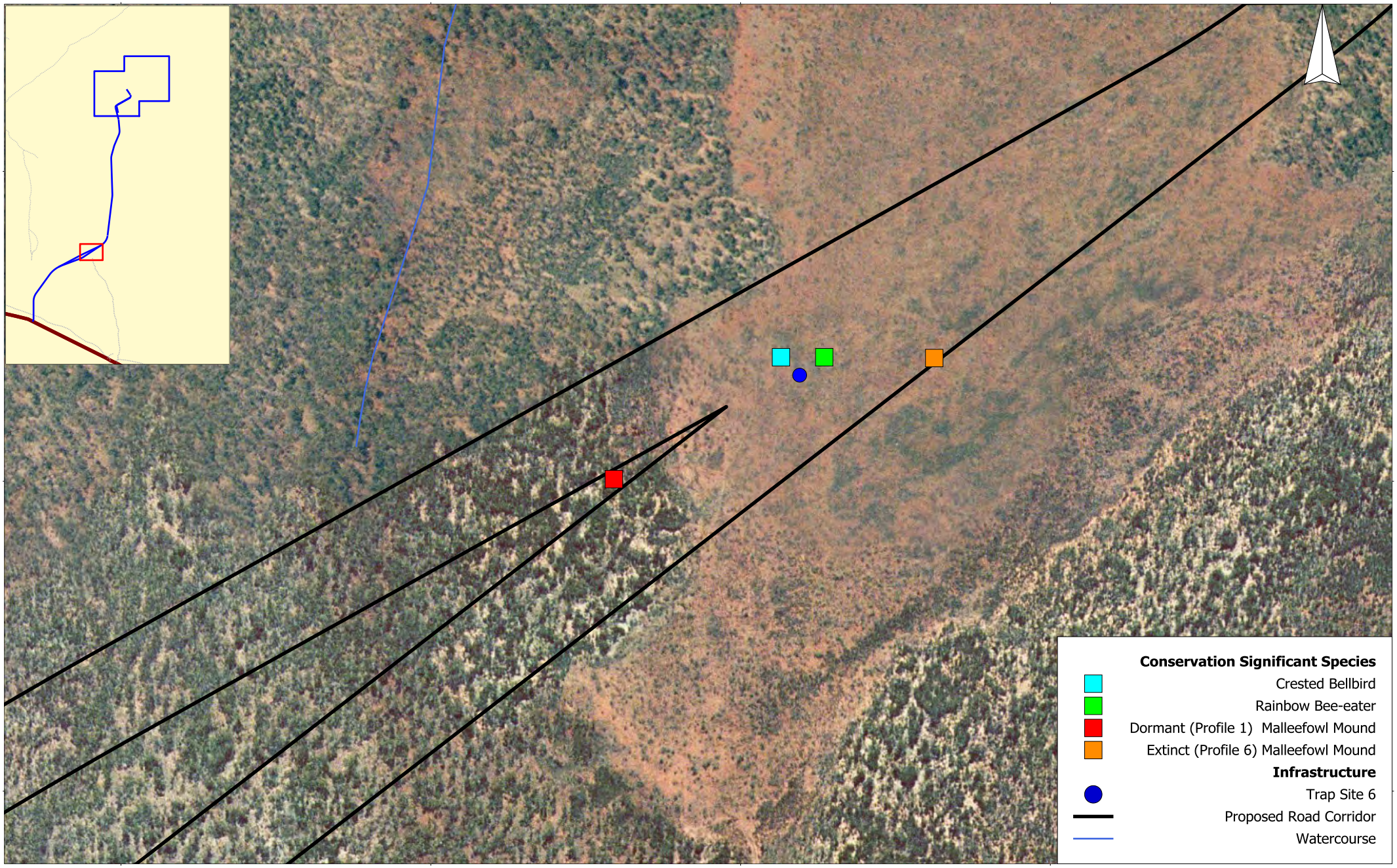
Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 8,000
Datum: MGA94 (51)

0 250 m

Trap Site 5 - Conservation Significant Species

Figure 17



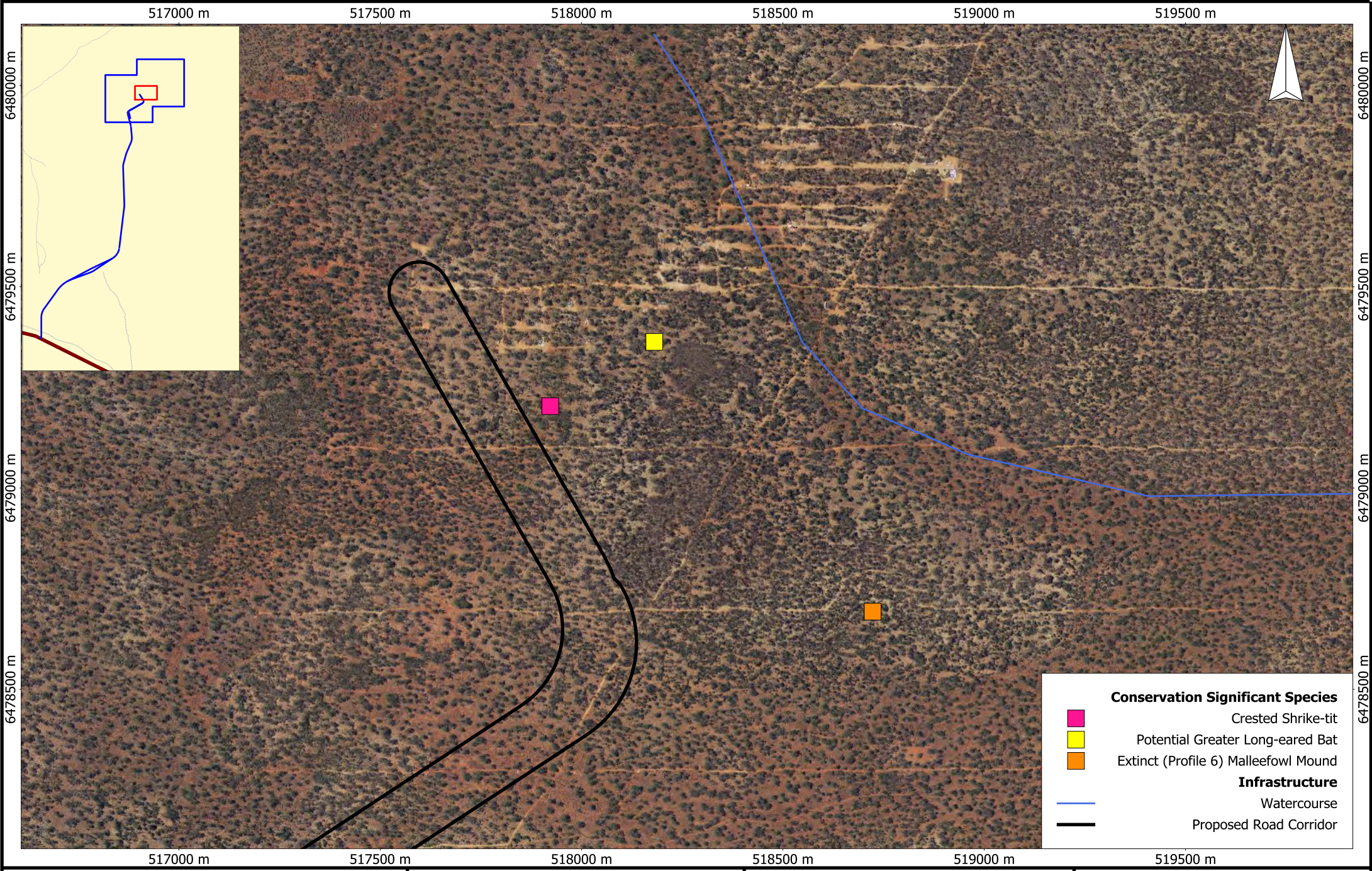
Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 8,000
Datum: MGA94 (51)
0 250 m

Trap Site 6
Conservation Significant Species

Figure 18



Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 10,000
Datum: MGA94 (51)
0 250 m

Exploration Camp Vicinity
Conservation Significant Species

Figure 19

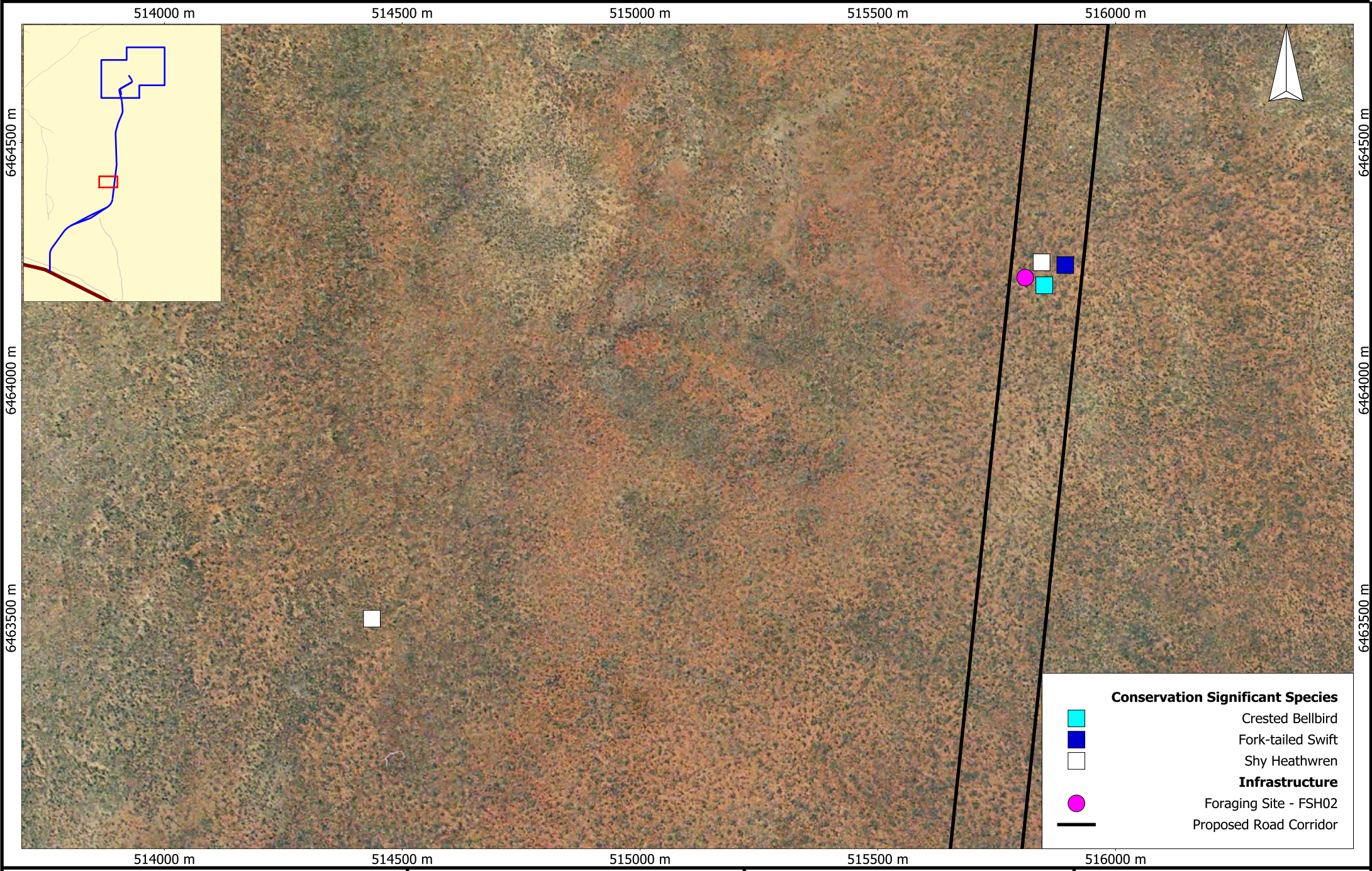
Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 8,000
Datum: MGA94 (51)
0 250 m

Foraging Site FSH01
Conservation Significant Species

Figure 20



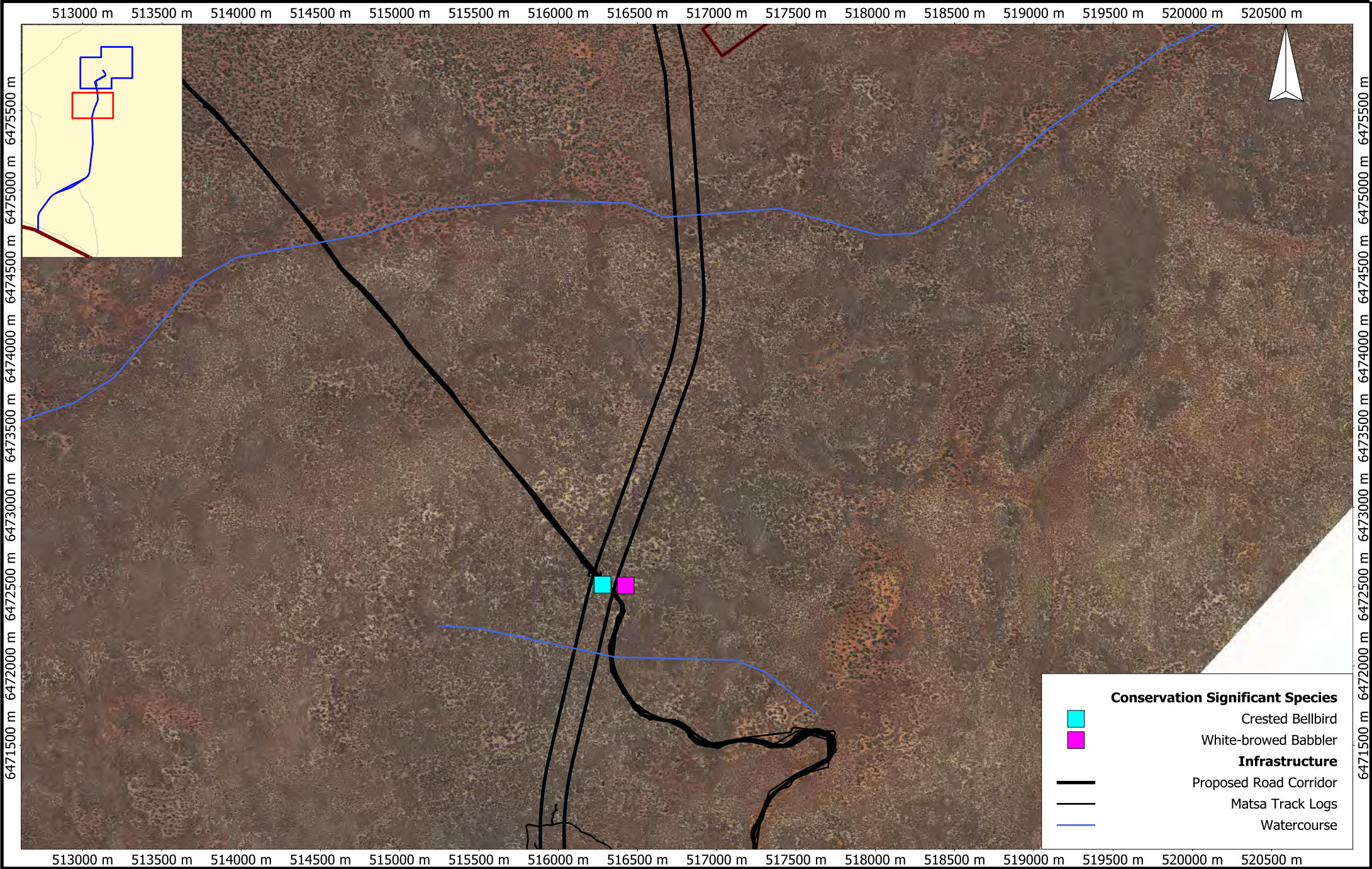
Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 10,000
Datum: MGA94 (51)
0 250 m

Foraging Site - FSH02
Conservation Significant Species

Figure 21



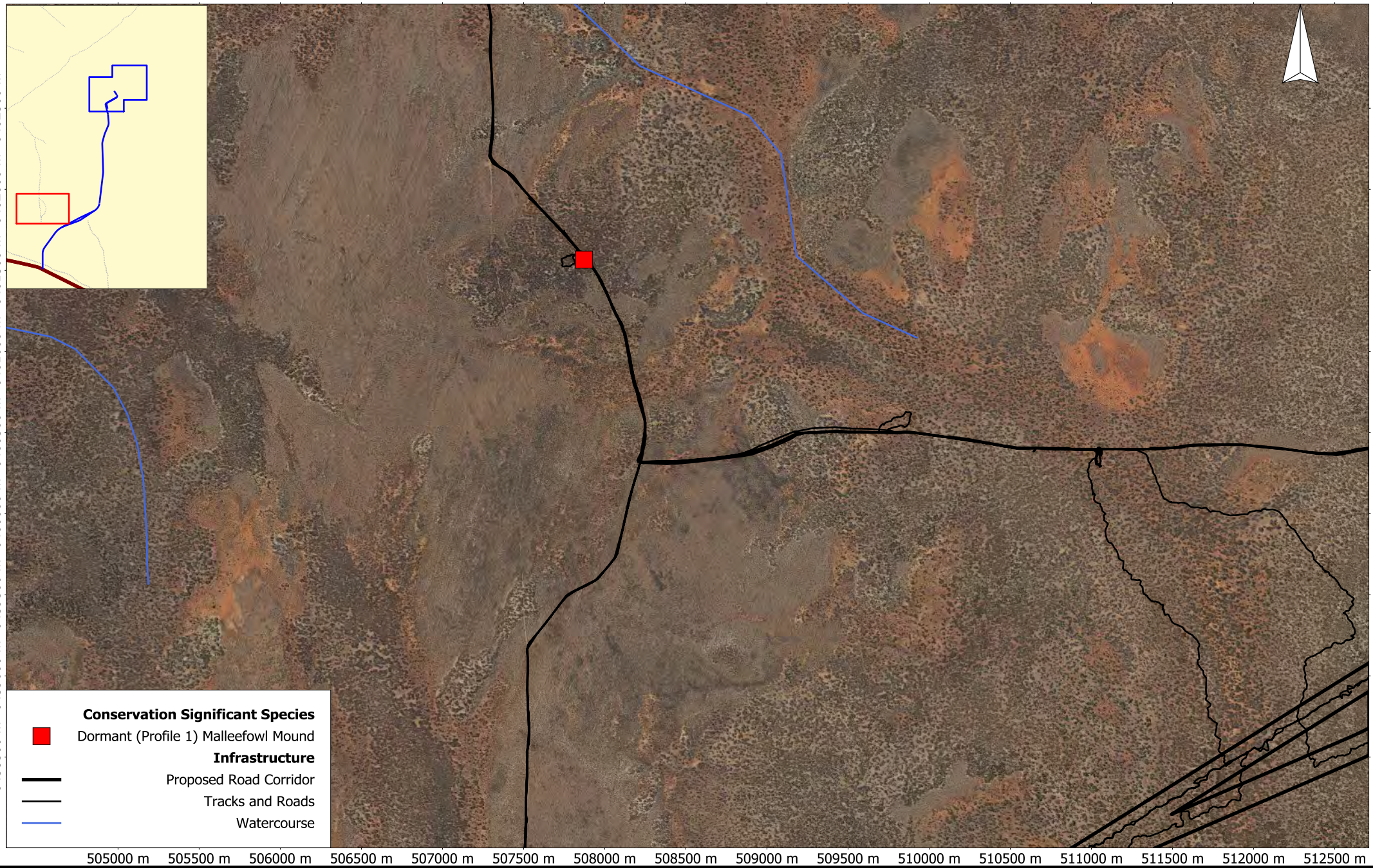
Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 30,000
Datum: MGA94 (51)
0 500 m

Matsa Track Junction
Conservation Significant Species

Figure 22



Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 30,000
Datum: MGA94 (51)
0 500 m

North-South Track
Cpnservation Significant Species

Figure 23

Table 17 Species of conservation significance with potential to occur in the project area

Scientific Name	Common Name	Conservation Status	Comments	Likelihood of Occurrence
Notoryctes typhlops	Southern Marsupial Mole	WC Act 1950 – Schedule 1: Fauna that is rare or likely to become extinct EPBC Act 1999 - Endangered	Inhabits the central sandy desert regions of Western Australia, northern South Australia (apart from records from the Fowlers Bay area near the SA coast) and the Northern Territory.	LOW: Incorrect habitat
Leipoa ocellata	Malleefowl	WC Act 1950 - Schedule 1: Rare or likely to become extinct EPBC Act 1999 - Vulnerable	This species was once widely distributed across southern Australia. It prefers woodland or shrubland with an abundant litter layer that provides essential material for the construction of its nest mound.	HIGH: Mounds observed from the survey area
Falco peregrinus	Peregrine Falcon	WC Act 1950 -Schedule 4: Other specially protected fauna	This species is uncommon and prefers areas with rocky ledges, cliffs, watercourses, open woodland or margins with cleared land.	MEDIUM: Infrequent visitor
Morelia spilota imbricata	South-West Carpet Python	WC Act 1950 -Schedule 4 Other specially protected fauna	This subspecies has been recorded from semi-arid coastal and inland habitats, Banksia woodland, eucalypt woodlands, and grasslands.	HIGH: Observed by Sirius staff within or close to survey area
Ardeotis australis	Australian Bustard	WC Act 1950 - Priority 4 Taxa in need of monitoring	Species widely distributed throughout Australia but has suffered massive range contractions in the southern portion of the country.	HIGH: Observed by Traditional Owners close to survey area
Falcunculus frontatus leucogaster	Crested Shrike-tit (south-western ssp)	WC Act 1950 - Priority 4 Taxa in need of monitoring	This species is an uncommon inhabitant of woodlands	HIGH: Observed from the survey area
Calamanthus (Hylacola) cauta whitlocki	Shy Heathwren (western ssp)	WC Act 1950 - Priority 4 Taxa in need of monitoring	This species is an uncommon resident in mallee undergrowth	HIGH: Observed from the survey area

Scientific Name	Common Name	Conservation Status	Comments	Likelihood of Occurrence
Platycercus icterotis xanthogenys	Western Rosella (inland ssp)	WC Act 1950 - Priority 4 Taxa in need of monitoring	This subspecies of the Western Rosella occurs in eucalypt and *Casuarina* woodlands and scrubs, especially of Salmon Gum and tall mallee.	HIGH: Suitable habitat present on survey area
Merops ornatus	Rainbow Bee-eater	EPBC Migratory Terrestrial Species	Migratory bird and will move north from the southern areas of Australia during winter	HIGH: Observed from the survey area
Calidris ruficollis	Red-necked Stint	EPBC Marine and Migratory (Bonn, CAMBA, JAMBA and ROKAMBA) WC ACT 1950 – Schedule 3 Migratory birds protected under international agreement	Breeds in north-eastern Siberia and northern and western Alaska. It follows the East Asian-Australasian Flyway to spend the southern summer months in Australia. It is found widely in Australia, except in the arid inland. Inhabits wetlands artificial and natural.	LOW: No wetlands on the survey area
Tringa nebularia	Common Greenshank	EPBC Marine and Migratory (Bonn, CAMBA, JAMBA and ROKAMBA) WC ACT 1950 – Schedule 3 Migratory birds protected under international agreement	Breeds in the Palaearctic regions and is widespread in Africa, Coastal Asia, the Indian subcontinent, the Philippines and southern New Guinea. Common throughout Australia in the summer. Inhabit both on the coast and inland, in estuaries and mudflats, mangrove swamps and lagoons, and in billabongs, swamps, sewage farms and flooded crops.	LOW: No wetlands on the survey area
Apus pacificus	Fork-tailed Swift	EPBC Marine and Migratory (CAMBA, JAMBA, ROKAMBA) WC ACT 1950 – Schedule 3 Migratory birds protected under an international agreement	Breeds in the north-east and mid-east Asia and winters in Australia and southern New Guinea. It is a visitor to most parts of Western Australia, arriving in the Kimberley in late September, in the Pilbara and Eucla by November and in the south-west land division by mid-December	HIGH: Observed from the survey area

Scientific Name	Common Name	Conservation Status	Comments	Likelihood of Occurrence
Ardea alba (Ardea modesta)	Great Egret	WC ACT 1950 – Schedule 3: Migratory birds protected under an international agreement EPBC Act 1999 - Marine and Migratory (CAMBA, JAMBA)	Inhabits terrestrial wetlands, estuarine, littoral habitats and grasslands. It prefers permanent water bodies on floodplains and the shallows of deep permanent lakes though it can be seen on any watered area including damp grasslands	LOW: no wetlands on the survey area
Ardea ibis	Cattle Egret	EPBC Marine and Migratory (CAMBA, JAMBA) WC ACT 1950 – Schedule 3: Migratory birds protected under an international agreement	Common in areas of medium to high rainfall. The Cattle Egret utilises grasslands, woodlands and wetlands, and is not common in arid areas	LOW: incorrect habitat
Not listed in the database search results for the survey area but possible occurrence				
Dasyurus geoffroii	Chuditch	WC Act 1950 - Schedule 1: Fauna that is rare or likely to become extinct. EPBC Act 1999 – Vulnerable	This carnivorous marsupial occupies large home ranges, is highly mobile and appears able to utilise bush remnants and corridors	LOW: No signs detected – likely to be outside range
Paroplocephalus atriceps	Lake Cronin Snake	WC Act 1950 - Priority 3: Taxa with several, poorly known populations, some on conservation lands	Poorly understood species known from just a few specimens from a very small area.	MEDIUM: Cryptic species
Pomatostomus superciliosus ashbyi	White-browed Babbler (western wheatbelt ssp)	WC Act 1950 - Priority 4 Taxa in need of monitoring	This species of bird lives in eucalypt forests and woodlands, and forages on or near the ground for insects and seeds.	HIGH: Observed from the survey area
Nyctophilus major tor	Greater Long-eared Bat (Central Form)	WC Act 1950 - Priority 4: Taxa in need of monitoring	Occurs in the south-west of Western Australia, in tall forest, in the goldfields of West Australia it is found in arid and open woodlands.	HIGH: Calls which may belong to this species were recorded in the project area.

Scientific Name	Common Name	Conservation Status	Comments	Likelihood of Occurrence
Oreoica gutturalis gutturalis	Crested Bellbird (Southern)	WC Act 1950 - Priority 4: Taxa in need of monitoring	This species is common in semi-arid woodlands and mallee but has experienced localised extinctions and at the fringe of its range.	HIGH: Observed from the survey area
Burhinus grallarius	Bush Stone-curlew	WC Act 1950 - Priority 4: Taxa in need of monitoring	Species widely distributed throughout Australia but has suffered massive range contractions in the southern portion of the country.	HIGH: Observed by Traditional Owners close to survey area
Calamanthus campestris montanellus	Rufous Fieldwren	WC Act 1950 - Priority 4: Taxa in need of monitoring	The species has suffered extensive declines inland away from coastal heaths where its primary habitat, chenopod flats, has been degraded by cattle and feral animals	HIGH: Observed from the survey area
Aspidites ramsayi	Woma	WC Act 1950 -Schedule 4: Other specially protected fauna	In the south-west of Western Australia populations have declined dramatically because of land clearing for agricultural purposes.	LOW: Incorrect Habitat

7 DISCUSSION

7.1 REPTILES

Many of the species recorded from the survey area were near the limits of their range. Species at the most easterly inland extremes of their distribution were *Strophurus assimilis, Hesperoedura reticulata, Hemiergis initialis, Parasuta gouldii and Ramphotyphlops australis.* At their most southerly extremes were *Morethia butleri, Ctenotus pantherinus* and *Strophurus elderi. Ctenotus atlas, Delma butleri* and *Stropherus elderi* represent an arid element of the fauna which extend southward over *Triodia* dominated habitats into the survey area. Dell and How (1984) reported this trend at the Woodline and Buningonia Springs survey sites. *Diplodactylus calciolus* and *Ctenotus chapmani* are at the northern edge of their distribution.

Other arid species recorded in close proximity to the survey area are *Ctenophorus reticulatus, Diporiphora reginae, Ctenophorus scutulatus, Ctenotus leonhardii, Liopholis inornata, Neelaps bimaculatas* (Dell and How 1984).

Reptiles of conservation significance are discussed in Section 6.

7.2 BIRDS

Species typical of the Great Western Woodland dominated the survey area. Characteristic species included Western Yellow Robin, Golden Whistler, Blue-breasted Fairy-wren, Shy Heathwren, Purple – crowned Lorikeet, White-eared Honeyeater, Brown-headed Honeyeater, Red Wattlebird, Gilbert's Whistler and Dusky Woodswallow. Arid species extending into the survey area included Scarlet-chested Parrot, Slaty-backed Thornbill, Black Honeyeater, Crimson Chat and Princess Parrot (a species recorded on site by Sirius staff).

Woodland species dominated the woodland habitats of the survey area. Interesting patterns were observed within the regenerating woodland habitats of the survey area.

The bird assemblages of the regenerating woodland habitats were found to be a subset of the long unburnt woodland habitats of the survey area. Species such as Striated Pardalote, Yellow-plumed Honeyeater, Brown-Headed Honeyeater and Red Wattlebird were common across both habitat types. Heathland species such as Shy Heathwren and Rufous Fieldwren were observed within the thick regenerating woodland habitats and absent from the long unburnt habitats. The denser habitats with good mid-level understorey were also good for White-eared Honeyeater, Crested Bellbird and Chestnut Quail-thrush, while the dead stag trees provided perches for species such as White-winged Triller and Crimson Chat.

Species that were expected but not recorded included Splendid Fairy-wren, Nankeen Kestrel, Little Eagle and Australian Hobby. The absence of Southern Scrub-robin was surprising as it was expected to occur in the thick regenerating woodland habitats together with Shy Heathwren and Rufous Fieldwren. Southern Scrub-robin was not recorded on the in Birdlife Atlas data in the area or by Dell and How (1984), suggesting that post fire regeneration habitats did not have a thick enough shrub layer. Southern Scrub-robin were recorded in high abundance in the thick melaleuca thickets at Exclamation Lake in 2008 (Rapallo 2008) and also recorded in the Dundas study area by Hall and Mckenzie (1993).

The Priority 4 species Western Rosella has potential to occur in the survey area based on distribution, regional records, and habitat requirements. This species is discussed further in section 6.8.

Despite being recorded regionally, water birds and waders were not present in the project area, as there were no wetlands either on the project area, or nearby.

The survey recorded significant range extensions for Scarlet Chested Parrot, White-cheeked Honeyeater and Bush-stone curlew (reported by Traditional Owners). The record of Princess Parrot (reported from the project area by Sirius staff) is also a significant range extinction.

Birds of conservation significance are discussed in section 6.

7.3 MAMMALS

The mammal assemblages recorded from the survey area reflected the woodland habits of the region.

Southern species typical of the Great Western Woodlands included the Western Pygmy-possum *Cercartetus concinnus*, Little Long –tailed Dunnart *Sminthopsis dolichura*, and Southern *Ningaui yvonn*ae. Interestingly the wide-ranging Fat-tailed Dunnart *Sminthopsis crassicaudata* was not recorded on the survey area possibly due to the relatively recent time since fire. Little Long –tailed Dunnart becomes abundant after fire and may temporarily displace other dunnarts (Van Dyck & Strahan 2008). Gilbert's Dunnart *Sminthopsis gilbert* was not recorded in the survey area and Dyke and Strahan (2008) report that there are no records of the species from the south-west interzone. Gilbert's Dunnart was recorded from Exclamation Lake to the south-west of the survey area (Rapallo 2009). Gilbert's Dunnart is allopatric with Little Long-tailed Dunnart along the 32 °S latitude which explains its absence from the survey.

Dell and How (1984) recorded Little Long –tailed Dunnart and Fat-tailed Dunnart from the Woodline and Buningonia Springs survey sites to the north. Interestingly Dell and How (1984) recorded both Southern Ningaui and Ride's Ningaui *Ningaui ridei* from Buningonia Springs therefore the survey area could potentially occur in the cross over zone for the two species, however Buningonia Springs does occur in an area of arid zone change-over and Ride's Ningaui would more likely be present in *Triodia basedowi* of that region rather than *Triodia scariosa* of the survey area (Magnus Peterson *pers. com*).

There were no records of Chuditch from the survey. This is addressed further in Section 6.15.

The Sandy Inland Mouse *Pseudomys hermansburgensis* is an arid species at the most southern edge of its distribution. Dell and How (1984) recorded the Sandy Inland Mouse from the Buningonia Springs survey sites to the north. The distribution of Bolam's mouse *Pseudomys bolami*, a southern species, overlaps with the Sandy Inland Mouse across part of its range. Bolam's Mouse was therefore expected to be recorded on the survey, but was not. Similarly, Dell and How (1984) did not record Sandy Inland Mouse at Woodline and Buningonia Springs survey sites to the north.

Six species of introduced fauna, including Feral Cat, Dingo/Feral Dog, European Rabbit, Dromedary Camel, Cattle, and House Mouse were recorded throughout the survey area.

7.4 SHORT RANGE ENDEMICS

None of the scorpions collected during the survey were found to be SRE. Of the Mygalomorph spiders collected, two species of SRE were identified. These were *Aganippe* sp. indet, collected from trap site 1 (Acacia Shrubland habitat) in the MLA, and *Aname* sp. indet collected from trap site 3 (Melaleuca Woodland habitat) in the MLA.

Additional spider surveys were undertaken in February 2014. These results, as well as taxonomic identifications of the pseudoscorpions and snails, will be presented in a separate report.

7.5 FOLLOW-UP FAUNA SURVEYS IN THE PROJECT AREA

Following the Level 2 Fauna survey described in this report, Rapallo completed additional surveys in the Nova project area in January and February 2014. These included:

- Targeted Malleefowl Survey of the road corridor in two phases.
- Additional fauna trapping at trap sites 2, 3, 4 and 5, as well as additional bird surveys.
- Surveys for spider burrows in selected areas of the MLA and road corridor.

The results of these surveys, as well as identifications of SRE that were completed after this report was finalised, will be presented in separate reports and memos, including Rapallo (2014) *Targeted Malleefowl Survey of the Nova Project Area*.

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Appendix I Regional Species Comparisons

Rapallo Group

Regional Comparison - Birds

Scientific Name	Common Name	NT	NAR	DPaW	EPBC	ASNN	ASD	Great Western Woodland Atlas			NM	Ex	K	F	MH & EA	HR	BSoEG- (Hyden to Lake Johnston)				BSoEG-N (Norseman to Balladonia)					BSoEG-W (Widgiemootha to Zanthus	
								FH	LK/N	PC							LC	MR	FH	PC	1	2	3	4	5	BS	W
Casuariidae																											
Dromaius novaehollandiae	Emu	▼	▼			▼	▼		▼		▼	▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Megapodiidae																											
Leipoa ocellata VU - WC Act and EPBC	Malleefowl		▼ mounds	▼	▼							▼ very old inactive mounds		▼		▼	▼	▼		▼	▼			▼ old mound			
Phasianidae																											
Coturnix pectoralis	Stubble Quail	▼																									
Anatidae																											
Anas castanea	Chestnut Teal																										
Anas gracilis	Grey Teal					▼	▼				▼						▼										
Anas superciliosa	Pacific Black Duck					▼	▼										▼				▼						
Biziura lobata	Musk Duck																										
Chenonetta jubata	Australian Wood Duck					▼	▼				▼						▼										
Cygnus atratus	Black Swan					▼	▼				▼						▼										
Malacorhynchus membranaceus	Pink-eared Duck																▼										
Oxyura australis	Blue-billed Duck																										
Tadorna tadornoides	Australian Shelduck					▼	▼					▼			▼	▼	▼										
Podicipedidae																											
Poliocephalus poliocephalus	Hoary-headed Grebe					▼					▼						▼										
Tachybaptus novaehollandiae	Australasian Grebe					▼					▼						▼										
Columbidae																											
Ocyphaps lophotes	Crested Pigeon					▼	▼	▼			▼	▼	▼		▼				▼								
Phaps chalcoptera	Common Bronzewing					▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼				▼
Phaps elegans	Brush Bronzewing							▼		▼				▼					▼	▼							
Podargidae																											
Podargus strigoides	Tawny Frogmouth					▼				▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼	▼		▼		▼	▼
Eurostopodidae																											
Eurostopodus argus	Spotted Nightjar											▼		▼	▼		▼		▼		▼	▼		▼		▼	▼
Aegothelidae																											
Aegotheles cristatus	Australian Owlet-nightjar					▼	▼	▼		▼	▼	▼		▼	▼	▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼
Apodidae																											
Apus pacificus IA	Fork-tailed Swift	▼	▼		▼																						
Ardeidae																											
Ardea modesta IA	Great Egret, White Egret, Eastern Great Egret		▼																								
Ardea ibis IA	Cattle Egret		▼																								
Ardea pacifica	White-necked Heron					▼					▼						▼										
Egretta novaehollandiae	White-faced Heron					▼											▼										
Accipitridae																											
Accipiter cirrocephalus	Collared Sparrowhawk					▼					▼			▼	▼	▼	▼	▼		▼							▼
Accipiter fasciatus	Brown Goshawk	▼	▼								▼	▼	▼					▼					▼				
Aquila audax	Wedge-tailed Eagle					▼	▼				▼	▼		▼	▼	▼				▼	▼		▼			▼	▼
Circus assimilis	Spotted Harrier					▼					▼																
Elanus axillaris	Black-shouldered Kite																										
Haliastur sphenurus	Whistling Kite					▼	▼				▼		▼														
Hieraaetus morphnoides	Little Eagle						▼					▼		▼		▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼
Lophoictinia isura	Square-tailed Kite	▼				▼	▼					▼		▼		▼	▼	▼	▼	▼	▼	▼	▼				▼
Falconidae																											
Falco longipennis	Australian Hobby					▼	▼				▼				▼	▼	▼			▼	▼						
Falco cenchroides	Nankeen Kestrel					▼	▼	▼			▼			▼	▼		▼		▼	▼	▼	▼	▼			▼	▼
Falco peregrinus S4	Peregrine Falcon			▼		▼					▼	▼		▼		▼				▼							

Scientific Name	Common Name	NT	NAR	DPaW	EPBC	ASNN	ASD	Great Western Woodland Atlas			NM	Ex	K	F	MH & EA	HR	BSoEG- (Hyden to Lake Johnston)				BSoEG-N (Norseman to Balladonia)					BSoEG-W (Widgiemootha to Zanthus	
								FH	LK/N	PC							LC	MR	FH	PC	1	2	3	4	5	BS	W
Falco berigora	Brown Falcon		▼			▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼						▼
Rallidae																											
Fulica atra	Eurasian Coot					▼					▼						▼										
Otididae																											
Ardeotis australis [P4]	Australian Bustard			▼		▼											▼		▼			▼	▼				
Recurvirostridae																											
Himantopus himantopus	Black-winged Stilt					▼											▼										
Recurvirostra novaehollandiae	Red-necked Avocet										▼																
Charadriidae																											
Charadrius ruficapillus	Red-capped Plover					▼					▼				▼		▼										
Thinornis rubricollis [P4]	Hooded Plover					▼						▼			▼												
Vanellus tricolor	Banded Lapwing					▼					▼										▼			▼		▼	
Scolopacidae																											
Calidris acuminata	Sharp-tailed Sandpiper														▼		▼										
Calidris ferruginea	Curlew Sandpiper																										
Calidris ruficollis [IA]	Red-necked Stint			▼	▼						▼				▼												
Tringa nebularia [IA]	Common Greenshank			▼	▼	▼					▼																
Turnicidae																											
Turnix velox	Little Button-quail		▼																								▼
Turnix varius	Painted Button-quail											▼		▼													
Cacatuidae																											
Calyptorhynchus latirostris [EN]	Carnaby's Black-Cockatoo													▼			▼										
Eolophus roseicapilla	Galah					▼	▼	▼		▼		▼		▼			▼									▼	
Psittacidae																											
Barnardius zonarius	Australian Ringneck	▼	▼			▼		▼		▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Glossopsitta porphyrocephala	Purple-crowned Lorikeet	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼		▼	▼	▼	▼
Melopsittacus undulatus	Budgerigar					▼					▼																
Neophema elegans	Elegant Parrot													▼			▼		▼								
Neophema splendida	Scarlet-chested Parrot	▼	▼																								
Platycercus icterotis [P4]	Western Rosella			▼			▼			▼				▼	▼		▼		▼	▼	▼			▼			▼
Polytelis anthopeplus	Regent Parrot	▼	▼				▼					▼		▼	▼	▼	▼		▼	▼	▼						▼
Psephotus varius	Mulga Parrot					▼	▼											▼	▼		▼	▼	▼	▼		▼	
Purpureiccephalus spurius	Red-capped Parrot							▼																			
Cuculidae																											
Cacomantis flabelliformis	Fan-tailed Cuckoo					▼	▼	▼		▼	▼	▼					▼	▼	▼	▼							
Cacomantis pallidus	Pallid Cuckoo	▼	▼			▼	▼			▼	▼	▼		▼	▼		▼		▼	▼	▼	▼				▼	▼
Chalcites basalis	Horsfield's Bronze-Cuckoo	▼	▼			▼				▼		▼				▼	▼		▼	▼		▼	▼			▼	▼
Chalcites lucidus	Shining Bronze-Cuckoo					▼				▼				▼													
Chalcites osculans	Black-eared Cuckoo	▼	▼			▼		▼				▼							▼	▼		▼	▼				▼
Strigidae																											
Ninox novaeseelandiae	Southern Boobook					▼	▼			▼	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼
Halcyonidae																											
Todiramphus pyrrhopygius	Red-backed Kingfisher					▼					▼		▼		▼						▼	▼					
Todiramphus sanctus	Sacred Kingfisher					▼	▼				▼	▼			▼	▼					▼	▼	▼				
Meropidae																											
Merops ornatus [IA]	Rainbow Bee-eater	▼	▼	▼	▼	▼				▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼
Climacteridae																											
Climacteris affinis	White-browed Treecreeper																									▼	
Climacteris rufa	Rufous Treecreeper	▼	▼			▼	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼		▼		▼	▼			▼
Maluridae																											
Malurus elegans	Red-winged Fairy-Wren																									▼	

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								FH	LK/N	PC							LC	MR	FH	PC	1	2	3	4	5	BS	W
Malurus leucopterus	White-winged Fairy-wren						▼						▼			▼											
Malurus pulcherrimus	Blue-breasted Fairy-wren					▼	▼	▼		▼	▼	▼	▼	▼			▼	▼		▼	▼	▼	▼		▼		▼
Malurus splendens	Splendid Fairy-wren																										
Stipiturus malachurus westernensis	Southern Emu-wren													▼													
Acanthizidae																											
Acanthiza apicalis	Inland Thornhill	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼	▼	▼	▼
Acanthiza chrysorrhoa	Yellow-rumped Thornbill					▼	▼	▼	▼		▼	▼	▼	▼		▼	▼	▼	▼	▼	▼					▼	
Acanthiza iredalei iredalei	Slender-Billed Thornbill (western)				▼	▼					▼																
Acanthiza uropygialis	Chestnut-rumped Thornbill	▼	▼			▼	▼				▼	▼	▼	▼		▼	▼	▼	▼							▼	▼
Aphelocephala leucopsis	Southern Whiteface																			▼						▼	
Calamanthus campestris [P4]	Rufous Fieldwren		▼							▼			▼	▼								▼					
Calamanthus fuliginosus	Striated Fieldwren																▼	▼	▼							▼	
Gerygone fusca	Western Gerygone						▼			▼		▼		▼	▼		▼				▼	▼	▼	▼			
Hylacola cauta whitlocki [P4]	Shy Heathwren (western ssp)[P4]			▼		▼	▼	▼	▼			▼		▼		▼	▼			▼	▼	▼					
Pyrrholaemus brunneus	Redthroat	▼	▼			▼	▼				▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼			▼	▼
Sericornis frontalis	White-browed Scrubwren						▼			▼							▼			▼							
Smicrornis brevirostris	Weebill					▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Pardalotidae																											
Pardalotus punctatus	Spotted Pardalote						▼	▼	▼	▼		▼		▼			▼	▼	▼		▼				▼		
Pardalotus striatus	Striated Pardalote	▼	▼				▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Meliphagidae																											
Acanthagenys rufogularis	Spiny-cheeked Honeyeater					▼	▼	▼			▼	▼		▼	▼	▼		▼		▼	▼	▼	▼	▼		▼	▼
Acanthorhynchus superciliosus	Western Spinebill																								▼		
Anthochaera carunculata	Red Wattlebird	▼	▼			▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Certhionyx variegatus	Pied Honeyeater																										
Certhionyx niger	Black Honeyeater		▼					▼																			
Ephthianura albifrons	White-fronted Chat					▼	▼				▼						▼	▼			▼		▼			▼	▼
Ephthianura tricolor	Crimson Chat		▼			▼					▼				▼							▼					
Lichenostomus ornatus	Yellow-plumed Honeyeater	▼	▼			▼	▼			▼		▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lichenostomus cratitius	Purple-gaped Honeyeater									▼		▼		▼	▼	▼	▼	▼	▼	▼					▼		
Lichenostomus leucotis	White-eared Honeyeater		▼			▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lichenostomus plumulus	Grey-fronted Honeyeater													▼													
Lichenostomus virescens	Singing Honeyeater	▼	▼			▼	▼	▼					▼	▼		▼		▼	▼	▼				▼	▼	▼	▼
Lichmera indistincta	Brown Honeyeater					▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼				▼
Manorina flavigula	Yellow-throated Miner	▼	▼			▼	▼				▼	▼	▼	▼		▼	▼	▼	▼	▼	▼	▼				▼	▼
Melithreptus brevirostris	Brown-headed Honeyeater	▼	▼			▼	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼		▼
Purnella albifrons	White-fronted Honeyeater	▼	▼			▼	▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼		▼	▼		▼
Glyciphila melanops	Tawny-crowned Honeyeater							▼	▼	▼		▼		▼		▼	▼	▼	▼	▼							
Phylidonyris novaehollandiae	New Holland Honeyeater									▼				▼						▼					▼		
Phylidonyris nigra	White-cheeked Honeyeater		▼											▼	▼					▼							
Pomatostomidae																											
Pomatostomus superciliosus ashbyi (subspecies ashyi is P4)	White-browed Babbler (western wheatbelt ssp)	▼^^	▼^^			▼^^	▼^^	▼^^	▼^^		▼^^	▼	▼^^	▼^^		▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^
Eupetidae																											
Cinclosoma castanotum	Chestnut Quail-thrush	▼	▼			▼	▼					▼	▼	▼	▼	▼	▼	▼		▼	▼	▼	▼				▼
Neosittidae																											
Daphoenositta chrysoptera	Varied Sittella	▼	▼				▼					▼	▼	▼		▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼
Campephagidae																											
Coracina novaehollandiae	Black-faced Cuckoo-shrike	▼	▼			▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Lalage sueurii	White-winged Triller	▼	▼					▼	▼	▼			▼	▼			▼									▼	
Pachycephalidae																											

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								FH	LK/N	PC							LC	MR	FH	PC	1	2	3	4	5	BS	W
Colluricincla harmonica	Grey Shrike-thrush	▼	▼			▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼	▼
Falcunculus frontatus leucogaster [P4]	Crested Shrike-tit (south-western ssp)			▼													▼				▼	▼					
Oreoica gutturalis subsp. gutturalis (subspecies gutturalis is P4)	Crested Bellbird (south-western ssp is P4)	▼^^	▼^^			▼^^	▼^^			▼^^	▼^^		▼^^	▼^^		▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^	▼^^
Pachycephala inornata	Gilbert's Whistler	▼	▼			▼	▼				▼	▼				▼					▼	▼				▼	
Pachycephala rufiventris	Rufous Whistler	▼	▼			▼	▼					▼			▼			▼	▼			▼	▼			▼	
Artamidae																											
Artamus cinereus	Black-faced Woodswallow					▼					▼		▼	▼			▼				▼					▼	
Artamus cyanopterus	Dusky Woodswallow	▼	▼			▼	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Artamus personatus	Masked Woodswallow	▼	▼							▼										▼				▼		▼	▼
Cracticus nigrogularis	Pied Butcherbird	▼	▼				▼				▼		▼	▼	▼	▼		▼			▼	▼	▼			▼	▼
Cracticus tibicen	Australian Magpie					▼	▼	▼		▼	▼	▼		▼		▼			▼	▼	▼					▼	
Cracticus torquatus	Grey Butcherbird	▼	▼			▼	▼	▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼		▼	▼
Strepera versicolor	Grey Currawong	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼	▼		▼	▼	▼	▼	▼
Rhipiduridae																											
Rhipidura albiscapa	Grey Fantail							▼		▼		▼		▼			▼		▼				▼				
Rhipidura leucophrys	Willie Wagtail	▼	▼			▼	▼	▼	▼	▼	▼	▼		▼	▼		▼	▼	▼	▼	▼	▼	▼	▼		▼	▼
Corvidae																											
Corvus bennetti	Little Crow	▼				▼	▼	▼	▼	▼	▼	▼						▼	▼		▼	▼				▼	▼
Corvus coronoides	Australian Raven	▼				▼	▼				▼	▼	▼	▼	▼	▼		▼	▼		▼	▼	▼			▼	
Monarchidae																											
Grallina cyanoleuca	Magpie-lark					▼	▼				▼	▼	▼	▼		▼							▼				
Myiagra inquieta	Restless Flycatcher						▼					▼	▼								▼						
Petroicidae																											
Drymodes brunneopygia	Southern Scrub-robin									▼		▼		▼		▼	▼	▼	▼	▼	▼	▼	▼		▼		
Eopsaltria griseogularis	Western Yellow Robin	▼				▼			▼	▼		▼		▼		▼	▼	▼	▼		▼	▼		▼	▼		▼
Melanodryas cucullata	Hooded Robin		▼									▼		▼			▼	▼	▼			▼	▼			▼	
Microeca fascinans	Jacky Winter	▼	▼			▼	▼				▼	▼	▼	▼		▼	▼	▼	▼		▼	▼	▼	▼		▼	▼
Petroica goodenovii	Red-capped Robin	▼	▼			▼	▼	▼			▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼
Megaluridae																											
Cincloramphus cruralis	Brown Songlark					▼													▼		▼						
Cincloramphus mathewsi	Rufous Songlark	▼	▼			▼	▼																				
Timaliidae																											
Zosterops lateralis	Silvereye					▼	▼				▼	▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼		▼		▼
Hirundinidae																											
Cheramoeca leucosterna	White-backed Swallow					▼						▼	▼														
Petrochelidon ariel	Fairy Martin																	▼				▼					
Hirundo neoxena	Welcome Swallow					▼	▼		▼		▼																
Petrochelidon nigricans	Tree Martin	▼	▼			▼	▼		▼			▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼
Nectariniidae																											
Dicaeum hirundinaceum	Mistletoebird					▼				▼			▼				▼	▼		▼		▼				▼	▼
Motacillidae																											
Anthus novaeseelandiae	Australasian Pipit		▼				▼					▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼

Rapallo Group

Regional Comparison of Species- Reptiles

Scientific Name	Common Name	NT	NAR	DPaW	EPBC	NM	EX	K	MH & EA	F	HR	BSoEG (Hyden to Lake Johnston)				BSoEG-N (Norseman to Balladonia)					BSoEG-N (Widgiemootha to Zanthus)	
												LC	MR	FH	PC	1	2	3	4	5	BS	W
Reptiles																						
Ctenophorus chapmani			▼				▼			▼	▼	▼		▼		▼	▼			▼		▼
Ctenophorus cristatus	Crested Dragon	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼
Ctenophorus fordi								▼														
Ctenophorus isolepis citrinus	Central Military Dragon												▼									
Ctenophorus isolepis gularis																					▼	
Ctenophorus maculatus griseus										▼												
Ctenophorus maculatus	Spotted Military Dragon											▼	▼	▼	▼			▼		▼		
Ctenophorus mackenziei																		▼				
Ctenophorus ornatus	Ornate Dragon								▼				▼	▼	▼							
Ctenophorus salinarum	Claypan Dragon					▼	▼	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼		▼	▼
Ctenophorus scutulatus	Lozenge-marked Dragon							▼													▼	
Diporiphora reginae						▼															▼	
Moloch horridus	Thorny Devil	▼				▼	▼		▼	▼	▼	▼	▼		▼	▼	▼		▼			▼
Pogona minor minor	Dwarf Bearded Dragon		▼				▼	▼	▼							▼	▼	▼	▼	▼	▼	▼
Pogona minor minima	Dwarf Bearded Dragon									▼	▼	▼	▼	▼	▼							
Tympanocryptis cephala	Pebble Dragon																					
Tympanocryptis houstoni						▼																
Boidae																						
Morelia spilota imbricata [S4]	Carpet Python	▼ fenceline road		▼			▼	▼	▼		▼				▼							
Elapidae																						
Demansia psammophis																					▼	
Drysdalia mastersii																		▼				
Echiopsis curta	Bardick									▼				▼	▼							
Neelaps bimaculatus	Black-naped Snake						▼	▼			▼	▼				▼						
Parasuta gouldii	Gould's Hooded Snake						▼	▼	▼	▼	▼	▼				▼	▼	▼				▼
Parasuta monachus								▼														
*Parasuta nigriceps^*	Mitchell's Short-tailed Snake						▼		▼	▼												
Parasuta spectabilis bushi																						
Paroplocephalus atriceps [P3]	Lake Cronin Snake						▼		▼	▼		▼										
Pseudechis australis	King Brown	▼ camp	▼ N-S track					▼	▼			▼									▼	
Pseudonaja affinis affinis	Dugite						▼		▼	▼		▼	▼	▼	▼	▼	▼					
Pseudonaja modesta	Ringed Brown Snake							▼					▼								▼	
Pseudonaja mengdeni	Western Brown Snake																			▼		
Brachyurophis semifasciata		▼	▼					▼	▼				▼								▼	▼
Simoselaps bertholdi	Jan's Banded Snake						▼	▼		▼			▼	▼							▼	▼
Gekkonidae																						
Christinus marmoratus	Marbled Gecko		▼			▼		▼	▼		▼		▼	▼		▼	▼	▼				
Crenadactylus ocellatus	Clawless gecko							▼	▼	▼	▼	▼	▼	▼	▼			▼				
Diplodactylus calciolus						▼																
Diplodactylus granariensis	Wheat-belt Stone Gecko	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼					▼	▼

Diplodactylus pulcher		▼	▼					▼		▼			▼								▼	
Diplodactylus wiru						▼																
Lucasium maini	Main's Ground gecko	▼	▼			▼	▼	▼						▼		▼	▼	▼		▼	▼	▼
Gehyra variegata		▼	▼			▼	▼	▼	▼	▼		▼				▼	▼	▼	▼	▼	▼	▼
Heteronotia binoei	Bynoe's Gecko					▼	▼	▼	▼		▼	▼				▼	▼	▼			▼	▼
Hesperoedura reticulata	Reticulated Velvet Gecko	▼	▼				▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	▼
Strophurus assimilis	Thorn-tailed Gecko	▼	▼					▼														
Strophurus elderi			▼					▼													▼	
Strophurus intermedius													▼					▼			▼	▼
Strophurus spinigerus												▼		▼								
Nephrurus laevissimus								▼														
Underwoodisaurus milii	Barking Gecko							▼	▼	▼		▼	▼								▼	▼
Pygopodidae																						
Delma australis		▼				▼	▼	▼	▼	▼						▼	▼				▼	
Delma butleri		▼				▼		▼									▼	▼			▼	▼
Delma fraseri							▼	▼	▼	▼		▼	▼									▼
Lialis burtonis	Burton's Snake-Lizard	▼				▼	▼	▼	▼	▼		▼			▼	▼	▼				▼	▼
Pygopus lepidopodus	Common Scaly-foot	▼	▼				▼	▼	▼	▼			▼		▼							▼
Scincidae																						
Cryptoblepharus buchanani		▼					▼	▼	▼	▼	▼	▼		▼	▼	▼	▼	▼	▼		▼	▼
Cryptoblepharus pulcher clarus																	▼					
Ctenotus atlas		▼						▼	▼		▼	▼	▼			▼	▼	▼	▼		▼	▼
Ctenotus impar	South-western Odd-striped Ctenotus									▼		▼		▼	▼					▼		
Ctenotus leonhardii																					▼	
Ctenotus pantherinus						▼															▼	
Ctenotus schomburgkii	Barred Wedge Snout Ctenotus	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼
Ctenotus uber		▼						▼								▼						
Ctenotus xenopleura													▼									
Cyclodomorphus melanops elongatus																						
Cyclodomorphus melanops elongatus																						
Cyclodomorphus melanops elongatus		▼				▼		▼	▼			▼	▼			▼	▼	▼	▼	▼	▼	▼
Egernia formosa								▼	▼													
Liopholis inornata	Desert Skink							▼	▼				▼				▼	▼	▼	▼	▼	▼
Liopholis multiscutata	Bull Skink						▼			▼		▼	▼			▼						
Egernia richardi	Bright Crevice Skink	▼	▼				▼	▼		▼	▼	▼	▼	▼		▼						▼
Eremiascincus richardsoni		▼	▼																		▼	
Hemiergis initialis initialis	South Western Earless Skink						▼	▼	▼	▼	▼		▼		▼	▼	▼	▼				
Hemiergis initialis brookeri		▼	▼			▼										▼	▼	▼	▼		▼	▼
Hemiergis millewae																					▼	▼
Hemiergis peronii																	▼	▼				
Hemiergis peronii peronii	Lowlands Earless Skink					▼	▼				▼			▼	▼							
Lerista distinguenda							▼	▼	▼	▼		▼		▼	▼							
Lerista dorsalis			▼				▼			▼						▼	▼	▼				
Lerista timida		▼	▼			▼															▼	▼

Lerista timida/kingii						▼		▼	▼				▼			▼	▼	▼				
Lerista picturata	Southern Robust Slider	▼	▼			▼	▼	▼	▼	▼	▼		▼			▼	▼	▼			▼	▼
Lerista tridactyla																	▼					
Menetia greyii		▼				▼	▼	▼	▼	▼		▼	▼	▼	▼	▼	▼	▼			▼	▼
Morethia adelaidensis								▼														
Morethia butleri	Woodland Morethis Skink	▼	▼				▼	▼	▼		▼	▼	▼	▼		▼	▼	▼	▼	▼	▼	▼
Morethia obscura	Shrubland Morethia Skink	▼	▼				▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼
Tiliqua occipitalis	Western Blue Tongue	▼							▼	▼	▼	▼		▼		▼	▼				▼	▼
Tiliqua rugosa	Bobtail	▼	▼				▼	▼	▼	▼			▼	▼		▼	▼			▼		
Varanidae																						
Varanus gouldii	Gould's Goanna	▼	▼			▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼	▼				▼
Varanus rosenbergi							▼		▼	▼				▼	▼	▼	▼					
Typhlopidae																						
Ramphotyphlops australis	Southern Blind Snake	▼					▼	▼	▼	▼	▼	▼			▼		▼					
Ramphotyphlops bicolor							▼															
Ramphotyphlops bituberchlata																					▼	▼
Ramphotyphlops hamatus									▼													
												FROGS										
Hylidae																						
Litoria cyclorhyncha																		▼				
Limnodynastidae																						
Limnodynastes dorsalis							▼					▼		▼	▼			▼				
Myobatrachidae																						
Crinia pseudinsignifera										▼		▼										
Heleioporus albopunctatus										▼		▼		▼								
Myobatrachus gouldii														▼	▼							
Neobatrachus albipes																						
Neobatrachus "centralis" likely to be *kunapalari*						▼						▼	▼								▼	▼
Neobatrachus kunapalari							▼															
Neobatrachus pelobatoides												▼	▼									
Neobatrachus sutor						▼						▼										▼
Neobatrachus sp.1														▼	▼							
Neobatrachus sp.2									▼													
Neobatrachus sp.3																						
Neobatrachus sp.										▼						▼		▼				
Pseudophryne guentheri														▼								
Pseudophryne occidentalis						▼			▼				▼		▼	▼	▼	▼				▼

Rapallo Group

Regional Comparison of Species - Mammals

Scientific Name	Common Name	NT	NAR	DPaW	EPBC	Ex	K	NM	MH & EA	F	HR	BSoEG - LJ (Hyden to Lake Johnston)				BSoEG-N (Norseman to Balladonia)					BSoEG-N (Widgiemootha to Zanthus)	
												LC	MR	FH	PC	1	2	3	4	5	BS	W
Tachyglossidae																						
Tachyglossus aculeatus	Short Beaked Echidna		▼			▼			▼	▼	▼	▼	▼	▼								▼
Dasyuridae																						
Dasyurus geoffroii[x, V]	Chuditch			▼	▼					▼				▼								
Ningaui ridei	Ride's Ningaui						▼														▼	
Ningaui yvonneae	Southern Ningaui	▼				▼	▼				▼	▼	▼				▼				▼	
Sminthopsis crassicaudata	Fat-tailed Dunnart					▼	▼			▼			▼			▼	▼			▼	▼	▼
Sminthopsis dolichura	Little Long-tailed Dunnart	▼	▼			▼	▼		▼		▼					▼	▼				▼	▼
Sminthopsis gilberti	Gilberts Dunnart					▼				▼		▼		▼								
Sminthopsis granulipes	White Tailed Dunnart									▼		▼		▼	▼							
Sminthopsis griseoventer										▼												
Macropodidae																						
Macropus fuliginosus	Western Grey Kangaroo	▼	▼			▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼
Macropus irma [P4]	Western Brush Wallaby									▼	▼			▼								
Macropus robustus	Euro		▼						▼	▼	?		▼								▼	▼
Macropus rufus																					▼	
Burramyidae																						
Cercartetus concinnus	Western Pygmy Possum	▼				▼	▼		▼	▼	▼	▼	▼	▼	▼	▼	▼			▼		
Tarsipeoidae																						
Tarsipes rostratus	Honey Possum									▼				▼	▼							
Vespertilionidae																						
Chalinolobus morio	Chocolate Wattled Bat					▼				▼				▼		▼					▼	▼
Chalinolobus gouldii	Gould's Wattled Bat					▼	▼	▼	▼	▼		▼	▼	▼		▼		▼	▼		▼	▼
Nyctophilus geoffroyi	Lesser Long-eared Bat								▼	▼		▼	▼			▼	▼	▼		▼	▼	▼
Nyctophilus major torr						▼	▼		▼				▼			▼	▼	▼				▼
Scotorepens balstoni	Western Broad Nosed Bat												▼								▼	
Vespadelus regulus	Southern Forest Bat					▼		▼	▼	▼		▼	▼	▼	▼	▼	▼	▼	▼		▼	▼
Molossidae																						
Mormopterus sp. 4.(Mormopterus planiceps)	Little Mastiff Bat					▼				▼		▼	▼	▼		▼	▼		▼		▼	
Tadarida australis	White-striped Freetail Bat					▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼
Muridae																						
Mus musculus	House Mouse	▼	▼			▼	▼		▼	▼	▼	▼	▼	▼	▼	▼	▼	▼		▼	▼	▼
Notomys mitchelli	Mitchell's hopping mouse					▼	▼			▼		▼	▼	▼	▼	▼	▼	▼		▼		

Scientific Name	Common Name	NT	NAR	DPaW	EPBC	Ex	K	NM	MH & EA	F	HR	BSoEG - LJ (Hyden to Lake Johnston)				BSoEG-N (Norseman to Balladonia)					BSoEG-N (Widgiemootha to Zanthus)	
												LC	MR	FH	PC	1	2	3	4	5	BS	W
Pseudomys albocinereus	Ash-grey Mouse								▼	▼		▼	▼	▼	▼							
Pseudomys sp.																						▼
Pseudomys hermannsburgensis	Sandy Inland Mouse	▼																			▼	
Pseudomys bolami	Bolam's Mouse						▼		▼			▼	▼			▼	▼	▼				
Rattus rattus	Black Rat																					
Leporidae																						
Orcytolagus cuniculus	Rabbit	▼	▼			▼			▼	▼	▼	▼	▼	▼	▼	▼	▼	▼			▼	
Canidae																						
Canis lupus/Canis lupus familiaris	Dingo/Feral Dog	▼	▼			▼			▼	▼	▼	▼	▼			▼	▼	▼			▼	▼
Vulpes vulpes	Fox					▼			▼	▼	▼	▼	▼			▼					▼	▼
Felidae																						
Felis catus	Feral Cat	▼	▼			▼			▼	▼	▼		▼		▼	▼	▼	▼			▼	▼
Camelidae																						
Camelus dromedarius	Camel	▼	▼													▼	▼	▼			▼	▼

*One record for Chuditch at Frank Hann National Park refers to an oral account of a Chuditch killed by a bait not a trapped individual during the How et al (1988) surveys, two other observations occurred in 1990 and 1993 - a road kill and a trapped individual (Keith Morris pers com). Chuditch trapped near Frank Hann National Park in February 2009 (Keith Morris pers com).

Regional Comparison - Key to Reports Cited

NT	NAR	DPaW	EPBC	AS NN	ASD	Great Western Woodland			NM	EX	K	F	MH & EA	HR	BSoEG- (Hyden to Lake Johnston)				BSoEG-N (Norseman to Balladonia)					BSoEG-W (Widgiemootha to Zanthus	
						FH	LK/N	PC							LC	MR	FH	PC	1	2	3	4	5	BS	W
Nova Tenement (This Survey)	Nova Access Road (This Survey)	DPaW Database Search	EPBC Protected Matters Seach	Atlas Search Near Nova Project Area	Atlas Search Dundas	Frank Hann	Lake King/Norseman	Peak Charles	Naturemap Database Search	Exclamation Lake (Salmon Gums)	Kambalda (St Ives)	Forrestania	Maggie Hays and Emily Ann	Honman Ridge	Lake Cronin	McDermid Rock	Frank Hann	Peak Charles	Camp 1	Camp 2	Camp 3	Camp 4	Camp 5	Buningonia Springs	Woodline
Eucalyptus woodland/ Triodia plain/ Eucalyptus regen	*Eucalyptus woodland/ Triodia plain/ Eucalyptus regen*	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified	Eucalyptis woodland/Mallee/ Melaleuca shrubland/Salt Lakes/ Broad Valleys	Saltlake dunes, sand dune, woodland, claypan shrubland, shrubland	Mallee, woodland, shrubland, heath	Eucalyptus woodland/ Mallee/Salt Lakes	Eucalyptus woodland/ Mallee/ *Triodia*. Banded Ironstone, Salt Lakes, Undulating Plain. Broad Valleys	Banded Ironstone, Salt Lake (*Halosarcia*), Sand Plain (*Hakea*), Plain (Eucalyptus woodland), Broad Valley (Eucalyptus woodland, Mallee and Melaleuca shrubland).	Granite (mallee, *Allocasuarina*), Salt Lake (*Melaleuca*), Sand Plain (*Allocasuarina*), Broad Valley (*Eucalyptus* woodland)	Granite, Salt lake (Mallee), Sand plain (Mallee and low *Hakea* shrubland, Broad Valley (Eucalyptus woodland, Mallee and *Melaleuca* shrubland)	*Granite (Melaleuca. Allocasuarina*), Salt Lake (*Atriplex* shrubland), Broad Valley (Mallee, *Eucalyptus* woodland)	Calcareous Plain (Eucalyptus woodland), Salt Lake (Eucalyptus woodland, Halosarcia shrubland), Granite (Acacia woodland/shrubland) 32O 24' 00"S 122o17'30"	Calcareous Plain (Eucalyptus low woodland), Salt Lake (Eucalyptus low woodland), Granite 32O 28' 00"S 123o23'00"	Calcareous Plain (Eucalyptus woodland, Melaleuca shrubland), Salt Lake (Halosarcia low shrubland, Callitris shrubland), Granite (Lepidosperma hummock grass) 32O 28' 00"S 123o23'00"	Calcareous Plain (Eucalyptus woodland), 32O 26' 30"S 122o49'00"	Calcareous Plain (Eucalyptus woodland, mixed mallee melaleuca), Salt Lake (mallee, Halosarcia shrubland), Granite 32O 28' 00"S 123o23'00"	Calcareous Plain, Undulating Plain, basic granulite, salt lake features, granites	Calcareous Plain, salt lake features, granites

Department of Parks and Wildlife (DPaW) Database search	Search Coordinates - 31°49'09" S, 123°11'25"E - 40km Buffer
EBPC Protected Matters Search	Search Coordinates - 31°49'09" S, 123°11'25"E - 40km Buffer
Birdlife Australia Atlas Searches (ASNN and ASD)	Search Coordinates - 32° 5'24.07"S 123°14'42.25"E and 32°33'13.68"S 122°57'7.74"E Buffer - 1 degree square
Naturemap Database Search (NM)	Search Coordinates - 31°49'09" S, 123°11'25"E - 40km Buffer
Birdlife Australia Great Western Woodland Atlas Surveys	Fox, E. (2013). Great Western Woodlands bird list October 2013. Western Australian Bird Notes, No 148
EX - Exclamation Lake (Salmon Gums)	Rapallo (2009). Draft, level two terrestrial fauna survey of the Salmon Gums Project Area for MBS Environmental. Unpublished report for MBS Environmental
Forrestania (F)	Coffey (2009). Environmental Protection Statement for the Spotted Quoll Mine. Summary of Biota Fauna Surveys (2006a, 2006b, 2007a and 2007b) - Tables 19 to 21.
Kambalda (K)	Western Wildlife (2006). St Ives Gold Fauna Survey. Spring 2005. Unpublished report for Jim's Seeds Trees and Weeds.
Biological Survey of the Eastern Goldfields of WA - Norseman to Balladonia (BSoEG-N)	Hall and McKenzie (1993). Biological Survey of the Eastern Goldfields of WA - Norseman to Balladonia
Maggie Hays and Emily Ann (MH & EA)	Brearley *et al* (1997, 1998). Biological Survey and Environmental Assessment of the Maggie Hays and Emily-Ann Project Areas.
Honman Ridge-Bremer Range District (HR)	Duncan *et al* (2006). Vertebrate Fauna of the Honman Ridge-Bremer Range District, Great Western Woodlands, Western Australia.
Biological Survey of the Eastern Goldfields of WA. Hyden to Lake Johnson. (BSoEG-LJ)	How *et al* (1988). Biological Survey of the Eastern Goldfields of WA. Hyden to Lake Johnson.
Biological Survey of the Eastern Goldfields of WA. Widgiemootha to Zanthus. (BSoEG-W)	Dell and How (1984) Biological Survey of the Eastern Goldfields of WA. Widgiemootha to Zanthus.

Highlighted text refers species unlikely to be present at Nova or Nova tenement based on distribution or habitat.

Appendix II Fauna Habitat Descriptions

Site Name	Trapsite 1 - Project Area
Date	11-Nov-13
Ecologist	MP
Camera ID	KG iphone
Photo Nr	7081-7085
GPS ID	MW
Waypoint	TS1 FACE
Landform	Flats
Location description	*Acacia* shrubland dominated flats
Soil Type	Red
Soil Colour	Loam
Rocks	Nil, Calcrete layer at depth
Habitat Notes	*Shrubland of Acacia acuminata* (?) to 4 metres over mixed low shrubs including acacia and senna. Emergent eucalyptus to 8 metres.
Vegetation Condition	Good except for drill lines
Burn notes	Long Unburnt
Leaf Litter Cover	Patchy - 1-2 cm under shrubs
Coarse Woody Debris	Fallen timber present - but not large logs - mostly sticks and twigs
Snail Shells	6 in 50 metre transect
Foraged Yes/No	Yes
Man Hours	1.5
Litter Collected	Yes
Bird Survey	20 minute 1 ha area searches and opportunistic records taken
MDC Deployed Yes /No	Yes
Comments	

Photo

Site Name	Trap Site 2 - Project Area
Date	11/11/2013
Ecologist	M.P
Camera ID	Marieke
Photo Nr	
GPS ID	Marieke
Waypoint	TS2 CRATE
Landform	Flat Plain
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum
Vegetation Condition	Good except for drill lines
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	6 per 50 metre transect
Foraged Yes/No	Y
Man Hours	1.5
Litter Collected	Y
Bird Survey	20 minute 1 ha area searches and opportunistic records taken
MDC Deployed Yes /No	Yes
Comments	From a fauna habitat perspective this site represented the majority of the Project area that was long unburnt.

Photo

Site Name	Trap Site 3 - Project Area
Date	12-Nov-13
Ecologist	MW, FH
Camera ID	Marieke
Photo Nr	103-0174 to 103-0177
GPS ID	MW
Waypoint	TS3 MELALU
Landform	Gently sloping plain
Location description	Gently sloping plain in between two ridges with eucalypt woodland. This vegetation type is adjacent to small patches of spinifex habitat
Soil Type	loamy clay
Soil Colour	pale orange-brown
Rocks	tiny scattered pebbles, calcrete layer at depth
Habitat Notes	Open eucalypt woodland over melaleuca thicket and over sparse shrubs
Vegetation Condition	Condition good, but disturbed including quad bike tracks, nearby clearing and adjacent road.
Burn notes	Not burned in a long time, large amounts of coarse woody debris
Leaf Litter Cover	dense leaf litter, thickest under bushes where it is up to 3 cm thick under bush
Coarse Woody Debris	Lots
Snail Shells	Many
Foraged Yes/No	Yes
Man Hours	1.5
Litter Collected	Yes
Bird Survey	20 minute 1 ha area searches and opportunistic records taken
MDC Deployed Yes /No	Yes
Comments	

Site Name	Trap Site 4 - Project Area
Date	11/11/2013
Ecologist	MP
Camera ID	KG Iphone
Photo Nr	7056 - 7060
GPS ID	Marieke
Waypoint	TS4 SPAG
Landform	Triodia Plain
Location description	Triodia plain under open Eucalyptus woodland (12 metres) with occasional eremophila, dodonea, exocarpus and groves of allocasuarina
Soil Type	Sandy Clay Loam
Soil Colour	Red
Rocks	Nil - surface sprinking of iron pisolith only, calcrete layer at depth
Habitat Notes	Triodia plain under an open woodland of Eucalyptus
Vegetation Condition	Disturbed only by drill lines and sump excavation
Burn notes	Long unburnt
Leaf Litter Cover	2 - 3 cm deep in patches under Eucalpts (aprox. 20%),
Coarse Woody Debris	Fallen timber present but not large logs - mostly sticks and twigs
Snail Shells	2 snails per 50 metre transect
Foraged Yes/No	Yes
Man Hours	1.5 hours
Litter Collected	Yes
Bird Survey	20 minute 1 ha area searches and opportunistic records taken
MDC Deployed Yes /No	Yes
Comments	

Photo

Site Name	Trap Site 5 - Project Area
Date	11-Nov-13
Ecologist	MW
Camera ID	MW
Photo Nr	103-0188-192
GPS ID	MW
Waypoint	TS5
Landform	Slope
Location description	Regenerating woodland
Soil Type	Sandy Clay
Soil Colour	Brown
Rocks	Nil
Habitat Notes	Dense regenerating Eucalyptus woodland - (dominated by tall saplings).
Vegetation Condition	Regenerating from a cool burn (burn aprox 5-10 years ago)
Burn notes	Cool burn
Leaf Litter Cover	Patchy and thick under bushes (<3 cm thick).
Coarse Woody Debris	Abundant course woody debris and fallen logs with hollows
Snail Shells	2 snails observed in 50 metres
Foraged Yes/No	Yes
Man Hours	1.5
Litter Collected	Yes
Bird Survey	20 minute 1 ha area searches and opportunistic records taken
MDC Deployed Yes /No	Yes
Comments	

Site Name	Trap Site 6 - Project Area
Date	11-Nov-13
Ecologist	MW
Camera ID	KG Iphone
Photo Nr	7130
GPS ID	MW
Waypoint	TS6 BURNT
Landform	Plain
Location description	Recently burnt plain
Soil Type	Clay/loam
Soil Colour	Red/Brown
Rocks	Some outcropping granite?
Habitat Notes	Regenerating low shrubland/herbland of mixed casuarina, triodia and ephemeral herbs
Vegetation Condition	Burnt, regeneration in the early stages
Burn notes	Recent hot burn (aprox < 2 years old)
Leaf Litter Cover	Low
Coarse Woody Debris	Low - due to hot burn
Snail Shells	2 snails per 50 metre transect
Foraged Yes/No	Yes
Man Hours	1.5
Litter Collected	Yes
Bird Survey	20 minute 1 ha area searches and opportunistic records taken
MDC Deployed Yes /No	Yes
Comments	Camel Tracks present

Photo

Site Name	HABCRATE 2
Date	13/11/2013
Ecologist	MW
Camera ID	
Photo Nr	No photos
GPS ID	Marieke
Waypoint	HABCRATE 2 - Project Area
Landform	Flat Plain
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum
Vegetation Condition	Good except for drill lines
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	N
Man Hours	
Litter Collected	N
Bird Survey	OPP
MDC Deployed Yes /No	N
Comments	From a fauna habitat perspective this site represented the majority of the Project area that was long unburnt.

Site Name	HABCRATE 3 - Project Area
Date	13/11/2013
Ecologist	MW
Camera ID	
Photo Nr	No photos
GPS ID	Marieke
Waypoint	HABCRATE 3
Landform	Flat Plain
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum
Vegetation Condition	Good except for drill lines
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	N
Man Hours	
Litter Collected	N
Bird Survey	OPP
MDC Deployed Yes /No	N
Comments	From a fauna habitat perspective this site represented the majority of the Project area that was long unburnt.

Site Name	HBT CRATEW
Date	13/11/2013
Ecologist	MW
Camera ID	
Photo Nr	No photos
GPS ID	Marieke
Waypoint	HBT CRATEW - Project Area
Landform	Flat Plain
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum
Vegetation Condition	Good except for drill lines
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	N
Man Hours	
Litter Collected	N
Bird Survey	OPP
MDC Deployed Yes /No	N
Comments	From a fauna habitat perspective this site represented the majority of the Project area that was long unburnt.

Site Name	HAB EUCO1 - Project Area
Date	13/11/2013
Ecologist	MW
Camera ID	MW
Photo Nr	103-0196
GPS ID	Marieke
Waypoint	HAB EUCO1
Landform	Flat Plain
Location description	Open Eucalyptus woodland no cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland - no cratystylis
Vegetation Condition	Good except for drill lines
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	N
Man Hours	
Litter Collected	N
Bird Survey	OPP
MDC Deployed Yes /No	N
Comments	

Site Name	HAB EUCO2 - Project Area
Date	13/11/2013
Ecologist	MW
Camera ID	MW
Photo Nr	No photos
GPS ID	Marieke
Waypoint	HAB EUCO2
Landform	Flat Plain
Location description	Open Eucalyptus woodland no cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland - no cratystylis
Vegetation Condition	Good except for drill lines
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	N
Man Hours	
Litter Collected	N
Bird Survey	OPP
MDC Deployed Yes /No	N
Comments	

Site Name	HAB2SPAG - Project Area
Date	13/11/2013
Ecologist	MW
Camera ID	MW
Photo Nr	No Photos
GPS ID	MW
Waypoint	HAB2SPAG
Landform	Spinifex Plain
Location description	Triodia plain under open Eucalyptus woodland
Soil Type	Sandy Clay Loam
Soil Colour	Red
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Triodia plain under an open woodland of Eucalyptus
Vegetation Condition	Disturbed only by drill lines and sump excavation
Burn notes	Long unburnt
Leaf Litter Cover	2 - 3 cm deep in patches under Eucalpts (aprox. 20%),
Coarse Woody Debris	Fallen timber present but not large logs - mostly sticks and twigs
Snail Shells	2 snails per 50 metre transect
Foraged Yes/No	N
Man Hours	
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Comments	Similar to Trapsite 4

Site Name	HABSPAG1 - Project Area
Date	13/11/2013
Ecologist	MW
Camera ID	MW
Photo Nr	No Photos
GPS ID	MW
Waypoint	HABSPAG1 - Project Area
Landform	Triodia Plain
Location description	Triodia plain under open Eucalyptus woodland
Soil Type	Sandy Clay Loam
Soil Colour	Red
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Triodia plain under an open woodland of Eucalyptus
Vegetation Condition	Disturbed only by drill lines and sump excavation
Burn notes	Long unburnt
Leaf Litter Cover	2 - 3 cm deep in patches under Eucalpts (aprox. 20%),
Coarse Woody Debris	Fallen timber present but not large logs - mostly sticks and twigs
Snail Shells	No transect
Foraged Yes/No	N
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Foraged Yes/No	N
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Comments	Similar to Trapsite 4

Site Name	HABSPAG3 - Near Haul Road
Date	13/11/2013
Ecologist	MW
Camera ID	MW
Photo Nr	No Photos
GPS ID	MW
Waypoint	HABSPAG3
Landform	Triodia Plain
Location description	Triodia plain under open Eucalyptus woodland
Soil Type	Sandy Clay Loam
Litter Collected	No
Comments	Similar to Trapsite 4

Site Name	HABSPIN1 - Near Haul Road
Date	14/11/2013
Ecologist	MW
Camera ID	MW
Photo Nr	No Photos
GPS ID	MW
Waypoint	HABSPIN1
Landform	Triodia Plain
Location description	Triodia plain under open Eucalyptus woodland
Soil Type	Sandy Clay Loam
Soil Colour	Red
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Triodia plain under an open woodland of Eucalyptus
Vegetation Condition	Disturbed only by drill lines and sump excavation
Burn notes	Long unburnt
Leaf Litter Cover	2 - 3 cm deep in patches under Eucalpts (aprox. 20%),
Coarse Woody Debris	Fallen timber present but not large logs - mostly sticks and twigs
Snail Shells	No transect
Foraged Yes/No	N
Man Hours	
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Comments	Similar to Trapsite 4

Site Name	HABSPIN2 - Near Haul Road
Date	14/11/2013
Ecologist	MW
Camera ID	MW
Photo Nr	No Photos
GPS ID	MW
Waypoint	HABSPIN2
Landform	Triodia Plain
Location description	Triodia plain under open Eucalyptus woodland
Soil Type	Sandy Clay Loam
Soil Colour	Red
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Triodia plain under an open woodland of Eucalyptus
Vegetation Condition	Disturbed only by drill lines and sump excavation
Burn notes	Long unburnt
Leaf Litter Cover	2 - 3 cm deep in patches under Eucalpts (aprox. 20%),
Coarse Woody Debris	Fallen timber present but not large logs - mostly sticks and twigs
Snail Shells	No transect
Foraged Yes/No	N
Man Hours	
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Comments	Similar to Trapsite 4

Site Name	HABSPIN3 - Near Haul Road
Date	14/11/2013
Ecologist	MW
Camera ID	MW
Photo Nr	No Photos
GPS ID	MW
Waypoint	HABSPIN3
Landform	Triodia Plain
Location description	Triodia plain under open Eucalyptus woodland
Soil Type	Sandy Clay Loam
Soil Colour	Red
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Triodia plain under an open woodland of Eucalyptus
Vegetation Condition	Disturbed only by drill lines and sump excavation
Burn notes	Long unburnt
Leaf Litter Cover	2 - 3 cm deep in patches under Eucalpts (aprox. 20%),
Coarse Woody Debris	Fallen timber present but not large logs - mostly sticks and twigs
Snail Shells	No transect
Foraged Yes/No	N
Man Hours	
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Comments	Similar to Trapsite 4

Site Name	Creek near HR
Date	15/11/2013
Ecologist	MW
Camera ID	MW
Photo Nr	103-0341 to 103-0342
GPS ID	MW
Waypoint	MDC Creek
Landform	Creekline
Location description	Creekline width approximately 50 metres, bordered on the north by REGEN habitat, and on the south by Triodia (SPAG) habitat.
Soil Type	Deep sand
Soil Colour	Red
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Creekline of dense woodland of regenerating eucalypts with emergent dead eucalypt stags, over open mixed shrubs including Eremophilas, over grasses, on deep red-brown sand.
Vegetation Condition	Good
Burn notes	Regenerating burn to the north
Leaf Litter Cover	Patchy
Coarse Woody Debris	Fallen timber present
Snail Shells	No transect
Foraged Yes/No	N
Man Hours	
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	Yes
Comments	

Site Name	Goodspin near - HR
Date	16/11/2013
Ecologist	MW
Camera ID	MW
Photo Nr	No Photos
GPS ID	MW
Waypoint	Goodspin
Landform	Triodia Plain
Location description	Triodia plain under open Eucalyptus woodland
Soil Type	Sandy Clay Loam
Soil Colour	Red
Rocks	Nil - surface sprinking of iron pisolith only, calcrete layer at depth
Habitat Notes	Triodia plain under an open woodland of Eucalyptus
Vegetation Condition	Good
Burn notes	Long unburnt
Leaf Litter Cover	2 - 3 cm deep in patches under Eucalpts (aprox. 20%),
Coarse Woody Debris	Fallen timber present but not large logs - mostly sticks and twigs
Snail Shells	No transect
Foraged Yes/No	N
Man Hours	
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Comments	

Site Name	REGEN 2 - near haul road
Date	8-Nov-13
Ecologist	MW
Camera ID	MW
Photo Nr	No photos
GPS ID	Marieke
Waypoint	REGEN 2
Landform	flat
Location description	Regenerating woodland
Soil Type	Sandy Clay
Soil Colour	Brown
Rocks	Nil
Habitat Notes	Dense regenerating Eucalyptus woodland - (dominated by tall saplings).
Vegetation Condition	Regenerating from a cool burn (burn aprox 7-10 years ago)
Burn notes	Cool burn
Leaf Litter Cover	Patchy and thick under bushes (<3 cm thick).
Coarse Woody Debris	Abundant course woody debris and fallen logs with hollows
Snail Shells	no transect
Foraged Yes/No	Yes
Man Hours	
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Comments	

Site Name	REGEN3- near haul road
Date	8-Nov-13
Ecologist	MW
Camera ID	MW
Photo Nr	No photos
GPS ID	Marieke
Waypoint	REGEN 3
Landform	flat
Location description	Regenerating woodland
Soil Type	Sandy Clay Loam
Soil Colour	Brown
Rocks	Nil
Habitat Notes	Dense regenerating Eucalyptus woodland - (dominated by tall saplings).
Vegetation Condition	Regenerating from a cool burn (burn aprox 7-10 years ago)
Burn notes	Cool burn
Leaf Litter Cover	Patchy and thick under bushes (<3 cm thick).
Coarse Woody Debris	Abundant course woody debris and fallen logs with hollows
Snail Shells	no transect
Foraged Yes/No	Yes
Man Hours	
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Comments	

Site Name	Q3 - Near Haul Road
Date	15/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No Photo
GPS ID	GPS 1
Waypoint	Q3
Landform	Flat
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	6 per 50 metre transect
Foraged Yes/No	No
Man Hours	
Litter Collected	No
Bird Survey	Opportunistic
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	HR14B
Date	15/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No Photo
GPS ID	GPS 1
Waypoint	HR14B
Landform	Slope to the North East
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum
Vegetation Condition	Good
Burn notes	Long Unburnt - Haul Road
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	6 per 50 metre transect
Foraged Yes/No	Y
Man Hours	1.5
Litter Collected	Y
Bird Survey	Opportunistic
MDC Deployed Yes /No	Yes - SR10
Comments	Very similar in habitat to Trap Site 2

Site Name	HR_rocky outcrop Near Haul Road
Date	15/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	
GPS ID	GPS 1
Waypoint	GPS1KG1
Landform	Hill
Location description	Small granite (?) hill
Soil Type	Loam and gravel
Soil Colour	Red/Brown
Rocks	Granite ?
Habitat Notes	Small spinifex dominated rocky hill with occasional mixed low shrub layer emergent Eucalypts
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patchy undershrubs
Coarse Woody Debris	Twigs and sticks
Snail Shells	N/A
Foraged Yes/No	N
Man Hours	N
Litter Collected	N
Bird Survey	Opportunistic
MDC Deployed Yes /No	N
Comments	

Site Name	KG02
Date	15/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	
GPS ID	GPS 1
Waypoint	2
Landform	Flat
Location description	Open Eucalyptus woodland over mixed low shrubs including (cratystylis, alyxia eremophila olearia)
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over mixed shrubs including (cratystylis, alyxia eremophila olearia)
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	N
Man Hours	N/A
Litter Collected	N
Bird Survey	Opportunistic
MDC Deployed Yes /No	N
Comments	

Site Name	HR01 Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	7189-7193
GPS ID	GPS 1
Waypoint	HR1
Landform	Flat
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum. Occasional Melaleuca thickets (as per trap site 3) and occasional patches of *Diocirea ternata*
Vegetation Condition	Some regen from a burn very close to the highway. Old tracks and sumps evident.
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	5 per 50 metres
Foraged Yes/No	Y
Man Hours	1.5
Litter Collected	Y
Bird Survey	20 minute 1 ha area search
MDC Deployed Yes /No	Y
Comments	Very similar in habitat to Trap Site 2

Site Name	WP07 - Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No photo
GPS ID	GPS 1
Waypoint	WP07
Landform	Flat
Location description	Open Eucalyptus woodland over low *Diocirea ternata* Shrubland
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over *Diocirea ternata* and occasional cratystylis .
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Comments	

Site Name	WP08 - Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No Photo
GPS ID	GPS 1
Waypoint	WP08
Landform	Flat
Location description	Open Eucalyptus woodland over *Diocirea ternata*
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over *Diocirea ternata* bush.
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	2 per 50 metre transect
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	Opp
MDC Deployed Yes /No	No
Comments	

Site Name	WP16 - Haul Road
Date	16-Nov-13
Ecologist	MP, KG
Camera ID	Kate Iphone
Photo Nr	7204-7208
GPS ID	GPS 1
Waypoint	WP16
Landform	Flat
Location description	Melaleuca thicket
Soil Type	loamy clay
Soil Colour	red-brown
Rocks	
Habitat Notes	Open eucalypt woodland over melaleuca thicket over *Diocirea ternata*
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	dense leaf litter, thickest under bushes where it is up to 3 cm thick under bush
Coarse Woody Debris	Lots
Snail Shells	3 per 50 metre transect
Foraged Yes/No	Yes
Man Hours	1.5
Litter Collected	Yes
Bird Survey	20 minute 1 ha area search
MDC Deployed Yes /No	No
Comments	

Site Name	WP18 - Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No photo
GPS ID	GPS 1
Waypoint	WP18
Landform	Flat
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum. Occasional Melaleuca thickets (as per trap site 3) and occasional patches of *Diocirea ternata*
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	5 per 50 metres
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	Opportunistic
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	WP19 - Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No Photo
GPS ID	GPS 1
Waypoint	WP19
Landform	Top of slight rise
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum. Occasional Melaleuca thickets (as per trap site 3) and occasional patches of *Diocirea ternata*
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	5 per 50 metres
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	WP20 - Haul Road
Date	
Ecologist	MP, KG
Soil Type	Sandy Clay Loam
Soil Colour	Red
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Open Mallee over Triodia grassland
Vegetation Condition	Good
Burn notes	Long unburnt
Leaf Litter Cover	2 - 3 cm deep in patches under Eucalpts (aprox. 20%),
Coarse Woody Debris	Fallen timber present but not large logs - mostly sticks and twigs
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	

Site Name	WP21 - Haul Road
Date	16/11/2013
Ecologist	MP, KG
Camera ID	KG Iphone
Photo Nr	7210-7214
GPS ID	GPS1
Waypoint	WP21
Landform	Wash zone (water infilitration evident - cracks - but no defined channel - suggesting water pools them infiltrates but is not fast flowing)
Location description	Low *Diocirea ternata* shrubland under occasional tall mallee
Soil Type	Loam
Soil Colour	Red/Brown
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Low *Diocirea ternata* shrubland under occasional tall mallee
Vegetation Condition	Good
Burn notes	Mostly unburnt - mallees show burnt trunks - suggesting a cool burn many years ago. No regenerating plants.
Leaf Litter Cover	2 - 3 cm deep in patches under Eucalpts (aprox. 20%),
Coarse Woody Debris	Fallen timber present but not large logs - mostly sticks and twigs
Snail Shells	25 snails per 50 metre transect
Foraged Yes/No	Yes
Man Hours	1.5 hours
Litter Collected	Yes
Bird Survey	20 minute area search
MDC Deployed Yes /No	Yes - MDC SR11
Comments	Habitat not encountered on site before

Site Name	WP23 - Haul Road
Date	16/11/2013
Ecologist	MP, KG
Camera ID	KG Iphone
Photo Nr	
GPS ID	GPS1
Waypoint	WP23
Landform	Plain
Location description	Triodia grassland under sparse straggly mallees to 3 metres. Occasional purple bush (frankenia??) and scaevola. Occasional Allocasuarina that can form groves.
Soil Type	Loam
Soil Colour	Light Brown
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Open Mallee over Triodia grassland
Vegetation Condition	Good
Burn notes	Long unburnt
Leaf Litter Cover	Low, some accumulating under mallees
Coarse Woody Debris	Low
Snail Shells	7 per 50 metre transect
Foraged Yes/No	No
Man Hours	N/A
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	

Site Name	WP25 - Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No Photo
GPS ID	GPS 1
Waypoint	WP25
Landform	Flat
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum. Occasional Melaleuca thickets (as per trap site 3) and occasional patches of *Diocirea ternata*
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	WP26 - Haul Road
Date	16/11/2013
Ecologist	MP, KG
Camera ID	KG Iphone
Photo Nr	No photos
GPS ID	GPS1
Waypoint	WP26
Landform	Plain
Location description	Triodia plain under sparse straggly mallees to 3 metres. Occasional purple bush (frankenia??) and scaevola. Occasional Allocasuarina that can form groves.
Soil Type	Loam
Soil Colour	Light Brown
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Open Mallee over Triodia grassland
Vegetation Condition	Good
Burn notes	Long unburnt
Leaf Litter Cover	Low, some accumulating under mallees
Coarse Woody Debris	Low
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	N/A
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	

Site Name	WP28 - Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No Photo
GPS ID	GPS 1
Waypoint	WP28
Landform	Flat
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum. Occasional Melaleuca thickets (as per trap site 3) and occasional patches of *Diocirea ternata*
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	WP30 - Haul Road
Date	16/11/2013
Ecologist	MP, KG
Camera ID	KG Iphone
Photo Nr	No photos
GPS ID	GPS1
Waypoint	WP30
Landform	Plain
Location description	Triodia plain under sparse straggly mallees to 3 metres. Occasional purple bush (frankenia??) and scaevola. Occasional Allocasuarina that can form groves.
Soil Type	Loam
Soil Colour	Light Brown
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Open Mallee over Triodia grassland
Vegetation Condition	Good
Burn notes	Long unburnt
Leaf Litter Cover	Low, some accumulating under mallees
Coarse Woody Debris	Low
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	N/A
Litter Collected	No
Bird Survey	Opportunistic
MDC Deployed Yes /No	No
Comments	

Site Name	WP 31
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No Photo - Haul Road
GPS ID	GPS 1
Waypoint	WP31
Landform	Flat
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum. Occasional Melaleuca thickets (as per trap site 3) and occasional patches of Diocirea ternata
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	WP 32 - Haul Road
Date	16/11/2013
Ecologist	MP, KG
Camera ID	KG Iphone
Photo Nr	7239-7244
GPS ID	GPS1
Waypoint	WP 32
Landform	Wash zone (water infilitration evident - cracks - but no defined channel - suggesting water pools them infiltrates but is not fast flowing)
Location description	Mixed shrubs (exocarpus, atriplex numularia, eremophila to 2 metres) with occasional emergent mallee to 4 metres. Occasional patches of triodia
Soil Type	Loam
Soil Colour	Red
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Mixed shrubs (exocarpus, atriplex numularia, eremophila to 2 metres) with occasional emergent mallee to 4 metres. Occasional patches of triodia
Vegetation Condition	Good
Burn notes	Unburnt
Leaf Litter Cover	Low, accumulating only at the base of shrubs
Coarse Woody Debris	Low
Snail Shells	1 snail per 50 metre transect
Foraged Yes/No	Yes
Man Hours	1.5 hours
Litter Collected	No
Bird Survey	Opportunistic
MDC Deployed Yes /No	No
Comments	

Site Name	WP33 Haul Road
Date	16/11/2013
Ecologist	MP, KG
Camera ID	KG Iphone
Photo Nr	7246-7248
GPS ID	GPS1
Waypoint	WP33
Landform	Plain
Location description	Allocasurina grove over Triodia with occasional emergent Eucalypts
Soil Type	Loam
Soil Colour	Light Brown
Rocks	Outcropping granite
Habitat Notes	Allocasurina grove within Open Mallee over Triodia grassland
Vegetation Condition	Good
Burn notes	Long unburnt
Leaf Litter Cover	Low, some accumulating under trees
Coarse Woody Debris	Low
Snail Shells	No transect
Foraged Yes/No	No
Man Hours	N/A
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	

Site Name	WP 34 – Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	7250-7253
GPS ID	GPS 1
Waypoint	WP34
Landform	Flat (but higher ground than the spinifex plain)
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum. Occasional Melaleuca thickets (as per trap site 3) and occasional patches of *Diocirea ternata*
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	WP35 - Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No Photos
GPS ID	GPS 1
Waypoint	WP35
Landform	Flat (but on lower slope that in the cratystylis)
Location description	Border of open Eucalyptus woodland over cratystylis and Open Mallee over Triodia grassland
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Border of open Eucalyptus woodland over cratystylis and Open Mallee over Triodia grassland
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs in the Cratystylis
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	WP 36 - Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No photo
GPS ID	GPS 1
Waypoint	WP36
Landform	Flat (but higher ground than the spinifex plain)
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum. Occasional Melaleuca thickets (as per trap site 3) and occasional patches of *Diocirea ternata*
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	WP 37 - Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	7255-7257
GPS ID	GPS 1
Waypoint	WP37
Landform	Flat (but higher ground than the spinifex plain)
Location description	Open Eucalyptus woodland over senna
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over a small patch of senna dominated understory
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	WP 38 - Haul Road
Date	16-Nov-13
Ecologist	KG, MW
Camera ID	KG iphone
Photo Nr	7259-7262
GPS ID	GPS 1
Waypoint	WP 38
Landform	Flat
Location description	Regenerating woodland
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Dense regenerating Eucalyptus woodland - (dominated by tall saplings).
Vegetation Condition	Regenerating from a cool burn (burn aprox 5-10 years ago)
Burn notes	Cool burn
Leaf Litter Cover	Patchy and thick under bushes (<3 cm thick).
Coarse Woody Debris	Abundant course woody debris and fallen logs with hollows
Snail Shells	No transect
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	

Site Name	WP39 - Haul Road
Date	16/11/2013
Ecologist	MP, KG
Camera ID	KG Iphone
Photo Nr	No photos
GPS ID	GPS1
Waypoint	WP 39
Landform	Plain
Location description	Triodia plain under sparse straggly mallees to 3 metres. Occasional purple bush (frankenia??) and scaevola. Occasional Allocasuarina that can form groves.
Soil Type	Loam
Soil Colour	Light Brown
Rocks	Nil - surface sprinking of iron pisolith only
Habitat Notes	Open Mallee over Triodia grassland
Vegetation Condition	Good
Burn notes	Long unburnt
Leaf Litter Cover	Low, some accumulating under mallees
Coarse Woody Debris	Low
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	N/A
Litter Collected	No
Bird Survey	Opportunistic
MDC Deployed Yes /No	No
Comments	

Site Name	WP 40 - Haul Road
Date	16/11/2013
Ecologist	KG and MP
Camera ID	KG Iphone
Photo Nr	No photo
GPS ID	GPS 1
Waypoint	WP 40
Landform	Flat (but higher ground than the spinifex plain)
Location description	Open Eucalyptus woodland over cratystylis
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Open Eucalyptus woodland (15 metres) over cratystylis dominated shrubland with scattered eromophila, atriplex, olearia and santalum. Occasional Melaleuca thickets (as per trap site 3) and occasional patches of *Diocirea ternata*
Vegetation Condition	Good
Burn notes	Long Unburnt
Leaf Litter Cover	Patch undershrubs (20-30%), 1 cm to 4 cm deep
Coarse Woody Debris	Lots of big fallen timber and fallen hollow logs
Snail Shells	No transect undertaken
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	Very similar in habitat to Trap Site 2

Site Name	WP 51 - Haul Road
Date	16-Nov-13
Ecologist	KG, MP
Camera ID	KG iphone
Photo Nr	7341-7344
GPS ID	GPS 1
Waypoint	WP 51
Landform	Flat
Location description	Regenerating woodland
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Dense regenerating Eucalyptus woodland - (dominated by tall saplings).
Vegetation Condition	Regenerating from a cool burn (burn aprox 7-10 years ago) , gridlines and survey bags
Burn notes	Cool burn
Leaf Litter Cover	Patchy and thick under bushes (<3 cm thick).
Coarse Woody Debris	Abundant course woody debris and fallen logs with hollows
Snail Shells	No transect
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	

Site Name	WP 52 - Haul Road
Date	16-Nov-13
Ecologist	KG, MP
Camera ID	KG iphone
Photo Nr	7341-7344
GPS ID	GPS 1
Waypoint	WP 52
Landform	Flat
Location description	Regenerating woodland
Soil Type	Powdery loam
Soil Colour	Red/Brown
Rocks	Nil
Habitat Notes	Dense regenerating Eucalyptus woodland - (dominated by tall saplings).
Vegetation Condition	Regenerating from a cool burn (burn aprox 7-10 years ago) , gridlines and survey bags
Burn notes	Cool burn
Leaf Litter Cover	Patchy and thick under bushes (<3 cm thick).
Coarse Woody Debris	Abundant course woody debris and fallen logs with hollows
Snail Shells	No transect
Foraged Yes/No	No
Man Hours	No
Litter Collected	No
Bird Survey	No
MDC Deployed Yes /No	No
Comments	

Site Name	FSH02 - Haul Road
Date	14-Nov-13
Ecologist	MW, CS, FH
Camera ID	MW
Photo Nr	328, 329, 330
GPS ID	MW
Waypoint	FSH02
Landform	Elevated plain
Location description	Regenerating woodland (dense whipstick mallee up to 3 metres) over eremophila shrubs over low heathshrubs bordering patches of spinifex with emergent shrubs and mallee in the lower part of the landscape.
Soil Type	Loam (soft and deep)
Soil Colour	Orange - Brown
Rocks	Nil
Habitat Notes	Dense regenerating Eucalyptus woodland - (dominated by tall saplings).
Vegetation Condition	Regenerating from a cool burn (burn aprox 7-10 years ago), gridlines
Burn notes	Cool burn
Leaf Litter Cover	Patchy under bushes
Coarse Woody Debris	Abundant course woody debris and fallen logs with hollows
Snail Shells	1 snail observed in 50 metres
Foraged Yes/No	Yes
Man Hours	1.5
Litter Collected	Yes
Bird Survey	20 minute 1 ha area search
MDC Deployed Yes /No	No
Comments	Similar habitat to trapsite 5

Site Name	FSH01 (WP18) - Haul Road
Date	14-Nov-13
Ecologist	MW, CS, FH
Camera ID	MW
Photo Nr	103-325 to 326
GPS ID	MW
Waypoint	FSH01 (WP18)
Landform	Gently sloping plain
Location description	Triodia grassland with emergent mallees
Soil Type	Loam with rocks and pebbles
Soil Colour	orange-brown
Rocks	Rocks and pebbles (laterite) on surface
Habitat Notes	Open Mallee over Triodia grassland
Vegetation Condition	Good, evidence of an old fire, gridlines
Burn notes	Evidence of an old burn
Leaf Litter Cover	Patchy under eucalypts
Coarse Woody Debris	Debris limited to twigs and sticks
Snail Shells	1 snail observed in 50 metres
Foraged Yes/No	Yes
Man Hours	1.5
Litter Collected	Yes
Bird Survey	20 minute 1 ha area search
MDC Deployed Yes /No	No
Comments	

Site Name	FSH03 - Haul Road
Date	14-Nov-13
Ecologist	MW, CS, FH
Camera ID	MW
Photo Nr	103-331
GPS ID	MW
Waypoint	FSH03
Landform	plain
Location description	Regenerating woodland (dense whipstick mallee up to 3 metres) over eremophila over shrubs forming a heath layer (melaleuca)
Soil Type	Loam
Soil Colour	Orange - Brown
Rocks	lateritic pebbles on surface
Habitat Notes	Dense regenerating Eucalyptus woodland - (dominated by tall saplings).
Vegetation Condition	Regenerating from a cool burn (burn aprox 7-10 years ago), gridlines
Burn notes	Cool burn
Leaf Litter Cover	Patchy - dense under bushes
Coarse Woody Debris	Abundant course woody debris and fallen logs with hollows
Snail Shells	1 snail observed in 50 metres
Foraged Yes/No	Yes
Man Hours	1.5
Litter Collected	Yes
Bird Survey	20 minute 1 ha area search
MDC Deployed Yes /No	No
Comments	Similar habitat to trapsite 5 and FSH02

Site Name	FSH04 - Haul Road
Date	15-Nov-13
Ecologist	MW, CS, FH
Camera ID	MW
Photo Nr	332-334
GPS ID	MW
Waypoint	FSH04
Landform	plain
Location description	Regenerating woodland (dense whipstick mallee up to 3 metres) over heathy shrubs (melaleuca)
Soil Type	Loam
Soil Colour	Orange - Brown
Rocks	scattered lateritic pebbles on surface
Habitat Notes	Dense regenerating Eucalyptus woodland - (dominated by tall saplings).
Vegetation Condition	Regenerating from a cool burn (burn aprox 7-10 years ago), gridlines
Burn notes	Cool burn
Leaf Litter Cover	Patchy - dense under bushes (covering 60%, more than 5 cm deep in places).
Coarse Woody Debris	Abundant course woody debris and fallen logs with hollows
Snail Shells	1 snail observed in 50 metres
Foraged Yes/No	Yes
Man Hours	1.5
Litter Collected	Yes
Bird Survey	20 minute 1 ha area search
MDC Deployed Yes /No	Yes -(KBC 002 - MDCFSH04)
Comments	Similar habitat to trapsite 5, FSH01 amd FSH02

Appendix III Malleefowl Mound Profiles

Profile 1 Mound

Profile 2 Mound

Profile 3 Mound

Profile 4 Mound

Profile 5 Mound

Profile 6 Mound

Appendix IV Bat Call Analysis Results

Bat call identification

from near Norseman, WA

Type:	Acoustic analysis
Prepared for:	Rapallo Pty Ltd
Date:	29 January 2013
Job No.:	SZ334
Prepared by:	Kyle Armstrong and Yuki Konishi Specialised Zoological ABN 92 265 437 422 Tel 0404 423 264 kyle.n.armstrong@gmail.com http://www.szool.com.au

SUMMARY

Bat identifications from acoustic recordings are provided from a project area c. 140 km north-east of Norseman, in the Goldfields region of Western Australia. At least six species of bat were identified as being present (**Tables 1** and **2**). Representative echolocation pulses are provided (**Figure 1**), as recommended by the Australasian Bat Society (ABS 2006). Further data are available should verification be required.

COMMENTS ON IDENTIFICATIONS

Call sequences attributed to long-eared bats *Nyctophilus* spp. could not be identified reliably to one species in each case. They may derive from either the lesser long-eared bat *Nyctophilus geoffroyi* or the central greater long-eared bat *Nyctophilus major tor*. In addition, the short duration call types of the chocolate wattled bat *Chalinolobus morio* and the southern forest bat *Vespadelus regulus* were examined carefully to avoid misattribution to a species of *Nyctophilus*.

Some calls of Gould's wattled bat *Chalinolobus gouldii* and the two candidate free-tailed bats *Mormopterus* sp. 3 and *Mormopterus* sp.4 are similar and can be difficult to distinguish. At all sites (unless indicated), there were sufficient high quality examples to make identifications at the level of genus based on both pulse shape and sequence patterns, however the two candidate *Mormopterus* could not be separated from each other.

METHODS

Data recorded in full spectrum lossless WAC0 format with Wildlife Acoustics SM2BAT+ bat detectors (sampling rate 384 kHz; trigger 6 dB above background; 48 dB gain; set to turn on automatically at sunset and off at sunrise) was converted to both WAV and Zero Crossings Analysis (ZCA) format using Kaleidoscope 1.1.22 software (using the "advanced signal enhancement" option). Identification was made from both WAV and ZCA files following inspection in AnalookW v.3.9f and Adobe Audition CS6 v.5.0.2. Species were identified based on information in Fullard et al (1991), and nomenclature follows Van Dyck et al. (2013).

REFERENCES

ABS (2006). Recommendations of the Australasian Bat Society Inc for reporting standards for insectivorous bat surveys using bat detectors. *The Australasian Bat Society Newsletter* 27: 6–9. [ISSN 1448-5877]

Fullard, J.H., Koehler, C., Surlykke, A. and McKenzie, N.L. (1991). Echolocation ecology and flight morphology of insectivorous bats (Chiroptera) in south-western Australia. *Australian Journal of Zoology* 39: 427–438.

Van Dyck, S., Gynther, I. and Baker, A. (eds.) (2013). *Field companion to the Mammals of Australia*. New Holland, London.

TABLE 1. Species identified in the present survey from all sites combined.

VESPERTILIONIDAE	
Gould's wattled bat	*Chalinolobus gouldii*
Chocolate wattled bat	*Chalinolobus morio*
Southern forest bat	*Vespadelus regulus*
MOLOSSIDAE	
White-striped free-tailed bat	*Austronomus australis*
Ambiguous	
Vespertilionidae	
Lesser long-eared bat	*Nyctophilus geoffroyi* /
and/or Central greater long-eared bat	*Nyctophilus major tor*
Molossidae	
Inland free-tailed bat	*Mormopterus* sp. 3 /
and/or South-western free-tailed bat	*Mormopterus* sp. 4

TABLE 2. Species identifications, with the degree of confidence indicated by a code. See **Table 1** for full species names.

Date	Site	Lat	Long	*A. australis*	*C. gouldii*	*C. morio*	*Mormopterus* sp.	*Nyctophilus* sp.	*V. regulus*
15/11/2013	Trap Site 1	-31.80191	123.16053	◆	◆	◆	—	—	◆
14/11/2013	Trap Site 2	-31.80101	123.21992	—	◆	—	NC	—	◆
12/11/2013	Trap Site 3	-31.83808	123.17422	◆	◆	◆	NC	NC	◆
13/11/2013	Trap Site 3	-31.83808	123.17422	◆	◆	◆	NC	NC	◆
11/11/2013	Trap Site 4	-31.82982	123.22833	◆	◆	◆	NC	—	◆
"31/12/1999"	camp dam	-31.82302	123.19068	◆	◆	◆	NC	NC	◆
"01/01/2000"	camp dam	-31.82302	123.19068	◆	◆	◆	NC	—	◆

***Note: dates were corrupted on some recordings*

Definition of confidence level codes:

— Not detected.

◆ Unambiguous identification of the species at the site based on measured call characteristics and comparison with available reference material. Greater confidence in this ID would come only after capture and supported by morphological measurements or a DNA sequence.

NC Needs Confirmation. Either call quality was poor, or the species cannot be distinguished reliably from another that makes similar calls. Alternative identifications are indicated in the *Comments on identifications* section of this report. If this is a species of conservation significance, further survey work might be required to confirm the record.

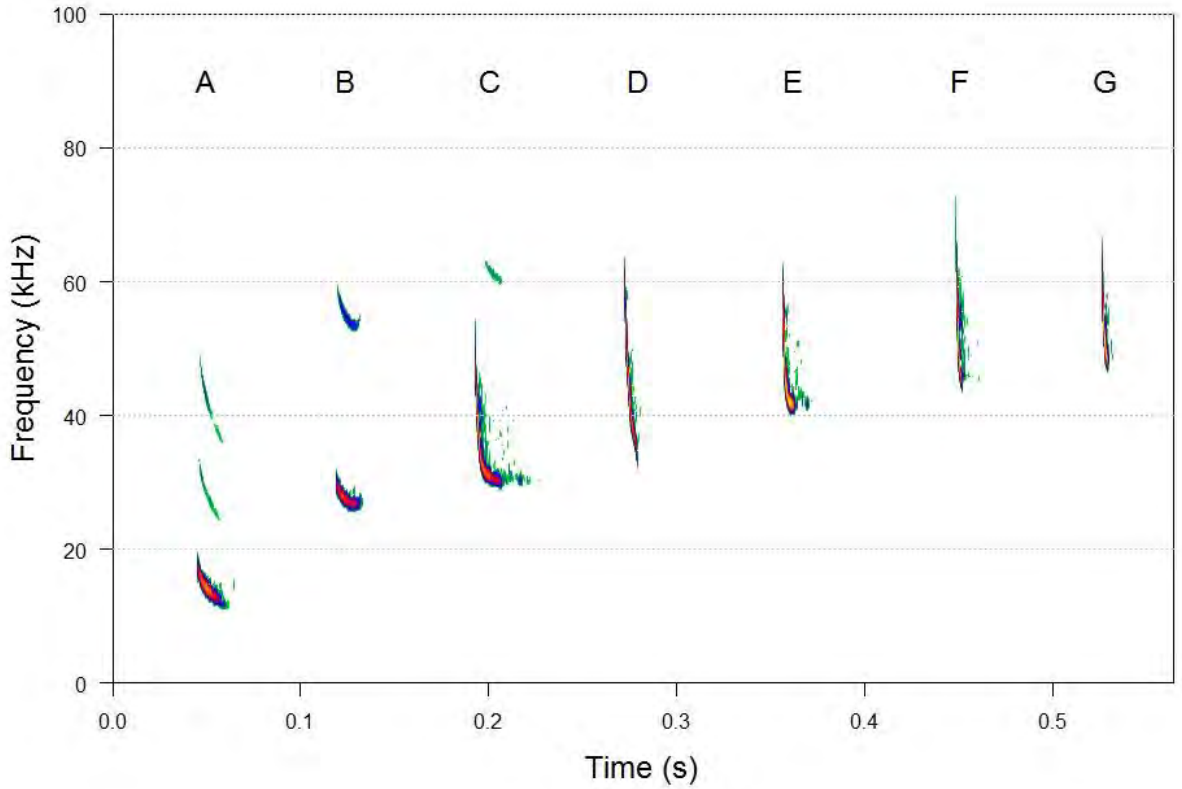

FIGURE 1. Representative echolocation pulses of the species identified (**A**: White-striped free-tailed bat *A. australis*; **B**: Unidentified free-tailed bat *Mormopterus* sp.; **C**: Gould's wattled bat *C. gouldii*; **D**: Unidentified long-eared bat *Nyctophilus* sp. (lower frequency type); **E**: Southern forest bat *V. regulus*; **F**: Unidentified long-eared bat *Nyctophilus* sp. (higher frequency type); **G**: Chocolate wattled bat *C. morio*.

Appendix V SRE Identification Reports

PHOENIX
ENVIRONMENTAL SCIENCES

Identification and assessment of short-range endemism of invertebrates from approximately 95 km north-west of Balladonia, Western Australia

Prepared for Rapallo

January 2014

Taxonomic Report

Identification and assessment of short-range endemism of invertebrates from approximately 95 km north-west of Balladonia, Western Australia

Prepared for Rapallo

Taxonomic Report

Authors: Volker Framenau

Reviewer: Erich Volschenk

Date: 24 Januar 2014

Submitted to: Chris Cooper (Rapallo)

Chain of authorship and review			
Name	Task	Version	Date
Volker Framenau	Draft for technical review	1.1	22 January 2014
Erich Volschenk	Technical review	1.2	23 January 2014
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EXECUTIVE SUMMARY

In December 2014, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Rapallo to identify invertebrates collected approximately 95 km north-west of Balladonia, Western Australia. A total of eleven specimens were identified and screened for short-range endemic (SRE) invertebrate taxa.

There are uncertainties in determining the range-restrictions of many invertebrates in Western Australia due to lack of surveys, lack of taxonomic resolutions within target taxa and problems in identifying certain life stages. To account for these uncertainties Phoenix uses a three-tier categorisation for short-range endemism: confirmed SRE, likely SRE and potential SRE.

The material included at least seven morphospecies in five genera and four families.

The material included two potential SREs:

- *Aganippe* sp. indet. (Idiopidae – true trapdoor spiders): morphologically unidentifiable female; SRE rating based on distribution patterns within the genus
- *Aname* sp. indet (not *Aname* 'MYG181'). (Nemesiidae – wishbone spiders): morphologically unidentifiable female; SRE rating based on distribution patterns within the genus.

1 SCOPE OF WORKS

In December 2014, Phoenix Environmental Sciences Pty Ltd (Phoenix) was commissioned by Rapallo to identify invertebrates collected approximately 95 km north-west of Balladonia, Western Australia. A total of eleven specimens were identified and screened for short-range endemic (SRE) invertebrate taxa.

2 BACKGROUND

2.1.1 Short-range endemic invertebrates

Short-range endemic fauna are defined as animals that display restricted geographic distributions, nominally less than 10,000 km^2, that may also be disjunct and highly localised (Harvey 2002; Ponder & Colgan 2002). The most appropriate analogy is that of an island, where the movement of fauna is restricted by the surrounding marine waters, therefore isolating the fauna from other terrestrial populations. Isolating mechanisms and features such as roads, urban infrastructure, large creek lines and ridges can act to prevent the dispersal and gene flow of the less mobile invertebrate species.

Short-range endemism in terrestrial invertebrates is believed to have evolved through two primary processes (Harvey 2002):

- **Relictual short-range endemism**: relictual SREs are thought to have had wider distributions during more mesic geological periods. Australia's aridification over the last 60 million years resulted in a contraction of the ranges of these species into relatively small habitat pockets where moist conditions persist (relictual Gondwanan habitats). Evolutionary processes over long periods of isolation typically resulted in each population developing into a distinctive species. Millipedes and slaters are typical relictual SREs and they are generally found in deep gullies often on the south-facing slopes of mountains, hills and ridges. Relictual SREs often inhabit areas with: high rainfall, areas where topography induces fog, areas with permanent water (swamps, creek lines and river systems) or deep litter beds. Sometimes habitats have various combinations of these features.
- **Habitat specialisation**: habitat specialist SREs may have settled in particular isolated habitat types by means of dispersal or phoresy (transport of one organism by another) and evolved in isolation into distinct species. Such habitat islands include rocky outcrops (pseudoscorpions in the genus *Synsphyronus* or spiders in the family Selenopidae are typical examples) or salt lakes (e.g. wolf spiders of the genus *Tetralycosa*). Unlike relictual SREs in mesic habitats, habitat specialist SREs are restricted by environmental parameters other than humidity and are often found in arid environments such as the Pilbara.

Invertebrate groups that contain SRE taxa are generally well distributed across the Australian landscape and well adapted to semi-arid environments due to a variety of behavioural and morphological features that have developed to avoid desiccation and predation. They generally possess (Harvey 2002):

- poor powers of dispersal
- confinement to discontinuous habitats
- seasonality, i.e. only active in cooler or wetter months
- slow growth
- low levels of fecundity.

2.1.2 Categories of short-range endemism

There is uncertainty in categorising a specimen as SRE which originates in a number of factors including:

- **Poor regional survey density** (sometimes taxon-specific): A regional fauna is simply not known well enough to assess the distribution of species. This factor also considers the fact that, simply because a species has not been found regionally, does not mean it is really absent; this confirmation ('negative proof') is almost impossible to obtain ('absence of proof is not proof of absence').
- **Lack of taxonomic resolution**: many potential SRE taxa (based on habitat constraints, SRE status of closely related species, or morphological peculiarities such as troglomorphism) have never been taxonomically treated and identification to species level is very difficult or impossible as species-specific character systems have not been defined. Good taxonomic resolution does not necessarily require a published revision, but generally requires a taxonomist to be actively working on this group or a well-established, preferably publicly available, reference collection (i.e. museum collection).
- **Problems of identification**: SRE surveys often recover life stages of potential SRE taxa that cannot be confidently identified based on morphological characters, even if revisions exist. These include, for example, juvenile or female millipedes, mygalomorph spiders and scorpions. Molecular techniques are increasingly being employed to overcome these identification problems.

Currently, there is no accepted system to determine the likelihood that a species is an SRE. The WA Museum has recently introduced a three tier-rating (confirmed, potential and not SRE - widespread) (Western Australian Museum 2013). In contrast, Phoenix employs a system that differentiates an additional level of short-range endemism, 'likely', which, in comparison to the WA Museum, discriminates further to facilitate setting conservation or management priorities (Table 2-1). These categories are dynamic and can change with every single survey as knowledge of SRE status is updated. For example, the millipede *Austrostrophus stictopygus* (order Spirobolida) has been shown to be widespread in the Pilbara based on material collected as part of environmental assessment studies, following its initial description from few localities (Harvey *et al.* 2011; Hoffman 2003).

Life stages of species that cannot be identified at the species level, e.g. some females and juveniles, are assessed based on the knowledge of the higher taxon they belong to, i.e. family or genus. For example, all juvenile or female *Antichiropus* millipedes would be classified as 'confirmed SRE' as all but a few of the 140+ known species in this genus are currently considered SREs (Wojcieszek *et al.* 2011).

Although the different categories of 'SRE-likelihood' may help to set conservation priorities, SRE taxa of all categories should be assessed on their merit, in order to determine appropriate conservation measures that adhere to the Precautionary Principle within environmental impact assessments. That is, "*where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation*" (EPA 2002).

Table 2-1 Phoenix SRE categories reflecting survey, taxonomic and identification uncertainties

SRE category	Criteria	Typical representative
Confirmed	Confirmed or almost certainly SRE; taxonomy of the group is well known (but not necessarily published); group well represented in collections, in particular from the region in question; high levels of endemism in documented species; inference is often possible from immature specimens	*Antichiropus* millipedes (Paradoxosomatidae); scorpions in the genus *Aops* (Urodacidae)
Likely	Taxonomically poorly resolved group; unusual morphology for the group (i.e. some form of troglomorphism); often singleton in survey and few, if any, regional records	Opiliones in the genus *Dampetrus*; some pseudoscorpions (*Synsphyronus*) and slaters (Philosciidae); araneomorph spiders in the genus *Karaops* (Selenopidae)
Potential	Taxonomically poorly resolved group; often common in certain microhabitats in SRE surveys (i.e. litter dwellers), but no other regional records; congeners often widespread	Many mygalomorph spiders; some centipedes (Cryptopidae; Geophilomorpha)
Widespread	Taxonomically well resolved (but often not published) and demonstrated wide distribution (i.e. > 10,000 km^2)	

2.2 IDENTIFICATION AND PERSONNEL

All taxa were examined in 70% or 100% ethanol under Leica M80 and M205C stereomicroscopes.

The method of identification for each taxon, i.e. by taxonomic literature or comparison with type or other reference material, is indicated in the taxonomic part of this report. Phoenix personnel involved in the identification are listed in Table 2-2.

Table 2-2 Phoenix personnel involved in identification

Name	Qualifications	Taxa
Dr Volker Framenau	Ph.D. (Zool.)	Araneae
Dr Erich Volschenk	Ph.D. (Zool.)	Scorpiones

2.3 TAXONOMY AND NOMENCLATURE

The taxonomic nomenclature of invertebrates follows the references detailed in Table 2-3.

Morphospecies designations of undescribed species are generally adopted from the parataxonomic framework of the scientist(s) working on the group. These informal morphospecies names are given between apostrophes. These names are not valid under the International Code of Zoological Nomenclature (ICZN 1999) and therefore not written in italics.

The Phylogenetic Species Concept, as defined by Cracraft (1983) is adopted when delineating morphospecies.

Table 2-3 Nomenclatural references, morphospecies designations and reference collections for the invertebrates from approximately 95 km north-west of Balladonia, Western Australia

Taxonomic group	Taxonomic reference for described species and higher taxa	Morphospecies designation and reference collection
Araneae (Mygalomorphae)	Platnick (2013)	"MYG"- morphospecies designation developed by V.W. Framenau (WAM, Phoenix), reference collection at WAM
Scorpiones	Fet *et al.* (2000), Glauert (1925), Koch, (1977), Kovařík (1997), Kovařík (2002), Volschenk and Prendini (2008), Volschenk *et al.* (2000) Volschenk *et al.* (2012)	Morphospecies designation developed by E.S. Volschenk (WAM, Phoenix), reference collection at WAM

2.4 SPECIMEN DEPOSITORY

The EPA guidance statement No. 20 ('*Sampling of short-range invertebrate fauna for environmental impact assessment in Western Australia*') (EPA 2009) recommends that all specimens representing SRE target groups are lodged with the WAM to enhance the knowledge of the distribution of putatively rare species. Phoenix adheres to this recommendation and the survey specimens will be lodged with the WA Museum.

3 RESULTS

3.1 SUMMARY

The material included at least seven morphospecies in five genera and four families (Table 3-1; Appendix 1). The material included two potential SREs (Table 3-1).

Table 3-1 Distribution (SRE status) of target invertebrates from approximately 95 km north-west of Balladonia, Western Australia

Higher taxon	Species	SRE status	Remarks
Araneae (spiders)			
Dipluridae	*Cethegus ischnotheloides*	Widespread	
Idiopidae	*Aganippe* sp. indet.	Potential	Unidentified female only, genus contains widespread and range-restricted species
Nemesiidae	*Aname tepperi*	Widespread	
	Aname 'MYG181'	Widespread	
	Aname sp. indet. (not *Aname* 'MYG181')	Potential	Unidentified female only, genus contains widespread and range-restricted species
Scorpiones (scorpions)			
Buthidae	*Isometroides* 'balladonia'	Widespread	Only known from this survey, SRE rating based on distribution patterns of species within the genus
	Lychas 'adonis'	Widespread	

3.2 ARANEAE – MYGALOMORPHAE (TRAPDOOR SPIDERS)

The Araneae (spiders) are characterised by a number of unique characters, including abdominal appendages modified as spinnerets, silk glands and associated spigots, cheliceral venom glands and male pedipalp tarsi modified as secondary genitalia from sperm transfer (Coddington & Levi 1991). Spiders are one of the largest and most diverse orders of arachnids with more than 40,000 described species worldwide (Platnick 2013), and approximately 3,400 species named from Australia (Framenau 2013).

Trapdoor spiders represent one of the focal groups in surveys of SRE taxa (Harvey 2002). A number of mygalomorph spiders, e.g. *Idiosoma nigrum, Kwonkan eboracum* and *Moggridgea tingle* are listed on Schedule 1 of the *Wildlife Conservation (Specially Protected Fauna) Notice 2013* (Western Australian Government 2013). The Western Australian mygalomorph fauna is vast and many families and genera remain taxonomically poorly known (e.g. Barychelidae: *Idiommata*; Idiopidae: *Aganippe*; Nemesiidae: *Aname*, *Chenistonia*, *Kwonkan*).

3.2.1 Family Dipluridae (curtain-web Spiders)

Six genera of the Dipluridae are currently known from Australia, including *Australothele*, *Caledothele*, *Carrai*, *Cethegus*, *Masteria* and *Namirea*, of which only *Cethegus* is found in Western Australia (Raven 1984, 1985a). Diplurids are known as curtain-web spiders due to the shape of their webs, which consist of numerous strands of silk hanging across the entrance of their burrows.

3.2.1.1 Genus *Cethegus*

The genus *Cethegus* currently includes 11 named species in Australia, including two, *C. fugax* (Simon, 1908) and *C. ischnotheloides* Raven, 1985, from Western Australia (Ecologia 2009; Main 1960; Raven 1984). A number of undescribed species from many different regions of the state are known from the collection of the Western Australian Museum. The status and distribution of these species are not well understood and detailed taxonomic work is needed to understand the Western Australian fauna. A recent molecular study on species in the *C. fugax*-complex from the Murchison region of WA discovered these spiders to be different to the nominal species *C. fugax* from the Jarrah forests around Perth and showed high intra-specific genetic divergence between subpopulation of different mountain ranges within the region, possibly caused by limited dispersal capabilities (Ecologia 2009). Most species from WA appear to belong to the *C. fugax*-complex which is characterised by dark patches on the booklung covers a long, curved embolus of the male pedipalp (Raven 1984).

The nest of *Cethegus* includes vertical, curtain-like strands of silk with adherent soil. At the centre of the nest are two or three funnel-like tubes that join into a common tube leading into a shallow burrow. Radiating from the main web are catching strands which entrap both crawling and flying insects. The nests may be up to thirty centimetres in height and width and they are generally supported against stems of trees or shrubs, tussocks of grass, logs or irregularities in soil such as banks or rocks. Mating and reproduction appears to depend on prevailing seasonal conditions in relation to region or location. Emergent spiderlings may be aerially dispersed over short distances (i.e. several meters) (Main 1995).

Cethegus ischnotheloides

Cethegus ischnotheloides occurs from central Western Australia into South Australia. It is not an SRE (Raven 1985a).

3.2.2 Family Idiopidae (true trapdoor spiders)

The mygalomorph spider family Idiopidae includes a number of genera in Western Australia, including *Anidiops*, *Gaius* (currently listed as junior synonym of *Anidiops*), *Euoplos*, *Blakistonia*, *Cataxia*, *Eucyrtops*, *Idiosoma* and *Misgolas* (Main 1985; Raven & Wishart 2005). They comprise the 'typical' trap door spiders, i.e. those species that usually close the burrow with a hinged door. Spiders of this family are abundant in Australia, in particular in relatively stable habitats in temperate to tropical regions (Main 1985).

3.2.2.1 Genus *Aganippe*

The idiopid genus *Aganippe* is common throughout Western Australia. Fourteen species are described from Australia and many new species await description (Main 1985). The genus has close morphological affinities to *Idiosoma*, as representatives of both genera have abdominal sigillae. However, *Idiosoma* differs from *Aganippe* by the larger size of the posterior sigillae, a generally more rugose abdomen that is posteriorly flattened in females and short tubercles on the finger-like process of the male pedipalp (Main 1985). *Aganippe* contains widespread and some range-restricted species and unidentified specimens are therefore considered potential SREs.

***Aganippe* sp. indet.**

The material included a single female of *Aganippe.* Based on known distribution patterns of *Aganippe*, it is considered a potential SRE.

3.2.3 Family Nemesiidae (wishbone trapdoor spider)

Members of the mygalomorph spider family Nemesiidae are represented in Western Australia by several genera, including *Aname*, *Chenistonia*, *Yilgarnia*, *Stanwellia*, *Teyl*, *Swolnpes* and *Kwonkan* (Main & Framenau 2009). They usually dig burrows in the soil, and do not cover their burrow entrances with lids.

3.2.3.1 Genus *Aname*

The genus *Aname* currently includes 37 named species in Australia and is well represented by four named and numerous unnamed species from many different regions in Western Australia. *Aname* currently represent a highly diverse array of species of very small to large spiders. Males generally have a spur and spine on the first tibia of males opposing an often incrassate metatarsus.

Members of the genus *Aname* are believed to be most common in sclerophyll forest, but are also known from rainforests and deserts (Raven 1981). *Aname* regularly belongs to the most diverse mygalomorph genera in biological spider surveys and with 12 species the Pilbara survey (Durrant *et al.* 2010) resulted in a similar number as found during the Carnarvon Basin survey (13 species) (Main *et al.* 2000). Many *Aname* species appear to have restricted distributions as shown by two studies from northern Australia, including the Pilbara (Harvey *et al.* 2012; Raven 1985b). Therefore, unidentifiable specimens are considered potential SREs.

Aname tepperi

Aname tepperi is a species that is widespread in southwest and central WA and also occurs into SA (Main 1982). It is not a short-range endemic species.

***Aname* 'MYG181'**

Aname 'MYG181' is characterised by a distinct male genital morphology, in particular a short embolus. It is known from a number of widely separated localities in south-eastern Western Australia, including west of Norseman (Forrestania) and and south-east of Kalgoorlie (Aldiss) and is therefore not an SRE.

A number of females and a juvenile are considered conspecific with Aname 'MYG181', although this can only be confirmed if the fauna of the area is better known or if established with molecular identifications.

***Aname* sp. indet. (not *Aname* 'MYG181')**

The material included a single female of an *Aname* that is clearly not conspecific with *Aname* 'MYG181'. However, species identification and an assessment of distribution pattern requires collection of conspecific males.

3.3 SCORPIONES (SCORPIONS)

Scorpions is a relatively small order of arachnids, with approximately 1,700 described species (Fet & Lowe 2000). Scorpions are instantly recognisable by the presence of chelate pedipalps, pectenes and an elongate metasoma with a terminal sting. Scorpions are infamous for their venomous sting which they use to subdue prey and for defence. In most species the venom is relatively benign, resulting in varying degrees of discomfort. The venom from only 25 species (all members of the family Buthidae) is known to be fatal to people (Fet & Lowe 2000). Scorpions are important predators and in some ecosystems their diversity and abundance contribute significantly to the biomass of animal assemblages (Polis 1993; Smith 1990, 1998).

3.3.1 Family Buthidae

The family Buthidae is the most diverse and widespread of all scorpion families (Fet & Lowe 2000). In Australia, Buthidae are represented by the genera *Australobuthus*, *Isometrus*, *Isometroides*, *Lychas*, and *Hemilychas*. In Western Australia, only the genera *Isometrus*, *Isometroides* and *Lychas*, have been recorded. The taxonomy of the constituent species of *Isometrus*, *Isometroides* and *Lychas* is very problematic and each genus contains numerous undescribed species, most notably in the genus *Lychas* (E. S. Volschenk, unpublished data). Most Authors refer to Koch (1977) for keys and identification. This revision represents an important study of the Australian scorpions; however, several taxonomic decisions made by Koch (1977) have been rejected by subsequent authors and the taxonomy in the publication is not up-to-date. Most Australian buthid species appear to have wide distributions; however, a few taxa have confirmed SRE distributions (E. S. Volschenk unpublished data).

3.3.1.1 Genus *Isometroides*

The taxonomy of the species in this genus is extremely poorly known. Only two species are presently recognised, *Isometroides vescus* and *Isometroides angusticaudus*; however, many undescribed species are known. Isometroides are ground dwelling scorpions and are the only scorpion species

known to be a predatory specialist. Main (1956) described the association of this species with burrowing spiders and numerous records have followed of this species preying on, and being found in trapdoor (Mygalomorphae) and wolf spider (Lycosidae) burrows (E.S. Volschenk, unpublished data). Species in this genus never appear to be particularly abundant in pitfall trap samples; the ground disturbance surrounding the pitfall trap may deter them. While their taxonomy is poorly resolved, most morphospecies appear to have fairly wide distributions.

***Isometroides* 'balladonia'**

The material includes two specimens of a so far unknown species of *Isometroides*. Whilst it is difficult ot comment on the distribution of this species, based on known distribution patterns of species within the genus, *Isometroides* 'balladonia' is here not considered an SRE.

3.3.1.2 Genus *Lychas*

The genus *Lychas* is widespread across the Australian mainland. The taxonomy of this genus is problematic, with numerous undescribed species known in Australia (Volschenk *et al.* 2010). The situation is further complicated with the genus being also represented in Africa, India and eastern Asia (Fet & Lowe 2000). All of the Australian species are endemic to the country and are currently under revision by E.S. Volschenk. Most species of *Lychas* appear to have wide distributions; however, a small number of undescribed species are known to be SREs.

***Lychas* 'adonis'**

*Lychas '*adonis' is widespread throughout Western Australia, and is not an SRE.

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Appendix 1 Invertebrates identified from approximately 95 km north-west of Balladonia, Western Australia

Field Number	WAM Rego Number	Order	Family	Species	Males	Females	Juveniles	Total
RAP-15410-TS5-REGEN-MYG-01	T128865	Araneae	Dipluridae	*Cethegus ischnotheloides* Raven, 1985	1			1
RAP-15410-TS1-FACE-MYG-05	T128867	Araneae	Idiopidae	*Aganippe* sp. indet.		1		1
RAP-15410-TS3-MELA-MYG-03	T128870	Araneae	Nemesiidae	*Aname tepperi* (Hogg, 1902)	1			1
RAP-15410-TS5-REGEN-MYG-02	T128866	Araneae	Nemesiidae	*Aname* 'MYG181'	1			1
RAP-15410-TS2-CRATE-MYG-08	PES Reference	Araneae	Nemesiidae	*Aname* 'MYG181'	1			1
RAP-15410-TS5-REGEN-MYG-07	T128869	Araneae	Nemesiidae	*Aname* 'MYG181'		1		1
RAP-15410-TS5-REGEN-MYG-09	T128871	Araneae	Nemesiidae	*Aname* 'MYG181'			1	1
RAP-15410-TS3-MELA-MYG-06	T128868	Araneae	Nemesiidae	*Aname* sp. indet. (not Aname 'MYG181')		1		1
RAP-15410-TS2-CRATE-SCP-10	T128416	Scorpiones	Buthidae	*Isometroides* 'balladonia'		1		1
RAP-15410-TS2-CRATE-SCP-11	T128417	Scorpiones	Buthidae	*Isometroides* 'balladonia'	1			1
RAP-15410-TS5-REGEN-SCP-12	T128401	Scorpiones	Buthidae	*Lychas* 'adonis'	1			1

APPENDIX 3: TARGETED MALLEEFOWL SURVEY OF THE NOVA PROJECT AREA (RAPALLO 2014B)

REPORT No. 15720

Targeted Malleefowl Survey of the Nova Project Area

Prepared for: Sirius Gold Pty Ltd
Date: March 2014

Rapallo Environmental is a Western Australian consultancy with a strong reputation for technical excellence, client-focus and innovation. We build long-term alliances through outstanding delivery on a range of services to the resource sector, government and associated industries.

ENVIRONMENTAL | ENGINEERING | CONSTRUCTION & OPERATIONS *NDT & Inspections* | MINING | RESOURCE MANAGEMENT

Report No. 15720
Targeted Malleefowl Survey of the Nova Project Area
Prepared for Sirius Gold Pty Ltd
March 2014

Revision	Revision Detail	Date	Prepared	Reviewed	Approved
A	Internal draft	14/02/2014	Marieke Weerheim Kate George	Chris Cooper	Kate George
B	Submitted for client review	17/02/2014	Kate George	Chris Cooper	Kate George
C	Client comments addressed	21/03/2014	Marieke Weerheim Chris Cooper	Kate George	Kate George
D	Final	31/03/2014	Marieke Weerheim	Kate George	Kate George

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EXECUTIVE SUMMARY

Sirius Gold Pty Ltd (Sirius) proposes to develop the Nova Project, in the Coolgardie biogeographical region of Western Australia. The project comprises a proposed nickel mining operation within mining lease application (MLA) 28/376, and an approximately 40 kilometre access corridor connecting the MLA with the Eyre Highway. The access road has a proposed disturbance corridor of 50 metres (m) wide.

The Malleefowl (*Leipoa ocellata*) occurs in all mainland states of Australia, except Queensland, and is listed as threatened wherever it occurs (Benshemesh 2000). Over the past century the species has experienced a severe decline in both numbers and distribution. The current populations are now highly fragmented, which makes them vulnerable to catastrophic events such as bushfires (Benshemesh 2000; Garnett *et al.* 2011; Department of the Environment 2013).

Nationally, the species is listed as Vulnerable under the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Department of the Environment 2013).

In Western Australia, the Malleefowl is listed under the *Wildlife Conservation Act 1950* as Schedule 1: Fauna that is rare or likely to be extinct (Government of Western Australia 2013).

Malleefowl are reported as occurring on Ngadju country which covers a significant portion of the Western Woodland (Prober *et al.* 2013). Locally, records for Malleefowl are scarce. This likely reflects a combination of poor survey effort and low densities due to suboptimal habitats at the edge the Malleefowl's Western Australian range.

Rapallo Environmental completed a targeted Malleefowl survey of the proposed access road corridor. The survey area was 39 km in length, and 150 m wide, as requested by Sirius, to allow positioning of the access road to avoid any Malleefowl mounds.

The survey was completed in two phases; Phase One from 14 to 24 January 2014, and Phase Two from 19 February to 24 February 2014. The survey adopted the 'Human chain methodology' used in the Rangelands by the Malleefowl Preservation Society. This involved walking a series of parallel line transects running north-south along the length of the proposed access road corridor. Additional opportunistic records of mounds from the MLA were also included in the survey results.

Five mounds were recorded in the road corridor during the targeted survey, and three mounds were recorded opportunistically in the MLA. None of the mounds recorded were active.

Including records from earlier surveys completed in the project area in 2013, the total number of mounds recorded in the project area to date is eleven. An additional twelfth mound was recorded opportunistically five km west of the proposed road corridor. The mounds found to date are:

- One dormant profile 1 mound, and three extinct profile 6 mounds recorded in the MLA
- Four dormant profile 1 mounds, and three extinct profile 6 mounds in the road corridor
- One dormant profile 1 mound recorded 5 km west of the road corridor

The mound located five km west of the road corridor (outside project area) was a dormant profile one mound and assessed to be more recent than the mounds recorded on the MLA and proposed corridor.

The long unburnt habitats of the proposed corridor (Woodland and Melaleuca habitat) were classified as having the highest relative habitat suitability for Malleefowl due to age post fire and relative abundance of litter.

The Mallee/Triodia and Woodland-dominated Inundation Zone habitats were classified as being medium to high habitat suitability due to the litter being low or patchily distributed especially in the larger *Triodia* patches.

The Regenerating Woodland habitat was deemed to have medium habitat suitability.

The Burnt Plain was classified as having a low suitability as a recent hot burn had resulted in low litter, cover and food resources.

Although much of the corridor habitat is deemed to be suitable for Malleefowl, no direct significant impacts are anticipated. This is due to:

- the narrow linear nature of the proposed road corridor
- the extent of suitable habitat outside of the proposed corridor and
- the apparent low density of Malleefowl in the region

Given the young dormant mound located five km west of the project area, it is precautionary to assume that there is a small population of Malleefowl in the local area, which may utilise the project area for foraging and potentially breeding. Small populations are more vulnerable to (localised) extinction, and require appropriate management planning at the time of project development.

1 INTRODUCTION

Sirius Gold Pty Ltd (Sirius) proposes to develop the Nova Project (the project), comprising a nickel mine and associated access road. The project is situated in the Shire of Dundas, about 140 km north-east of Norseman in Western Australia. The project is located in the Coolgardie Biogeographical region, and forms part of the Great Western Woodlands (Figure 1).

The proposed mining area falls within exploration tenement E28/1724. Sirius has applied for a mining tenement which has provisionally been designated as Mining Lease Application MLA28/376 (hereafter referred to as the MLA). The mining area will comprise an underground mine, storage and processing facilities, a camp, an air strip and power generation infrastructure, with a combined impact area of approximately 300 hectares (ha).

The proposed access road will run north-south from the mining area to the Eyre highway, over a length of approximately 40 km. The road corridor will have a width of approximately 50m, hence a disturbance area of approximately 200 ha.

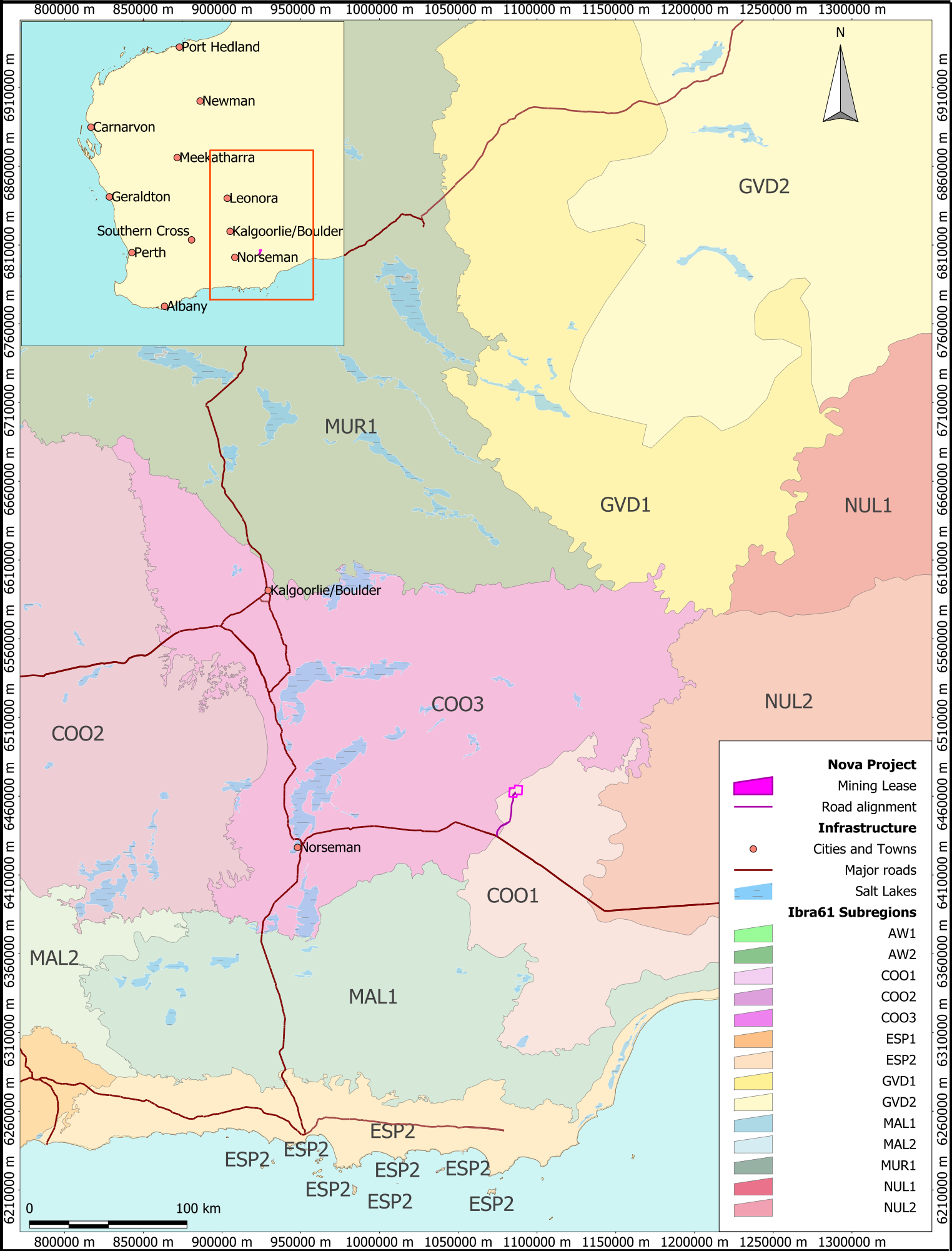
1.1 SCOPE AND OBJECTIVES

Recent biological surveys located Malleefowl mounds in the project area: one mound in the MLA (Terrestrial Ecosystems 2012), two mounds within the access road corridor, and one mound located five km west of the road corridor (Rapallo Environmental 2014a).

Rapallo Environmental (Rapallo) was commissioned by Sirius to conduct a targeted Malleefowl survey along the proposed road corridor. A survey of a 150 m corridor (600 ha) was undertaken to allow scope for positioning of the access road within the corridor to avoid any Malleefowl mounds, and to provide significant buffer distances from mounds. Detailed methods are outlined in Section 3.

The objectives of the targeted Malleefowl survey were:

- Conduct a targeted Malleefowl survey along a 150 m wide corridor of the proposed access road to identify signs of Malleefowl presence within the boundaries of the proposed access road corridor including birds, mounds, tracks and feathers.
- If/when Malleefowl mounds are found: record mound characteristics and establish permanent photo monitoring points of active mounds.
- Complete habitat suitability mapping of Malleefowl within the access road corridor.



Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 3,000,000
Datum: MGA94 (Zone 51)

Figure 1

Location of the Project Area

2 MALLEEFOWL

2.1 CONSERVATION STATUS

The Malleefowl occurs in all mainland states of Australia, except Queensland, and is listed as threatened wherever it occurs (Benshemesh 2000). Over the past century the species has experienced a severe decline in both numbers and distribution. The current populations are now highly fragmented, which makes them vulnerable to catastrophic events such as bushfires (Benshemesh 2000; Garnett *et al.* 2011; Department of the Environment 2013).

Nationally, the species is listed as Vulnerable under the Federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Department of the Environment 2013).

In Western Australia, the Malleefowl is listed under the *Wildlife Conservation Act 1950* as Schedule 1: Fauna that is rare or likely to be extinct (Government of Western Australia 2013).

2.2 ECOLOGY

The Malleefowl belongs to the ancient family Megapodiidae whose members all build terrestrial mounds for nesting. It is the only species in the genus *Leipoa*, which is endemic to Australia. The Malleefowl is a large ground-dwelling bird, with adults weighing up to 2.5 kilograms. The species usually occurs singly or in pairs near mounds. The Malleefowl rarely flies, instead preferring to walk slowly across the terrain and if disturbed runs rapidly to escape (Marchant & Higgins 1993).

Malleefowl forage on the ground, and have a generalist diet including seeds, leaves, flowers, invertebrates, lerp (a sugary substance secreted by leaf-boring insects), fungi, and tubers (Frith 1959; Benshemesh 1992, 2000; Marchant & Higgins 1993).

Malleefowl do not incubate their eggs but instead construct a large incubation mound into which they lay their eggs. The mound comprises a large mass of sand or soil, into which a large volume of moist organic matter is buried. The mound is tended year-round, mostly by the male. Mounds are usually four or five metres in diameter, and one metre high (Frith 1959; Benshemesh 1992; Marchant & Higgins 1993). Mound profiles can vary over the course of the year, as males add or remove sand and leaf litter to keep temperatures at a level suitable for incubation (see Appendix II).

Malleefowl breed almost year-round, with breeding activity recorded from spring through to late autumn (Marchant & Higgins 1993). Eggs are laid from September onwards, at five to 17 day intervals. Chicks hatch after an incubation period of on average 60 days. They dig themselves out of the mound unaided by their parents, and receive no parental care after hatching (Frith 1959; Marchant & Higgins 1993; Benshemesh 2000).

The Malleefowl is a sedentary species. Established pairs and individuals usually remain in the same area throughout the year, and pairs tend to breed in the same general area for many years in succession (Frith 1959; Booth 1987; Benshemesh 1992). Some movements may occur during the non-breeding period, when pairs may wander away from their nesting mounds and at times congregate into small flocks (Mattingley 1908; Frith 1959, 1962).

Radio-tracking studies show that Malleefowl move (i.e. range over) distances of several kilometres during the course of a year (Booth 1987; Benshemesh 1992). Following their emergence from nesting mounds, juvenile Malleefowl may disperse widely. For example, one juvenile moved a distance of nine

km in three weeks, and another 15-month-old bird travelled 17 km within a period of five weeks (Marchant & Higgins 1993); and at Wyperfeld National Park in Victoria, the average distance travelled by newly-hatched chicks away from their nesting mounds was 600 m per day (and some chicks averaged more than two km per day during the first two days) (Benshemesh 1992).

The dispersal of Malleefowl is apparently achieved on foot. In areas of cleared or open land, Malleefowl travel through corridors of dense, native vegetation (Benshemesh 1992, 2005). The fragmentation of the remnant native habitats that are occupied by Malleefowl provides a barrier to dispersal, jeopardising the survival of many small and isolated Malleefowl populations (Benshemesh 1992, 2005).

The home ranges of individual Malleefowl can vary in size from 0.5 to 4.6 km², and can overlap considerably (Booth 1987; Benshemesh 1992). The majority of the home range appears not to be defended, but during the breeding season male Malleefowl defend a breeding territory from other Malleefowl. The breeding territory lies within the home-range, and consists of the area that immediately surrounds an active nesting mound (Frith 1959, 1962; Marchant & Higgins 1993). There can be local shifts in territories and home ranges, with some pairs changing nesting mounds between breeding seasons (Frith 1959; Booth 1987). However, some (usually older) pairs will return to the same nesting mounds for several years in succession (Frith 1959; Marchant & Higgins 1993).

Protection of all known Malleefowl mounds is very important for conservation of the species, even if they appear to be old and 'inactive'. As Malleefowl tend to renovate old mounds, rather than construct new mounds, every old mound is a potential future breeding site (National Heritage Trust 2007).

The home ranges can differ in size between the breeding and non-breeding seasons (Booth 1987; Benshemesh 1992, 2005). No clear patterns have been established (Marchant & Higgins 1993), but this appears to be partly tied to differences between the sexes. During the breeding season, the home ranges of male Malleefowl are smaller than those of female Malleefowl (Booth 1987; Benshemesh 1992), because the males remain close to their nests (Benshemesh 1992), presumably so they can guard their territories. However, during the non-breeding season, the sexes tend to remain together and, consequently, their home ranges tend to be similar in size (Benshemesh 2005).

2.3 DISTRIBUTION

Parsons *et al*. (2008) examined the distribution of Malleefowl within the Western Australian Wheatbelt. Figure 2 shows the distribution of Malleefowl records to be concentrated within the Avon Wheatbelt, Mallee and Esperance Plains IBRA regions. Records of Malleefowl have been recorded from the Coolgardie IBRA region (in which the Project falls), however distribution of records is sparse.

Knowledge of the status of the Malleefowl in the woodlands to the east of the Wheatbelt is poor (Short & Parsons 2008). Due to lack of systematic surveys, aimed at recording absence as well as presence, published density and distribution maps do not exist for the region.

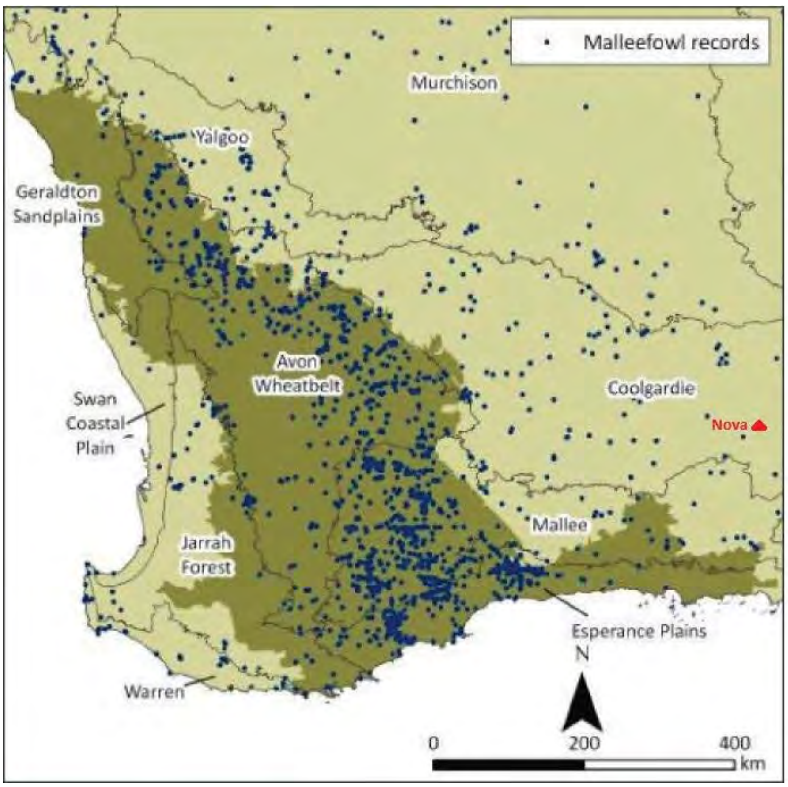
2.4 HABITAT

In Western Australia, Malleefowl occur mainly in scrubs and thickets of Mallee (*Eucalyptus spp*.), Boree (*Melaleuca lanceolata*) and Bowgada (*Acacia linophylla*), and also other dense, litter-forming shrublands including Mulga (*Acacia aneura*) Shrublands (Johnstone & Storr 1998). Nesting is typically restricted to dense shrublands (which provide protection and nesting material) on a range of substrates (such as sand, loam and gravel) while heavy (clay) soils are avoided (Bamford Consulting Ecologists 2012).

In the wheatbelt, Malleefowl were historically found in most vegetation, being most common in mallee, Acacia shrublands, and scrub thickets. To a lesser extent, they were known also from open woodlands such as York gum *Eucalyptus loxophleba* and gimlet *E. salubris (*Parsons *et al.* 2008*).* Modelling undertaken by Parsons *et al.* (2008), found that in the wheatbelt on a finer scale, Malleefowl occurrence was associated with mallee/shrubland and thicket vegetation and sandy soil types (excluding deep sands, which typically support Banksia woodlands and kwongan heath). Woodland represented poor habitat for the species.

Malleefowl do persist in woodland habitats. Dryandra woodland is an example of where the site is neither a mallee nor *Acacia* shrubland, being predominantly brown mallet, wandoo and powderbark wandoo woodlands with a lack *of Acacia* shrubs in the understorey (Short 2004). However, despite fox controls since 1984 there has been no obvious recovery of the species suggesting the Dryandra woodland habitat is marginal for Malleefowl.

In the northern Western Woodlands (in core habitat), Malleefowl mounds have been recorded in the Mt Jackson area within dense *Acacia* shrublands with a gravelly substrate and also within dense *Allocasuarina* and *Melaleuca* thickets and on gravel, sandy or loam soils (Bamford Consulting Ecologists 2012). In addition mounds have been found concentrated on the slopes of hills, in gravelly loam soils where the vegetation consists of a dense tall shrubland (Bamford Consulting Ecologists 2008).



The spatial distribution of Malleefowl records across IBRA regions within south-west Western Australia.

Figure adapted from Short and Parsons (2008) *Malleefowl Conservation - Informed and integrated community action. Final report to WWF Australia and Avon Catchment Council, May 2008.*

Dark green shading indicates boundaries of the Western Australian wheatbelt.

Approximate location of the Nova Project area MLA is shown in red.

Figure 2 Malleefowl Distribution in Western Australia

2.5 THREATS

The main threat to the Malleefowl is habitat destruction and clearance for agriculture and grazing, which has removed a large proportion of the original high-quality Malleefowl habitat. This has resulted in localised extinctions and fragmented populations. The remaining isolated populations now mostly occur in suboptimal habitat, since the most productive mallee in higher rainfall areas on the best soil

has been cleared. Their fragmented status makes them vulnerable to catastrophic events, such as bushfires (Garnett *et al.* 2011).

Studies in eastern Australia have shown that the effect of fire on Malleefowl is severe, with breeding in burnt areas usually reduced for at least 30 years (Tarr 1965; Cowley *et al.* 1969; Benshemesh 1990, 1992). Malleefowl will feed in recently burnt areas, but they require unburnt areas for breeding and shelter (Marchant & Higgins 1993; Benshemesh 2000).

Studies in Western Australia suggest mallee habitats recover quicker after fire than that suggested for the Victorian Mallee. Short and Parsons (2008) found that in the Western Australian wheatbelt, mallee developed a complex understorey and rich litter layer after approximately 15 years post-fire, and maintained these characteristics beyond 45 years. *Acacia* sp. shrubland took somewhat longer to develop a litter layer and this layer and the shrubby understorey tended to diminish after about 25-30 years. Hence, in the Western Australian wheatbelt, it appears that the Malleefowl may be able to re-occupy key habitats, from 15 years post-fire (Short & Parsons 2008).

Fox predation appears to be the second greatest threat to Malleefowl survival (Department of the Environment 2013), with virtually no juveniles surviving to adulthood in areas where fox numbers are high (Priddel & Wheeler 1997). In the wheatbelt and goldfields regions of Western Australia, fox densities are mapped as "Common/Widespread" (Invasive Animals Cooperative Research Centre *et al.* 2007). Fraser Range station undertakes baiting periodically.

2.6 LOCAL MALLEEFOWL RECORDS

Malleefowl are reported as occurring on Ngadju country which covers a significant portion of the Western Woodland (Prober *et al.* 2013). Locally, records for Malleefowl are scarce (Figure 2); this likely reflects a combination of poor survey effort and low densities due to suboptimal habitats at the edge the Malleefowl's Western Australian range.

Desktop searches completed as part of a Level 2 fauna survey of the project area (Rapallo 2014a) identified regional records for the Malleefowl, spanning three decades of surveys. Within the Hyden – Lake Johnstone Study Area, How *et al*. (1980) recorded Malleefowl at Lake Cronin (old mound), McDermid Rock (actual observation) and Peak Charles (old mound and actual observation). Hall and McKenzie (1993) report old mounds at Camps One and Four within the Norseman – Balladonia Study Area. Duncan *et al*. (2006) recorded Malleefowl from the Honman Ridge via a dog/fox scat. Rapallo (2009) recorded old mounds near Exclamation Lake (approximately 170 km south-west of the Nova project area).

None of these surveys were targeted for Malleefowl and most were restricted to an indication of presence/absence.

Recent fauna surveys (Rapallo 2014; Terrestrial Ecosystems 2012) recorded dormant and extinct Malleefowl mounds within or in close proximity to the proposed road corridor (Section 4.1.2). Traditional Owners have also mentioned the existence of a mound close to the Matsa Track (see Figure 4 for indicative location). The discovery of these mounds was the motivation for this Targeted Malleefowl Survey.

3 METHODS

3.1 SURVEY GUIDANCE

The Targeted Malleefowl survey was completed according to the following Environmental Protection Authority (EPA) guidance documents:

- *Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002)
- *Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004)
- *Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010)

In addition to these general guidance documents, the field survey methods were developed with reference to the *National Manual for the Malleefowl Monitoring System*, as developed by the National Heritage Trust (2007) and the methods of the Malleefowl Preservation Society (Dennings 2009).

3.2 PERSONNEL

The field survey was completed by a team of six ecologists, eight Traditional Owners working for Goldfields Land and Sea Council (GLSC), and two technical support staff. The complete list of personnel involved in the project is provided in Table 1.

Table 1 Personnel involved in this survey

Name	Organisation	Position	Field Survey	Reporting
Kate George	Rapallo	Principal Scientist	●	●
Chris Cooper	Rapallo	Ecologist	●	●
Magnus Peterson	Rapallo	Ecologist	●	●
Felicity Humann	Rapallo	Ecologist	●	
Andrew Grant	Rapallo	Field Ecologist	●	
Kelly Dobson	Rapallo	Field Ecologist	●	
Daniel Martin	Rapallo	Technical Officer	●	
Nicholas Thomas	Rapallo	Technical Officer	●	
Marieke Weerheim	Rapallo	Ecologist	●	●
Floyd Holmes	Rapallo	Ecologist	●	
Steven Rule	GLSC	Traditional Owner Ranger	●	
Barry Smith	GLSC	Traditional Owner Ranger	●	
Heathen Wicker	GLSC	Traditional Owner Ranger	●	

Name	Organisation	Position	Field Survey	Reporting
Danny Graham	GLSC	Traditional Owner Ranger	•	
Daniel Graham	GLSC	Traditional Owner Ranger	•	
Jack Champion	GLSC	Traditional Owner Ranger	•	
Robert Graham	GLSC	Traditional Owner Ranger	•	

3.3 TARGETED MALLEEFOWL SURVEY

The survey adopted the 'human chain methodology' used in the Rangelands by the Malleefowl Preservation Society (Dennings 2009). This involved walking a series of parallel line transects running north-south along the 39 km length of the proposed access road corridor (Figure 3).

A team of nine walked the proposed road corridor. Team members walked staggered; with each person staying in visual contact with the people on adjacent transect lines. This method allowed for line adjustment if the team fell back in any section.

Depending on density of the vegetation, transects were spaced either 15-20 m apart, or 5-10 m apart. Hence, in open areas where members could easily see the ground and each other, only one pass was needed. In denser areas two passes were needed, with each "sweep" covering a width of 75 m.

Due to weather constraints the survey was completed in two phases: Phase 1 from 14 to 24 January 2014, and Phase 2 from 19 February to 24 February 2014.

3.3.1 RECORDING MALLEEFOWL SIGHTINGS AND SIGNS

Malleefowl are difficult to detect as they are generally shy and well camouflaged for their preferred habitat (Marchant & Higgins 1993). They have distinctive calls, described as "loud deep booming" (Johnstone & Storr 1998), and leave distinctive footprints that are readily detected in sandy areas (National Heritage Trust 2007). The most conspicuous sign of Malleefowl presence is their mounds.

Every time a live bird, mound, or track was encountered, the following data was collected:

- Coordinates (on hand-held GPS)
- Sighting type (bird seen, call heard, mound, track, or other secondary sign)
- Mound descriptions (section 3.3.2)
- Soil type
- Vegetation
- Digital photograph

In addition, a search was conducted within a 250 m radius from the locality where a bird or sign of presence was recorded, in order to locate any additional mounds, birds, or other signs of activity.

3.3.2 *Recording Mound Characteristics*

All mounds recorded during the survey were measured in diameter and height, and rated for activity using the National Malleefowl Monitoring System (NMMS) rating scale (National Heritage Trust 2007). The scale is listed below, with greater detail provided in Appendix I.

- Profile 1 – Crater with raised rims, typical of an inactive (dormant) mound
- Profile 2 – Mound fully excavated (litter may be present)
- Profile 3 – Mound with litter, thick layers of litter are evident on the surface
- Profile 4 – Mounded up
- Profile 5 – Sandy crater with peak in the centre (actively being closed by the Malleefowl)
- Profile 6 – A long unused (extinct) mound.

In addition, notes were taken on the presence of footprints, egg shells, and whether vegetation grew within the boundaries of the mound. Previously recorded mounds were also assessed.

Mounds deemed to be active or dormant (Profiles 1 to 5) were marked with crossed sticks, placed in the centre of the mound, so that activity could be monitored by re-visiting the mounds if required.

3.3.3 *Habitat Suitability Mapping*

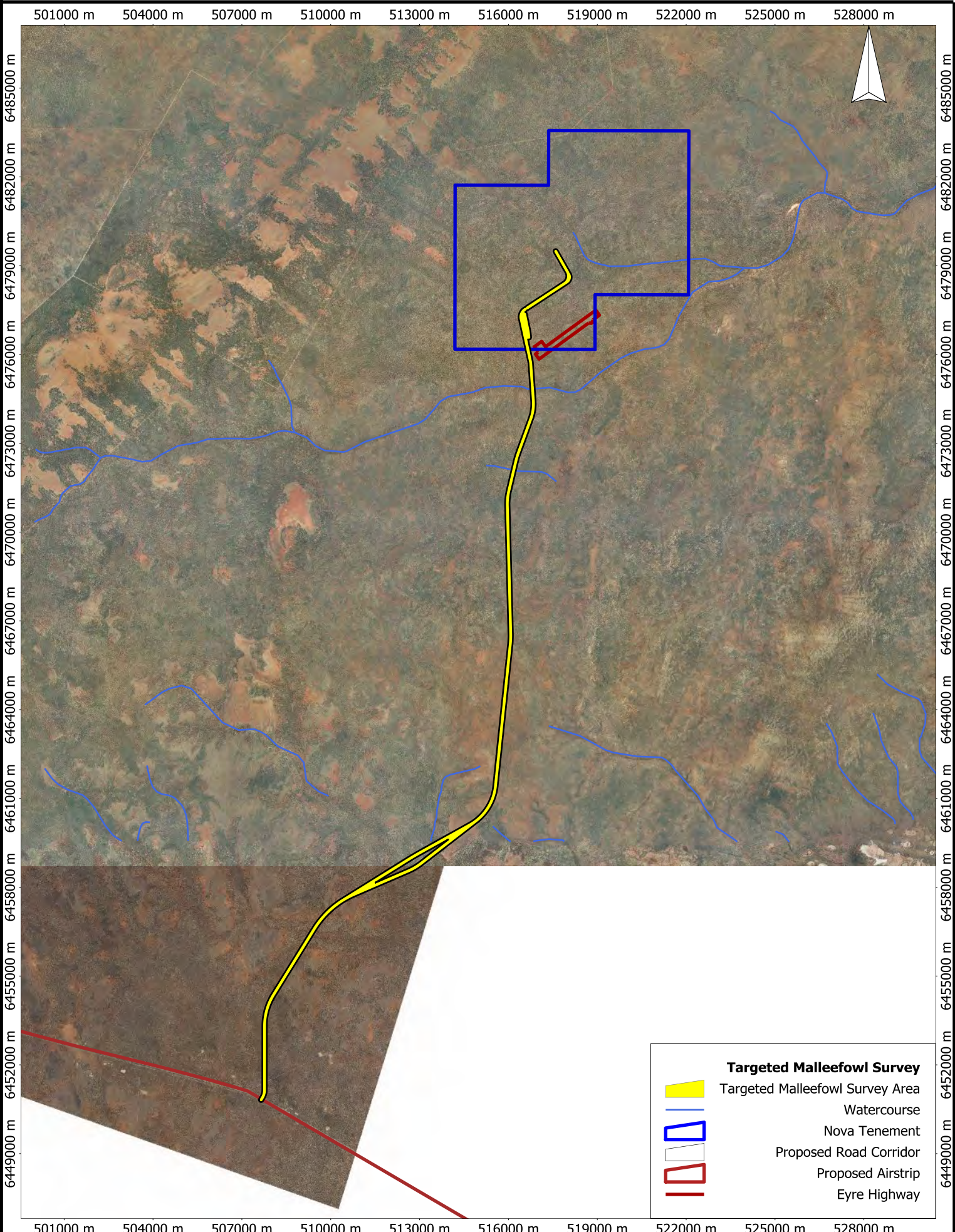
The habitat quality for supporting Malleefowl within the survey corridor was classified into 'high', 'medium' and 'low' based on general known habitat requirements of fire history, leaf litter, soil suitability and presence/absence of mounds. Classifiers were kept general due to the deficiency in knowledge of Malleefowl habitat requirements within the marginal habitats at the edge of its Western Australian Range.

3.4 Opportunistic Records

In February 2014, Rapallo completed additional fauna trapping in the MLA (Rapallo 2014b, in prep.). During this work, opportunistic records were taken of any Malleefowl signs, including mounds, both on the project area and in close proximity while travelling to and from trapping sites.

Mounds reported by Sirius staff within the MLA were also visited by Rapallo and assessed. For all opportunistic records, the mound characteristics were recorded as described for the Targeted survey. These records are also reported in the results section 4.1.2

Opportunistic records were made during non-systematic traverses of the MLA and while travelling to and from the survey area, and do not constitute a targeted survey for Malleefowl within the MLA.



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Scale: 1 : 160,000
Datum: MGA94 (51)

0 5 km

Survey Area Outline

Figure 3

3.5 LIMITATIONS AND CONSTRAINTS

An assessment of the limitations of the survey is presented in Table 2 in accordance with Guidance Statement No. 56 (EPA 2004).

Table 2 Discussion of potential limitations and constraints experienced during the survey

Aspect	Constraint	Discussion
Experience of Consultants	No	Senior members of the survey team have experience in completing fauna surveys in Western Australia. All Rapallo ecologists are highly familiar with Malleefowl, their mounds, calls, and secondary signs. Other team members were trained during the survey and their records verified by senior staff, while field manuals were distributed to all team members prior to the survey.
Scope	No	Scope and intensity of survey were suitable to achieve the survey aims as outlined in Section 1.1.
Proportion of fauna identified, recorded and/or collected	No	All mounds, tracks and other signs were accurately identified in the field, and all sightings by junior staff were verified in the field by senior staff.
Information sources e.g. previously available information (whether historic or recent) vs. new data	No	Sufficient regional information was available to prepare the survey and interpret survey findings. Rapallo staff had previously familiarised themselves thoroughly with the survey area during a Level 2 fauna survey completed in November 2013.
Proportion of task achieved and further work may be required	No	The entire 150 m survey corridor was accessed and searched.
Timing, weather, seasons, cycle	No	Weather during the survey was hot at the start, with maximum daytime temperatures of 38.6 degrees recorded on 15th January, followed by a gradual drop in temperature to 21 degrees on Wednesday 22nd. The survey program was completed in two phases due to a large rainfall event near the end of the first phase. Addition of a second phase allowed the program to be completed as planned.
Disturbances that affected the survey	No	There were no disturbances, injuries, or major incidents that affected the survey.
Survey Intensity	No	Survey intensity was appropriate to survey the 150 m corridor requested by Sirius. Methods were adjusted to compensate for the thickness of the regenerating bush.
Completeness of Survey	No	The survey program was completed in two phases due to a large rainfall event.
Resources	No	The survey was adequately resourced.
Access Problems and Remoteness	No	The entire survey corridor was accessed on foot. Deploying support vehicles and quad bikes ensured that staff members were safe, and supplied with sufficient food and water during the survey, and that any incidents could be dealt with appropriately and timely.
Availability of contextual information within the region	Yes	There are few recent published reports on Malleefowl from the region.

4 RESULTS AND DISCUSSION

4.1 MALLEEFOWL RECORDS

4.1.1 MALLEEFOWL OBSERVATIONS

No records of Malleefowl (direct observation or calls) were obtained during the survey. No tracks, scats or other secondary signs of Malleefowl were obtained during the survey.

4.1.2 MOUNDS RECORDED

Five mounds were recorded during the targeted Malleefowl survey of the road corridor. In addition, three mounds were recorded opportunistically in the MLA.

Including the two mounds found in the road corridor during the Level 2 fauna survey (Rapallo 2014a), and one mound recorded in the MLA during habitat assessments (Terrestrial Ecosystems 2012), this sets the total number of mounds recorded in the project area at eleven.

In addition, one mound was recorded five km west of the proposed road corridor (Rapallo 2014a) from mallee woodland habitat. This mound was recorded opportunistically along a well maintained track that was used to access the project area. The mallee woodland habitat type does not occur in the project area, and is different from the Mallee/Triodia habitat occurring in the southern section of the road corridor.

All Malleefowl mounds found to date are listed in Table 3 below. The locations of the mounds are mapped in Figures 4 and 5. Photographs of the mounds, and the position of the mounds relative to the proposed access road and the 150 m wide survey area, are displayed in Table 4.

Of the seven mounds recorded to date in the proposed road corridor, four were assessed as dormant profile 1 mounds, and three were assessed as extinct profile 6 mounds. The profile six mounds were deemed to be extinct because there was little mound structure remaining (see Appendix I for details).

The profile 1 mounds in the road corridor were assessed as dormant due to the amount of perennial vegetation that had re-established on the mounds, the extent of erosion of the mound, and the absence of feathers, shell fragment or leaf litter within the mound crater. These mounds cannot be assessed as extinct because Malleefowl have been known to re-establish old mounds (National Heritage Trust 2007). However, erosion and perennial vegetation on the mound suggested that the mounds were likely to be older than 5 - 10 years.

The dormant profile 1 Malleefowl mound located five km west of the road corridor was assessed to be more recent (less than 5 years old) than the mounds in the MLA and road corridor. Evidence to support this includes presence of shell fragment, degree of erosion, lack of colonising perennial vegetation and lack of soil crusts.

The profile 6 mound recorded in 2012 was described as “old and long unused”, (Terrestrial Ecosystems 2012). The photo taken of the mound shows it to be a profile 6 (see Plate 12). The mound was located in an area of high vehicle and equipment activity, and could not be located by Rapallo when they revisited the coordinates in November 2013.

In addition to the twelve mounds described in this report, one of the TO's had knowledge of a nearby mound which he recorded during previous work in the local area (unrelated to the Nova project). The indicative location of this mound is shown in Figure 4. Rapallo did not attempt to re-locate this mound as it was in dense regenerating vegetation and well outside the survey area.

4.1.3 HABITATS IN WHICH MOUNDS WERE RECORDED

Of the twelve mounds recorded to date, of which eleven in the project area, three were recorded in Melaleuca habitat, three in Woodland, one in Mallee (not in the project area), and the remainder in areas of regenerating vegetation after a burn, i.e. Regenerating Woodland and Burnt Plain (see Table 3 , Table 4, and section 4.2 for further discussion).

It was noted that mounds were typically located in close proximity to *Melaleuca* sp. trees or shrubs. Three mounds were recorded within Melaleuca habitat, while mounds in Woodland were often within five metres of a *Melaleuca* tree or shrub. Mounds in Regenerating Woodland were typically found close to regenerating *Melaleuca* patches, or in areas of patchily burned vegetation where the unburnt vegetation contained *Melaleuca*. The profile 1 mound recorded outside the project area along the North/South track was located in an area of Mallee Woodland that also contained a mid-storey of *Melaleuca* sp.

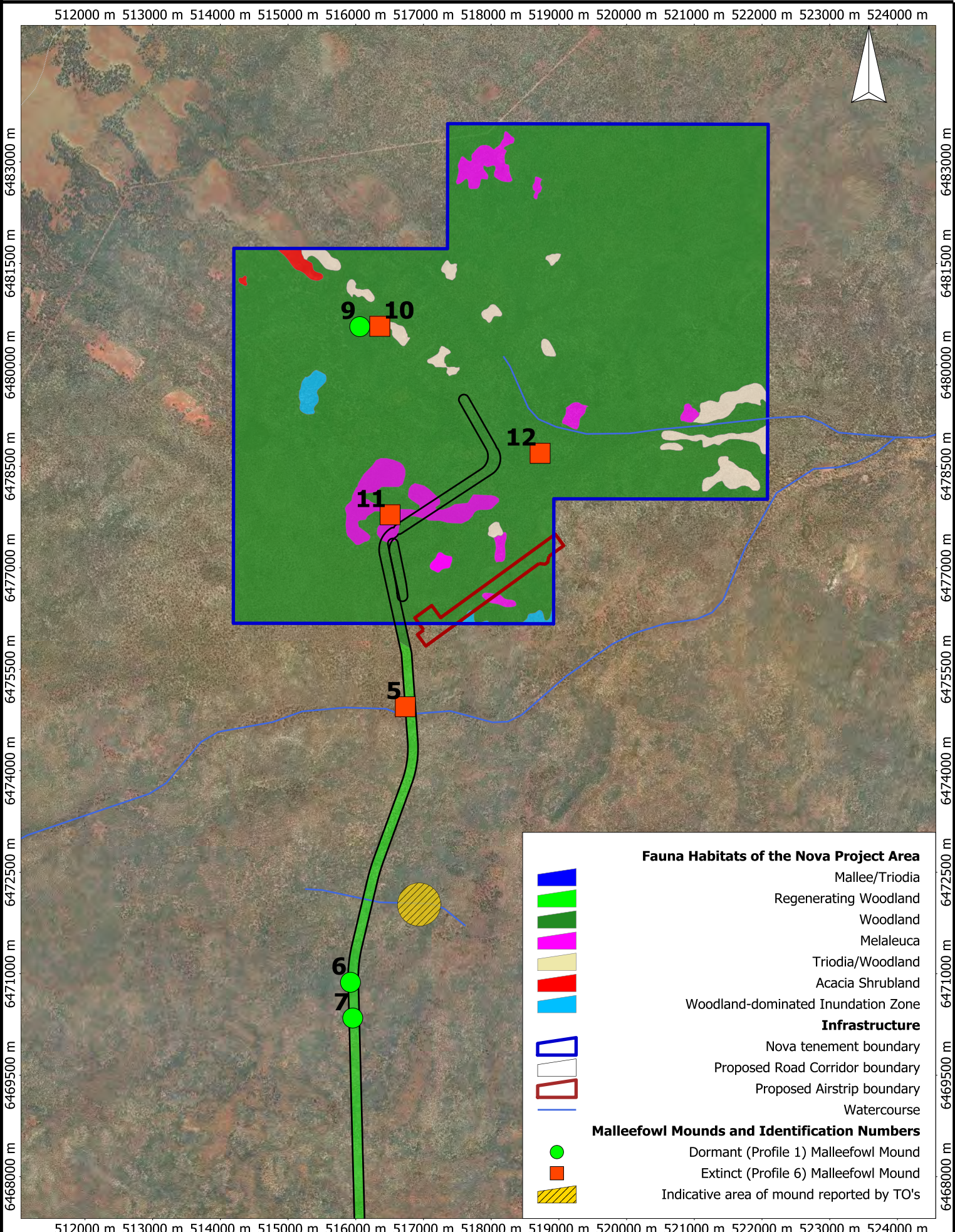
4.1.4 PREDATOR OBSERVATIONS

Feral dog/dingo scats were recorded at five locations across the proposed road corridor.

Table 3 Malleefowl mounds recorded to date in the project area

Survey	Date Recorded	Location	Coordinates	Profile and status	Habitat	Mound and Map Number	Photograph (Table 4)
Level 2 fauna survey (Rapallo 2014)	10/11/13	Road Corridor	51H, 513796 E, 6459503 N	Profile 1 - Dormant	Melaleuca	Mound 1: Figure 5	Plate 1
Level 2 fauna survey (Rapallo 2014)	10/11/13	Road corridor	51J, 514313 E, 6459699 N	Profile 6 - Extinct	Burnt Plain	Mound 2: Figure 5	Plate 2
Level 2 fauna survey (Rapallo 2014)	15/11/13	5 km west of Road Corridor*	51J, 507873 E, 6461567 N	Profile 1 - Dormant	Mallee Woodland (not in project area)	Mound 3: Figure 5	Plate 3
Targeted Malleefowl Survey - Phase 1	16/01/14	Road Corridor	51H, 512696 E, 6458571 N	Profile 1 - Dormant	Woodland	Mound 4: Figure 5	Plate 4
Targeted Malleefowl Survey - Phase 1	19/01/14	Road Corridor	51J, 516732 E, 6474947 N	Profile 6 - Extinct	Regenerating Woodland	Mound 5: Figure 4	Plate 5
Targeted Malleefowl Survey - Phase 2	21/02/14	Road Corridor	51J, 515922 E, 6470874 N	Profile 1 - Dormant	Regenerating Woodland	Mound 6: Figure 4	Plate 6
Targeted Malleefowl Survey - Phase 2	21/02/14	Road Corridor	51J, 515955 E, 6470345 N	Profile 1 - Dormant	Regenerating Woodland	Mound 7: Figure 4	Plate 7
Targeted Malleefowl Survey - Phase 2	22/02/14	Road Corridor	51J, 516110 E, 6466264 N	Profile 6 - Extinct	Regenerating Woodland	Mound 8: Figure 5	Plate 8
Opportunistic record	21/02/14	MLA	51J, 516297 E, 6480286 N	Profile 1 - Dormant	Woodland	Mound 9: Figure 5	Plate 9
Opportunistic record	21/02/14	MLA	51J, 516270 E, 6480390 N	Profile 6 - Extinct	Melaleuca	Mound 10: Figure 5	Plate 10
Opportunistic record	22/02/14	MLA	51J, 516507 E, 6477784 N	Profile 6 - Extinct	Melaleuca	Mound 11: Figure 5	Plate 11
Level 1 habitat assessment (Terrestrial Ecosystems 2012)	12/12/12	MLA	51J, 518723 E, 6478693 N	Profile 6 - Extinct	Woodland	Mound 12: Figure 5	Plate 12

** Note this mound is located off the Nova Project Area.*



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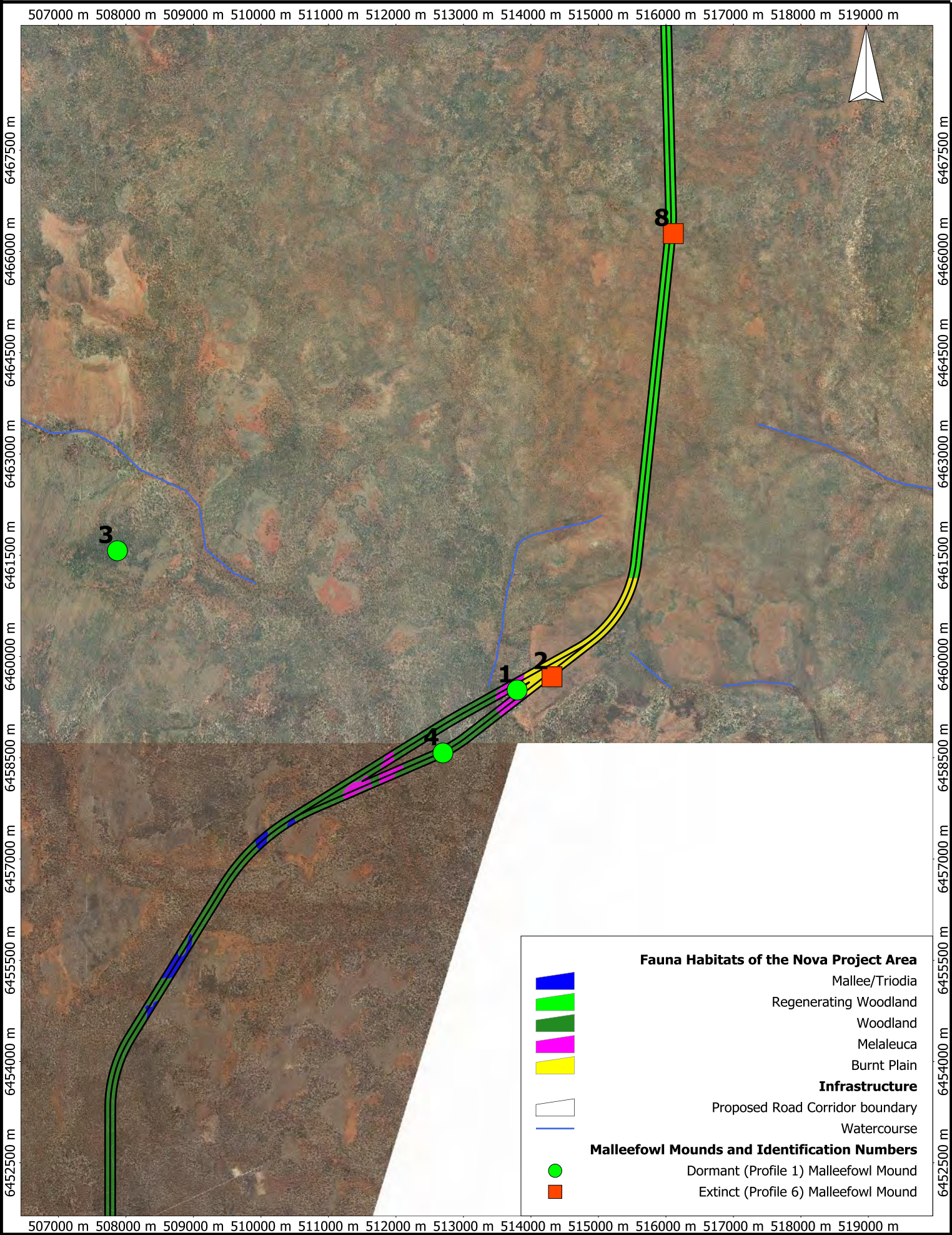
Scale: 1 : 70,000
Datum: MGA94 (51)

0 2 km

Malleefowl Mounds Recorded to date in MLA and Northern section of Road Corridor

Figure 4



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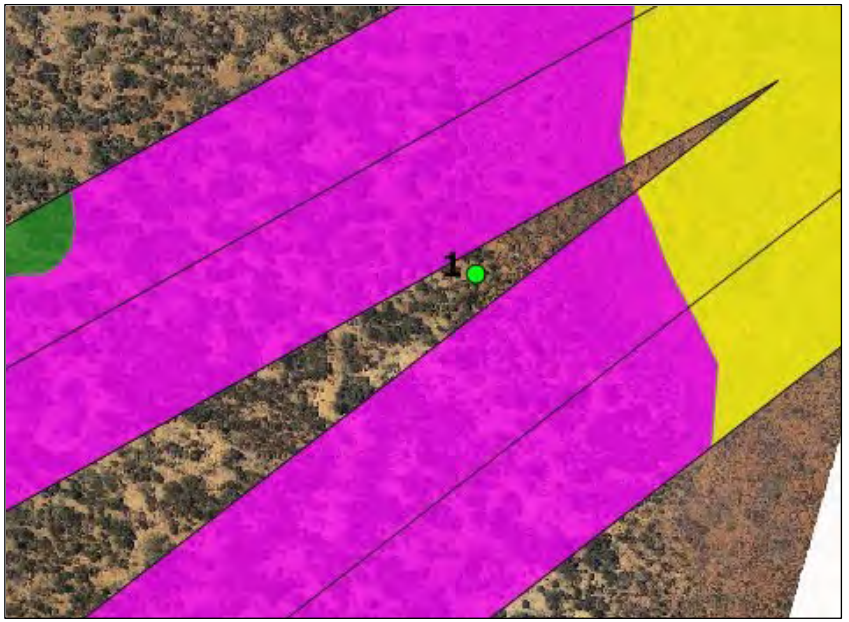
Scale: 1 : 70,000
Datum: MGA94 (51)

0 2 km

Malleefowl Mounds recorded to date in Southern section of Road Corridor

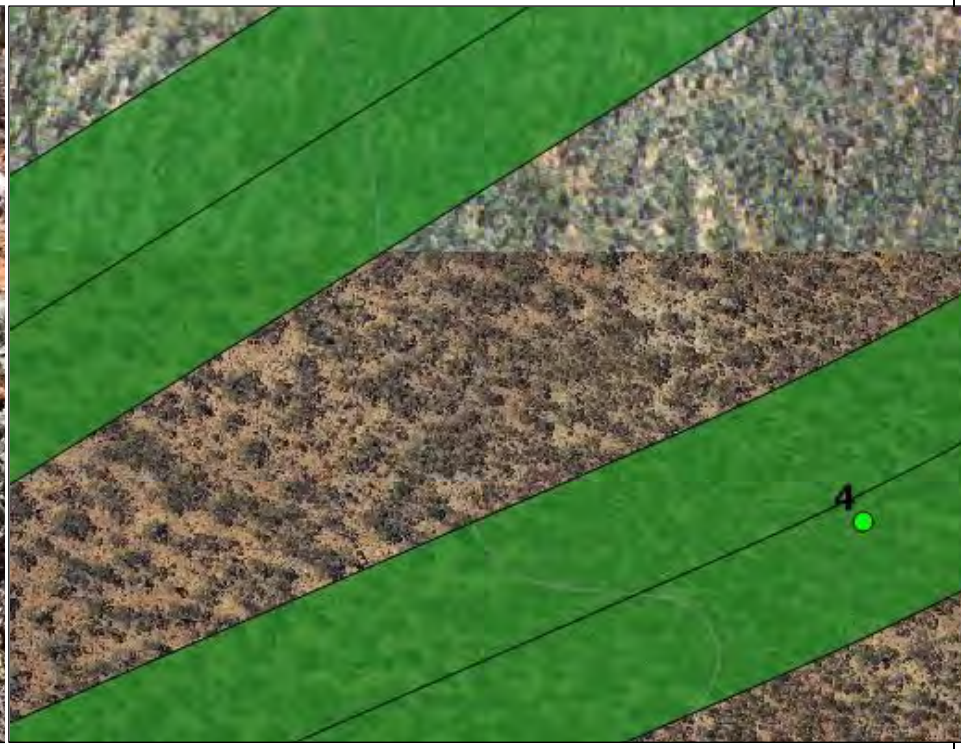
Figure 5

Table 4 Photographs and locality maps of Malleefowl mounds found in the project area to date

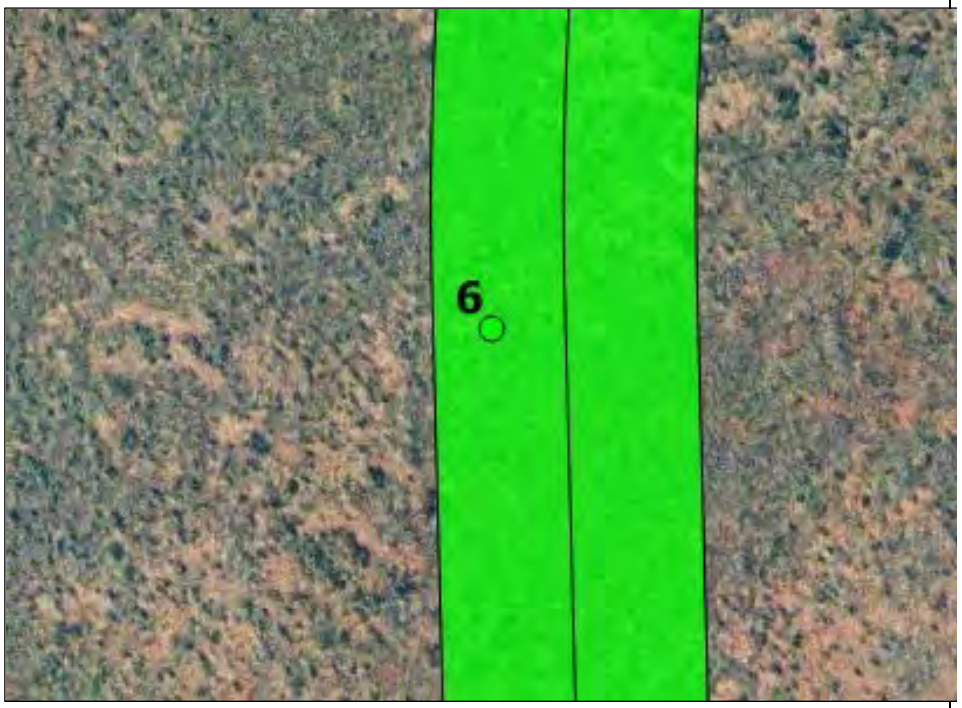
Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 1: Dormant Profile 1 mound recorded in the road corridor in Melaleuca habitat on 10 November 2013	Distance from centre line of proposed road corridor: 90 m.

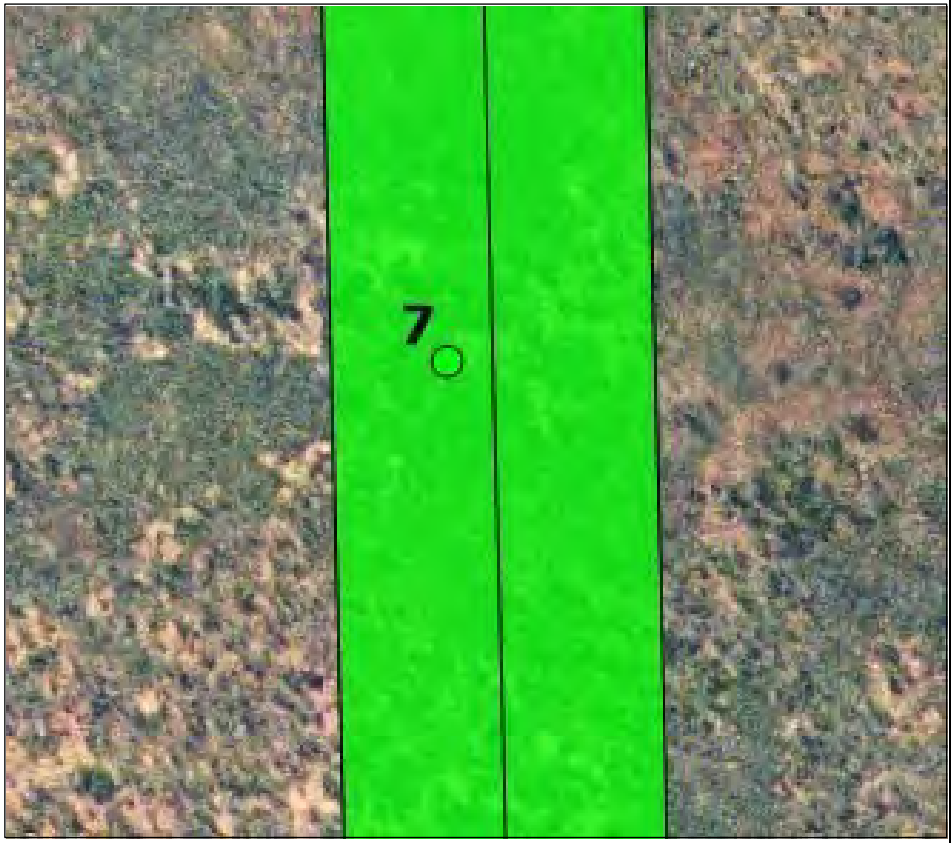
Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 2: Extinct Profile 6 mound recorded in Road Corridor in Burnt Plain habitat on 10 November 2013.	Distance from centre line of proposed road corridor: 70 m.

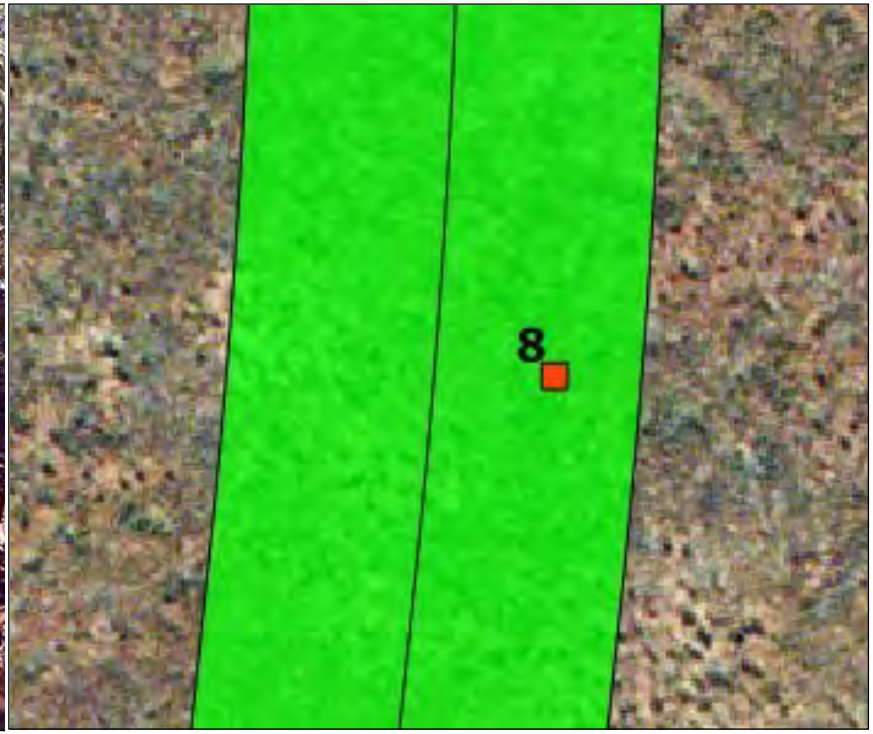
Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 3: Dormant Profile 1 mount recorded five km west of road corridor in Mallee Woodland on 15 November 2013	Distance from centre line of proposed road corridor: 4.7 km.

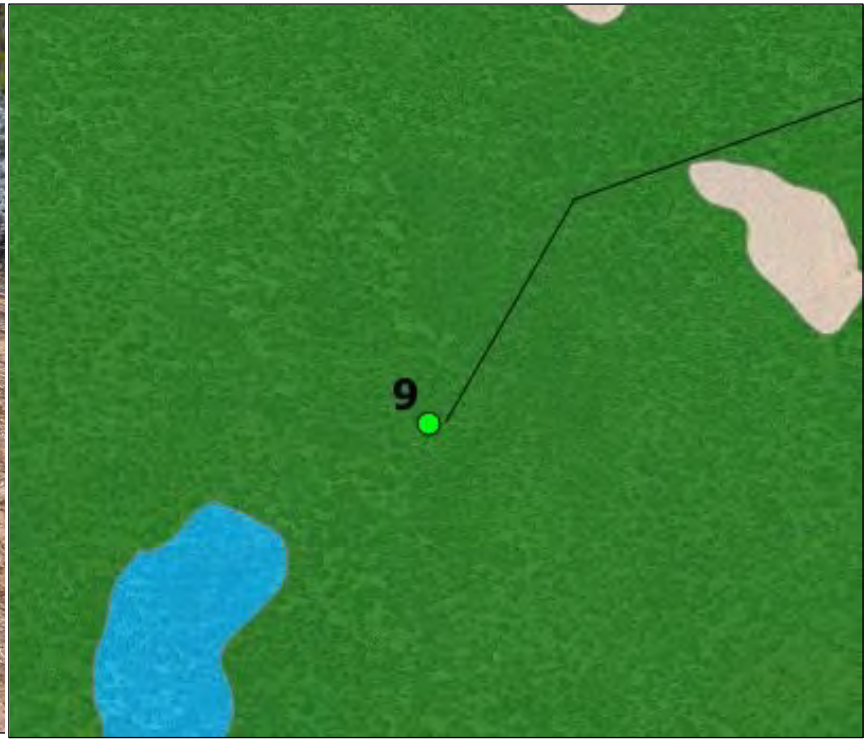
Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 4: Dormant Profile 1 mound recorded in road corridor in Woodland habitat on 16 January 2014	Distance from centre line of proposed road corridor: 15 m.

Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 5: Extinct Profile 6 mound recorded in road corridor in Regenerating Woodland habitat on 19 January 2014	Distance from centre line of proposed road corridor: 73 m.

Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 6: Dormant Profile 1 mound recorded in the road corridor in Regenerating Woodland habitat on 21 February 2014	Distance from centre line of proposed road corridor: 40 m.

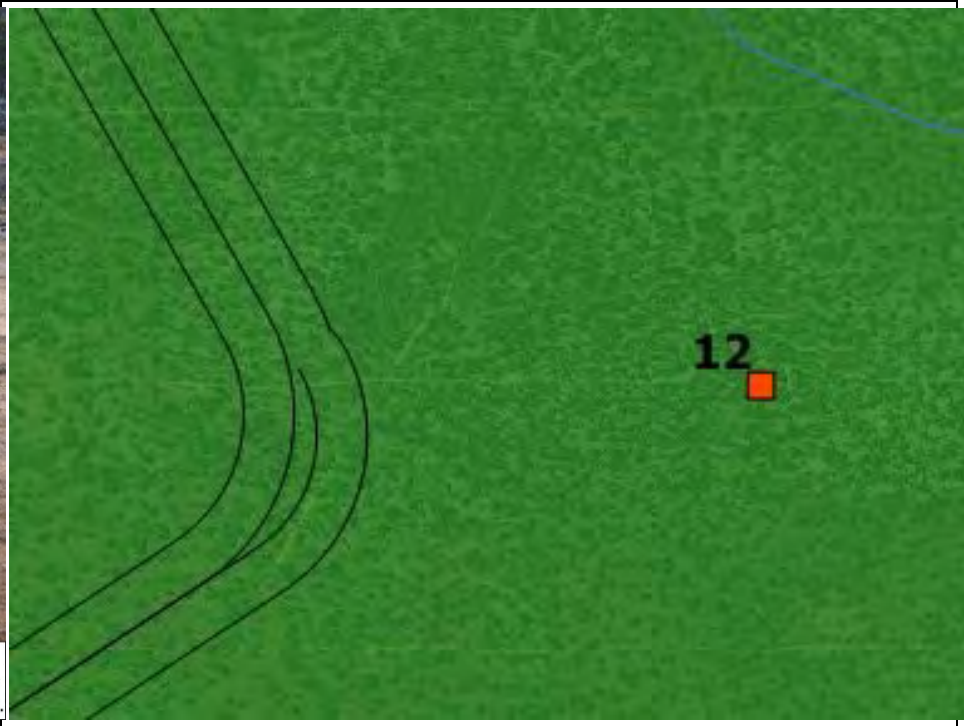
Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 7: Dormant Profile 1 mound recorded in the road corridor in Regenerating Woodland on 21 February 2014	Distance from centre line of proposed road corridor: 25 m.

Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 8: Extinct Profile 6 mound recorded in the Road Corridor in Regenerating Woodland habitat on 22 February 2014	Distance from centre line of proposed road corridor: 45 m.

Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 9: Dormant Profile 1 mound recorded opportunistically in the MLA in Woodland habitat on 21 February 2014	Distance from centre line of proposed road corridor: 1.8 km.

Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 10:Extinct Profile 6 mound recorded opportunistically in the MLA in Melaleuca habitat on 22 February 2014	Distance from centre line of proposed road corridor: 1.8 km.

Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 11:Extinct Profile 6 mound recorded opportunistically in the MLA in Melaleuca habitat on 22 February 2014	Distance from centre line of proposed road corridor: 250 m.

Mound Photograph	Locality map of mound (Refer to Figure 4 and Figure 5 for overview map)
	
Plate 12:Extinct Profile 6 mound recorded by Terrestrial Ecosystems in the MLA in December 2012	Distance from centre line of proposed road corridor: 673 m.

4.2 HABITAT SUITABILITY

Due to paucity of data, little information is known about the Malleefowl habitats and ecological drivers at the south-eastern edge of its Western Australian distribution. It is well documented that across its core distribution, woodland represents poor habitat for the species (Section 2.4), therefore habitat suitability in this report relates to a probability of occurrence for the species rather than an indication of population density.

The long unburnt habitats of the proposed corridor (Woodland and Melaleuca) were classified as having the highest relative habitat suitability for Malleefowl due to age post fire and relative abundance of litter. The Mallee/Triodia and Woodland-dominated Inundation Zone habitats were classified as being medium to high habitat suitability due to the litter being low or patchily distributed especially in the larger *Triodia* patches.

The recently burnt areas were classified as having a low suitability as a recent hot burn had resulted in low litter, cover and food resources.

The Regenerating Woodland habitat was deemed to have medium habitat suitability. The Regenerating Woodland habitat was burnt between five and 10 years ago, was not deemed to be preferred nesting habitat, but provided cover and resources to be used in foraging. Malleefowl will feed in recently burnt areas, but they require unburnt areas for breeding and shelter (Marchant & Higgins 1993; Benshemesh 2000).

In the Western Australian wheatbelt, the Malleefowl may be able to re-occupy key habitats 15 years post-fire (Short & Parsons 2008). The time taken for Malleefowl to recolonise vegetation post fire in the Western Woodlands is unknown, but like the Western Australian wheatbelt, it could be less than the 30 years reported from studies conducted in Eastern Australia.

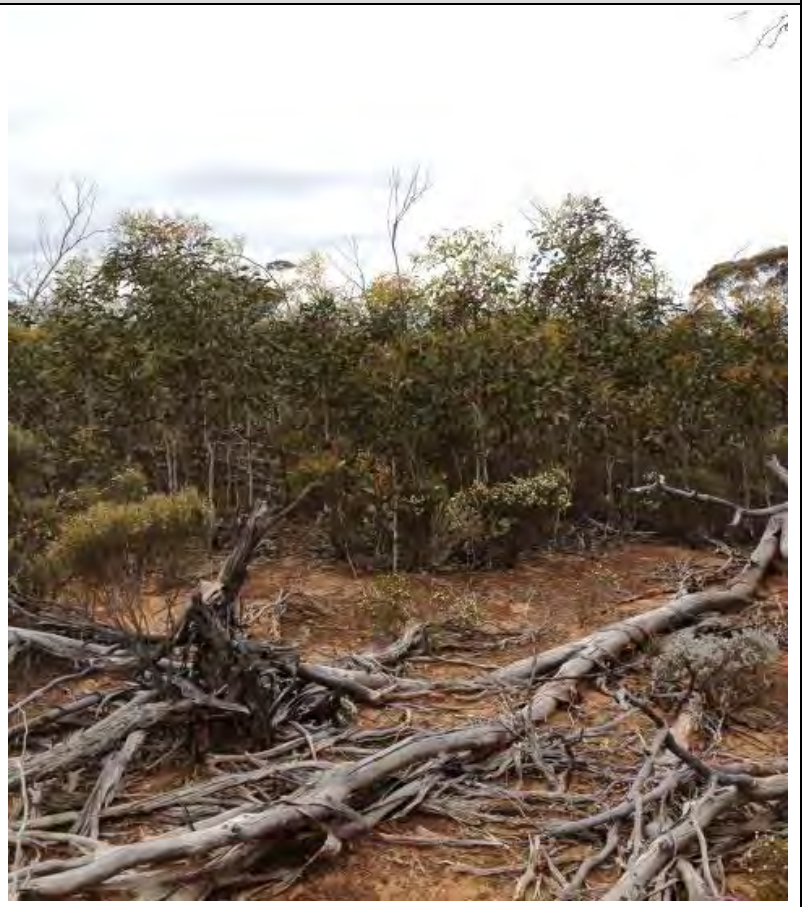
The other factor affecting the suitability of the Regenerating Woodland habitat is the patchiness of the burn. The deleterious effect of fire appears to be mitigated if fires burn patchily (Benshemesh 1990, 1992). Small patches of unburnt woodland occur within this habitat type. Table 5 displays the road corridor habitats and assessed relative habitat suitability.

It was noted that the presence of *Melaleuca* sp. trees or shrubs, either mature or regenerating, was a typical element of the localities where mounds were found. This pattern may indicate that either melaleucas are providing high quality leaf litter for mound construction, or that they are an indicator of suitable soil for digging, or both.

Table 5 Classification of suitability for Malleefowl of habitats recorded in the project area

Habitat	Habitat Quality Classification	Photo
Woodland Open *Eucalyptus* woodland to 15 m often over low *Cratystylis concephala* dominated shrubland Covers the majority of the MLA and significant areas of the proposed road corridor. This habitat makes up approximately 80% of the MLA and approximately 37% of the Road Corridor.	**High** quality for Malleefowl Reasons for classification: ▪ Fire Age: Long unburnt ▪ Soil Suitability for mounds: Easy to dig ▪ Abundant Leaf Litter: Yes ▪ Active Mounds Present: No ▪ Dormant Mounds Present: Yes ▪ Extinct Mounds Present: Yes ▪ Melaleuca Present: Yes Habitat is highly suitable for nesting and foraging. Three mounds found in this habitat type in the project area to date.	

Habitat	Habitat Quality Classification	Photo
Melaleuca Open *Eucalyptus* woodland over tall *Melaleuca* shrubland. Pockets of melaleuca habitat occur scattered throughout the matrix of woodland habitat in the MLA and in small areas of the Road Corridor. This habitat was recorded in both the MLA and the Road Corridor. It makes up approximately 9% of the MLA and approximately 6% of the Road Corridor.	**High** quality for Malleefowl Reasons for classification: ▪ Fire Age: Long unburnt ▪ Soil Suitability for mounds : Easy to dig ▪ Abundant Leaf Litter: Yes ▪ Active Mounds Present : No ▪ Dormant Mounds Present: Yes ▪ Extinct Mounds Present: Yes ▪ Suitable for nesting: Yes ▪ Suitable for foraging: Yes ▪ Melaleuca Present: Yes Habitat is highly suitable for Malleefowl nesting and foraging. Three mounds were found in this habitat to date, one in the Road Corridor, and two in the MLA.	

Habitat	Habitat Quality Classification	Photo
Regenerating Woodland Very dense, regenerating *Eucalyptus* woodland Covers significant areas of the proposed road corridor. Representing likely a combination of burnt Woodland, Mallee/Triodia and Melaleuca habitats. This habitat was only recorded in the Road Corridor, where it makes up approximately 45% of the total area.	**Medium** quality for Malleefowl Reasons for classification: ▪ Fire Age: Extensive burn within 5-10 years small patches of unburnt woodland occur within this zone. Extant logs suggest burn was cool to medium. ▪ Soil Suitability for mounds: Easy to dig ▪ Abundant Leaf Litter: No ▪ Active Mounds Present: No ▪ Dormant Mounds Present: No ▪ Extinct Mounds Present: Yes ▪ Suitable for nesting: No ▪ Suitable for foraging: Yes ▪ Melaleuca Present: Yes This habitat is suitable for foraging, as the regenerating vegetation supports abundant invertebrates and other food items. It has low nesting suitability because it is very dense and not much leaf litter yet. This habitat is likely to become high quality in the future as the vegetation matures.	

Habitat	Habitat Quality Classification	Photo
Burnt Plain Regenerating low shrubland/herbland of mixed *Allocasuarina*, *Triodia* and ephemeral herbs. Regeneration in early stage, with 80% bare soil. This habitat was only recorded in the Road Corridor, where it makes up approximately 9% of the total area.	**Low** quality for Malleefowl Reasons for classification ▪ Fire Age: Hot burn less than 5 years ▪ Soil Suitability for mounds: Easy to dig ▪ Abundant Leaf Litter: No ▪ Active Mounds Present: No ▪ Dormant Mounds Present: No ▪ Extinct Mounds Present: Yes ▪ Suitable for nesting: No ▪ Melaleuca Present: No This habitat does not provide any nesting opportunities, and is also not suitable for foraging due to limited food resources and lack of cover for predator evasion. One extinct mound was found in this habitat, indicating that the habitat was suitable before the burn and may become suitable again as the vegetation recovers.	

Habitat	Habitat Quality Classification	Photo
Mallee/Triodia *Triodia* plain under sparse mallees to 3 metres. Occasional *Allocasuarina* that can form groves. This habitat was only recorded in the Road Corridor, where it covers approximately 3% of the total area.	**Medium** quality for Malleefowl Reasons for classification: ▪ Fire Age: Generally unburnt with small areas of patchy cool burn evident. ▪ Soil Suitability for mounds: Easy to dig ▪ Leaf Litter: Low to abundant in patches ▪ Active Mounds Present: No ▪ Dormant Mounds Present: No ▪ Extinct Mounds Present: No ▪ Suitable for nesting: Possibly, although litter in the *Triodia* may be a limiting factor in the larger *Triodia* patches. *Allocasuarina* groves high in litter. ▪ Suitable for foraging: Yes ▪ Melaleuca Present: No	

Habitat	Habitat Quality Classification	Photo
Woodland-dominated Inundation Zones Eucalyptus woodland such as gimlet over mixed low shrubland such as *Eremophila*, *Diocirea ternate,* (not *Cratystylis concephala*). This habitat was only recorded in the MLA where it covers approximately 2% of the total area.	**Medium** quality for Malleefowl Reasons for classification: ▪ Fire Age: Long unburnt ▪ Soil Suitability for mounds: Easy to dig ▪ Abundant Leaf Litter: Low to abundant in patches under gimlets ▪ Active Mounds Present: No ▪ Dormant Mounds Present: No ▪ Extinct Mounds Present: No ▪ Suitable for nesting: Possibly, although the low amount of leaf litter may be a limiting factor. ▪ Suitable for foraging: Yes ▪ Melaleuca Present: No	

5 CONCLUSION

No active mounds or Malleefowl were observed during the 39 km survey of the proposed corridor. Although much of the corridor habitat is deemed to be suitable for Malleefowl no direct significant impacts are anticipated. This is due to:

- the narrow linear nature of the proposed road corridor
- the extent of suitable habitat outside of the proposed corridor and
- the apparent low density of Malleefowl in the region

Given the young dormant mound located five km west of the project area, it is precautionary to assume that there is a small population of Malleefowl in the local area, which may utilise the project area for foraging and potentially breeding. Small populations are more vulnerable to (localised) extinction, and require appropriate management planning at the time of project development.

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Appendix I Malleefowl mound profiles

Malleefowl Mound Profiles

Malleefowl Mound Profiles as described in the National Manual for the Malleefowl Monitoring System (National Heritage Trust 2007). Photos presented on next page.

- **Profile 1** – Typical crater with raised rims

  This is the typical shape of an inactive (dormant) mound. However, the mound may also be active and open.

- **Profile 2** – Mound fully dug out

  The characteristic of this profile is that the crater slopes down steeply, and at the base the sides drop vertically to form a box-like structure with sides usually 20-30 cm deep. Often litter will have been raked into windrows, and may have started to enter the mound.

- **Profile 3** – Mound with litter

  This is the next stage after Profile 2. Litter will have been raked into the mound by Malleefowl, and thick layers of litter are evident on the surface. There may or may not be sand mixed with the litter at this stage.

- **Profile 4** – Mound mounded up (no crater)

  This is the typical profile of an active but unopened Malleefowl mound.

- **Profile 5** – Mound that has a sandy crater with peak in centre

  This is a typical profile of an active mound which is in the process of being closed by Malleefowl.

- **Profile 6** – Mound low and flat without peak or crater

  This is a typical profile of a very long unused (extinct) mound, or a deliberately flattened mound late in a breeding season to capture heat from the sun.

Profile 1 Mound

Profile 2 Mound

Profile 3 Mound

Profile 4 Mound

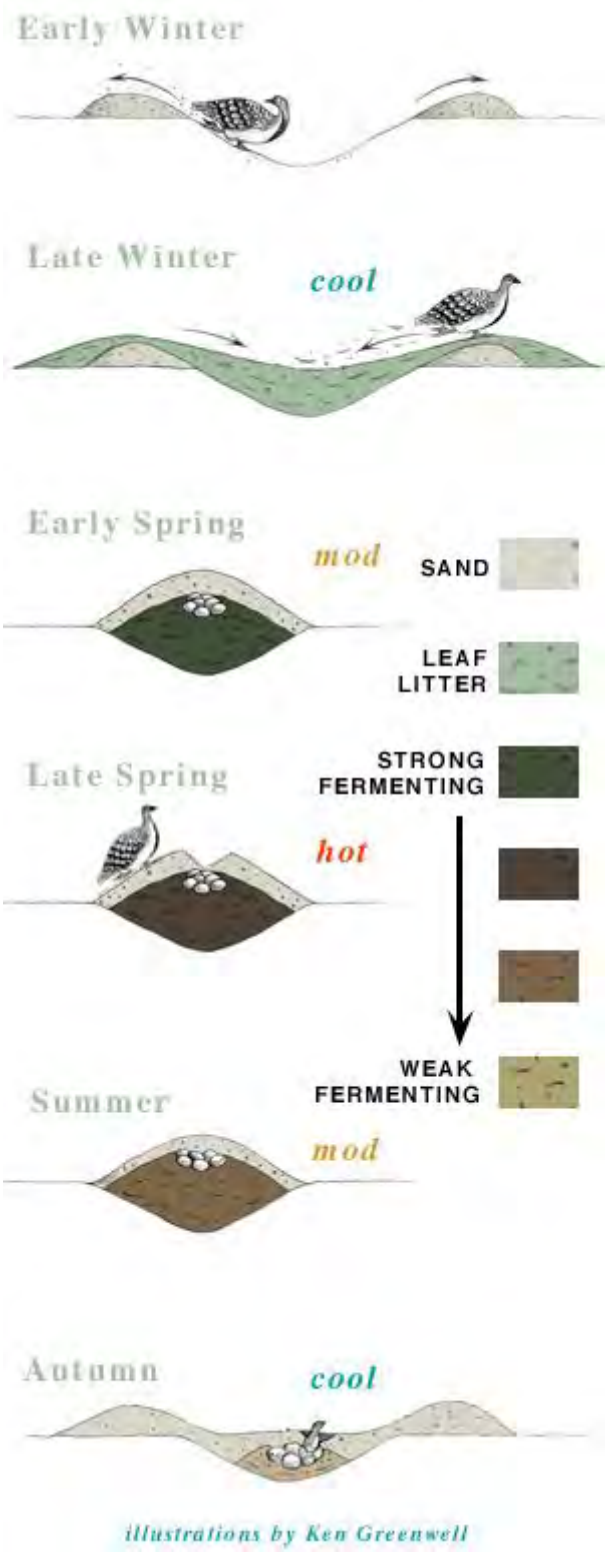
Profile 5 Mound

Profile 6 Mound

Appendix II Sequence of events at a Malleefowl mound during the year

Sequence of Events at a Malleefowl Mound during the Year

Illustration by the Malleefowl Preservation Group Inc. (2014).



APPENDIX 4: MEMORANDUM: TARGETED MALLEEFOWL SURVEY OF PROPOSED BORROW PITS (RAPALLO 2014E)

Rapallo
GROUP

12 June 2014

MBS Environmental
4 Cook Street
West Perth WA 6005

Attention: Kristy Sell

Dear Kristy

MEMORANDUM: TARGETED MALLEEFOWL SURVEY OF PROPOSED BORROW PITS

Please find attached the results of the targeted Malleefowl survey of the proposed Nova borrow pits conducted in May 2014. This data is designed to be viewed in conjunction with the data reported in *Targeted Malleefowl Survey of the Nova Project Area* (Rapallo 2014b).

A total of 17 Malleefowl mounds were recorded during the survey (five dormant profile 1 mounds, 12 extinct profile 6 mounds). No active mounds were recorded and no further evidence of Malleefowl (birds, tracks and feathers) was recorded during the survey.

Four species of conservation significant birds were also recorded during the survey. These were the Shy Heathwren, White-browed Babbler, Crested Bellbird, and Australian Bustard, all listed as Priority 4 by the Department of Parks and Wildlife. The Australian Bustard was a species not previously recorded from the Nova Project area, but assessed in earlier reports as likely to occur based on habitat, range, and verbal accounts by Traditional Owners.

Regards,

Chris Cooper

Ecologist
Rapallo Group
www.rapallo.com.au

1 Background and Scope of Works

Rapallo Environmental (Rapallo) was engaged by MBS Environmental to conduct further targeted Malleefowl surveys on behalf of Sirius Gold Pty Ltd. The survey area included several proposed borrow pits and associated access tracks and dams, as well as a proposed realignment of the Nova Access Track within the MLA (Figures 1 and 2).

Rapallo has previously conducted fauna surveys of the Nova project area in November 2013 (Rapallo 2014a) and January/February 2014 (Rapallo 2014b) during which several Malleefowl mounds were recorded.

The objectives of the additional targeted Malleefowl survey were to:

- Conduct a targeted Malleefowl survey of 22 borrow pits and their associated access tracks
- Conduct a targeted Malleefowl survey of the proposed Access Road realignment within the MLA
- If/when Malleefowl mounds are found: record mound characteristics and establish permanent photo monitoring points of active mound.

2 Methods

2.1 Targeted Malleefowl Survey

A targeted Malleefowl survey of the proposed borrow pits and access tracks was completed in the Nova project area between the 19th and 28th of May 2014. The survey was completed by a team comprised of six Rapallo ecologists, and four Ngadju Traditional Owners of the Goldfields Land and Sea Council (Table 1).

The Targeted Malleefowl survey was completed in accordance with the following Environmental Protection Authority (EPA) guidance documents.

- *Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002)
- *Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004)
- *Technical Guide: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010)

In addition to these general guidance documents, the field survey methods were developed with reference to the *National Manual for the Malleefowl Monitoring System*, as developed by the National Heritage Trust (National Heritage Trust 2007) and the methods developed by the Malleefowl Preservation Society (Dennings 2009).

The methods followed during the borrow pit survey are synonymous with those reported earlier in Rapallo (2014b) *Targeted Malleefowl Survey of the Nova Project Area*.

Table 1 Personnel involved in the survey and reporting

Name	Organisation	Position	Field survey	Reporting
Kate George	Rapallo	Principal Scientist	•	•
Chris Cooper	Rapallo	Ecologist	•	•
Marieke Weerheim	Rapallo	Ecologist		•
Magnus Peterson	Rapallo	Ecologist	•	
Margot Oorebeek	Rapallo	Ecologist	•	
Floyd Holmes	Rapallo	Ecologist	•	
Chris Jackson	Rapallo	Ecologist	•	
Jeffrey Wicker	GLSC	Traditional Owner Ranger	•	
Heathen Wicker	GLSC	Traditional Owner Ranger	•	
Eric Wilson	GLSC	Traditional Owner Ranger	•	
Grantley Flynn	GLSC	Traditional Owner Ranger	•	
David Graham	GLSC	Traditional Owner Ranger	•	

3 Results

3.1 Malleefowl survey

A total of 17 mounds were recorded during the Malleefowl survey of the proposed borrow pits. These are listed in Table 2. Localities of mounds are shown in Figures 1 and 2, with mound photos depicted in the plates in Table 3. All mounds located during the survey were characterised as either dormant (profile 1) or extinct (profile 6). No active mounds or signs of Malleefowl were recorded during the survey.

Of the 17 Malleefowl mounds recorded during the survey, five mounds were assessed as dormant profile 1 mounds and twelve were assessed as extinct profile 6 mounds (Table 2). One extinct mound was recorded outside the survey area on the North/South track and has been included in the totals listed in Table 3. The profile 6 mounds were deemed to be extinct as there was little mound structure remaining while the profile 1 mounds were assessed to be dormant due to the amount of perennial vegetation that had re-established on the mounds, the extent of erosion of the mound, and the absence of feathers, shell fragment and/or leaf litter within the mound crater. These mounds cannot be assessed as extinct because Malleefowl tend to renovate old mounds, rather than construct new mounds (National Heritage Trust 2007).

A single extinct profile 6 mound (mound 1) was recorded within the boundary of the proposed Access Road realignment and proposed airstrip within the MLA (Figure 1, Tables 2 and 3).

Five Malleefowl mounds were recorded within the boundaries of Borrow Pit 2 (Figure 1). Four of these were assessed as extinct profile 6 mounds (mounds 13, 14, 15, 16) while one mound (mound 17) was assessed as a dormant profile 1 mound (Tables 2 and 3).

Four Malleefowl mounds were recorded within the boundaries of Borrow Pit 5. Two of these were assessed as dormant profile 1 mounds (mounds 2 and 5), while the other two (mounds 3 and 4) were assessed as extinct profile 6 mounds (Figure 1, Tables 2 and 3).

Two mounds (mounds 9 and 10) were recorded within Borrow Pit 6 (Figure 1). These mounds were both assessed as being extinct profile 6 mounds (Tables 2 and 3).

One mound assessed as an extinct profile 6 mound (mound 7) was recorded within the boundaries of Borrow Pit 13 (Figure 2, Tables 2 and 3).

Three mounds were recorded in association with Borrow Pit 18. One of these, a dormant profile 1 mound (mound 11) was recorded along the Borrow Pit 18 Access Road while a dormant profile 1 (mound 6) and an extinct profile 6 mound (mound 8) were both located within the boundary of Borrow Pit 18 (Figure 2, Tables 2 and 3).

While commuting between survey areas an extinct profile 6 mound (mound 12) was found approximately 50m west of the edge of the North/South track. This mound was discovered 50m from a previously discovered dormant profile 1 mound recorded during the Targeted Malleefowl Survey of the Nova Project Area (Figure 1, Tables 2 and 3). These mounds fall outside the survey boundaries of this survey and the survey boundaries of the previous Targeted Malleefowl Survey conducted by Rapallo. This report only presents the mound found in May 2014; the earlier record is described in Rapallo (2014b).

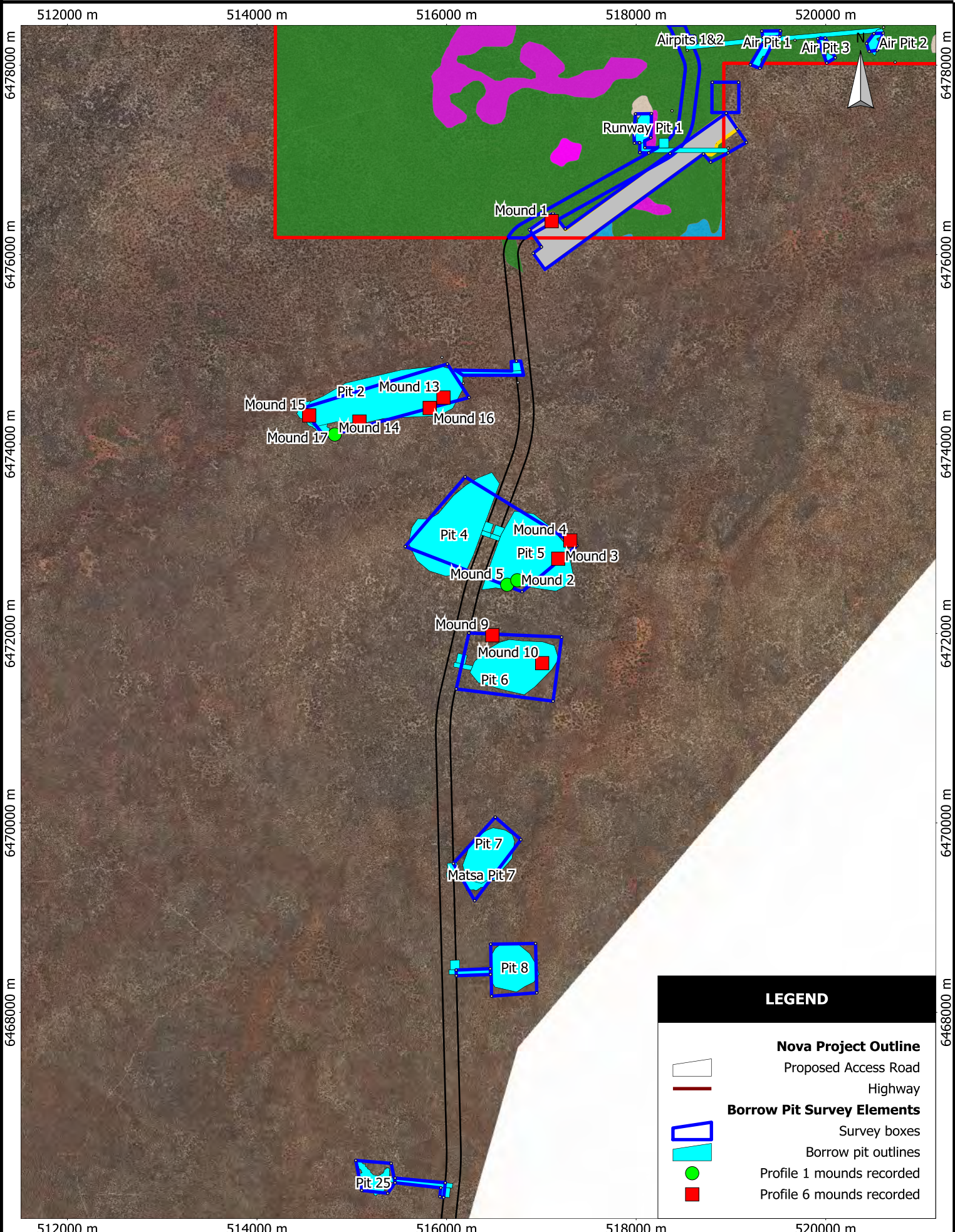
3.2 Opportunistic records

Four species of conservation significance were recorded during the survey, all of which were birds. These were:

- Shy Heathwren (*Calamanthus cautus whitlocki*) – P4
- White-browed Babbler (*Pomatostomus superciliosus ?ashbii*) – P4
- Crested Bellbird (*Oreoica gutturalis ?gutturalis*) – P4
- Australian Bustard (*Ardeotis australis*) – P4

The Australian Bustard is a new record for the Nova project area, as it had not been recorded in previous fauna surveys. It had been assessed in earlier reports as likely to occur, based on habitat, range, and verbal accounts by Traditional Owners (Rapallo 2014a).

Profiles of these species are presented in Rapallo (2014a).



Rapallo environmental

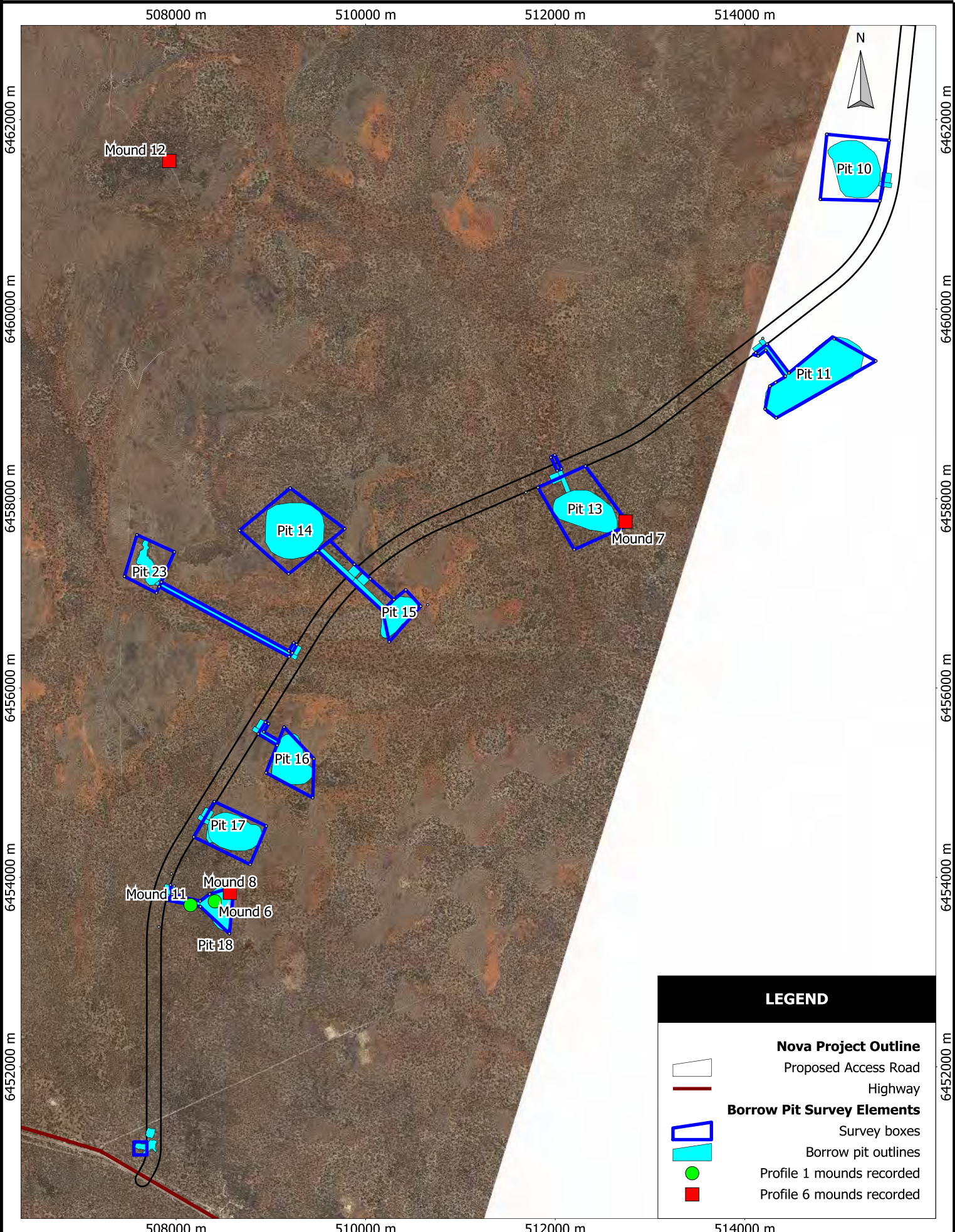
Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 50,000
Datum: MGA94 (Zone 51)

0 1.5 km

Overview map North: Survey areas and mounds recorded

Figure 1



Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 50,000
Datum: MGA94 (Zone 51)

0 1.5 km

Overview map South: Survey areas and mounds recorded

Figure 2

Table 2 Coordinates and details of mounds recorded during the targeted Malleefowl survey of proposed borrow pits (May 2014)

Mound number	Date recorded	Location	Coordinates (UTM)	Profile and status	Habitat*)	Plate number in Table 3
Mound 1	20/05/2014	New Access Road Alignment within MLA	51J, 517109 E, 6476353 N	Profile 6 - Extinct	Melaleuca patch within Eucalypt Woodland	Plate 1
Mound 2	23/05/2014	Borrow Pit 5	51J, 516746 E, 6472561 N	Profile 1 - Dormant	Regenerating woodland	Plate 2
Mound 3	23/05/2014	Borrow Pit 5	51J, 517177 E, 6472789 N	Profile 6 - Extinct	Regenerating woodland	Plate 3
Mound 4	23/05/2014	Borrow Pit 5	51J, 517305 E, 6472981 N	Profile 6 - Extinct	Regenerating woodland	Plate 4
Mound 5	23/05/2014	Borrow Pit 5	51J, 516639 E, 6472514 N	Profile 1 - Dormant	Regenerating woodland	Plate 5
Mound 6	22/05/2014	Borrow Pit 18	51H, 508409 E, 6453746 N	Profile 1 - Dormant	Woodland	Plate 6
Mound 7	21/05/2014	Borrow Pit 13	51H, 512742 E, 6457756 N	Profile 6 - Extinct	Melaleuca thicket	Plate 7
Mound 8	22/05/2014	Borrow Pit 18	51H, 508567 E, 6453836 N	Profile 6 - Extinct	Melaleuca thicket	Plate 8
Mound 9	22/05/2014	Borrow Pit 6	51J, 516481 E, 6471981 N	Profile 6 - Extinct	Regenerating woodland	Plate 9
Mound 10	22/05/2014	Borrow Pit 6	51J, 517008 E, 6471686 N	Profile 6 - Extinct	Regenerating woodland	Plate 10
Mound 11	22/05/2014	Borrow Pit 18 Access Road	51H, 508152 E, 6453707 N	Profile 1 - Dormant	Woodland	Plate 11
Mound 12	24/05/2014	North/South Track	51J, 507928 E, 6461564 N	Profile 6 - Extinct	Woodland	Plate 12
Mound 13	26/05/2014	Borrow Pit 2	51J, 515966 E, 6474491 N	Profile 6 - Extinct	Regenerating woodland	Plate 13

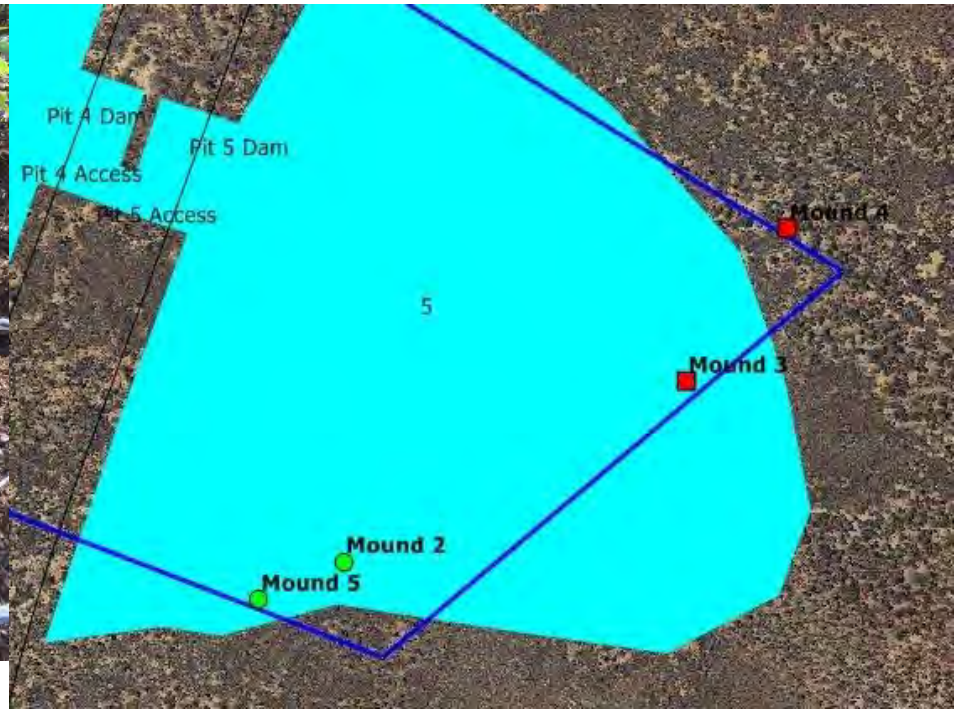
Mound number	Date recorded	Location	Coordinates (UTM)	Profile and status	Habitat*)	Plate number in Table 3
Mound 14	26/05/2014	Borrow Pit 2	51J, 515080 E, 6474237 N	Profile 6 - Extinct	Regenerating woodland	Plate 14
Mound 15	26/05/2014	Borrow Pit 2	51J, 514550 E, 6474301 N	Profile 6 - Extinct	Regenerating woodland	Plate 15
Mound 16	26/05/2014	Borrow Pit 2	51J, 515821 E, 6474380 N	Profile 6 – Extinct	Regenerating woodland	Plate 16
Mound 17	26/05/2014	Borrow Pit 2	51J, 514820 E, 6474101 N	Profile 1 – Dormant	Regenerating woodland	Plate 17

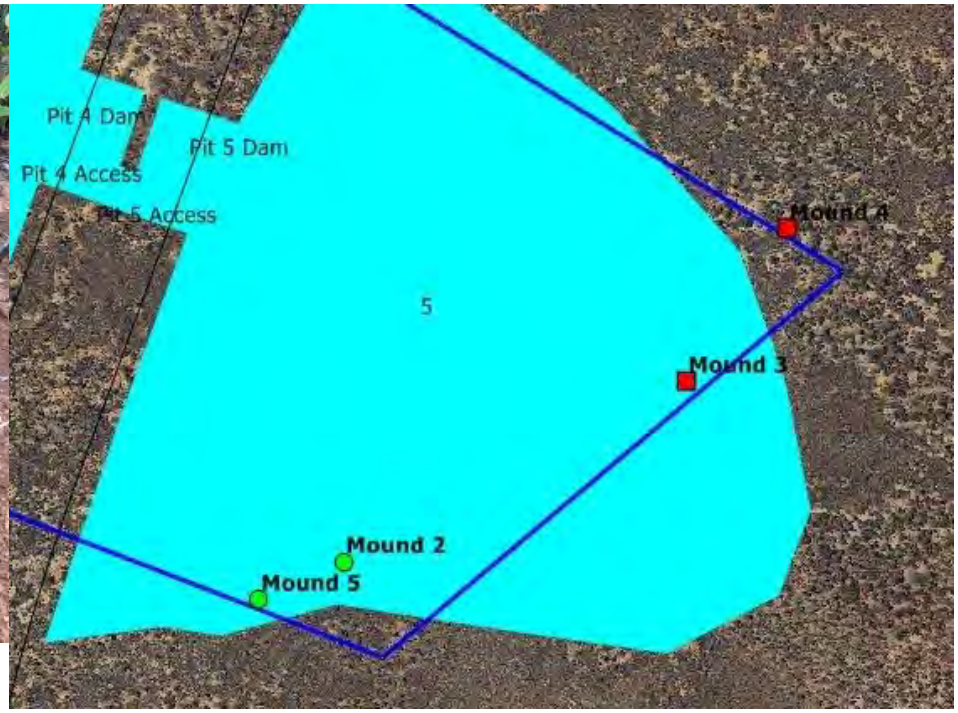
Footnotes with Table 2:

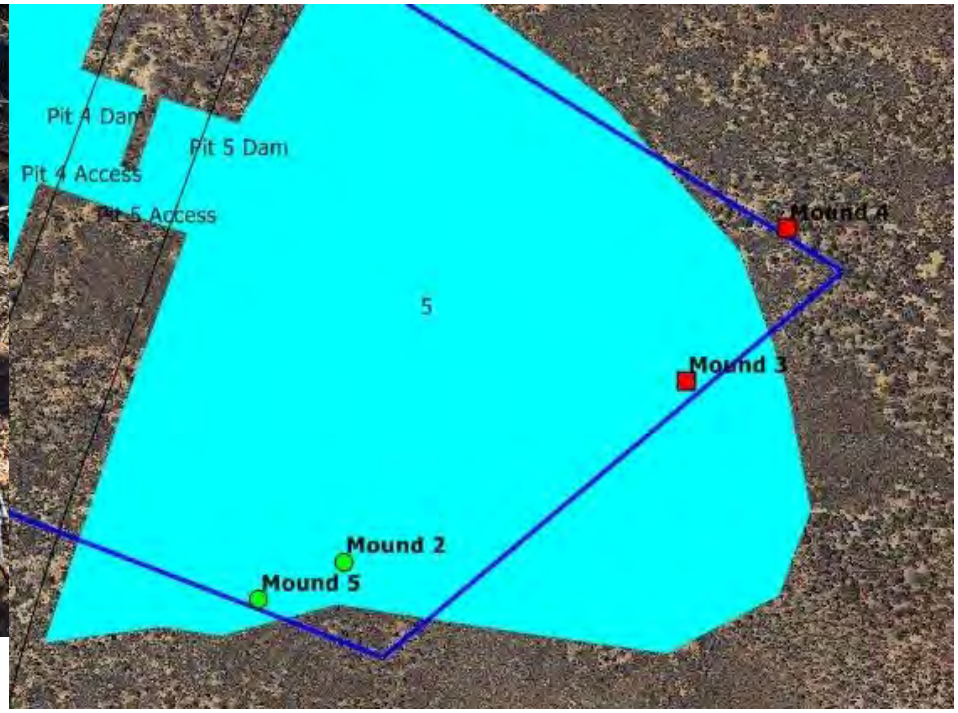
**) See Rapallo (2014a, b) for detailed descriptions of habitats in the project area*

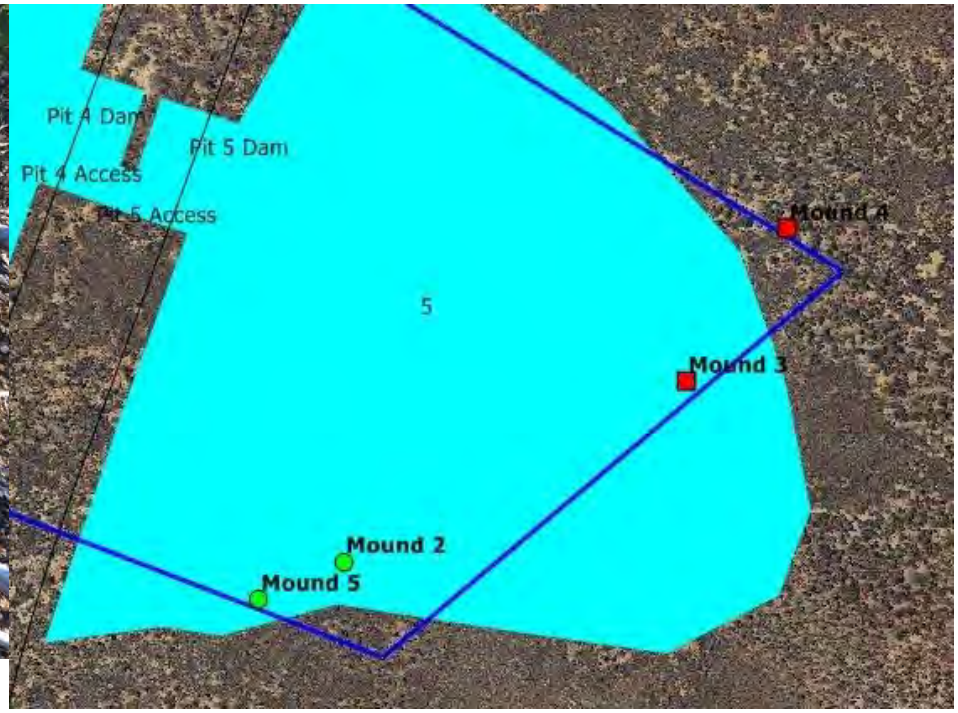
Table 3 Mound photographs and close-up maps

Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 1: Extinct Profile 6 mound within the boundary of the new Access Road alignment and airstrip boundaries.	Plate depicts Mound 1 on locality map (see Figure 1 for overview)

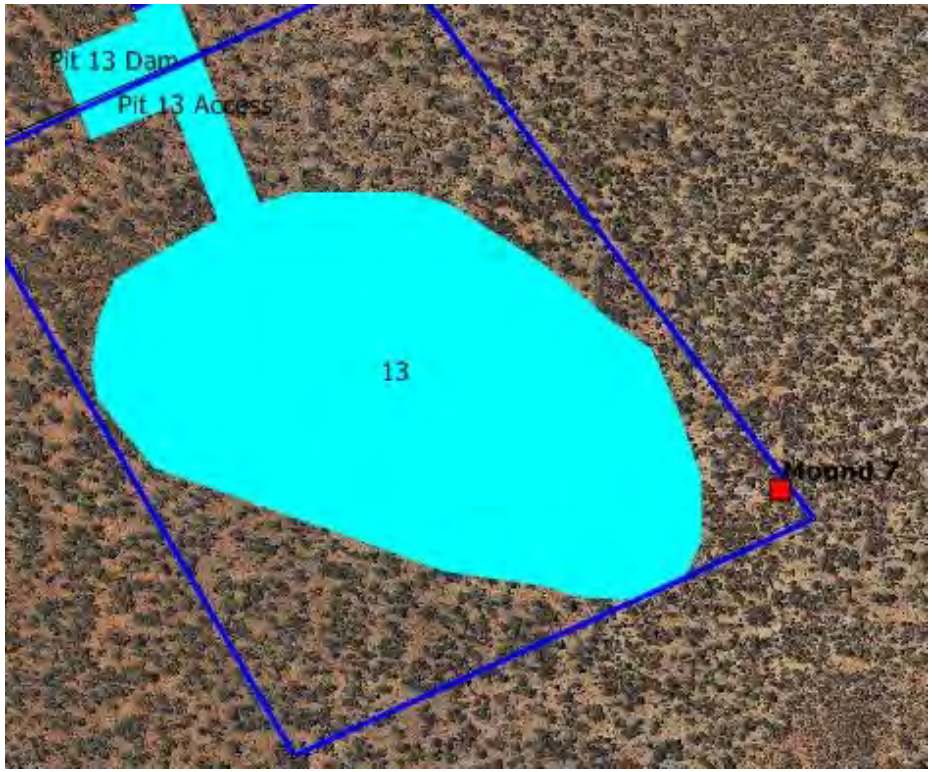
Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 2: Dormant Profile 1 mound located within Borrow Pit 5	Plate depicts Mound 2 on locality map (see Figure 1 for overview)

Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 3: Extinct Profile 6 mound located within Borrow Pit 5	Plate depicts Mound 3 on locality map (see Figure 1 for overview)

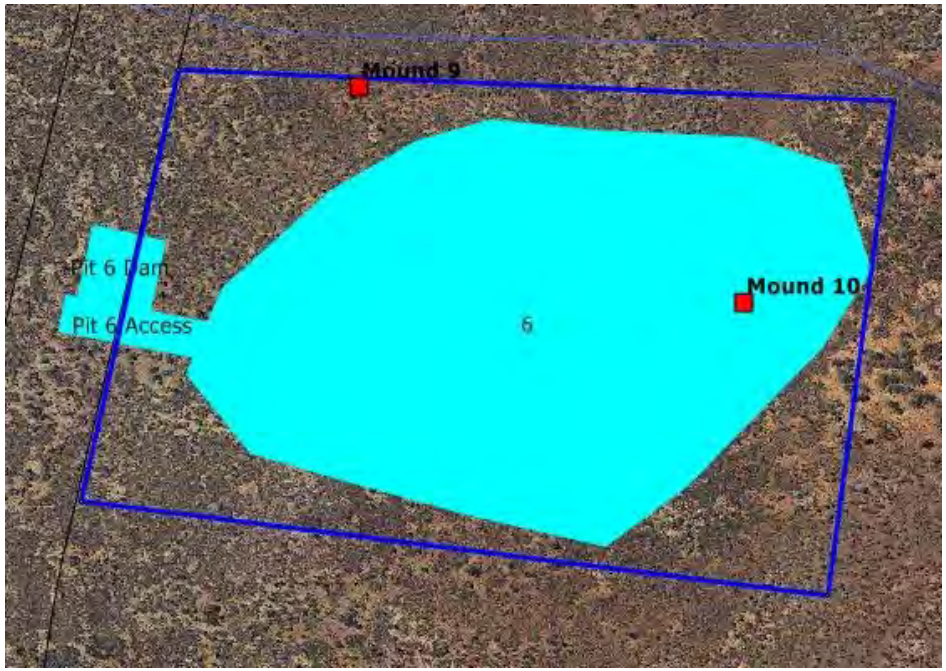
Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 4: Extinct Profile 6 mound located within Borrow Pit 5	Plate depicts Mound 4 on locality map (see Figure 1 for overview)

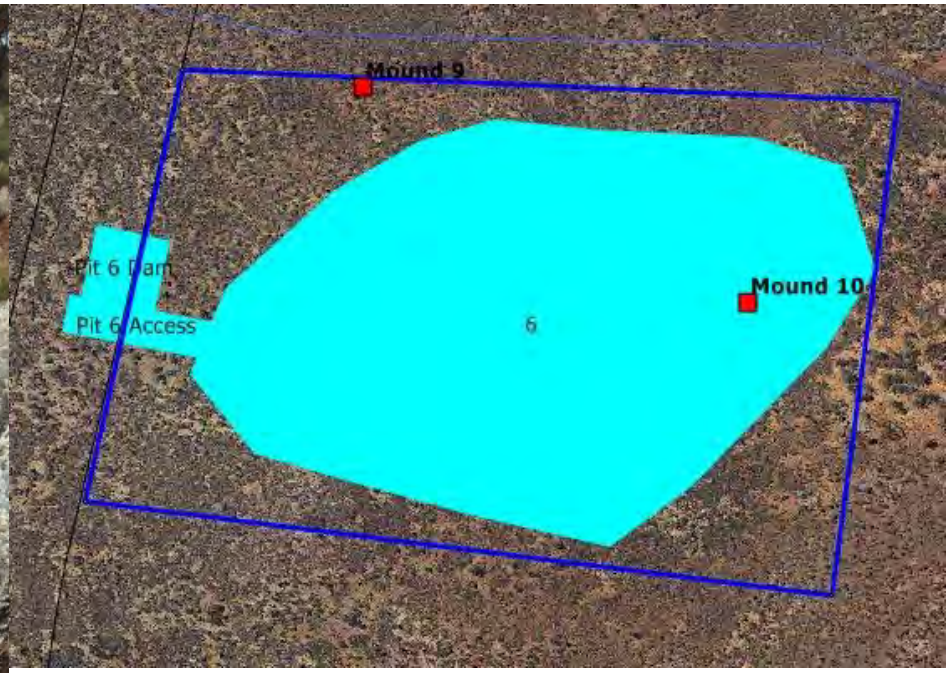
Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 5: Dormant Profile 1 mound located within Borrow Pit 5	Plate depicts Mound 5 on locality map (see Figure 1 for overview)

Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 6: Dormant Profile 1 mound located within Borrow Pit 18	Plate depicts Mound 6 on locality map (see Figure 2 for overview)

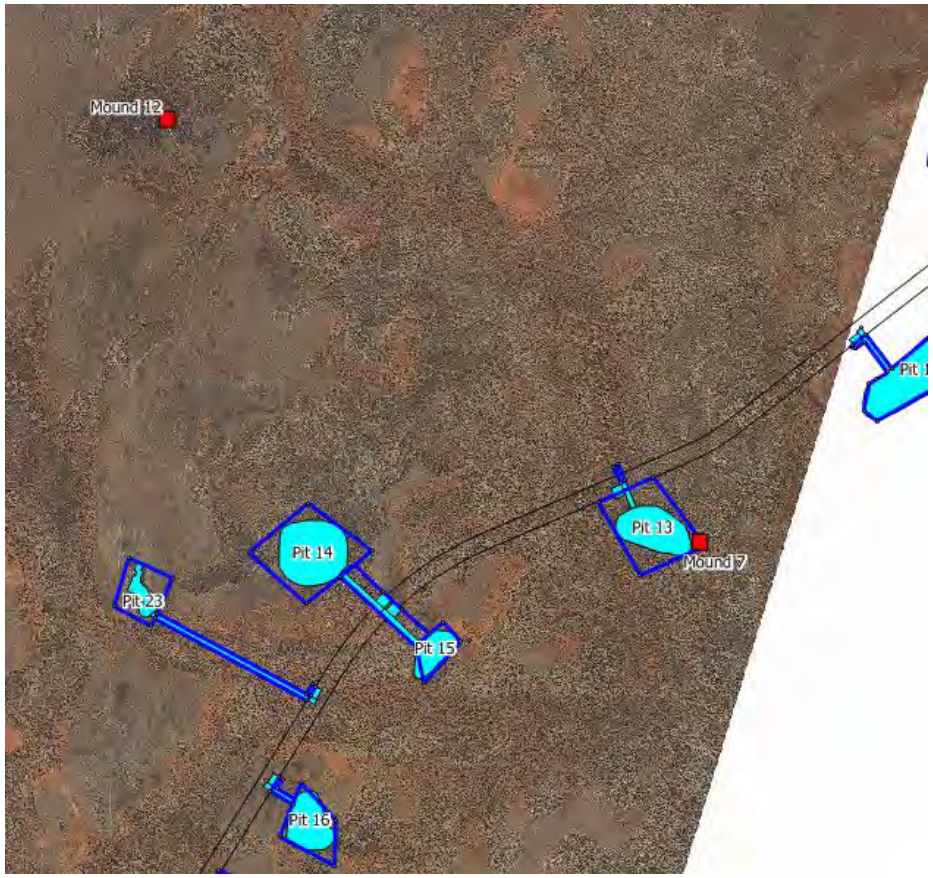
Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 7: Extinct Profile 6 mound located within Borrow Pit 13	Plate depicts Mound 7 on locality map (see Figure 2 for overview)

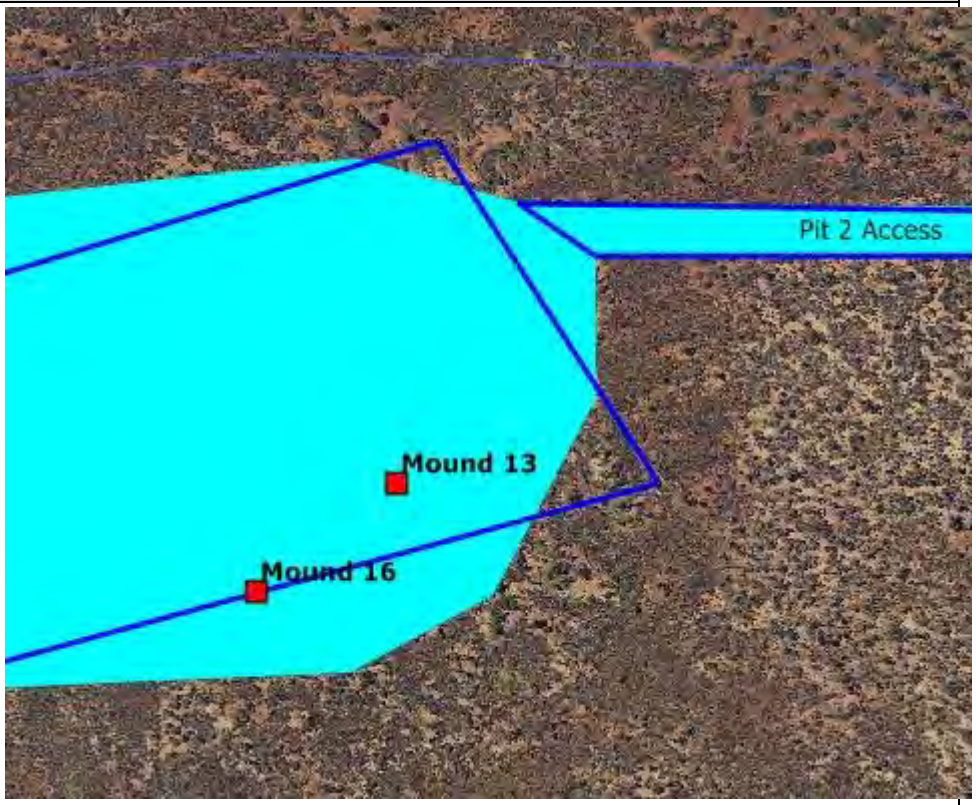
Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 8: Extinct Profile 6 mound located within Borrow Pit 18	Plate depicts Mound 8 on locality map (see Figure 2 for overview)

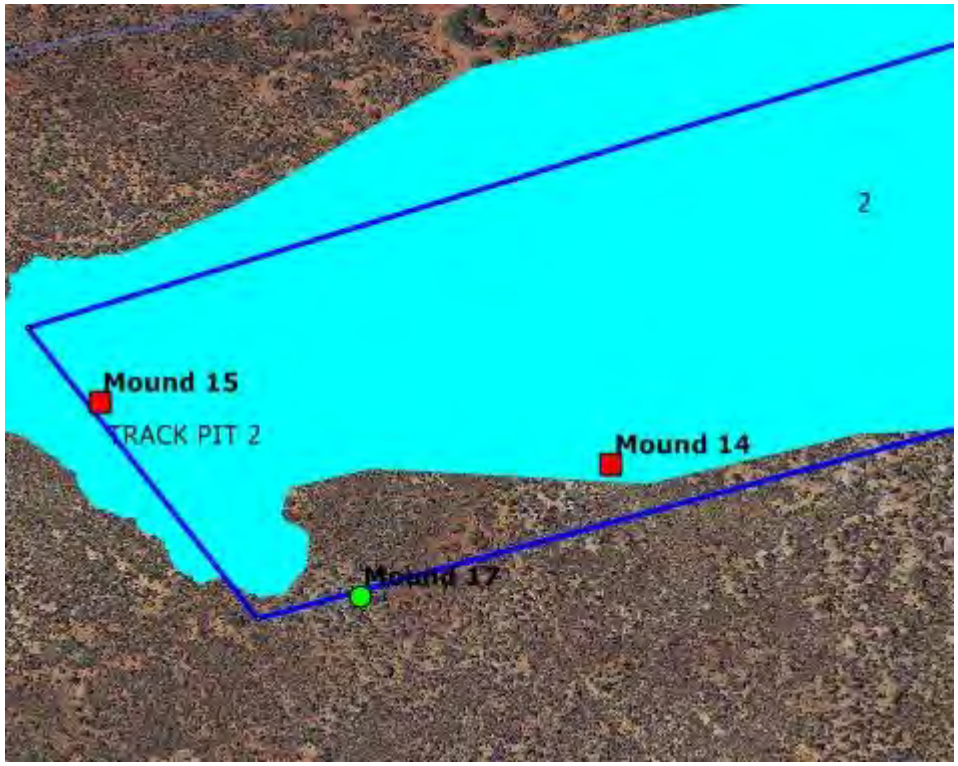
Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 9: Extinct Profile 6 mound located within Borrow Pit 6	Plate depicts Mound 9 on locality map (see Figure 1 for overview)

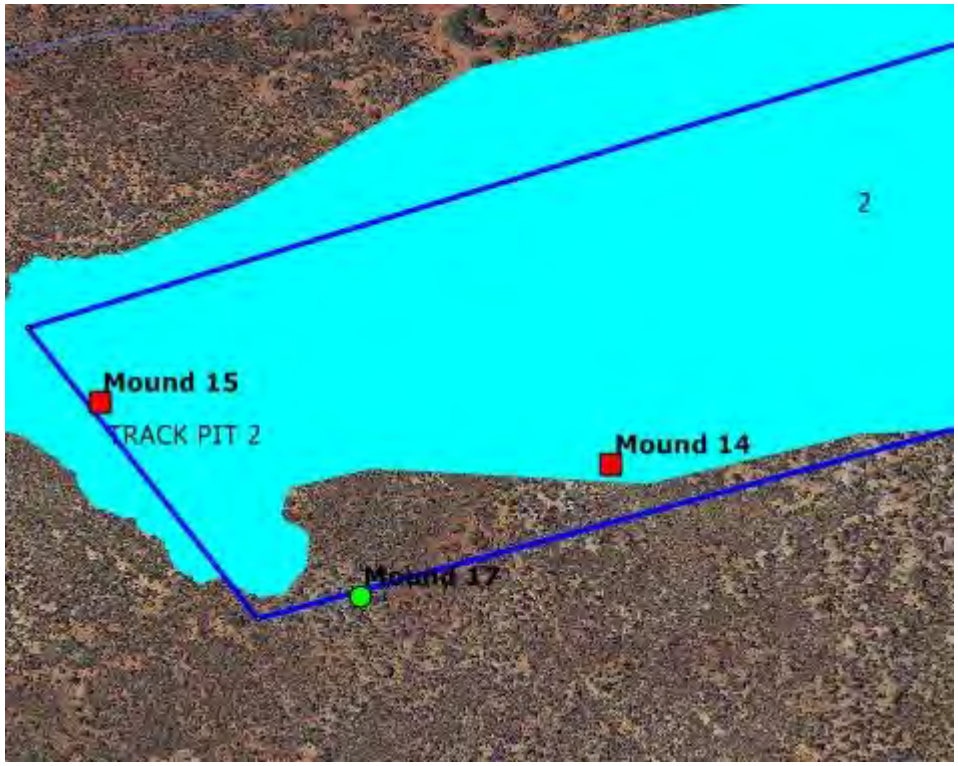
Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 10: Extinct profile 6 mound located within the boundaries of Borrow Pit 6. Mound highly degraded.	Plate depicts Mound 10 on locality map (see Figure 1 for overview)

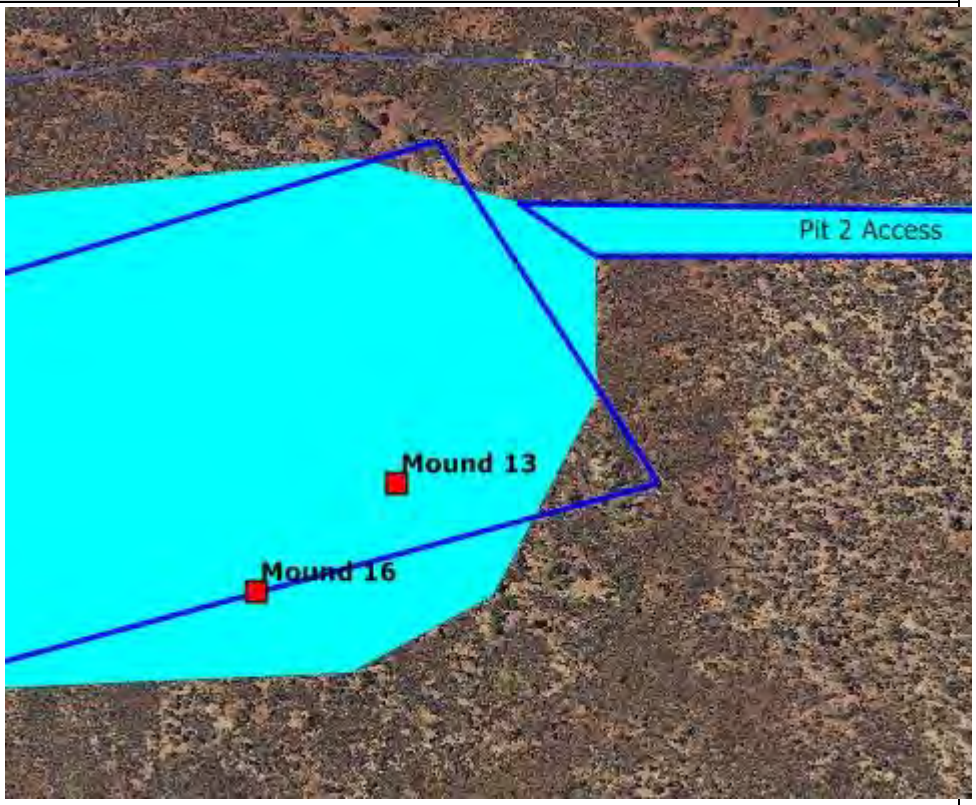
Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 11: Dormant Profile 1 mound located on the Borrow Pit 18 Access Road	Plate depicts Mound 11 on locality map (see Figure 2 for overview)

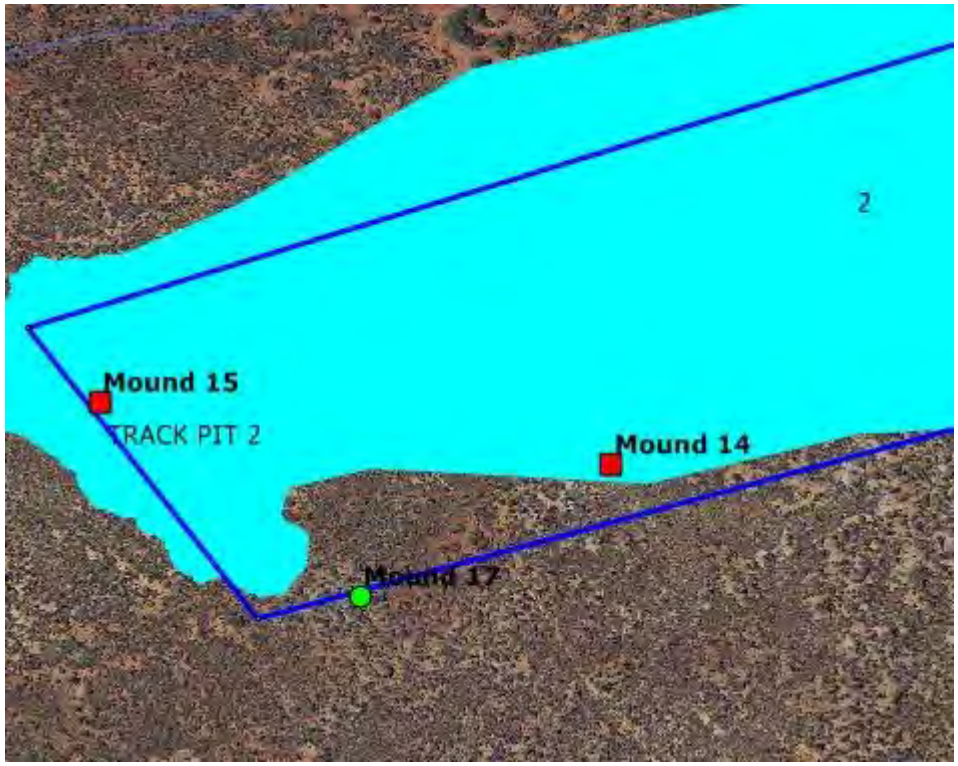
Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 12: Extinct Profile 6 mound recorded along North-South track	Plate depicts Mound 12 on locality map (see Figure 2 for overview)

Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 13: Extinct Profile 6 mound located within Borrow Pit 2	Plate depicts Mound 13 on locality map (see Figure 2 for overview)

Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 14: Extinct Profile 6 mound located within Borrow Pit 2	Plate depicts Mound 14 on locality map (see Figure 2 for overview)

Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 15: Extinct Profile 6 mound located within Borrow Pit 2	Plate depicts Mound 15 on locality map (see Figure 2 for overview)

Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 16: Extinct Profile 6 mound located within Borrow Pit 2	Plate depicts Mound 16 on locality map (see Figure 2 for overview)

Mound photograph	Locality map of mound (Refer to Figures 1 and 2 for overview map)
	
Plate 17: Dormant Profile 1 mound located within Borrow Pit 2	Plate depicts Mound 17 on locality map (see Figure 2 for overview)

4 Discussion

The large number of mounds recorded during the May borrow pit surveys, relative to the earlier survey of the road alignment (Rapallo 2014b), may be due to the difference in survey area shape. The previous survey focused on a linear area, i.e. the outline of the proposed road corridor, while the current survey covered a large number of rectangular areas.

Studies on territory size and movements of adult birds (Frith 1959; Marchant & Higgins 1990; Benshemesh 2005) suggest that the likelihood of mound detection within a given area increases after the first mound has been discovered, as Malleefowl breeding pairs tend to stay within the same general area. Therefore, conducting a rectangular area search within the region rather than following a narrow linear corridor increased the likelihood of detecting clusters of Malleefowl mounds.

No active Malleefowl mounds were recorded during the survey, nor was any recent evidence of live Malleefowl recorded, such as footprints, feathers, calls, or sightings of birds. All the mounds recorded were inactive, and in various degrees of degradation (Tables 2 and 3).

The survey areas were situated in three broad habitat types: Woodland, Melaleuca, and Regenerating Woodland (Refer to Rapallo 2014a for habitat descriptions and maps). Mounds of both profile 1 and 6 were recorded in each of these habitats (Table 2).

Melaleuca made up approximately 1-2 % of the total survey area (visual estimate in the field), while 3 out of the total 17 mounds were recorded in this habitat (18%). This finding aligns with earlier observations suggesting that Melaleucas may be indicative of high quality habitat for mound construction (see Rapallo 2014b).

The majority of mounds were recorded in Regenerating Woodland, which made up the majority of the survey area (estimate of 60%). This habitat comprises dense regrowth of whipstick mallee after a fire approximately five to ten years prior to the survey. Based on the condition of the mounds and surrounding vegetation, it is assumed that these mounds were constructed prior to the fire, in the original mature vegetation that occurred at that time. This original vegetation appears to have been a combination of Woodland and Mallee/Triodia (Rapallo 2014b). Woodland was assessed as having high suitability for Malleefowl, while Regenerating Woodland was assessed as having medium suitability (Rapallo 2014b). Only three mounds were recorded in the Woodland habitat during the survey.

Although nearly all of the areas surveyed are deemed to be suitable for Malleefowl, no direct significant impacts are anticipated. This is due to:

- No active mounds or indication of recent Malleefowl activity being recorded during any of the fauna surveys and targeted surveys completed in the project area to date;
- the extent of suitable habitat outside of the proposed impact areas, and
- the apparent low density of Malleefowl in the region.

Given the presence of two mounds located five km west of the project area on the North/South track (see section 3.1 and Rapallo 2014b), it is precautionary to assume that there is a small population of Malleefowl in the local area, which may utilise the project area for foraging and potentially breeding. Small populations are more vulnerable to (localised) extinction, and require appropriate management planning at the time of project development.

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APPENDIX 5: MEMORANDUM: SURVEY DATA – PHASE TWO FAUNA SURVEY OF THE NOVA PROJECT AREA (RAPALLO 2014C)

Rapallo GROUP

4 June 2014

MBS Environmental
4 Cook Street
West Perth WA 6005

Attention: Kristy Sell

Dear Kristy

MEMORANDUM: SURVEY DATA – PHASE TWO FAUNA SURVEY OF THE NOVA PROJECT AREA

Please find attached the phase two survey data collected from the Nova project area. The results incorporate data collected during a condensed vertebrate fauna trapping programme completed by Rapallo between 20 and 23 February 2014.

Survey data reflected the reduced survey effort and seasonality.

Additional records from the survey were limited:

- there were no additional herpetofauna species recorded
- one additional native mammal species was recorded
- five additional bird species were recorded
- one additional introduced species was recorded
- six species of conservation significance were recorded. All of these species had been previously recorded during the first survey phase in November 2013, but the new records include additional locations.

Regards,

Kate George

Principal Environmental Scientist
Rapallo Group
www.rapallo.com.au

1 Background

Rapallo Environmental was commissioned by Sirius Gold Pty Ltd (Sirius) to conduct a Level 2 fauna survey of the Nova project area. The survey area comprised the Mining Lease Application (MLA) (4,600 hectares [ha]) and the access road corridor (400 ha). The survey included a desktop review of regional data, and a single-phase Level 2 field survey.

The field survey was completed from 5 to 19 November 2013 by a team of six Rapallo ecologists and staff. Survey work included installation and deployment of six systematic trapping grids, bird surveys, bat surveys by means of acoustic recordings, hand foraging, deployment of Motion Detecting Cameras (MDCs), and opportunistic survey records. The survey focused on recording vertebrate fauna, while any putative Short-Range Endemic (SRE) invertebrate fauna were also recorded.

Eight broad fauna habitat types were identified in the project area. The dominant habitat type in the MLA was Eucalyptus Woodland, which included the sub-units Acacia shrubland, Melaleuca, and Woodland/Triodia. The dominant habitat type in the road corridor was Regenerating *Eucalyptus* Woodland, within which were smaller patches of the habitats Burnt Plain, Mallee/Triodia, and Woodland dominated inundation zone. In addition, one sub-type was recorded, comprising a narrow creek line within the Regenerating Woodland habitat, considered to be a subset of this habitat.

A total of 136 (potentially 138) vertebrate fauna species were recorded from the project area in November 2013, comprising 19 (potentially 21) mammals, 40 reptiles and 77 birds.

Nine vertebrate fauna species of conservation significance were identified in the project area, comprising eight bird species, and (potentially) one species of bat. One conservation listed snake was recorded from an unconfirmed location either within or close to the MLA.

The results of the phase one fauna survey are reported in Rapallo (2014a) *Fauna Survey of the Nova Project Area*.

2 Scope of Works

In February 2014 Rapallo was commissioned by Sirius to conduct a condensed second phase trapping programme in the Nova project area while they were already on site completing a targeted Malleefowl survey. At the request of MBS Environmental, four of the original six trap sites were reopened (sites 2, 3, 4 and 5). The reopened sites were those that represented the habitats most likely to be disturbed by the project. Trapping was for three nights only.

The objective of the condensed vertebrate fauna trapping programme was to take advantage of significant rainfall events (138 millimetres - Ian Lowrie *pers. comm.*) that had occurred in the three weeks prior to the phase two survey.

3 Methods

A condensed terrestrial fauna survey was completed in the Nova project area between 20 and 23 February 2014. The survey was completed by ecologists Magnus Peterson and Marieke Weerheim of Rapallo.

The February 2014 work, although supplementary to the November 2013 survey, was not designed to adhere to the requirements of a second season as per Environmental Protection Authority (EPA) *Guidance Statement 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004). This was at the request of the client. The number of trap sites was reduced from six to four, and traps were only opened for three nights. Foraging, litter sampling, motion-detecting cameras, acoustic bat surveys, and spotlighting were not part of the condensed survey programme.

Additional data was collected by Rapallo during a targeted Malleefowl survey in the proposed road corridor, and while walking selective transects in the MLA. Malleefowl records collected in this period are reported in Rapallo (2014b) *Targeted Malleefowl Survey of the Nova Project Area*. SRE records are reported in Rapallo (2014c) *Memorandum: SRE Invertebrates Collected from the Nova Project Area*. Only vertebrate fauna records other than Malleefowl are included in this memorandum.

Dry Pitfall Trapping

Trap sites two, three, and four in the MLA, and site five in the road corridor were re-opened for three nights from 20 to 23 February 2014. All vertebrate fauna and potential SRE invertebrate taxa were recorded. Potential SRE were kept and stored in 100% ethanol. Al vertebrate fauna were identified and released in the field.

Rapallo used a nested pitfall trap grid; trap configuration is illustrated in Figure 5 of Rapallo (2014a). Each systematic trap site consisted of:

- 20 Elliot traps
- 10 funnel traps (2 lines of 5)
- 12 bucket pitfall traps (2 lines of 6)
- 4 cage traps

Table 1 shows the total number of trap nights by trap site and habitat type. Fauna habitats are described in section 5.2 of Rapallo (2014a).

Table 1 Trap night summary and trap configuration per site

Site number and habitat	Pitfall Traps	Elliot Traps	Funnel Traps	Cage Traps	Total Nights
Site 2 - Woodland	36	60	30	12	**138**
Site 3 - Melaleuca	36	60	30	12	**138**
Site 4 – Woodland/Triodia	36	60	30	12	**138**
Site 5 - Regenerating	36	60	30	12	**138**
Total	**144**	**240**	**120**	**48**	**552**

Bird surveys and Opportunistic Records

Bird surveys were completed at all trap sites as per Birds Australia (2013) Atlas survey guidelines, comprising 20 minute surveys of a two hectare area. Opportunistic fauna records were also taken while traversing the project area, focusing on conservation significant species and species previously not recorded in the survey area.

Opportunistic records of conservation significant vertebrate fauna were collected in the proposed road corridor during a targeted Malleefowl survey, and while walking selective transects in the MLA (Rapallo 2014b; c).

4 Results

During the February 2014 survey, a total of 67 vertebrate fauna species were recorded, comprising ten mammal species (three introduced), ten reptile species, and 47 bird species. The results are presented in Appendix I and II.

Six species of conservation significance[*)] were recorded during the survey, all of which birds. These were:

- Rainbow Bee-eater (*Merops ornatus*) – M
- Shy Heathwren (*Calamanthus cautus whitlocki*) – P4
- White-browed Babbler (*Pomatostomus superciliosus ?ashbii*) – P4
- Crested Bellbird (*Oreoica gutturalis ?gutturalis*) – P4
- Crested Shrike-tit (*Falcunculus frontatus leucogaster*) – P4
- Malleefowl (*Leipoa ocellata*) (mounds only) – T, V

All of these species had been previously recorded during the first phase of surveying (Rapallo 2014a), but the February 2014 records included many new localities for these species. Bird records from the supplementary survey are presented in Appendix II.

Additional records from the condensed second phase were limited, and comprised five bird species, one native mammal, and one introduced mammal, none of which of conservation significance. No additional reptiles were recorded. The additional species were:

- Owlet Nightjar (*Aegotheles cristatus*) – Trap site 2
- Fan-tailed Cuckoo (*Cacomantis flabelliformis*) – Woodland habitat in MLA
- Red-backed Kingfisher (*Todiramphus pyrrhopygius*) – Trap site 4
- Western Gerygone (*Gerygone fusca*) – Trap site 5
- Zebra Finch (*Taeniopygia guttata*) – Trap site 4
- Ash Grey Mouse (*Pseudomys albocinereus*) – Trap site 3
- European Fox (*Vulpes vulpes*) – Introduced fauna. Footprints recorded in the road corridor in Regenerating Woodland habitat

** Footnotes:*

T Wildlife Conservation Act 1950 (WC Act): Threatened (Schedule 1)
V Environment Protection and Biodiversity Conservation Act (EPBC Act): Vulnerable
M WC Act: Migratory (Schedule 3), and EPBC Act: Migratory
P4 Department of Parks and Wildlife (DPaW): Priority 4.

5 Discussion

Differences in survey effort such as habitats trapped, trap nights and numbers of observers make direct comparisons between phases 1 and 2 difficult. However, the general trend was that reptile activity was higher in phase 1, and mammal activity was higher in phase 2. This reflects seasonal differences in general activity patterns between two species groups, which affects the likelihood of species being captured in traps.

Over the two phases combined, sites 3 and 5 recorded less small mammals (2 species at each site) compared to sites 2 and 4 (4 and 5 species, respectively) (see table Appendix III). This may be a reflection of the greater amount of low ground cover available at sites 2 and 4, which provides shelter for small mammals. However, if non-trappable mammals (larger species and bats) are taken into account, there appears to be no difference in total mammal species between sites 2, 3, 4 and 5 (Rapallo 2014a).

Over the two phases combined, there was no difference between sites in the number of reptile species captured in traps, with respectively 13, 13, 12 and 14 species recorded for sites 2, 3, 4 and 5.

Reptiles

No additional species of reptile were recorded during the survey. In section 5.6.2 of Rapallo (2014a), species richness estimators indicated that the systematic trapping grids recorded approximately 71% of all potential trappable mammals and reptiles. This was also reflected in the species accumulation curve which continued to rise at the end of the survey, and did not approach the predicted species richness of 50 species.

Despite the February 2014 survey being shorter in duration and much smaller in survey area than the work completed in November 2013, the fact that no new species were recorded suggests that it is likely that the common species occurring on the project area have all been recorded and only cryptic species remain. A three night survey program is not long enough to detect cryptic species, however it is known that uncommon cryptic species such as South West Carpet Python (*Morelia spilota imbricata)* do occur on the project area (Rapallo 2014a). Therefore further trap nights are unlikely to yield much more information on conservation significant reptiles.

Frogs

No amphibians were recorded during the survey. The latter was likely due to the absence of standing water in the project area, or high rainfall events immediately prior to or during the survey. Sirius staff members heard frogs calling during the rainfall events that preceded the survey, but they were unable to obtain an acoustic recording that might have enabled species identification (Ian Lowrie *pers. comm.*).

Mammals

One additional mammal species was recorded, the native Ash Grey Mouse (*Pseudomys albocinereus*). This species was not unexpected as its range extends from Shark Bay to Israelite Bay inhabiting areas of low heath and shrubland over much of the south-west of Western Australia (Menkhorst & Knight 2011).

Birds

The number of species recorded in February 2014 was dramatically lower than during November 2013 (46 bird species, compared to 77 species in November 2013). Part of this can be explained by the much reduced survey effort in February 2014, however there were some families that appeared much less frequently compared to November 2013.

In the first phase of surveying, Honeyeaters of the family Meliphagidae were the most species-rich family with eleven species recorded across the project area. During the second phase of survey, only five species of Honeyeater were recorded. This likely reflects the irruptive nature of Honeyeater species.

The Scarlet Chested Parrot (*Neophema splendida*) is another irruptive species missing from the second phase of survey.

The first phase of survey was carried out at the end of spring during a period of peak flowering and by February flowering had subsided. High breeding activity was noted during the first phase of surveying with many juvenile Yellow-plumed Honeyeaters (*Lichenostomus ornatus*) and White-fronted Honeyeater (*Purnella albifrons*) observed. Other juveniles or nesting birds noted in the first phase were Western Yellow Robin (*Eopsaltria griseogularis*), Red-capped Robin (*Petroica goodenovii*), Emu (*Dromaius novaehollandiae*), Scarlet Chested Parrot, Australasian Pipit (*Anthus novaeseelandiae*) and Red Throat (*Pyrrholaemus brunneus*). Pallid Cuckoo (*Cacomantis pallidus*), Gilberts Whistler (*Pachycephala inornata*) and Horsfield's Bronze -cuckoo (*Chalcites basalis*) were heard frequently calling indicating breeding, and a recently fledged juvenile Pallid Cuckoo was recorded at trap site 2. By February 2013, breeding had reduced, although Black-eared Cuckoo (*Chalcites osculans*)was heard calling and a Golden Whistler (*Pachycephala pectoralis)* nestling was observed at trap site 3.

Two extinct Profile 6 (National Heritage Trust 2007), Malleefowl mounds were recorded on the MLA during the second phase survey. Further information on Malleefowl on the project area is documented in Rapallo (2014c).

6 References

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Rapallo Environmental. (2014c) Memorandum: SRE Invertebrates Collected from the Nova Project Area. Report Prepared for MBS Environmental.

Appendix I Mammal and reptile records (systematic and opportunistic) from the second phase sampling - February 2014.

Date	Site Name	Trap No.	Common Name	Scientific Name	Quantity
21/02/2014	Site 2	B3A	Main's Gecko	*Lucasium maini*	1
21/02/2014	Site 2	B5A	Western Pygmy-possum	*Cercatetus concinnus*	1
21/02/2014	Site 2	B4B		*Sminthopsis dolichura*	1
21/02/2014	Site 2	B6B	Sandy Inland Mouse	*Pseudomys hermannsburgensis*	1
21/02/2014	Site 2	E11	Sandy Inland Mouse	*Pseudomys hermannsburgensis*	1
21/02/2014	Site 4	B6A		*Ningaui yvonnae*	1
21/02/2014	Site 4	F5B		*Ctenotus atlas*	1
21/02/2014	Site 4	B3B	Sandy Inland Mouse	*Pseudomys hermannsburgensis*	1
21/02/2014	Site 4	B4B	Sandy Inland Mouse	*Pseudomys hermannsburgensis*	1
21/02/2014	Site 4	B5B		*Diplodactylus granariensis*	1
21/02/2014	Site 4	B6B		*Menetia greyii*	1
21/02/2014	Site 4	B1B		*Menetia greyii*	1
21/02/2014	Site 4	B1B	Sandy Inland Mouse	*Pseudomys hermannsburgensis*	1
21/02/2014	Site 4	E19	Sandy Inland Mouse	*Pseudomys hermannsburgensis*	1
21/02/2014	Site 3	B3B	Mygalomorph spider		1
22/02/2014	Site 2	B1A	Western Pygmy-possum	*Cercatetus concinnus*	1
22/02/2014	Site 2	B3A	Western Pygmy-possum	*Cercatetus concinnus*	1
22/02/2014	Site 2	B6A		*Diplodactylus granariensis*	1
22/02/2014	Site 2	E11	Sandy Inland Mouse	*Pseudomys hermannsburgensis*	1
22/02/2014	Site 2	E14	House Mouse	*Mus musculus*	1
22/02/2014	Site 3	B2B	Sandy Inland Mouse	*Pseudomys hermannburghensis*	1
22/02/2014	Site 4	B2A		*Hemiergis initialis brookeri*	1
22/02/2014	Site 4	B3A		*Ningaui yvonnae*	1
22/02/2014	Site 4	B4A	Sandy Inland Mouse	*Pseudomys hermannsburgensis*	1
23/02/2014	Site 4	B3A	Thorny Devil	*Moloch horridus*	1
23/02/2014	Site 4	B3A	Ash Grey Mouse	*Pseudomys albocinereus*	1
23/02/2014	Site 4	B2A	Western Pygmy-possum	*Cercatetus concinnus*	1
23/02/2014	Site 4	F1A		*Ctenotus atlas*	1
23/02/2014	Site 4	B6B		*Ningaui yvonnae*	2
23/02/2014	Site 4	F2A		*Ningaui yvonnae*	1
23/02/2014	Site 2	Cage		*Varanus gouldii*	1
23/02/2014	Site 2	Cage	Rufous Treecreeper	*Climacteris rufa*	1
23/02/2014	Site 3	F4A	Thorny Devil	*Moloch horridus*	1
23/02/2014	Site 3	F3A		*Morethia butleri*	1
23/02/2014	Site 3	B3B	Sandy Inland Mouse	*Pseudomys hermannsburgensis*	1

Date	Site Name	Trap No.	Common Name	Scientific Name	Quantity
21/02/2014	Site 5	E9	House Mouse	*Mus musculus*	1
22/02/2014	Site 5	B4B	House Mouse	*Mus musculus*	1
22/02/2014	Site 5	F2B		*Diplodactylus granariensis*	1
23/02/2014	Site 5	B5B	House Mouse	*Mus musculus*	1
23/02/2014	Site 5	B3A		*Egernia richardi*	1
23/02/2014	Site 5	B4A	House Mouse	*Mus musculus*	1
Opportunistic					
			Macropod/Western Grey Kangaroo	*Macropus fuliginosus*	Signs from all sites - likely to be *Macropus fuliginosus*
		Opp	Rabbit		Signs from all sites
		Opp	Camel		Signs from most sites
22/02/2014	51J 0516009 6470621	Opp	European Fox	*Vulpes vulpes*	Recorded from regen habitat

Appendix II: Bird records from the second phase sampling (systematic and opportunistic) - February 2014.

Date	Time	Site Name	Coordinates	Habitat	Record Type	Common Name	Scientific Name	Quantity
18/02/2014	Afternoon	51J 0350723 6593472	51J, 0350723 E, 6593472 N	Creek	Opportunistic	Crested Bellbird	*Oreoica gutturalis*	2
20/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Opportunistic	Striated Pardalote	*Pardalotus striatus*	H = Heard
20/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Opportunistic	White-eared Honeyeater	*Lichenostomus leucotis*	H
20/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Opportunistic	White-fronted Honeyeater	*Purnella albifrons*	H
20/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Opportunistic	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	H
21/02/2014	Dusk	Fenceline Track		Woodland	Opportunistic	Tree Martin	*Petrochelidon nigricans*	10
21/02/2014	Midday		51J, 516424 E, 6468804 N	Regen.Woodland	Opportunistic	Crested Bellbird	*Oreoica gutturalis*	H
21/02/2014	Afternoon	Matsa Track (waypoint in GPS 2)	51J, 515613 E, 6468417 N	Regen.Woodland	Opportunistic	White-browed Babbler	*Pomatostomus superciliosus*	1
21/02/2014	Afternoon	MF transect walk (waypoint in GPS 1)	51J, 516033 E, 6467216 N	Regen.Woodland	Opportunistic	Shy Heathwren	*Calamanthus cautus*	H
21/02/2014	Afternoon	Sirius Camp	51J, 518044E, 6479165N	Woodland	Opportunistic	Australian Raven	*Corvus coronoides*	1
21/02/2014	Afternoon	Sirius Camp	51J, 518044E, 6479165N	Woodland	Opportunistic	Willie Wagtail	*Rhipidura leucophrys*	1
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Owlet Nightjar	*Aegotheles cristatus*	H
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Chestnut Quail-thrush	*Cinclosoma castanotum*	H
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Grey Butcherbird	*Cracticus torquatus*	H
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	6
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	2
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Regent Parrot	*Polytelis anthopeplus*	2
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Rufous Treecreeper	*Climacteris rufa*	2
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Spotted Pardalote	*Pardalotus punctatus*	2
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Striated Pardalote	*Pardalotus striatus*	1
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	4
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	6
21/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	4
21/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Golden Whistler	*Pachycephala pectoralis*	2
21/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	2
21/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	3
21/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Western Yellow Robin	*Eopsaltria griseogularis*	2
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Red-backed Kingfisher	*Todiramphus pyrrhopygius*	1
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	H
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Grey Shrike-thrush	*Colluricincla harmonica*	1
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	4
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	2
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Rufous Treecreeper	*Climacteris rufa*	H
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Striated Pardalote	*Pardalotus striatus*	1
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	10
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	8
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Crested Bellbird	*Oreoica gutturalis*	H
21/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Zebra Finch	*Taeniopygia guttata*	1
21/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Shy Heathwren	*Calamanthus cautus*	2

Date	Time	Site Name	Coordinates	Habitat	Record Type	Common Name	Scientific Name	Quantity
21/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	H
21/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	H
21/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	H
21/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	H
21/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Crested Bellbird	*Oreoica gutturalis*	H
21/02/2014	Late morning	Waypoint "DAVES OLD MOUND"	51J, 516290 E, 6480290 N	Woodland/Triodia	Opportunistic	Crested Bellbird	*Oreoica gutturalis*	H
21/02/2014	Late morning	Waypoint "FLAT MOUND"	Waypoint "FLAT MOUND"	Melaleuca	Opportunistic	Malleefowl	*Leipoa ocellata*	Extinct Profile 6 mound *
21/02/2014	Late morning	Waypoint "DAVES OLD MOUND"	51J, 516290 E, 6480290 N	Woodland/Triodia	Opportunistic	Malleefowl	*Leipoa ocellata*	Extinct Profile 6 mound*
21/02/2014	Late morning	Waypoint "FLAT MOUND"	Waypoint "FLAT MOUND"	Melaleuca	Opportunistic	Emu	*Dromaius novaehollandiae*	Scat
22/02/2014	Afternoon	51J 0516046 6469737	51J, 0516046 E, 6469737 N	Regen.Woodland	Opportunistic	Crested Bellbird	*Oreoica gutturalis*	1
22/02/2014	Dawn	Fenceline Track		Woodland	Opportunistic	Wedge-tailed Eagle	*Aquila audax*	1
22/02/2014	Afternoon	Haul Rd (waypoint SHY HEATHWR 4 in GPS2)	51J, 516019 E, 6466228 N	Regen.Woodland	Opportunistic	Brown-headed Honeyeater	*Melithreptus brevirostris*	6
22/02/2014	Afternoon	Haul Rd (waypoint SHY HEATHWR 4 in GPS2)	51J, 516019 E, 6466228 N	Regen.Woodland	Opportunistic	Redthroat	*Pyrrholaemus brunneus*	4
22/02/2014	Afternoon	Haul Rd (waypoint SHY HEATHWR 4 in GPS2)	51J, 516019 E, 6466228 N	Regen.Woodland	Opportunistic	Striated Pardalote	*Pardalotus striatus*	2
22/02/2014	Afternoon	Haul Rd (waypoint SHY HEATHWR 4 in GPS2)	51J, 516019 E, 6466228 N	Regen.Woodland	Opportunistic	Weebill	*Smicrornis brevirostris*	2
22/02/2014	Afternoon	Haul Rd (waypoint SHY HEATHWR 4 in GPS2)	51J, 516019 E, 6466228 N	Regen.Woodland	Opportunistic	White-eared Honeyeater	*Lichenostomus leucotis*	1
22/02/2014	Afternoon	Haul Rd (waypoint SHY HEATHWR 4 in GPS2)	51J, 516019 E, 6466228 N	Regen.Woodland	Opportunistic	Shy Heathwren	*Calamanthus cautus*	4
22/02/2014	Afternoon	transect	51J, 516063E 6466424N	Regen.Woodland	Opportunistic	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	1
22/02/2014	Morning	Sirius Camp	51J, 518044E, 6479165N	Woodland	Opportunistic	Dusky Woodswallow	*Artamus cyanopterus*	6
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Opportunistic	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	H
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Opportunistic	Grey Shrike-thrush	*Colluricincla harmonica*	H
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Owlet Nightjar	*Aegotheles cristatus*	H
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Australian Ringneck Parrot	*Barnardius zonarius*	H
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Black-eared Cuckoo	*Chalcites osculans*	H
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Grey Butcherbird	*Cracticus torquatus*	H
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Jacky Winter	*Microeca fascinans*	H
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	12
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	4
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Rufous Treecreeper	*Climacteris rufa*	5
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Spotted Pardalote	*Pardalotus punctatus*	H
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Varied Sittella	*Daphoenositta chrysoptera*	3
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	8
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	6
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	6
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	5
22/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Crested Bellbird	*Oreoica gutturalis*	H
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Australian Ringneck Parrot	*Barnardius zonarius*	2

Date	Time	Site Name	Coordinates	Habitat	Record Type	Common Name	Scientific Name	Quantity
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Australian Ringneck Parrot	*Barnardius zonarius*	2
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Golden Whistler	*Pachycephala pectoralis*	H
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Grey Butcherbird	*Cracticus torquatus*	H
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Grey Shrike-thrush	*Colluricincla harmonica*	H
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	4
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	3
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Striated Pardalote	*Pardalotus striatus*	H
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	6
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	White-eared Honeyeater	*Lichenostomus leucotis*	H
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	3
22/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Crested Bellbird	*Oreoica gutturalis*	H
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Opportunistic	Grey Butcherbird	*Cracticus torquatus*	H
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Opportunistic	Crested Bellbird	*Oreoica gutturalis*	H
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Rainbow Bee-eater	*Merops ornatus*	2
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Australian Ringneck Parrot	*Barnardius zonarius*	4
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Brown Falcon	*Falco berigora*	1
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Common Bronzewing	*Phaps chalcoptera*	1
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Grey Shrike-thrush	*Colluricincla harmonica*	H
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	30
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	8
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Rufous Treecreeper	*Climacteris rufa*	H
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Tree Martin	*Petrochelidon nigricans*	2
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	4
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	20
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	10
22/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Zebra Finch	*Taeniopygia guttata*	2
22/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Shy Heathwren	*Calamanthus cautus*	H
22/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	H
22/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Striated Pardalote	*Pardalotus striatus*	H
22/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	H
22/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	H
22/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	H
23/02/2014	Morning	Site 1	51J, 515195 E, 6481510 N	Acacia	Systematic (20 min)	Australian Ringneck Parrot	*Barnardius zonarius*	1
23/02/2014	Morning	Site 1	51J, 515195 E, 6481510 N	Acacia	Systematic (20 min)	Inland Thornbill	*Acanthiza apicalis*	1
23/02/2014	Morning	Site 1	51J, 515195 E, 6481510 N	Acacia	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	H
23/02/2014	Morning	Site 1	51J, 515195 E, 6481510 N	Acacia	Systematic (20 min)	Red-capped Robin	*Petroicagoodenovii*	H
23/02/2014	Morning	Site 1	51J, 515195 E, 6481510 N	Acacia	Systematic (20 min)	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	H
23/02/2014	Morning	Site 1	51J, 515195 E, 6481510 N	Acacia	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	1
23/02/2014	Morning	Site 1	51J, 515195 E, 6481510 N	Acacia	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	3
23/02/2014	Morning	Site 1	51J, 515195 E, 6481510 N	Acacia	Systematic (20 min)	White-browed Babbler	*Pomatostomus superciliosus*	H
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Australian Ringneck Parrot	*Barnardius zonarius*	H

Date	Time	Site Name	Coordinates	Habitat	Record Type	Common Name	Scientific Name	Quantity
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Grey Butcherbird	*Cracticus torquatus*	H
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Grey Currawong	*Strepera versicolor*	H
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	7
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	H
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Rufous Treecreeper	*Climacteris rufa*	H
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	H
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	H
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	White-eared Honeyeater	*Lichenostomus leucotis*	H
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	H
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	4
23/02/2014	Morning	Site 2	51J, 520817 E, 6481599 N	Woodland	Systematic (20 min)	Crested Bellbird	*Oreoica gutturalis*	H
23/02/2014	Afternoon	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Opportunistic	Rainbow Bee-eater	*Merops ornatus*	4
23/02/2014	Afternoon	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Opportunistic	Golden Whistler	*Pachycephala pectoralis*	H
23/02/2014	Afternoon	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Opportunistic	Grey Shrike-thrush	*Colluricincla harmonica*	1
23/02/2014	Afternoon	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Opportunistic	Western Yellow Robin	*Eopsaltria griseogularis*	3
23/02/2014	Afternoon	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Opportunistic	Crested Bellbird	*Oreoica gutturalis*	1
23/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	2
23/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	H
23/02/2014	Morning	Site 3	51J, 516485 E, 6477498 N	Melaleuca	Systematic (20 min)	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	H
23/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Dusky Woodswallow	*Artamus cyanopterus*	5
23/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	6
23/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Red Wattlebird	*Anthochaera carunculata*	3
23/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Redthroat	*Pyrrholaemus brunneus*	H
23/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Rufous Treecreeper	*Climacteris rufa*	3
23/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Striated Pardalote	*Pardalotus striatus*	2
23/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Striated Pardalote	*Pardalotus striatus*	H
23/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	White-fronted Honeyeater	*Purnella albifrons*	11
23/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	9
23/02/2014	Morning	Site 4	51J, 521607 E, 6478405 N	Woodland/Triodia	Systematic (20 min)	Crested Bellbird	*Oreoica gutturalis*	H
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Shy Heathwren	*Calamanthus cautus*	1
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Western Gerygone	*Gerygone fusca*	1
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Australian Ringneck Parrot	*Barnardius zonarius*	2
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Brown-headed Honeyeater	*Melithreptus brevirostris*	1
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Grey Shrike-thrush	*Colluricincla harmonica*	1
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Inland Thornbill	*Acanthiza apicalis*	9
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Redthroat	*Pyrrholaemus brunneus*	1
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	1
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Striated Pardalote	*Pardalotus striatus*	H
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Weebill	*Smicrornis brevirostris*	5
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Willie Wagtail	*Rhipidura leucophrys*	1
23/02/2014	Morning	Site 5	51J, 516013 E, 6468557 N	Regen.Woodland	Systematic (20 min)	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	15

Date	Time	Site Name	Coordinates	Habitat	Record Type	Common Name	Scientific Name	Quantity
23/02/2014	Morning	Waypoint "BABBLERS 23 FEB" in GPS2	51J, 520549 E, 6478302 N	Woodland/Triodia	Opportunistic	White-browed Babbler	*Pomatostomus superciliosus*	3
23/02/2014	Morning	Waypoint "BABBLERS 23 FEB" in GPS2	51J, 520549 E, 6478302 N	Woodland/Triodia	Opportunistic	Chestnut Quail-thrush	*Cinclosoma castanotum*	H
23/02/2014	Morning	Waypoint "BABBLERS 23 FEB" in GPS2	51J, 520549 E, 6478302 N	Woodland/Triodia	Opportunistic	Emu	*Dromaius novaehollandiae*	5
23/02/2014	Morning	Waypoint "BABBLERS 23 FEB" in GPS2	51J, 520549 E, 6478302 N	Woodland/Triodia	Opportunistic	Weebill	*Smicrornis brevirostris*	H
23/02/2014	Morning	Waypoint "BELLBIRD 23FEB" in GPS2	51J, 520950 E, 6478284 N	Woodland/Triodia	Opportunistic	Crested Bellbird	*Oreoica gutturalis*	2
23/02/2014	Morning	Waypoint "BELLBIRD 23FEB" in GPS2	51J, 520950 E, 6478284 N	Woodland/Triodia	Opportunistic	Inland Thornbill	*Acanthiza apicalis*	2
23/02/2014	Morning	Waypoint "BELLBIRD 23FEB" in GPS2	51J, 520950 E, 6478284 N	Woodland/Triodia	Opportunistic	Weebill	*Smicrornis brevirostris*	H
23/02/2014	Morning	Waypoint "BELLBIRD 23FEB" in GPS2	51J, 520950 E, 6478284 N	Woodland/Triodia	Opportunistic	White-eared Honeyeater	*Lichenostomus leucotis*	1
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Fan-tailed Cuckoo	*Cacomantis flabelliformis*	1
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Rainbow Bee-eater	*Merops ornatus*	3
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	1
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Brown-headed Honeyeater	*Melithreptus brevirostris*	2
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Chestnut Quail-thrush	*Cinclosoma castanotum*	2
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Collared Sparrowhawk	*Accipiter cirrocephalus*	1
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Crested Bellbird	*Oreoica gutturalis*	1
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Crested Shrike-tit	*Falcunculus frontatus leucogaster*	1
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Dusky Woodswallow	*Artamus cyanopterus*	3
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Emu	*Dromaius novaehollandiae*	tracks
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Grey Butcherbird	*Cracticus torquatus*	H
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Grey Currawong	*Strepera versicolor*	1
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Grey Shrike-thrush	*Colluricincla harmonica*	1
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Inland Thornbill	*Acanthiza apicalis*	1
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Inland Thornbill	*Acanthiza apicalis*	2
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Purple-crowned Lorikeet	*Glossopsitta porphyrocephala*	6
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Red Wattlebird	*Anthochaera carunculata*	2
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Redthroat	*Pyrrholaemus brunneus*	2
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Rufous Treecreeper	*Climacteris rufa*	H
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Spotted Pardalote	*Pardalotus punctatus*	2
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Striated Pardalote	*Pardalotus striatus*	3
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Tree Martin	*Petrochelidon nigricans*	H
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Weebill	*Smicrornis brevirostris*	4

Date	Time	Site Name	Coordinates	Habitat	Record Type	Common Name	Scientific Name	Quantity
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Western Yellow Robin	*Eopsaltria griseogularis*	H
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	White-fronted Honeyeater	*Purnella albifrons*	2
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Yellow-plumed Honeyeater	*Lichenostomus ornatus*	2
23/02/2014	Afternoon	Waypoint: MW SHRIKETIT (in GPS2)	51J, 514928 E, 6477849 N	Woodland	Opportunistic	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	4
* Mounds have been reported in Rapallo (2014c).								

Appendix III: Trapping Data Comparison for sites 2, 3, 4 and 5 between Phase 1 (November 2013) and Phase 2 (February 2014)

Type/Total	Scientific Name	Common Name	Site 2		Site 3		Site 4		Site 5	
			Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2	Phase 1	Phase 2
Mammals	*Cercartetus concinnus*	Western Pygmy possum	1	3	3			1		
	Mus musculus	House Mouse	1	1					1	4
	Ningaui yvonnae	Southern Ningaui					4	5		
	Pseudomys albocinereus	Ash-grey Mouse						1		
	Pseudomys hermannsburgensis	Sandy Inland Mouse		3		2	3	5		
	Sminthopsis dolichura	Little Long-tailed Dunnart		1					1	
Mammals Total			**2**	**8**	**3**	**2**	**7**	**12**	**2**	**4**
Reptiles	*Brachyurophis semifasciatus*	Southern Shovel-nosed Snake					1		2	
	Cryptoblepharus buchanani	Buchanan's Snake-eyed Skink	2		1					
	Ctenophorus cristatus	Crested Dragon	1							
	Ctenotus atlas	Southern Spinifex Ctenotus					24	2		
	Ctenotus schomburgkii	Barred Wedge-snouted Ctenotus	1						9	
	Cyclodomorphus melanops elongatus	Spinifex Slender Blue-tongu					1			
	Delma australis	Marble-faced Delma					1			
	Delma butleri	Spinifex Delma					4			
	Diplodactylus granariensis	Western Stone Gecko	1	1	3			1	5	1
	Diplodactylus pulcher	Pretty Gecko	4		1					
	Egernia richardi	Richard's Crevice-skink			2				1	1
	Eremiascincus richardsoni	Broad-banded Sandswimmer							1	
	Gehyra variegata	Tree Dtella	1						7	
	Hemiergis initialis brookeri	Western Earless Skink			5		1	1		
	Hesperoedura reticulata	Reticulated Velvet Gecko	1							
	Lerista dorsalis	South Coast Slider							1	
	Lerista picturata	Southern Robust Slider	6		2		1		1	
	Lerista timida	Dwarf Three-toed Slider	2		6				1	
	Lialis burtonis	Burton's Legless Lizard					1			
	Lucasium maini	Main's Ground Gecko	6	1	1				1	
	Menetia greyi	Common Dwarf Skink	5		2		1	2		
	Moloch horridus	Thorny Devil				1		1		
	Morethia butleri	Butler's Snake-eyed Skink			1	1			1	
	Morethia obscura	Shrubland Snake-eyed Skink			1				2	
	Pogona minor	Dwarf Bearded Dragon							1	
	Pygopus lepidopodus	Common Scaly-foot			2				2	
	Ramphotyphlops australis	Southern Blind Snake	1				2			
	Varanus gouldii	Sand Goanna		1						
Reptiles Total			**31**	**3**	**27**	**2**	**37**	**7**	**35**	**2**
Grand Total			**33**	**11**	**30**	**4**	**44**	**19**	**37**	**6**

APPENDIX 6: MEMORANDUM: SRE INVERTEBRATES COLLECTED FROM THE NOVA PROJECT AREA (RAPALLO 2014D)

Rapallo GROUP

9 June 2014

MBS Environmental
4 Cook Street
West Perth WA 6005

Attention: Kristy Sell

Dear Kristy

MEMORANDUM: SRE INVERTEBRATES COLLECTED FROM THE NOVA PROJECT AREA

Please find attached the taxonomic identifications of all putative Short-Range Endemic (SRE) invertebrates collected from the Nova project area. The results include all SRE collected during a Level 2 fauna survey completed by Rapallo in November 2013, and additional SRE collected in January and February 2014.

SRE fauna are considered to be invertebrate species with a naturally small range (less than 10,000 square kilometres). SRE species possess a combination of ecological and life-history traits that make them vulnerable to extinction. Major invertebrate groups with a high proportion of SRE species include mygalomorph spiders, scorpions, pseudoscorpions, millipedes, and land snails.

Over the three sampling periods combined, 46 putative SRE specimens were collected. These comprised 11 molluscs, 23 mygalomorph spiders, seven scorpions, and five pseudoscorpions.

Taxonomic work identified ten morphospecies of potential SRE. These comprised eight mygalomorph spiders (15 specimens), and two pseudoscorpions (five specimens), collected in both the Mining Lease Application (MLA) and the road corridor from six different habitats.

In addition, five non-SRE mygalomorph spider taxa were identified. None of the molluscs or scorpions were identified as SRE.

Regards,

Marieke Weerheim

Environmental Scientist
Rapallo Group
www.rapallo.com.au

1 Scope of Works

Rapallo Environmental (Rapallo) was engaged by MBS Environmental to conduct SRE sampling in the Nova project area on behalf of Sirius Gold Pty Ltd. The survey area included the MLA and the proposed road corridor.

The objectives of the SRE sampling were to:

- Identify the presence of invertebrates from groups known to include SRE species, specifically:
- Obtain, if possible, live specimens of land snails, particularly those belonging to the genus *Bothriembryon*.
- Determine of any additional surveys are required.

2 Methods

SRE invertebrates were collected in three periods: November 2013, January 2014, and February 2014.

2.1 SRE sampling in November 2013

SRE sampling was conducted in conjunction with a Level 2 vertebrate fauna survey, completed from 5 to 19 November 2013. Putative SRE specimens were captured in pitfall trap sites set up to also catch vertebrate fauna. Four trap sites were established in the MLA, and two in the proposed road corridor.

Additional SRE were collected during foraging searches, including selective searches for *Bothriembryon* snails. Leaf litter samples were collected from all trap sites and foraging sites, and transported to the Rapallo laboratory. Invertebrates were extracted from the leaf litter material using Tullgren funnels, and sorted under a microscope to separate out putative SRE.

2.2 SRE sampling in January 2014

SRE were sampled in conjunction with phase one of a targeted Malleefowl survey, completed from 14 to 24 January 2014. SRE were collected opportunistically from the MLA and along access tracks.

2.3 SRE sampling in February 2014

SRE were sampled in conjunction with additional pitfall trapping for vertebrate fauna, and phase two of a targeted Malleefowl survey. Work was completed from 19 to 24 February 2014.

Trap sites two, three, and four in the MLA, and site five in the road corridor were re-opened for three nights. Any SRE caught in the traps was collected.

Mygalomorph spider burrows were recorded opportunistically during transect surveys for Malleefowl in the road corridor. Spider burrows identified as likely to house Mygalomorph spiders were marked with a GPS and dug up at the end of the Malleefowl survey.

Additional spider burrows were recorded during a targeted spider transect walk in woodland habitat in the MLA. The targeted spider transects were completed by a team of ten people on 23 February 2014. Due to time constraints only a single targeted spider walk was possible.

The area for the targeted spider walk was selected on the basis of it being (a) in the MLA, which was relatively under-surveyed in terms of searching directly for burrows, (b) located in Woodland habitat, which is the most extensive habitat in the MLA, and (c) located in an area outside of proposed project impact.

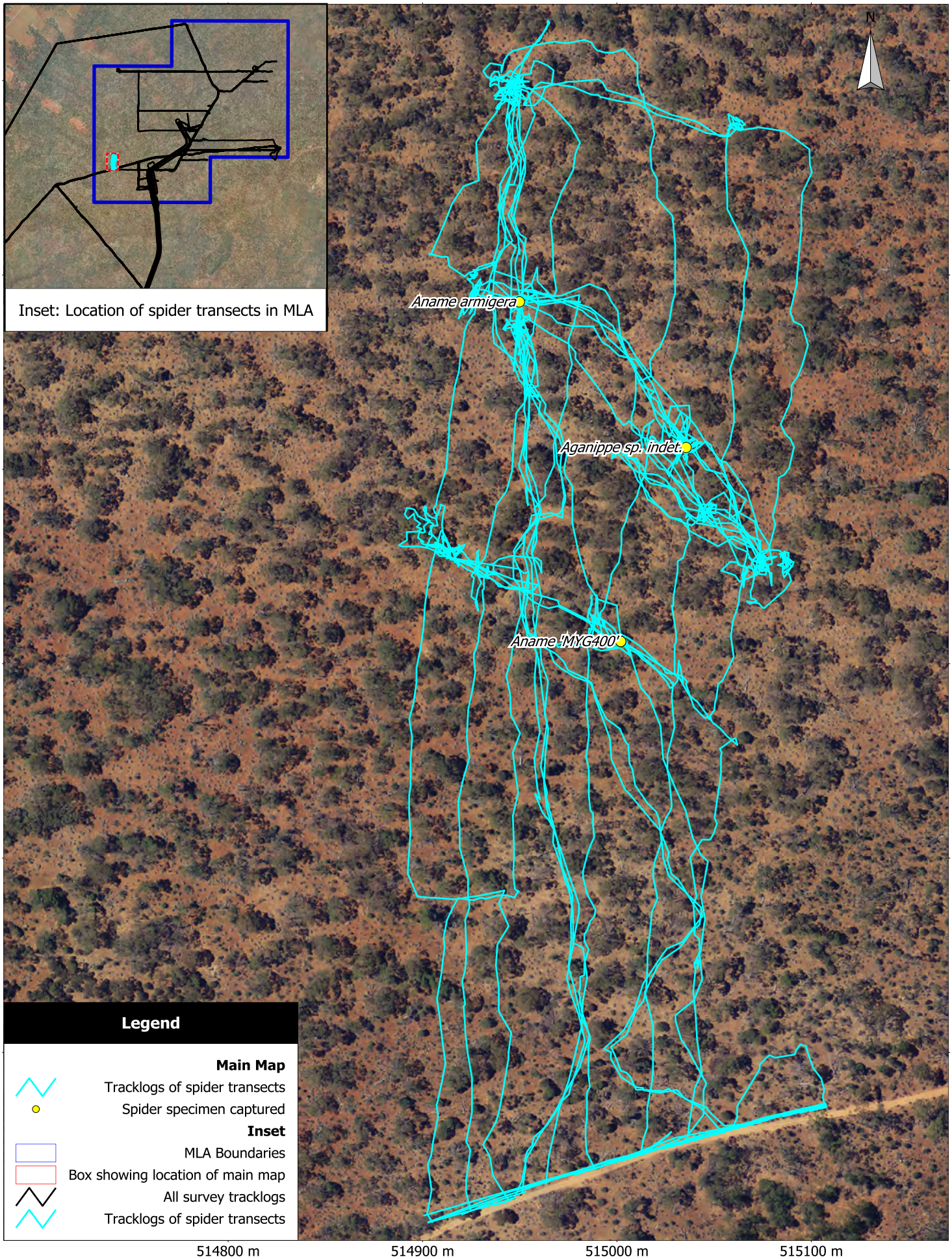
The spider transect walk is mapped in Figure 1. Please note that not all members of the survey team carried a GPS. Spider burrows identified as likely to house mygalomorph spiders were dug up, and spiders were collected.

2.4 Taxonomic Identification

Putative SRE specimens were sent to taxonomists at the Western Australian Museum (WAM) and Phoenix Environmental Services (Phoenix) for identification.

Molluscs and Pseudoscorpions were only collected during the November 2013 survey, and were sent to the WAM. Snails were identified using molecular genetic analysis, while pseudoscorpions were identified under a microscope using morphological characteristics.

Spiders and scorpions were sent to Phoenix in two batches: the first comprising the November 2013 specimens, and the second comprising the January and February 2014 specimens. All specimens were identified under a microscope using morphological characteristics. Specimens were identified to genus level as a minimum; and to species level where possible (e.g. adults of described species). Specimens identified as belonging to distinct, yet undescribed species, were assigned morphospecies names, as outlined in Phoenix (2014a; b).



Rapallo environmental

Sirius Gold Pty Ltd
Nova Project

Scale: 1 : 2,500
Datum: MGA94 (51)

0 100 m

Spider Transects in
MLA Woodland Habitat
23 February 2014

Figure 1

3 Results

The taxonomic results for all specimens collected are presented in Table 2, and described in detail below. Please refer to Rapallo (2014a; b) for full habitat descriptions.

3.1 Molluscs

A total of 11 molluscs were collected from the MLA, the road corridor, and a location 20 km south of the road corridor. All specimens were morphologically identified as belonging to the same species. A subset was selected for molecular identification. The molecular analysis indicated that all specimens belonged to the widespread species *Bothriembryon dux*, and were not SRE (WAM 2014a).

3.2 Mygalomorph Spiders

A total of 23 mygalomorph spiders were collected over the three survey periods combined. These were identified as 13 morphospecies, belonging to four different families. Of these, eight morphospecies were identified as potential SRE, based on known distribution patterns of species within their respective genus. Only the potential SRE are described below:

3.2.1 Family Barychelidae, Genus Synothele

The genus *Synothele* is widespread throughout Western Australia, with most species known only from very limited ranges (Phoenix 2014b). A single specimen of *Synothele* was collected during the survey. Because the specimen was a juvenile, it could not be identified beyond genus level on morphological characteristics. It is considered a potential SRE based on distribution patterns of species within the genus (Phoenix 2014b).

- *Synothele* sp. indet. – Juvenile collected from Trap Site 3 in the MLA, in Melaleuca habitat.

3.2.2 Family Idiopidae, Genus Aganippe

The genus *Aganippe* contains widespread and some range restricted species, and unidentified species are therefore considered potential SRE. Two specimens of *Aganippe* were collected during the survey. Because they were a female and a juvenile, it was not possible to determine whether they belonged to the same, or to different species. The specimens are therefore treated as belonging to two distinct morphospecies (Phoenix 2014a; b).

- *Aganippe* sp. indet. 'November 2013' – A female collected from Trap Site 1 in the MLA, in Acacia Shrubland habitat.
- *Aganippe* sp. indet 'February 2014' – Juvenile collected opportunistically in the MLA, in Woodland habitat. Dug up from a burrow.

3.2.3 Family Nemesiidae, Genus Aname

The genus *Aname* occurs throughout Australia, and includes a diverse array of species. Many *Aname* species have restricted distributions, and therefore unidentifiable specimens, or undescribed species, are considered potential SREs (Phoenix 2014a; b). Over the three periods

combined, 18 *Aname* specimens were collected, representing six morphospecies and two described species. Five of the morphospecies were considered potential SRE:

- *Aname* 'MYG400' – One male and two females, collected from Woodland habitat in the MLA and from Regenerating Woodland habitat in the road corridor.
- *Aname* sp. indet. (1 of 2) – Three females, collected from Woodland habitat in the MLA and Regenerating Woodland habitat in the road corridor.
- *Aname* sp. indet. (2 of 2) – A single female collected from the road corridor in Regenerating Woodland habitat.
- *Aname* sp. indet. (not 'MYG181') – A single female collected from Trap Site 3 in the MLA, in Melaleuca habitat.
- *Aname* sp. indet. (juvenile) – Four juveniles, collected in the MLA, road corridor, and a location 2 km west of the road corridor, in respectively Woodland, Regenerating Woodland, and Mallee Woodland habitat. The specimens may represent several species, but are too juvenile to differentiate and are currently treated as a single morphospecies.

The sixth morphospecies, *Aname* 'MYG181' was identified as widespread and not SRE. The two described species were *Aname tepperi* and *Aname armigera*, both not SRE.

3.3 Scorpions

Seven scorpion specimens were collected during the survey. Of these, six were captured in pitfall buckets at trap sites 2, 4 and 5, and one was collected opportunistically at Fraser Range Station, 30 km west of the project area. Taxonomic work identified three morphospecies, from two genera: *Isometroides* 'balladonia', *Isometroides* 'goldfields 1', and *Lychas* 'adonis'.

Isometroides 'goldfields 1' and *Lychas* 'adonis' are widespread throughout Western Australia, and are not SRE (Phoenix 2014a,b). *Isometroides* 'balladonia' is currently only known from the Nova project area. However, most species of the genus *Isometroides* appear to have fairly wide distributions, and *Isometroides* 'balladonia' is not considered an SRE (Phoenix 2014b).

3.4 Pseudoscorpions

Five specimens of pseudoscorpion were extracted from leaf litter, collected in November 2013. They were identified as two morphospecies, from the families Cheiridiidae (n=1) and Garypidae (n=4). Both were classified as potential SRE, with the sub-category Data Deficient, i.e. "There is insufficient data available to determine SRE status" (WAM 2014b).

- *Apocheiridium* sp. – A single female, collected from Acacia Shrubland habitat in the MLA. This specimen could not be identified further due to lack of taxonomic information.
- *Synsphyronus* sp. indet. (juvenile) – Four juveniles collected from Woodland/Triodia in the MLA and Regenerating Woodland habitat in the road corridor. The specimens could not be identified further because they were all juveniles.

4 Discussion

4.1 Occurrence of SRE in the project area

Ten taxa of Potential SRE were identified in the Nova project area, comprising eight mygalomorph spiders and two pseudoscorpions. SRE specimens were collected throughout the project area; specifically from all trap sites in the MLA, trap site 5 in the road corridor, and a range of opportunistic locations in the MLA and road corridor.

Four SRE taxa were represented by multiple specimens, collected from different locations in the project area. These were: *Aname* 'MYG400', *Aname* sp. indet (1 of 2), *Aname* sp. Indet. (juvenile), and *Synsphyronus* sp. indet. (juvenile). Specimens of these four taxa were collected from two to three different habitats, indicating that these morphospecies are not restricted to a single habitat.

SRE were collected from six different habitats. The most prospective habitats yielding SRE were Regenerating Woodland (n=8) in the road corridor, and Woodland (n=5) in the MLA. These represent the most common habitats in the project area (Rapallo 2014a), and were also subject to the most intensive survey effort. Both habitats also occur extensively outside the boundaries of the project area.

Regenerating Woodland habitat comprises dense regrowth after what appears to have been a patchy cool to medium fire, five to ten years prior to the survey. This habitat contains many small pockets of unburned trees and shrubs. It should be noted that the mygalomorph spiders collected from this habitat were all dug from burrows within unburned pockets, while the scorpions and pseudoscorpions were collected from previously burned dense regrowth.

Mygalomorph spiders were the most commonly recorded SRE taxa, with five morphospecies from two genera identified. The majority of spiders were captured by digging up their burrows. It was noted that putative mygalomorph burrows were common throughout the Woodland and Regenerating Woodland habitats. It is therefore likely that the SRE morphospecies identified in the survey are relatively common throughout these habitats in the project area, and outside the project area where these same habitats occur.

4.2 SRE status of specimens collected and potential for further work

SRE surveys often collect specimens that are of life stages where full identification based on morphology is not possible, such as females and juveniles (Phoenix 2014a; b). This survey was no different, with only *Aname* 'MYG400' represented by a male specimen. When full identification is not possible, the SRE status of specimens is rated based on various factors, including the known distribution of other species in the same genus (see: Phoenix 2014a; b, and WAM 2014b for more details).

The SRE morphospecies recorded in this survey were assessed as Potential SRE, based on the known distribution of species within their respective genera. The higher category of Confirmed SRE can only be obtained after more extensive sampling, including collection of adult males, or after molecular genetic studies. The latter would involve comparing the DNA of specimens from within the project area with those collected outside. This, however, is a costly process

and the level of 'success' depends on the availability of genetic material outside of the project area.

4.3 Conclusions

This survey did not comprise a full Level 2 SRE survey, but rather involved opportunistic sampling of SRE alongside a Level 2 vertebrate fauna survey and a targeted Malleefowl survey. This method presents limitations on as assessing project impacts. Instead, a relative vulnerability rating is presented below, based on the locations from which specimens were collected. This rating, rather than a risk assessment, is a reflection of the currently available data, and is subject to change should more specimens be collected, or after molecular genetic studies provide higher-level identifications.

Table 1 Relative Vulnerability Rating of SRE collected from the Project Area

Morphospecies Name	Collected from multiple locations	Collected from common habitat	Relative vulnerability
Synothele sp. indet.			Most
Aganippe sp. indet. 'February 2014'		√	Medium
Aganippe sp. indet. 'November 2013'			Most
Aname 'MYG400'	√	√	Least
Aname sp. indet.	√	√	Least
Aname sp. indet. (1 of 2)	√	√	Least
Aname sp. indet. (2 of 2)		√	Medium
Aname sp. indet. (not 'MYG181')			Most
Apocheiridium sp.			Most
Synsphyronus sp. indet. (juvenile)	√	√	Least

Of the ten morphospecies identified in the project area, four were collected from multiple locations, and six were recorded in the relatively common habitat types Woodland and Regenerating Woodland. These specimens would be rated as the least vulnerable to any disturbances, as their habitat is extensive and/or they are known from multiple locations.

The four morphospecies that are represented by a single specimen, collected from a relatively uncommon habitat, are rated as the most vulnerable to any disturbances. It is recommended that any further work completed for the project focus on these morphospecies.

5 Reports Cited

Phoenix Environmental Sciences. (2014a) Identification and Assessment of Short-Range Endemism of Invertebrates from Approximately 95 Km North-West of Balladonia, Western Australia. Report Prepared for Rapallo, January 2014.

Phoenix Environmental Sciences. (2014b) Identification and Assessment of Short-Range Endemism of Invertebrates from Approximately 90 Km North-West of Balladonia, Western Australia. Report Prepared for Rapallo, April 2014.

Rapallo Environmental. (2014a) Level 2 Fauna Survey of the Nova Project Area. Unpublished Report for Sirius Resources. March 2014.

Rapallo Environmental. (2014b) Targeted Malleefowl Survey of the Nova Project Area. Report Prepared for Sirius Gold Pty Ltd, March 2014.

Western Australian Museum. (2014a) WAM-TS278: Mollusca. Molecular Identification of Molluscs from Ca. 86-102 Km NW and W of Balladonia, Western Australia. Brief Report to Rapallo Group, 18 February 2014.

Western Australian Museum. (2014b) WAM-TS278: Terrestrial Zoology. Pseudoscorpions from near Balladonia, Western Australia. Report to Rapallo, 01 April 2014.

Table 2 Taxonomic identifications and collection details of all potential SRE specimens collected from the Nova Project area

Family	Species	Specimens	SRE Status	Notes [1)]	Area	Habitat [2)]	Coordinates	Collection Date	Rapallo ID Number	WAM Reg.No.	Taxonomic Report [3)]
MOLLUSCS											
Bothriembryontidae	*Bothriembryon ?dux*	1	No	Most likely = *B. dux*	MLA	Woodland	51J, 520720 E, 6481558 S	13 November 2013	RAP-15410-FHSNAIL1-MOL-13	(not sequenced)	n/a
	Bothriembryon dux	1	No	Widespread	MLA	Woodland	51J, 520746 E, 6481558 S	13 November 2013	RAP-15410-CSSNAIL-MOL-14	S66487	WAM (2014a)
	Bothriembryon dux	1	No	Widespread	MLA	Woodland	51J, 520746 E, 6481558 S	13 November 2013	RAP-15410-CSSNAIL-MOL-14	S66488	WAM (2014a)
	Bothriembryon ?dux	1	No	Most likely = *B. dux*	MLA: Trap Site 4	Woodland	51J, 521607 E, 6478405 S	11 November 2013	RAP-15410-TS4-SPAG-MOL-18	(not sequenced)	n/a
	Bothriembryon ?dux	3	No	Most likely = *B. dux*	MLA: Trap Site 2	Woodland	51J, 520817 E, 6481599 S	13 November 2013	RAP-15410-TS2-CRATE-MOL-19	(not sequenced)	n/a
	Bothriembryon ?dux	1	No	Most likely = *B. dux*	Road corridor	Regenerating Woodland	51H, 513245 E, 6459291 S	15 November 2013	RAP-15410-HR14B-MOL-23	(not sequenced)	n/a
	Bothriembryon dux	1	No	Widespread	20 km south of road corridor	Woodland/Triodia	51H, 487206 E, 6449900 S	19 November 2013	RAP-15410-SW_Sirius-MOL-24	S66489	WAM (2014a)
	Bothriembryon dux	1	No	Widespread	20 km south of road corridor	Woodland/Triodia	51H, 487206 E, 6449900 S	19 November 2013	RAP-15410-SW_Sirius-MOL-24	S66490	WAM (2014a)
	Bothriembryon dux	1	No	Widespread	20 km south of road corridor	Woodland/Triodia	51H, 487206 E, 6449900 S	19 November 2013	RAP-15410-SW_Sirius-MOL-24	S66491	WAM (2014a)
MYGALOMORPH	**SPIDERS**										
Barychelidae	*Synothele* sp. indet.	1 juvenile	Potential	UnID-juv, GenDis	MLA: Trap Site 3	Melaleuca	51J, 516485 E, 6477498 S	21 February 2014	RAP-15720-Site 3-MYG-30	T128887	Phoenix (2014b)
Dipluridae	*Cethegus ischnotheloides*	1 male	No	Widespread	Road corridor: Trap Site 5	Regenerating Woodland	51J, 516013 E, 6468557 S	16 November 2013	RAP-15410-TS5-REGEN-MYG-01	T128865	Phoenix (2014a)
Idiopidae	*Aganippe* sp. indet. 'November 2013'	1 female	Potential	UnID-fem, GenDis	MLA: Trap Site 1	Acacia Shrubland	51J, 515195 E, 6481510 S	18 November 2013	RAP-15410-TS1-FACE-MYG-05	T128867	Phoenix (2014a)
	Aganippe sp. indet. 'February 2014'	1 juvenile	Potential	UnID-juv, GenDis	MLA	Woodland	51J, 515036 E, 6477911 S	23 February 2014	RAP-15720-MainLong-MYG-40	T128914	Phoenix (2014b)
	Anidiops sp. indet.	1 juvenile	No	Widespread	MLA	Woodland	51J, 517453 E, 6478085 S	18 January 2014	RAP-15720-Mygal#15-MYG-27	T128889	Phoenix (2014b)
Nemesiidae	*Aname tepperi*	1 male	No	Widespread	MLA: Trap Site 3	Melaleuca	51J, 516485 E, 6477498 S	11 November 2013	RAP-15410-TS3-MELA-MYG-03	T128870	Phoenix (2014a)
	Aname armigera	1 female	No	Widespread	MLA	Woodland	51J, 514950 E, 6477986 S	23 February 2014	RAP-15720-KGA01-MYG-37	T128920	Phoenix (2014b)
	Aname 'MYG181'	1 male	No	Widespread	Road corridor: Trap Site 5	Regenerating Woodland	51J, 516013 E, 6468557 S	09 November 2013	RAP-15410-TS5-REGEN-MYG-02	T128866	Phoenix (2014a)
	Aname 'MYG181'	1 female	No	Widespread	Road corridor: Trap Site 5	Regenerating Woodland	51J, 516013 E, 6468557 S	17 November 2013	RAP-15410-TS5-REGEN-MYG-07	T128869	Phoenix (2014a)
	Aname 'MYG181'	1 male	No	Widespread	MLA: Trap Site 2	Woodland	51J, 520817 E, 6481599 S	15 November 2013	RAP-15410-TS2-CRATE-MYG-08	PES Reference	Phoenix (2014a)

Family	Species	Specimens	SRE Status	Notes [1)]	Area	Habitat [2)]	Coordinates	Collection Date	Rapallo ID Number	WAM Reg.No.	Taxonomic Report [3)]
Nemesiidae (continued)	*Aname* 'MYG181'	1 juvenile	No	Widespread	MLA: Trap Site 5	Regenerating Woodland	51J, 516013 E, 6468557 S	13 November 2013	RAP-15410-TS5-REGEN-MYG-09	T128871	Phoenix (2014a)
	Aname 'MYG400'	1 female	Potential	GenDis	Road corridor	Regenerating Woodland	51J, 516291 E, 6472327 S	23 February 2014	RAP-15720-WPT_002-MYG-31	T128917	Phoenix (2014b)
	Aname 'MYG400'	1 female	Potential	GenDis	MLA	Woodland	51J, 515002 E, 6477811 S	23 February 2014	RAP-15720-MP_MYGAL-MYG-38	T128916	Phoenix (2014b)
	Aname 'MYG400'	1 male	Potential	GenDis	MLA: Trap Site 2	Woodland	51J, 520817 E, 6481599 S	21 February 2014	RAP-15720-Site 2-MYG-29	T128919	Phoenix (2014b)
	Aname sp. indet. (not 'MYG181')	1 female	Potential	UnID-fem, GenDis	MLA: Trap Site 3	Melaleuca	51J, 516485 E, 6477498 S	19 November 2013	RAP-15410-TS3-MELA-MYG-06	T128868	Phoenix (2014a)
	Aname sp. indet. (1 of 2)	1 female	Potential	GenDis	MLA	Woodland	51J, 516584 E, 6476670 S	18 January 2014	RAP-15720-Mygal#18-MYG-28	T128918	Phoenix (2014b)
	Aname sp. indet. (1 of 2)	1 female	Potential	GenDis	Road corridor	Regenerating Woodland	51J, 516291 E, 6472327 S	22 February 2014	RAP-15720-WPT_002-MYG-32	T128892	Phoenix (2014b)
	Aname sp. indet. (1 of 2)	1 female	Potential	GenDis	Road corridor	Regenerating Woodland	51J, 516291 E, 6472327 S	23 February 2014	RAP-15720-WPT_002-MYG-34	T128891	Phoenix (2014b)
	Aname sp. indet. (2 of 2)	1 female	Potential	GenDis	Road corridor	Regenerating Woodland	51J, 516291 E, 6472327 S	23 February 2014	RAP-15720-WPT_002-MYG-36	T128915	Phoenix (2014b)
	Aname sp. indet. (juvenile)	1 juvenile	Potential	UnID-juv, GenDis	2 km west of road corridor	Mallee Woodland	51H, 507420 E, 6456475 S	18 January 2014	RAP-15720-Blue_Tape-MYG-26	T128888	Phoenix (2014b)
	Aname sp. indet. (juvenile)	1 juvenile	Potential	UnID-juv, GenDis	Road corridor	Regenerating Woodland	51J, 516291 E, 6472327 S	23 February 2014	RAP-15720-WPT_002-MYG-33	T128894	Phoenix (2014b)
	Aname sp. indet. (juvenile)	1 juvenile	Potential	UnID-juv, GenDis	Road corridor	Regenerating Woodland	51J, 516291 E, 6472327 S	23 February 2014	RAP-15720-WPT_002-MYG-35	T128890	Phoenix (2014b)
	Aname sp. indet. (juvenile)	1 juvenile	Potential	UnID-juv, GenDis	MLA	Woodland	51J, 515002 E, 6477811 S	23 February 2014	RAP-15720-MP_MYGAL-MYG-39	T128893	Phoenix (2014b)
SCORPIONS											
Buthidae	*Isometroides* 'balladonia'	1 female	No	Widespread: GenDis. Currently only known from Nova project	MLA: Trap Site 2	Woodland	51J, 520817 E, 6481599 S	12 November 2013	RAP-15410-TS2-CRATE-SCP-10	T128416	Phoenix (2014a)
	Isometroides 'balladonia'	1 male	No	Widespread: GenDis. Currently only known from Nova project	MLA: Trap Site 2	Woodland	51J, 520817 E, 6481599 S	13 November 2013	RAP-15410-TS2-CRATE-SCP-11	T128417	Phoenix (2014a)
	Isometroides 'goldfields 1'	1 male	No	Widespread	Road corridor: Trap Site 5	Regenerating Woodland	51J, 516013 E, 6468557 S	21 February 2014	RAP-15720-Site 5-SCP-42	T128813	Phoenix (2014b)
	Isometroides 'goldfields 1'	1 male	No	Widespread	Fraser Range Station	Station homestead	51H, 480568 E, 6456349 S	21 February 2014	RAP-15720-FraserRangeStn-SCP-43	T128814	Phoenix (2014b)
	Lychas 'adonis'	1 male	No	Widespread	MLA: Trap Site 5	Regenerating Woodland	51J, 516013 E, 6468557 S	17 November 2013	RAP-15410-TS5-REGEN-SCP-12	T128401	Phoenix (2014a)

Family	Species	Specimens	SRE Status	Notes [1)]	Area	Habitat [2)]	Coordinates	Collection Date	Rapallo ID Number	WAM Reg.No.	Taxonomic Report [3)]
Buthidae (continued)	*Lychas* 'adonis'	1 male	No	Widespread	MLA: Trap Site 4	Woodland/Triodia	51J, 521607 E, 6478405 S	23 February 2014	RAP-15720-Site 4-SCP-44	T128811	Phoenix (2014b)
	Lychas 'adonis'	1 male	No	Widespread	MLA: Trap Site 5	Regenerating Woodland	51J, 516013 E, 6468557 S	23 February 2014	RAP-15720-Site 5-SCP-45	T128812	Phoenix (2014b)
PSEUDOSCORPIONS											
Cheiridiidae	*Apocheiridium* sp.	1 female	Potential	DD-tax	MLA: Trap Site 1	Acacia Shrubland	51J, 515195 E, 6481510 S	11 November 2013	RAP-15410-TS1-FACE-PSE-20	132238	WAM (2014b)
Garypidae	*Synsphyronus* sp. indet. (juvenile)	1 juvenile	Potential	DD-juv	MLA: Trap Site 3	Melaleuca	51J, 516485 E, 6477498 S	12 November 2013	RAP-15410-TS3-MELA-PSE-16	132236	WAM (2014b)
	Synsphyronus sp. indet. (juvenile)	1 juvenile	Potential	DD-juv	MLA: Trap Site 4	Woodland/Triodia	51J, 521607 E, 6478405 S	11 November 2013	RAP-15410-TS4-SPAG-PSE-17	132237	WAM (2014b)
	Synsphyronus sp. indet. (juvenile)	1 juvenile	Potential	DD-juv	Road corridor	Regenerating Woodland	51J, 516063 E, 6466424 S	16 November 2013	RAP-15410-HR21-PSE-21	132239	WAM (2014b)
	Synsphyronus sp. indet. (juvenile)	1 juvenile	Potential	DD-juv	Road corridor	Regenerating Woodland	51H, 513245 E, 6459291 S	15 November 2013	RAP-15410-HR14B-PSE-22	132240	WAM (2014b)

Footnotes with Table 1

1) Notes:

Widespread *Taxonomically well resolved and demonstrated wide distribution (i.e. >10,000 km2)*
Potential *Taxonomically poorly resolved group, often common in certain microhabitats in SRE surveys, but no other regional records.*
UnID-juv *Unidentifiable juvenile*
UnID-fem *Unidentifiable female*
GenDis *SRE rating based on distribution patterns within the genus.*
DD-tax *Data deficient, lack of taxonomic information*
DD-juv *Data deficient: juveniles*

2) Habitat:

For detailed habitat descriptions, please refer to: Rapallo (2014a). Level 2 Fauna Survey of the Nova Project Area. Unpublished Report for Sirius Resources, March 2014.

3) Taxonomic Reports:

WAM (2014a). WAMTS278: Mollusca. Molecular Identification of Molluscs from ca. 86-102 km NW and W of Balladonia, Western Australia. Brief report to Rapallo Group, 18 February 2014.
WAM (2014b). WAMTS278: Terrestrial Zoology. Pseudoscorpions from near Balladonia, Western Australia. Report to Rapallo, 01 April 2014.
Phoenix (2014a). Identification and assessment of short-range endemism of invertebrates from approximately 95 km north-west of Balladonia, Western Australia. Report prepared for Rapallo, January 2014.
Phoenix (2014b). Identification and assessment of short-range endemism of invertebrates from approximately 95 km north-west of Balladonia, Western Australia. Report prepared for Rapallo, April 2014.

APPENDIX 7: STAKEHOLDER CONSULTATION REGISTER

STAKEHOLDER CONSULTATION REGISTER

Date	Time	Govt Department	Section	Officer Name	Sirius Member Name	Project Area	Discussion	Actions	Document Reference	Key Words
11-Feb-13	1400	Department of Environment and Conservation	Nature Conservation – Kensington	• Chris Bishop • Julie Futter	• Carrie Pritchard • Jeff Foster		In relation to Exploration Activities within Nature Reserves. An opportunistic introduction to the Nova Project.	Nil.	20130211 DEC scoping meeting minutes re: CMP	Nil
18-Mar-13	1000	Shire of Dundas	Council	Richard Brooks	Carrie Pritchard (Calytrix)		General introductions (as requested by Jeff Foster) Request information regarding establishment of Dongas & permanent sewage facilities for the Nova Camp. Richard Brooks will provide forms for planning consent. Waste water approvals must be approved through Health Department WA as total volume generated will be more than 540 L/day.		Email sent to JF 19-03-2013	• Waste water approval • Planning Approval
23-Mar-13	1130	Department of Mines and Petroleum (DMP)		• Laura Copeland • Daniel Endacott • Clare Grosser • Tom Brooks (water.wa.gov.au)	• David English • Martin Reed • Freea Itzstein-Davey (MBS) • Kristy Sell (MBS)	Water Exploration	Water exploration east of Norseman.			Water
11-Apr-13	0900	Department of Environment and Conservation	Albany Office – Industry Licensing	Caron Goodbourn	Carrie Pritchard (Calytrix)	General	General introduction to the Nova project as a concept. Caron explained she manages a team at the Albany office. Esperance office will not only manage Nature Conservation.	Nothing until sufficient information is available for Application Enquiry Process		Application Enquiry
11-Apr-13	0930	DMP	Kalgoorlie Office – Environmental branch	Laura Copeland	Carrie Pritchard (Calytrix)	General	General introduction to the Nova project as a concept. Laura explained that the office currently does not have a manager. Daniel Endacott is acting as manager, from the Perth office.	Nothing until sufficient information is available for a scoping meeting		Nil
28-May-13	1400	DMP		• Trevor Beardsmore • Abey Abeyshinghe • Don Flint	• David English • Martin Reed	MLA	Pending application of a Mining Lease over the Nova deposit.			Mining Lease
31-May-13	1100	Station Owners Southern Hills (Chris South) and Fraser Range (Ben Holman)	Fraser Range Station	• Chris South • Ben Holman	• David English • Jeff Foster • Martin Reed • John Bartlett	General	Overview of the project development. Concept layouts and timelines. Current focus on obtaining required approvals and completing the project study. Construction mid next year at the earliest.	Informal update meeting every 2 months. SIR to organise.	Nil.	Station Overview
31-May-13	1400	Dundas Shire	Chief Executive Officer	Richard Brookes	• David English • Jeff Foster • Martin Reed	General	Overview of the project development. Concept layouts and timelines. Current focus on obtaining required approvals and completing the project study. Construction mid next year at the earliest.	Nil.	Nil.	Dundas Shire Overview
27-Jun-13	1230	Dundas Shire	Chief Executive Officer	• Richard Brookes • Barry Gibbs	• David English • Vic Oakes • Peter Cue	Camp Plans	Update on site accommodation and conceptual plans to install semi-permanent facilities.	SIR to submit building application. Building Surveyor to approve plans prior to submission of building permit.	Nil.	Dundas Shire Building Permit Camp
27-Jun-13	1530	Main Roads Western Australia (MRWA)	Goldfields-Esperance	• Shane Power • Mark Russel • Kellie Keable	• David English • Maren Umbach (GHD)	Site Access Road	Overview of Sirius and the Nova Project. Summary of access road options and intersection interface with the Eyre Highway. Discussion on road route options, road limits, concessional loading and access to the Fraser Range quarry.	SIR to submit application for access point to Main Roads (Goldfields-Esperance) once access road selection has been finalised.	Nil.	Main Roads access road concessional loading quarry

Date	Time	Govt Department	Section	Officer Name	Sirius Member Name	Project Area	Discussion	Actions	Document Reference	Key Words
31-Jul-13	1230	Station Owners Southern Hills (Chris South) and Fraser Range (Ben Holman)		• Chris South • Ben Holman	David English					
02-Aug-13	1130	Matsa		• Oli Nikolovske • Richard Breyley • Dave Fielding • Frank Sibbel	• David English • Martin Reed		Neighbouring tenements			
23-Aug-13	1500	DMP		• Trevor Jones • Jeb Brownley • Jan DeLange • Pat McCluskey • Michael Telford • Marius Hanekom • Kev Thomas • Great Bailey • Terry Siefken	• David English • Freea Itzstein-Davey (MBS) • Jeff Foster		Brief introduction and update on SIR Nova Project			
23-Sep-13	1530	DMP		• Phil Gorey • Steve Tantala • Ivor Roberts	• David English • Kristy Sell (MBS) • Freea Itzstein-Davey (MBS)		Update on Nova Project			
16-Oct-13	1000	DMP		[Unknown, Environmental Department Officer]	David English		DE to draft a note / letter to accompany PoW application.			
31-Oct-13	1100	Environmental Protection Authority (EPA)	Assessment & Compliance Division	Dr. Paul Vogel	• David English • Kristy Sell (MBS)	Nova – EPA referral	EPA approval process and option to self refer			
31-Oct-13	1100	EPA		• Paul Vogel • Anthony Sutton	• David English • Kristy Sell (MBS) • Freea Itzstein-Davey (MBS)		Project introduction	EPA invited Sirius to present again before referral submitted		EPA Referral
08-Nov-13	1600	Department of Parks and Wildlife (DPaW)	Esperance Office	Stephen Butler	• David English • Bill Cunningham					
13-Nov-13	1230	Department of Environment Regulation (DER)	Albany Office	• Nathan Hallett • Caron Goodbourn	• Freea Itzstein-Davey (MBS) • David English					
15-Nov-13	0930	Gondwanalink		Peter Price	• David English • Kristy Sell (MBS) • Freea Itzstein-Davey (MBS)		Introduction to Gondwanalink and Nova Project			Gondwanalink
26-Nov-13	1400	DMP		Katherine Mansas	• David English • Ian Hooke • Freea Itzstein-Davey (MBS)		Temporary Airstrip for exploration			Airstrip
29-Nov-13	1330	Station Owners Southern Hills (Chris South),Fraser Range (Ben Holman)		• Chris South • Ben Holman	David English		SIR personnel movements			

Date	Time	Govt Department	Section	Officer Name	Sirius Member Name	Project Area	Discussion	Actions	Document Reference	Key Words
29-Nov-13	12:30pm	Southern Hills & Fraser Range Station		• Chris South • Ben Holman	David English	Nova	Update, up and coming works in the area			
11-Dec-13	0900	DMP		• Jessica Shemeld • Jan DeLange • Laura Copeland	• Freea Itzstein-Davey (MBS) • David English • Tristan Sommerford (Entech) • Dave Luppnow (SRK)		TSF			TSF
12-Dec-13	1330	Station Owners Southern Hills (Chris South), Fraser Range (Ben Holman)		• Chris South • Ben Holman	• David English • Freea Itzstein-Davey (MBS)		Control of feral animals			
12-Dec-13	12:30pm	Southern Hills & Fraser Range Station		• Chris South • Ben Holman	• David English • Freea Itzstein-Davey (MBS)	Nova				
17-Dec-13	-	DER	Industry Regulation	• James Milne • Sarah Hull	Freea Itzstein-Davey (MBS)	Exploration	Exploration Landfill and general site introduction	MBS to draft Works Approval Document for Exploration Landfill		Exploration Landfill Facility
14-Jan-14	1000	DMP	Environment	Ian Mitchell	• Alan Wright (MBS) • Tiffaney George (MBS)		Mine Closure Plan requirements	MBS to draft MCP		Closure
05-Feb-14	1100	EPA		• Paul Vogel • Anthony Sutton	• Rob Dennis • David English • Kristy Sell (MBS) • Freea Itzstein-Davey (MBS)		Project update in anticipation of referral.	Need to submit supporting document and rationale to support position of Not Assessed		EPA Referral
06-Feb-14	0900	DPaW	EMB	• Daniel Coffey • Chris Bishop • Val English	Freea Itzstein-Davey (MBS)	Flora – Nova Project	Methodology to assess PEC within Nova project area	Mattiske to provide recommendations on changing PEC boundaries to DPaW in their report		PEC, Flora
06-Feb-14	1030	DPaW	EMB	Chris Bishop	• Jeff Foster • John Bartlett • Siobhan Pelliccia (MBS) • Freea Itzstein-Davey (MBS)	Crux/Southern Hills	Discussion of CMP version 3 ahead of document submission	MBS to submit CMP following meeting feedback		CMP
31-Mar-14		DER	Industry Regulation	Sarah Hull	Freea Itzstein-Davey (MBS)		Email to accept changes to Works Approval Application for Exploration Landfill Facility. Resignation and change in officer to Fiona Cormier.			Exploration Landfill Facility Works Approval
04-Apr-14	1600	Main Roads Western Australia (MRWA)	Kalgoorlie Office	Kellie Keable	• David English • Maren Umbach (GHD)	Nova – Access Road	Access Road & Eyre Highway intersection.	Submit application for MRWA review and approval.		Main roads, access road intersection
10-Apr-14	Midday	Southern Hills Station	Fraser Range Station (camp kitchen)	Chris South	• David English • Rob Dennis	Nova	Nova Project update			
10-Apr-14	1700	Fraser Range Station	Kalgoorlie	Ben Holman	• David English • Rob Dennis	Nova	Nova Project update			
22-Apr-14		DER	Industry Regulation	Fiona Cormier	Freea Itzstein-Davey (MBS)		Email draft Works Approval W5613/2014/1			Exploration Landfill Facility Works Approval

Date	Time	Govt Department	Section	Officer Name	Sirius Member Name	Project Area	Discussion	Actions	Document Reference	Key Words
30-Apr-14		Department of Fire and Emergency Services (DFES)	Environmental Protection Branch	• Ralph Smith • Trevor Tasker	• Rob Dennis • David English • Freea Itzstein-Davey (MBS)		Discussion of fire management at Nova and experiences from Tropicana. Potential for mosaic burns to reduce fuel load and potential fire severity for life of mine.	DFES to prepare a proposal. Freea to email through Mattiske vegetation report		Fire management
01-May-14	3pm	Fraser Range Station		Ben Holman	Rob Dennis	Nova				
02-May-14		DER	Industry Regulation	Fiona Cormier	Freea Itzstein-Davey (MBS)		Comments on Draft Works Approval W5613/2014/1			Exploration Landfill Facility Works Approval
09-May-14	1500	Ngadju	Perth	Tony Shaw and Donna	Rob Dennis	Nova	Cleaning contract opportunities			
12-May-14	1500	Ngadju	Perth	Les Schulze	Rob Dennis	Nova	Fire training and bush fire management			
14-May-14	0830	Main Roads Western Australia (MRWA)	Kalgoorlie Office	Kellie Keable	• David English • Maren Umbach (GHD)	Nova – Access Road	Access Road & Eyre Highway intersection.	Submitted application for MRWA review and approval, re: Access Road and Eyre Highway intersection.		Main roads, access road intersection
14-May-14	0830	Fraser Range Station	Kalgoorlie	• Ben Holman • Kerry Holman	Rob Dennis	Nova	Site access, compensation agreement			
16-May-14	1100	Ngadju	Kalgoorlie	• Betty • John • Eddie	Rob Dennis	Nova	Follow up on native title and opportunities for engagement.			
20-May-14		DFES	Environmental Protection Branch	Ralph Smith	David English		Email with proposal for fire management at Nova.			Fire management
28-May-14		DFES	Environmental Protection Branch	Ralph Smith	Freea Itzstein-Davey (MBS)		Email requesting advice on fire management regarding stored green waste (vegetation stockpiles).			Fire management
28-May-14		DPaW	EMB	Chris Bishop	Freea Itzstein-Davey (MBS)		Email Mattiske memo on recommended changes to PEC boundary and Level 2 Flora Report.		Mattiske Level 2 Flora Report, Memo on PEC changes.	PEC, Flora
04-Jun-14	1619	DMP	Tenure and Native Title	Neil Spencer	• Shane Taylor • Michael Behrendt (WTS)	Nova	Supports the miscellaneous application for the road to include the borrow pits, with a requirement to partial surrender areas when a borrow pit is no longer required	WTS will be submitting the miscellaneous applications on grant of mining lease		DMP, Access Road, borrow Pits, miscellaneous licence
04-Jun-14		DPaW	EMB	• Daniel Coffey • Chris Bishop • Val English	• Rob Dennis • Libby Mattiske (Mattiske) • Freea Itzstein-Davey (MBS)		Meeting to discuss recommended changes to PEC boundaries. Lack of understanding of methodology for PEC boundary changes, likely look at impacts to communities at a community/floristic level. Also discussion on fire management on vegetation stockpiles – some areas may have vegetation stockpiled for over 10 years whilst it may be more suitable to mulch vegetation along the access road as that may remain post closure. Also brief discussion of dust issues at Crux/Talbot following on from site inspection.	DPaW to confirm assessment approach and requirement for further work.	Meeting minutes	PEC, Flora
05-Jun-14		DPaW	EMB	Chris Bishop	Freea Itzstein-Davey (MBS)		Email to confirm that impact assessment documentation should use the current PEC boundaries and assess impacts at the vegetation/floristic level.			PEC, Flora
12-Jun-14		DFES	Environmental Protection Branch	Ralph Smith	Freea Itzstein-Davey (MBS)		Email with advice on green waste storage and request for letter to authorise take of flora for bushfire fuel analysis and burning.	Freea to draft letter for flora licence application.		Fire management