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2024
REPORT

Baseline Survey of Invasive Fauna on McPhee Iron Ore Project

By APMS

Date: June 2024

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Contents

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Executive Summary

Animal Pest Management Services conducted a baseline survey at McPhee Creek Iron Ore Project to assess invasive fauna, finding Wild Dogs and Feral Cats as the primary species. Wild Dogs were detected at five locations, indicating pack behavior, while Feral Cats were widespread across 13 locations. The study used camera traps and transects over 395 trap nights, with no significant difference in results between methods. Passive observations also noted Fox tracks and a Donkey. Compared to the Roy Hill Mining Lease, Wild Dog numbers were similar, but Feral Cats were more abundant. Recommendations include targeted Wild Dog management, extensive Feral Cat control, and regular biannual monitoring to track and manage invasive species effectively.

1. Background

Animal Pest Management Services (APMS) was commissioned by HANROY to undertake a baseline survey of the invasive fauna at McPhee Creek Iron Ore Project. The purpose of this survey was to determine the presence or absence of invasive fauna species on the project site and to determine their current relative abundance and distribution as a baseline for occupancy rates. The survey outcomes will be used to help implement an invasive fauna management plan. The survey consisted of one data collection period via camera trapping, transects, and track/activity observation. Target species included: Wild Dogs (*Canis lupus familiaris/Canis lupus dingo*) (The term Wild Dog refers to all feral domestic Dogs, Dingoes and their hybrids.), Foxes (*Vulpes vulpes*), Cats (*Felis catus*) Rabbits (*Oryctolagus cuniculus*), Camels (*Camelus dromedarius*), Donkeys (*Equus asinus*), Horses (*Equus caballus*), Feral Pigs (*Sus Scrofa), and* Cane Toads *(Rhinella marina*).

2. Climate and Habitat

The McPhee Creek Iron Ore Project is located approximately 230km north of Newman and 80km south of Marble Bar in the Pilbara region of Western Australia.
The climate of this region is characterized by hot summers and mild winters with variable to low annual rainfall. The Northern Inland area where the project is located is classified as a hot desert environment and maximum summer temperatures often exceed 40 degrees Celsius, with winter temperatures averaging around 20 degrees Celsius. Rainfall is most common in summer and autumn and less common during winter and spring (Department of Climate Change, n.d.; Sudmeyer, 2016). The project site lies at the top of the catchment area of four creeks, McPhee Creek, Lionel Creek, Sandy Creek and Spinaway Creek. The surrounding landscape is characterized by inland mountain ranges, gorges and coastal plains. Vegetation in the area consists predominately of sparse hummock grasses, tussock grasses and shrubs (GHD, 2021, Biologic, 2020).

3. Program Period

The baseline survey took place over three weeks between the 13th of May and the 31st of May 2024. APMS staff were present on site between the 13th and 17th of May and between the 27th and 31st of May. Trap cameras were left running between the two active survey periods.

4. Survey Methodology

The baseline survey was undertaken using camera traps, transects, and track/activity observations. These methods were selected and used together, to gain the most possible data over a wide survey area. Cameras were set between the 14th and 17th of May 2024 and were removed on the 29th of May 2024. Some cameras were reinstalled in different locations on the 29th and 30th of May in areas with suspected Bilby (*Macrotis logotis)* activity. These cameras were then removed on the 31st of May. Transects were conducted between the 14th and 17th of May and the 27th and 31st of May 2024. Track/activity observations took place whenever APMS staff were available on-site for the duration of the program.

4.1 Camera trapping

Camera traps were used over the course of the data collection period, to capture images of invasive fauna that passed in front of the camera during the day and night. Three types of cameras were used during the survey period: Browning (Model BTC-8E-HP5), Browning (Model BTC-6PX 1080) and BolyGuard (ModelSG2060-K). 29 cameras were set in a total of 35 locations across the survey area between the 14th and the 31st of May. Active trap nights (nights when the camera is switched on and has the potential to photograph a target animal) ranged between 1 and 16 nights.

Cameras were set to take images of high resolution to minimize observations that could not be attributed to a certain species as sometimes happens with low-quality images (Bengsen et al. 2011; Meek et al. 2015). Cameras were secured to trees, shrubs and picket stakes and set between approximately 400mm and 600mm to capture full body images of targeted fauna species such as Wild Dogs, Foxes, Cats, Rabbits and partial images of larger target fauna such as Camels. Full body images assist in identifying individuals by sex and markings. Branches, grass, and leaves directly in front of cameras were removed to minimize false trigger events.

Cameras were set at known points of interest to maximize capture rates during the short survey period as has proven useful in other carnivore surveys (Towerton et al. 2011; Cusack et al. 2015). Points of interest when surveying invasive fauna include water sources, potential food sources, regular travel paths or pads, crossroads and suspected den sites. Cameras were also set across varying areas of vegetation and terrain.

Images taken by camera traps were collected and examined to determine the number of capture events that occurred each day of the survey period. Every photo taken was date and time stamped. Capture events were determined based on the number of individual target animals photographed at a camera trap on a particular day. Due to the uniformity of coat colour and pattern of the targeted species in the area and the fact that most images captured were taken at night and were therefore monochromatic, it was nearly impossible to identify individuals when multiple captures occurred on a single day or night (Meek et al. 2015). To rectify this, unidentifiable animals that disappeared from the camera detection zone and reappeared more than 15 minutes later were assumed to be different individuals. The 15-minute interval was chosen to allow animals to linger at a point of interest.

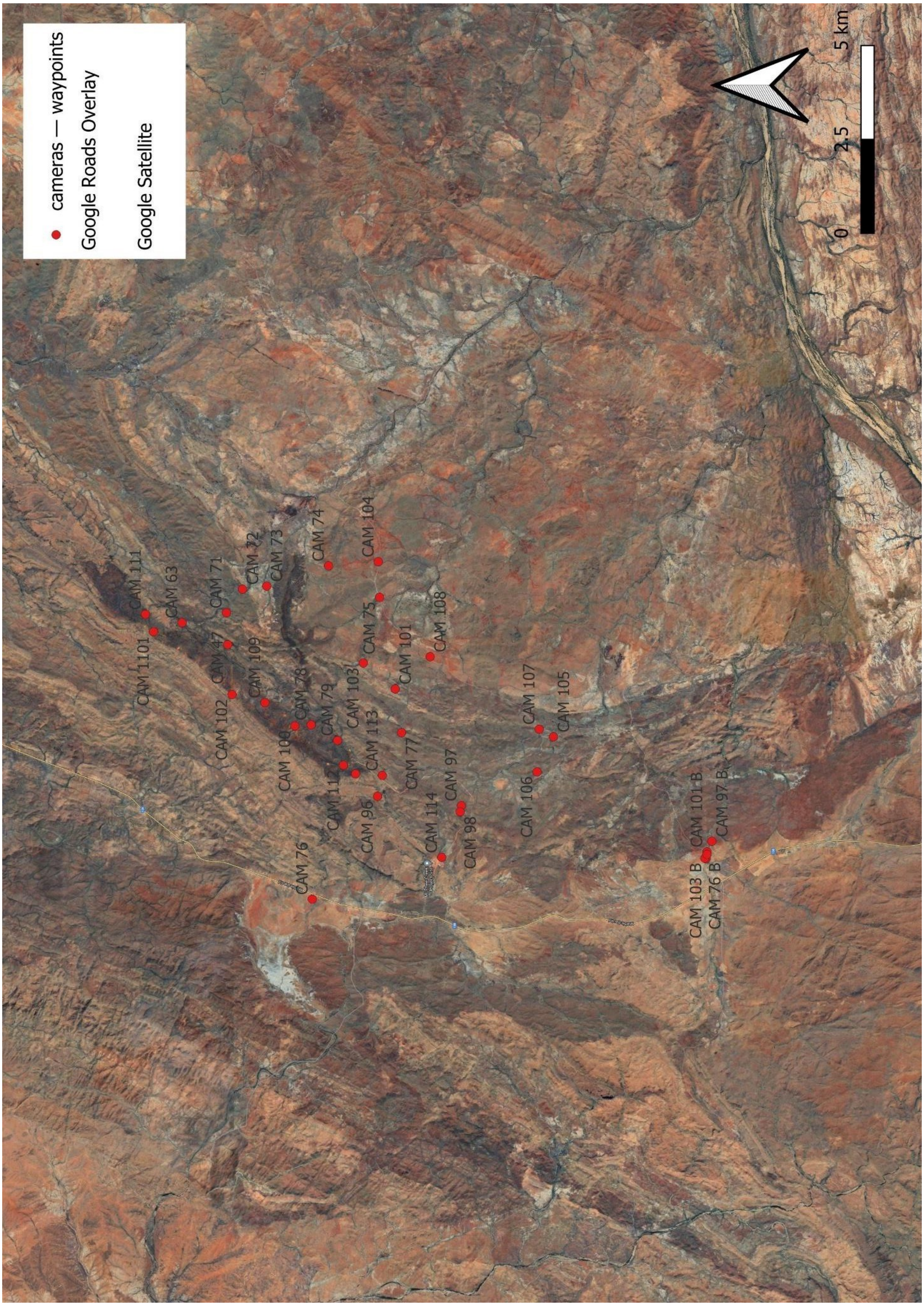

Figure 1. Map of camera locations across McPhee Creek Iron Ore Project site.

4.2 Transects

Transects were used to passively gather presence and absence data across multiple environs occurring on the project site. Transects were 100 meters long and the surveyed area included one meter either side of the transect line. Identifiable tracks and scats were recorded as presence and absence data for each species along each transect. 33 transects were surveyed across the project area. Transect locations were selected to cover differing vegetation types and terrains.

4.3 Track Observation

Track/activity observations of target species were used passively to assess the presence or absence of target species throughout the mining lease. Identifiable tracks were observed and recorded along sandy roads with caution taken to only record a single set of tracks (tracks of one animal that continue unbroken for some distance) once. Other signs of activity recorded included identifiable scats, diggings (e.g. Rabbits), animal sightings and carcasses suspected of being killed by target species. Track/activity observations undertaken at the beginning of the survey period helped to identify points of interest when setting cameras. Observations were also undertaken throughout the survey period.

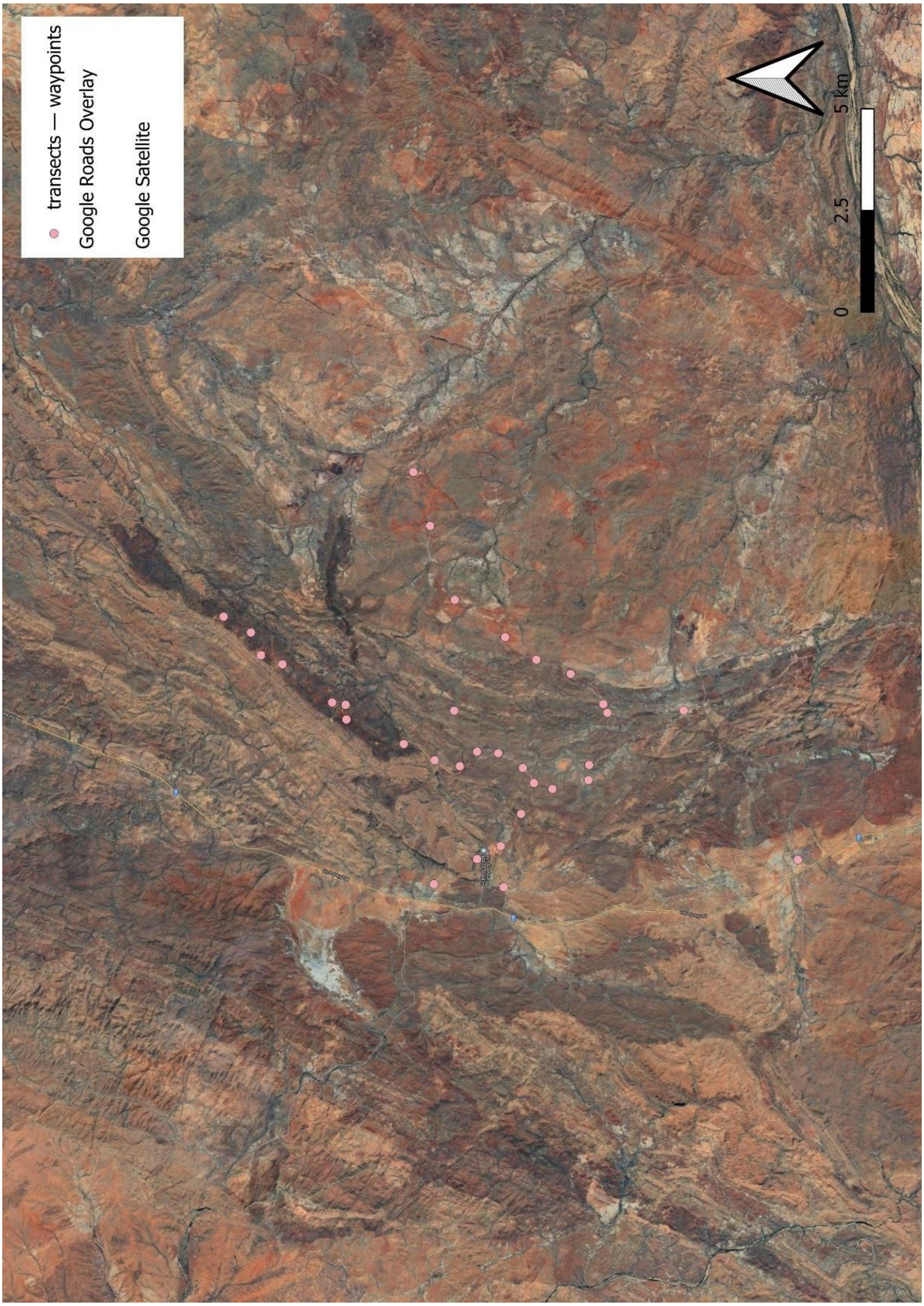

Figure 2. Map of transect locations across McPhee Creek Iron Ore Project site.

4.4 Data Analysis

Target species numbers were calculated as Relative Abundance Indices (RAI). RAIs are often used to track changes in abundance, habitat use variation, species interactions, activity patterns and can be used to track population size changes when individual identification of animals is not viable (Burton et al. 2015; Kämmerle et al. 2018). Camera traps can be used to calculate RAIs given the assumption that photographic rates are lineally related to animal abundance (Jenks et al. 2011). Analysis of photographic rates of capture is a promising way of deriving RAI’s and is calculated as the number of captures per camera trap night (Palmer et al. 2018). Camera trap nights were calculated by examining capture images to determine periods when the camera was not operational as per Kämmerle et al. 2018. Transect RAIs were calculated as number of presence scores for each target species per total number of transects.

Two sample t-tests assuming unequal variance were conducted to compare the RAI results of the transect and camera surveys across the project area. This was done to determine if the RAI calculated from the camera traps and transects on the lease differed significantly.

4.5 Appropriateness of Using Relative Abundance Indices (RAI) to Calculate Baseline Numbers

Given the consistency between camera trap and transect RAIs observed in the survey, RAIs can be considered a viable method for calculating baseline numbers in this context. However, researchers should remain cautious of the assumptions and potential biases associated with this method.

4.5.1 Advantages of RAIs

- Flexibility:
  RAIs can track changes in abundance, habitat use variation, species interactions, and activity patterns (Burton et al. 2015; Kämmerle et al. 2018).
  Useful for monitoring population size changes where individual identification is not possible.

- Non-invasive:
  Camera traps and transect surveys are non-invasive, reducing disturbance to wildlife.

- Cost-effective:
  RAIs are generally more cost-effective than methods requiring individual identification, such as genetic analysis or tagging.

- Feasibility:
  Particularly suitable for large areas and elusive species where direct counts are impractical.

4.5.2 Limitations and Assumptions of RAIs

- Linearity Assumption:
  The assumption that photographic rates are linearly related to animal abundance may not always hold true. Factors like animal behavior, camera placement, and habitat complexity can affect capture rates (Jenks et al. 2011).

- Detection Probability:
  RAIs do not account for varying detection probabilities among species and individuals. This can introduce bias if detection probability is not uniform.

- Temporal Variability:
  RAIs can be influenced by temporal factors such as seasonality, which may affect animal movement and behavior.

- Comparative Limitations:
  The two sample t-tests assuming unequal variance showed no significant difference between the methods, but this does not confirm absolute accuracy. It only indicates consistency between methods under the given conditions.

5 Results

A total of 43 camera events involving target species and 13 transect events were recorded on the project area across the survey period.

Table 1. Camera Events and Calculated RAIs per Target Species.

Species	Events	RAI
Dog	25	0.06
Cat	18	0.05
Rabbit	0	0
Fox	0	0
Cane Toad	0	0
Pig	0	0
Total	43	0.11

Table 2. The Number of Times Target Species were present in Transects on McPhee Creek Iron Ore Project with calculated RAIs.

Species	Times Present	RAI
Dog	3	0.09
Cat	10	0.30
Rabbit	0	0
Fox	0	0
Cane Toad	0	0
Pig	0	0
Total	13	0.39

T-test two samples assuming unequal variance statistical analysis comparing the calculated RAIs of transects and camera traps across the project area yielded the following: P(T<=t) two-tail= 0.168 α=0.05.

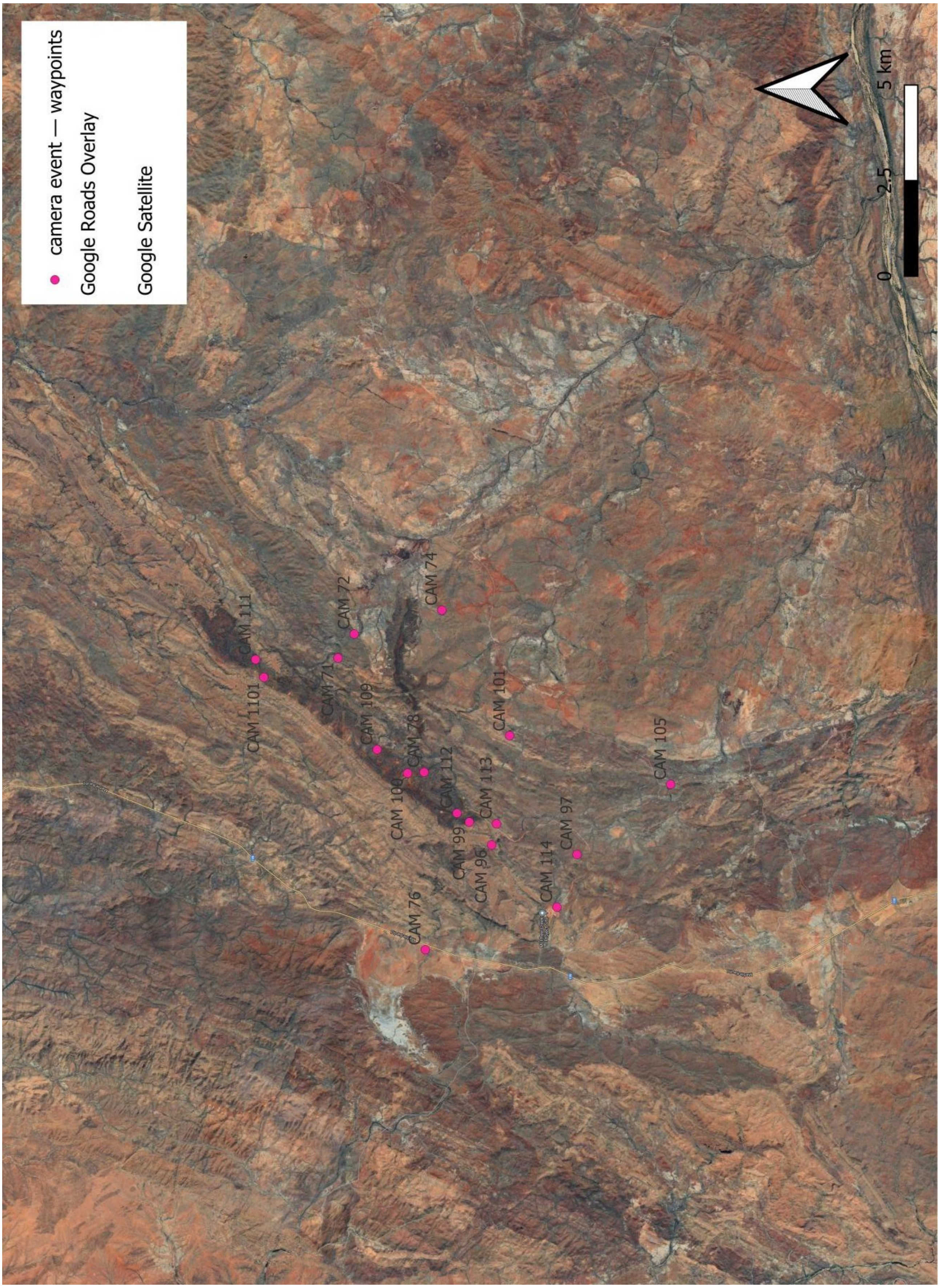

Figure 3. Map of camera waypoint events locations across McPhee Creek Iron Ore Project site.

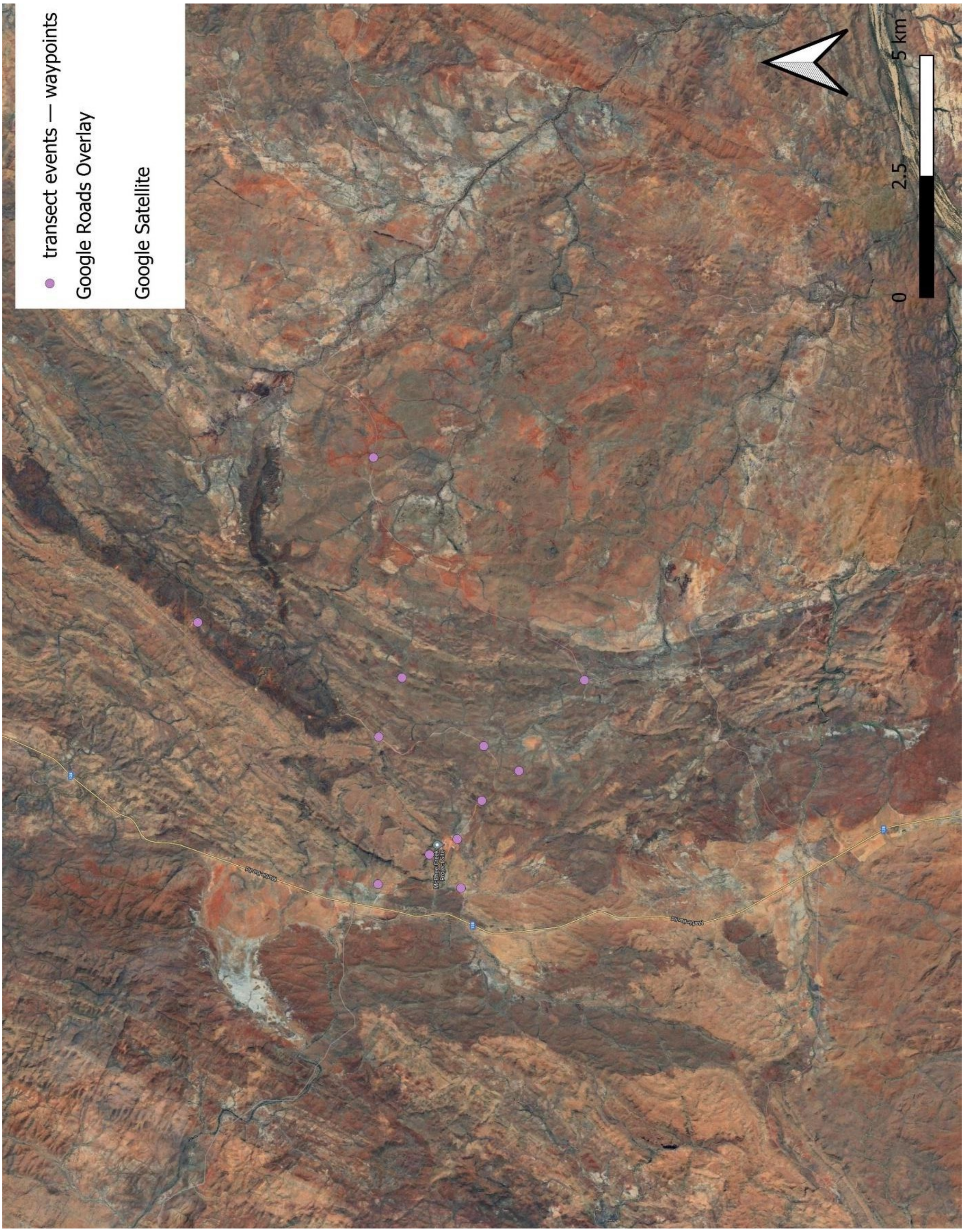

Figure 4. Map of transect events locations across McPhee Creek Iron Ore Project site.

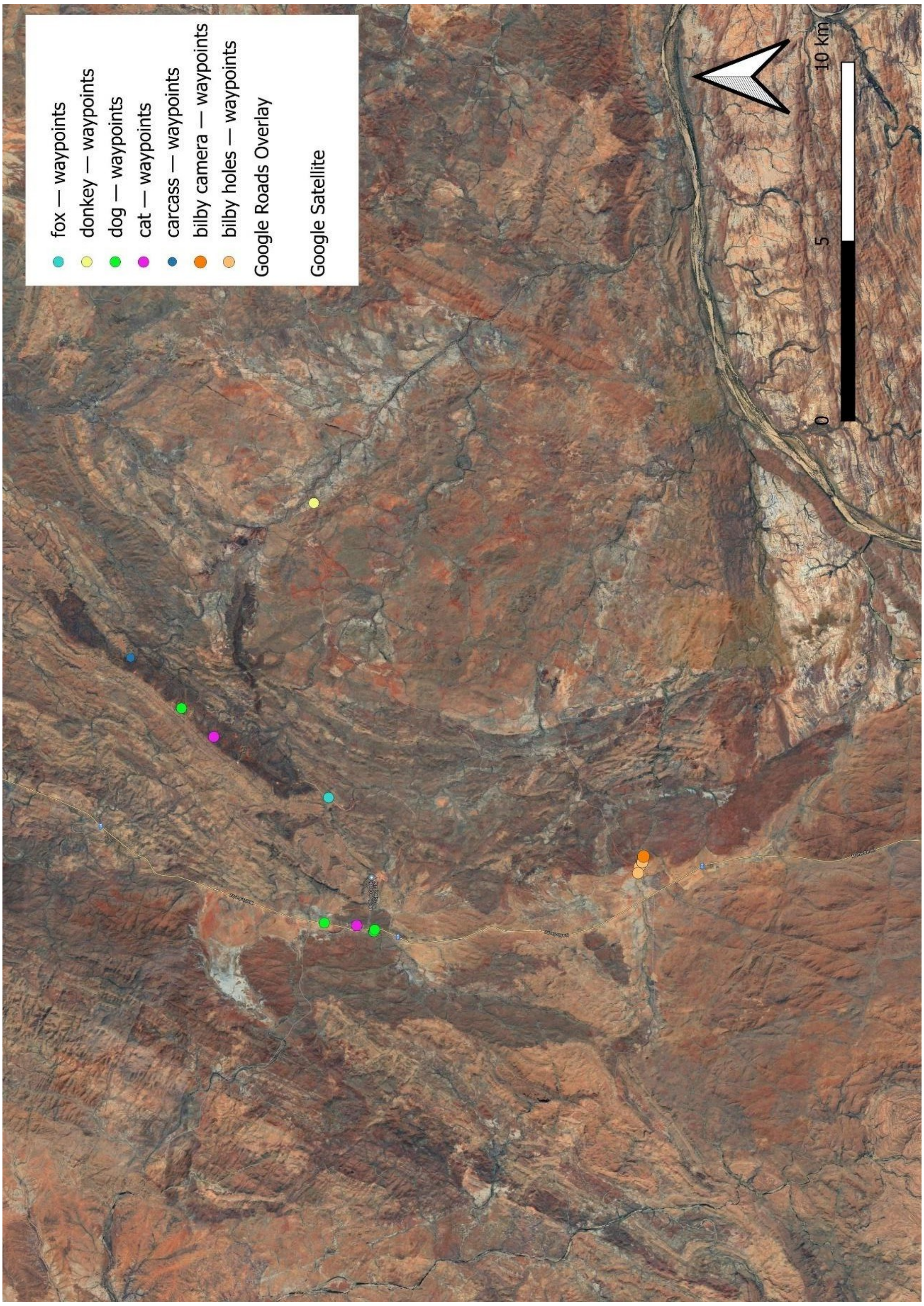

Figure 5. Map of Target Species Activity Observations across McPhee Creek Iron Ore Project site

Figure 6. Two adult male Wild Dogs photographed during the day at different locations.


28.66 inHg 18C 05/27/2024 08:51PM APMS 72


28.74 inHg 18C 05/20/2024 08:06PM APMS 74

Figure 7. Wild Dogs photographed at night at three different locations.

Figure 8. Similarly patterned and coloured Feral Cats in different locations.

Figure 9. Similarly patterned and coloured Feral Cats in same location on different days.

Figure 10. Two black Feral Cats photographed at different locations.

Figure 11. Two spotted tabby Feral Cats at different locations.

Figure 12. Less identifiable Feral Cats in four different locations.

Other species observed on camera included.

- Bilby

- Bats (Species unknown)
- Brush Stone Curlew (*Burhinus grallarius*)
- Spinifex Pigeon (*Geophaps plumifera*)
- Cattle (*Bos taurus)*
- Budgerigar (*Melopsittacus undulatus*)
- Goanna (Species unknown)
- Euro (Macropus robustus)

Figure 13. Bilby photographed on McPhee Creek Iron Ore Project site.

Figure 14. Euros photographed on McPhee Creek Iron Ore Project site.

Figure 15. Brush Stone Curlew photographed on McPhee Creek Iron Ore Project site.

Figure 16. Cattle photographed on McPhee Creek Iron Ore Project site.

Other species identified on transects included

- Goanna (Species unknown)
- Spinifex Hopping Mouse (*Notomys alexis*)
- Northern Quoll (*Dasyurus hallucatus*)
- Mulgara (*Dasycercus species*)
- Snake (Species unknown)

6 Discussion

Cameras were active for a total of 395 trap nights and recorded two target species Wild Dogs and Feral Cats. Wild Dogs were photographed at five camera locations and were present across three transects. Feral Cats were photographed at 13 camera locations and were present across 10 transects. Neither cameras nor transects detected the presence of any other target species. The two sample t-test assuming unequal variance conducted to compare the calculated RAIs obtained by these two methods showed that there was no significant statistical difference in results between the two. The minor difference in the raw data can be explained spatially. Wild dogs were more frequently recorded on camera than Feral Cats, however, these recordings were limited to fewer locations, whereas Feral Cats were less frequently photographed but were over a multitude of locations as is reflected in the transect data. This indicates pockets of Wild Dog activity and widespread Feral Cat activity across the project site.

The distance between the five camera locations where Wild Dogs were recorded averaged only 2.7km. This strongly indicates that the individuals photographed belong to a single pack. Home ranges vary greatly depending on the availability of resources. Home ranges studied in the Fortescue River area of Western Australia were shown to average approximately $95km^2$ but may be much greater or smaller. These home ranges tend to remain stable but may change over time (Fleming et al., 2001; Thomson & Marsack, 1992). Figure 6 shows that there are at least two identifiable adult male Wild Dogs in the area.

Figures 8 and 9 display similarly patterned and coloured Feral Cats at five different locations across multiple days. Given the days the images were captured on and the distance between the cameras it is highly probable that the Feral Cats observed on camera 78 (on separate days) and the Feral Cat observed on camera 100 are the same animal, given the less than half a kilometer distance between the two cameras.

It is also possible that the Feral Cats observed on cameras 112 and 109 are the same animal as observed on cameras 100 and 78, given the average distance between the four cameras is approximately 1.4km. Studies show that the home range for Feral Cats in northwestern Australia varies from between an average of $3km^2$ for adult females to $8km^2$ for adult males (McGregor et al., 2015). However, without being able to confirm that these observations are of a single animal it should be assumed that there are multiple individuals present and actions taken to address the issue.

Figure 10 shows two black Feral Cats observed at different locations. Given the 4.4km distance between the two cameras it would be safer to assume these are two individual animals.

Figure 11 shows two Feral Cats with similar appearances, at different locations. Given the less than 1km distance between the cameras and the similarity of the markings it is possible this is the same animal but again without a positive identification and with a five-day period between recordings it would be prudent to assume otherwise.

The passive observation of tracks and other target species activity conducted by APMS staff identified the presence of two other target species on McPhee Creek Iron Ore Project. One set of Fox tracks was recorded on site and a Donkey was sighted by APMS staff members. The location of these recordings can be found in Figure 5.

In comparison to a recent baseline survey of Roy Hill Mining Lease (located approximately 100km south of McPhee Creek Iron Ore Project) conducted by APMS, Wild Dog abundance appears very similar though possibly more spatially restricted at McPhee Creek Iron Ore Project. Feral Cat numbers however appear to be notably higher than at Roy Hill in comparison.

7. Analysis of survey findings

7.1 Camera Trapping Results

- Duration: Cameras were active for a total of 395 trap nights.
- Target Species Detected:
  Wild Dogs: Photographed at 5 camera locations across 3 transects.
  Feral Cats: Photographed at 13 camera locations across 10 transects.
- Other Species: No other target species were detected by cameras or transects.

7. 2 Statistical Analysis

- A two-sample t-test assuming unequal variance was conducted to compare the calculated Relative Indices of Abundance (RAIs) obtained by the camera and transect methods.
- Result: No significant statistical difference between the methods.

7. 3 Spatial Analysis

- Wild Dogs:
  More frequently recorded on camera than Feral Cats but limited to fewer locations.
  Indicates specific areas of high activity, likely due to pack behavior.
- Feral Cats:
  Less frequently photographed but spread across multiple locations, indicating widespread activity.
  Spatially extensive presence indicates a larger population than Wild Dogs.

7. 4 Home Range and Identification

- Wild Dogs:
  Average distance between camera locations with Wild Dog activity: 2.7km.
  Home range in Fortescue River area averages 95km^2.
  At least two identifiable adult male Wild Dogs were present.
- Feral Cats:
  Some likely to be the same individual due to proximity and appearance.
  Home range varies from 3km^2 (females) to 8km^2 (males).
  Observations suggest multiple individuals are present due to lack of confirmed positive identifications.
- Home Range and Identification Challenges:
  Difficult to determine exact numbers due to overlapping home ranges and similar appearances.
  Multiple sightings in close proximity likely represent a few individuals, but prudent management assumes multiple individuals.

7. 5 Passive Observations

- Fox Tracks: One set identified on-site.
- Donkey Sighted: Observed by APMS staff members.

- Presence detected through passive observation methods.
- Indicates additional species of concern that were not captured by cameras or transects.

7. 6 Comparative Analysis with Roy Hill Mining Lease

- Wild Dogs: Similar abundance to Roy Hill, possibly more spatially restricted at McPhee Creek.
- Feral Cats: Notably higher numbers at McPhee Creek compared to Roy Hill.

7. 7 Implication for Management

- Wild Dogs:
  Targeted management could focus on specific high-activity areas.
  Continuous monitoring to track pack stability and movements.
- Feral Cats:
  Widespread control measures required due to extensive presence.
  Likely difficulties in effective management due to relatively low and widespread abundance.
  Further identification efforts to determine individual counts and movements.

8. Recommendations

8.1 Wild Dog Management

Wild Dog activity should be continually monitored to ensure that the present population does not increase beyond numbers that would be naturally occurring and sustainable in the area. This will be particularly important as the project grows and more infrastructure and staff become present. Wild Dogs can be attracted to mine sites and villages by increased resources in the area such as water points, food from landfills, rubbish bins, lighting attracting insects at night (a source of food), potentially being provided food by personnel on site and other anthropogenic sources.
Food sources from rubbish bins can provide a ready source of food for Wild Dogs. Managing the ability for these animals to source food from rubbish bins is an important aspect for the overall management of populations. Increased availability of water points can result in increased numbers of Wild Dogs as the presence of water is often a limiting factor in occupancy rates of Wild Dogs in arid regions. As young animals leave their natal areas, these may migrate to the mine where water and potential increased food sources exist. The primary risk from Wild Dogs is their potential negative interactions with personnel on-site. Access to foods supplied by humans can result in habituation whereby Wild Dogs lose their innate fear or caution of humans, and the risk of dangerous behavior is greatly increased. Proper disposal of food waste in bins and landfills and exclusion to man made water points will help prevent Wild Dogs becoming attracted to infrastructure. Strict no-feeding policies and education will help prevent the habituation of Wild Dogs receiving food from humans. Where Wild Dog numbers become too high there may be an adverse effect on the biodiversity within the area due to unsustainable levels of predation. There is evidence that Wild Dogs/Dingoes can have a significant impact on populations of native animals such as the Bilby and Mulgara (Paltridge 2002, Whitehouse 1977) both of which have been identified as present at McPhee Creek Iron Ore Project, particularly where Wild Dog/Dingo numbers are excessive or during drought.

8.2 Feral Cat Management

The Feral Cat (and Fox) has had a devastating effect on some Australian native wildlife and are considered, at least partially, responsible for the extinction or massive contraction in the range and abundance of several species (Burbidge and McKenzie 1989; Morton 1990; Gibson et al. 1994; Dickman 1996). Ground-nesting birds on islands and mammals within the ‘critical weight range’ of 35–5500 g have been particularly vulnerable to these exotic predators. Several of these medium-sized, native mammal species have subsequently increased in population size and range following effective Fox or Feral Cat control. Feral Cats also prey on a wide range of other vertebrates. In one 2500ha enclosure, 80% of the Numbat population was killed by a single Feral Cat over a period of 6 months (M Butcher, personal observation). Feral Cat trapping is recommended for McPhee Creek Iron Ore Project. Cage traps should be deployed either at locations where Cats have been noted (sightings, tracks, cameras) or strategically placed across the landscape to protect vulnerable high conservation value fauna.

Using cage traps for feral cat control is considered one of the more cost-efficient methods currently available. Here's why it's effective and when it's most practical:

Cost Efficiency: Cage traps are relatively inexpensive compared to other methods like shooting or poisoning (using fixed or permanent baited devices). Trapping programs can be repeated or undertaken multiple times or when needed based on activity levels.

Effectiveness: Cage traps can directly target individual cats without affecting non-target species. This precision is crucial for conservation efforts where non-target species must be protected.

Year-Round Feasibility: While trapping can technically be conducted year-round, its effectiveness varies with the season. In the Pilbara region, trapping is recommended during the cooler months (March to October). This timing is strategic because;

Reduced Food Availability: During cooler times, traditional food sources for feral cats (like small mammals, birds, and reptiles) may be scarcer. This makes the cats more likely to investigate traps baited with alternative food sources.

Behavioral Patterns: Feral cats may be more active during cooler periods, increasing their chances of encountering traps.

Environmental Considerations: Operating traps in cooler weather also minimises stress on trapped animals, as extreme heat can be detrimental to captured cats.

In summary, while cage traps are cost-efficient and versatile, their effectiveness in the Pilbara region is maximised during the cooler months when natural food sources for feral cats are reduced. Trapping programs can be a once off, or undertaken more routinely, depending on activity levels and findings from potential future surveys. This approach aligns with both practical and ethical considerations for effective feral cat control.

8.3 Fox and other Feral Species Management

Other feral animal species, such as Camels and Donkeys can be dealt with on an as-needed basis. Continued monitoring would also help in making sure Foxes don't start encroaching.

8.4 Monitoring

Monitoring programs should be undertaken in a manner that allows for the calculation of an RAI or population estimate for each target species. These results should be compared to the RAIs of target species calculated from this survey. These comparisons should show changes or fluctuations in species abundance. Monitoring programs should take place at least biannually and be focused during the summer and winter seasons.

8.5 Timing and Frequency

Establish long-term monitoring programs to track changes in species distribution and abundance over time. A second baseline survey conducted during winter or spring is recommended to complement this initial program. This second survey would provide data on species presence and absence and relative abundance in the area during a cooler drier time of the year and would allow for a more complete understanding of invasive species fluctuations over the seasons. Annual monitoring will provide an opportunity to track the changes in species distribution and abundance over time and assist in determining the effectiveness of control measures implemented, or determine if management should be conducted.

8.6 Conclusion

The survey findings provide a comprehensive understanding of the presence and distribution of Wild Dogs and Feral Cats at the McPhee Creek Iron Ore Project. The data highlights specific areas of concern and indicates the need for targeted and widespread management actions to address the identified species. Further studies and enhanced monitoring are essential for effective wildlife management and conservation efforts in the area.

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