Conservation Significant Fauna Monitoring 2015/2016 - North Star

Fortescue Metals Group

ecoscape

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- Todd Edwards for assisting with the field survey, data requirements and coordinating the monitoring event logistics.
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EXECUTIVE SUMMARY

FMG Iron Bridge Limited ('FMG Iron Bridge'), a subsidiary of Fortescue, is developing the North Star Stage 1 (Hematite) and Stage 2 (Magnetite) Project. To comply with project approvals, North Star project, monitoring must satisfy North Star's EPBC Listed Threatened Fauna Management Plan (NS-PL-EN- 0003_Rev0).

Monitoring was undertaken in accordance with methodologies outlined in the EPBC Listed Threatened Fauna Management Plan ('TFMP'), North Star Hematite Project (NS-PL-EN-0003). Fortescue's overarching *Conservation Significant Fauna Management Plan* (100-PL-EN-0022), Environmental Protection Authority's *Guidance Statement No. 56, Position Statement No 3* and *Technical Guide – Terrestrial Vertebrate Fauna surveys for Environmental Impact Assessment* were also considered in the monitoring design. Furthermore, species specific guidelines were consulted such as the Department of the Environment's *Referral Guide for Northern Quolls*, as well as *Survey Guidelines for Australia's Threatened Mammals and Reptiles*.

This report outlines the results of the second year of monitoring for Northern Quolls and the third year of monitoring for Pilbara Olive Pythons. Pilbara Leaf-nosed Bats were monitored throughout 2014 at two long-term monitoring sites (Bat Call WA), and this was continued during this years' monitoring period (4 December 2015 to 12 December 2015). However, this report only details the analysis of recordings covering a seven day period, as required to meet requirements of the TFMP. Results of the 2015/2016 monitoring for the two long-term sites will be reported on separately.

Monitoring was conducted during two separate seasons; the winter season with a trapping program for Northern Quolls (19-28 August 2015), and a subsequent radio collar retrieval event (26-29 September 2015), and the summer season with a Pilbara Olive Python and Pilbara Leaf-nosed bat monitoring (4-13 December 2015).

Northern Quoll

Monitoring sites and methodology were kept consistent with the previous year of monitoring. A total of eight monitoring sites (four impact and four control sites) were installed, each site consisting of 25 cage traps. A total of eight male and eight female Northern Quolls were recorded, of which nine individuals (four males, five females) were captured at four impact sites, and seven individuals (four males, three females) were recorded from three control sites. Three of the females captured during the current monitoring period were also trapped in 2014. The breeding season was well advanced with females showing developed pouches and in some cases pouch young. The male to female ratio was even during the current monitoring whereas the number of males outweighed the number of females during the baseline survey in 2011 and the first year monitoring in 2014. This indicates that breeding had taken place prior to the current monitoring with male die-off being well advanced. Northern Quolls were also recorded on motion cameras from five impact sites and two control sites. Statistical analysis of the trapping data indicated that no significant changes in population size and density have occurred since the 2014 monitoring. When compared to baseline survey data recorded in 2011, no significant changes in population size and density are identified.

GPS radio collar tracking was conducted on two individuals (one male, one female), in the vicinity of the mine pit (impact sites NQ I1) to investigate behaviour of Northern Quoll in response to the construction and operation of the project. Results indicated that the individuals were not impacted by mining development and operation, and GPS locations were recorded from within the mine pit and mine infrastructure (Ore processing facility, lay down areas and offices).

The monitoring program has shown that the Northern Quoll has not experienced a decline or changes in abundance at North Star to date. As Stage 1 of the North Star mine site is approaching completion, the project will potentially progress into the larger Magnetite Stage 2 which consists of additional ore bodies, and will be developed over several years. It is estimated that there will be a period where little to no development occurs on site, thus a period where potential impacts are minimal. During the period between Stage 1 and Stage 2, Northern Quoll monitoring should be reduced in intensity and frequency, and consist of only monitoring for the continued presence of this species within the impact areas of both the Stage 1 and Stage 2. The use of motion cameras is considered to be the most suitable method as units can be deployed for relatively long periods and the continued presence of this species can be determined whilst mining activities are minimal.

Pilbara Olive Python

Monitoring methodology was consistent with the two previous years of monitoring. Eight monitoring sites (four impact and four control sites) were searched for six nights. One additional site (POP I5) was established within the impact area during the monitoring event and searched. This supplementation site was added to the program due to the artificial creation of potential habitat by seepage from a tailings dam pooling in a previously dry drainage line. In addition, road transects of 40 km long were completed throughout the impact and control area. A total of three individuals were recorded from one impact sites (POP I4) and from two control sites (POP C2 and C4), during the wet season monitoring (December 2015). In addition, one male Pilbara Olive Python was recorded during the dry season monitoring (August 2015) from control site POP C3. This individual was previously recorded during the 2014 monitoring.

Site conditions were relatively dry, with surface water levels appearing lower at impact site POP I1 when compared to previous years of surveying and monitoring (2011, and wet seasons of 2013/2014 and 2014/2015). The Pilbara Olive Python has an ongoing presence at the North Star mine based on the current monitoring data. Statistical analysis shows that an estimated 75% of the four impact sites and 50% of the four control sites is occupied by the species.

The Pilbara Olive Python population associated with the North Star mine site is still not adequately understood and due to the slower reproductive rate of this species, changes in the population size and structure of this species will take longer to become apparent. Therefore, monitoring should continue during the inactive period using the current monitoring methodology to continue to build on the data already collected. Suitable alternative methods are not currently available; however, any future developments in monitoring methodologies should be considered.

Pilbara Leaf-nosed Bat

The Pilbara Leaf-nosed Bat was monitoring using a total of 24 SM2 bat recorder which were installed at three impact and three control sites over seven consecutive nights. Each site was 5 hectare in size, and comprised of four bat recorders. The species was recorded from all three impact sites and all three control sites, indicating that this species maintains a presence within the North Star mine site. The number of recorded calls was highest at the Fig Pool site (one of the two long-term monitoring sites), whereas recordings from the other long-term monitoring site (Cave 13) suggest that the site is used by a low number of individuals during the wet season. Comparable analysis with the baseline data indicates that numbers of calls are consistent between the baseline survey (2011) and the current monitoring, suggesting the species' abundance and utilisation of the North Star mine site has not undergone significant changes, satisfying TFMP. However, as this is the first year using the 24 short term monitoring subsites, direct population changes and statistical analysis cannot be detected at this time.

Analysis of the 2015/16 data from long-term (continuous) monitoring at Cave 13 and Fig Pool is still ongoing and will be reported separately at the end of the financial year.

Pilbara Leaf-nosed Bat monitoring should also continue using the current monitoring methodology. Confirming the extent of this population prior to the development of Stage 2 will assist with future monitoring programs associated with Stage 2.

The continuation of monitoring during the inactive period should also be reassessed after each monitoring event to ensure that monitoring activities are consistent with the ongoing level of activity on site.

Rehabilitation Areas

To address the effectiveness of management measured implemented on site, monitoring of rehabilitation areas has been undertaken as required under the TFMP. For this purpose, six motion cameras were installed at three rehabilitation areas to monitor the usage of the areas by Northern Quoll. No conservation significant fauna were recorded from rehabilitation sites in the current monitoring period. However, the progress of the rehabilitation and revegetation was early with no vegetation present within the sites at the time of monitoring.

1 INTRODUCTION

1.1 BACKGROUND

FMG Iron Bridge Limited ('FMG Iron Bridge'), a subsidiary of Fortescue, is developing the North Star Stage 1 (Hematite) and Stage 2 (Magnetite). To comply with project approvals, monitoring must satisfy North Star's EPBC Listed Threatened Fauna Management Plan (NS-PL-EN- 0003_Rev0).

Due to changes in the reporting timeframes of the monitoring from a financial year period to a calendar year period to meet compliance reporting requirements, this report outlines the results of the second year of monitoring for Northern Quolls and the third year of monitoring for Pilbara Olive Pythons. Pilbara Leaf-nosed Bats were monitored throughout 2014 (Bat Call WA) which was continued during this years' monitoring, although additional methods were used.

1.2 PREVIOUS MONITORING AND SURVEYS

A baseline Level 2 terrestrial fauna assessment of the North Star mine site was completed in March and October 2011 (ecologia 2011c) and recorded the presence of Northern Quoll, Pilbara Olive Python and Pilbara Leaf-nosed Bat at the North Star mine site. Additional targeted conservation significant fauna surveys were conducted to better understand the populations of each species present in the North Star mine site and surrounding region (ecologia 2011c).

All previous survey and monitoring events to date at North Star are listed in **Table 1**. Two years of monitoring have been conducted for Pilbara Olive Python (wet season of 2013/2014 and 2014/2015), and one year of monitoring for Northern Quoll (2014). Pilbara Leaf-nosed Bats have been monitored at two potential roost caves, continuously since March 2014 (Bat Call WA 2013; Bat Call WA 2015).

Timing of the monitoring report this year has altered from a financial year timeframe to a calendar year timeframe to meet compliance reporting requirements, and as such the monitoring that has been completed to date is uneven.

Table 1: Summary of previous surveys and monitoring events

Surveys	Dates	Survey types
ecologia (2011a) Baseline survey Phase 1	29 Mar – 9 Apr 2011 (Phase 1) 25 Oct – 5 Nov 2011 (Phase 2)	Two phase Level 2 survey
ecologia (2011a) Baseline survey Additional Area Phase 1	10 – 21 Oct 2011	Single phase Level 2 survey
ecologia (2011b) Targeted survey North Star and Additional Area	7 – 15 Jul 2011 (North Star) 22 – 30 Jul 2011 (Additional Area)	Targeted survey (Northern Quoll, Pilbara Olive Python and Pilbara Leaf-nosed Bat)
Bat Call WA (2013)	7-13 Apr 2013	Bat Cave assessment
ecologia (2014) Monitoring	5 – 11 Apr 2014 (summer) 23 – 31 Aug 2014 (winter)	Monitoring program (first year)
Bat Call WA	March 2014 – March 2015	Bat monitoring (first year)
Ecoscape (2015) Pilbara Olive Python Monitoring	19-25 Feb 2015 (summer)	Pilbara Olive Python Monitoring program (second year)

1.3 OBJECTIVES

The objective of the fauna monitoring at the North Star mine site is to measure the potential impact of construction and operation over the life of the project and measuring the success of management practices in protecting the EPBC listed threatened fauna species.

The monitoring program aims to:

- Measure the impacts of the project over time by undertaking ongoing annual monitoring of EPBC Act listed threatened fauna species: Northern Quoll, Pilbara Leaf-nosed Bat and Pilbara Olive Python; and
- Measure the success of management practices to inform an adaptive management approach that may be implemented during construction and operation of the mine.

The two main potential impacts to threatened fauna from the project are:

- Direct mortality or injury to fauna through construction and operation of the project; and
- Loss or alteration of fauna habitat.

Three EPBC listed threatened fauna species have been identified in the North Star fauna management plan as likely to occur within the North Star mine site, based on baseline assessments of the mine site (ecologia 2011a). Following, two hypothesis are to be addressed as stated in the North Star fauna management plan:

- Hypothesis 1: There will be no long-term statistically significant decline in relative abundance of Northern Quoll across impact sites compared to control sites.
- Hypothesis 2: EPBC listed fauna species previously recorded within the area of impact will continue to have an ongoing presence.

To address the above hypothesis the relative abundance of populations needed to be determined by utilising the following survey techniques (as per North Star fauna management plan):

- Northern Quoll:
  - Mark-recapture and radio-tracking and/or
  - Non-invasive techniques such as observations of burrows, diggings, scats, hair traps and motion sensors
- Pilbara Olive Python and Pilbara Leaf-nosed Bat:
  - Other monitoring techniques such as observation of bat calls, scats, burrow and motion cameras

2 METHODS

Monitoring was undertaken in accordance with methodologies outlined in the *EPBC Listed Threatened Fauna Management Plan, Nor Star Hematite Project* (NS-PL-EN-0003) (Fortescue 2012).

Fortescue's overarching *Conservation Significant Fauna Management Plan* (100-PL-EN-0022) (Fortescue 2014), EPA's Guidance Statement No. 56 (EPA 2004), Position Statement No 3 (EPA 2002) and Technical Guide – Terrestrial Vertebrate Fauna surveys for Environmental Impact Assessment (EPA and DEC 2010) were also consulted to design monitoring design. Furthermore, species specific guidelines were consulted such as the *Referral Guide for Northern Quolls* (DSEWPaC 2011b), as well as *Survey Guidelines for Australia's Threatened Mammals and Reptiles* (DSEWPaC 2011c; DSEWPaC 2011d).

2.1 MONITORING SITES

Northern Quoll and Pilbara Olive Python monitoring sites established during the 2014 monitoring event (ecologia 2014; Ecoscape 2015b), were monitored during this monitoring event. The sites are located within suitable Northern Quoll and Pilbara Olive Python habitat as mapped in TFMP, and in close proximity to previous records. All monitoring sites were kept consistent with the exception of some traps at site NQ C4 and NQ I3, which were relocated within the monitoring site area, due to safety related hazards (i.e. feral bee hives and proximity to cliff faces). However, general site locations and habitats sampled were consistent to previous years of monitoring, as such no impacts on results were expected.

Monitoring techniques for Pilbara Leaf-nosed Bats was based on above (DSEWPaC 2011c; DSEWPaC 2011d) guideline documentation, fauna management plans and incorporated methodologies used during the 2014/2015 monitoring event (ecologia 2014). Pilbara Leaf-nosed Bat monitoring effort was increased during this year's monitoring to comply with the TFMP. Monitoring sites were located where previous records of the Pilbara Leaf-nosed bat had been made during the baseline assessments.

All Northern Quolls and Pilbara Olive Pythons encountered or trapped were microchipped for individual identification, weighted and measured. Tissue samples were taken by either ear notch (Northern Quoll) or scale clip (Pilbara Olive Python) and submitted to the WA Museum (WAMTS409).

2.2 NORTHERN QUOLL

2.2.1 MONITORING SITES

The locations of monitoring trap sites were kept consistent with the 2014 monitoring. Four impact sites and four control sites, each consisting of 25 traps, where set-up and left open for seven consecutive nights. A number of sites from the baseline survey in 2011 were in close proximity or overlapping with the monitoring sites (two impact sites, four control sites) utilised for the monitoring program (2104 and 2015). Data from these sites has been utilised for statistical analysis and long-term comparison. However, due to the different number of traps per site during the baseline survey (8-16 traps per site in 2011, 25 traps per site during monitoring), the result from the statistical analysis should be treated with caution. The location and details of each monitoring site and correlating baseline survey site are listed in **Table 2** and displayed in **Map 1**. Site descriptions are provided in **Appendix 1**.

Table 2: Northern Quoll monitoring sites

Site	Coordinates		Baseline survey Dates 2011	Previous Monitoring Dates 2014	Dates 2015
	Easting	Northing			
Impact sites					
Impact site 1 (NQ I1)	712230	7650449	7-14/07/11	24-31/08/14	21-28/08/15
Impact site 2 (NQ I2)	712928	7648666	7-14/07/11	24-31/08/14	20-27/08/15
Impact site 3 (NQ I3)	713238	7647910	-*	24-31/08/14	19-26/08/15
Impact site 4 (NQ I4)	715886	7649262	-*	24-31/08/14	20-27/08/15
Control sites					
Control site 1 (NQ C1)	713087	7646363	8-15/07/11	23-30/08/14	20-27/08/15
Control site 2 (NQ C2)	713098	7644804	8-15/07/11	23-30/08/14	20-27/08/15
Control site 3 (NQ C3)	713514	7656960	22-29/07/11	23-30/08/14	21-28/08/15
Control site 4 (NQ C4)	717917	7655642	22-29/07/11	23-30/08/14	20-27/08/15

Datum: GDA94, Zone 50K

*No site was set up in this location in 2011

2.2.2 MOTION CAMERAS

A total of 18 long-term motion cameras were installed for 48 days. Of the 18 motion cameras, nine were installed within the impact area, the remaining nine cameras were set-up in the control areas. This set-up was consistent between the 2014 and 2015 monitoring events. The aim of camera trapping over an extended period of time is to monitor habitat use, behaviour, area occupation and movement pattern. This will assist in determining if Northern Quolls are impacted by the operation of the North Star mine. Locations and other details are listed in **Table 3** and displayed in **Map 1.**

Table 3: Motion Camera sites

Site	Coordinates		Baseline survey Dates 2011	Dates 2014	Dates 2015
	Easting	Northing			
Impact sites					
MC I1	711442	7653629		29/08-15/10/14	25/08-11/10/15
MC I2	713164	7648148	29/03/11	29/08-15/10/14	25/08-12/10/15
MC I3	716114	7648059		29/08-15/10/14	26/08-10/10/15
MC I4	712243	7648686	8-13/07/11	29/08-15/10/14	25/08-11/10/15
MC I5	710081	7654709	-	29/08-15/10/14	25/08-11/10/15
MC I6	711680	7650946	-	27/08-15/10/14	25/08-11/10/15
MC I7	711695	7650618	-	27/08-15/10/14	26/08-11/10/15
MC I8	713806	7651410	-	29/08-15/10/14	27/08-11/10/15
MC I9	713230	7647232	-	29/08-15/10/14	27/08-12/10/15
Control sites					
MC C1	710162	7656606	25-28/07/11	29/08-15/10/14	25/08-11/10/15
MC C2	714688	7655548	-	29/08-15/10/14	24/08-10/10/15
MC C3	713314	7657098	-	29/08-15/10/14	25/08-11/10/15
MC C4	717005	7654105	-	29/08-15/10/14	24/08-10/10/15
MC C5	718296	7655613	-	29/08-15/10/14	24/08-10/10/15
MC C6	715887	7654732	24-28/07/11	29/08-15/10/14	24/08-10/10/15
MC C7	713280	7643833	9-12/07/11	27/08-15/10/14	25/08-12/10/15
MC C8	713237	7645594	10-13/07/11	29/08-15/10/14	25/08-12/10/15
MC C9	713451	7643392	10-13/07/11	29/08-15/10/14	26/08-12/10/15

Datum: GDA94, Zone 50K

2.2.3 RADIO TRACKING

To investigate impacts of construction and operation of the North Star mine site on Northern Quoll, radio tracking of individual Northern Quolls was implemented.

A total of four Sirtracks Pinpoint 50 GPS were purchased for the monitoring program. These collars were selected based on discussions with suppliers and DPaW (Judy Dunlop, Northern Quoll specialist at DPaW). Criteria such as weight of the collar, memory and battery life were critical.

Details such as weights and size of Northern Quoll individuals captured at monitoring sites were reviewed and suitable individuals (above 400g and with suitable neck circumference) were fitted with the GPS radio collars.

One male and two female Northern Quolls had collars fitted. The timing of the radio tracking was in the post-breeding season (August/September) to ensure that breeding success and pouch young are not impacted. Collars consisted of a VHF transmitter, which is used to locate the animal for retrieval of the collar, and a GPS unit that records accurate location data. The collars were programmed to record a GPS location three times per night (10.00 pm, 2.00 am and 4.30 am). If no satellite reception was received due to the animal hiding inside the den or caves then no GPS location was recorded. The collars were set up to record from the first night of release of the animal until the memory was filled up.

To remove collars, a separate field event was undertaken approximately four weeks after fitting the collars to the Northern Quolls. Animals were located via VHF signal (hand held VHF receiver) and tracked on foot. When the animal was located, cage traps were set-up and baited with universal bait (Peanut butter, rolled oats, sardines) as per relevant guidelines (DSEWPaC 2011b; Fortescue 2011). All collars were successful removed, and animals released with no harm.

2.2.3.1 Home Range Mapping

The radio tracking data was analysed and used for Kernel density mapping, a function in ArcGIS Spatial Analysis, to show areas that were occupied on a more regular basis by one individual (Hart & Dorcas 2016; Katajisto & Moilanen 2006; Wauters *et al.* 2007). Percentage volume contours (PVC) were mapped with the areas where individuals were likely to occur 50% of the time indicating the core home range, and the area used 95% of the time indicating the total home range (Pace 2001). The resulting home ranges are only valid for the period where the observations were made and may change outside of the monitoring period. ArcGIS Spatial Analyst software was used to determine the home ranges of the tracked individuals.

2.2.4 TIMING

The trapping program for the Northern Quoll was conducted in winter from 19 to 28 August 2015, to align with the recommended season for Northern Quoll surveying as per Northern Quoll referral guideline (DSEWPaC 2011b).

A subsequent GPS collar retrieval field event was undertaken from 26 to 29 September 2015 (four weeks after radio collars were attached), to retrieve radio collars and data.

Long-term motion cameras were collected by site personnel from the 10 to 12 October 2015, to ensure a consistent duration of cameras set-up (of approximately 48 days).

2.2.5 POPULATION CHANGES

To determine change in population size, population density and capture probability, statistical analyses were completed for the Northern Quoll trapping data using the program DENSITY 5.0 (Efford *et al.* 2009; Efford 2011; Efford & Fewster 2013). For Northern Quoll densities and population size, all trapping data were used. Estimates were based on mark-recapture data collected using an array of 'detectors'. Animals were captured in cage traps and uniquely marked with Passive Integrated Transponder (PIT) tags to ensure re-capture data was taken correctly The following calculations were determined for each site with sufficient data:

- Estimate population size including standard error (SE) and confidence interval (CI);
- Overall capture probability (defined as the probability of capturing an individual which is present at least once during the trapping period); and
- Density (Maximum Likelihood (ML)) of animals present per hectare.

Population size and density analysis using the program DENSITY can only be completed on monitoring sites where re-capture data is available (e.g. at least one individual has been captured and recaptured during the same trapping period).

Estimators were calculated for each site in the impact and control area. These were combined and an average for each estimator was given. In addition, overall estimators were determined using the combined data in one data set. Overall estimators for impact or control area may not represent true values as the monitoring sites were spread throughout the mine site, leaving areas without trapping effort. In addition, the analysis for the 2011 survey are based on the trapping sites utilised for the targeted survey which were set-up in different locations to the current monitoring program (2014 and 2015) and also comprised of a lower number of traps (8-16 cages each trap site).

Statistical analysis was utilised to demonstrate changes in the presence and population density within impact and control sites. This assisted in addressing the objectives of the fauna management plan which focused on whether the species' population is continuing to have an ongoing presence at North Star mine site.

2.3 PILBARA OLIVE PYTHON

2.3.1 MONITORING SITES

The location of monitoring sites for Pilbara Olive Pythons was kept consistent with the 2015 monitoring. Four impact and four control sites were set-up and monitored each night for one person hour over six consecutive nights. One additional opportunistic site was established in the vicinity of the mine infrastructure (Ore Processing Facility), where habitat for Pilbara Olive Python was identified. The locations and details of each site is listed in **Table 4** and displayed in **Map 2**.

Table 4: Pilbara Olive Python monitoring sites

Site	Coordinates		Monitoring Dates 2014	Monitoring Dates 2015	Monitoring Dates 2015/2016
	Easting	Northing			
Impact Area					
POP I1	716035	7649291	5-11/04/14	19-25/02/15	6-12/12/15
POP I2	713315	7647875	5-11/04/14	19-25/02/15	6-12/12/15
POP I3	711670	7650610	5-11/04/14	19-25/02/15	6-12/12/15
POP I4	711133	7648580	5-11/04/14	19-25/02/15	6-12/12/15
POP I5	713900	7650037	-	-	9/12/15
Control Area					
POP C1	712586	7655834	5-11/04/14	19-25/02/15	6-12/12/15
POP C2	714541	7655513	5-11/04/14	19-25/02/15	6-12/12/15
POP C3[#]	713209	7657188	5-11/04/14	19-25/02/15	6-12/12/15
POP C4	718288	7655586	5-11/04/14	19-25/02/15	6-12/12/15

Datum: GDA94, Zone 50K

2.3.2 TIMING

As per guidelines and fauna management plan, the Pilbara Olive Python monitoring was conducted during recommended monitoring season (summer), when reptile activity is highest and conditions are optimal (DSEWPaC 2011d; Fortescue 2014; 2011; 2012). The field monitoring was completed from 7 to 13 December 2015.

Records of this species were also collected opportunistically during the winter field monitoring event (Northern Quoll trapping, 19 to 28 August 2015), as some monitoring sites are located at the same sites; however, the species is usually not active, and monitoring is not efficient during the cooler months.

2.3.3 POPULATION CHANGES

The program MARK was used to determine two statistical values for the Pilbara Olive Python, the probability of occupancy and the probability of detection.

The dataset consisted of the search nights per site for each monitoring event (2014, 2015 and current) and was separated into control and impact sites to determine differences between the two areas and potential changes over the life of the monitoring. The following parameters were determined for the impact sites and control sites per monitoring event:

- Occupancy (ψA - probability that the area is occupied by the species), and
- Detection (pi - probability of detecting species in survey i, given presence).

To estimate the p value, the strongest model was used for each parameter. This process, which incorporates model uncertainty into the estimates of p, involved estimating Akaike weights (AICs) for each model in the program MARK. These weights represent the likelihood that a given model was the best model to explain this particular data set, relative to the remaining models in the set of models examined.

In addition to parameters estimated by the program MARK, the naïve estimator (NED) was determined based on the observed detections (number of sites that detected each species/number of sites sampled). This value can give an indication of occupancy of the species if the value for occupancy (ψA) as determined by MARK appears inaccurate or invalid due to insufficient data

2.4 PILBARA LEAF-NOSED BATS

2.4.1 MONITORING SITES

Six monitoring sites for Pilbara Leaf-nose Bats (three impact sites and three control sites) were selected based on the results of previous monitoring (Bat Call WA 2013; 2015) and baseline fauna surveys (ecologia 2011a; ecologia 2011b).

Two of the sites are long-term monitoring sites (Cave 13 and Fig Pool) because they have been identified locations of high Pilbara Leaf-nosed Bat activity.

Each site was monitored for seven consecutive nights using four SM2 Bat recorders resulting in 168 nights of recording from 24 subsites. The recorders were placed across each 50 hectare site with each subsite placed in suitable foraging habitat and along potential flyways to allow detection of bat movement across the landscape (**Figure 1** - **Figure 6**).

All site details and locations are presented in **Table 5** and **Map 3**.

All recordings were analysed using the SongScope (Version 4.1.3A Wildlife Acoustics Inc.) software package which utilises previously developed recognisers to automatically scan each recording and identify all matching calls. The time of each call and the number of pulses within each call was then recorded for further analysis.

Table 5: Pilbara Leaf-nosed Bat monitoring sites

Site	Subsite	Coordinates		Dates 2011	Dates 2013	Dates 2014/2015	Dates 2015
		Easting	Northing				
Impact Area							
PLNB I1 (Cave 13)	I1.1	713368	7647895	12/07/11	7-13/04/13	Ongoing – long-term monitoring	04-11/12/15
	I1.2	712712	7647973			-	
	I1.3	713559	7648164				
	I1.4	713052	7648438				
PLNB I2 (Fig Pool)	I2.1	711675	7650626	-		Ongoing – long-term monitoring	04-11/12/15
	I2.2	711983	7650710			-	
	I2.3	711043	7650797				
	I2.4	711088	7651472				
PLNB I3 (Cave 14)	I3.1	713217	7647232	13/07/11		-	05-12/12/15
	I3.2	713294	7647556				
	I3.3	712936	7647561				
	I3.4	712912	7647249				
Control Area							
PLNB C1 (Cave 4)	C1.1	704341	7646345	13/07/11		-	05-12/12/15
	C1.2	704826	7646031				
	C1.3	705206	7645687				
	C1.4	704268	7646864				
PLNB C2 (Cave 11)	C2.1	713257	7645215	10/07/11		-	05-12/12/15
	C2.2	713067	7644923				
	C2.3	713259	7645466				
	C2.4	713170	7644974				
PLNB C3 (Cave 2)	C3.1	713341	7643864	08/07/11		-	05-12/12/15
	C3.2	713414	7643416				
	C3.3	712633	7643451				
	C3.4	712692	7643829				

Datum: GDA94, Zone 50K

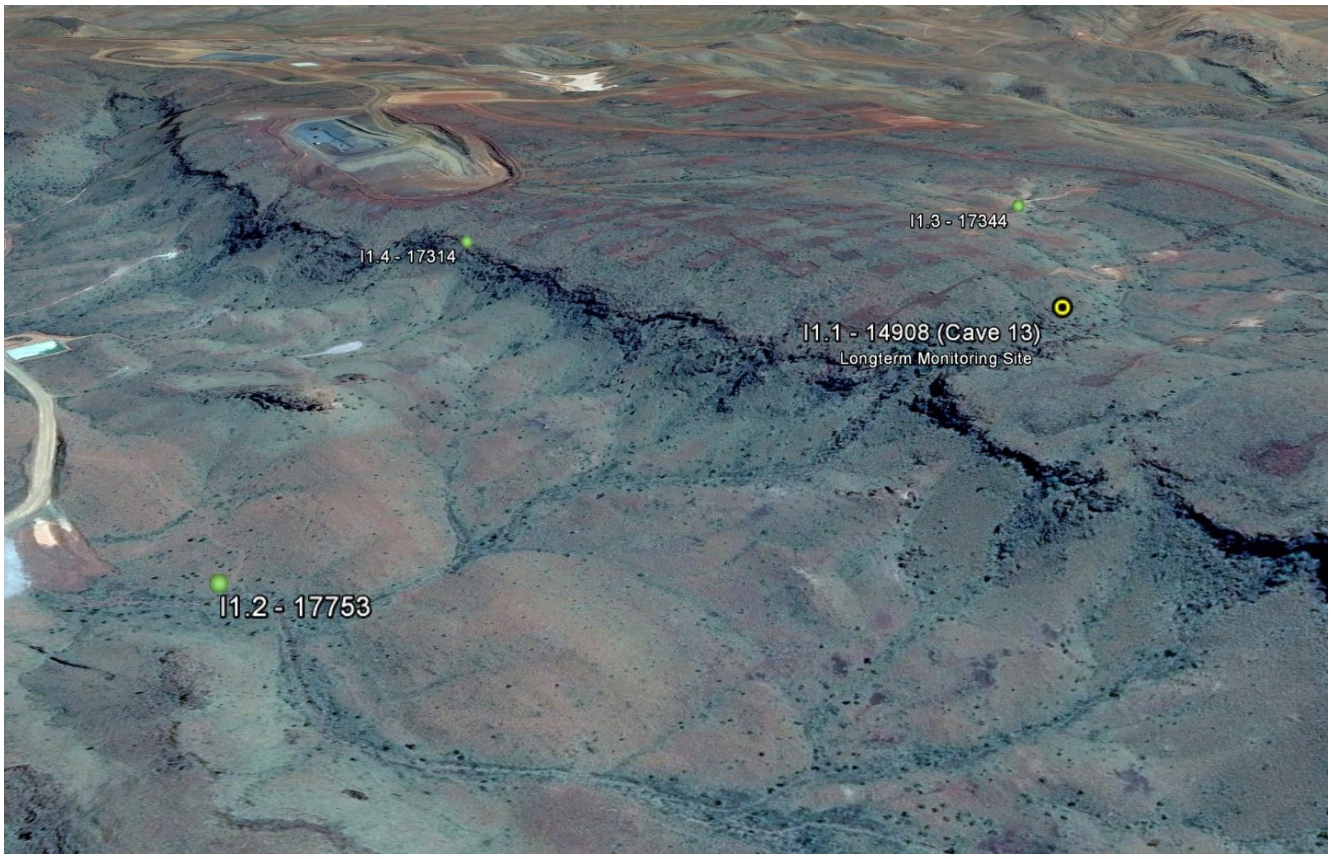


Figure 1: Aerial view of Pilbara Leaf-nosed Bat Impact Site 1 (Fortescue Earth 2015)

Figure 2: Aerial view of Pilbara Leaf-nosed Bat Impact Site 2 (Fortescue Earth 2015)

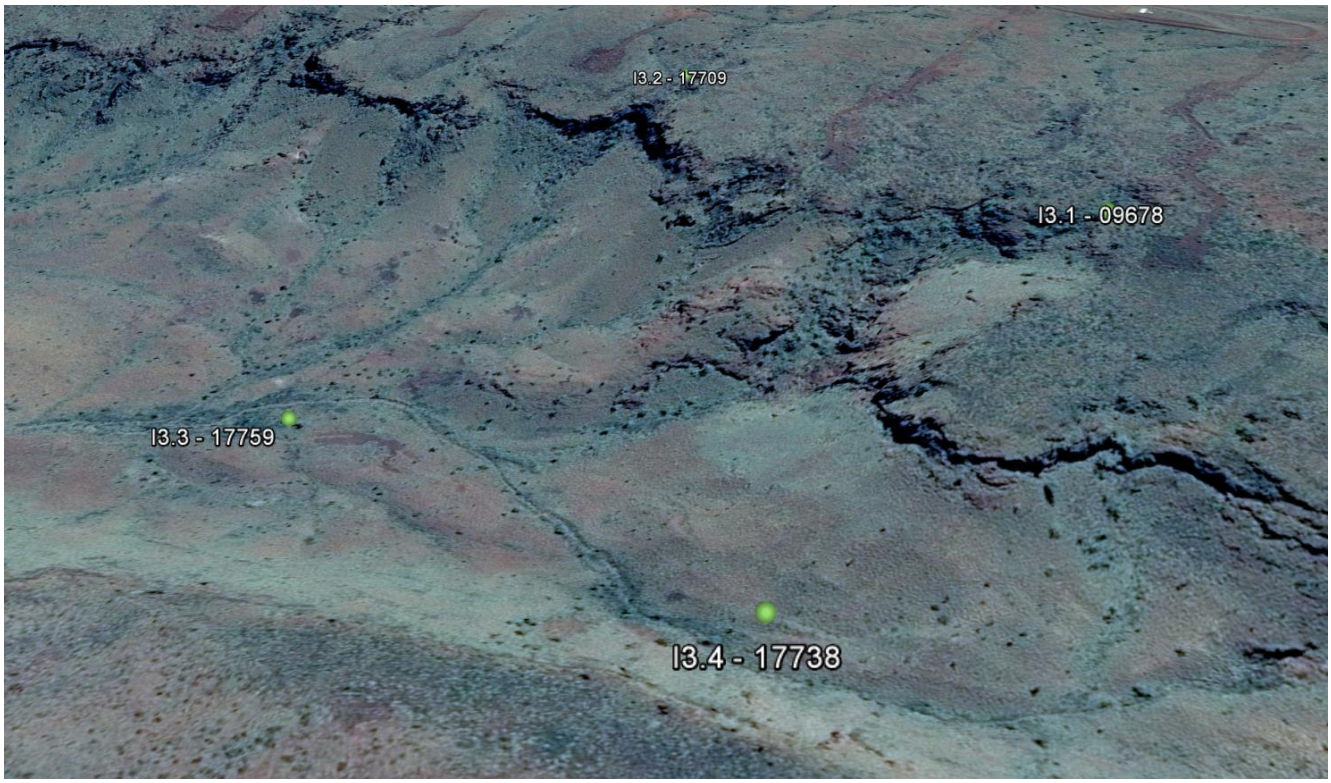


Figure 3: Aerial view of Pilbara Leaf-nosed Bat Impact Site 3 (Fortescue Earth 2015)

Figure 4: Aerial View of Pilbara Leaf-nosed Bat Control Site 1 (Fortescue Earth 2015)

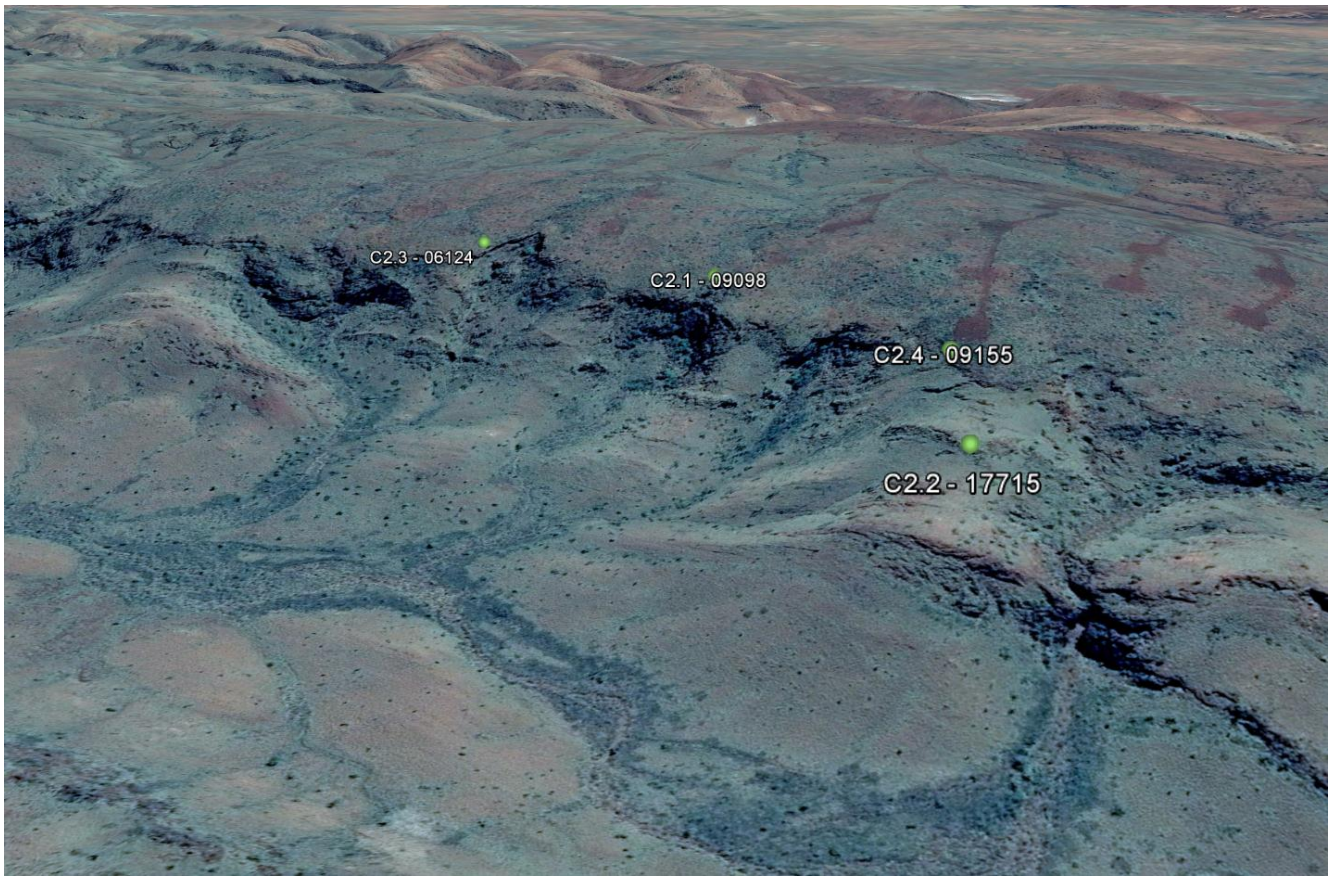


Figure 5: Aerial View of Pilbara Leaf-nosed Bat Control Site 2 (Fortescue Earth 2015)

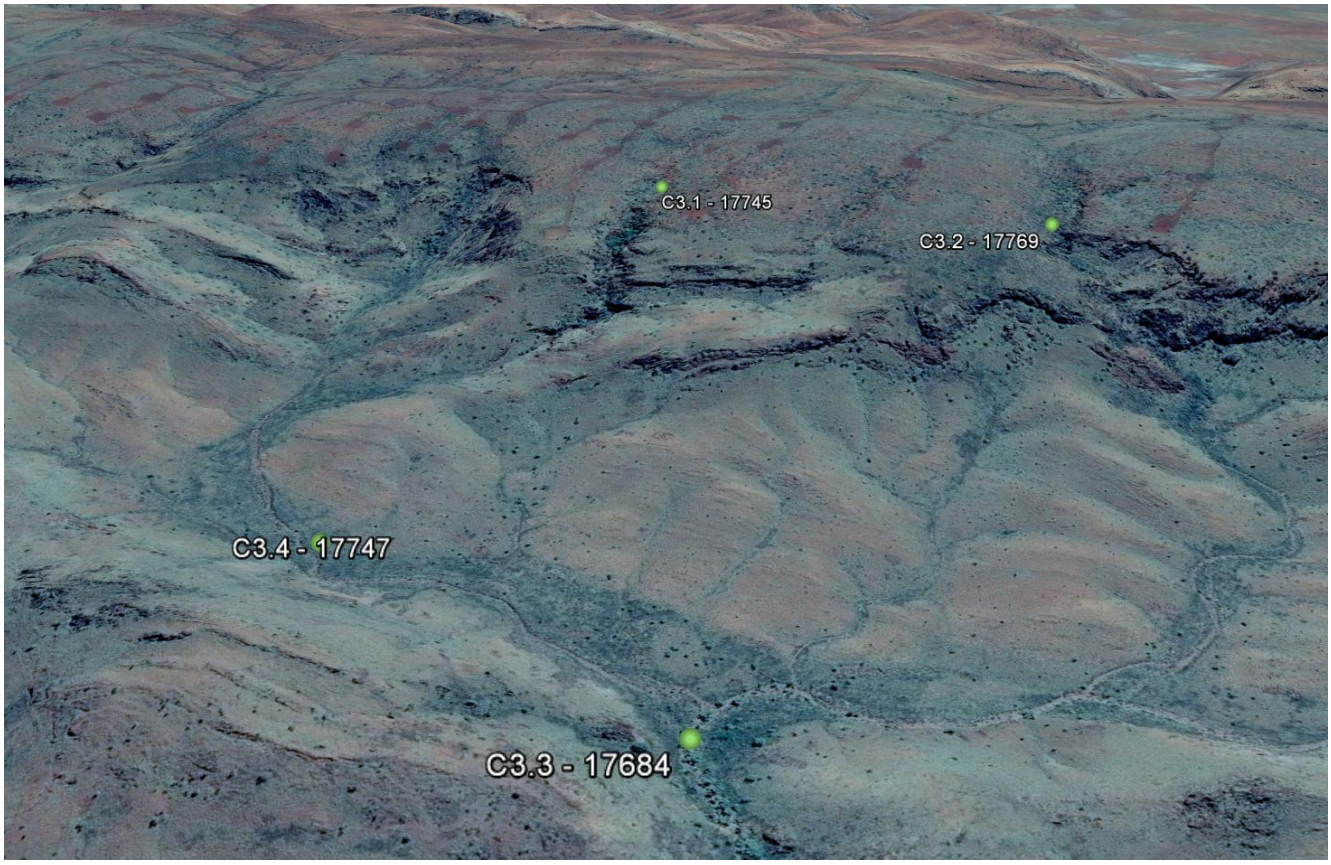


Figure 6: Aerial View of Pilbara Leaf-nosed bat Control Site 3 (Fortescue Earth 2015)

2.5 CONSERVATION SIGNIFICANT BIRDS

Monitoring for conservation significant birds was undertaken to be consistent with Fortescue's overarching Fauna Conservation Significant Management Plan (100-PL-EN-0022). Conservation significant birds were monitored during the winter/dry season field event. The only conservation significant bird species previously recorded from within the current impact area is the Rainbow Bee-eater. Two more species, the Fork-tailed Swift (*Apus pacificus*, EPBC Migratory, WC Act S5) and the Grey Falcon (*Falco hypoleucos*, WC Act S1) have been recorded from the vicinity of the mine site (ecologia 2011a), however these species are not expected to be residents and therefore the Rainbow Bee-eater was targeted in the monitoring.

Three impact and three control sites were established in habitat suitable for conservation significant bird species, for example creek and drainage lines (i.e. Rainbow Bee-eater habitat). At each site a 20 min avian monitoring event was completed (**Table 6**). Any opportunistic sightings were also recorded and documented. The locations of all conservation significant bird sites are shown in **Map 4** and details presented in **Table 6.** Site descriptions are provided in **Appendix 1**.

Table 6: Migratory Bird Monitoring sites

Site	Coordinates		Date
	Easting	Northing	
Impact Area			
MiB I1	713368	7647895	25/08/15
MiB I2	711699	7650632	23/08/15
MiB I3	713205	7647235	25/08/15
Control Area			
MiB C1	704322	7646345	23/08/15
MiB C2	713262	7645204	22/08/15
MiB C3	713307	7643882	25/08/15

Datum: GDA94, Zone 50K

2.6 REHABILITATION AREAS

To satisfy the requirements of the TFMP, rehabilitation sites were monitored for the presence or absence of conservation significant fauna. A total of three rehabilitated drill pads were monitored using two motion cameras per site for three to four consecutive nights, resulting in a total of 22 camera nights. All rehabilitation sites were located on hilltops in the closest available rehabilitation earthworks to mapped Northern Quoll habitat. Although not all sites were placed in the critical habitat, Northern Quolls are known to traverse hilltops during foraging and mating periods; as per the ecologia (2014) radio tracking results in the 2014/2015 monitoring event and the current monitoring event. Each rehabilitation site was also searched for secondary evidence of conservation significant species for one person hour. The details and locations of each rehabilitation site are shown in **Table 7** and displayed in **Map 1**.

Table 7: Rehabilitation sites

Site	Coordinates		No. Motion Cameras	Dates	No. Camera nights	Search time (person hr)	Targeted habitat
	Easting	Northing					
NS R1	713755	7648409	2	20/08-24/10/15	8	1	Proximity to Northern Quoll
NS R2	713753	7647791	2	20/08-24/10/15	8	1	Northern Quoll
NS R3	713302	7647982	2	21/08-24/10/15	6	1	Proximity to Northern Quoll

Datum: GDA94, Zone 50K

2.7 CONSERVATION SIGNIFICANT BIRDS

Fieldwork was carried out under DPaW Regulation 17 licence SF010456.

Table 8: Field personnel

Person	Qualification	Experience
Damien Cancilla	BSc Hons (Zool)	10 years
Astrid Heidrich	MSc (Zool)	8 years
Chris Parker	BAqSc, BSc	4 years
Jordan Vos	-	10 years
Leigh Smith	Vet nursing	3 years
Kyle Goodwin	B.Sc.	1 year

3 RESULTS

3.1 ENVIRONMENTAL CONDITIONS

A weather station has been established at the North Star mine site to record rainfall data. The rainfall data for North Star mine is presented in **Figure 7**. In addition, the humidity levels recorded in 2015 by the Bureau of Meteorology (BOM) in Marble Bar station (station #4106) were collated and are displayed in **Figure 8.** The data gives an indication of the humidity levels experienced within the region, however humidity data is not available from the North Star mine at this stage.

The rainfall data shows that the majority of rainfall events were experienced in January, and between March and May 2015. None to very little rain was recorded from August to December 2015 (maximum of 14.5 mm per month), followed by some rainfall in January 2016 (37 mm of rain). The temperature was as expected; highest during the wet season and lowest during the dry season. Humidity levels correlated with the amount of rainfall, being highest between March and May with the 9am average to be between 40.8% and 48.4%, and 3pm average of 27% to 34%. Another peak of humidity levels was also recorded between December 2015 and February 2016 with 9am average of 32.5% and 41.9%, and 3pm average between 11.5% and 27.4% (**Figure 8)**.

Long-term weather data from January 2011 until December 2015 was collated using the rainfall data from the North Star weather station data. In addition, online data available from the Bureau of Meteorology (BOM) was also collated from two locations (Hillside station #4015 and Marble Bar station #4106, due to gaps in both weather recordings) for comparison purpose and also for months where no data is available from the North Star mine site (BoM 2015). The data, comprising monthly rainfall, average temperature, minimum and maximum temperature per month, as well as timing of targeted surveys and monitoring events is displayed in **Figure 9**. The data shows that rainfall events experienced during the baseline survey in 2011 were relatively low with an annual total of 152 mm (Fortescue at North Star) and 163.6 mm (BoM at Marble Bar) across the year in comparison to 554.5 mm at North Star in 2012 (474.2 mm in Marble Bar), 698.5 mm in 2013 (705.4 mm in Marble Bar), 193.5 mm in 2014 with some missing data (383.2 mm in Marble Bar) and 517.5 mm in 2015 (314 mm in Marble Bar) (Fortescue; BoM 2015). The timing of rainfall was also unusual in 2011 where rain was recorded in nine of 12 months (some data is missing from North Star weather station) **Figure 9**. The following four years (2012-2015) experienced rainfall events typical for the arid-tropical climate zone with bimodal rainfall distributions where rain concentrates around the wet season (December – March). Some additional heavy rainfall was recorded in May/June 2013 and April/May 2015 as part of cyclonic events (BoM 2015).

The monitoring events were undertaken during months of similar weather conditions to that experienced during the baseline survey, however heavy rainfall events prior to monitoring may have increased the ephemeral water levels and vegetation health on site, in particular for the wet season monitoring in February 2015 and dry season monitoring in Aug 2015 (**Figure 9)**.

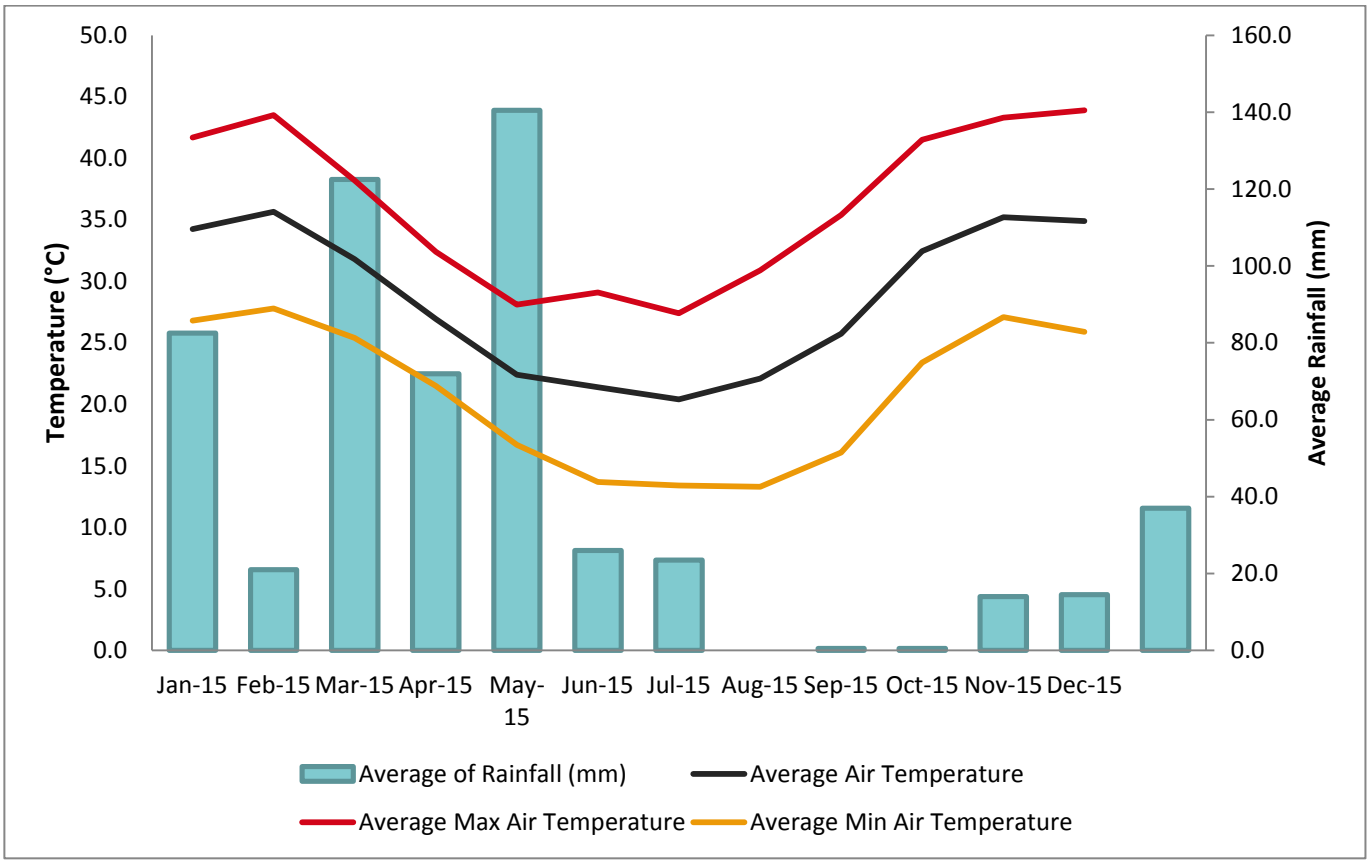


Figure 7: North Star rainfall data (2015)

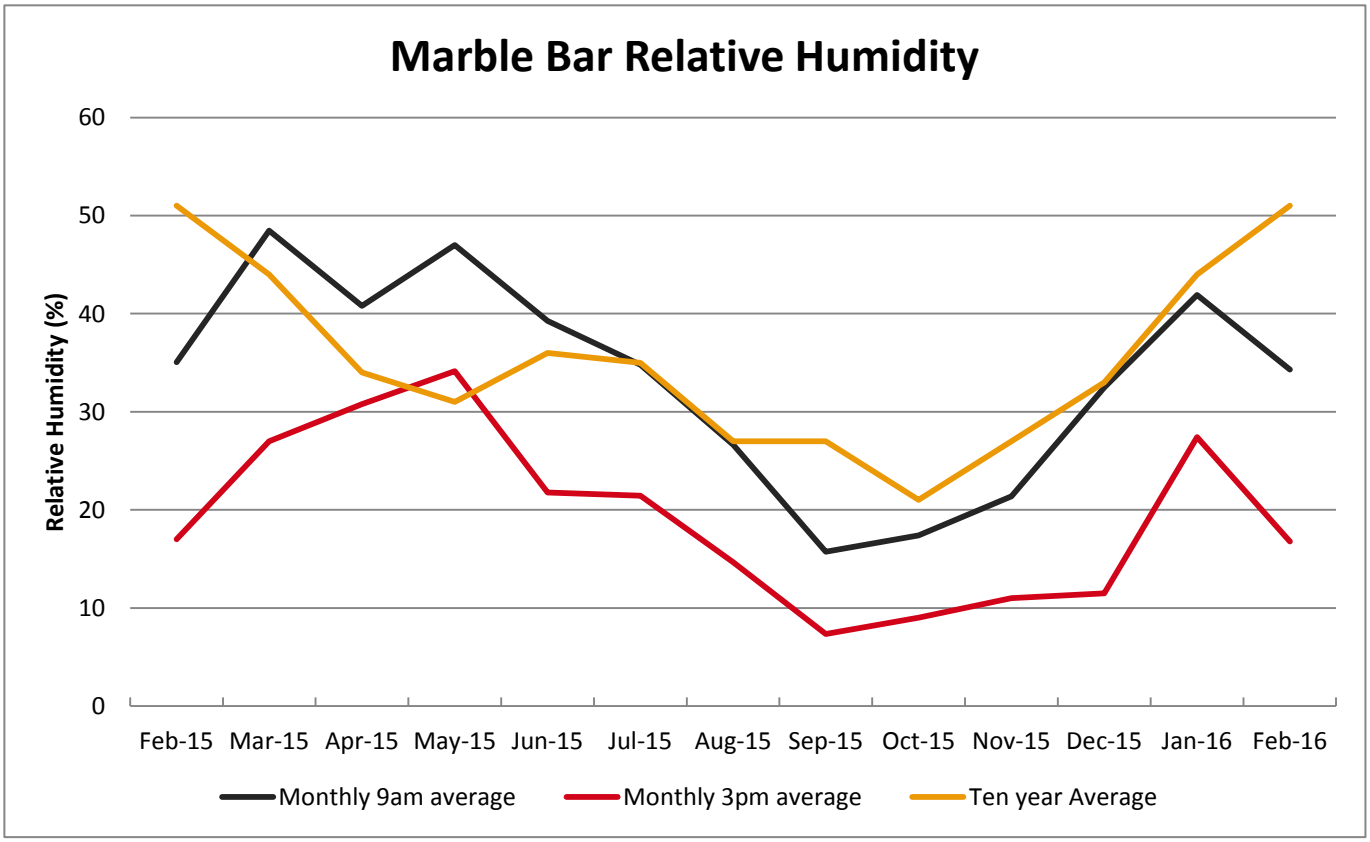


Figure 8: Relative humidity recorded from Marble Bar (2015) (BoM #4106)

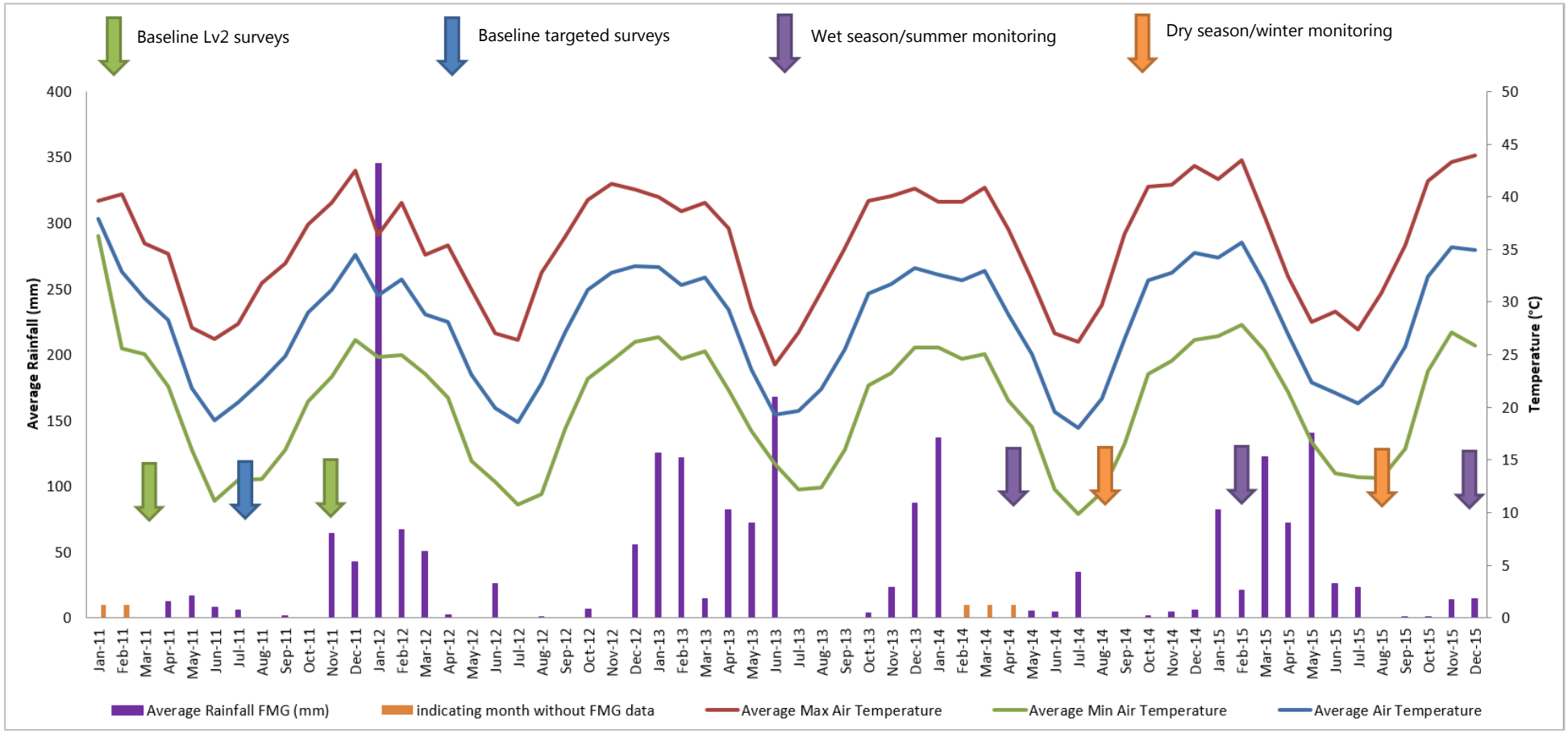


Figure 9: North Star weather data (2011-2015)

3.2 NORTHERN QUOLLS

3.2.1 TRAPPING

During the current monitoring, a total of 16 individual Northern Quolls (eight males and eight females) were recorded of which nine Northern Quolls were captured at four impact sites (four males, five females) and the remaining seven individuals (four males, three females) were recorded from three control sites.

In total, three individual females were recaptured that were originally captured and microchipped during the 2014 monitoring (**Appendix 2**). All three females were captured at the same trap sites as in 2014 (impact site NS NQ I1, and control sites NS NQ C1 and C2). As detailed in **Appendix 2**, a total of four females were recorded during 2014, three of which were re-captured. The forth female was identified as road kill in February 2015 at North Star. In addition to the re-captures, two females were recorded in proximity of the recaptures. These new records were of lighter weight (w_{Δ}= 374g) indicating that these may represent last years' offspring. Males were not recaptured, which was expected due to their short live span and annual die-off after the breeding season. Tissue samples were taken of all individuals and have been submitted to the Western Australia Museum for any future genetic work.

The sex ratio of the captures during this year was evenly distributed, 8 males and 8 females, compared with previous sex ratios of 16/4 (male/female) in 2011 and 12/6 in 2014. In addition, the reproductive condition of the individuals captured during the current monitoring indicated that the breeding season had started with females showing developed pouches and teats. Males were generally in poor condition with signs of fighting, missing fur and a generally low body weight in comparison to previous years (**Appendix 2**). This condition is expected as the breeding period was observed to be in the late stages as indicated by female pouch development and presence of young in the early development stages.

The average weight of males was lower during this years' monitoring, with males weighting w_{Δ}=530g, in comparison to w_{Δ}=671g in 2011 and w_{Δ}=583g in 2014. In contrast, the average weight of females increased compared to 2011, from w_{Δ}=360g in 2011, to w_{Δ}=370g in 2014, and w_{Δ}=394g during the current monitoring event.

Details of all results from the baseline survey (2011), and the two years of monitoring (2014 and 2015) are presented in **Appendix 2.**

Plate 1: Sign of mating - loss of fur on thighs

Plate 2: Developed pouch of female

3.2.2 MOTION CAMERAS

Northern Quoll were recorded on motion cameras from five impact site locations and from two control site locations. Individual identification was in some cases difficult (e.g. only body parts were recorded or spot pattern was not distinct on camera recording). At least five individuals were recorded of which at least three were females (this was assumed based on patches of bare skin on their thighs which females developed as a result of mating (**Plate 1**).

During the previous year of monitoring, Northern Quolls were recorded from five impact sites and six control sites (ecologia 2014). During the current monitoring event, the recording rate of Northern Quolls at impact sites was consistent with the rates from the 2014 data; whereas, recordings of Northern Quolls within the control area saw a reduction in records compared to the 2014 data. Sites NS MC C3, NS MC C6, NS MC C8 and NS MC C9 did not record the species during the current monitoring period despite recordings during the 2014 monitoring (ecologia 2014). The data suggests that the spatial extent of Northern Quoll distribution at the North Star mine site is similar between the two monitoring events which is based on the number of motion cameras recording the species at camera sites.

An additional 18 species (five native mammals, two introduced mammals, seven birds and four reptiles) were recorded, none of which were conservation significant (**Appendix 3**).

Results of all Northern Quoll recordings are listed in **Table 9** and their locations are displayed in **Map 7.**

Table 9: Northern Quolls recorded from Motion Camera sites

Species	Site	Dates	Coordinates		Count
			Easting	Northing	
Impact Area					
Northern Quoll	NS MC I3	24/08/15	716114	7648059	1 individual (female)
Northern Quoll	NS MC I4	04/09/15	712243	7648686	1 individual (female)
Northern Quoll	NS MC I6	03/09/15 28/09/15	711680	7650946	1 individual (female 941 000016595571)
Northern Quoll	NS MC I7	27/08/15, 29/08/15	711695	7650618	Probably 2 individuals
Northern Quoll	NS MC I9	26/08/15	713230	7647232	1 individual
Control Area					
Northern Quoll	NS MC C5	31/08/15	718296	7655613	1 individual
Northern Quoll	NS MC C7	01/09/15 05/09/15	713280	7643833	1 individual (male)

Datum: GDA94, Zone 50K

3.2.3 RADIO TRACKING

Three collars were attached to Northern Quoll individuals (one male, two females) and all were retrieved successfully, and animals released with no harm; however of these only two collars had location data. The third collar was found in a small crevice (female PIT 941 000016595497 at site NQ C2) with no location data, therefore it is assumed that the quoll slipped out of the collar soon after it was fitted.

The collar attached to the female Northern Quoll (PIT 941 000017452055 at site NQ I1) recorded for 14 nights (25 Aug until 8 Sep 2015), and the collar attached to the male (PITS 941 000017452056 at site NQ I1) recorded for 24 nights (from 26 Aug until 18 Sep 2015). Each collar was programmed to record a GPS coordinate three times per night. The collar attached to the female recorded a total of 16 GPS location over 12 nights with intermittent failure of recording due to the lack of satellite connection. This was most likely caused by the female hiding in caves and rock shelter at the time of recording. The collar attached to the male recorded a total of 70 GPS fixes over a period of 24 nights (26 Aug – 18 Sep 2015).

The GPS tracking data collected from the female individual showed that an area of 80 ha was utilised by the female (**Map 8)** of which 13 ha represented core habitat (50% of overall utilisation). The longest distance travelled was recorded on the 3 September 2015, where the recorded locations were 1.06 km apart, and were recorded at 2 am and 4.30 am. The location of the 2 am fix was in the lay down area in proximity to the mine infrastructure (offices) and Ore Processing Facility (OPF), whilst the 4 am fix was at the base of the rocky cliff that forms the edge of the ridge. The core territory of the female was recorded from a gully with adjacent breakaway structure 350 m north-northwest of the Mine Pit. Infrastructure and mine pit areas were visited by the female over two nights during the 12 nights of GPS tracking.

The data collected from GPS tracking of male Northern Quoll show that the individual occupied an area of 5.9 ha (home range) which is smaller than the area occupied by the female. The majority of GPS fixes were recorded from a small area of dense shrubs in proximity of the main North Star access track (**Map 8**). The home range of the male individual was recorded to be smaller than that of a male recorded during the previous year (2014 monitoring). The GPS tracking data indicated a home range of 525 ha of core territory and a total of 3,887 ha during the GPS radio tracking in 2014. The home range recorded during this years' monitoring was a total of 5.9 ha of which 1.7 ha represent the core habitat for the male (50% of all GPS fixes were recorded from this area).

To investigate potential impacts of the mining operation, blasting data was reviewed and compared with movements of the collared Northern Quolls. The male Northern Quoll recorded so little movement, it appeared to not be impacted by the blasting activities. The male was a considerable distance from the blasting (1.6 km), so any impacts would likely to be diminished. However, it was residing within an area immediately adjacent to the haul road (30 m) and was also recorded from infrastructure areas (laydown) (**Map 8**). The female Northern Quoll was residing in closer proximity to the mine pit and infrastructure area at the time of GPS tracking. When comparing the GPS locations shown in **Appendix 4** with the blasting times as shown in **Table 10**, no clear correlation between blasting and any negative behaviour can be identified. However, the female was recorded travelling towards the blasting location two days after the blast on the 26 Aug 2015. A GPS fix was recorded from the mining pit (IMA) on the 28 Aug 2015 (**Map 8**).

All recorded GPS locations for the female and male Northern Quoll are presented in **Appendix 4** and displayed in **Map 8**.

Table 10: Blasting information

Blasting dates	Times	Location
26/08/15	1:00pm	IMA (Mine Pit)
31/08/15	3:00pm	IMA (Mine Pit)
05/09/15	10:00am	IMA (Mine Pit)
15/09/15	5:00pm	IMA (Mine Pit)

3.2.4 POPULATION CHANGES

To address the Hypothesis 1 of the TFMP (no significant changes in the spatial distribution of Northern Quolls occur), spatial analysis of the trapping results was completed to determine population size, capture probability and population density. Data was analysed for the baseline survey in 2011 and for each subsequent monitoring event. Results from the baseline data should be treated with caution due to difference in the set-up of trapping sites in 2011 (less traps per site (8-16 vs. 25) and different location of some of the sites). When compared between the years, potential changes in population can be determined. Estimates were calculated separately for all impact and control sites. The data was then combined into one dataset for the impact sites and another dataset comprising the data from all control sites.

During the current monitoring event the population size at the impact sites was estimated at one to three individuals per site and a corresponding population density estimate of 0.36 to 0.73 individual Northern Quolls per hectare at each impact sites. The data from two of the impact sites (NQ I1 and NQ I3) was too low for statistical analysis due to the lack of recaptures at these sites. When averaging the capture probability for sites NQ I2 and NQ I4 it appears that 45% of the local population present at the two sites were captured.

When combining the data from all impact sites into one dataset, population size was estimated to be 10 individuals across the impact area (trapped area) with a corresponding population density estimate of 0.01 Quoll per hectare (**Table 11**). The capture probability was 26% across the impact area. This value considers that areas have not been trapped and that the local population of Northern Quolls extend outside the monitoring sites.

The population sizes at the control sites were estimated at between one and four individuals per site and a corresponding population density estimate of 0.17 to 0.75 individuals per hectare. The average overall capture probability for the three control sites with sufficient data was estimated to be 56.5%. When combining the data for all sites (sites NQ C1-C4) into one dataset and reapplying the analysis, the capture probability reduces to 46.9% for the entire control area. This considers that the local population of Northern Quolls extends outside the monitoring sites. The population size for the combined control sites dataset was estimated at seven individuals with a corresponding population density of 0.002 individuals per hectare (**Table 11**).

Statistical analysis of the 2011 baseline data and the 2014 monitoring data showed that four individuals were present within the impact area in 2011, and nine individuals were present in 2014 based on the combined sites dataset. The total of individuals trapped in 2015 was eight. The overall capture probability in 2011 was 53%, whereas in 2014 it was 42% in the impact area sites. In 2015 the capture probability for impact sites was at 26%. This decrease is likely to be caused by the lack of recaptures at two of the four monitoring sites. Capture probability for the control area was 34% in 2011, 33% in 2014 and 46% in 2015. This results suggests a slight increase of capture probability across all control sites over the years. This is most likely due to the large number of recaptures at control site NQ C4 where four individuals were recaptured multiple times over the duration of the monitoring (**Table 11, Appendix 2)**. The overall density was consistent for the control sites between all years of trapping and monitoring. The overall density estimated for the impact area decreased from 0.094 in 2011 to 0.016 in 2014 which is similar to that recorded in 2015 (0.017). However, this result cannot be compared directly due to a lower survey effort in 2011 in relation to current monitoring sites.

When comparing the 2015 monitoring with the 2014 monitoring, it indicates that there is a slight increase of the population in the impact area whereas the Northern Quoll population recorded from control sites is stable.

Table 11: Statistical results for Northern Quoll

Site	Individuals trapped (actual)			Estimated population size ± SE (CI)						Overall capture probability (%)						Density ML/ha					
	2011#	2014	2015	Per site			Overall[1]			Per site			Overall[1]			Per site (2015)			Overall[1]		
Impact sites				2011	2014	2015	2011	2014	2015	2011	2014	2015	2011	2014	2015	2011	2014	2015	2011	2014	2015
NQ I1	3	2	3	3 ± 0.1 (3.0-3.6)	2 ± 0.5 (2.0-5.2)	-*	4 ± 0.1 (4.0-4.6)	9 ± 0.5 (9.0-10.4)	10 ± 1.8 (9.0-17.7)	0.524	0.333	-*	0.536	0.428	0.267	0.816	0.672	-*	0.094	0.016	0.017
NQ I2	1	3	1	1 ± 0.1 (1.0-1.5)	3 ± 0.4 (3.0-4.4)	1 ± 0.3 (1.0-4.7)				0.571	0.381	0.400				0.210	1.083	0.361			
NQ I3	Δ	2	2	Δ	2 ± 0.1 (2.0-2.7)	-*				Δ	0.381	-*				Δ	0.496	-*			
NQ I4	Δ	2	3	Δ	2 ± 0.1 (2.0-2.8)	3 ± 0.2 (3.0-3.9)				Δ	0.600	0.500				Δ	0.488	0.731			
Control sites																					
NQ C1	1	3	2	1 ± 0.0 (1.0-1.2)	3 ± 0.5 (3.0-4.9)	2 ± 0.2 (2.0-3.1)	7 ± 0.7 (7.0-9.5)	9 ± 0.8 (9.0-12.2)	7 ± 0.3 (7.0-8.0)	0.857	0.389	0.625	0.3469	0.333	0.4694	0.2	0.255	0.170	0.002	0.002	0.002
NQ C2	1	5	1	2 ± 0.2 (2.0-3.0)	5 ± 1.0 (5.0-11.8)	1 ± 0.3 (1.0-4.2)				0.428	0.381	0.500				3.740	0.518	0.183			
NQ C3	1	1	0	-*	-*	-*				-*	-*	-*				-*	-*	-*			
NQ C4	4	2	4	4 ± 2.3 (3.0-49.4)	2 ± 0.4 (2.0-3.2)	4 ± 0.1 (4.0-4.5)				0.167	0.500	0.571				3.716	0.376	0.753			

* No recapture data available

Sites surveyed in 2011 are not identical with monitoring sites in 2014 and 2015

Δ Site not surveyed in 2011

[1] Overall relates to the data being combined into one dataset and estimators calculated on this one dataset.

3.3 PILBARA OLIVE PYTHON

Three individual Pilbara Olive Pythons were recorded from one impact site (POP I4) and two control sites (POP C2 and POP C4 during the 2015/2016 summer monitoring period (**Table 12**, **Plate 3**). Each individual was sighted once during the current phase. There were no recaptures during the monitoring.

In addition, one Pilbara Olive Python (male) was recorded opportunistically at control site POP C3 during the winter trapping program for Northern Quolls (**Plate 4**). The individual was originally recorded during the winter trapping program in 2014 and recaptured at the same location. Details of all sightings are listed in **Table 12** and shown in **Map 8**. All capture details from the baseline survey and previous monitoring events are detailed in **Appendix 5**.

Conditions during the field monitoring were relatively dry with little surface water present. This was particularly visible at impact site POP I1, where dry conditions were recorded during the current field event (**Plate 5** and **Plate 6**). Low water levels at this site was also recorded during the previous monitoring in February 2015 in comparison to the baseline survey in 2011 (Ecoscape 2015a). Water markings and records from the baseline survey in 2011 indicate that higher water levels can be recorded from this site (ecologia 2011a; 2011b). The cause of the lack of water at this site is mainly unknown since total amount of rainfall in 2015 was comparable with previous years, however rainfall experienced during the months prior to the current summer monitoring event was relatively low (**Figure 9**).

The conditions and methodologies during the current monitoring events were deemed adequate for the monitoring of Pilbara Olive Python. An additional 12 herpeto-fauna species were recorded during the monitoring summer phase. Conditions on sites were relatively dry in comparison to previous monitoring events, despite being conducted at the start of the wet seasons; however, the temperature was warm to ensure high activity of reptiles.

Plate 3: Pilbara Olive Python recorded during summer phase (PIT #941 000017452069)

Plate 4: Pilbara Olive Python recorded during winter phase (PIT #941 000016202860)

Plate 5: Water level at site POP I1 in Feb 2015

Plate 6: Water level at site POP I1 in Dec 2015

Table 12: Pilbara Olive Pythons recorded 2015

Species	Chip ID	Sex	Capture Type	Site	Date	Coordinates	
						Easting	Northing
Impact sites							
Pilbara Olive Python	941 000017452059	M	Capture	NS POP I4	12/12/15	711133	7648580
Control sites							
Pilbara Olive Python	941 000016202860	M	Recapture (2014)	NS NQ C3/POP C3	28/08/15	713667	7656755
Pilbara Olive Python	941 000016595531	F	Capture	NS POP C2	07/12/15	714540	7655512
Pilbara Olive Python	941 000017452069	M	Capture	NS POP C4	11/12/15	718287	7655586

Datum: GDA94, Zone 50K

3.3.1 POPULATION CHANGES

Four models were determined to be applicable to the Pilbara Olive Python capture data (**Table 13**). Of these, two models have the lowest AIC/highest Model likelihood (AIC = Akaike information criterion) which measures the relative quality of a statistical model for a given set of data). The models with the lowest AIC value were the most suitable for this years' monitoring event (highlighted in red in **Table 13**). These models were used to estimate the occupancy (ψA) and detection (p_i) of the Pilbara Olive Python within the impact and control sites which are displayed in **Table 14.** No statistical analysis can be undertaken for the 2011 baseline and targeted surveys as the methodology for these surveys was based on opportunistic searches, in comparison to repetitive systematic searches as part of the monitoring program undertaken in 2014/2015 and the current monitoring (2015/2016).

The estimates of the occupancy probability and detection probability were estimated using results from all three monitoring events (wet season 2013/2014, 2014/2015 and 2015/2016). Based on this data, the occupancy probability (ψA) during the current monitoring was estimated as 75% (ψA = 0.75) for the impact area. This is an increase of estimated occupancy compared to previous years, which is likely the result of ongoing records of the species over all three years' of monitoring across three of the four impact sites. The occupancy probability estimated for control sites increased to 59% (ψA = 0.59) between the first and second monitoring event and decreased to 50% (ψA = 0.50) during the current monitoring (**Table 14**.)**.**

The occupancy probability was also estimated as naïve estimator (NED), which considers the records of each monitoring event separately. An overall NED was also determined, which considers the records of all monitoring events to date (**Table 14)**. The naïve estimator (NED) for the current monitoring period indicates that 25% of all impact sites and 50% of all control sites were occupied by the Pilbara Olive Python. When considering the results of the previous monitoring events this estimator suggests that 75% of impact and control sites have been occupied by the Pilbara Olive Python to date.

The detection probability of the Pilbara Olive Python is estimated at 59% at impact sites, and 98% at control sites for this year's monitoring event. This result suggests that all Pilbara Olive Pythons occurring at the control sites were detected during this years' monitoring, whereas the detection of the species at impact sites may have potentially been increased with additional site visits and if surface water was present at impact site POP I1.

Table 13: Statistical results (Models) for Pilbara Olive Pythons

Model	AIC		ΔAIC		AIC wgt		Model Likelihood		No. of Parameter		Deviance	
	Impact	Control	Impact	Control	Impact	Control	Impact	Control	Impact	Control	Impact	Control
Psi(.)p1(.)p2(.)p3(.)	38.21	59.59	0.00	6.38	0.48	0.04	1.00	0.04	2	5	32.87	39.59
Psi(t)p1(.)p2(.)p3(.)	38.21	53.21	0.00	0.00	0.48	0.95	1.0	1.0	2	4	32.87	39.49
Psi(t)p1(t)p2(t) p3(t)	43.54	64.18	5.32	10.97	0.03	<0.01	0.07	<0.01	5	7	23.54	22.18
Psi(.)p1(t)p2(t) p3(t)	56.49	64.18	18.28	10.97	<0.01	<0.01	<0.01	<0.01	6	7	27.69	22.18

Table 14: Parameters for Pilbara Olive Pythons

Parameter	Impact sites			Control sites		
	Wet season 2014	Wet season 2015	Wet season 2015/2016 (Current)	Wet season 2014	Wet season 2015	Wet season 2015/2016 (Current)
ψA (CI)	0.10 ± 0.00	0.50 ± <0.01	0.75 ± <0.21	0.39 ± 0.15	0.59 ± 0.22	0.50 ± 0.25
pi (CI)	<0.01 ± 0.00	1.00 ± 0.00	0.59 ± <0.01	0.52 ± 0.26	0.75 ± 0.54	0.98 ± <0.01
NED (overall)	0 (0)	0.75 (0.75)	0.25 (0.75)	0.50 (0.50)	0.50 (0.75)	0.50 (0.75)

ψA = occupancy probability CI = 95% confidence interval overall = NED for all sites over the life of monitoring
pi = detection probability NED = Naïve estimator

3.4 PILBARA LEAF-NOSED BATS

Pilbara Leaf-nosed bat calls were recorded at all of the six monitoring sites during the monitoring period. Five subsites recorded calls on each night, thirteen subsites only recorded calls on a few nights, and six subsites did not record any calls during the monitoring period. Each call consisted of a series of pulses (1-30). The number of calls recorded from impact sites totalled 650 calls, whereas calls recorded from all control sites totalled 330 calls. The call patterns recorded at each monitoring site are shown in the below sections.

Bat activity and call patterns have previously been recorded in 2011 and 2013 (Bat Call WA 2013; ecologia 2011a; ecologia 2011b) from six subsites: the two long-term monitoring sites PLNB I1.1 (Cave 13) and PLNB I2.1 (Figpool), and from PLNB I3.1 (Cave 14), PLNB C1.1 (Cave 6), PLNB C2.1 (Cave 11) and PLNB C3.1 (Cave 2). No previous data has been collected from the remaining 18 subsites.

The overall call patterns from the two subsites PLNB I1.1 and PLNB I2.1 (long-term monitoring sites) recorded during the current monitoring period are consistent with previous results (Bat Call WA 2013) during the period of monitoring (December). The long-term data also shows that the activity level at those two subsites decreases in December when individuals are able to disperse during the hot humid summer months. Previous data recorded from subsites I3.1, C1.1, C2.1 and C3.1 indicated that a potential roost cave is present in the vicinity, however the current monitoring only supported this at control site C2 and C3.

Table 15: Pilbara Leaf-nosed Bat Calls Recorded in 2015 Monitoring Event

Site	Subsite	SM2BAT+ #	Date (start of night)	Calls	Comment
PLNB Impact 1	PLNB I1.1	14908	4 Dec 15	7	Number of calls relatively low but consistent with dispersal of bats during hot humid weather
			5 Dec 15	7	
			6 Dec 15	10	
			7 Dec 15	9	
			8 Dec 15	1	
			9 Dec 15	6	
			10 Dec 15	5	
			11 Dec 15	2	
			12 Dec 15	3	
	PLNB I1.2	17753	9 Dec 15	1	Low number of calls on only a few nights
			11 Dec 15	2	
			12 Dec 15	4	
	PLNB I1.3	17344	7 Dec 15	1	Single call recorded
	PLNB I1.4	17314	5 Dec 15	1	Low number of calls on only a few nights
			9 Dec 15	1	
PLNB Impact 2	PLNB I2.1	14851	10 Nov 15	39	Fig Pool: High number of calls with peaks around 9:00 pm and 1:30 am, consistent with bats foraging and drinking.
			25 Nov 15	233	
			26 Nov 15	199	
			2 Dec 15	53	
	PLNB I2.2	17724	No PLNB calls recorded		
	PLNB I2.3	17723	No PLNB calls recorded		
	PLNB I2.4	17731	6 Dec 15	3	Low number of calls on only a few nights
			11 Dec 15	1	

Site	Subsite	SM2BAT+ #	Date (start of night)	Calls	Comment
PLNB Impact 3	PLNB I3.1	9678	5 Dec 15	2	Relatively low number of calls spread across the night with one peak of calls recorded within 30 min indicating a foraging individual flying around the recording device.
			6 Dec 15	12	
			7 Dec 15	4	
			8 Dec 15	3	
			9 Dec 15	3	
			10 Dec 15	13	
			11 Dec 15	3	
			12 Dec 15	3	
	PLNB I3.2	17709	5 Dec 15	2	Relatively low number of calls with only 2-3 calls recorded per night
			8 Dec 15	2	
			9 Dec 15	2	
			10 Dec 15	1	
			11 Dec 15	3	
			12 Dec 15	3	
	PLNB I3.3	17759	6 Dec 15	1	Low number of calls on only a few nights
			12 Dec 15	5	
	PLNB I3.4	17738	No PLNB calls recorded		
PLNB Control 1	PLNB C1.1	17755	9 Dec 15	2	Low number of calls on only a few nights
			11 Dec 15	1	
	PLNB C1.2	17697	6 Dec 15	4	Low number of calls on only a few nights
			11 Dec 15	1	
	PLNB C1.3	17716	No PLNB calls recorded		
	PLNB C1.4	6766	No PLNB calls recorded		
PLNB Control 2	PLNB C2.1	9098	5 Dec 15	1	Only a few single call sequences recorded across the night indicating individuals flying past the sub site
			6 Dec 15	1	
			7 Dec 15	3	
			8 Dec 15	2	
			9 Dec 15	1	
	PLNB C2.2	17715	6 Dec 15	1	Only a three calls all recorded around 4:00 am
			8 Dec 15	1	
			9 Dec15	1	
	PLNB C2.3	6124	5 Dec 15	5	Majority of calls were recorded around 3:30 am – 4:00 am with a spread of calls across the remainder of the night.
			6 Dec 15	74	
			7 Dec 15	12	
			8 Dec 15	24	
			9 Dec 15	30	
			10 Dec 15	18	
			11 Dec 15	44	
			12 Dec15	4	

Site	Subsite	SM2BAT+ #	Date (start of night)	Calls	Comment
	PLNB C2.4	9155	5 Dec 15	3	Lower number of calls when compared to subsite C2.3, however they are also clustered around the 4:00 am time
			6 Dec 15	7	
			7 Dec 15	4	
			8 Dec 15	3	
			9 Dec 15	3	
			10 Dec 15	4	
			11 Dec 15	2	
			12 Dec 15	1	
PLNB Control 3	PLNB C3.1	17745	No PLNB calls recorded		
	PLNB C3.2	17769	5 Dec 15	5	Consistent low activity between 7-8 pm and around 4 am with occasional calls during the middle of the night. Indicates proximity to a roost site
			6 Dec 15	15	
			7 Dec 15	7	
			8 Dec 15	13	
			9 Dec 15	4	
			10 Dec 15	2	
			11 Dec 15	1	
			12 Dec 15	8	
	PLNB C3.3	17684	6 Dec 15	1	Single call recorded
	PLNB C3.4	17747	7 Dec 15	4	Low number of calls with a distinct bimodal pattern based between 7:30 pm and 4:00 am
			8 Dec 15	1	
			9 Dec 15	3	
			10 Dec 15	2	
			11 Dec 15	6	
			12 Dec 15	1	

Datum: GDA94, Zone 50K

3.4.1 PILBARA LEAF-NOSED BAT IMPACT SITE 1

Impact Site 1 was located around Cave 13, with subsite I1.1 located in the entrance of the cave, and the remaining subsites located on either side of the hill located to the north and at the bottom of the valley to the west (**Figure 1**). Data from the cave entrance shows very low numbers of calls (maximum of 5 calls in a 30 min period) with calls recorded consistently throughout the night, with a small peak around 3:30 am – 4:00 am (**Figure 10**). The remaining subsites recorded very few calls (I1.2 (6 calls), I1.3 (2 calls), I1.4 (1 call)) suggesting that the bats dispersed quickly into the surrounding landscape with no discernible pattern detectable at this stage. This data indicates the presence of a small number of Pilbara Leaf-nosed Bats at Impact Site 1 during the current wet season monitoring period. No typical call pattern indicating a roost site was recording during the wet season monitoring of this site.

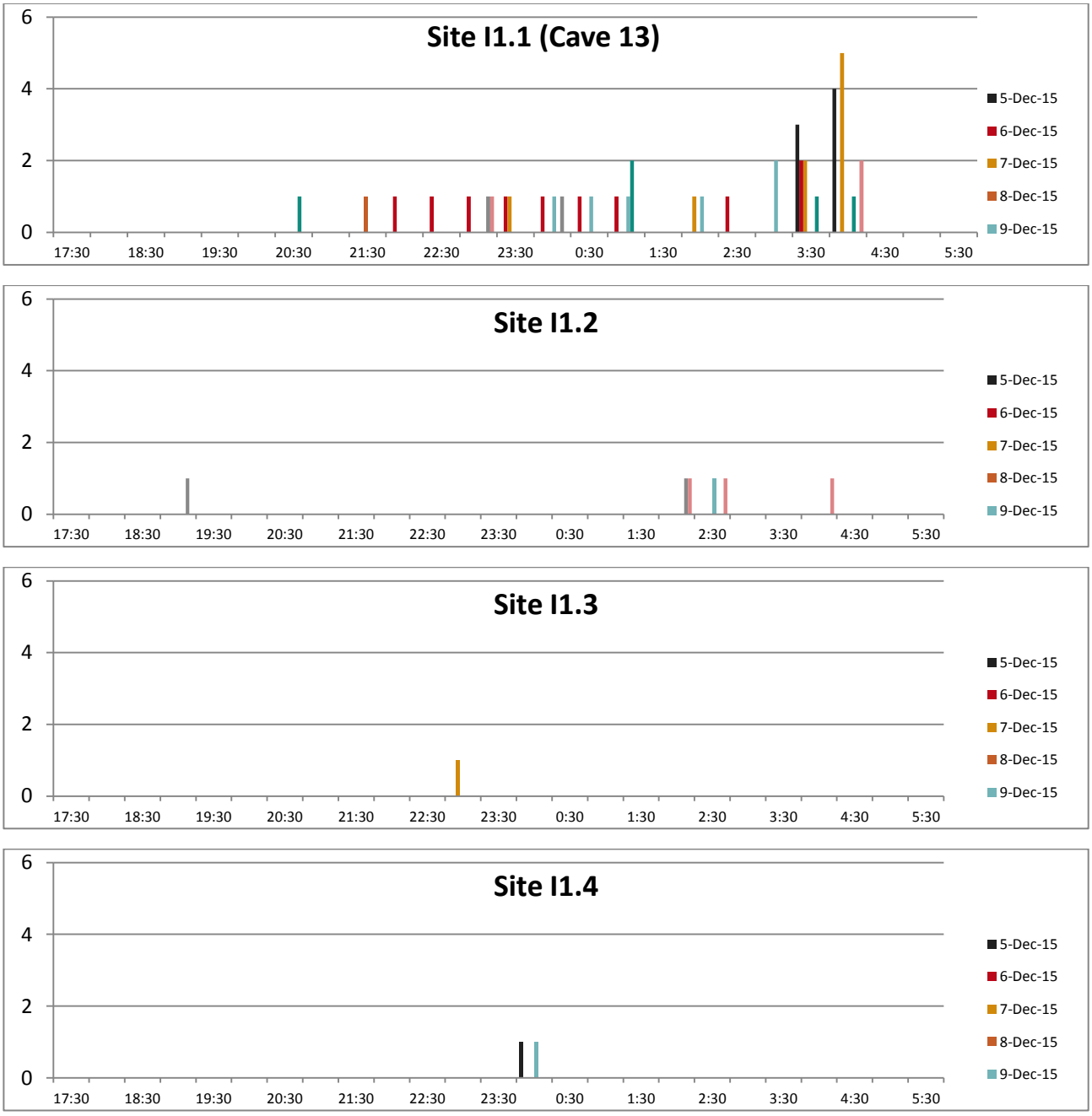


Figure 10: Call patterns from PLNB Impact Site 1 (Cave 13)

3.4.2 PILBARA LEAF-NOSED BAT IMPACT SITE 2

Impact Site 2 was located around the permanent spring known as Fig Pool with subsite 2.1 located on the edge of the pool (one of the long-term monitoring site locations), and the remaining sub sites located to the north along the valley (I2.4) and on the edges of the valley walls (I2.2 and I2.3) (**Figure 2**).

No calls were recorded from the two subsites located on the edges of the valley walls, and only four calls over two nights were recorded at subsite 2.4 located down the valley to the north of Fig Pool (**Figure 11**). The call data suggests that a relatively higher numbers of bats were utilising Fig Pool in late November and early December (when compared to all the data collected during this monitoring period), which appears to indicate that, with the onset of the wet season and its associated hot and humid conditions, the majority of the Pilbara Leaf-nosed Bat population has dispersed.

The call sequence from Fig Pool shows a slight bimodal pattern with slight activity peaks from bats coming to drink and forage at Fig Pool around 9:00 pm and again around 1:00 pm, although calls were recorded at all points between 7:30 pm and 4:00 am (**Figure 11)**.

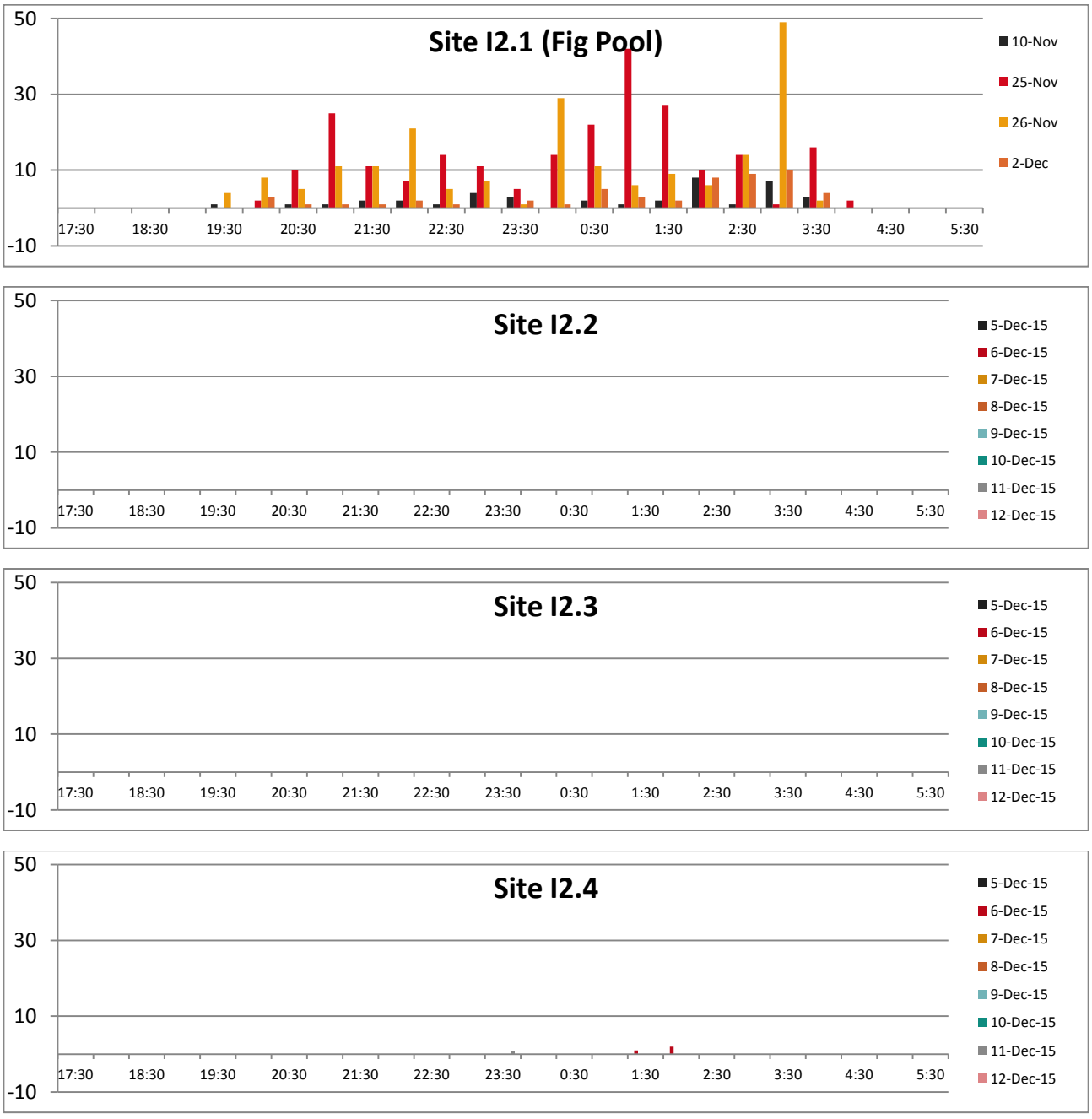


Figure 11: Call patterns from PLNB Impact Site 2 (Fig Pool)

3.4.3 PILBARA LEAF-NOSED BAT IMPACT SITE 3

Impact Site 3 was located around Cave 14 (originally referred to by ecologia (2011a; 2011b)), which is located less than 1 km to the south of impact site PLNB I1 (**Map 3**). Subsite 3.1 was located on the top of the cliff above Cave 14, with the additional subsites located in another suitable gorge to the north (I3.2), and in the valley below the mesa cliff edge (I3.3 and I3.4) (**Figure 3**). Call patterns recorded from all of the sites are relatively low with only one or two calls recorded at a time and less than 20 calls recorded per night. Most of the calls were recorded from subsites I3.1 and I3.2, which were located on top of the cliff (**Figure 12**). Six calls over two nights were recorded at subsite I3.3 and no calls were recorded at subsite I3.4 (both located in the valley below the mesa cliff). The call patterns are spread relatively evenly over the night (11 of the 13 calls recorded on the 10 December were recorded within 4 mins of each other, indicating an individual flying around the SM2Bat+ device) suggesting a foraging individual(s) moving past the site which is located on top of a gully (**Figure 3**). Previous data collected in 2011 from this site indicates the presence of a potential roost cave at subsite I3.1, however the baseline survey was undertaken during the dry season (July 2011) whereas the current monitoring event was completed during the wet season (December 2015).

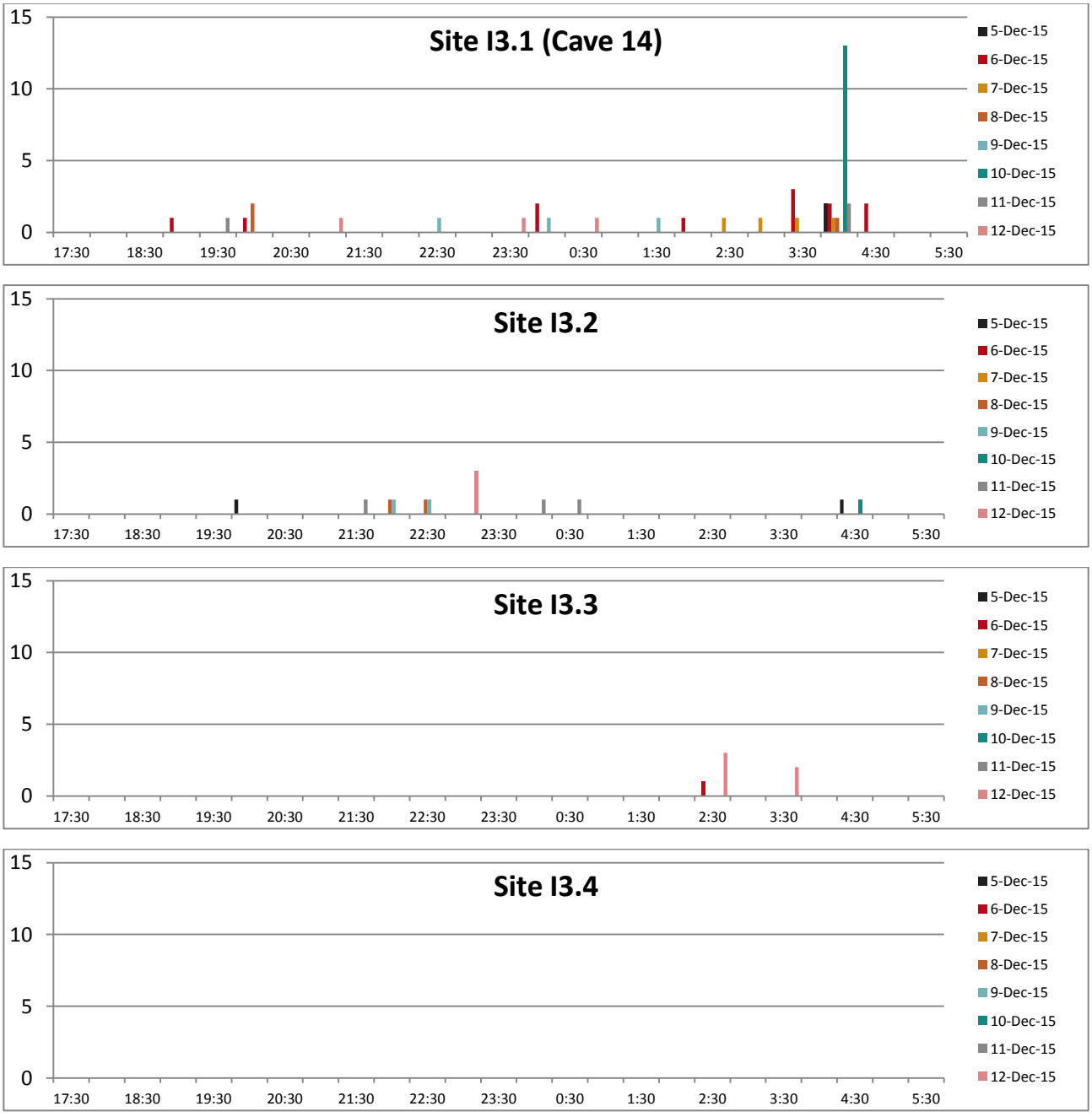


Figure 12: Call patterns from PLNB Impact Site 3 (Cave 14)

3.4.4 PILBARA LEAF-NOSED BAT CONTROL SITE 1

Control Site 1 was located in a creekline approximately 8 km to the west of the mining area (**Map 3**), and is centred around Cave 4 (refers to naming by ecologia (2011a; 2011b). All subsites were located along the bottom of a creekline (**Figure 4**). Only a very low number of calls were recorded from subsites C1.1 (5 calls) and C1.2 (3 calls), and no calls were recorded from subsites C1.3 and C1.4 (**Figure 13**). Calls indicating a potential roost cave were recorded from C1.1 during the baseline survey in 2011 (2011a; 2011b). This data indicates that only a small number of foraging bats utilised the site during the monitoring period. Call patterns recorded during the wet season do not suggest a roost cave. Previous data collected from subsite C1.1 (Cave 6) suggested that the cave may have been used as roost cave during the baseline survey (ecologia2011a; ecologia 2011b), however the data collection in 2011 was completed in the dry season (July 2011) whereas the current monitoring of this site was undertaken during the wet season (December 2015). No definite conclusion can be made from the current data about the use of this site as a dry season roost site.

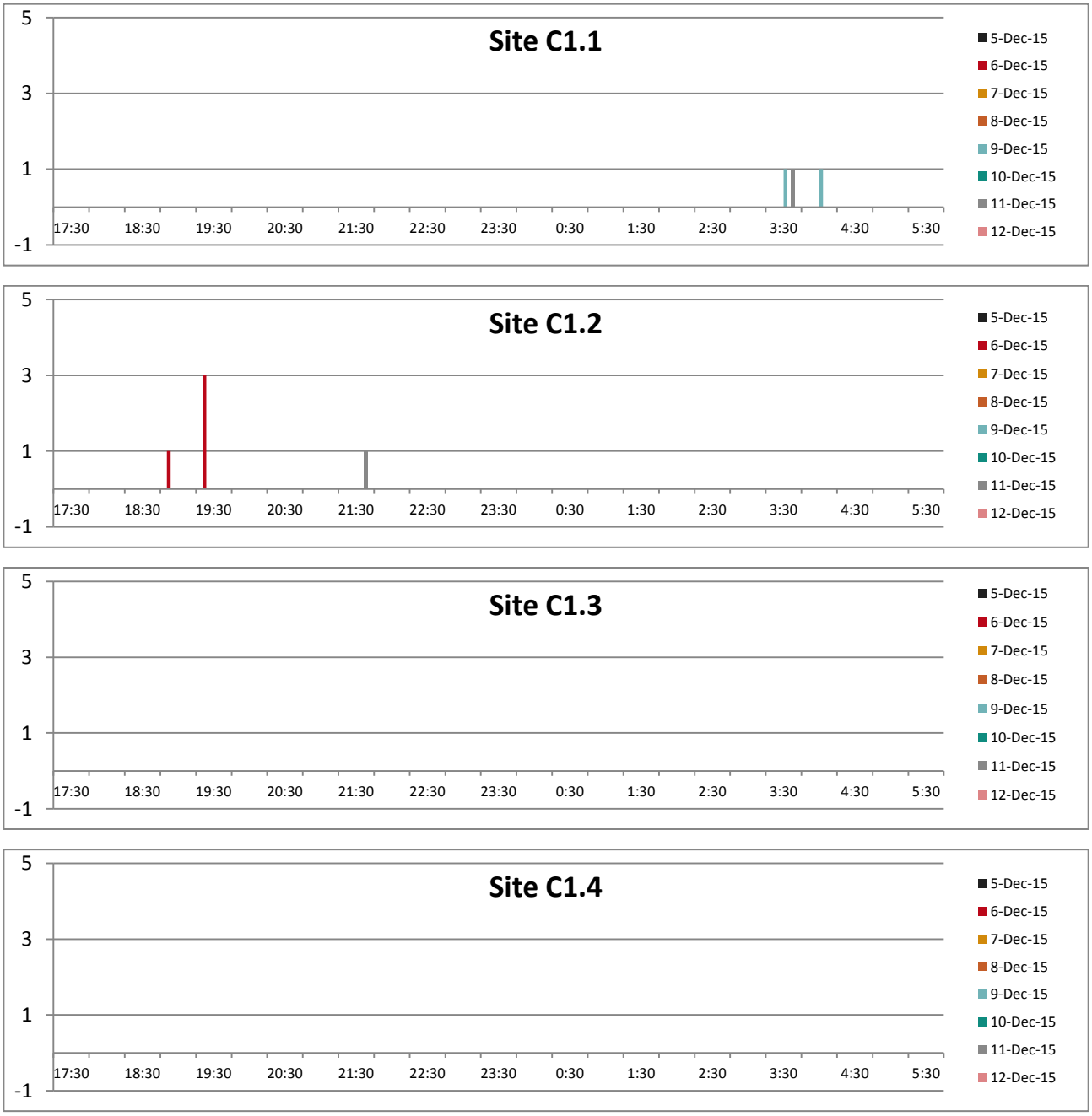


Figure 13: Call patterns from PLNB Control Site 1

3.4.5 PILBARA LEAF-NOSED BAT CONTROL SITE 2

Control Site 2 was located on the edge of the mesa approximately 4 km south of the mining area and is centred around Cave 11 (name refers to ecologia (2011a; 2011b). Although all of the subsites were located on the edge of the mesa cliff, a relatively high number of calls were recorded from subsites C2.3 (211 calls), whilst a low number of calls were recorded at the remaining three subsites C2.4 (27 calls), C2.1 (8 calls) (located near Cave 11), and C2.2 (3 calls) (**Figure 14**). The timing of the calls was spread throughout the nights for all subsites. However, there was a slight peak between 3:30 am – 4:30 am at subsite C2.3 suggesting a low number of individuals foraging in the area during the night, with either bats returning to a roost site pre-dawn or remaining in proximity to the SM2Bat+ unit. Data was collected from subsite C2.1 during the baseline survey in 2011 which suggested that a potential roost cave is located closeby (ecologia 2011a; ecologia 2011b). The current data indicates that the roost site is in the vicinity of subsite C2.3 which lies on top of a rocky gully, approximately 240 m north of subsite C2.1. No caves were recorded, however future monitoring events will be utilised to investigate the location further.

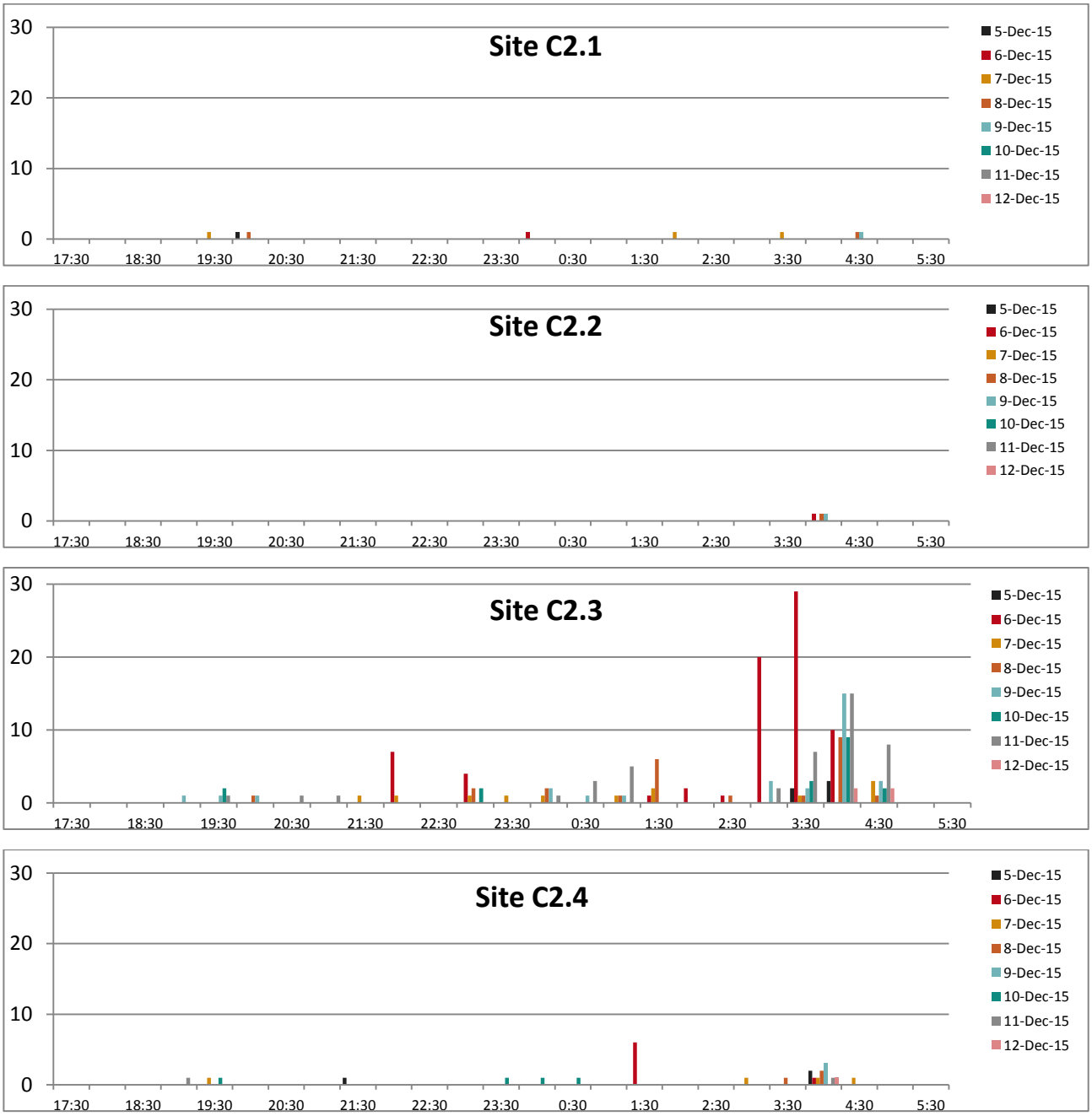


Figure 14: Call patterns from PLNB Control Site 2

3.4.6 PILBARA LEAF-NOSED BAT CONTROL SITE 3

Control Site 3 is located approximately 1 km further south along the mesa cliff edge from Control Site 2, and approximately 6 km south of the mining area and is associated with Cave 2 (ecologia 2011a; 2011b). Subsites C3.1 and C3.2 were located in gorges on the top of the mesa cliff edge, whilst subsites C3.3 and C3.4 were located in a large creekline located in the valley below (**Figure 6**). Subsite C3.2 recorded a relatively high number of calls (55 calls), spread throughout the night, with small peaks around 7:30 pm and 4:00 am. This could indicate the presence of a potential roost site for a very small number of individuals. The site was set-up above a large deep gorge with the potential to harbour small caves, however no roost cave was identified (**Plate 7**). The subsite C3.4 was installed 800 m north-west of the gorge along a creeklines. The call pattern observed at subsite C3.4, whilst relatively low in number (12 calls), has a distinct bimodal pattern, with calls recorded around 7:30 pm and 4:00 am. This pattern suggests a potential roost site for a small number of individuals in the vicinity of control site C3, possibly along the gorge of C3.2. No calls were recorded from subsite C3.1 and only one call was recorded from C3.3 (**Figure 15**). Previous data recorded in 2011 suggested a potential roost cave at subsite C3.1 (approximately 430 m north of C3.2).

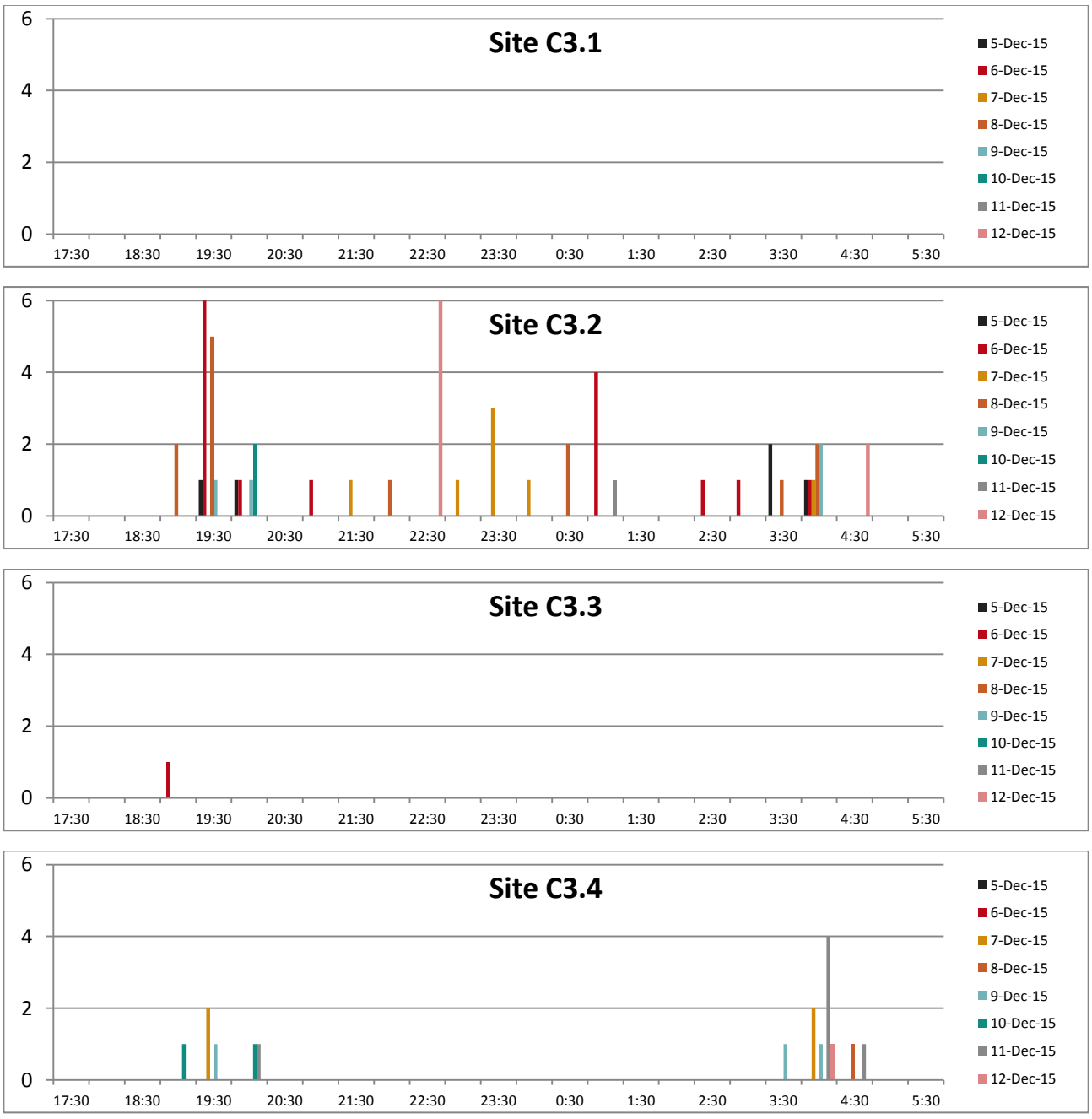


Figure 15: Call patterns from PLNB Control Site 3

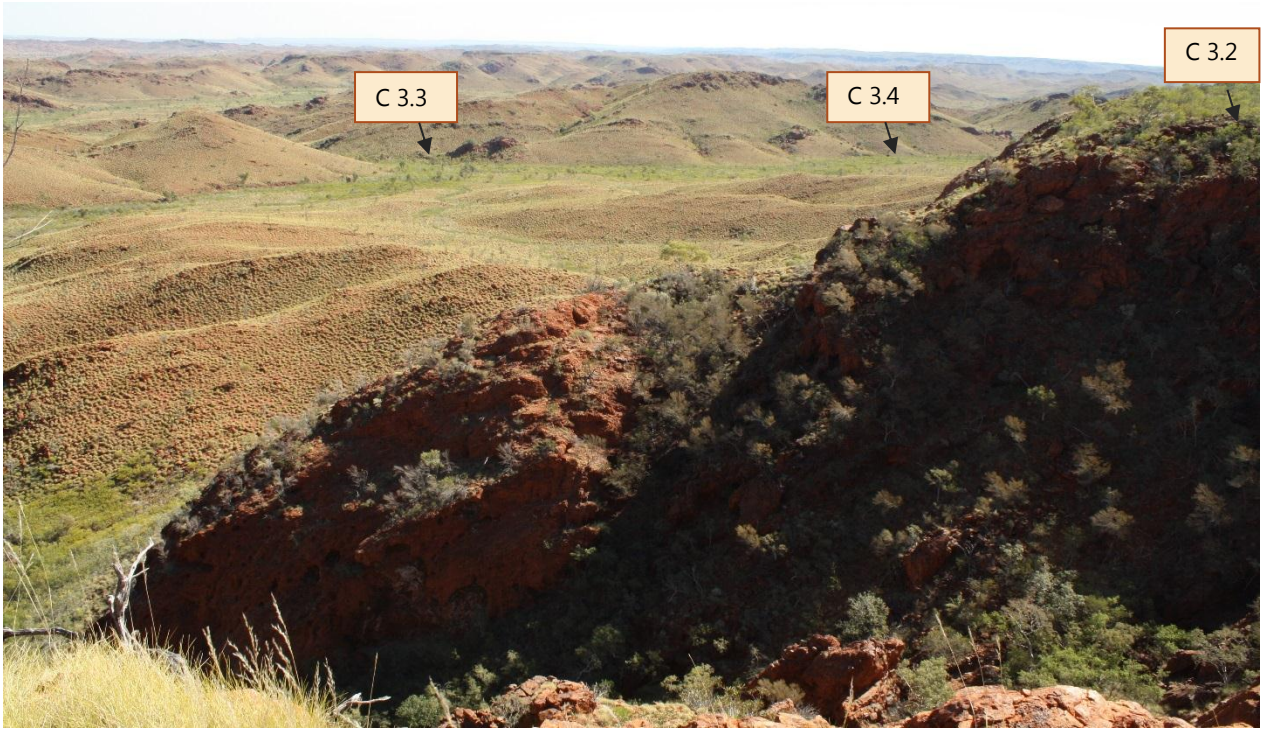


Plate 7: Subsites at Control Site PLNB C3.2

3.5 CONSERVATION SIGNIFICANT BIRDS

One species of migratory bird was recorded from the North Star mine site in impact and control sites: Rainbow-Bee-eater (*Merops ornatus*, EPBC Migratory, WC Act S5). The species was recorded from four locations which are shown in **Table 16** and presented in **Map 11**. The Rainbow Bee-eater is the only species previously recorded from the current mine impact area. Two more species, the Fork-tailed Swift (*Apus pacificus*, EPBC Migratory, WC Act S5) and the Grey Falcon (*Falco hypoleucos* WC Act S1) have been recorded from the vicinity of the mine site during the baseline survey (ecologia 2011a), however these species are not expected to be residents and therefore the Rainbow Bee-eater was targeted in the monitoring. No other migratory bird or listed Falcon species was recorded during the current monitoring event. This result suggests that the Rainbow Bee-eater continues to have a presence, and is not impacted by the mine.

Table 16: Conservation Significant Bird Species Recorded

Species	Site	Date	Count	Coordinates	
				Easting	Northing
Impact sites					
Rainbow Bee-eater	NS NQ-OPP	25/08/2015	1	709525	7647397
Rainbow Bee-eater	NS NQ I4	23/08/2015	1	715908	7649251
Control sites					
Rainbow Bee-eater	NS MiB C2	22/08/2015	1	718106	7655617
Rainbow Bee-eater	NS NQ-OPP	23/08/2015	2	716901	7653382

Datum: GDA94, Zone 50K

3.6 REHABILITATION AREAS

No fauna of conservation significance were recorded from the rehabilitation sites. One reptile species, the Ring-tailed Dragon (*Ctenophorus caudicinctus*) was recorded from one location (NS R1).

All rehabilitation sites were located on hilltops in the closest available rehabilitation earthworks to mapped Northern Quoll habitat. These sites are established in habitats dominated by rocky, stony soils with dominant vegetation of *Eucalyptus leucophloia* low isolated trees, over tall *Acacia tumida* sparse shrubland over *A. orthocarpa* and *A. ptychophylla* mid open shrubland, *over Triodia wiseana* hummock grassland. Not all sites were placed in the critical habitat due to the absence of rehabilitation works within the majority of Northern Quoll habitat. However, foraging or roaming Northern Quolls are known to traverse hilltops and may utilise rehabilitation areas as easily traversable terrain; as per the ecologia (2014) radio tracking results in the 2014 monitoring event and the current monitoring event.

3.7 SITE BASED RECORDS OF CONSERVATION SIGNIFICANT FAUNA

Records from Fortescue's Plant and Animal register were provided on the 22/01/2016 and reviewed for conservation significant fauna records of target species being monitored.

Sightings were sorted into verified and unverified records based on the information available. The categories are as following:

- Photograph = Confirmed
- No photograph, but anecdotal evidence suggests likely = Probable confirmed
- No photograph, or supporting evidence = Unconfirmed

Three Northern Quoll and eight Pilbara Olive Python have been recorded by site personnel at the North Star mine in 2015. All records are listed in **Table 17**. The data also includes the road death of two individual Northern Quolls which in both cases were captured during the monitoring program in 2014 (female) and during the current monitoring (male). One Pilbara Olive Python was also recorded as road kill from site personnel. Ecoscape staff scanned the individual for microchips which resulted in no positive identification.

Table 17: Species recorded by site personnel

Species	Inc. no.	Dates	Coordinates		Notes	Verified
			Easting	Northing		
Northern Quoll	PAR-1197	21/03/2015	7647791	712555	1 individual	Probable confirmed
Northern Quoll	INC-44740	24/02/2015	712542	7647772	Female road kill (PIT 941000016595479)	Confirmed, microchip scanned
Northern Quoll	INC-48890	19/10/2015	712221	7649994	Male road kill (PIT 941 000017452061)	Confirmed, microchip scanned
Pilbara Olive Python	PAR-1128	25/01/2015	7648451	708829	1 individual	Confirmed
Pilbara Olive Python	PAR-1133	26/01/2015	7650318	713354	1 individual	Confirmed
Pilbara Olive Python	PAR-1254	24/04/2015	7647975	706327	1 individual	Confirmed
Pilbara Olive Python	PAR-1180	10/02/2015	708186	7648219	3 individuals, relocated to 711068mE, 7647951mN	Probable confirmed
Pilbara Olive Python	PAR-1179	24/02/2015	708152	7648236	1 individual, relocated to 711046mE, 7647980mN	Confirmed
Pilbara Olive Python	INC-43357	26/12/2014	-	-	1 individual (2m TL), road kill on haul road	Confirmed
Rainbow Bee-eater	PAR-1470	13/11/2015	708151	7648592	1 individual	Probable confirmed

Datum: GDA94, Zone 50K

3.8 INTRODUCED FAUNA SPECIES

Two species of introduced fauna species were recorded on motion cameras during the current monitoring: European Cattle (*Bos taurus*) and the Feral Cat (*Felis catus*). European Cattle was recorded from one motion camera at site location (MC I1) and Feral Cats were recorded from three locations (MC I1, MC I2 and MC I6). Feral Cats have not been previously recorded from the North Star mine site during previous surveys and monitoring.

4 DISCUSSION

4.1 NORTHERN QUOLLS

During the 2014 monitoring, four females Northern Quolls were captured from one impact and two control sites (NQ I1, NQ C1 and NQ C2). During the 2015 monitoring, three of these female Northern Quolls were recorded that were originally trapped in 2014. The fourth female was found deceased on the main North Star access tract in February 2015 approximately 400 m from the initial capture in 2014. The location and monitoring sites from which the three recaptured females in this monitoring event were recorded was consistent with that from the monitoring in 2014 (e.g. female PIT 941000016595571 was captured at impact site NQ I1 in 2014 and was also recaptured from this site in 2015). The female captured at site NQ I1 was captured 730 m from the infrastructure (Ore Processing Facility and laydown areas) and showed signs of breeding with a developed pouch and small pouch young. The repeated capture of this female in combination with signs of breeding suggests that female Northern Quolls at North Star utilise consistent areas and habitats for breeding, despite ongoing mining activities.

No males were recaptured in 2015, from those captured in 2014. This may be due to a change in breeding season which took place earlier in 2015 (prior to monitoring) than in 2014 (post monitoring event). However, it is also thought that males do not live through the breeding season and instead undergo an annual die-off (Braithwaite & Griffiths 1994; Oakwood 2000; Oakwood 2002). Females are known to live through up to two or three breeding seasons which is also supported by the data collected from the North Star site during the current monitoring (recapture of breeding females) (Braithwaite & Griffiths 1994).

The average weight of males during this years' monitoring was lower in comparison to that recorded in 2011 and in 2014. However, it is hypothesised that this is related to the timing of the breeding season in relation to the trapping program. The breeding season was well advanced during this years' monitoring in comparison the previous years when no developed pouches were recorded during monitoring in late August. Females would have been putting on weight in preparation for the physiological demands of rearing young; males will have lost condition (and hence weight) due to reduced food intake and the exertion of roaming and mating. Due to the variation of weight due to the timing of the breeding season inferences made from the data should be treated with some caution. Since males are known to travel long distances during the mating season, their health condition and possibly weight decreases during this period, which often results in the male die-off (Braithwaite & Griffiths 1994; Oakwood 2000; Oakwood 2002). In contrast, the average weight of females has increased since 2011.

Population size estimates suggests that the species' presence is ongoing with a consistent density of Northern Quolls and a slight increase of the population across the impact area. Data collected from motion cameras support the statistical analysis undertaken to determine population trends in Northern Quolls on site. Motion camera recordings have been consistent in the impact area with five motion camera impact sites recording the presence of the species during the two monitoring events (2014 and 2015). Records at motion camera control sites decreased between 2014 and 2015 with four sites not recording the species in 2015 where it was recorded in 2014. One of these motion camera sites (MC C9) was located at a monitoring trap site (NQ C2), where the number of individuals captured also decreased from five individuals in 2014 (two females, three males) to one individual (female) in 2015. The lack of records on motion cameras is likely due to a decrease in population size at this site. The reason for the lack of records at the remaining three motion camera control sites may be due to fact that the mating season had taken place prior to the 2015 monitoring and that the males' home range reduced. Mating was still ongoing during the 2014 monitoring which made it more likely to record roaming males from those sites. Males are less likely to travel long distances and therefore have a lower likelihood to be recorded on motion cameras once the mating season is finished. However, the decrease of records across the motion camera control sites is supported by the decreased population size and density estimates across the control trap sites.

The GPS tracking results have shown that home ranges of males can vary significantly between different seasons. The home range of a radio tracked male in 2014 was significantly larger (3,887 ha with a core territory of 525 ha) than that of the GPS tracked male during the current monitoring period (5.9 ha territory) which was even smaller than that of the female Northern Quoll (80 ha home range). Based on the observation from the trapping program, breeding season had started which supports the relatively small home range of the radio tracked male in 2015. This result is expected to be a representation of the changes in roaming behaviour that male quolls exhibit during the different phases of the breeding season with home ranges being largest during the mating period (Braithwaite & Griffiths 1994; Dunlop *et al.* 2015; Oakwood 2000).

The data from the two radio tracked individual Northern Quolls suggests that the behaviour of the local population has not been impacted by the mining activity on site. The male resided in close proximity (30 m) to the haul road and also utilised lay down areas one occasion with further crossings of the haul road (**Map 8)**. In addition, the data of the female Northern Quoll indicate residence within 400 m to the mine pit whilst blasting activities occurred. The movement pattern of the radio tracked female show the individual travelled up to 1.06 km during a single night, which correlates well to typical movement patterns between dens in females Northern Quoll described in literature (Oakwood 2002). The recorded home range of the female of 80 ha (13 ha core territory) is similar to territories of females recorded during other studies in the northern Pilbara (8.2 – 15.8 ha), Kimberley region (0.8 – 15.38 ha) and Northern Territory (average of 35 ha) (Cook 2010; Dunlop *et al.* 2015). Typical home ranges for the male Northern Quoll in the northern Pilbara were recorded between 1002 ha and 2896 ha, whereas the home ranges in the Northern Kimberley are known to be less than 421 ha and larger than 100 km in the Northern Territory (Cook 2010; Dunlop *et al.* 2015; Oakwood 2002).

The recapture data suggesting that females reside within the impact area over successive years to breed (observed in 2015) is also supported by the results from the GPS tracking, and the statistical analysis which shows that no changes in population density has occurred since 2015. The overall density estimated for the impact area in 2014 (0.016) is consistent with that recorded in 2015 (0.017). When comparing the 2015 monitoring with the 2014 monitoring, it indicates that there is no significant change evident in population size and density.

The close proximity (730 m) of a breeding female (impact site NQ I1) to the mining infrastructure (Ore Processing Facility and laydown areas) and the recording of female residing within 500 m to the active mining area throughout the tracking period (over four weeks) suggests that the behaviour of the Northern Quoll population on site is not impacted by mining activities. Some impacts may occur on single individuals in form of road deaths; however, it does not appear to impact the ongoing occurrence of the local population to date.

4.2 PILBARA OLIVE PYTHON

The occupancy probability and detection probability were estimated using results from all three monitoring events (wet season 2013/2014, 2014/2015 and 2015/2016). Based on this data, the occupancy probability (ψA) during the current monitoring was estimated as 75% (ψA = 0.75) for impact sites. This is an increase from previous years (10% 2013/2014 and 50% 2014/2015) and is likely a reflection of the analysis being run with comparatively more robust and complete data (three years compared to one or two years in previous monitoring events), rather than a reflection on population structure change. The occupancy probability estimated for control sites increased to 59% (ψA = 0.59) between the first and second monitoring event and decreased to 50% (ψA = 0.50) during the current monitoring. As with the impact sites, it should be noted that these statistics are conducted with a more robust dataset as there is now three years of data in the analysis as compared to one and two years in previous years' analysis (**Table 14**). The occupancy probability was also estimated as naïve estimator (NED), for both each monitoring event separately, as well as all monitoring events to date (**Table 14)**. The NED for the current monitoring period indicates indicated that 25% of all impact sites and 50% of all control sites were occupied by Pilbara Olive Python. When considering the results of the previous monitoring events this estimator suggests that 75% of impact and control sites have been occupied by the Pilbara Olive Python to date.

The detection probability of the Pilbara Olive Python is estimated at 59% at impact sites and 98% at control sites after this year's monitoring event. This result suggests that all Pilbara Olive Pythons occurring at the control sites were detected during this years' monitoring, whereas the detection of the species at impact sites could have potentially been increased with additional site visits. This may have resulted from the lack of records at impact sites POP I1 (possibly due to lack of surface water during the monitoring) and the lack of recaptures of individuals at impact sites. The cause of the dry conditions at this site is mainly unknown since total amount of rainfall in 2015 was with 517.5 mm comparable with previous years, however rainfall prior to monitoring was relatively low (**section 3.1**).

The repetition of monitoring events over the last three years has improved the robustness of the statistical analyses that can be calculated using the available data; however, changes in population sizes have not been able to be determined to date, due to the lack of suitable recapture data associated with the low detectability associated with the cryptic nature and low population density exhibited by this species (Pearson 2003).

When comparing the number of Pilbara Olive Pythons recorded on site, a slight decrease of Pilbara Olive Pythons was observed between the baseline monitoring in 2011 and the first year of monitoring in 2014, which was then followed by an increase in numbers in 2015 and a decrease again during the current monitoring at North Star mine site. However, these results are observations only and cannot be statistically tested and as such should be treated with some caution. The number of Pilbara Olive Python recorded was highest during the 2011 baseline surveys, when five individuals were recorded from the impact area and one individual was sighted at the control sites. A direct comparison of these results cannot be made due to the differences in methodology and survey effort in 2011, compared to the three monitoring events.

During the past two monitoring events, a number of juveniles have been recorded from impact sites. This shows that the species is present on site and has remained as a viable breeding population. The ongoing occurrence satisfies the Hypothesis as outlined in the TFMP which requires that the species continues to be present on site. At this point, it appears that a relationship between the number of individuals and the rainfall experienced on site does not exist (**Figure 16**) as the species has been recorded during dry an wet conditions. However, the monitoring events were undertaken during years with more rain than that recorded from 2011 (**section 3.1**), which has potentially changed the movement patterns of the species.

Conditions during the monitoring events were relatively dry with minimal surface water in particular at impact site POP I1 (ecologia 2011a; ecologia 2011b; Ecoscape 2015a) which may be due to the low amount of rainfall events immediately prior to the summer monitoring event in 2015 (total of 14.5 mm in Nov & Dec 2015). However, the total amount of rainfall recorded across 2015 is comparable with previous years (**section 3.1**).

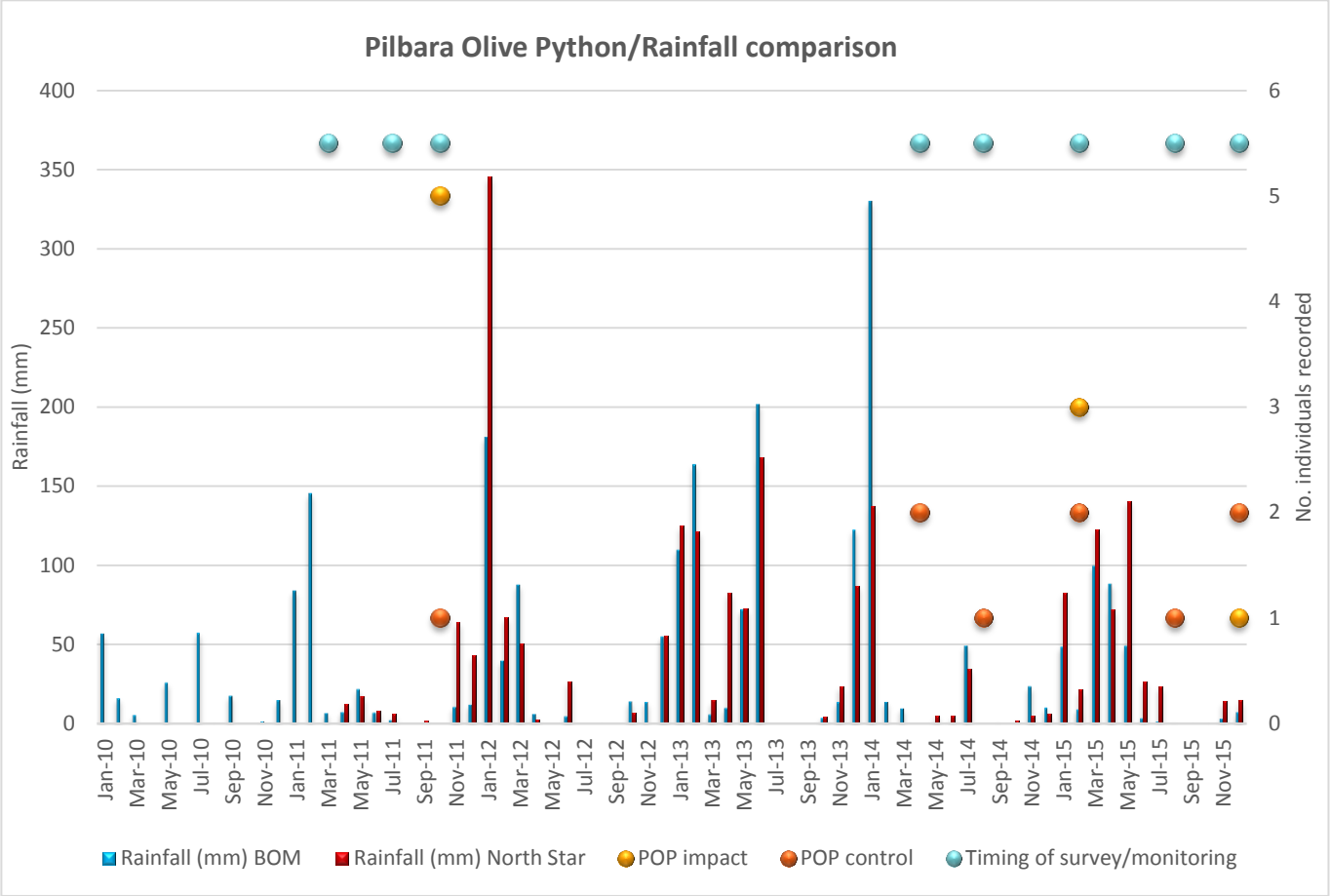


Figure 16: Rainfall at North Star (FMG) and Marble Bar (BoM station no. 4106) for each monitoring event

4.3 PILBARA LEAF-NOSED BATS

The highest frequency of Pilbara Leaf-nosed Bat calls were recorded at Fig Pool (one of the long-term monitoring sites), although not directly comparable due to the different dates analysed. The high number of calls from the location may be due to a high frequency of individuals passing through the area, producing a larger number of unique calls; or a lower number of individuals remaining in the vicinity of the site where repeated calls are recorded. All calls recorded show a typical foraging call pattern with recordings across the night (between 7:30 pm and 4:00 am with some indication of peaks around 9:00 pm and 2:00 am, which may indicate foraging individuals coming in to drink after foraging. The second long-term monitoring site is site PLNB I2.1 (Cave 13), where a low number of calls were recorded across the night, which typically indicates that it is not used as a roost cave at the time of monitoring. This data needs to be treated with caution due to the timing of the monitoring. The current monitoring of the Pilbara Leaf-nosed Bats at North Star was completed during the wet season when the climate is generally wetter and more humid (**section 3.1**). However, this years' wet season was relatively late with very little rainfall experienced prior to monitoring. The wet season also coincides with the species' breeding season. Females are then leaving their dry season roost cave shortly before giving birth in late December/early January to utilise other food sources, and roost along creeklines and other habitats that provide a high humidity (Churchill 1998; Churchill *et al.* 1988; Churchill 1991). Females and young then return to their dry season roost sites.

Sites that recorded a call pattern indicating a foraging site may be used as dry season roost habitat during the cooler months when humidity is less likely to be high enough outside of caves. Call patterns from control subsite C3.2 were spread across the night with small peaks just after sunset and before sunrise. This could indicate the presence of a roost site for a very small number of individuals. The call pattern observed at subsite C3.4 whilst is still relatively low in number, the distinct bimodal pattern with calls recorded around sunset and sunrise also indicates a roost site for a small number of individuals. This subsite lies at the bottom of the gully in relation to subsite C3.2 and may have recorded some of the individuals leaving the

roost. During the baseline survey in 2011, the site near C3.2 was identified as a potential roost cave due to the bimodal pattern of calls recorded from this location (Bat Call WA 2013; ecologia 2011a; ecologia 2011b). This result may indicate that Pilbara Leaf-nosed Bats are utilising a location within the gorge where C3.2 is located as roost on an ongoing basis. Subsites C2.3 and C2.4 are thought to be located in the vicinity of a roost cave. Both sites lie 240 m north (C2.3) and south (C2.4) of subsite C2.1 which was assessed as potential roost site in 2011. During the current monitoring subsite C2.1 did not record a call pattern typical for a dry roost site (**Figure 14**). No cave was present at subsites C2.3 and C2.4, however it is likely that a suitable roost cave is located along the breakaway near subsite C2.3. Future monitoring will investigate the area further to try and locate the population of Pilbara Leaf-nosed Bats in this vicinity.

All other recordings from sites indicate foraging bats only and no further roost sites were identified. The call patterns from the two subsites PLNB I1.1 and PLNB I2.1 (long-term monitoring sites) recorded during the current monitoring period are consistent with previous results in 2014 (Bat Call WA 2015) during the month of December. This coincides with the season when individuals are able to disperse during the hot humid summer months and activity at dry roost caves is generally low. Overall, the bat activity at the monitoring sites was comparable between the baseline survey and the current monitoring (ecologia 2011a; ecologia 2011b). This is shown in recordings from control sites PLNB C3 where approximately 20 calls per night where recorded during the baseline survey and up to 15 calls were recorded during the current monitoring. At control site PLNB C2, a total of 66 calls were recorded during a single night during the baseline survey, whereas up to 74 calls were recorded during the current monitoring (ecologia 2011a; ecologia 2011b). Calls recorded from the impact area were also comparable with a total of 10 calls (single night) recorded from impact site PLNB I3 during the baseline survey (2011) and up to 13 calls per night during the current monitoring (ecologia 2011a; ecologia 2011b). However, the baseline survey was undertaken during the dry season whereas the current monitoring was undertaken during the early wet season so any comparison of data is to be treated with caution.

The continued presence of bats at all sites indicates that Pilbara Leaf-nosed Bats remain present at the North Star mine site.

4.4 CONSERVATION SIGNIFICANT BIRDS

The Rainbow Bee-eater was the only conservation significant birds species recorded during the monitoring. In addition, the Fork-tailed Swift and the Grey Falcon were recorded during the baseline survey from site and the infrastructure corridor. The Fork-tailed Swift is not a resident at the North Star mine site due to its aerial lifestyle (Simpson & Day 2004). The Grey Falcon was associated with repeater towers along the BHP IO rail line to the west (ecologia 2011a) with two individuals observed on a radio tower next to the BHP rail line during the journey to site for the summer monitoring event (pers. comms. D. Cancilla 2015). The Rainbow Bee-eater has an ongoing presence at the North Star mine site impact sites and control sites.

4.5 REHABILITATION AREAS

No Northern Quolls or other fauna of conservation significance were recorded from the rehabilitation sites. Sites were placed in the closest suitable rehabilitation area to critical habitat. NS R3 had the highest probability of recording the Northern Quoll (if present) as it is in the closest vicinity to the ridgeline (approximately 30 m). NS R1 and NS R2 are located on the hilltop approximately 700 m and 500 m from the ridgeline respectively; and have a lower chance of recording the Northern Quoll. However, it is possible to record roaming or foraging individuals in these locations as radio tracking data during this monitoring event shows that Northern Quolls do frequent hilltops within 1.06 km of their core habitat.

One reptile species, the Ring-tailed Dragon (*Ctenophorus caudicinctus*) was recorded from one location (NS R1). Further monitoring events will identify the use of rehabilitated areas in particular when larger areas have undergone rehabilitation.

4.6 LIMITATIONS AND CONSTRAINS

All aspects of the conservation significant fauna monitoring were completed during the current monitoring event. The requirements of the TFMP have been satisfied; however, some limitations have been experienced during the current monitoring period.

All Northern Quoll monitoring sites were kept consistent with the previous monitoring events with the exception of some traps at site NQ C4 and NQ I3 being moved within the monitoring site due to safety related hazards, including feral bee hives and walking in proximity to cliff faces. However, general site locations and habitats sampled were consistent to previous years of monitoring; as such, no impacts on results were expected.

The timing of the Pilbara Leaf-nosed Bat monitoring was in the wet season to be consistent with the TFMP. Bats, in particular the Pilbara Leaf-nosed Bats are known to almost always leave their dry season roost site which typically consist of deep humid caves (Baudinette *et al.* 2000; Churchill 1998) to forage and roost along water courses which provide a high level of humidity (Churchill 1991). Due to the abandonment of the dry season roost caves during wet season, any direct comparison of data between the baseline survey (undertaken in dry season) and the current monitoring needs to be treated with caution.

During the current monitoring, technical issues were experienced associated with long-term monitoring sites, no data was recorded at subsite 1.1 during the monitoring period, therefore available data from four non-consecutive days preceding the monitoring period was used for comparison.

5 COMPLIANCE WITH FAUNA MANAGEMENT PLAN

5.1 METHODOLOGY

The methodology used during the current monitoring was compliant with the North Star fauna management plan.

5.2 HYPOTHESIS

Hypothesis 1: There will be no long-term statistically significant decline in relative abundance of Northern Quoll across impact sites compared to control sites.

The relative abundance of Northern Quolls across the impact area was determined to be comparable to previous years of monitoring and to control sites. Overall capture probability was slightly lower in comparison to the 2014 monitoring (26% in 2015 to 42% in 2014); however, this is thought to be due to the early mating season which is thought to have occurred prior to the trapping in 2015, as indicated by the lower number of trapped males in the current monitoring event in comparison to the previous year (eight in 2015 versus 12 in 2014 and 16 in 2011).

The overall density was consistent for the control sites between all years of trapping and monitoring. Within the impact area, the overall density estimated was consistent between the 2014 and 2015 monitoring, indicating that there has been no significant change in population size and density. In addition, the recapture data suggests that females reside within the impact area over successive years to breed (observed in 2015) and the results from the GPS tracking indicate that the behaviour of Northern Quolls is not impacted by the mining activity on site.

Hypothesis 2: EPBC listed fauna species previously recorded within the area of impact will continue to have an ongoing presence.

All three species listed under the EPBC Act and occurring at the North Star mine site are present and have been recorded on an ongoing basis. In addition, the Rainbow Bee-eater is shown to have an ongoing presence on the North Star mien site and no impact has been recorded to date.

Northern Quoll were recorded with no significant change in presence and abundance between 2014 and 2015, even when considering the baseline data from 2011. The estimated population size on site was consistent at the impact area between the two years of monitoring (nine individuals in 2014 and 10 individuals in 2015) whereas the population size at the control area experienced a slight decrease (nine individuals in 2014 and seven individuals in 2015). Density estimates are consistent between the two monitoring periods for both, impact and control areas.

Pilbara Olive Pythons were recorded with no significant changes between the three years of monitoring. The species is present within both the impact and control area. The number of Pilbara Olive Pythons has varied slightly between the monitoring periods (two in 2014, five in 2015 and three during the current monitoring); however, this is thought to be due to the elusive nature of the species and difficulties in the detection of the species. Site based records throughout the year have also shown that the species is still present on site.

Pilbara Leaf-nosed Bats were recorded at all sites in varying densities showing that the North Star mine site is still being utilised by this species. The timing of the monitoring appears to have been post the summer dispersal of the species, with relatively lower numbers of individuals remaining in dry season roost caves during the wet season. However, the overall number of calls recorded at sites surveyed during the baseline survey and the current monitoring was comparable.

5.3 LESSONS LEARNT

One of the most important stages when using adaptive management plans is when the information that has been collected is used to make informed decisions about the continued implementation of the monitoring program. With regard to the North Star mine site, the Stage 1 (Hematite) is approaching completion and there is currently two years of monitoring data and additional baseline and targeted survey information. Using this information, which has been discussed in detail above, some basic questions regarding the North Star mine site and its impact on the conservation significant fauna species included in this monitoring program can be answered.

Once Stage 1 of the North Star mine site is complete, the mine site will potentially progress into the much larger Stage 2 (Magnetite) which consists of additional ore bodies and infrastructure, and will be developed over several years. It is estimated that there will be a period where little to no development occurs on site, thus a period where potential impacts are minimal. The below section looks at what has been learnt from the current monitoring program and how it can be adapted based on the upcoming changes to activity levels on site.

5.3.1 NORTH STAR HAEMATITE (STAGE 1)

The results from the Northern Quoll monitoring indicates that the species has not been significantly impacted by Stage 1. Viable and active breeding populations remain in the vicinity of the North Star mine site with both larger second year females (recaptured) and smaller first year recruits recorded during each monitoring event. The results of the radio tracking has shown that Northern Quoll will venture into both the mining and infrastructure areas (despite active blasting in close proximity) and maintain home ranges in proximity to the Stage 1 development for extended periods, all of which indicates that they are not being pushed away from the suitable habitat located in proximity to the North Star mine site.

The results of the Pilbara Olive Python monitoring need to be treated with caution (mainly due to the low detectability associated with the cryptic nature of the species, and a lack of sufficient recapture events); however, the monitoring program has shown that Pilbara Olive Python are maintaining a presence within suitable habitat associated with Stage 1. The presence of new individuals during each monitoring event and the presence of juveniles indicated the presence of a breeding population associated with Stage 1. However, no individuals have been recaptured at the impact monitoring sites, which precludes the accurate estimation of population sizes and densities. As such the current monitoring has yet to collect sufficient data to accurately detect potential impacts to the local Pilbara Olive Python population.

The results of the Pilbara Leaf-nosed Bat monitoring has also shown that populations are persisting in proximity to Stage 1 with areas previously identified as roost sites maintaining populations. As the current monitoring event is the first year using the short-term monitoring sites, only the continued presence of this species can be confirmed. Activity levels at these sites are similar to those recorded during the baseline survey in 2011. Data from the long-term monitoring sites will be detailed in a separate report in May 2016.

The monitoring of conservation significant bird species has also shown that the Rainbow Bee-eater continues to be present on site and that no impacts have been experienced. No other conse3rvation significant birds are considered likely to occur, or are impacted by the North Star mine site.

The monitoring program up to this point has shown that all four conservation significant fauna species are persisting in proximity to Stage 1 which has reached the point where no additional development is expected. Therefore we can state that based on the current monitoring data, Stage 1 has not resulted in the loss of Northern Quoll, Pilbara Olive Python, Pilbara Leaf-nosed Bat or Rainbow Bee-eater populations associated with the North Star mine site.

5.3.2 POTENTIAL INACTIVE PERIOD BETWEEN STAGES

Stage 1 is expected to conclude in mid-2016 with the development of the Magnetite Stage 2 expected in the near future, thus resulting in a period where no development and therefore no additional impacts are expected to occur. Generally, it can be considered that during the period between stages, the level of monitoring can potentially be reduced to a level that will detect the continued ongoing presence of each species. Once development is planned to begin for Stage 2 the monitoring program should be continued in a manner that is consistent with monitoring programs across the Pilbara, whilst also addressing the specific needs of Stage 2.

During the inactive period between Stage 1 and Stage 2 Northern Quoll monitoring should be reduced to only consist of monitoring for the continued presence of this species within the impact areas of both the Stage 1 and Stage 2. The use of motion cameras is considered to be the most suitable method as units can be deployed for relatively long periods and the continued presence of this species can be determined whilst mining activities are minimal.

The Pilbara Olive Python population associated with the North Star mine site is still not adequately understood and due to the slower reproductive rate of this species, changes in the population size and structure of this species will take longer to become apparent, therefore monitoring should continue during the inactive period using the current monitoring methodology to continue to build on the data already collected. Suitable alternative methods are not currently available however any future developments should be considered.

Pilbara Leaf-nosed Bat monitoring should also continue during the inactive period using the current monitoring methodology. Confirming the extent of this population prior to the development of the Stage 2 will assist with future monitoring programs associated with Stage 2.

As the impact on Rainbow Bee-eater is not likely to be significant during the inactive period, monitoring for conservation significant birds may not be undertaken during this period.

The continuation of monitoring during the inactive period should also be reassessed after each monitoring event to ensure that monitoring activities are consistent with the ongoing level of activity on site.

5.3.3 NORTH STAR MAGNETITE (STAGE 2)

As Stage 2 timelines are yet to be confirmed the timing of the implementation of monitoring programs specific to this stage cannot be estimated; however, monitoring should be continued within the calendar year that Stage 2 is expected to begin development. This will allow the collection of monitoring data from the beginning of the development process which is often the period when the greatest impacts can occur. The monitoring design should also be developed to both utilise current monitoring sites, whilst also taking into account the increased development size associated with Stage 2.

Once the development of Stage 2 begins, monitoring of Northern Quoll should continue using monitoring methodology that allows population density to be determined whilst major impacts are occurring in Northern Quoll habitat such as the breakaway of the mesa, west of the current mining area; with the frequency and intensity reviewed after two years. One option would be to align monitoring with DPAW Pilbara monitoring for Northern Quoll. This would potentially allow the reduction of the number of control sites required.

Pilbara Olive Python, Pilbara Leaf-nosed Bat and conservation significant bird monitoring should continue using the current methodology with site locations determined based on the ongoing and future development of Stage 2 taken into consideration. The intensity and frequency of the monitoring should be based on ongoing analysis of results and the ongoing development of Stage 2. If after two years monitoring data shows that there are no impacts to populations, the frequency and intensity of monitoring may be reduced, if appropriate.

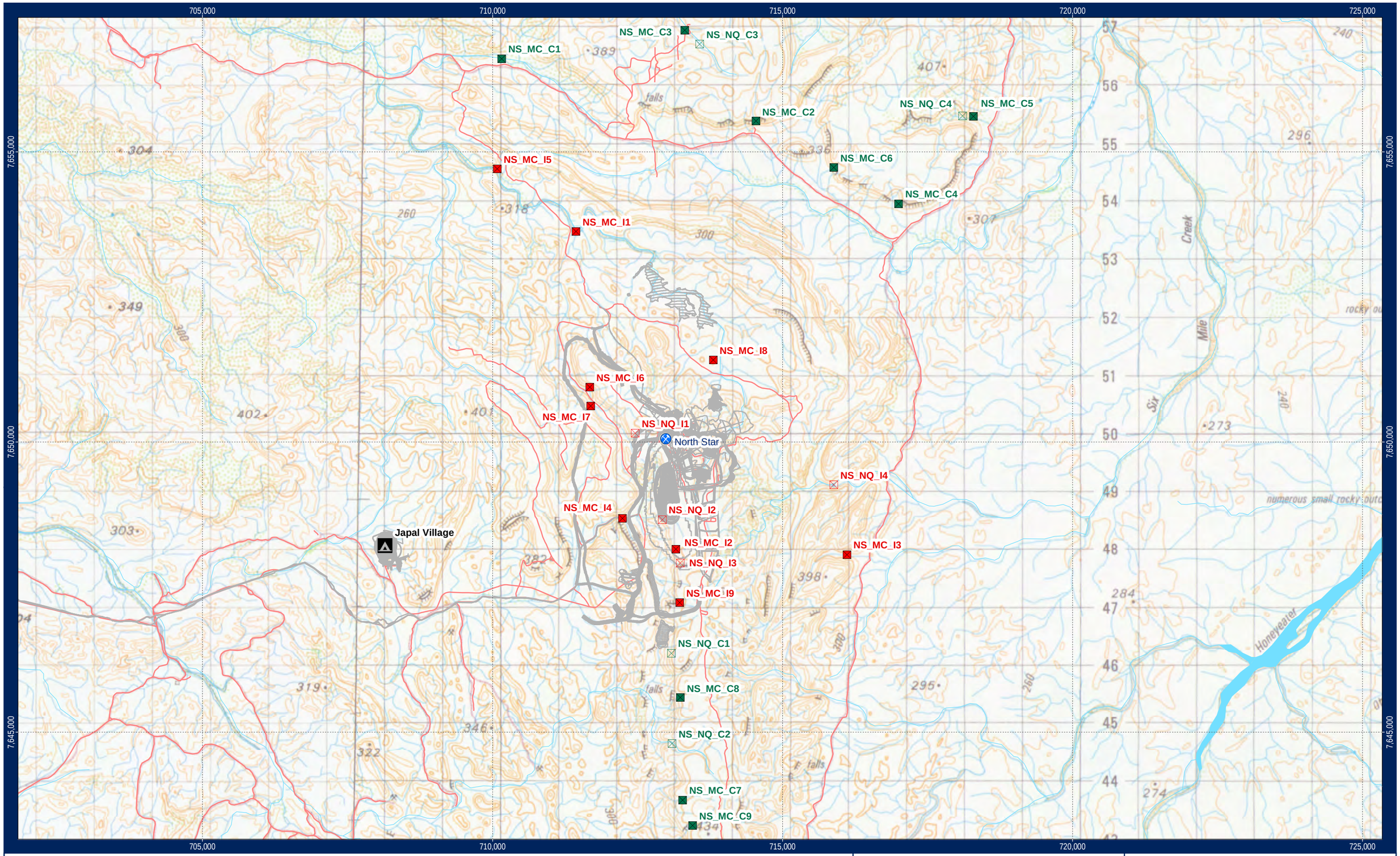
As with all ongoing monitoring programs, alternative methodologies should be continually assessed to determine if they can better meet the requirements of the monitoring program.

6 CONCLUSION

Below are the main conclusions of the current monitoring at North Star:

- Methodology was consistent with previous years of monitoring and satisfies the requirements of North Star's EPBC Listed Threatened Fauna Management Plan (NS-PL-EN- 0003_Rev0) as well as relevant guidelines (DSEWPaC 2011a; DSEWPaC 2011c; DSEWPaC 2011d; EPA 2004; EPA and DEC 2010)
- A total of 16 Northern Quolls (eight males and eight females) were recorded from four impact sites (four males, five females) and three control sites (four males, three females) indicating that the species is maintaining a presence within the North Star mine site. Three of the four females recorded in 2014 were recaptured at the same sites in 2015. A fourth female was found dead on the main access track in February 2015. In addition to the three recaptured females, five previously unrecorded females were trapped, of which four individuals were of a size (weight <405g) that indicates they are offspring from the previous year. All females had develop pouches and in some cases small pouch young. This indicated that the breeding season was well advanced during the current monitoring event, whereas previous monitoring events were undertaken during the mating season, when females showed no signs of breeding. Monitoring timing was consistent between the monitoring events, and therefore the difference in breeding is indicative of natural seasonal variation. The recapture data suggesting that females reside within the impact area over successive years to breed (observed in 2015) is also supported by the results from the GPS tracking, and the statistical analysis which showed that no change in population density has occurred to date (2015). When comparing the 2015 and 2014 monitoring data, it indicates that there is no significant change evident in population size and density.
- The GPS tracking of two individuals (1 male, 1 female) recorded both individuals home range in the vicinity of the mine pit and mine infrastructure. The home range of the two individuals was considerable smaller than that recorded from a male during the previous monitoring event. This is attributed to probable natural fluctuation in breeding timing, with the current radio tracking occurring after the mating period, when males roam extensively (as seen in the previous monitoring).
- Pilbara Olive Pythons were recorded from one impact site and three control sites indicating that the species is maintaining a presence within the North Star mine site. In addition, seven individuals were recorded by site personnel at the North Star mine. Statistical analysis indicated that the species continues to be present at the mine site and that approximately 75% of the four impact sites (POP I1-4) are potentially occupied by the species.
- Pilbara Leaf-nosed Bats were recorded from all three impact sites and all three control sites indicating that the species is maintaining a presence within the North Star mine site. As this is the first year using standardised monitoring methodology for Pilbara Leaf-nosed Bats direct population changes cannot be detected at this time. Analysis of the long-term monitoring data at Cave 13 and Fig Pool is still ongoing and will be reported separately at the end of financial year (covering the period March 2015 to April 2016).
- Conservation significant birds were monitored for the first year; currently, Rainbow Bee-eaters are the only species recorded to date from North Star. Three impact and three control sites were searched for 20 minutes for species listed as Migratory under the EPBC Act and two Falcon species (Grey Falcon and Peregrine Falcon). Rainbow Bee-eaters were recorded; this is consistent with the baseline data indicating that relevant conservation significant bird species are maintaining a presence within the North Star site.
- Both Hypothesis 1 (There will be no long-term statistically significant decline in relative abundance of Northern Quoll across impact sites compared to control sites) and Hypothesis 2 (EPBC listed fauna species previously recorded within the area of impact will continue to have an ongoing presence) have been satisfied based on the results of the current monitoring data.

MAPS



LEGEND

- Northern Quoll Monitoring (Motion Camera) - Impact Site
- Northern Quoll Monitoring (Motion Camera) - Control Site
- Northern Quoll Monitoring (Trapping) - Impact Site
- Northern Quoll Monitoring (Trapping) - Control Site
- FMG Project Areas and Prospects
- FMG Camp
- Tracks and Roads
- North Star Stage 1 Infrastructure
- Water Courses and Water Regions

Data Sources:
Watercourses, Landgate.
Topology, GA, 2003.
All other data: FMG, 2015.

N

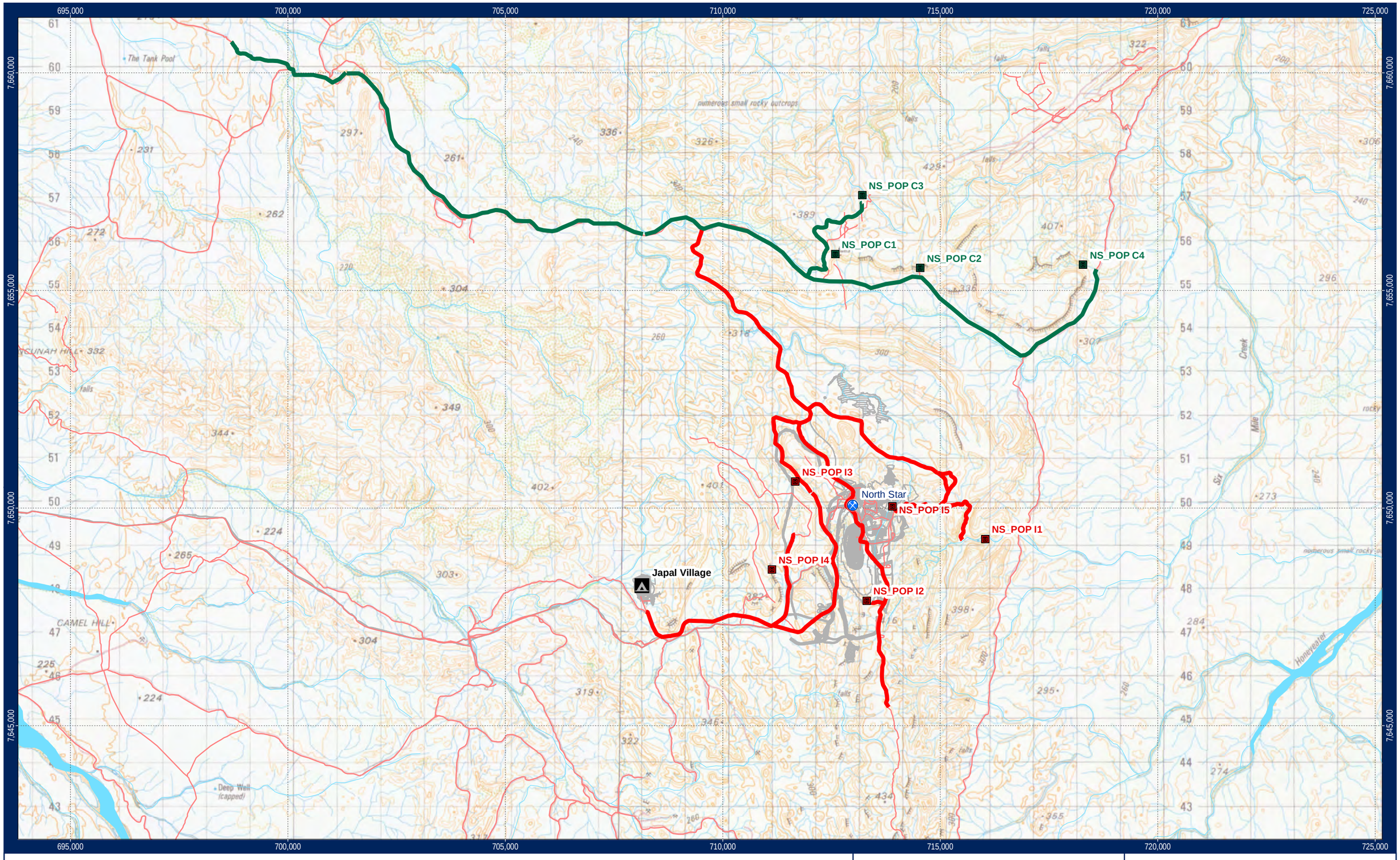
0 1 2 3 4
Kilometres

Requested By: T. Edwards
Drawn By: S. Costello
Revised By: rslevin
Approved By: P. Mastalir
Scale: 1:60,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 100_MP_EN_0037.015_r1

Date: 18/03/2016
Size: A3L
Revision: 1
Confidentiality: 0

North Star Fauna Monitoring Sites
Northern Quoll

Iron Bridge



LEGEND

- Pilbara Olive Python Monitoring (Searches) - Impact Site
- Pilbara Olive Python Monitoring (Searches) - Control Site
- Pilbara Olive Python Monitoring (Transect) - Impact Site
- Pilbara Olive Python Monitoring (Transect) - Control Site
- FMG Project Areas and Prospects
- FMG Camp
- Tracks and Roads
- North Star Stage 1 Infrastructure
- Water Courses and Water Regions

Data Sources:
Watercourses, Landgate.
Topology, GA, 2003.
All other data: FMG, 2015.

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Approved By: P. Mastalir
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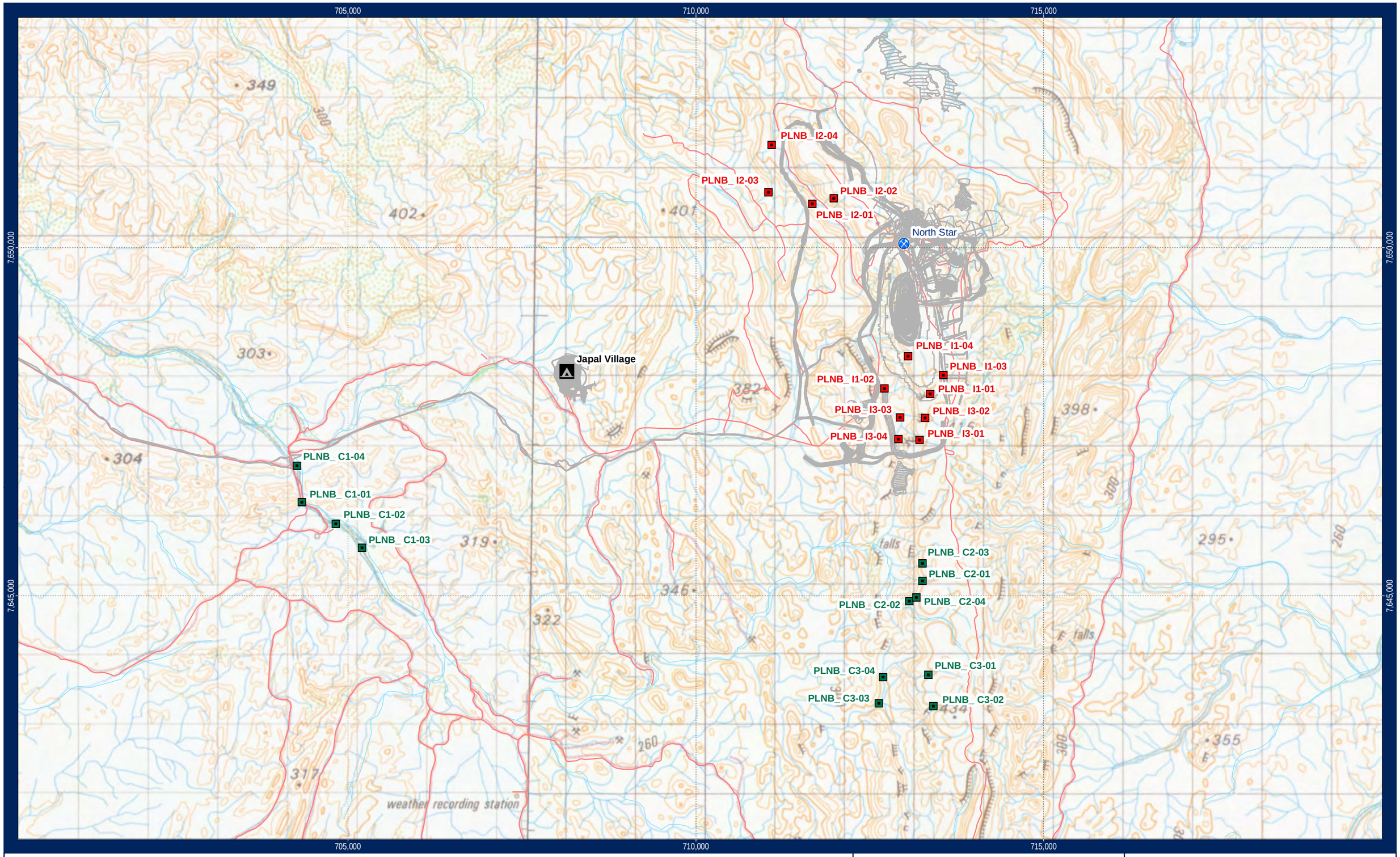
Confidentiality: 0

North Star Fauna Monitoring Sites
Pilbara Olive Python

Iron Bridge



LEGEND

- Pilbara Leaf-nosed Bat Monitoring (SM2) - Impact Site
- Pilbara Leaf-nosed Bat Monitoring (SM2) - Control Site
- FMG Project Areas and Prospects
- FMG Camp
- Tracks and Roads
- North Star Stage 1 Infrastructure
- Water Courses

Data Sources:
Watercourses, Landgate.
Topology, GA, 2003.
All other data: FMG, 2015.

N

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Kilometres

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Drawn By: S. Costello
Revised By: rslevin
Approved By: P. Mastalir
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Document Name: 100_MP_EN_0037.017_r2

Date: 18/03/2016
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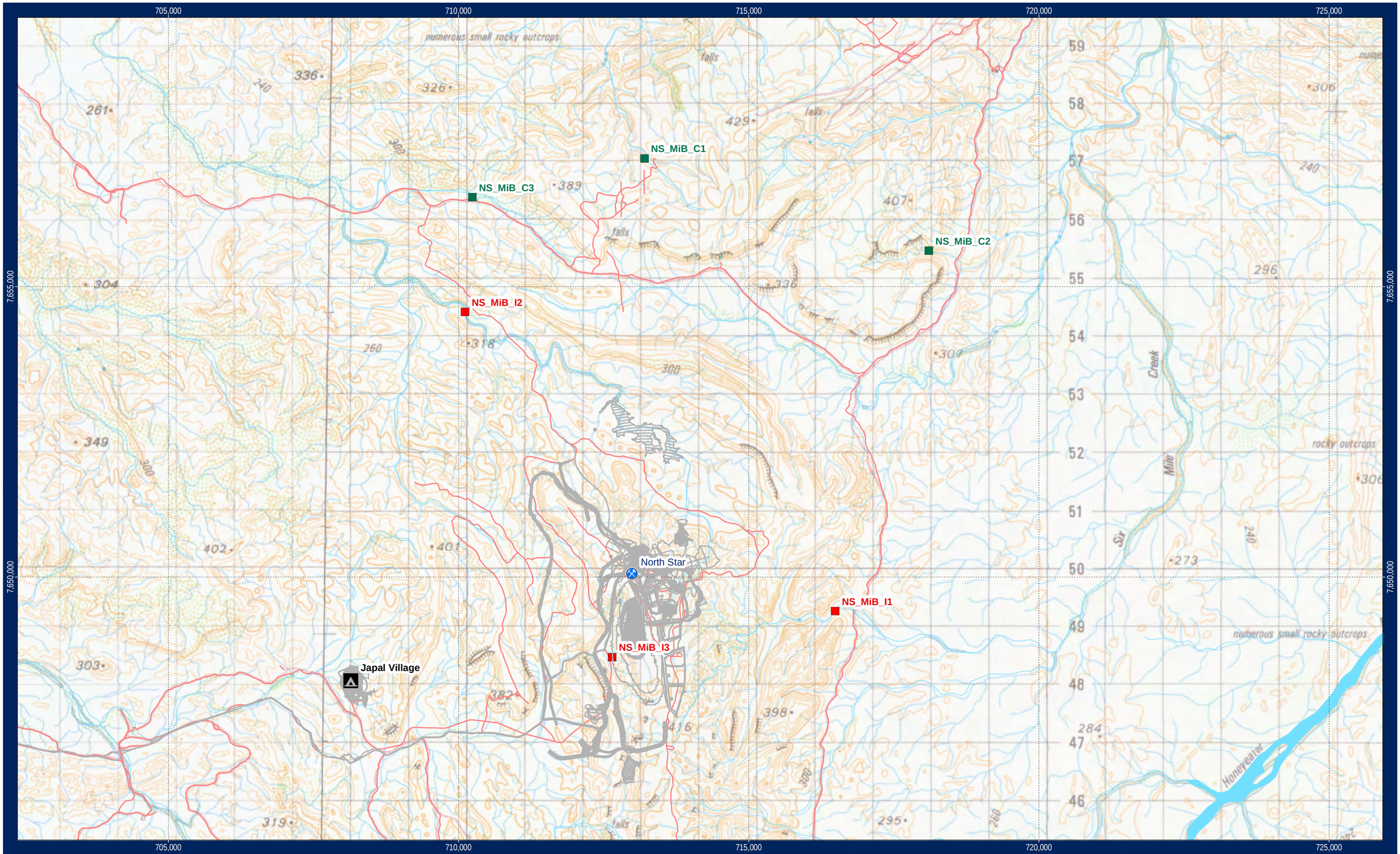
Revision: 2
Confidentiality: 0

North Star Fauna Monitoring Sites
Pilbara Leaf-nosed Bat

Iron Bridge



LEGEND

- Migratory Birds Monitoring - Impact Site
- Migratory Birds Monitoring - Control Site
- FMG Project Areas and Prospects
- FMG Camp
- Tracks and Roads
- North Star Stage 1 Infrastructure
- Water Courses and Water Regions

Data Sources:
Watercourses, Landgate.
Topology, GA, 2003.
All other data: FMG, 2015.

N

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Kilometres

Requested By: T. Edwards
Drawn By: S. Costello
Revised By: rslevin
Approved By: P. Mastalir
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Document Name: 100_MP_EN_0037.014_r1

Date: 18/03/2016
Size: A3L
Revision: 1
Confidentiality: 0

North Star Fauna Monitoring Sites
Migratory Birds

Iron Bridge

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7,649,000
7,648,000

NS_RE_1
NS_RE_2
NS_RE_3

LEGEND

- Rehabilitation Fauna Monitoring (Motion Cameras)
- North Star Stage 1 Infrastructure

Data Sources:
Topology, GA, 2003.
All other data: FMG, 2015.

N

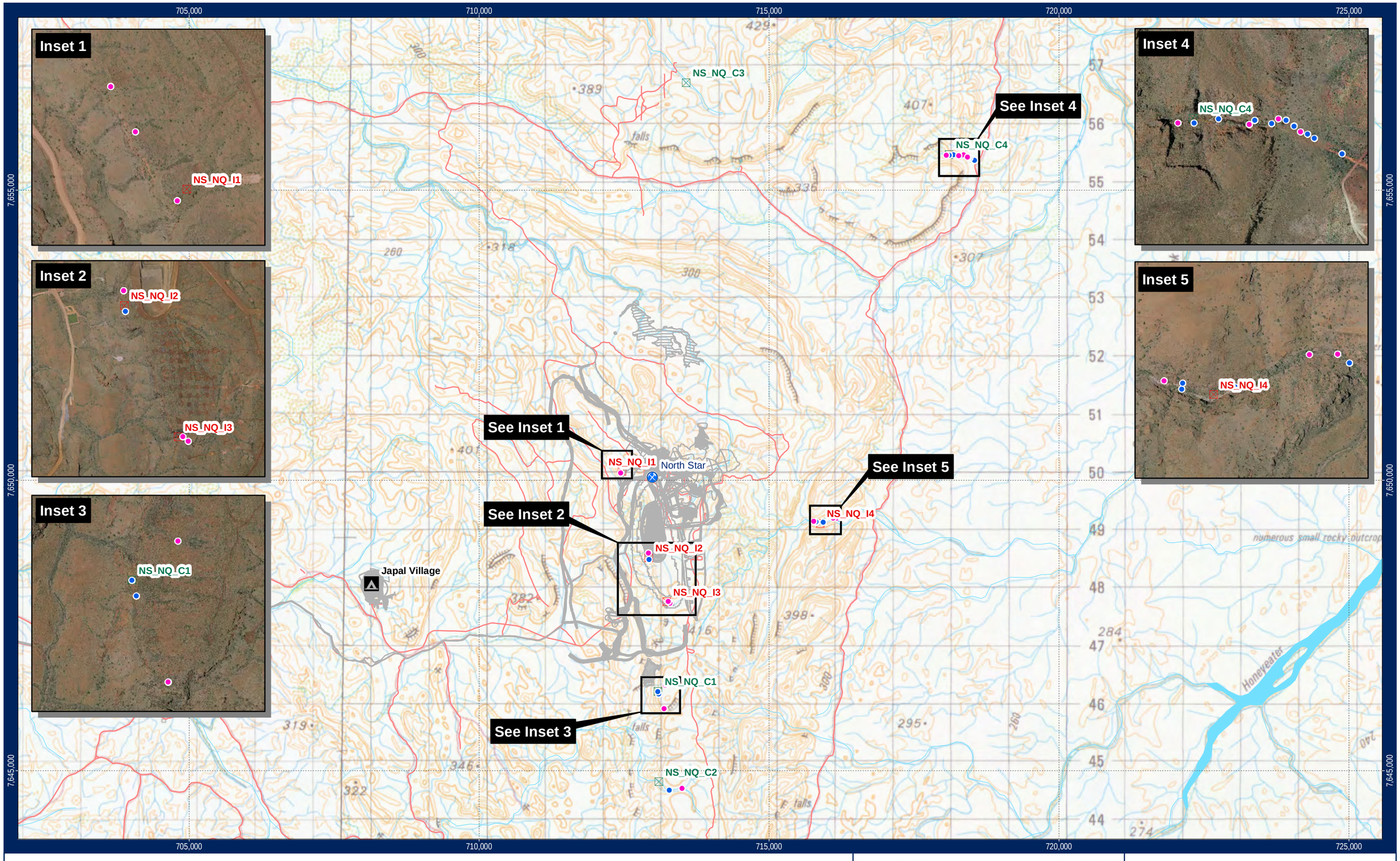
0 100 200 300 400 500
Meters

Requested By: T. Edwards
Drawn By: S. Costello
Revised By: rslevin
Approved By: P. Mastalir
Scale: 1:10,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 100_MP_EN_0037.018_r1

Date: 18/03/2016
Size: A3P
Revision: 1
Confidentiality: 0

North Star
Rehabilitation Fauna Monitoring Sites

Iron Bridge



LEGEND

- Northern Quoll Records
- Northern Quoll (Recapture)
- Northern Quoll Monitoring (Trapping) - Impact Site
- Northern Quoll Monitoring (Trapping) - Control Site
- FMG Project Areas and Prospects
- FMG Camp
- Tracks and Roads
- North Star Stage 1 Infrastructure
- Water Courses and Water Regions

Data Sources:
Watercourses, Landgate.
Topology, GA, 2003.
All other data: FMG, 2015.

N

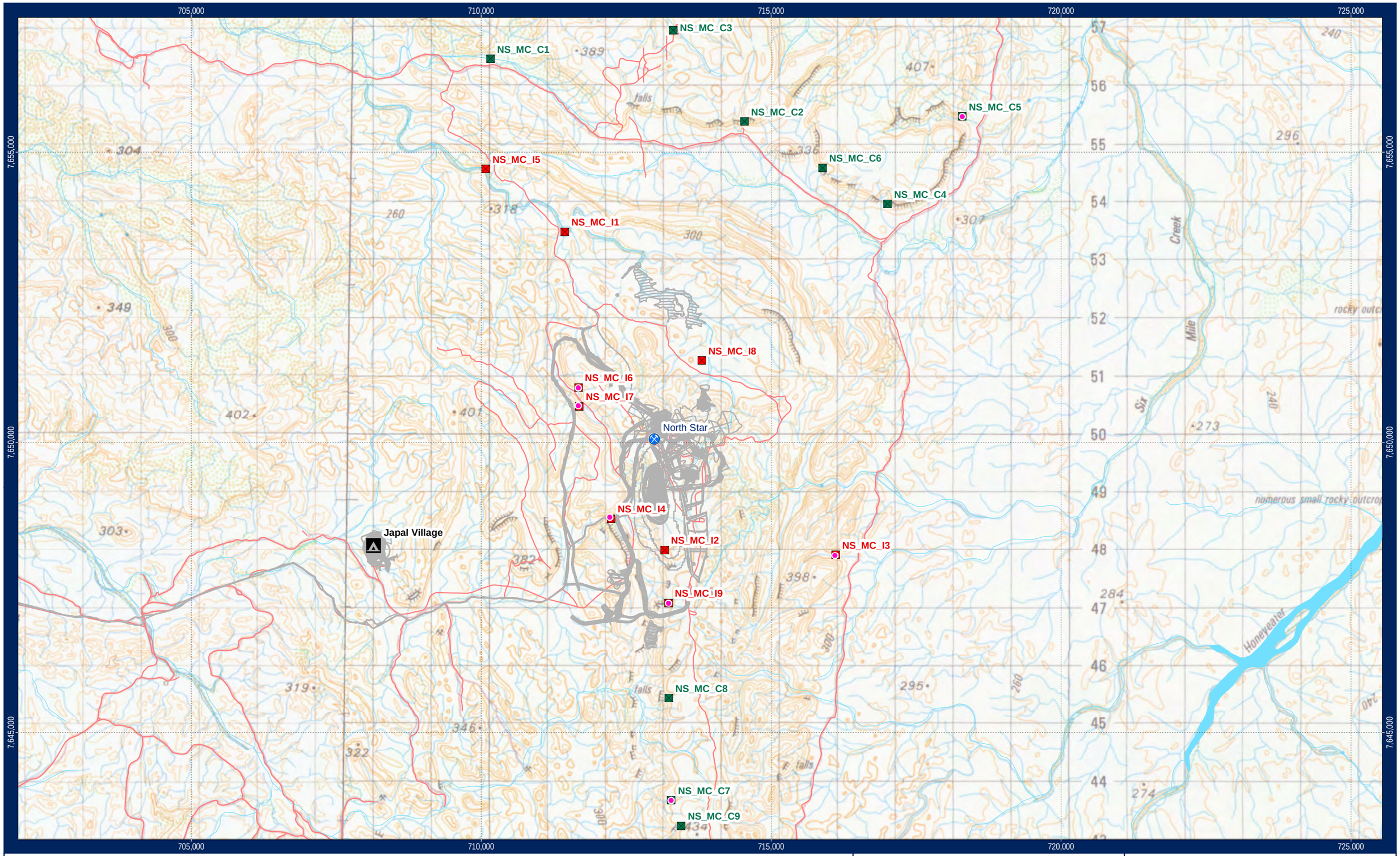
0 1 2 3 4
Kilometres

Requested By: T. Edwards
Drawn By: S. Costello
Revised By: rslevin
Approved By: P. Mastalir
Scale: 1:60,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 100_MP_EN_0038.009_r0

Date: 18/03/2016
Size: A3L
Revision: 0
Confidentiality: 0

North Star Fauna Records
Northern Quoll (Trapped)

Iron Bridge



LEGEND

- Northern Quoll Records
- Northern Quoll Monitoring (Motion Camera) - Impact Site
- Northern Quoll Monitoring (Motion Camera) - Control Site
- FMG Project Areas and Prospects
- FMG Camp
- Tracks and Roads
- North Star Stage 1 Infrastructure
- Water Courses and Water Regions

Data Sources:
Watercourses, Landgate.
Topology, GA, 2003.
All other data: FMG, 2015.

N

0 1 2 3 4
Kilometres

Requested By: T. Edwards
Drawn By: S. Costello
Revised By: rslevin
Approved By: P. Mastalir
Scale: 1:60,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 100_MP_EN_0038.0010_r0

Date: 18/03/2016
Size: A3L
Revision: 0
Confidentiality: 0

North Star Fauna Records
Northern Quoll (Motion Camera)

Iron Bridge

712,000 712,500 713,000 713,500

7,651,500 7,651,000 7,650,500 7,650,000 7,649,500 7,649,000

5/09/2015
14/09/2015
18/09/2015
6/09/2015
12/09/2015
1/09/2015
5/09/2015
28/08/2015
27/08/2015
7/09/2015
8/09/2015

3/09/2015
2/09/2015
1/09/2015
7/09/2015
8/09/2015
29/08/2015
31/08/2015
3/09/2015
28/08/2015
4/09/2015
5/09/2015
26/08/2015
27/08/2015
26/08/2015
4/09/2015
28/08/2015

LEGEND

- Collar GPS Locations
- GPS Location Connector Lines
- 50% Home Range PVC
- 95% Home Range PVC

712,000 712,500 713,000 713,500

N

0 100 200 300 400 500

Meters

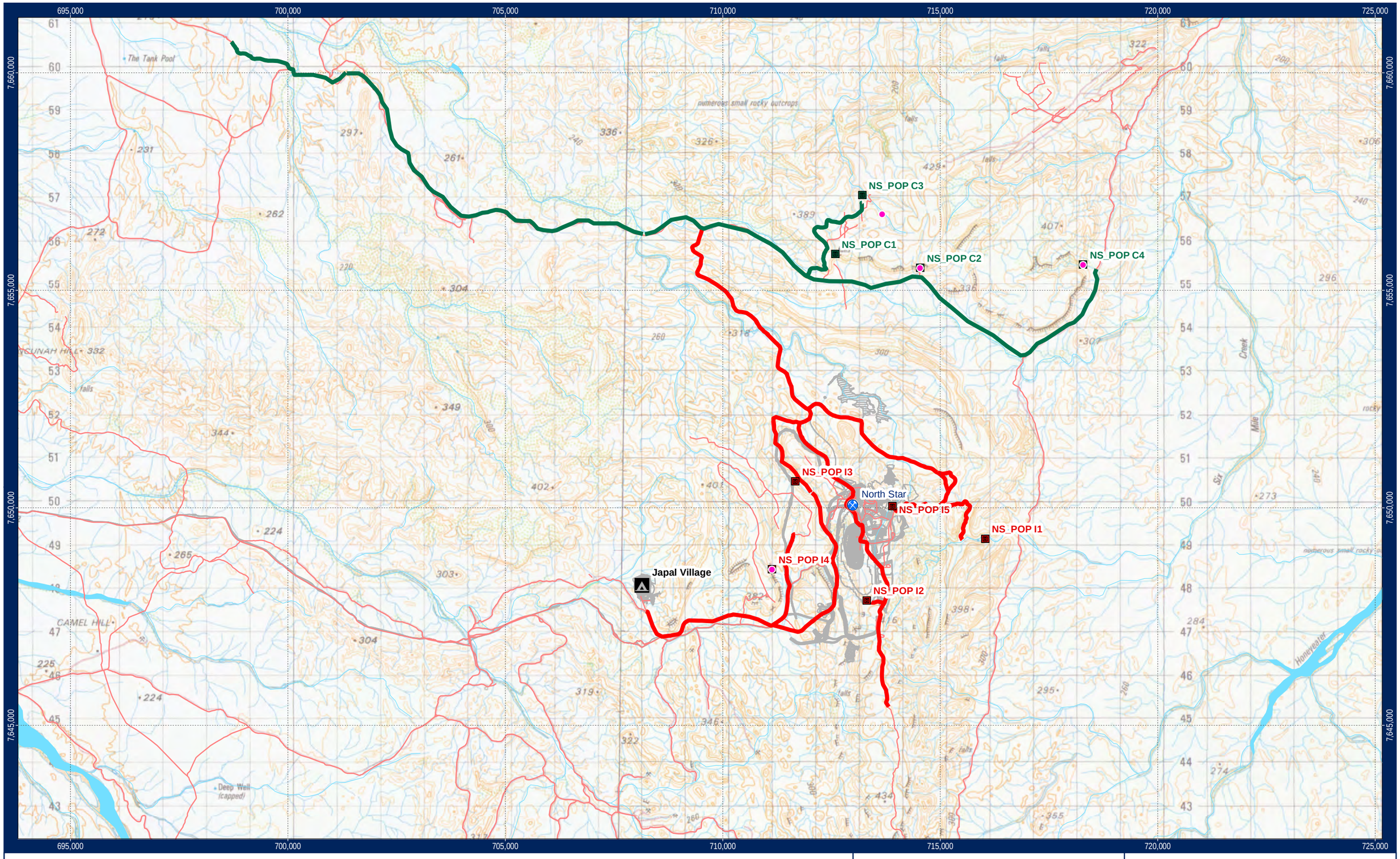
Data Sources:
All data, FMG, 2015.

Requested By: A. Heidrich
Drawn By: S. Costello
Revised By: rslevin
Approved By: P. Mastalir
Scale: 1:8,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 661CO_0000_MP_EN_0041_r0

Date: 18/03/2016
Size: A3P
Revision: 0
Confidentiality: 0

North Star
GPS Collar Locations

Iron Bridge



LEGEND

- Pilbara Olive Python Records
- Pilbara Olive Python Monitoring (Searches) - Impact Site
- Pilbara Olive Python Monitoring (Searches) - Control Site
- Pilbara Olive Python Monitoring (Transect) - Impact Site
- Pilbara Olive Python Monitoring (Transect) - Control Site
- FMG Project Areas and Prospects
- FMG Camp
- Tracks and Roads
- North Star Stage 1 Infrastructure
- Water Courses and Water Regions

Data Sources:
Watercourses, Landgate.
Topology, GA, 2003.
All other data: FMG, 2015.

N

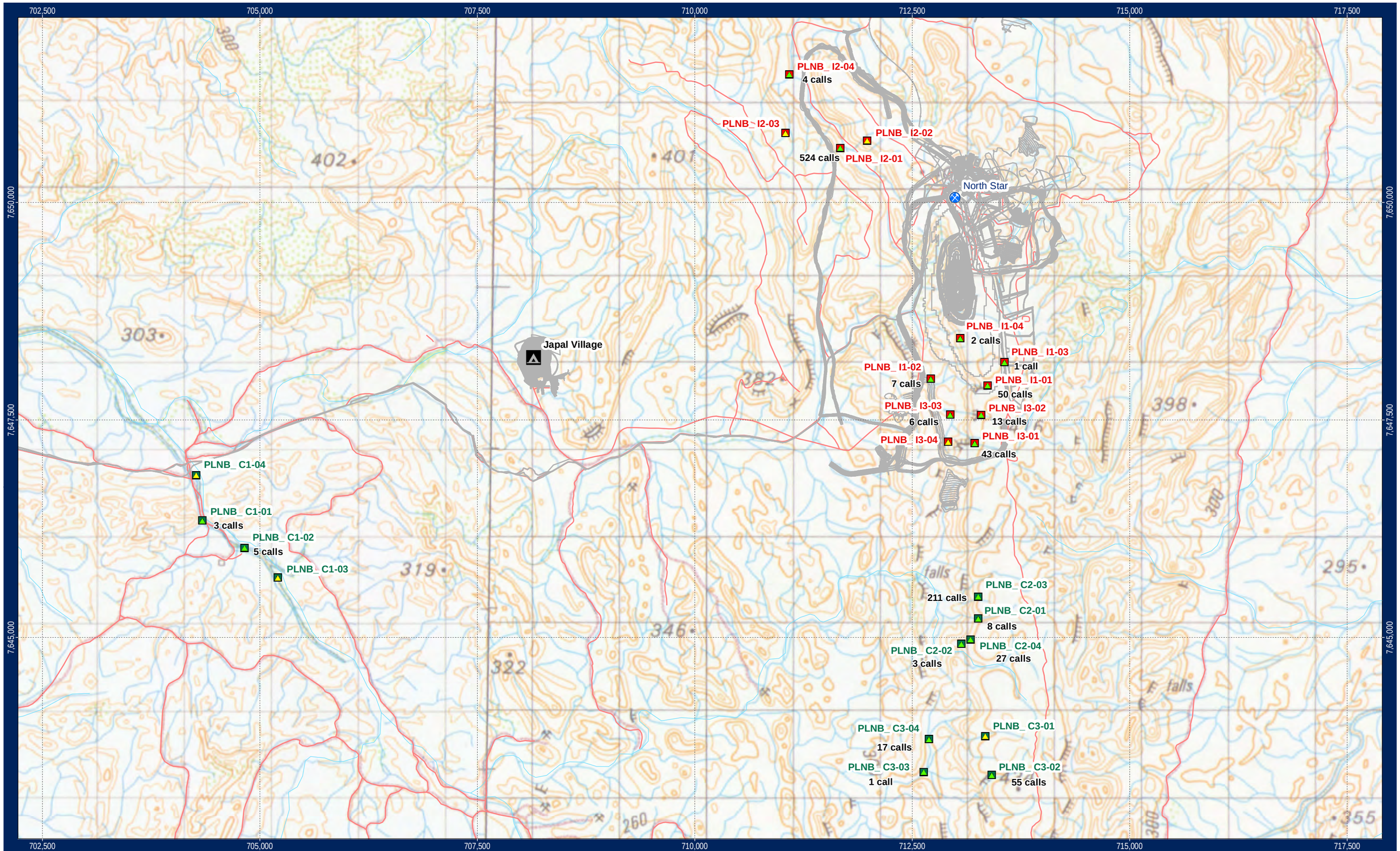
0 1 2 3 4 5
Kilometres

Requested By: T. Edwards
Drawn By: S. Costello
Revised By: rslevin
Approved By: P. Mastalir
Scale: 1:80,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 100_MP_EN_0038.0011_r0

Date: 18/03/2016
Size: A3L
Revision: 0
Confidentiality: 0

North Star Fauna Records
Pilbara Olive Python

Iron Bridge



LEGEND

- Pilbara Leaf-nosed Bat - Absent
- Pilbara Leaf-nosed Bat - Presence
- Pilbara Leaf-nosed Bat Monitoring (SM2) - Impact Site
- Pilbara Leaf-nosed Bat Monitoring (SM2) - Control Site
- FMG Project Areas and Prospects
- FMG Camp
- Tracks and Roads
- North Star Stage 1 Infrastructure
- Water Courses

Data Sources:
Watercourses, Landgate.
Topology, GA, 2003.
All other data: FMG, 2016.

N

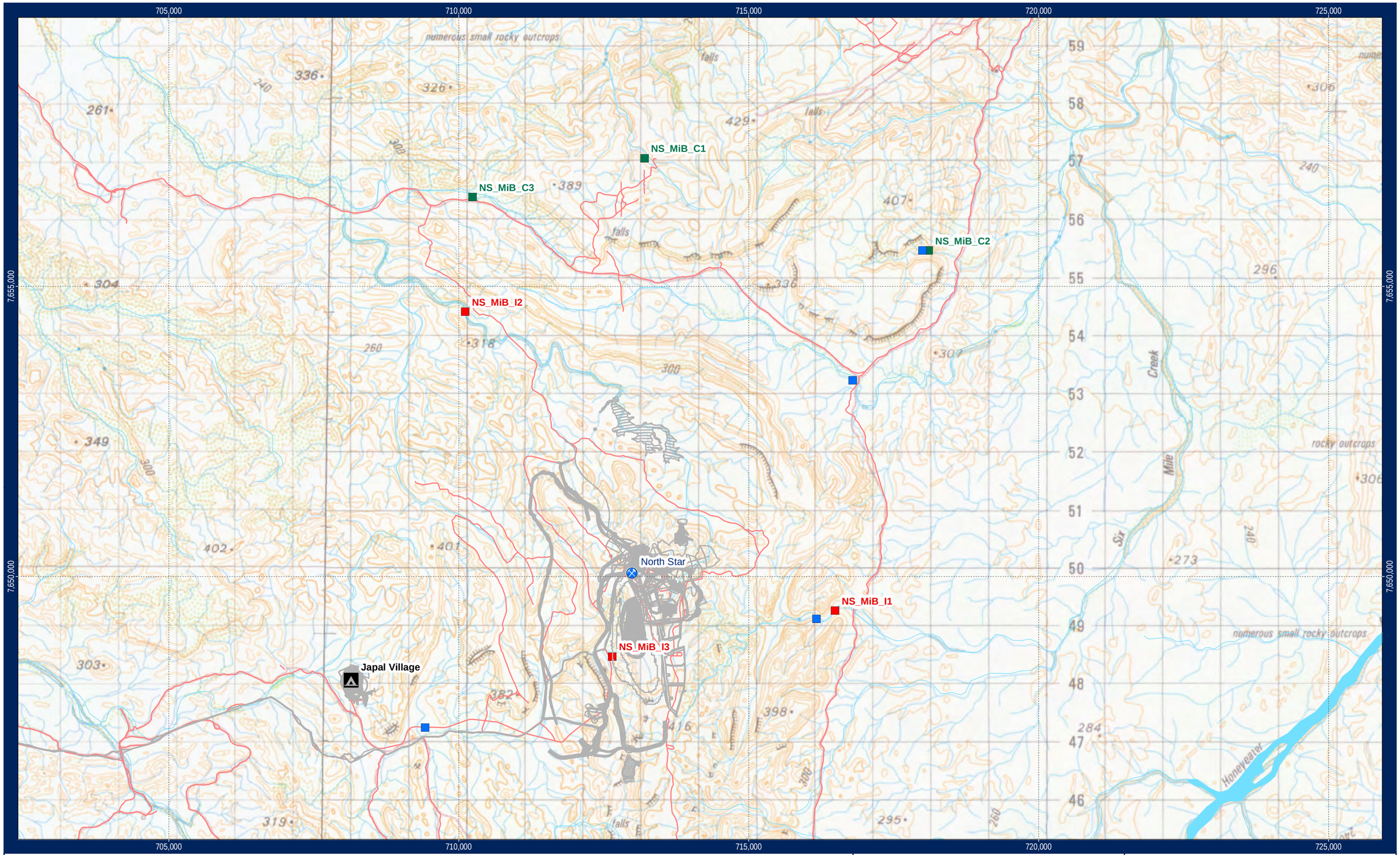
0 1 2 3
Kilometres

Requested By: T. Edwards
Drawn By: S. Costello
Revised By: rslevin
Approved By: P. Mastalir
Scale: 1:40,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 100_MP_EN_0038.0012_r1

Date: 18/03/2016
Size: A3L
Revision: 1
Confidentiality: 0

North Star Fauna Records
Pilbara Leaf-nosed Bat

Iron Bridge



LEGEND

- Rainbow Bee-eater Records
- Migratory Birds Monitoring - Impact Site
- Migratory Birds Monitoring - Control Site
- FMG Project Areas and Prospects
- FMG Camp
- Tracks and Roads
- North Star Stage 1 Infrastructure
- Water Courses and Water Regions

Data Sources:
Watercourses, Landgate.
Topology, GA, 2003.
All other data: FMG, 2015.

N

0 1 2 3 4 5
Kilometres

Requested By: T. Edwards
Drawn By: S. Costello
Revised By: rslevin
Approved By: P. Mastalir
Scale: 1:60,000
Coordinate System: GDA 1994 MGA Zone 50
Document Name: 100_MP_EN_0038.008_r0

Date: 18/03/2016
Size: A3L
Revision: 0
Confidentiality: 0

North Star Fauna Records
Migratory Birds

Iron Bridge

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APPENDIX 1: SITE DESCRIPTIONS

Site Description:	**NS-NQ-C1**
Description: Ridge line and rocky drainage line/gully. No surface water present. **Vegetation:** *Eucalyptus leucophloia* sparse woodland over *Acacia tumida* tall shrubland over *Acacia acradenia* and *Acacia orthocarpa* mid shrubland over *Triodia wiesiana* open hummock grassland.	
Site Description:	**NS-NQ-C2**
Description: Rocky gorge with small seasonal water pool. **Vegetation:** *Corymbia candida* and *Eucalyptus leucophloia* low open woodland over *Acacia tumida*, *Melaleuca glomerata* and *Ehretia saligna* mid open shrubland over *Cymbopogon procerus* and *Eriachne mucronata* open tussock grassland and *Triodia pungens* open hummock grassland.	

Site Description:	**NS-NQ-C3 / NS-MiB-C3**
Description: Rocky gorge with seasonal water pools **Vegetation:** *Corymbia candida* low sparse woodland, *over Acacia tumida, Ficus brachypoda* and *Acacia orthocarpa* mid open shrubland, over *Eriachne mucronata* isolated tussock grasses *and Triodia longiceps* open hummock grassland.	
Site Description:	**NS-NQ-C4 / NS-MiB-C2**
Description: Rocky gorge/creekline with permanent water pools **Vegetation:** *Melaleuca argentea* and *Corymbia candida* mid woodland, over *Acacia tumida* mid open shrubland, over *Triodia pungens* and *Triodia longiceps* open hummock grassland.	

Site Description:	**NS-NQ-I1**
Description: Ridgetop with adjacent cliff and boulders. No water sources present **Vegetation:** *Eucalyptus leucophloia* low open woodland over *Grevillea wickhamii, Acacia arcadenia* and *Acacia ptychophylla* sparse low shrubland over *Triodia wiseana* open hummock grassland.	
Site Description:	**NS-NQ-I2**
Description: Ridgetop with adjacent cliff and boulders. No water sources present **Vegetation:** *Eucalyptus leucophloia* and *Corymbia candida* low sparse woodland over tall *Acacia tumida* shrubland over *Acacia orthocarpa* and A. *ptychophylla* mid open shrubland, *over Triodia wiseana* hummock grassland.	

Site Description:	**NS-NQ-I3**
Description: Rocky gully and drainage line. No permanent water present. **Vegetation:** *Corymbia candida* and *Eucalyptus leucophloia* low sparse woodland over *Acacia tumida* and *Gossypium robinsonii* tall open shrubland over *Cymbopogon procerus* sparse tussock grassland and *Triodia pungens* sparse hummock grassland.	
Site Description:	**NS-NQ-I4 / NS-MiB-I1**
Description: Rocky gorge/creekline with semi-permanent water **Vegetation:** *Melaleuca argentea*, *Terminalia canescens*, mid to low open woodland, over *Acacia pyrifolia*, *A. tumida and Tephrosia rosea* mid shrubland, over dense patches of *Cyperus vaginatus* over *Triodia* spp. open hummock grassland.	

Site Description:	**NS-MiB-I2**
Description: large riverbed with boulders and seasonal, semi-permanent water pools. **Vegetation:** *Eucalyptus camaldulensis* mid open woodland, over *Acacia tumida* and *Gossypium robinsonii* tall shrubland over *Triodia longiceps* open hummock grassland.	**No Photograph**
Site Description:	**NS-MiB-I3**
Description: Artificial water storage (turkey nest). **Vegetation:** Surrounded by *Eucalyptus leucophloia* and *Corymbia hamersleyana* low sparse shrubland over *Acaia tumida* and *Petalostylis labicheoides* tall shrubland over *Acacia bivenosa* mid shrubland over *Triodia wiseana* hummock grassland.	

Site Description:	**NS-MiB-C1**
Description: Dry, seasonally inundated creekbed with rock outcropping. **Vegetation:** *Corymbia hamersleyana* low open woodland, over *Acacia tumida* and *Gossypium robinsonii* tall shrubland over *Triodia wiseana* open hummock grassland	
Site Description:	**NS-POP-I5**
Description: Previously dry drainage gully now with permanent water from tailings dam seepage. **Vegetation:** *Corymbia candida* low sparse woodland over *Acacia tumida* and *Gossypium robinsonii* tall open shrubland over *Cymbopogon procerus* and *Eriachne mucronata* sparse tussock grassland with emergent sedges.	

APPENDIX 2: NORTHERN QUOLL CAPTURE DETAILS

Microchip/ID	sex	date	Record	site		trap	Easting	Northing	WAM Tissue No.	Weight (g)	short peds (mm)	head length (mm)	Scrotum (mm)	Caudal (mm)	health rating	comments	Vegetation Condition	Local impacts	Rainfall seasonality
Impact sites																			
2011				**Old site name**	**New site nearby**														
M1	Male	08-Jul-11	capture	A	-	C04	711537	7651137	TM381	705	33.2	77.3	-	17.5	**5**	No signs of fighting	Excellent	Low, cleared tracks	Dry
		09-Jul-11	recapture	B	NS I1	C13	712167	7650597											
		10-Jul-11	recapture			C11	712029	7650678											
		11-Jul-11	recapture			C11	712029	7650678											
		12-Jul-11	recapture			C13	712167	7650597											
		13-Jul-11	recapture			C11	712029	7650678											
		14-Jul-11	recapture			C11	712029	7650678											
M2	Male	08-Jul-11	capture	A	-	C06	711648	7651037	TM382	615	32.7	70.1	-	13.5	**3**	Thin fur, few signs of fighting	Excellent	Low, cleared tracks	Dry
		10-Jul-11	recapture			C06	711648	7651037											
		12-Jul-11	recapture			C02	711578	7651211											
M5	Male	10-Jul-11	capture	C	NS I2	C23	712918	7648805	TM385	595	34.6	70.9	-	16.4	**5**	No signs of fighting	Excellent	Low, cleared tracks	Dry
		11-Jul-11	recapture			C24	713028	7648914											
		12-Jul-11	recapture			C23	712918	7648805											
		13-Jul-11	recapture			C22	712893	7648932											
F6	Female	10-Jul-11	capture	B	NS I1	C10	711957	7650706	TM386	330	30.8	63.5	-	15	**5**	No signs of fighting	Excellent	Low, cleared tracks	Dry
		12-Jul-11	recapture			C11	712029	7650678											
		14-Jul-11	recapture			C13	712167	7650597											
M7	Male	11-Jul-11	capture	A	-	C03	711476	7651205	TM387	630	35.4	75	--	17.1	-	Pouch not developed	Excellent	Low, cleared tracks	Dry
		12-Jul-11	recapture			C03	711476	7651205											
		13-Jul-11	recapture			C02	711578	7651211											
M10	Male	13-Jul-11	capture	B	NS I1	C14	712257	7650549	TM390	778	40	75.7	-	18.5	-	No signs of fighting	Excellent	Low, cleared tracks	Dry
		14-Jul-11	recapture			C14	712257	7650549											
2014																			
941000016595571[F1-1]	Female	27/08/14	capture	NQ I1		C21	712261	7650571	WAMTS326	395	27.5	57.0	N/A	11.0	2.5	-	Very good	Some noise and dust from nearby mining activities	Dry
		29/08/14	recapture			C17	712230	7650449											
		30/08/14	recapture			C5	712303	7650321											
941000016595479	Female	29/08/14	capture	NQ I2		C18	712924	7648751	WAMTS326	360	3.77	46.8	N/A	17.0	3.5	appears to have been mated, no young in pouch, large scars on both thighs, small patch of hair missing on back	Very good	Some noise and dust from nearby mining activities	Dry
941000016202872	Male	25/08/14	capture	NQ I1		C21	712261	7650571	WAMTS326	275	36.5	69.0	-	11.5	4	Slender and small	Very good	Some noise and dust from nearby mining activities	Dry
		26/08/14	recapture	NQ I2		C18	712924	7648751									Very good	Some noise and dust from nearby mining activities	Dry
		27/08/14	recapture			C17	712924	7648726											
		28/08/14	recapture			C16	712928	7648696											
		29/08/14	recapture			C14	712934	7648633											
		30/08/14	recapture			C14	712934	7648633											
		31/08/14	recapture			C7	713050	7648530											

Microchip/ID	sex	date	Record	site	trap	Easting	Northing	WAM Tissue No.	Weight (g)	short peds (mm)	head length (mm)	Scrotum (mm)	Caudal (mm)	health rating	comments	Vegetation Condition	Local impacts	Rainfall seasonality
941000016595484	Male	31/08/14	capture	NQ I2	C18	712924	7648751	WAMTS326	640	32.0	-		20.0	-	signs of combat suggesting reproductive	Very good	Some noise and dust from nearby mining activities	Dry
941000016595499	Male	29/08/14	capture	Site office	Additional	712658	7650700	WAMTS326	530	37.3	59.0	-	15.0	3.5	-	Very good	Some noise and dust from nearby mining activities	Dry
		30/08/14	recapture	NQ I2	C18	712924	7648751											
941000016595477	Male	26/08/14	capture	NQ I2	C6	713065	7648513	WAMTS326	800	38.5	79.0	-	15.5	4	Equipped with radio collar	Very good	Some noise and dust from nearby mining activities	Dry
		28/08/14	recapture	NQ I3	C4	713383	7647871											
		30/08/14	recapture		C6	713319	7647876											
		31/08/14	recapture		C6	713319	7647876											
941000016595575	Female	25/08/14	capture	NQ I3	C5	713352	7647875	WAMTS326	375	27.0	62.0	N/A	15.5	3.5	Healing wound	Very good	Some noise and dust from nearby mining activities	Dry
		27/08/14	recapture		C4	713383	7647871											
		29/08/14	recapture		C12	713192	7647903											
		30/08/14	recapture		C5	713352	7647875											
941000016595478	Male	25/08/14	capture	NQ I4	C17	715813	7649275	WAMTS326	560	21.3	62.9	16.0	17.0	3.5	reproductive male, signs of combat, missing fur on head and tail	Very good	Some noise and dust from nearby mining activities	Dry
		29/08/14	recapture		C15	715837	7649277											
941000016595496	Male	26/08/14	capture	NQ I4	C19	715772	7649294	WAMTS326	370	34.5	69.5	-	11.0	4.5	-	Very good	Some noise and dust from nearby mining activities	Dry
		27/08/14	recapture		C19	715772	7649294											
		28/08/14	recapture		C15	715837	7649277											
		29/08/14	recapture		C15	715837	7649277											
2015																		
941 000016595571[F1-2]	Female	22/08/15	capture	NQ I1	C12	712296	7650382	TBA	410	30.0	68.0	-	15.0	4	mated and has missing fur on sides, developed pouch, very grumpy mood	Very good	Some noise and dust from nearby mining activities	Dry
941 000017452055^	Female	25/08/15	capture	NQ I1	C24	712443	7650130	TBA	403	32.0	67.0	-	15.0	4	developed pouch with small embryos in it, some sores and signs of fighting	Very good	Some noise and dust from nearby mining activities	Dry
941 000017452056^	Male	26/08/15	capture	NQ I1	C18	712350	7650282	TBA	524	36.0	76.0	-	14.0	3	some fighting and mating some fighting and fur missing, not much fat	Very good	Some noise and dust from nearby mining activities	Dry
941 000016202842	Female	24/08/15	capture	NQ I2	C1	712924	7648751	TBA	345	33.0	65.0	-	13.0	4	developed pouch, missing fur on both sides indicating signs of mating	Very good	Some noise and dust from nearby mining activities	Dry
		25/08/15	recapture		C5	712934	7648633											
941 000017452061	Male	22/08/15	capture	NQ I3	C7	713295	7647886	TBA	613	36.0	84.0	-	15.0	3	wounds	Very good	Some noise and dust from nearby mining activities	Dry
941 000017452064	Female	24/08/15	capture	NQ I3	C9	713264	7647912	TBA	445	40.9	72.0	-	1.5	4	developed pouch, no embryos, pretty good condition	Very good	Some noise and dust from nearby mining activities	Dry

Microchip/ID	sex	date	Record	site		trap	Easting	Northing	WAM Tissue No.	Weight (g)	short peds (mm)	head length (mm)	Scrotum (mm)	Caudal (mm)	health rating	comments	Vegetation Condition	Local impacts	Rainfall seasonality
941 000017452060	Male	23/08/15	capture	NQ I4		C6	716171	7649355		565	36.0	76.0	-	12.0	3.5	skinny	Very good	Limited but occasional noise from nearby mining activities	Dry
		24/08/15	recapture			C6	716171	7649355											
		25/08/15	recapture			C5	716198	7649334											
941 000017452063	Female	25/08/15	capture	NQ I4		C8	716106	7649354	TBA	347	31.0	63.0	-	10.0	4	good, developed pouch	Very good	Limited but occasional noise from nearby mining activities	Dry
941 000017452071	Male	22/08/15	capture	NQ I4		C13	715935	7649279	TBA	547	48.9	82.0	-	15.5	3.5	fleas, mating and fighting, some hair loss	Very good	Limited but occasional noise from nearby mining activities	Dry
		23/08/15	recapture			C13	715935	7649279											
		25/08/15	recapture			C19	715813	7649275											
		26/08/15	recapture			C18	715815	7649288											
		27/08/15	Recapture			C21	715772	7649294											
Control sites																			
2011				**Old site**	**New site**														
M3	Male	09-Jul-11	capture	D	NS C1	C28	713394	7643895	TM383	590	35.6	71.3	**-**	15.5	**5**	No signs of fighting	Excellent	Low, cleared tracks	Dry
		10-Jul-11	recapture			C28	713394	7643895											
		11-Jul-11	recapture			C31	713490	7643914											
		12-Jul-11	recapture			C29	713410	7643903											
		13-Jul-11	recapture			C32	713551	7643910											
		14-Jul-11	recapture			C30	713423	7643918											
M4	Male	10-Jul-11	capture	E	NS C2	C36	713311	7644664	TM384	727	36.1	80	-	15.6	5	Coat thick with no patches, some body fat	Excellent	Low, cleared tracks	Dry
		11-Jul-11	recapture			C37	713278	7644659											
		12-Jul-11	recapture			C39	713233	7644651											
		13-Jul-11	recapture			C36	713311	7644664											
		14-Jul-11	recapture			C37	713278	7644659											
M8	Male	11-Jul-11	capture	S4	-	C47	713117	7646259	TM388	605	34.5	78.5	-	13.4	5	some body fat, no missing fur	Excellent	Low, cleared tracks	Dry
		12-Jul-11	recapture			C47	713117	7646259											
		13-Jul-11	recapture			C48	713098	7646325											
F9	Female	11-Jul-11	capture	E	-	C36	713311	7644665	-	320	32.1	59.2	-	14.8	5	Pouch not developed	Excellent	Low, cleared tracks	Dry
AAM1	Male	25-Jul-11	capture	S9	NS C4	C135	718348	7655633	TM391	660	35.9	83.2	-	-	4.5	No signs of fighting	Excellent	Low, cleared tracks	Dry
AAM2D	Male	27-Jul-11	capture	S3	NS C3	C75	713229	7657185	TM392	795	35.2	74.3	-	17.9	4	No signs of fighting	Excellent	Low, cleared tracks	Dry
AAM2B	Male	27-Jul-11	capture	S9	NS C4	C140	718069	7655602	TM393	575	35.8	68.0	-	-	4.5	No signs of fighting	Excellent	Low, cleared tracks	Dry
AAF3	Female	25-Jul-11	capture	S8	-	C124	718914	7658171	TM394	385	33	62.6	N/A	-	4.5	Pouch not developed	Excellent	Low, cleared tracks	Dry
AAF4	Female	25-Jul-11	capture	S8	-	C127	718680	7658073	TM395	405	30	68.5	-	-	4.5	Pouch not developed	Excellent	Low, cleared tracks	Dry
		28-Jul-11	recapture			C132	718628	7658202								Pouch not developed	Excellent	Low, cleared tracks	Dry
AAM5	Male	26-Jul-11	capture	S9	NS C4	C140	718069	7655602	TM396	690	36.6	74.6	-	-	4.5	No signs of fighting	Excellent	Low, cleared tracks	Dry
		27-Jul-11	recapture			C139	718134	7655582		705									
		28-Jul-11	recapture	S8	-	C128	718659	7658149		685									
		29-Jul-11	recapture			C126	718765	7658124		680									

Microchip/ID	sex	date	Record	site		trap	Easting	Northing	WAM Tissue No.	Weight (g)	short peds (mm)	head length (mm)	Scrotum (mm)	Caudal (mm)	health rating	comments	Vegetation Condition	Local impacts	Rainfall seasonality
AAM6	Male	26-Jul-11	capture	S8	-	C124	718914	7658171	TM397	800	36.6	80.8	-	-	4.5	No signs of fighting	Excellent	Low, cleared tracks	Dry
		27-Jul-11	recapture			C127	718680	7658073		780									
		28-Jul-11	recapture			C126	718765	7658124		830									
		29-Jul-11	recapture			C128	718659	7658149		-									
AAM7	Male	29-Jul-11	capture	S8	-	C124	718914	7658171	TM398	730	37.6	78.2	-	-	4.5	No signs of fighting	Excellent	Low, cleared tracks	Dry
AAM8	Male	27-Jul-11	capture	S8	-	C126	718765	7658124	TM399	610	36.2	75	-	-	4.5	No signs of fighting	Excellent	Low, cleared tracks	Dry
		29-Jul-11	recapture			C127	718680	7658073											
AAM9	Male	24-Jul-11	capture	S8	-	C127	718680	7658073	TM400	655	36.8	74.5	-	-	4.5	No signs of fighting	Excellent	Low, cleared tracks	Dry
2014																			
941000016595482	Male	26/08/14	capture	NQ C1		4	713392	7646226	WAMTS326	860	40.0	67.8	-	16.5	-	adult male, reproductive	Very good	Low, some noise from nearby mine activities, cleared tracks	Dry
		28/08/14	recapture			17	713099	7646318											
		27/08/14	recapture			18	713087	7646363											
941000016595486[F2-1]	Female	24/08/14	capture	NQ C1		9	713247	7646030	WAMTS326	340	17.4	54.4	N/A	17.4	4	-	Very good	Low, some noise from nearby mine activities, cleared tracks	Dry
		25/08/14	recapture			5	713371	7646193											
		28/08/14	recapture			9	713247	7646030											
941000016595485	Male	26/08/14	capture	NQ C2		19	713106	7644714	WAMTS326	580	38.0	65.5	-	12.0	3.5		Very good	Low, some noise from nearby mine activities, cleared tracks	Dry
941000016595495	Male	28/08/14	capture	NQ C2		10	713236	7644684	WAMTS326	635	34.0	65.0	-	16.5	3.5	Average, missing fur on tail	Very good	Low, some noise from nearby mine activities, cleared tracks	Dry
		30/08/14	recapture			21	713223	7644656											
941000016595497[F3-1]	Female	28/08/14	capture	NQ C2		4	713509	7644697	WAMTS326	385	26.0	60.0	N/A	11.5	4	No pouched young	Very good	Low, some noise from nearby mine activities, cleared tracks	Dry
		29/08/14	recapture			8	713322	7644657											
		30/08/14	recapture			8	713322	7644657											
941000016595498	Female	28/08/14	capture	NQ C2		18	713101	7644777	WAMTS326	365	28.0	51.0	N/A	14.0	3.5	-	Very good	Low, some noise from nearby mine activities, cleared tracks	Dry
941000016202871	Male	24/08/14	capture	NQ C2		19	713106	7644714	WAMTS326	725	27.5	70.0	-	16.5	5	-	Very good	Low, some noise from nearby mine activities, cleared tracks	Dry
		25/08/14	recapture			8	713322	7644657											
		28/08/14	recapture	NQ C1		18	713087	7646363											
941000016595535	Male	25/08/14	capture	NQ C3		1	713202	7657203	WAMTS326	560	23.5	61.0	17.0	14.0	3	-	Excellent	Low, some cleared tracks	Dry
941000016595534	Male	25/08/14	capture	NQ C4		3	718449	7655567	WAMTS326	480	21.0	51.0	17.0	9.2	3.5	Young male, missing fur on tail but no sign of fighting	Excellent	Low, some cleared tracks	Dry
		26/08/14	recapture			4	718429	7655572											
		27/08/14	recapture			4	718429	7655572											
		28/08/14	recapture			5	718387	7655606											
2015																			
941000016595486[F2-2]	Female	23/08/15	capture	NQ C1		C25	713219	7646475	TBA	426	32.0	65.0	-	17.0	4	recap from prev year, pouched, good condition	Very good	Low, some noise from nearby mine activities, cleared tracks	Dry
		24/08/15	Recapture			C17	713099	7646318											
		25/08/15	Recapture			C18	713087	7646363											

Microchip/ID	sex	date	Record	site	trap	Easting	Northing	WAM Tissue No.	Weight (g)	short peds (mm)	head length (mm)	Scrotum (mm)	Caudal (mm)	health rating	comments	Vegetation Condition	Local impacts	Rainfall seasonality
941000016595533	Female	23/08/15	capture	NQ C1	C11	713191	7646070	TBA	337	27.0	71.0	-	13.0	4	none	Very good	Low, some noise from nearby mine activities, cleared tracks	Dry
		26/08/15	recapture		C11	713191	7646070											
941000016595497^ F3-2	Female	24/08/15	capture	NQ C2	C6	713503	7644693	TBA	446	35.0	73.0	-	15.0	4	none	Very good		
		25/08/15	recapture		C14	713283	7644663											
941000017452062	Male	23/08/15	capture	NQ C4	C7	718404	7655595	TBA	406	36.0	70.0	-	16.0	3	fur missing	Excellent	Low, some cleared tracks	Dry
		24/08/15	recapture		C17	718182	7655616									Excellent		
		26/08/15	recapture		C21	718110	7655604									Excellent		
		27/08/15	recapture		C25	718062	7655604									Excellent		
941000017452068	Male	22/08/15	capture	NQ C4	C9	718359	7655616	TBA	622	37.2	82.0	-	17.5	3.5	fur missing	Excellent	Low, some cleared tracks	Dry
		26/08/15	recapture		C7	718404	7655595											
985170002967064	Male	21/08/15	capture: MWH recapture	NQ C4	C1	718547	7655513	TBA	489	37.0	80.0	-	13.0	2.5	few fight wounds	Excellent	Low, some cleared tracks	Dry
		25/08/15	recapture		C6	718424	7655577											
		26/08/15	recapture		C12	718289	7655612											
985170002971079	Male	21/08/15	capture: MWH recapture	NQ C4	C8	718381	7655612	TBA	522	35.0	70.0	-	12.0	3	few fight wounds	Excellent	Low, some cleared tracks	Dry
		22/08/15	recapture		C4	718458	7655554											
		23/08/15	recapture		C12	718289	7655612											
		24/08/15	recapture		C13	718272	7655599											
		25/08/15	recapture		C10	718338	7655602											
		26/08/15	recapture		C5	718445	7655570											
		27/08/15	recapture		C13	718272	7655599											

^ Denotes individuals fitted with GPS tracking collars

Superscript Denotes individuals captured over multiple years (Unique number-number of years captured)

APPENDIX 3: MOTION CAMERA RESULTS

Motion Camera	Common Name	Scientific Name	EPBC Act	WC Act	DPaW	Comments
Impact Sites						
MC I1	Grey Shrike-thrush	*Colluricincla harmonica*				
	Spinifex Pigeon	*Geophaps plumifera*				
	European Cattle	*Bos taurus*				
	Feral cat	*Felis catus*				
MC I2	Common Rock-rat	*Zyzomys argurus*				
	Rothschild's Rock-wallaby	*Petrogale rothschildi*				
	Feral Cat	Felis catus				
MC I3	Northern Quoll	*Dasyurus hallucatus*	EN	S1	EN	Female (bare skin on thighs), no ear notch visible
	Perentie	*Varanus giganteus*				
	Pilbara Rock Monitor	*Varanus pilbarensis*				
	Common Bronzewing	*Phaps chalcoptera*				
MC I4	Common Rock-rat	*Zyzomys argurus*				
	Northern Quoll	*Dasyurus hallucatus*	EN	S1	EN	Female (bare skin on thighs)
	Rothschild's Rock-wallaby	*Petrogale rothschildi*				
	Grey Shrike-thrush	*Colluricincla harmonica*				
	Western Bowerbird	*Ptilonorhynchus guttatus*				
	Grey-headed Honeyeater	*Lichenostomus keartlandi*				
	Pilbara Rock Monitor	*Varanus pilbarensis*				
	Torresian Crow	*Corvus orru*				
MC I5	Common Rock-rat	*Zyzomys argurus*				

Motion Camera	Common Name	Scientific Name	EPBC Act	WC Act	DPaW	Comments
MC I6	Northern Quoll	*Dasyurus hallucatus*	EN	S1	EN	Female 941 000016595571
	Pseudantechinus species	*Pseudantechinus* sp.				
	Common Rock-rat	*Zyzomys argurus*				
	Grey Shrike-thrush	*Colluricincla harmonica*				
	Feral Cat	*Felis catus*				
	Echidna	*Tachyglossus aculeatus*				
	Grey-headed Honeyeater	*Lichenostomus keartlandi*				
	Spinifex Pigeon	*Geophaps plumifera*				
	Striated Grasswren	*Amytornis striatus*				
MC I7	Northern Quoll	*Dasyurus hallucatus*	EN	S1	EN	Most likely male
	Euro	*Macropus robustus*				
	Common Bronzewing	*Phaps chalcoptera*				
	Rothschild's Rock-wallaby	*Petrogale rothschildi*				
MC I8	Torresian Crow	*Corvus orru*				
	Pilbara Rock Monitor	*Varanus pilbarensis*				
	Grey Shrike-thrush	*Colluricincla harmonica*				
MC I9	Common Rock-rat	*Zyzomys argurus*				
	Echidna	*Tachyglossus aculeatus*				
	Pseudantechinus species	*Pseudantechinus* sp.				
	Northern Quoll	*Dasyurus hallucatus*	EN	S1	EN	
	Rothschild's Rock-wallaby	*Petrogale rothschildi*				
	Pilbara Rock Monitor	*Varanus pilbarensis*				
	Perentie	*Varanus giganteus*				

Motion Camera	Common Name	Scientific Name	EPBC Act	WC Act	DPaW	Comments
Control sites						
MC C1	Grey Shrike-thrush	*Colluricincla harmonica*				
	Western Bowerbird	*Ptilonorhynchus guttatus*				
	Grey-headed Honeyeater	*Lichenostomus keartlandi*				
MC C2	Common Rock-rat	*Zyzomys argurus*				
	Torresian Crow	*Corvus orru*				
MC C3	Torresian Crow	*Corvus orru*				
	Perentie	*Varanus giganteus*				
	Ring-tailed Dragon	*Ctenophorus caudicinctus*				
	Goldfield's Crevice-skink	*Egernia formosa*				
	Common Rock-rat	*Zyzomys argurus*				
	Spinifex Pigeon	*Geophaps plumifera*				
MC C4	Western Bowerbird	*Ptilonorhynchus guttatus*				
	Euro	*Macropus robustus*				
	Grey Shrike-thrush	*Colluricincla harmonica*				
	Perentie	*Varanus giganteus*				
MC C5	Northern Quoll	*Dasyurus hallucatus*	EN	S1	EN	Ear notch present
	Grey Shrike-thrush	*Colluricincla harmonica*				
MC C6	Grey Shrike-thrush	*Colluricincla harmonica*				
MC C7	Northern Quoll	*Dasyurus hallucatus*	EN	S1	EN	No ear notch
	Spinifex Pigeon	*Geophaps plumifera*				
	Echidna	*Tachyglossus aculeatus*				
	Grey-headed Honeyeater	*Lichenostomus keartlandi*				
	Grey Shrike-thrush	*Colluricincla harmonica*				
	Western Bowerbird	*Ptilonorhynchus guttatus*				

Motion Camera	Common Name	Scientific Name	EPBC Act	WC Act	DPaW	Comments
MC C8	Grey Shrike-thrush	*Colluricincla harmonica*				
	Perentie	*Varanus giganteus*				
	Rothschild's Rock-wallaby	*Petrogale rothschildi*				
MC C9	Western Bowerbird	*Ptilonorhynchus guttatus*				
	Pied Butcherbird	*Cracticus nigrogularis*				
	Rothschild's Rock-wallaby	*Petrogale rothschildi*				
	Rothschild's Rock-wallaby	*Petrogale rothschildi*				
Rehab 1	Ring-tailed Dragon	*Ctenophorus caudicinctus*				

Plate 8: Northern Quoll recorded at NS MC I3

Plate 9: Northern Quoll recorded at NS MC I4

Plate 10: Northern Quoll recorded at NS MC I6

Plate 11: Northern Quoll recorded at NS MC I7

Plate 12: Northern Quoll (tail) recorded at NS MC I9

Plate 13: Northern Quoll recorded at NS MC C5

Plate 14: Northern Quoll recorded at NS MC C7

APPENDIX 4: RADIO TRACKING RESULTS

Table 18: Radio tracking co-ordinates Female GPS3_#139

Date	Time	Coordinates		No. of Night
		Easting	Northing	
25/08/2015	10:01:10 PM	No satellite reception		1
26/08/2015	2:01:07 AM	712852	7649374	1
26/08/2015	4:31:10 AM	713484	7649346	1
26/08/2015	10:01:10 PM	No satellite reception		2
27/08/2015	2:00:48 AM	712867	7649406	2
27/08/2015	4:31:10 AM	No satellite reception		2
27/08/2015	10:01:10 PM	No satellite reception		3
28/08/2015	2:00:42 AM	712891	7649428	3
28/08/2015	4:31:10 AM	No satellite reception		3
28/08/2015	10:01:10 PM	713030	7649099	4
29/08/2015	2:01:10 AM	712920	7649470	4
29/08/2015	4:31:10 AM	No satellite reception		4
29/08/2015	10:01:10 PM	No satellite reception		5
30/08/2015	2:01:10 AM	No satellite reception		5
30/08/2015	4:31:10 AM	No satellite reception		5
30/08/2015	10:01:10 PM	No satellite reception		6
31/08/2015	2:01:10 AM	No satellite reception		6
31/08/2015	4:31:10 AM	712992	7649496	6
31/08/2015	10:01:10 PM	No satellite reception		7
1/09/2015	2:00:19 AM	713083	7649641	7
1/09/2015	4:31:10 AM	No satellite reception		7
1/09/2015	10:01:10 PM	No satellite reception		8
2/09/2015	2:00:48 AM	713278	7649820	8
2/09/2015	4:31:10 AM	No satellite reception		8
2/09/2015	10:01:10 PM	No satellite reception		9
3/09/2015	2:01:10 AM	713527	7650028	9
3/09/2015	4:30:49 AM	712638	7649457	9
3/09/2015	10:01:10 PM	No satellite reception		10
4/09/2015	2:00:48 AM	712643	7649454	10
4/09/2015	4:31:10 AM	No satellite reception		10
4/09/2015	10:01:10 PM	712870	7649278	11
5/09/2015	2:01:10 AM	712788	7649465	11
5/09/2015	4:31:10 AM	No satellite reception		11
5/09/2015	10:01:10 PM	No satellite reception		12
6/09/2015	2:01:10 AM	No satellite reception		12
6/09/2015	4:31:10 AM	No satellite reception		12
6/09/2015	10:01:10 PM	No satellite reception		13
7/09/2015	2:01:10 AM	No satellite reception		13
7/09/2015	4:31:10 AM	712937	7649564	13
7/09/2015	10:01:10 PM	No satellite reception		14
8/09/2015	2:00:18 AM	712752	7649488	14

Table 19: Radio tracking coordinates Male GPS1_#099

Date	Time	Coordinates		No. of Night
		Easting	Northing	
26/08/2015	9:59:48 PM	712491	7650696	1
27/08/2015	2:00:36 AM	712423	7650633	1
27/08/2015	4:30:42 AM	712493	7650701	1
27/08/2015	10:00:43 PM	712491	7650695	2
28/08/2015	2:00:42 AM	712423	7650637	2
28/08/2015	4:30:42 AM	712482	7650700	2
28/08/2015	10:00:36 PM	712486	7650695	3
29/08/2015	2:00:42 AM	712486	7650695	3
29/08/2015	4:30:48 AM	712484	7650694	3
29/08/2015	10:00:36 PM	712487	7650693	4
30/08/2015	2:00:43 AM	712483	7650687	4
30/08/2015	4:31:07 AM	712491	7650691	4
30/08/2015	10:01:10 PM	712479	7650710	5
31/08/2015	2:00:42 AM	712488	7650695	5
31/08/2015	4:31:06 AM	712484	7650693	5
31/08/2015	10:01:06 PM	712484	7650692	6
1/09/2015	2:01:10 AM	712854	7650807	6
1/09/2015	4:30:48 AM	712486	7650695	6
1/09/2015	10:00:48 PM	712497	7650686	7
2/09/2015	2:00:48 AM	712491	7650695	7
2/09/2015	4:30:48 AM	712483	7650694	7
2/09/2015	10:00:36 PM	712486	7650696	8
3/09/2015	2:00:43 AM	712478	7650696	8
3/09/2015	4:30:43 AM	712490	7650695	8
3/09/2015	10:00:43 PM	712479	7650699	9
4/09/2015	2:00:37 AM	712490	7650691	9
4/09/2015	4:30:42 AM	712486	7650695	9
4/09/2015	10:00:48 PM	712486	7650693	10
5/09/2015	2:00:42 AM	712488	7650696	10
5/09/2015	4:31:10 AM	711999	7651472	10
5/09/2015	10:00:42 PM	712264	7650676	11
6/09/2015	2:00:48 AM	712488	7650694	11
6/09/2015	4:31:10 AM	712357	7650787	11
6/09/2015	10:00:36 PM	712488	7650692	12
7/09/2015	2:00:36 AM	712485	7650698	12
7/09/2015	4:30:37 AM	712484	7650693	12
7/09/2015	10:00:18 PM	712513	7650621	13
8/09/2015	2:00:36 AM	712489	7650693	13
8/09/2015	4:30:36 AM	712490	7650686	13
8/09/2015	10:00:19 PM	712516	7650615	14
9/09/2015	2:00:36 AM	712487	7650692	14
9/09/2015	4:30:36 AM	712490	7650689	14
9/09/2015	10:00:36 PM	712488	7650691	15

Date	Time	Coordinates		No. of Night
		Easting	Northing	
10/09/2015	2:00:36 AM	712486	7650698	15
10/09/2015	4:30:37 AM	712484	7650693	15
10/09/2015	10:00:36 PM	712490	7650688	16
11/09/2015	2:00:36 AM	712487	7650696	16
11/09/2015	4:30:37 AM	712486	7650692	16
11/09/2015	10:00:36 PM	712488	7650690	17
12/09/2015	2:00:36 AM	712562	7650766	17
12/09/2015	4:30:36 AM	712483	7650707	17
12/09/2015	10:00:36 PM	712489	7650691	18
13/09/2015	2:00:36 AM	712488	7650694	18
13/09/2015	4:30:37 AM	712489	7650696	18
13/09/2015	10:00:36 PM	712488	7650692	19
14/09/2015	2:00:36 AM	712489	7650695	19
14/09/2015	4:30:42 AM	712457	7650856	19
14/09/2015	10:00:36 PM	712491	7650690	20
15/09/2015	2:00:36 AM	712492	7650695	20
15/09/2015	4:30:36 AM	712490	7650687	20
15/09/2015	10:00:36 PM	712491	7650692	21
16/09/2015	2:00:36 AM	712485	7650690	21
16/09/2015	4:30:36 AM	712487	7650678	21
16/09/2015	10:00:36 PM	712488	7650691	22
17/09/2015	2:00:36 AM	712491	7650696	22
17/09/2015	4:30:42 AM	712490	7650692	22
17/09/2015	10:00:36 PM	712490	7650694	23
18/09/2015	2:00:36 AM	712576	7650878	23
18/09/2015	4:30:36 AM	712492	7650686	23
18/09/2015	10:00:36 PM	712488	7650688	24

APPENDIX 5: PILBARA OLIVE PYTHON DETAILS

POP I.D.	Capture	Microchip No	Sex	Site	Date	Coordinates		WAM #	Weight (G)	Length (CM)	Health rating (1-5)	Veg condition	Local impact	Rainfall seasonality
						Easting	Northing							
2011														
POP 1	Initial Capture	-	unknown	NS12/POP I1	17/10/14	716113	7649224	-	-	-	-	Excellent	Few cattle closeby	Dry
POP 2	Initial Capture	-	unknown	NS12/POP I1	17/10/14	716313	7649424	-	-	-	-	Excellent	Few cattle closeby	Dry
POP 3	Initial Capture	-	unknown	NS12/POP I1	17/10/14	716213	7649324	-	-	-	-	Excellent	Few cattle closeby	Dry
POP 4	Initial Capture	-	unknown	Opportunistic/POP C4	18/10/14	717827	7655606	-	-	-	-	Excellent	Some track clearing nearby	Dry
POP 5	Initial Capture	-	unknown	Opportunistic/POP I4	28/10/14	711107	7648592	-	-	-	-	Excellent	Few cattle closeby	Dry
POP 6	Initial Capture	-	unknown	Opportunistic/POP I3	29/10/14	711673	7650631	-	-	-	-	Excellent	Some tracks and dust from vehicle traffic	Dry
2014														
NS POP C-1	Initial Capture	941000016202864	Female	POP C4	06/04/14	718305	7655591	WAMTS 326	3,295	240	5	Excellent	Some track clearing nearby	Wet
NS POP C-2	Initial Capture	941000016202865	Female	POP C2	06/04/14	714539	7655508	WAMTS 326	1,845	200	3.5 (little body fat)	Good	Low impacts, some cattle	Wet
	Recapture				07/04/14	714542	7655517							
	Recapture				08/04/14	714547	7655523							
	Recapture				09/04/14	714547	7655523							
NS POP C-3[#]	Initial Capture	941000016202860	Male	NQ C3	25/08/14	713613	7656809	WAMTS 326	1,260	240	5	Excellent	Some track clearing nearby	Wet
2014/15														
NS POP I-1	Initial Capture	9410000017452072	Female	POP I2	22/02/15	713368	7647866	WAMTS361	475	160	4	Excellent	Some track clearing nearby, noise from mining activity	Wet
NS POP I-2	Initial Capture	941000016595537	Juvenile	POP I3	20/02/15	711680	7650632	WAMTS361	500 (including prey)	125	4.5 (fed recently)	Excellent	Some dust and noise from nearby traffic, main track activity nearby.	Wet
NS POP I-3	Initial Capture	941000017452073	Juvenile	POP I4	21/02/15	711098	7648587	WAMTS361	150	90	4 (scar on neck)	Excellent	Some track clearing nearby	Wet
NS POP C-4	Initial Capture	941000016595541	Juvenile	POP C1	22/02/15	712588	7655823	WAMTS361	125	80	5 (fed recently)	Good	Low impacts, some cattle	Wet
NS POP C-2	Recapture from 2014	941000016202865	Female	POP C2	19/02/15	714547	7655523	WAMTS361	1,500	210	3.5 (little body fat)	Good	Some ground disturbance by cows and track clearing nearby	Wet
	Recapture				20/02/15	714546	7655531							
2015/2016														
NS POP C-3[#]	Recapture from 2015	941000016202860	Male	NQ C3	28/08/15	713667	7656755	-	-		4 (little body fat)	Excellent	Very little impact from some nearby exploration tracks	Dry
NS POP C-5	Initial Capture	941 000016595531	Female	POP C2	07/12/15	714540	7655512	-	1,250	180	4.5	Good	Some ground disturbance by cows and track clearing nearby	Wet
NS POP C-6	Initial Capture	941 000017452069	Male	POP C4	11/12/15	718287	7655586	-	1,125	190	2 (scars & spinal disfigurement from injury)	Excellent	Some track clearance nearby	Wet
NS POP I-4	Initial Capture	941 000017452059	Male	POP I4	12/12/15	711133	7648580	-	2,875	220	5	Excellent	Some track clearing nearby	Wet

[#] Recorded during winter phase