



SPOTTED QUOLL OPEN PIT NICKEL MINE

MINISTERIAL STATEMENT 808

PERFORMANCE REVIEW REPORT



Prepared by:  
IGO Limited

Prepared for:  
Department of Water and Environment Regulation

Date:  
September 2022

---

## EXECUTIVE SUMMARY

This Performance Review Report (PRR) outlines the current status of compliance of the Spotted Quoll nickel mine, operated by Western Areas Limited (WSA) as a wholly owned subsidiary of IGO Limited (IGO) with the proposal implementation conditions set out in Ministerial Statement 808, Condition 5. Western Areas was purchased by IGO Limited in June 2022 which continues to operate as Western Areas Limited as a wholly owned subsidiary of IGO Limited.

Condition 5 of Statement 808 relates to Performance Review and Reporting as follows:

*Condition 5-1: The proponent shall submit to the Chief Executive Officer of the Department of Environment and Conservation, a Performance Review Report at the conclusion of the first year after the start of implementation and then annually, which addresses:*

- 1. the major environmental risks and impacts; the performance objectives, standards and criteria related to these; the success of risk reduction/impact mitigation measures and results of monitoring related to management of the major risks and impacts;*
- 2. the level of progress in the achievement of sound environmental performance, including industry benchmarking, and the use of best available technology where practicable; and*
- 3. improvements gained in environmental management which could be applied to this and other similar projects.*

A risk assessment was carried out prior to implementation of the project, identifying the major environmental risks and impacts. All identified risks have been documented and environmental industry standard and best practice management strategies have been, and are, currently being implemented.

The high and medium environmental risk pathways associated with the project are:

### *High Risk Pathways*

- Fire
- Vegetation Clearance (Unauthorised)

### *Medium Risk Pathways*

- Environmental Weed infestation
- Feral animals
- Direct animal mortality
- Changes to surface water hydrology from waste rock storage
- Direct changes to groundwater levels
- Hyper-saline water
- Hydrocarbon spills
- Dust generation
- Greenhouse gas emissions
- Inadequate revegetation regeneration

For the reporting period WSA achieved satisfactory environmental performance in relation to these risk factors.

Key environmental improvement activities undertaken during the reporting period include:

- 
- Continuation of a site wide Malleefowl monitoring program incorporating the use of aerial photography assessment and motion sensor cameras and including the Malleefowl monitoring commitments of the Spotted Quoll project area;
  - Engagement with the National Malleefowl Recovery Team;
  - Waste resource recovery which recycled 450mt scrap steel and 100mt of poly pipe;
  - Rehabilitation monitoring program using ground surveys, and where possible remote sensing techniques; with results used to guide further rehabilitation efforts at the Forrestania Nickel Operation (FNO);
  - Ongoing maintenance and continuous improvement of the Environmental Management System in line with the ISO 14001 (EMS) standard; and
  - The ongoing review and continuous improvement of key environmental management plans.

---

## TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	i
TABLE OF CONTENTS .....	iii
1. INTRODUCTION.....	4
2. ENVIRONMENTAL RISKS AND IMPACTS .....	4
3. SUMMARY OF RISK ASSESSMENT .....	6
4. PERFORMANCE OF RISK MANAGEMENT .....	7
4.1. High Risk Pathways.....	7
4.1.1. Vegetation Clearance (authorised and unauthorised).....	7
4.1.2. Fire.....	8
4.2. Medium Risk Pathways .....	10
4.2.1. Environmental Weed Infestation.....	10
4.2.2. Dust.....	11
4.2.3. Greenhouse Gas Emissions .....	12
4.2.4. Direct Animal Mortality .....	12
4.2.5. Feral Animals .....	13
4.2.6. Hyper-saline Water .....	14
4.2.7. Changes to Groundwater Hydrology .....	14
4.2.8. Fuel Spills .....	15
4.2.9. Inadequate Revegetation Regeneration.....	16
5. IMPROVEMENTS IN ENVIRONMENTAL MANAGEMENT .....	18
6. PLATES .....	19
7. FIGURES .....	20
8. APPENDICES .....	23
8.1. Spotted Quoll Open Pit Nickel Mine Environmental Risk Analysis Summary .....	23
8.2. Fire Damage Assessment (Botanica 2020).....	33
8.3. Spotted Quoll Nickel Mine Ministerial Statement 808: Condition 6.4 Monitoring Report on health and abundance of the Declared Rare Flora <i>Eucalyptus steedmanii</i> populations .....	39

---

## 1. INTRODUCTION

The Forrestania Nickel Operation (FNO) is situated approximately 160 kilometres south of Southern Cross and 80 kilometres east of Hyden in the Shire of Kondinin (Figure 1). On the 17th of September 2009 the Environmental Impact Assessment report (1334) for the Spotted Quoll open pit mine (the project), released by the Western Australian Environmental Protection Authority (EPA) was approved and signed off by the Western Australian Minister for the Environment (Ministerial Statement No. 808, henceforth known as Statement 808).

A Works Approval (WA 4499/2008/1) for the construction of dewatering infrastructure including dewatering bores and a pipeline system including a settling pond was granted by the Department of Environment and Conservation (DEC) on 24th September 2009 (ref: DEC9635).

On the 7th of October 2009 the project was signed off (RegID# 22286) by the Environmental Division of the Department of Mines and Petroleum (DMP) and ground disturbance activities commenced on the 9th of October 2009.

The Department of Water (DoW) granted a Water Abstraction Licence for Spotted Quoll (GWL 170112) on the 19th of November 2009.

Ground disturbing activities at Spotted Quoll commenced on the 9th of October 2009. A total of 7,988,829 m<sup>3</sup> of waste was excavated from the open pit along with 487,935 tonnes of ore for 28,422 tonnes of nickel metal. The open pit mine ceased production on 14th February 2012 with underground mining operations continuing through to date. Underground mining is expected to continue for another 5 to 9 years from September 2021 placing closure between 2026 and 2030.

An amendment was made to the Flying Fox Prescribed Premises Licence (L8041/1991/3) on the 4th of February 2010 to include the dewatering activities associated with the Spotted Quoll open pit mine. On the 17 October 2013 all site prescribed premises licenses were amalgamated to form a contiguous boundary and operate in an integrated entity under L8041/1990/5.

Figure 2 shows the general layout of the Spotted Quoll project.

## 2. ENVIRONMENTAL RISKS AND IMPACTS

This section of the report details an assessment of the potential risks associated with the project as identified in the Environmental Protection Statement. The methodology for assessing and managing environmental risk follows AS/NZS 4360:2004 for risk management. The approach is designed to specifically address potential ecological risks posed by resource development activities in sensitive environments; however, it can be broadly applied to environmental management programs in general.

The main elements of the environmental risk assessment process used for the project involve:

- Identification of the key aspects of the project (including those relating to development, operation and closure);
- Identification of the potential sources of risk, risk events and potential impacts for each of these environmental aspects;
- An estimation of the likelihood of each risk event occurring, the potential consequences if it did occur and subsequent determination of an inherent risk rating for each risk event; and
- An assessment of the acceptability of the risk associated with each of the events or impacts.

Table 1 and 2 outline the likelihood and consequence definitions plus the risk assessment matrix used to document potential environmental risks and impacts.

Table 1: Likelihood and Consequences Definitions

Likelihood Definitions		Significance/Environmental Consequence	
Almost Certain	Is expected to occur in most circumstances Common repeating occurrence Planned occurrence/action	Catastrophic	Widespread Persistent Threatens biodiversity at regional level Extensive impacts at species and community level that are regionally significant Requires massive intervention over long period of time
Likely	Will probably occur in most circumstances Known to occur or "it has happened"	Major	Extensive impacts at vegetation community and species level that are locally significant Widespread Can be ameliorated over medium to long term Requires intervention to ameliorate
Possible	Might occur at some time Could occur or "I've heard of it happening"	Moderate	Sub-lethal impacts to humans May cause significant deterioration of local communities Medium term Requires some intervention to ameliorate
Unlikely	Could occur at some time Not likely to occur	Minor	Nuisance value to humans May cause adverse effects in sensitive individuals Insignificant impact at population level Some mortality amongst sensitive biota at community level Short term Minor intervention to ameliorate
Rare	May occur only in exceptional circumstances Practically impossible	Insignificant	No impacts on humans Minor impact on biota No intervention required Short term Instantaneous impact on biota

Table 2: Risk Assessment Matrix

Likelihood		Consequence				
		Catastrophic	Major	Moderate	Minor	Insignificant
1	Almost Certain	Extreme	Extreme	High	Medium	Medium
2	Likely	Extreme	Extreme	High	Medium	Medium
3	Possible	High	High	Medium	Medium	Low
4	Unlikely	High	High	Medium	Low	Low
5	Rare	High	High	Low	Low	Low

Proposed risk reduction approaches are provided in Table 3.

Table 3: Risk Reduction Philosophy

Level of Risk	Philosophy
Extreme	Unacceptable, project should be redesigned or not proceed.
High	Undesirable risks that require re-engineering or a management plan for the event to prevent its occurrence and to monitor changes that could place the risk in a higher level.
Medium	Tolerable risks that can be management by routine procedures, training and monitoring as the project progresses.
Low	No action required.

### 3. SUMMARY OF RISK ASSESSMENT

The environmental hazard and risk assessment for the Spotted Quoll Mining project is provided in Appendix A. A summary of High and Medium risks/events are provided in Table 4. No changes to the risk assessment from the initial performance review have been identified.

There were no risks/events identified as being 'Extreme', however two risks were identified as being 'High', these being:

- Vegetation Clearance (unauthorised); and
- Fire.

Table 4: Prioritisation of Environmental Issues/Risks

Risk	Potential Risk/Event	Impact
High	Vegetation Clearance (Unauthorised)	Declared Rare Flora (DRF)
High	Fire	DRF, Priority Species and Humans
Medium	Dust from vegetation clearance, construction and decommissioning activities and earthworks, overburden and ore excavation, transport and deposition, vehicle movement, and rehabilitation and revegetation activities	Vegetation communities, DRF, Priority Species and Humans
Medium	Vegetation clearance (Authorised and Unauthorised)	Vegetation communities, vertebrate fauna and short-range endemics
Medium	Greenhouse Gas Emissions from electricity generation and diesel use	Air quality
Medium	Changes to surface water hydrology from waste rock storage	Vegetation communities, DRF, Priority Species, vertebrate fauna and short-range endemics
Medium	Direct animal mortality	Fauna
Medium	Introduction of weeds	Vegetation communities, DRF and Priority Species

Risk	Potential Risk/Event	Impact
Medium	Hydrocarbon spills (<100L)	Soil quality, surface water quality, groundwater quality, vegetation communities, DRF, Priority Species and humans
Medium	Feral animals	Fauna
Medium	Spill of hyper-saline water from Settling Pond	Surface water quality, soil quality
Medium	Inadequate revegetation regeneration	Biodiversity
Medium	Changes to groundwater hydrology from saline water disposal (aquifer recharge)	Groundwater levels

#### 4. PERFORMANCE OF RISK MANAGEMENT

##### 4.1. High Risk Pathways

##### 4.1.1. Vegetation Clearance (authorised and unauthorised)

#### Risk Assessment

Vegetation clearing can result in permanent changes to the topography and vegetation of the area. There is potential for unauthorised vegetation clearing to have a direct impact on significant flora or significant floristic communities.

The loss of vegetation habitat will impact on fauna species living in the area. Most of the terrestrial species will be lost from the immediate cleared area during the clearing process. Most birds will move to adjacent areas once clearing commences. This displacement alters the available habitat and will increase competition for resources in adjacent areas until a new balance develops.

Malleefowl may be potentially affected by unauthorised clearing through direct impacts on nesting mounds.

#### Performance Discussion

The objective is to have as little impact to the topography and vegetation of the area as possible; additionally, the impact on loss of habitat is to be minimal.

This has been achieved through a reduction in the total footprint cleared and selectively leaving any larger habitat trees such as Salmon Gums where possible. Vegetation clearing has been kept to the minimum required to implement and manage the mining operations. A total of 140 ha of clearing had been initially approved. WSA reduced the amount of vegetation clearing to ~125.50 ha in the first 72 months. No further clearing of Spotted Quoll was undertaken by WSA during the reporting period. This has been achieved through the utilisation of previously disturbed areas (historical exploration activities) for infrastructure locations, and utilising topsoil directly on shaped areas of the waste dump. This has minimised the footprint required for topsoil and vegetation stockpiles.

As unauthorised clearing is considered a high environmental risk, a management plan has been implemented and all clearing is conducted under WSA's internal ground disturbance procedure; a controlled document and part of the Environmental Management System (EMS). All clearing activities are checked against relevant approvals; clearing boundaries are clearly marked by the survey department, all clearing is supervised by qualified environmental staff and actual disturbance area is measured using GPS pickups.

The clearing corridor was designed to avoid all known individuals of the DRF species *Eucalyptus steedmanii*. A 'Permit to Take' (Permit No 55 – 0910) for inadvertent damage as a result of secondary



---

impacts from mining operations was obtained. No DRF plants were taken during clearing activities. A DRF Management Plan was developed for the species *Eucalyptus steedmanii* prior to implementation of the project.

Additionally, WSA environmental staff undertook detailed transect surveys to better define the local populations of the DRF species *Eucalyptus steedmanii*. Surveys were undertaken along transects at approximately 50 m spacing within a 12 km<sup>2</sup> rectangular area defined by the following co-ordinates (751400, 6407800 and 753800, 6402800). The extent of original DRF populations has been expanded during these surveys and new DRF location documentation has been submitted to the relevant authorities.

At the commencement of the project, independent consultants (Keith Lindbeck and Associates & Biota) inspected the clearing envelope for potential Malleefowl mounds prior to commencement of clearing however no active mounds were recorded in the area.

During the 2019/20 reporting period there was a significant bushfire event within the Forrestania region and beyond. Among the native vegetation impacted, a portion of *E. steedmanii* Population 8 located to the east of Spotted Quoll mine infrastructure was also impacted. Further details are provided in Section 6.2 below and in an assessment undertaken by Botanica Consultants (2020) attached to this submission.

During the reporting period WSA continued to monitor *Leipoa ocellata* (Malleefowl) activity across the FNO, including the Spotted Quoll project footprint. This work enables a quick assessment of the potential for Malleefowl mounds to be present in any areas that might be proposed for future clearing activities.

WSA has also continued to engage with the National Malleefowl Recovery Team (NMRT) and have undertaken annual monitoring and provided updated data to the national database using 'Cybertracker'; providing up to date information to the NMRT on mounds within the Great Western Woodlands.

## Conclusion

WSA have achieved industry best practice in minimising the amount of clearing required, all clearing has been set out using differential GPS and satellite imagery. In addition, GPS pickups have been used to document the actual level and location of the clearing.

No impacts on the DRF species *Eucalyptus steedmanii* from FNO operations have been recorded. Impacts to Population 8 as a result of the February 2020 bushfire event are further discussed in Section 6.2 and an assessment undertaken by Botanica Consultants (2020) attached to this submission.

Further knowledge has been gained regarding the behaviour of the Malleefowl. This information will be used to aid in the management of FNO activities to minimise impacts on this species.

### 4.1.2. Fire

## Risk Assessment

Fire ignition and subsequent spread may present a significant threat to the long-term survival of *Eucalyptus steedmanii* and can impact on the biodiversity of floristic communities. Fire can cause large fluctuations in population size, age of plants and geographical distribution of re-seeder species.

The potentially significant impacts resulting from fires on the environmental values of the Spotted Quoll mine site area have been identified below.

Impacts from frequent high intensity fires may:

- threaten the local DRF with degradation and extinction;
- reduce or significantly alter fauna habitat;
- destroy vegetation on a massive front; and

- 
- kill fauna that cannot escape the fire front in time.

Mining activities and the availability of rapid management response to fires may result in a reduction in the area burnt and the fire intensity for a given fire event either natural or mine related.

## Performance Discussion

The objective is to have no impact from fires on the Spotted Quoll nickel mine and associated infrastructure, nor on any adjacent DRF or priority species.

A Fire Management Plan (FMP) was developed by Strategen Environmental Consultants and implemented by WSA (2013). Key aspects of the plan included an assessment of fuel loads and fire risks particularly relating to site infrastructure and the provision of recommendations relating to the implementation of a FMP work program which included site clean-up and establishment of 30 m wide low fuel buffer zones around critical infrastructure. During September 2017, the FMP was reviewed and updated. As a result of this review, a number of improvements were made to bushfire preparedness and response capability at the FNO. The FNO also maintains a Bush Fire Response Management Plan (last updated in March 2019) which provides clear guidance for the management of personnel and critical assets in the event of an uncontrolled bush fire affecting FNO operations.

Other management actions implemented to reduce the risk of fire include installation of fire suppression systems including fixed 23,000 L and 34,000 L water tanks and a standpipe with quick fill located at the dewatering settling ponds. Additional actions include upgrades to the mobile fire and emergency trucks. Furthermore, all vehicles carry handheld fire extinguishers and two-way radios.

The FNO has an emergency response team that is regularly trained in fire suppression techniques. Smoking is only permitted in designated areas on site. Hot work permits are required to be issued by the mine manager prior to this type of work commencing onsite. All flammable substances are stored and used in compliance with the *Dangerous Goods Act 2004* and Australian Standard AS 1940-1993 for the Storage and Handling of Flammable and Combustible Liquids.

In February 2020 there was a significant bushfire event within the Forrestania region and beyond. The fire was likely to have been caused by lightning strikes (DEFS, 2020) and resulted in impacts to WSA infrastructure, including Spotted Quoll mine infrastructure, as well as surrounding native vegetation. Among the native vegetation impacted, a portion of *E. steedmanii* Population 8 located to the east of Spotted Quoll mine infrastructure was impacted (Figure 3). This impact was caused by firebreaks cleared by the Department of Fire and Emergency Services to track the fire and direct fire damage.

Following the event WSA engaged Botanica Consulting to undertake assessment of the damage to Population 8 and provide advice to WSA on potential operational measures that could add further protection to this community and/or aid in the recovery of this population. The assessment determined that approximately 3.6 ha (6.7%) of Population 8 had been burnt during the event. More refined mapping by WSA has determined the area of disturbance is slightly larger (i.e., approximately 4.74 ha [9%] which includes both Department of Fire and Emergency Services firebreaks created to track the fire [0.64 ha] as well as burnt areas [4.1 ha]). Botanica concluded that given Population 8 comprised mainly mature seeds prior to the fire, the potential to regenerate from seed is possible. Evidence of this occurring in the past is shown by the 1994 fire that swept through Forrestania affecting known populations, which regenerated with many trees now present in mallee form. Botanica further concluded that given the small proportion of the population impacted it is unlikely that the bushfire will result in a significant impact to *E. steedmanii*. Photo point monitoring of Population 8 commenced in 2021. Photo monitoring has recorded the early stages of regrowth of the native vegetation.

---

## Conclusion

WSA has achieved the best environmental performance possible since the implementation of the project, which can be attributed to development of an FMP and ongoing improvements to bushfire preparedness and response capability at the FNO. The significant February 2020 Forresteria bushfire event resulted in impacts of approximately 4.74 ha to Population 8 of *E. steedmanii*. This was due to both Department of Fire and Emergency Services firebreaks created to track the fire as well as burnt areas. Photo point monitoring has been implemented at Population 8 for ongoing assessment of regeneration.

### 4.2. Medium Risk Pathways

#### 4.2.1. Environmental Weed Infestation

### Risk Assessment

Environmental weeds (weeds) have potential to establish, reproduce and disperse and have a serious impact on natural systems and nature conservation values. These weeds can displace native plants by competing for resources (water, nutrients, light, etc.), and may alter fuel and fire dynamics. The introduction and/or spread of weeds as a result of human activities may result in the decline of significant flora and/or floristic communities. In addition, weeds can also have a significant adverse impact on fauna habitats.

Environmental weed species that are highly invasive will have a high rating for potential to impact on the environment. Species with a fast rate of spread will have a more extensive final distribution. Early action to remove these plants is highly effective in preventing serious weed problems.

### Performance Discussion

The objective is to minimise the risk of introduction and spread of weeds generally at the FNO including mining tenements M77/583 and M77/545. Weed management is conducted under FNO's internal weed spraying and vehicle hygiene procedures; which are part of the FNO Environmental Management System (EMS). FNO's Vehicle Hygiene for Weed and Disease Control Procedure requires that:

- All vehicles are inspected prior to commencing work onsite; and
- All machinery is washed/blown down to remove soil/seeds prior to utilisation at FNO.

FNO continues to develop its environmental management system (EMS), aligned to the ISO14001 standard. The improvement of the EMS will continue, with plans to undertake a review of key management plans and the continual improvement of implementation elements of the EMS during the forthcoming reporting period.

FNO environmental staff undertake quarterly weed monitoring and GPS mapping of weed population or former known locations on WSA tenements. Where weed species are identified they are controlled either via mechanical or chemical methods.

No significant weed outbreak in the natural systems has been observed to date in the project area, including during the reporting period. Some small patches of weeds have been observed during quarterly monitoring and have been treated. WSA has invested significant resources into the ongoing weed control undertaken across site including the Spotted Quoll areas cover by this MS808.

---

## Conclusion

WSA has continues to invest resources to control weed populations by regularly inspecting sites for weeds and controlling weeds as soon as they are identified and, where possible, prior to seed set. Individual weeds are controlled using the latest information and techniques as described by the Department of Primary Industries and Regional Development.

### 4.2.2. Dust

## Risk Assessment

It is possible that cumulative settled dust on plant surfaces may reduce that plant's ability to photosynthesise, reproduce or regulate water transpiration. Any reduction of plant functions by dust may result in a decline in plant and the population health. Dust is a potential hazard close to the mine (e.g., less than 1000 m); while away from the mine, dispersion reduces this hazard for given wind speed and direction.

To a lesser extent than plants, fauna may also be forced to move to adjacent habitats to avoid dust.

## Performance Discussion

The objective is to minimise the impact of dust generated from the mining operation on adjacent vegetation and particularly the DRF species *Eucalyptus steedmanii*.

FNO maintains a Steedman's Gum (*Eucalyptus steedmanii*) Management Plan (MP) as part of its obligations under Ministerial Statement 808 (Environmental Protection Act, 1986) to protect the DRF species *Eucalyptus steedmanii*. This Management Plan is based on the works conducted by Coffey (2009) and Astron (2014). A revised Steedman's Gum Management Plan (v2) accepted by the Executive Director of EPA Services on 22 November 2021.

A dust management plan and dust deposition monitoring network were developed prior to commencement of the operations. Dust deposition records are collected via dust deposition gauges (placed in accordance with the Australian Standard) and analysed on a monthly basis. Analysis of dust deposition results collected to date suggests that there was a spike in dust deposition during the clearing phase of construction of the project with some elevated levels also recorded during the operation of the Spotted Quoll open pit.

Dust suppression is undertaken by utilising water carts with dribble bars on the haul road between the underground operation and the waste dump and also the main haul road. This appears to have been effective during the drier months. The Forrestania area has regular winter rainfall and it is apparent that dust generation is not a significant issue at this time of the year. Vehicle speed limits are restricted to 40 km/hr around the mine and 90 km/hr on the haul roads.

WSA undertook a review of dust monitoring data from the previous six years (2015-2021) during which dust deposition sampling had been undertaken on a monthly basis. Results over the 6 years indicated that dust deposition has not been a factor in regards to the health of the *E. steedmanii* populations at the FNO. Accordingly, the DWER approved the dust deposition sampling to be continued, but on a reduced, quarterly basis.

Over the reporting period, the monitoring of *E. steedmanii* has continued as per the MP. Monitoring indicates there has been no decline to *E. steedmanii* population health associated with direct operations of the Spotted Quoll mine, however, declines to Populations 7 and 8 have been attributed to dieback and bushfire, respectively (See 7.3 for further details).

---

## Conclusion

During the reporting period dust management has been achieved through the use of standard industry practice methods in dust management including utilising water trucks with dribble bars and reducing traffic speeds around the mine site.

### 4.2.3. Greenhouse Gas Emissions

#### Risk Assessment

Greenhouse gases will be liberated as a result of using grid electricity; production of onsite wastewater; solid waste generation and movement, storage and combustion of diesel fuels and other hydrocarbons. The most significant greenhouse gases for FNO have been identified as CO<sub>2</sub> and N<sub>2</sub>O. It is estimated that approximately 52,560 tonnes CO<sub>2</sub> equivalents will be emitted during the project life.

#### Performance Discussion

The objective is to minimise the amount of greenhouse gases emitted during the project life. This has been achieved by extending the overhead power line from the Flying Fox mine 6 km north to utilise grid power thus reducing the requirements for diesel generator power (diesel generators are used for backup power only).

Other management strategies to reduce greenhouse emissions include ensuring that vehicles and equipment are regularly serviced and fitted with appropriate emission control equipment that meets required standards; integrating processes to minimise material handling and monitoring energy consumption and calculating emissions.

Greenhouse gas emissions have reduced with maturity of the project, reducing to approximately ~2.4 t CO<sub>2</sub> e per tonne of contained nickel metal mined from the Spotted Quoll underground mine from ~2.7 t CO<sub>2</sub> e per tonne of contained nickel metal mined at the peak of the Spotted Quoll open pit operation in 2011.

## Conclusion

WSA have achieved a satisfactory level of performance in the minimisation of greenhouse gas generation, this has been achieved mostly through the utilisation of grid power rather than diesel powered electricity generation.

### 4.2.4. Direct Animal Mortality

#### Risk Assessment

There is a risk that individual animals may be killed by interaction with vehicles due to increased vehicle activity including light vehicle, haulage and machinery operation; and entering water holding facilities. For all vertebrates and the majority of invertebrate taxa, it is unlikely that the loss of individuals associated with such direct mortalities will be significant enough to affect the conservation status of any species recorded in the area.

#### Performance Discussion

The objective is to minimise the frequency of animal and vehicle interactions. Any animal fatalities are recorded with awareness campaigns running throughout the year.

---

Vehicle speed restrictions; fauna warning signs and workforce education (inductions; workplace safety meetings and environmental focus campaigns) have been implemented to minimise the number of animal road deaths. Other measures to protect fauna have been to fence off the water ponds (both non-saline and hyper-saline) of the dewatering system and to ensure that all pits, trenches and ponds are fitted with appropriate fauna egress structures.

The site uses inverted leach drains as part of the septic system, thus reducing exposure of animals to septic ponds.

## Conclusion

WSA have achieved standard industry best practice and a satisfactory level of performance in relation to direct animal mortality through the measures outlined above.

### 4.2.5. Feral Animals

## Risk Assessment

An increase in human activity is often associated with an increase in the abundance of feral species such as *Mus Musculus* (common house mouse), *Felis catus* (cat) and *Vulpes vulpes* (fox). This may be due to the decline in habitat health, increased direct animal mortalities or poor waste disposal practices.

The house mouse, cat and fox have been recorded in fauna surveys at Forrestania. Predation by foxes and cats is one of the major threats to both Malleefowl and *Dasyurus geoffroii* (Chuditch). Fox predation is the most significant threat after large scale vegetation clearing and burning.

## Performance Discussion

The objective is to minimise the impact of feral animal species on native fauna. Feral animal management is conducted under FNO's internal procedures as part of the EMS. FNO continues to develop its EMS, aligned to the ISO14001 standard. The continual improvement of the EMS and the processes and procedures will continue into the future, with plans to undertake a review of key management plans and the implementation methods during the forthcoming reporting period.

The above objective has been met through implementation of management measures including the temporary placement of putrescible waste in enclosed bins; removing putrescible wastes off-site on a weekly basis and through extending the feral animal control program which includes camera and bait trapping and 1080 baiting (via the Eastern Wheatbelt Declared Species Group) to the adjacent areas around the Spotted Quoll tenements. WSA maintains a sponsorship agreement with the Eastern Wheatbelt Declared Species Group which is currently in place until Q1 2023.

## Conclusion

WSA have achieved a satisfactory level of performance in relation to feral animal control through the measures outlined above.

---

#### 4.2.6. Hyper-saline Water

##### **Risk Assessment**

The mining operation requires dewatering, transport and discharge of hyper-saline water. Saline water has the potential to destroy native plants and contaminate surface water.

##### **Performance Discussion**

The objective is to minimise the impact and likelihood of a hyper-saline water spill contaminating adjacent landforms or the surface or ground water. Saline Water Management is conducted under FNO's internal procedures; which are a controlled document and part of the EMS. FNO continues to develop its EMS, aligned to the ISO14001 standard. The improvement of the EMS will continue into the future, with plans to undertake a review of key management plans and the implementation of the EMS during the forthcoming reporting period.

All hyper-saline dewatering pipelines are buried and fitted with a telemetry-based leak detection system in the form of a flow meter and transmitter at each end of the pipeline. Leak monitoring is via a PLC and control circuit containing software and programming to detect any discrepancy of flow rates between the associated magnetic flow meters.

In the event of a leak or breach in the pipeline, the pipeline pump stations can be shut down. Additionally, all dewatering infrastructure is visually inspected on a daily basis in accordance with prescribed premises licence L8041/1990/5 (EP Act, Part V). Surface water management structures have been built along the dewatering pipeline corridor so that in the event of a failure of the pipeline water is contained within the corridor.

A comprehensive network of monitoring bores has been set up around all discharge facilities and these are managed through L8041/1990/5. Contingency measures including the operation of recovery bores are implemented where licence trigger levels are exceeded.

##### **Conclusion**

The established system for saline water management at the FNO is comparable to the high standards within the mining industry. The use of leak detection and automatic shutoff systems, plus drainage infrastructure ensures that the risk of saline water escaping the dewatering system into the surrounding environment in any significant quantity is minimal.

#### 4.2.7. Changes to Groundwater Hydrology

##### **Risk Assessment**

Groundwater levels and water quality in the project area do not support phreatophytic vegetation and groundwater is generally hyper-saline and of low quality with generally no other benefitting users. Subterranean fauna populations may be adversely impacted by loss of habitat through dewatering operations.

##### **Performance Discussion**

The objective is to maintain the quantity of groundwater so that existing and potential environmental values, including ecosystem maintenance are protected.

---

The Triennial Groundwater Review for 2019 to 2022 (Rockwater) has indicated that generally, groundwater levels show declining trends at the active dewatering and extraction sites: Spotted Quoll mine, Cosmic Boy underground workings, Digger Rocks pit, and Jackson Rock bore field. Stable or declining water levels are evident at the inactive injection and discharge locations; these include the Liquid Acrobat and Seagull injection bore fields, and the disused evaporation pond at Digger Rocks. Groundwater levels have also been declining at Flying Fox, as a result of continued mine dewatering. Groundwater levels have generally increased locally at the active discharge locations, i.e., Sibelius injection bore field and Mossco Farm evaporation pond.

Several monitoring bores at the injection and discharge sites have compliance limits (minimum water-level depths, below ground surface) assigned to them due to the possible detrimental effect that shallow saline groundwater could have on native vegetation. During the review period (July 2019 to June 2022), no compliance limits were breached for any of the monitoring bores that have compliance limits assigned to them.

Vegetation has shown some fluctuations in plant density and condition from year to year. However, similar variations were observed at both the monitoring sites and the analogue sites (the latter being located outside the inferred impact area); it is thought that the fluctuations reflect the impacts of natural (uncontrollable) conditions (i.e., rainfall) or localised incidences (e.g., clearing for firebreaks or bushfires), and not the dewatering or water-discharge activities at Forrestania.

There have been no observed long-term detrimental effects to the aquifer or vegetation attributable to either dewatering, bore field operation, or discharge activities conducted by FNO. Although groundwater levels do respond to these activities locally, the changes measured in monitoring bores have not been environmentally significant or sustained after the activity has ceased; or, the changes have been replicated in regional monitoring bores/sites (where present). Where there have been possible implications for the environment, remediation programmes (i.e., groundwater recovery, to reduce groundwater levels) have been implemented and have shown positive results.

The next Triennial Groundwater Review is due in 2025.

## Conclusion

The activities relating to groundwater at FNO are outlined in the Groundwater Licence Operating Strategy (WSA, 2021), which contains the commitments regarding pumpage, discharge and groundwater monitoring across the operation. A high level of compliance with the GLOS Monitoring Program has been achieved during the 2021/2022 reporting period.

The data collated by WSA and its consultants has been sufficient to provide an indication of long-term groundwater trends. Dewatering impact in the shallower aquifers adjacent to Spotted Quoll has been, and is predicted to be into the future, less than was originally anticipated meaning impacts to any subterranean fauna habitat that is available are also less than was anticipated.

### 4.2.8. Fuel Spills

## Risk Assessment

The storage of large volumes of diesel fuel onsite increases the risk of a spill or leak occurring from storage vessels, pipelines or vehicles. Fuel spills can cause soil contamination leading to reduced growth and plant death from local toxic action on roots and contamination of surface and ground water.



---

## Performance Discussion

The objective is to minimise the impact and likelihood of a hydrocarbon spill contaminating the adjacent landform or surface or groundwater.

Strategies utilised at the Spotted Quoll project to ensure this objective is met include, installing self-bunded bulk fuel tanks. The fuel filling location is located on a reinforced concrete hardstand area which drains to a collection tank; all bulk storage areas are bunded to allow containment of 110 % of the volume of the largest container stored and 25 % of the volume of the aggregate of containers stored; oily runoff is collected and treated through an appropriately designed and sized oil/water separator system which is regularly maintained; waste oils, spent solvents, coolants and other chemical wastes are collected in drums or holding tanks and are removed offsite by licensed contractor. If inadvertent spillage of hydrocarbons occurs, the spill will be contained as much as possible by the use of earthen bunds and recovered with hydrocarbon absorbent materials for bioremediation or disposal through a licenced disposal operator.

Hydrocarbon contaminated soil will be removed, collected and taken to the project bioremediation site. These sites are managed in accordance with DEC's guidance material '*Bioremediation of hydrocarbon-contaminated soils in Western Australia* (Department of Environment, WA, 2004)'. Used oils, greases and lubricants will be stored in designated tanks in a bunded area constructed in accordance with Australian Standard 1940; and staff will be trained in appropriate incident/emergency response procedures. All waste oil is removed from site by a licensed contractor.

## Conclusion

WSA have achieved a satisfactory level of performance in relation to hydrocarbon management onsite.

### 4.2.9. Inadequate Revegetation Regeneration

## Risk Assessment

Large scale clearing of native vegetation (up to the approved 140 ha) has the potential to remove both whole vegetation communities and individual species in the long term. Without successful regeneration there is potential that the disturbed areas will not rehabilitate sufficiently to achieve a stable and functioning landform which is consistent with the surrounding landscape and environmental values.

## Performance Discussion

The objective of the rehabilitation and closure program at the Spotted Quoll nickel mine is to rehabilitate the disturbed areas to ensure that the sites are safe and stable; that soil erosion and subsequent sedimentation are minimal and that the rehabilitated areas have established a self-sustaining vegetation complex into which local fauna are able to return and re-establish.

All revegetation material is sourced from local provenance sources and from reputable seed suppliers. Various erosion control measures are currently being trialled on the waste dump rehabilitation sites. FNO has trialled shredded vegetation material for erosion control and to create niches for seed germination and growth. Preliminary observations suggest this technique may be successful in promoting rapid growth and erosion control on waste dumps in areas of the southern goldfields.

Rehabilitation trials at the Spotted Quoll project commenced in 2010 and will be ongoing over the life of the project. Rehabilitation trials incorporated various topsoil treatments, seed mixes and erosion control strategies. Approximately 75% of the Spotted Quoll waste dump has been rehabilitated to date.

---

The 2021 rehabilitation monitoring survey (Spectrum Ecology, 2021) examined a total of 34 sites (29 rehabilitation sites and five control sites) and found that the 16 rehabilitation areas, 15 areas had improved in mean species richness. Weed presence and cover increased in 11 out of 34 sites, with covers ranging from 0.1% to 59.3%. Erosion was present at six out of 34 sites. Flying Fox rehabilitation plots reported some rills, while Spotted Quoll and Lounge Lizard had both rills and gullies. Overall, Spectrum Ecology were of the view that the rehabilitation plots appear to be progressing well. The following summaries were made:

- Flying Fox sites have generally improved; no weeds were present, and the high native shrub cover surrounding the sites may facilitate natural seedling recruitment over time. It was noted that Flying Fox sites lacked a native overstorey, which will prevent the sites from resembling the control and from meeting the provisional completion criteria.
- Hang Dog sites are improving and vegetation at the two younger sites is growing well. Native perennial cover is progressing well and no weed species were recorded in 2019 or 2021. Rehabilitation plots in this area lack Grass and Herb lifeforms, but recruitment and growth of these species may occur naturally over time as the overstorey establishes and provides more shade.
- Lounge Lizard slope sites did not match the control; however, the plots appear to be progressing successfully into Eucalyptus dominated woodlands. Sites have generally improved, with native perennial cover remaining relatively stable and weed species richness and cover remaining at zero. Lounge Lizard flat appears to be progressing well but lacks Grass and Herb lifeforms. Sites were dominated by Shrub lifeforms with no overstorey, which matches the structure at the control site.
- MACA Explosives sites have generally improved, native perennial cover has increased and no weed cover was recorded. Eucalypt cover and growth was unlikely to match the control at some sites, and re-seedling may be advised if no overstorey growth is observed within the next few years.
- Diggers Rocks sites have generally diminished over the last two years, mostly due to weed abundance and a lack of native perennial growth.
- Spotted Quoll sites had burnt since 2019 and consequently weed cover and weed species richness had increased. Eucalypts were resprouting at some sites, but other sites had suffered significantly more fire damage. Re-seeding may be advised if no growth is seen over the next few years.

The 2021/2022 annual rehabilitation program was successfully completed from late autumn to early winter 2022, in order to take advantage of cool seasonal conditions and winter rainfall. The rehabilitation program activities included earthworks, tube stock planting from local provenance seed, signage and setting up of photo monitoring of recent rehabilitated sandpits.

## Conclusion

WSA are committed to achieving industry best practice in relation to the rehabilitation results of disturbed areas at the FNO.

Monitoring shows that there is scope for improvement in the rehabilitation results achieved so far and FNO will be working towards this as a priority going forward.

FNO intends to continue rehabilitation monitoring as per the DMIRS approved Mine Closure Plan.

---

## 5. IMPROVEMENTS IN ENVIRONMENTAL MANAGEMENT

The Spotted Quoll nickel mine has now been operational for approximately 10 years. During this time several innovations in environmental management have been trialled and may prove to be useful in this and other similar projects. Key environmental improvement activities have included:

- Continuation of a site wide Malleefowl monitoring program incorporating the use of aerial photography assessment and motion sensor cameras and including the Malleefowl monitoring commitments of the Spotted Quoll project area;
- Engagement with the National Malleefowl Recovery Team and providing data from monitoring for the Forrestania area within the Great Western Woodlands;
- Rehabilitation monitoring program using ground surveys, and where possible remote sensing, techniques; with results used to guide further rehabilitation efforts at the FNO;
- Waste resource recovery which recycled 450mt scrap steel and 100mt of poly pipe; and
- Ongoing maintenance and continual improvement of the EMS in line with the ISO 14001 standard.

All other aspects of environmental management are undertaken in accordance with industry standard or best practice.

6. PLATES



DRF monitoring – Population One (1) Transect Seven (7)

Camera trap capturing Malleefowl laying activity



Camera trap capturing Malleefowl chick emerging

Camera trap capturing Malleefowl pair on mound



Batter rehabilitation Spotted Quoll waste dump

Spotted Quoll waste dump rehabilitation top surface

7. FIGURES



Figure 1: Location of Forrestania Nickel Project in Western Australia

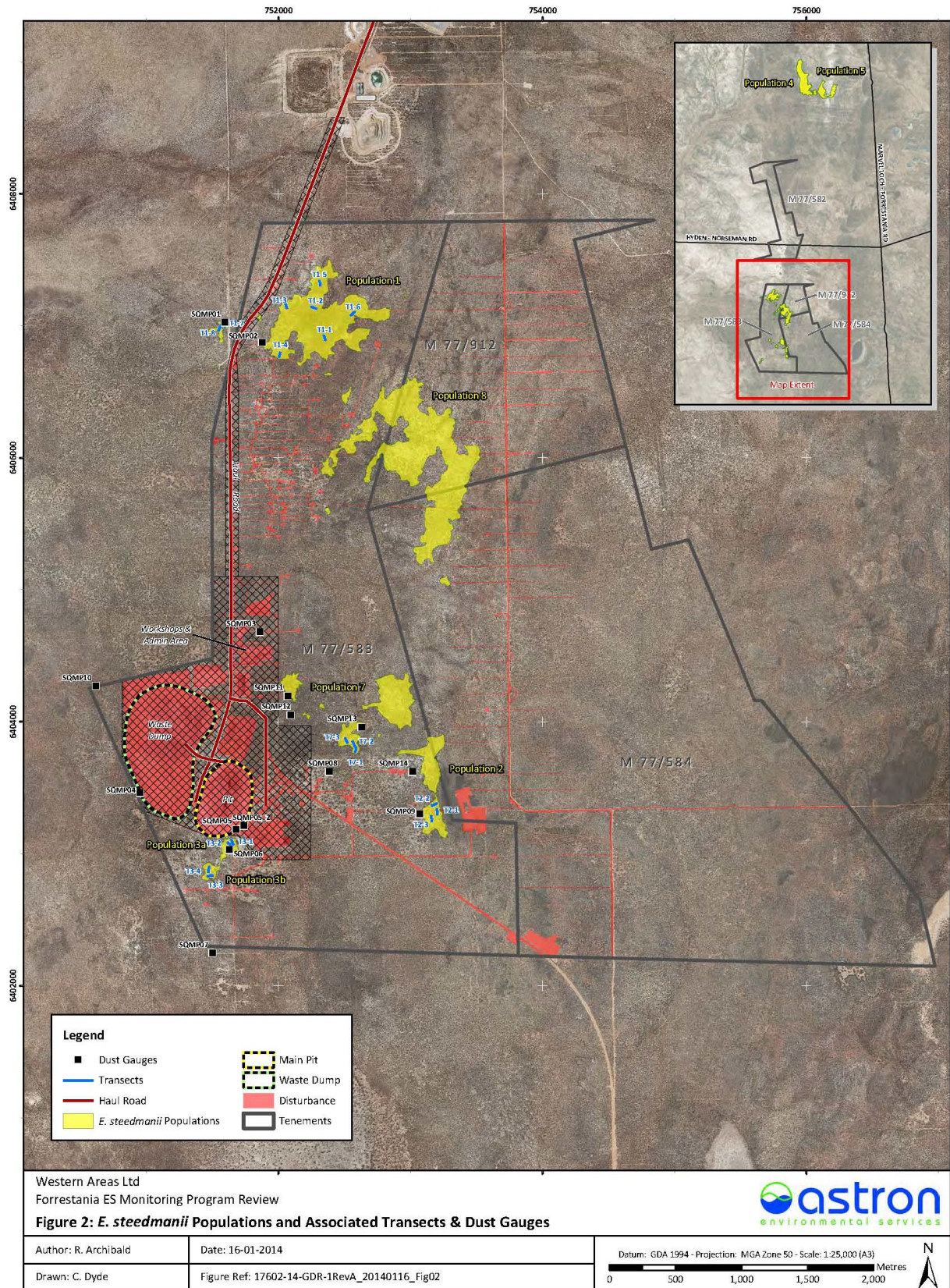


Figure 2: Spotted Quoll project – general site layout plan

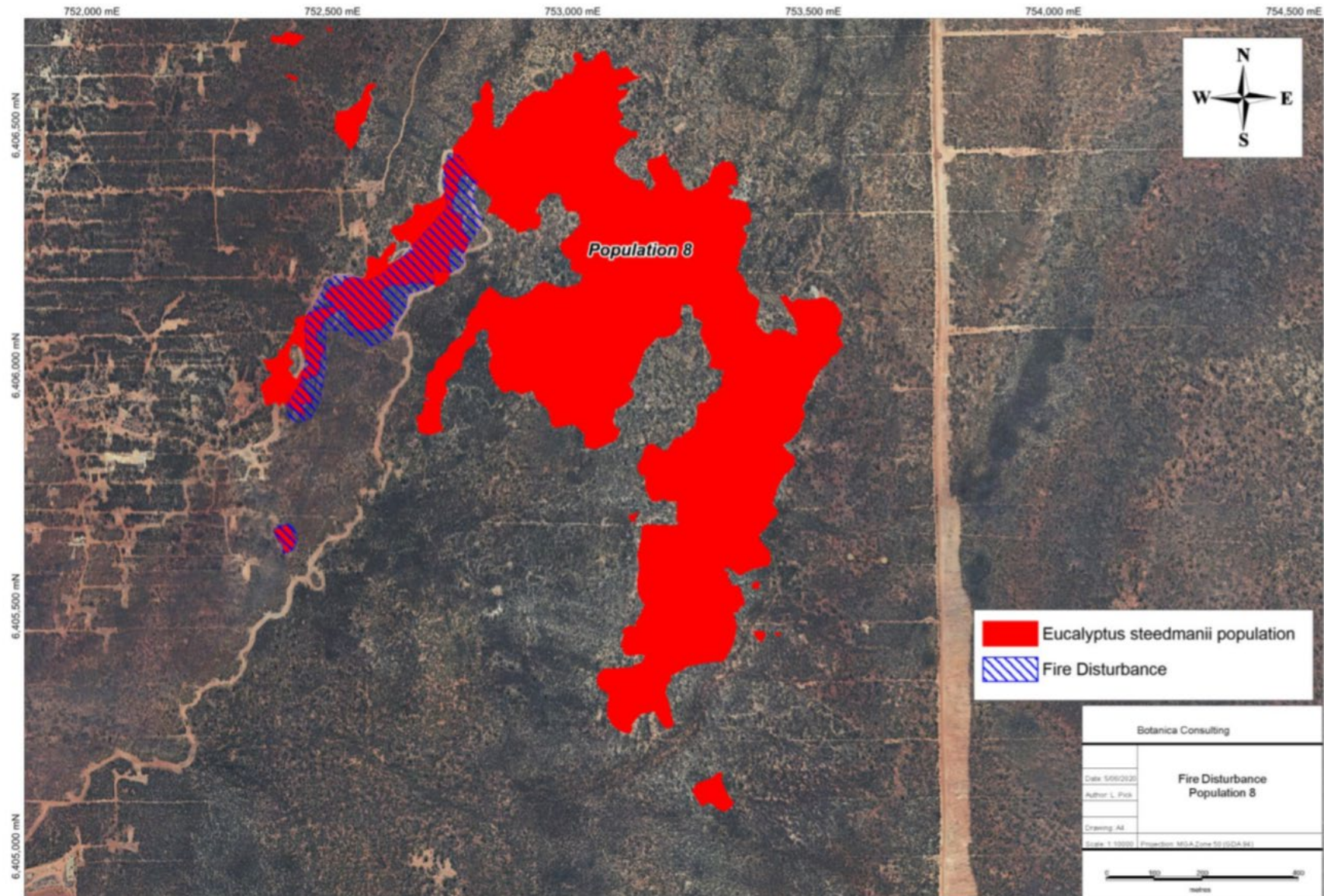


Figure 3: Fire disturbance identified within Population 8 (Botanica 2020)

## 8. APPENDICES

### 8.1. Spotted Quoll Open Pit Nickel Mine Environmental Risk Analysis Summary

#### Risk Identification and Assessment

Risk identification			Risk Analysis		Risk Evaluation	Comments
Activity	Hazard/Risk	Impact	Consequence	Likelihood		
<b>Construction</b>						
Vegetation Clearance	Dust	Impact on vegetation communities	Insignificant	Almost certain	Medium	Clearing activities likely to be undertaken in winter period when soil is moist
		Impact on DRF	Insignificant	Almost certain	Medium	Clearing activities likely to be undertaken in winter period
		Impact on Priority Species	Insignificant	Almost certain	Medium	Clearing activities likely to be undertaken in winter period
		Impact on Humans	Minor	Likely	Medium	Clearing activities likely to be undertaken in winter period
	Vegetation Clearance	Impact on vegetation communities	Minor	Almost certain	Medium	Vegetation communities well represented in the region
		Impact on DRF	Moderate	Rare	Low	No DRF being cleared
		Impact on Priority Species	Minor	Rare	Low	One priority species being cleared
		Impact on vertebrate fauna and SRE	Minor	Almost certain	Medium	Habitat well represented in the region
		Impact on archaeological/ethnographic sites	Minor	Unlikely	Low	No known sites of significance within the project area
	Noise	Impacts on humans	Insignificant	Almost certain	Medium	
	Erosion and sedimentation	Impact on soil and water quality	Minor	Unlikely	Low	
Construction of roads, parking area, ROM pad, workshop,	Dust	Impact on vegetation communities	Insignificant	Almost certain	Medium	Vegetation communities well represented in region



Risk identification			Risk Analysis		Risk Evaluation	Comments
Activity	Hazard/Risk	Impact	Consequence	Likelihood		
office, powerlines and pipeline						
		Impact on DRF	Insignificant	Almost certain	Medium	
		Impact on Priority Species	Insignificant	Almost certain	Medium	
		Impact on humans	Minor	Likely	Medium	
	Erosion and sedimentation	Impact on soil and water quality	Minor	Moderate	Medium	
	Noise	Impacts on humans	Insignificant	Almost certain	Medium	
	Change to surface hydrology	Impact on vegetation communities	Low	Unlikely	Low	Vegetation communities well represented in region
		Impact on DRF	Minor	Unlikely	Low	
		Impact on Priority Species	Minor	Unlikely	Low	
		Impact on fauna	Minor	Unlikely	Low	
	<b>Operations</b>					
Blasting	Noise	Impact on humans	Insignificant	Unlikely	Low	
	Vibration	Impact on humans	Insignificant	Unlikely	Low	
	Dust	Impact on vegetation communities	Insignificant	Unlikely	Low	Dust likely to be restricted to area of blast. Ore and waste being blasted will be moist.
		Impact on DRF	Insignificant	Unlikely	Low	Dust likely to be restricted to area of blast. Ore and waste being blasted will be moist.

Risk Identification			Risk Analysis		Risk Evaluation	Comments
Activity	Hazard/Risk	Impact	Consequence	Likelihood		
		Impact on Priority Species	Insignificant	Unlikely	Low	Dust likely to be restricted to area of blast. Ore and waste being blasted will be moist.
		Impact on humans	Insignificant	Unlikely	Low	Dust likely to be restricted to area of blast. Ore and waste being blasted will be moist.
	Greenhouse Emissions	Impact on air quality	Insignificant	Almost certain	Medium	
Overburden and Ore excavation	Noise	Impact on humans	Insignificant	Almost certain	Medium	
	Dust	Impact on vegetation communities	Insignificant	Almost certain	Medium	Vegetation communities well represented in region
		Impact on DRF	Insignificant	Almost certain	Medium	
		Impact on Priority Species	Insignificant	Almost certain	Medium	
		Impact on humans	Minor	Likely	Medium	
Greenhouse emissions	Impact on air quality	Insignificant	Almost certain	Medium		
Pit Dewatering	Changes to groundwater hydrology	Impact on vegetation communities	Moderate	Rare	Low	Groundwater below root impact zone. Vegetation communities well represented in region
		Impact on DRF	Moderate	Rare	Low	Groundwater below root impact zone
		Impact on Priority Species	Moderate	Rare	Low	Groundwater below root impact zone
		Impact on humans (other resource users)	Insignificant	Unlikely	Low	No known users in the vicinity of the project
	Changes to surface water hydrology	Impact on surface water quality	Moderate	Rare	Low	No known groundwater discharge sites on the project site

Risk identification			Risk Analysis		Risk Evaluation	Comments
Activity	Hazard/Risk	Impact	Consequence	Likelihood		
Waste rock transport and deposition	Dust	Impact on vegetation communities	Insignificant	Almost certain	Medium	Vegetation communities well represented in region
		Impact on DRF	Insignificant	Almost certain	Medium	
		Impact on Priority Species	Insignificant	Almost certain	Medium	
		Impact on humans	Minor	Likely	Medium	
	Noise	Impact on humans	Insignificant	Almost certain	Medium	
	Greenhouse gas Emissions	Impact on air quality	Insignificant	Almost certain	Medium	
	Soil compaction/soil quality	Impact on soil quality	Insignificant	Almost certain	Medium	
Waste rock storage	Changes to surface water hydrology	Impact on vegetation communities	Insignificant	Almost certain	Medium	Vegetation communities well represented in region
		Impact on DRF	Insignificant	Almost certain	Medium	
		Impact on Priority Species	Insignificant	Almost certain	Medium	
		Impact on vertebrate fauna and SRE	Insignificant	Almost certain	Medium	
	Acid generation	Impact on soil quality	Minor	Unlikely	Low	
		Impact on groundwater quality	Minor	Unlikely	Low	
		Impact on surface water quality	Moderate	Unlikely	Low	

Risk identification			Risk Analysis		Risk Evaluation	Comments	
Activity	Hazard/Risk	Impact	Consequence	Likelihood			
		Impact on vegetation communities	Minor	Unlikely	Low	Vegetation communities well represented in region	
		Impact on DRF	Insignificant	Unlikely	Low		
		Impact on Priority Species	Insignificant	Unlikely	Low		
		Impact on vertebrate fauna and SRE	Minor	Unlikely	Low		
		Impact on humans	Insignificant	Rare	Low		
<b>Ancillary Operations</b>							
Vehicle Movement	Dust	Impact on vegetation communities	Minor	Almost Certain	Medium	Impact restricted to areas adjacent to roads and access areas.	
		Impact on DRF	Minor	Almost Certain	Medium		
		Impact on Priority Species	Moderate	Possible	Medium		
		Impact on fauna	Minor	Possible	Medium		
		Impact on humans	Minor	Possible	Medium		
	Traffic on roads	Impact on vertebrate fauna and SRE	Moderate	Possible	Medium		
	Noise	Impact on humans	Insignificant	Rare	Low		
	Greenhouse Gas Emissions	Impact on air quality	Insignificant	Almost certain	Medium		
	Introduction of weeds	Impact on vegetation communities	Minor	Likely	Medium	Vegetation communities well represented in region	
		Impact on DRF	Minor	Likely	Medium		
		Impact on Priority Species	Minor	Likely	Medium		
	Dangerous goods storage and handling	Fuel spills (<100L)	Impact on soil quality	Minor	Likely	Medium	

Risk identification			Risk Analysis		Risk Evaluation	Comments
Activity	Hazard/Risk	Impact	Consequence	Likelihood		
		Impact on surface water quality	Minor	Likely	Medium	
		Impact on groundwater quality	Insignificant	Likely	Medium	
		Impact on vegetation communities	Insignificant	Likely	Medium	Vegetation communities well represented in region
		Impact on DRF	Insignificant	Likely	Medium	
		Impact on Priority Species	Insignificant	Likely	Medium	
		Impact on humans	Insignificant	Likely	Medium	
	Fuel Spills (>100L)	Impact on soil quality	Moderate	Unlikely	Low	
		Impact on surface water quality	Moderate	Unlikely	Low	
		Impact on groundwater quality	Minor	Unlikely	Low	Depth to groundwater is 30m
		Impact on vegetation communities	Minor	Unlikely	Low	Vegetation communities well represented in region
		Impact on DRF	Minor	Unlikely	Low	No DRF near fuel storage facility
		Impact on Priority Species	Minor	Unlikely	Low	No Priority species near fuel storage facility
		Impact on humans	Minor	Unlikely	Low	
General waste management	Litter	Impact on fauna	Minor	Possible	Medium	
		Impact on visual amenity	Minor	Possible	Medium	
	Odour	Impact on humans	Insignificant	Unlikely	Low	
	Introduction of Weeds	Impact on vegetation communities	Insignificant	Unlikely	Low	Vegetation communities well represented in region
		Impact on DRF	Insignificant	Unlikely	Low	

Risk identification			Risk Analysis		Risk Evaluation	Comments
Activity	Hazard/Risk	Impact	Consequence	Likelihood		
		Impact on Priority Species	Insignificant	Unlikely	Low	
		Impact on fauna	Insignificant	Unlikely	Low	Modification of habitat
	Attract feral animals	Impact on fauna	Insignificant	Likely	Medium	Fauna within the area is likely to be limited
Artificial Lighting	Change nocturnal habits of animals	Impact on fauna	Insignificant	Likely	Medium	May influence habits of nocturnal animals
Hypersaline water storage	Spill from settling pond	Impact on surface water quality	Moderate	Unlikely	Medium	Overflow contained in secondary/emergency storage pond
		Impact on soil quality	Moderate	Unlikely	Medium	
		Impact on vegetation communities	Insignificant	Unlikely	Low	Overflow contained in secondary/emergency storage pond. Vegetation communities well represented in region
		Impact on DRF	Insignificant	Unlikely	Low	Overflow contained in secondary/emergency storage pond
		Impact on Priority Species	Insignificant	Unlikely	Low	Overflow contained in secondary/emergency storage pond
		Impact on vertebrate fauna and SRE	Insignificant	Unlikely	Low	Overflow contained in secondary/emergency storage pond
		Impact on groundwater quality	Insignificant	Unlikely	Low	Groundwater quality is already saline
Saline water transport (via pipeline)	Spill from pipeline	Impact on surface water quality	Insignificant	Unlikely	Low	Subsurface pipeline, scour sumps
		Impact on vegetation communities	Insignificant	Unlikely	Low	Vegetation communities well represented in region
		Impact on DRF	Minor	Unlikely	Low	

Risk identification			Risk Analysis		Risk Evaluation	Comments
Activity	Hazard/Risk	Impact	Consequence	Likelihood		
		Impact on Priority Species	Minor	Unlikely	Low	
		Impact on fauna	Minor	Unlikely	Low	
		Impact on groundwater quality	Insignificant	Unlikely	Low	Groundwater quality is already saline
Saline water disposal (aquifer recharge)	Changes to groundwater hydrology	Impact on groundwater quality	Insignificant	Unlikely	Low	Groundwater quality is already saline
		Impact on groundwater levels	Minor	Unlikely	Medium	
		Impact on vegetation communities	Insignificant	Unlikely	Low	Groundwater levels monitored and required to be maintained generally 10m below ground level (specified in site specific licences/works approvals from DEC)
Electricity usage	Greenhouse Gas Emissions	Impact on air quality	Minor	Almost certain	Medium	
<b>Unplanned Events</b>						
Unauthorised clearing	Vegetation Clearance	Impact on vegetation communities	Minor	Unlikely	Low	Vegetation communities well represented in region
		Impact on DRF	Major	Unlikely	High	
		Impact on Priority Species	Moderate	Unlikely	Medium	
		Impact on vertebrate fauna and SRE	Moderate	Unlikely	Medium	
		Impact on archaeological/ethnographic sites	Minor	Unlikely	Low	No known sites of significance within the project area
	Noise	Impacts on humans	Insignificant	Unlikely	Low	
	Erosion and sedimentation	Impact on soil and water quality	Minor	Unlikely	Low	

Risk identification			Risk Analysis		Risk Evaluation	Comments
Activity	Hazard/Risk	Impact	Consequence	Likelihood		
Presence of humans (cigarette butt (littering), ignition from spark plugs etc	Fire	Impact on surface water quality	Insignificant	Possible	Low	No permanent water courses
		Impact on vegetation communities	Moderate	Possible	Medium	Vegetation communities well represented in region
		Impact on DRF	Major	Possible	High	May impact population numbers if there are high frequency of fires
		Impact on Priority Species	Major	Possible	High	May impact population numbers if there are high frequency of fires
		Impact on fauna	Moderate	Possible	Medium	
		Impact on local air quality	Minor	Possible	Medium	
		Impact on humans	Major	Possible	High	
<b>Closure, Decommissioning and Rehabilitation</b>						
Demolition, waste management and site earthworks	Dust	Impact on vegetation communities	Insignificant	Almost certain	Medium	
		Impact on DRF	Insignificant	Almost certain	Medium	
		Impact on Priority Species	Insignificant	Almost certain	Medium	
		Impact on Humans	Minor	Likely	Medium	
	Noise	Impacts on humans	Insignificant	Almost certain	Medium	
	Erosion and sedimentation	Impact on soil and water quality	Minor	Unlikely	Low	



Risk Identification			Risk Analysis		Risk Evaluation	Comments
Activity	Hazard/Risk	Impact	Consequence	Likelihood		
Transportation, spreading and ripping of topsoil	Dust	Impact on vegetation communities	Insignificant	Almost certain	Medium	
		Impact on DRF	Insignificant	Almost certain	Medium	
		Impact on Priority Species	Insignificant	Almost certain	Medium	
		Impact on Humans	Minor	Unlikely	Low	
	Noise	Impacts on humans	Insignificant	Unlikely	Low	
	Erosion and sedimentation	Impact on soil and water quality	Minor	Likely	Medium	
Revegetation	Inadequate vegetation regeneration	Impact on soil and water quality (from erosion and sedimentation)	Minor	Possible	Low	
		Reduction of visual amenity	Minor	Possible	Low	
		Change in biodiversity from surrounding environment	Moderate	Possible	Medium	
	Introduction of Weeds	Impact on vegetation communities	Insignificant	Possible	Low	Vegetation communities well represented in region
		Impact on DRF	Insignificant	Possible	Low	
		Impact on Priority Species	Insignificant	Possible	Low	
		Impact on fauna	Insignificant	Possible	Low	Modification of habitat

## 8.2. Fire Damage Assessment (Botanica 2020)



Mobile: 0419 916 034  
Email: [jim@botanicaconsulting.com.au](mailto:jim@botanicaconsulting.com.au)  
52 to 56 Oroya St, Boulder  
PO Box 2027 Boulder WA 6432  
ABN 47141175297

Colm Harkin  
Senior Environmental Advisor  
Western Areas Limited  
Forrestania Nickel Operations

14<sup>th</sup> July 2020

### Memorandum: *Eucalyptus steedmanii* Fire Damage Assessment-March 2020

Botanica Consulting (Botanica) were commissioned by Western Areas Limited (WSA) to assess the damage caused by recent bushfires (which occurred in February 2020) and construction of firebreaks to populations of the Threatened Flora taxon *Eucalyptus steedmanii*.

*Eucalyptus steedmanii* is listed as "Vulnerable" under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act). *Eucalyptus steedmanii* is best described as a mallet which grows up to 12 metres tall and is notable for the densely glandular and usually olive green leaves which have numerous round oil glands. The most distinguishing feature is the pendulous, double conic bud which is square in cross section. *Eucalyptus steedmanii* lacks a lignotuber so recovery from fire disturbance (including fire) is by seed (DAWE, 2018). This taxon is currently known from eight populations which occupy a total area of 383.2 ha (Table 1). Five of the eight populations occur near the Spotted Quoll mine site (Population 1, 2, 3, 7 and 8) as shown in Figure 1. Prior to the recent fire event, population census monitoring was conducted by Botanica in May 2019 in which the average percentage of sterile, immature and mature fruits for each population was recorded as summarized in Table 1.

Table 1: Population Census for *Eucalyptus steedmanii* (Botanica, 2019)

Population ID	Population area (ha)	Average sterile	Average immature fruits	Average mature fruits
Population 1	32.9	18.11%	0.66%	81.23%
Population 2	9.2	0.00%	0.00%	100.00%
Population 3	2.7	10.94%	3.13%	85.94%
Population 4	115.4	41.43%	5.56%	53.02%
Population 5	54.2	45.66%	1.35%	52.99%
Population 6	102.0	0.00%	0.00%	100.00%
Population 7	14.2	40.41%	0.00%	59.58%
Population 8*	52.5	0.00%	0.00%	100.00%
Total	383.2	N/A	N/A	N/A

\*Includes population 8a

In March 2020, Jim Williams from Botanica carried out an assessment of the recently burnt areas within or nearby to the *Eucalyptus steedmanii* populations, which included Population 3 and Population 8. The area was traversed on foot to visually assess the damage caused by both fire and firebreak construction. The extent of bushfire damage in relation to the populations was mapped using a held hand Garmin GPS device and photographic records were taken of both fire and firebreak construction damage.

The first area that was visited was Population 3 which is located directly south of the Spotted Quoll mine site (Figure 1). This population had not been affected by the bushfire but the fire had come close to population with fire damage observed for other common mallee species near the population (Plate 1). A firebreak has also been constructed near this population; however, no *Eucalyptus steedmanii* plants were damaged (Plate 1). The second area that was visited was Population 8 which is located approximately 1.5km north-east of the Spotted Quoll mine site (Figure 1). Population 8 had been affected by both bushfire and firebreak construction (Figure 2 and Plate 2). The extent of fire disturbance of each population is specified in Table 2. The area of fire and fire break construction disturbance represents a 7.9% impact on the population extent for Population 8 and 1.1% impact on the total known extent of *Eucalyptus steedmanii* populations.

**Table 2: Population extent and fire disturbance**

Population ID	Population area (ha)	Population area burnt (ha)	Population area cleared for firebreak (ha)	Percentage of population impacted (%)
Population 1	32.9	0	0	0
Population 2	9.2	0	0	0
Population 3	2.7	0	0	0
Population 4	115.4	0	0	0
Population 5	54.2	0	0	0
Population 6	102.0	0	0	0
Population 7	14.2	0	0	0
Population 8	52.5	3.6	0.6	7.9
<b>Total</b>	<b>383.2</b>	<b>3.6</b>	<b>0.6</b>	<b>1.1</b>

As specified in the Commonwealth "Approved conservation advice for *Eucalyptus steedmanii* (Steedmans Gum)" the main threat to *Eucalyptus steedmanii* is fire. Fire kills adult plants, but regeneration by seed has been observed following fire (Durell & Buehrig, 2001). In 1994 fire swept through the Forrestania region, affecting all known populations at the time however the populations regenerated with many trees now present in mallee form (DAWE, 2018). Prior to the bushfires in February 2020, there has been no record of fires impacting the populations since 1994. As shown in Table 1, all populations had mostly mature fruits, with Population 8 comprising only of mature seeds prior to the fire which indicates that the potential to regenerate from seed is possible. Given Population 8 comprised of mature fruits prior to the fire and only a small proportion of the population was impacted (as specified in Table 2) it is unlikely that the recent bushfires have resulted in a significant impact to *Eucalyptus steedmanii*.

Based on the findings of the assessment, the following recommendations are provided:

- Maps and spatial data of known occurrences of *Eucalyptus steedmanii* should be provided to local and state fire services to assist with ongoing fire management of *Eucalyptus steedmanii* populations (in accordance with DAWE Conservation Advice recommendations).
- Consultation with the DBCA Species and Communities Program regarding conducting rehabilitation work around *Eucalyptus steedmanii* populations.
- Proposed rehabilitation works to be conducted include light scarifying of firebreaks and levelling of windrows. Through conducting rehabilitation works in collaboration with DBCA, the works can potentially be conducted under the *Conservation and Land Management Act 1984* (CALM Act) and avoid the requirement for other approvals to conduct works within the Environmentally Sensitive Area encompassing *Eucalyptus steedmanii* population.
- Establish photographic monitoring points within burnt areas to assess regeneration of populations over time.

---

#### References

Botanica (2018), *Detailed Flora and Vegetation Survey and Targeted Flora Survey of the New Morning Project*. Botanica Consulting. Prepared for Western Areas Limited.

Botanica (2019), *Eucalyptus steedmanii population census monitoring report*. Botanica Consulting. Prepared for Western Areas Limited.

DAWE (2013), *Approved Conservation Advice for Muelleranthus crenulatus (a herb)*. Department of Agriculture, Water and Environment.

DAWE (2018), *Approved Conservation Advice for Eucalyptus steedmanii (Steedmans Gum)*. Department of Agriculture, Water and Environment.

Durell, GS & Buehrig, RM 2001, *Declared Rare and Poorly Known Flora in the Narrogin District*, Wildlife Management Program No. 30, Department of Conservation and Land Management, Western Australia.

WAHERB, (2020), *Florabase – Information on the Western Australian Flora*, Department of Biodiversity, Conservation and Attractions.

Available: <https://florabase.dpaw.wa.gov.au/>

Accessed 5<sup>th</sup> June 2020

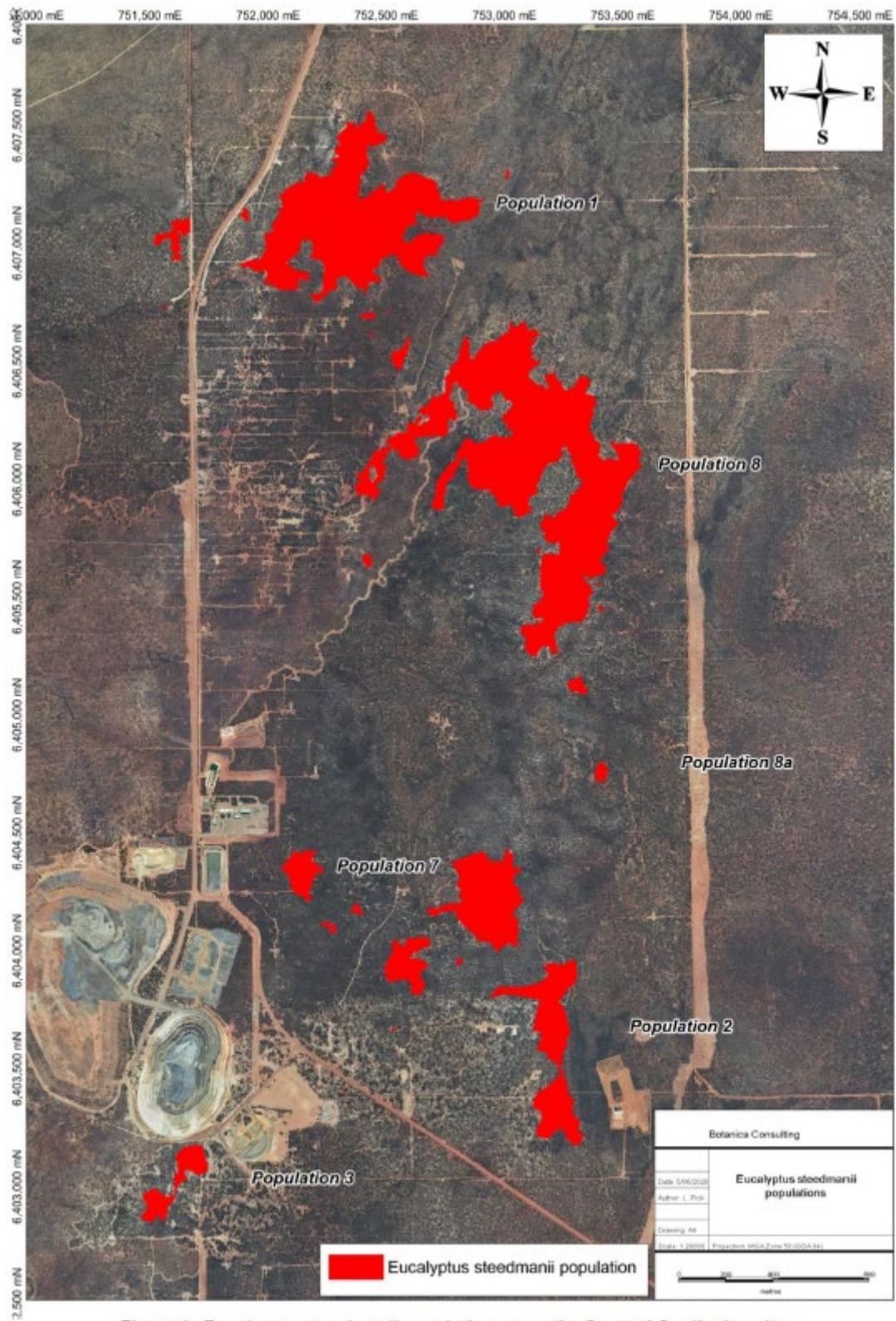


Figure 1: *Eucalyptus steedmanii* populations near the Spotted Quoll mine site

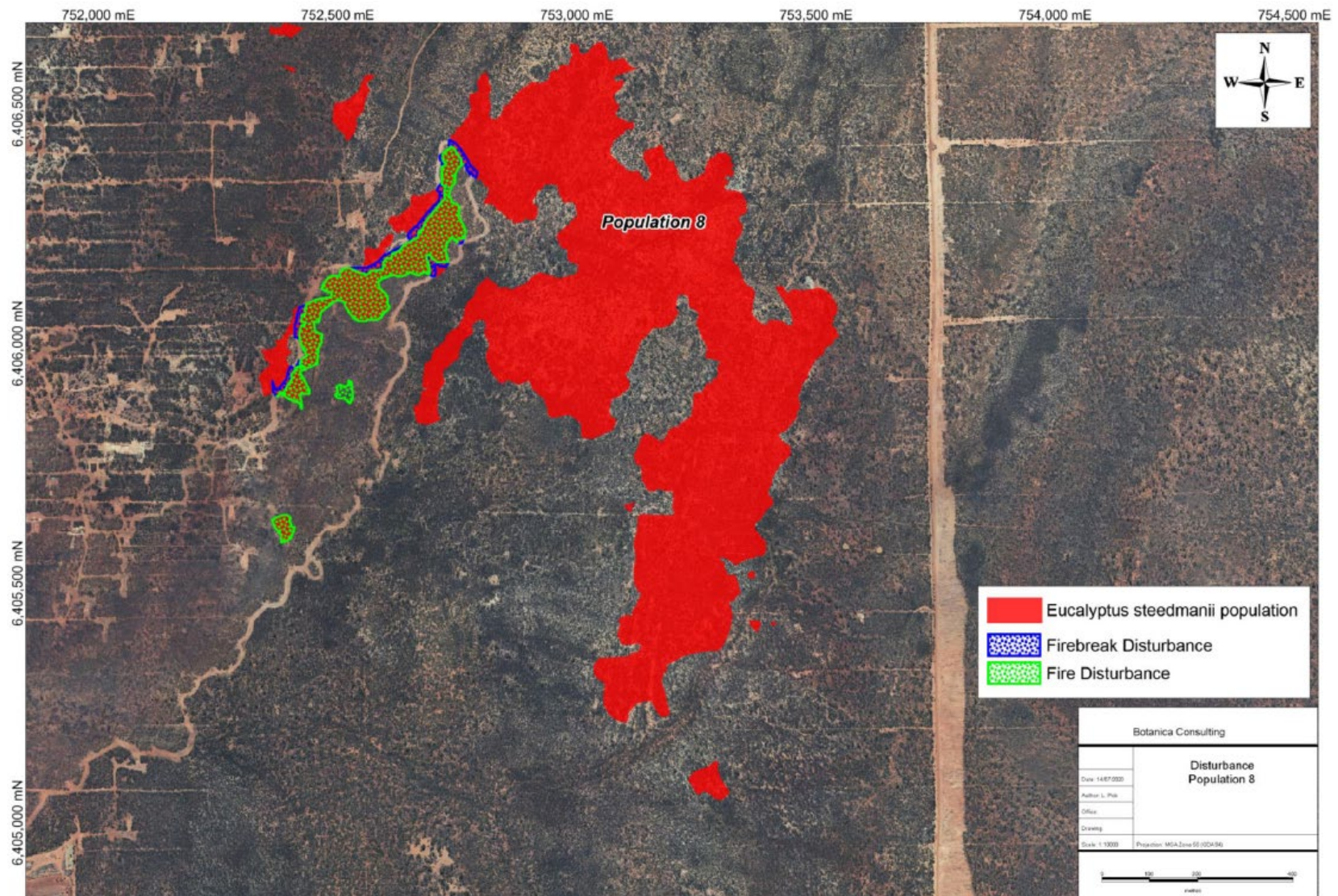


Figure 2: Fire and firebreak disturbance identified within Population 8



**Plate 1: Fire and firebreak damage evident near Population 3**



**Plate 2: Fire and firebreak damage evident at Population 8**

---

**8.3. Spotted Quoll Nickel Mine Ministerial Statement 808: Condition 6.4 Monitoring Report on health and abundance of the Declared Rare Flora *Eucalyptus steedmanii* populations**