

**WESTERN AREAS LTD**



# Spotted Quoll Nickel Mine Ministerial Statement 808: Condition 6.4 Monitoring Results

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**Reporting Period:** 01 July 2018 to 30 June 2019

**Prepared by:** Western Areas Limited

**Prepared for:** Office of the Environmental Protection Authority - Compliance Branch

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## 1. Introduction

In 2009, Western Areas Limited (WAL) engaged Coffey to produce a Management Plan (dated 10 June 2009) for Declared Rare Flora (DRF) species *Eucalyptus steedmanii* (*E. steedmanii*) to satisfy monitoring requirements as per Condition 6-3 of MS808. In 2014, WAL engaged Astron Environmental Services (AES) to revise and update the *E. steedmanii* management plan. AES provided a 'Steedman's Gum Conservation Management Plan for Operational and Closure Stages of the Spotted Quoll Mine' (dated April 2014). This plan was submitted to the Office of the EPA for review on 15<sup>th</sup> April 2014, which was formally accepted on the 20 May 2014. This report has been compiled to meet Condition 6-3 of Ministerial Statement 808 and report on the health and abundance of *E. steedmanii* as per the updated Management Plan dated April 2014.

## 2. Ministerial Statement 808: Condition 6

Ministerial statement 6 has been set to protect flora and vegetation (*E. steedmanii*) within the project area. There are six parts to MS808 Condition 6 which are detailed within Table 1. These conditions are audited annually by WAL and information provided within the audit table of the Compliance Assessment Report (CAR).

Table 1: Condition 6 of Ministerial Statement 808

Audit Code	Subject	Requirement
808:M6.1	Flora and Vegetation	The proponent shall not cause the loss of the Declared Rare Flora <i>Eucalyptus steedmanii</i> from the implementation of the proposal.
808:M6.2	Flora and Vegetation	Prior to ground disturbing activities, the proponent shall undertake baseline monitoring of the health and abundance of the Declared Rare Flora <i>Eucalyptus steedmanii</i> populations 2, 3a, 3b, 7 and population 1 (including individuals in close proximity to the haul road and the population fragment to the west of the haul road) identified in Figure 3, schedule 1
808:M6.3	Flora and Vegetation	The proponent shall monitor impacts on the health and abundance of the Declared Rare Flora <i>Eucalyptus steedmanii</i> populations and individuals as identified in condition 6-2, from activities undertaken in implementing the proposal. This monitoring shall be carried out to the satisfaction of the Chief Executive Officer of the Department of Environment and Conservation.
808:M6.4	Flora and Vegetation	The proponent shall submit annually the results of monitoring required by condition 6-3 to the Chief Executive Officer of the Department of Environment and Conservation.
808:M6.5	Flora and Vegetation	In the event that monitoring required by condition 6-3 indicates a decline in the health or abundance of Declared Rare Flora <i>Eucalyptus steedmanii</i> outside the areas to be cleared: <ul style="list-style-type: none"> <li>the proponent shall report such findings to the Chief Executive Officer of the Department of Environment and Conservation within 21 days of the decline being identified;</li> <li>provide evidence which allows determination of the cause of the decline;</li> <li>if determined by Chief Executive Officer of the Department of Environment and Conservation to be a result of activities undertaken in implementing the proposal, the proponent shall submit actions to be taken to remediate the decline to the Chief Executive Officer; and</li> </ul>

Audit Code	Subject	Requirement
		<ul style="list-style-type: none"> <li>the actions to remediate the decline of Declared Rare Flora shall be undertaken upon approval of the Chief Executive Officer of the Department of Environment and Conservation.</li> </ul>
808:M6.6	Flora and Vegetation	The proponent shall make the monitoring reports required by condition 6-5 publicly available in a manner approved by the Chief Executive Officer of the Department of Environment and Conservation.

### 3. Monitoring Requirements

Monitoring requirements dictated within the *E. steedmanii* Management Plan dated April 2014 are summarised in Table 2. Figure 1 shows a layout plan of the DRF monitoring associated with MS808.

Table 2: *Eucalyptus steedmanii* Revised Monitoring Requirements April 2014

Activity	Parameters	Populations	Frequency
Census	Plant density Plant condition rating Reproductive status	1 to 8 <sup>^</sup>	Quadrennial
<i>E. steedmanii</i> health monitoring (observation)	Visual observations and photographs	1, 3A/3B and plants identified by Botanica (2009)	Quarterly
<i>E. steedmanii</i> health monitoring (ratings)	Plant condition rating. Presence of seed. Seed development. Recruitment.	1, 2, 3A/3B and 7.	Quarterly
		4 and 5.	Annually
Dust deposition (gauges)	Weight per unit area per unit per area time	At-risk populations and control areas*	Quarterly
Dust deposition ( <i>E. steedmanii</i> )	Deposition rating	At-risk populations and control areas*	Quarterly
Fuel Load	Unspecified	Areas surrounding Spotted Quoll operations.	Annual
Miscellaneous potential threats	Unintentional clearing. Spillage of saline water. Fire and its management. Uncontrolled vehicle access.	Areas surrounding Spotted Quoll operations.	Concurrent with above monitoring activities and opportunistic surveillance at other times

\*At-risk populations with respect to dust deposition are those adjacent to the haul road and those to the south of the pit; therefore, Population 1, 3a and 3b. Dust gauges and *E. steedmanii* monitoring transects at population 2 and 7 are therefore assumed at present to be controls (that is, sites where no impact of dust from operations is expected).



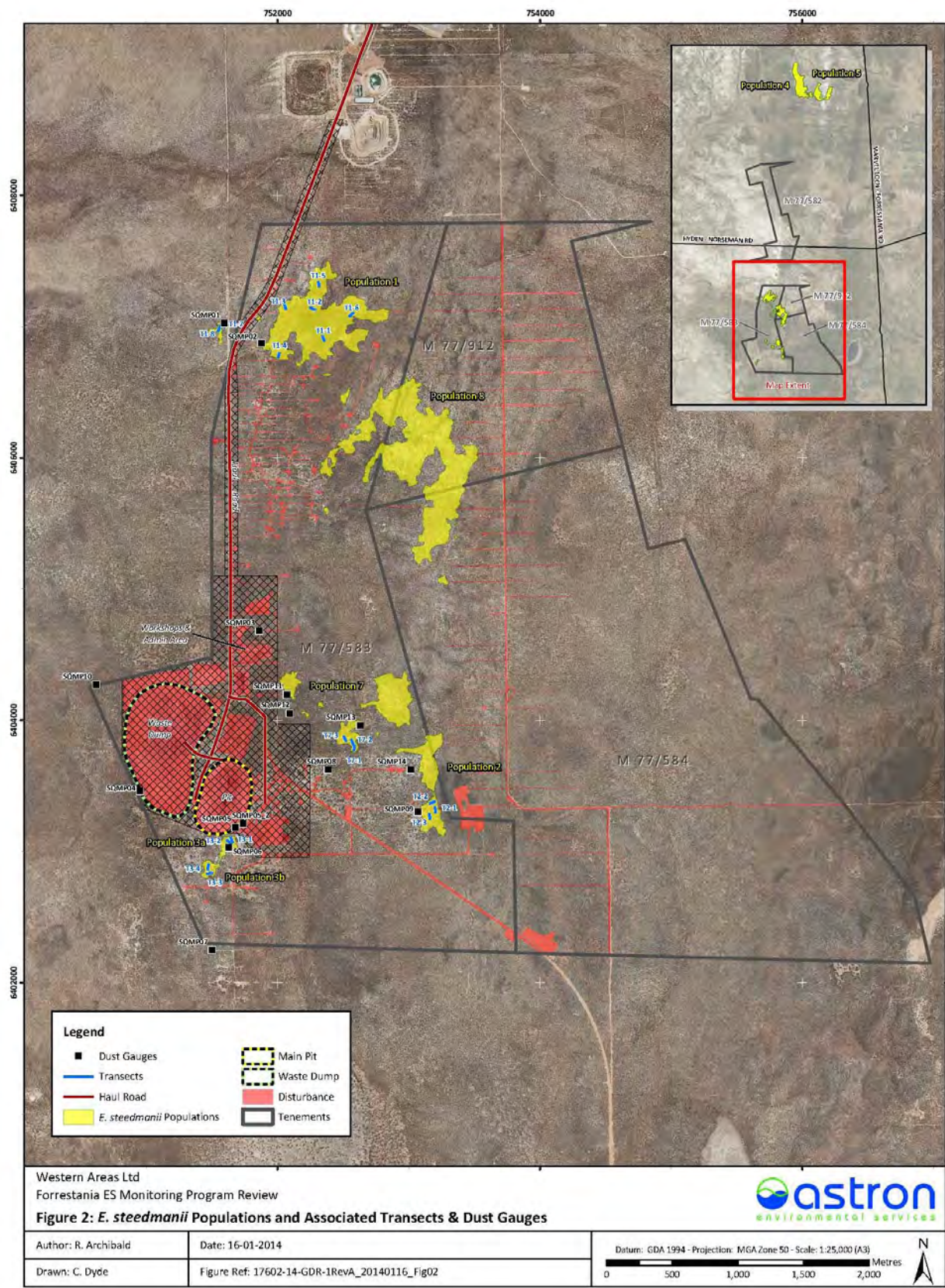


Figure 1: DRF Monitoring Layout Plan

## 4. Monitoring Results

### 4.1. Quadrennial Population Census

A quadrennial population census was undertaken by Botanica in January 2014 for all eight *E. steedmanii* populations. The next census was due to be completed in January 2018, however, this was postponed due to the discovery of Dieback occurrence (*Phytophthora boodjera*) within population seven, from monitoring undertaken during the 2017/18 reporting period; subsequently notified to the CEO of DWER on 26/07/17 as per Condition 6.4 of MS808. Further investigations have been undertaken, with the assistance of expert consultants, during the reporting 2018/19 reporting period.

Subsequent actions taken include the development of a Dieback Occurrence Map for the Spotted Quoll area, which was completed in the 2018-2019 reporting period. A Dieback Management Plan and a Dieback Hygiene Procedure for the FNO have also been developed as part of the WSA Environmental Management System (EMS), in order to manage the potential environmental risk and impacts from Dieback. With the completion of these EMS controls, the quadrennial census was undertaken by Botanica in May 2019.

With the exception of the Dieback impact at Population 7, the populations closer to the Spotted Quoll mine operation (Population 1, 2, 3 and 7), have shown no ascertainable difference in individual tree health assessments, percentage cover of *E. steedmanii*, or the overall population estimations in the 2019 monitoring period, when compared to the analogue population's (Populations 4, 5, 6 and 8). The most notable evidence of decline since the baseline monitoring was recorded for the analogue sites with Population 4 and 5 showing an increase in sterile plants and decrease in plant numbers since the baseline monitoring period.

### 4.2. Health Observations

Visual observations and photographs are taken at populations 1; 3A and 3B on a quarterly basis. Observations are made during population health monitoring of transects and notes made in any instance where population health appears to be declining outside of transects. Photographs are taken of each transect at the start and end.

Since monitoring began in 2009, photo monitoring of DRF transects has continued (Appendix 1) and the following observations have been made:

- Some tree branches have snapped and fallen or trees fallen over from natural causes.
- Some trees have native *Casputa* (dodder) – a parasitic plant throughout their canopies.
- One isolated tree showed signs of disease/ parasitic infestation in July 2015 the fruit were noted to be deformed and the tree was heavily infested with black ants.
- In July 2017, WAL staff noted a decline in tree health in populations 1, 2, 3 and 7 during quarterly monitoring.
- Notification to DWER was provided regrading Dieback occurrence in population 7 (2017/18).

### 4.3. Health Ratings

Quarterly monitoring of *E. steedmanii* health and reproductive status along transects in populations 1, 2, 3A/3B and 7, and annual monitoring of *E. steedmanii* health in Populations 4 and 5 was conducted during the annual reporting period.

Health for each *E. steedmanii* tree that intersects the transect was assessed using two scoring systems. The first is the same 0 to 3 system as used during the baseline period and the second is the modified version of the Grimes (1978) system based on a 0 to 17 point scale that takes into account canopy density, dead branches and epicormic growth as component scores (Table 3).

Table 3: Health Rating

Component	Health Score	Score Description
Crown Density	1	Very Sparse
	3	Sparse
	5	Average
	7	Dense
	9	Very Dense
Dead Branches	1	Most of Crown (Main & Small)
	2	Part of Crown (Main & Small)
	3	Part of Crown (Small Only)
	4	Part of Crown (Terminal Only)
	5	No Dead Branches
Crown Epicormic Growth	1.5	Severe
	2	Moderate
	2.5	Slight
	3	Nil

Reproductive status for each *E. steedmanii* that intersects the transects was recorded for presence or absence of fruit; and if present the stage of development (mature or immature) was recorded for each plant along with a rating of abundance based on Souter et al. (2009), Table 4.

Table 4: Reproductive Rating

Component	Health Score	Score Description
Fruit	0	Absent
	1	Scarce
	2	Common
	3	Abundant
Mature	0	Absent
	1	Scarce
	2	Common
	3	Abundant
Immature	0	Absent
	1	Scarce
	2	Common
	3	Abundant



Ratings for each tree in transects for each population were averaged to obtain an overall population health (Table 5) and reproduction score (Table 6) for the 2018/19 reporting period. Raw data has been provided in Appendix 2.

Table 5: Grimes Health Rating for *E. steedmanii* Populations

Date	Population 1	Population 2	Population 3	Population 4	Population 5	Population 7
Jul-18	12.8	11.9	12.3	-	-	9.1
Oct-18	12.9	11.9	12.7	3.69	5.96	9
Jan-19	12.9	11.3	13.0	-	-	9
Apr-19	12.8	11.3	12.9	-	-	9

Table 6: Reproductive (Fruit Abundance) Rating for *E. steedmanii* Populations

Date	Population 1	Population 2	Population 3	Population 4	Population 5	Population 7
Jul-18	1.6	1.4	1.9	-	-	1
Oct-18	1.6	1.7	1.9	0.35	0.39	1
Jan-19	1.6	1.8	1.8	-	-	1
Apr-19	1.6	1.8	2.0	-	-	1

### 4.3.1. Population 1

Since using the grimes rating method, the health of Population 1 has increased by ~1%. The reasons are due to consistent ratings in most health parameters over the 2018/19 reporting period. Mortality of trees along transects was also recorded by WAL and 7 of the 101 trees monitored for Population 1 have died since monitoring began.

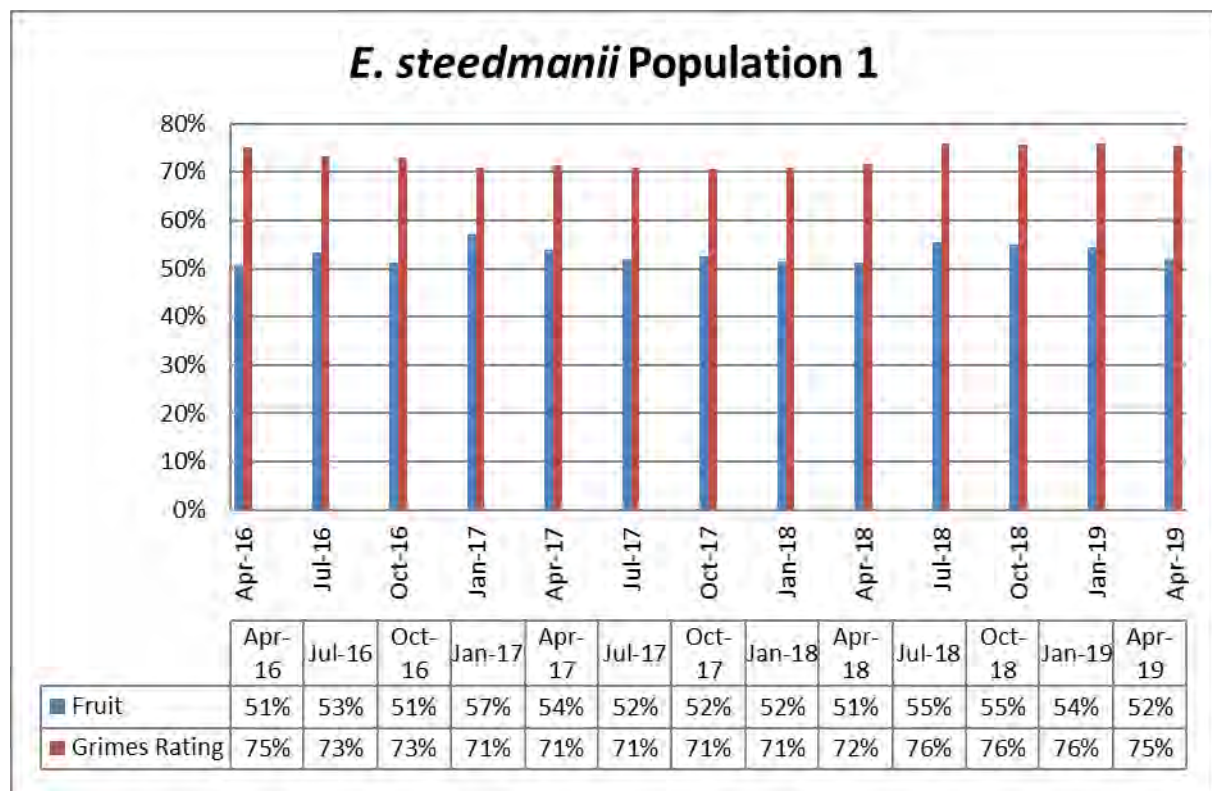




Figure 2: Health and Reproduction Graph (Population 1)

### 4.3.2. Population 2

Using the grimes rating method, Population 2 has shown a minor decrease of 2% compared to the previous reporting period with similar levels of crown density, dead branches and epicormic growth. However, there was increase of mature (7%) and immature fruit (30%) recorded over the same period. Dodder was present in 4 of the 35 monitored trees (11%) and a total of 4 trees (11%) have been recorded as dead since monitoring began. Population 2 is considered a control population for dust deposition monitoring for the Spotted Quoll project.

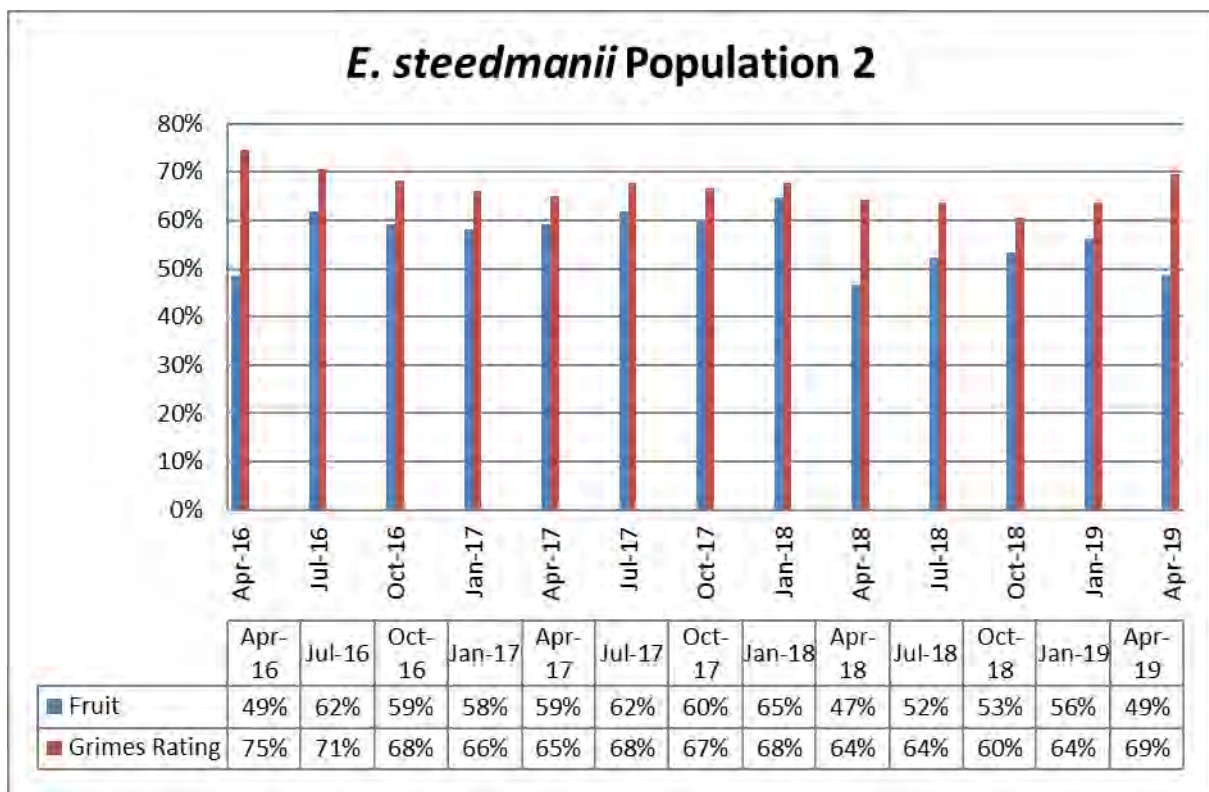


Figure 3: Health and Reproduction Graph (Population 2)

### 4.3.3. Population 3

Population 3 is situated just south of the Spotted Quoll open pit and is the closest population to mining operations. It is protected by a fence which WSA installed in 2010 to deter personnel entering the Environmentally Sensitive Area. The grime's health rating for Population 3 has remained relatively stable and increased by ~3% during the 2018/19 reporting period. This was due to a greater canopy density (4%) and less epicormic growth observed. Fruit abundance has increased by 2% (increasing from 64% to 66%).

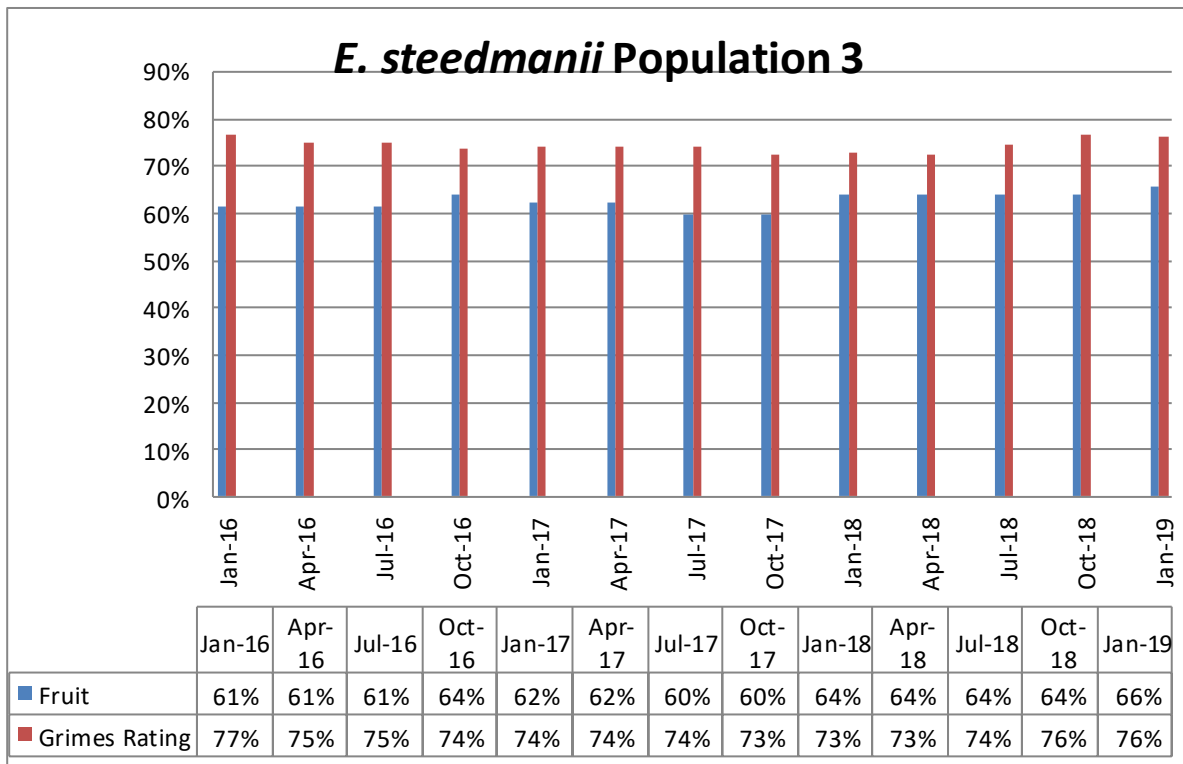


Figure 4: Health and Reproduction Graph (Population 3)

#### 4.3.4. Populations 4 and 5

Populations 4 and 5 are located approximately 16 km to the north-east of the project. Due to their location and distance from the Spotted Quoll mine, these populations are monitored annually.

Grimes rating health for Population 4 has decreased by ~3% since the previous reporting period. Mature fruit has increased slightly to 11% and little immature fruit was observed (1%). Dead trees observed increased by to 19 trees out of 131 along the transects (14%).

Grimes rating health for Population 5 has decreased by ~4%. Fruit abundance has increased within the year, with mature fruit increasing to 10% and immature to 7%. Additionally, dead trees recorded increased to 20 individual dead trees out of 135 along the transects (14%).

One of the challenges whilst monitoring trees within transects for Populations 4 and 5 was tree identification. A significant number of trees; 57% within Population 4 transects and 39% within Population 5 transects; could not be verified due to no tags being present (come loose or disintegrated). Hence the average grimes rating of 22% for Population 4 and 35% for Population 5 were lower than Populations 1, 2, 3 and 7.

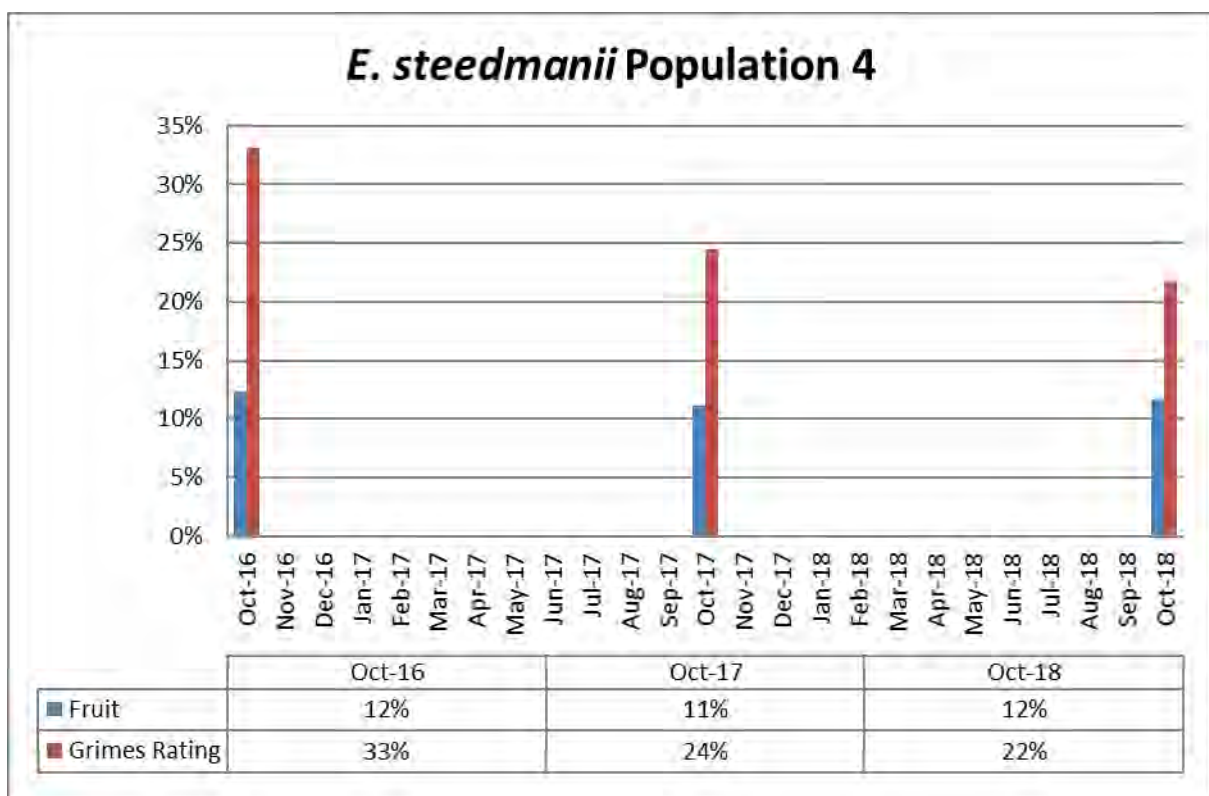


Figure 5: Health and Reproduction Graph (Population 4)

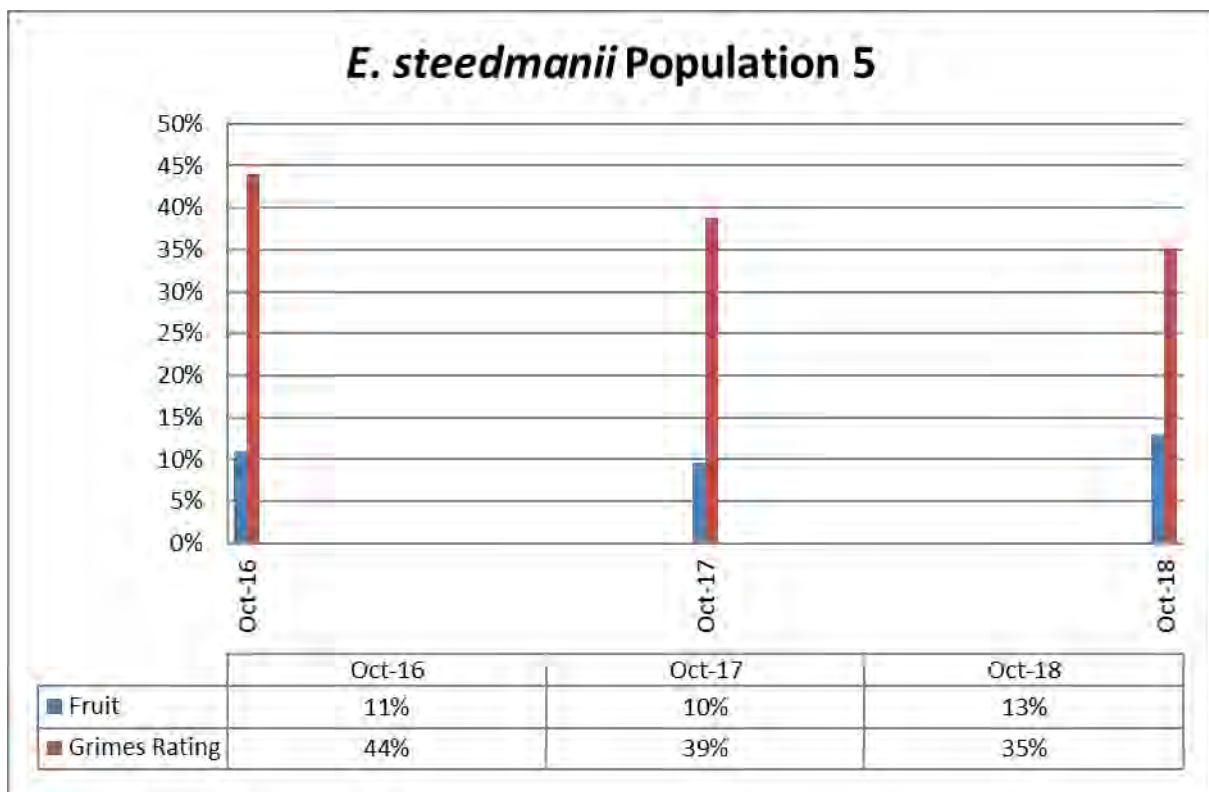


Figure 6: Health and Reproduction Graph (Population 5)

### 4.3.5. Population 7

Population 7 has decreased in health by ~25% since using the grimes rating method. The 2018/19 reporting period has shown a minor decline of 2%, from the previous reporting period. With the death of one additional tree being recorded from a total of 11 trees (28%). Fruit abundance has declined by 5%, with most fruit observed being rated as mature and few trees with immature fruit. Population 7 is considered a control population for dust deposition monitoring for the Spotted Quoll project.

Dieback (*Phytophthora boodjera*) was identified during the previous reporting period (as previously noted).

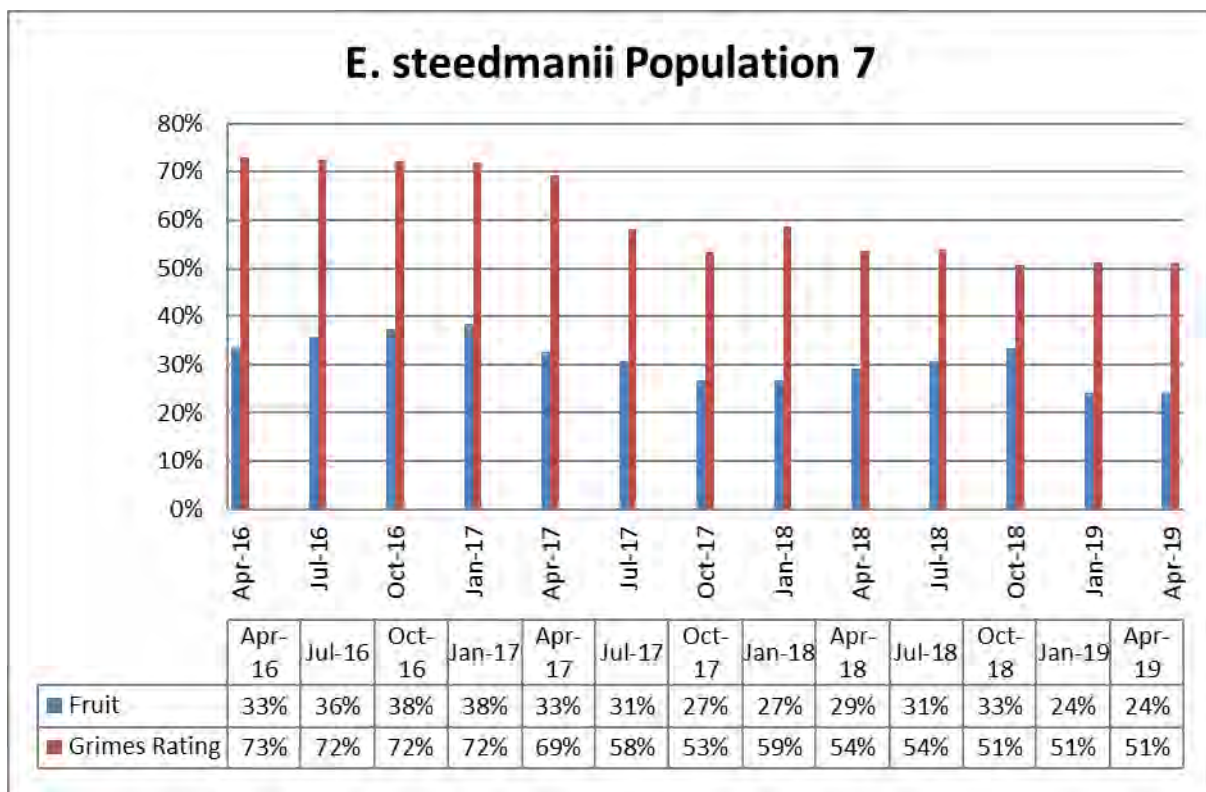


Figure 5: Health and Reproduction Graph (Population 7)

## 4.4. Dust Deposition Gauges

Dust deposition gauges have been installed within *E. steedmanii* populations 1, 2, 3 and 7 to monitor for dust deposition levels from mining operations that could potentially impact tree health. As per the commitments within the *E. steedmanii* Gum Conservation Management Plan (2014), monitoring was undertaken quarterly and samples analysed for total dust deposition (g/m<sup>2</sup>/month).

An acceptable limit for dust deposition has been set at three standard deviations of the mean for each monitoring point based on deposition records to date (values below three standard deviations but exceeding two standard deviations provide an alert to management). In the event that these



three standard deviation limits are exceeded, dust suppression measures will be reviewed and more stringent measures implemented as appropriate. In addition, monthly monitoring of dust deposition on plants will occur at the transects in the populations near the dust gauge where any exceedance is recorded, until dust deposition readings return to below three standard deviations from the mean. Dust deposition results have been presented in Table 7.

During the 2018/19 reporting period, standard deviation analysis has been refined to data selected from each seasonal quarter. This has allowed the physical vegetation health monitoring to occur during the middle of each dust deposition monitoring quarter. Analysis of seasonal dust monitoring data has shown exceedances of 2 and 3 standard deviations, however do these have not corresponded with any observed adverse health impacts noted from the transect monitoring. A further review of dust monitoring data from the previous ten years (2009-2019) indicates that dust deposition has not been a significant factor in regards to the health of the *E. steedmanii* populations at the FNO.

Table 7: Number of sampling point exceedances of management triggers (2 & 3 Std deviations) per season.

	Winter	Spring	Summer	Autumn
2 Std Dev	0	0	0	1
3 Std Dev	1	1	0	0

#### 4.5. Dust Deposition DRF

A 1 to 5 rating (Table 8) for the quantity of dust deposition on each *E. steedmanii* intersecting transects was recorded (Table 9) during quarterly monitoring. All trees within transects during the annual period had shown no visible dust on leaves when rubbed or shaken.

Table 8: Dust Deposition Rating Descriptors

Dust Dep Leaf Rating	Dust Dep Descriptor	Definition
1	Negligible	No dust obviously visible on plant Virtually no cloud of dust when plant is shaken No trace of dust when rubbing plant
2	Low	Thin layer of dust apparent on leaves / stems Dust may or may not come off when plant is shaken Only very small amount of dust can be rubbed off Amount of dust too little to be noticeable between fingers
3	Moderate	Plant obviously covered in dust but leaf colour plainly visible Dust falls off in a thin cloud when plant is shaken Dust can be rubbed off plant Grit/powder noticeable between fingers, smear thin when wet
4	High	Plant covered in dust, but leaf colour is faintly visible through dust layer Dust falls off in a cloud when plant is shaken Dust can be rubbed off plant Grit/powder noticeable between fingers, smear opaque when wet
5	Extreme	Dust is caking the plant thickly, leaf/stems take on colour of dust Dust falls off in a thick cloud when plant is shaken Dust can be rubbed off leaves or stems Dust feels powdery/gritty between fingers, smear clayey when wet

Table 9: *E. steedmanii* Dust Deposition Rating

Date	Population 1	Population 2	Population 3	Population 4	Population 5	Population 7
Jul-18	1	1	1	-	-	1
Oct-18	1	1	1	1	1	1
Jan-19	1	1	1	-	-	1
Apr-19	1	1	1	-	-	1

## 4.6. Fuel Loading

Annual fuel-loading assessments were undertaken in the areas surrounding the Spotted Quoll operations during the 2018/19 reporting period. Results are shown in Table 10 and Figure 6 below. WSA have consulted with DPaW and DFES, where required, to consider appropriate management options.

Fuel Load monitoring results are provided to the WSA Heath, Safety and Training Manager annually for the purpose of fire risk assessment, as per the FNO Bushfire Management Plan (Strategen, 2018).

Table 10: Spotted Quoll Fire Fuel Load Monitoring

Location			SQFL05	SQFL06	SQFL07	SQFL08
Date			12/09/2018	12/09/2018	12/09/2018	12/09/2018
Ground Litter	Fuel Moisture		Dry	Dry	Dry	Dry
	% litter cover in 2m Radius		50	50	30	40
	Mean litter depth in 2m radius (mm)		14	12.4	5.0	11
	Calculate d fuel tonnage t/ha		35	3.1	0.8	2.2
Scrub Fuels	0.0 - 0.5m	Fuel Moisture	B/line	B/line	B/line	B/line
		% Cover	15	10	20	5
	Calculate d fuel tonnage t/ha		0.8	0.5	1.0	0.3
	0.5-1.0m	Fuel Moisture	B/line	B/line	B/line	B/line
		% Cover	5	1	5	1
	Calculate d fuel tonnage t/ha		0.3	0.1	0.3	0.1
	1.0-1.5m	Fuel Moisture	B/line	B/line	B/line	B/line
		% Cover	1	1	1	1
	Calculate d fuel tonnage t/ha		0.1	0.1	0.1	0.1
	1.5-2.0m	Fuel Moisture	B/line	B/line	B/line	B/line
		% Cover	1	1	1	1
	Calculate d fuel tonnage t/ha		0.1	0.1	0.1	0.1
	>2.0m	Fuel Moisture	B/line	B/line	B/line	B/line
		% Cover	1	1	1	1
		Max Height	6.0	4.0	2.2	5.0
	Calculated fuel tonnage t/ha		0.1	0.1	0.1	0.1



Figure 6: Fuel Load Monitoring Point SQFL06

#### 4.7. Miscellaneous Potential Threats

Whilst undertaking routine monitoring; WAL aims to record the location and extent of any unintentional clearing, saline water spillage, fire or fire management activity or uncontrolled vehicle access where *E. steedmanii* that may be present within the Spotted Quoll tenements. Such incidences are also noted during general surveillance by WAL environmental personnel or via reports from other WAL staff. These records enable any impacts on *E. steedmanii* from these incidences to be investigated and assessed over time.

During the reporting period there were no incidences of unintentional clearing, saline water spillage, fire or fire management activity or uncontrolled vehicle access where *E. steedmanii* is present.

#### 5. Conclusion

The monitoring for *E. steedmanii* has continued as per the Management Plan with no evidence suggesting a decline in population health from identified potential threats (e.g. vegetation or unintentional clearing, mining activities, saline water use and spillage, and fire management) during the operation of the Spotted Quoll mine.

As reported previously, WAL environmental staff noted a decline in tree health within Population 7 during the 2017-2018 monitoring season, which was identified as a pathogenic infection of *Phytophthora boodjera*. Subsequent investigations have been undertaken, with the assistance of expert consultants, and this work has been used to produce a Dieback Occurrence Map of the Spotted Quoll area. A Dieback Management Plan and Dieback Hygiene Procedure for the FNO have

also been produced in order to manage any potential threat to *E. steedmanii* populations and other vegetation from Dieback.

An internal review of the *E. steedmanii* Management Plan has been undertaken during the reporting period. The aim of this review was to establish the relevance of current management provisions and monitoring outcomes. This review has determined that current dust monitoring practices do not provide value in determining health risk to *E. steedmanii* populations. The review of dust monitoring data from the previous ten years (2009-2019) indicates that dust deposition has not been a significant factor in regards to the health of the *E. steedmanii* populations at the FNO.

It is therefore proposed that dust monitoring should be withdrawn as an outcomes based management provision within future iterations of the *E. steedmanii* Management Plan. A revised Management Plan will be developed during 2019 and submitted to DWER (EPA Services) for review and approval).