

Appendix F

Species Habitat Associations

1 Introduction

Pacific Aluminium (Alcan Gove Pty Ltd) are proposing to construct a natural gas pipeline from the south of Katherine, to its bauxite mine and alumina refinery at Gove. As part of this proposal, an environmental impact assessment (EIS) is required with the controlling provisions including Listed threatened species and communities (section 18 and 18A) and Listed migratory species (sections 20 and 20A).

Historically, extensive species surveys conducted in the Northern Territory (NT) have been concentrated in certain areas with factors such as rugged terrain hindering access. This has resulted in limitations in the knowledge of species habitat distribution. To aid in the identification of potential habitat preferred by targeted species as part of the EIS document, Eco Logical Australia Pty. Ltd. (ELA) was contracted by Pacific Aluminium to carry out broad habitat associations based on current information available on the biology and distribution of targeted threatened species. Five species were selected and analysed for the northern section of the NT and included:

- Gouldian Finch.
- Red Goshawk.
- Crested Shrike-tit (northern).
- Partridge Pigeon.

The resulting habitat associations can be used to provide a broad-scale indication of the relative suitability of areas as habitat for flora and fauna species within a given study area based on available information. These associations, while broad, can be used as a general guide to further survey effort, and aid in assessment and strategic planning.

2 Methodology and results

A literature review was conducted for the targeted threatened species and utilised resources such as the species profile and threats database (DSEWPaC, 2013) and national recovery plans.

Geographic Information Systems (GIS) software was used to spatially analyse datasets that potential habitat mapping might be derived from. The process is user driven and not a statistical modelling process. For each species, a variety of combinations of the datasets listed in Table 1 were assessed for their suitability in extracting information relating to associated habitat preferences. Suitability was determined by analysing known threatened species records from Atlas data (Department of Land Resource Management, 2012) and Eco Logical Australia 2012 field survey data, by comparing their distribution against the extracted data. In some instances, iterations of the process were required to extract data that appeared to yield the strongest correlation between potential habitat and known species records. The extracted information was then overlaid and a higher ranking applied to those areas exhibiting a greater number of preferences in habitat associated with a particular species.

Table 1

DATASET	SOURCE	SCALE
NVIS Vegetation	Department of Land Resource Management	1:250, 000
Drainage	Bureau of Meteorology	1:250, 000
Water bodies	Bureau of Meteorology	1:250, 000
Land systems	Department of Land Resource Management	1:250, 000 and 1:1, 000, 000
Geology	Northern Territory Geological Survey	1:2, 500, 000
Rainforests	Department of Land Resource Management	1: 250, 000

2.1 GOULDIAN FINCH

The Gouldian Finch prefers open *Eucalyptus* woodlands that have a grassy understorey (*Sorghum*) and nest exclusively in tree hollows of Snappy gum *Eucalyptus brevifolia* in western NT, and Territory Salmon Gum *E. tintinnans* in eastern NT (O'Malley, 2006). While breeding habitat is usually found in ridges and rocky hill slopes, this preference may be due to the availability of *Sorghum* rather than topology (DSEWPaC, 2013a). Dry season foraging habitat is dominated by annual spear grasses or native *sorghum* (O'Malley, 2006). Wet season foraging habitat includes *Alloteropsis semialata*, *Chrysopogon fallax*, Spinifex-dominated communities (*Triodia bitextura*; *T. acutispicula*; *T. bynoei*; *T. schinzii*), *Heteropogon triticeus*, *Sehima nervosum* *Xerochloa laniflora* and *Themeda triandra*. The Gouldian Finch is typically found near water sources, ranging 2-4km from waterholes and springs that have available water through the dry season (O'Malley, 2006).

Based on this available information, the datasets analysed to draw habitat associations included vegetation, land systems and drainage.

A first run to pull out only the vegetation communities associated with all the listed species preferred by the Gouldian Finch resulted in potential habitat mapped which did not appear to have a strong correlation with the known record locations. A second iteration of this process was then undertaken to pull out communities more broadly associated with eucalyptus woodlands. This second iteration yielded stronger correlations and was input into the potential habitat extent.

Although it is not certain whether Gouldian Finches have topographic preferences, it is still useful in helping identifying potential habitat as there appears to be a correlation between the topography of available food sources which may play a role in determining breeding habitat. The Land systems mapping was used to extract areas associated with hilly topography including hills and plains and rises. The correlation appeared to be strong and was also input into the potential habitat extent.

Perennial drainage and water bodies were pulled out from drainage data and buffered 4 km in an attempt to simulate permanent water sources and to capture the distance from these areas that Gouldian Finches may prefer to be located. The results did not yield strong correlations between known locations and was not used as a result of this.

The resulting potential habitat mapping (Figure 1) identifies areas that may contain preferences favoured by the Gouldian Finch. Almost 70% of the known records occur within the areas mapped as higher probability for potential habitat, and a further 20% are located within areas mapped as moderate to higher probability. As approximately 90% of known records are mapped in the areas of moderate-higher probability, there is high degree of confidence in the results based off this correlation.

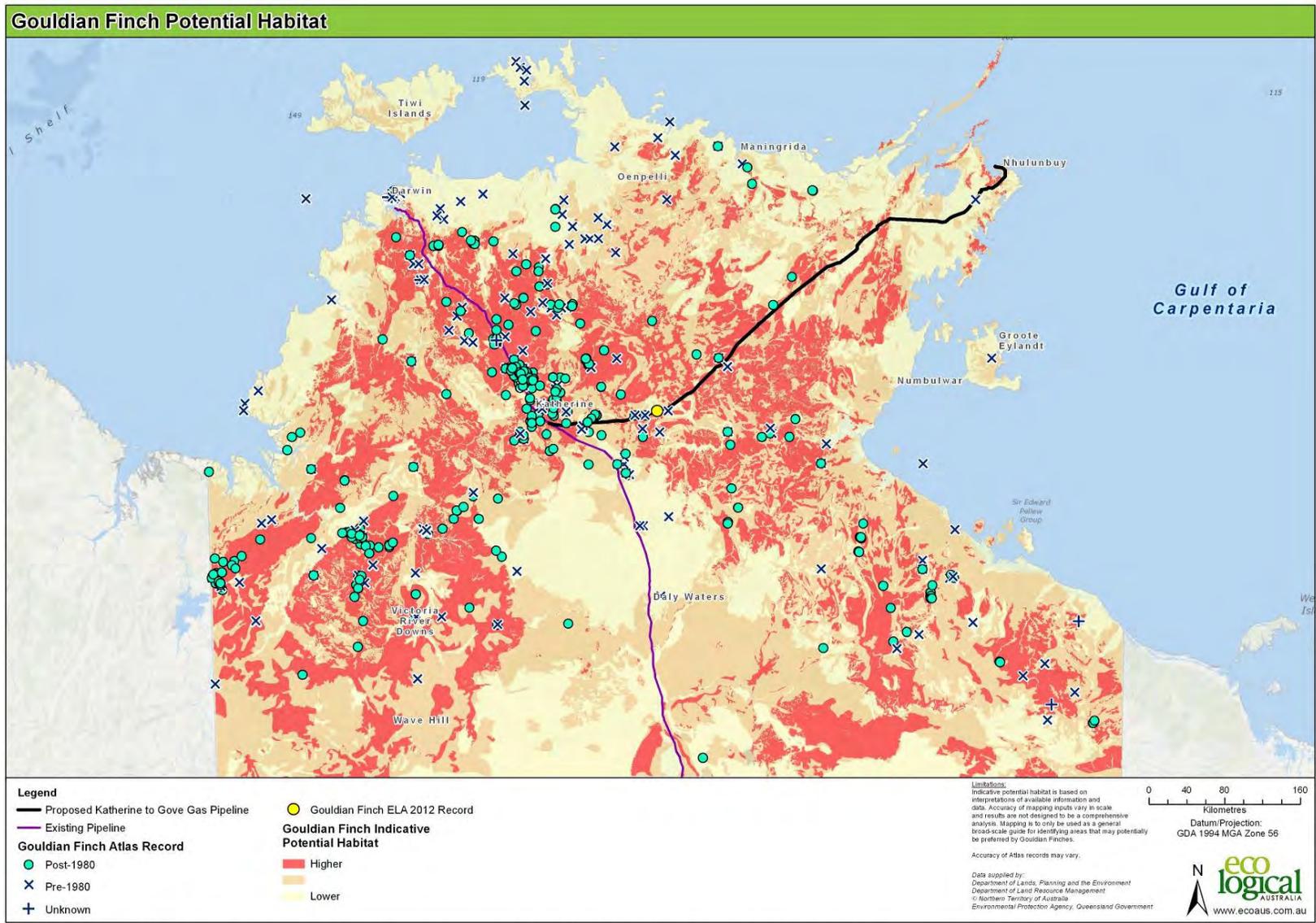


Figure 1: Goulden Finch Potential Habitat

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2.2 RED GOSHAWK

In the Top End and Tiwi Islands, Red Goshawks prefer extensive open forest, open woodlands and riparian vegetation dominated by mature *E. tetradonta*, *E. miniata*, and *Melaleuca leucadendron* (DERM, 2012). Forests of intermediate density are preferred, or ecotones between habitats of differing densities (DSEWPaC, 2013b). Red Goshawks avoid very dense and very open habitats (DSEWPaC, 2013b). All nest trees identified have been within 1 km of permanent water, often adjacent to rivers or clearings. Red Goshawks hunt and breed in both lowland and rugged terrain (DERM, 2012).

Based on this available information, the datasets analysed to draw habitat associations included vegetation, land systems and drainage.

Vegetation communities associated with open forest, open woodlands and riparian vegetation that contain *E. Tetradonta*, *E. Miniata*, and *Melaleuca leucadendron* were extracted. The resulting layer exhibited a good correlation to known records and was input into the potential habitat extent.

Land systems mapping was used to extract areas associated with lowland and rugged terrain. The results generated only showed a strong preference to lateritic plains with nearly half of the records found in this class. Other landscape types did not appear to have any strong correlations with known records. The good spread of records around this land system resulted in the inclusion of this one class as an input to the potential habitat extent. The land systems were also used to extract alluvial floodplains to flag habitat areas adjacent to, and along rivers that are preferred by the Red Goshawk.

Perennial drainage and water bodies were pulled out from drainage data and buffered 1 km in attempt to simulate permanent water sources and to capture the distance from these areas that Red Goshawks may prefer to be located. The result showed a possible correlation and was input into the potential habitat extent.

The resulting potential habitat mapping (Figure 2) identifies potential habitat areas that may contain preferences favoured by the Red Goshawk. Approximately 31% of the known records fall within the higher probability areas for potential habitat, with a further 58% falling within moderate to higher probability areas. Given that almost 90% of the records are mapped within the moderate-higher probability areas, there is a high degree of confidence in the results based off this correlation,

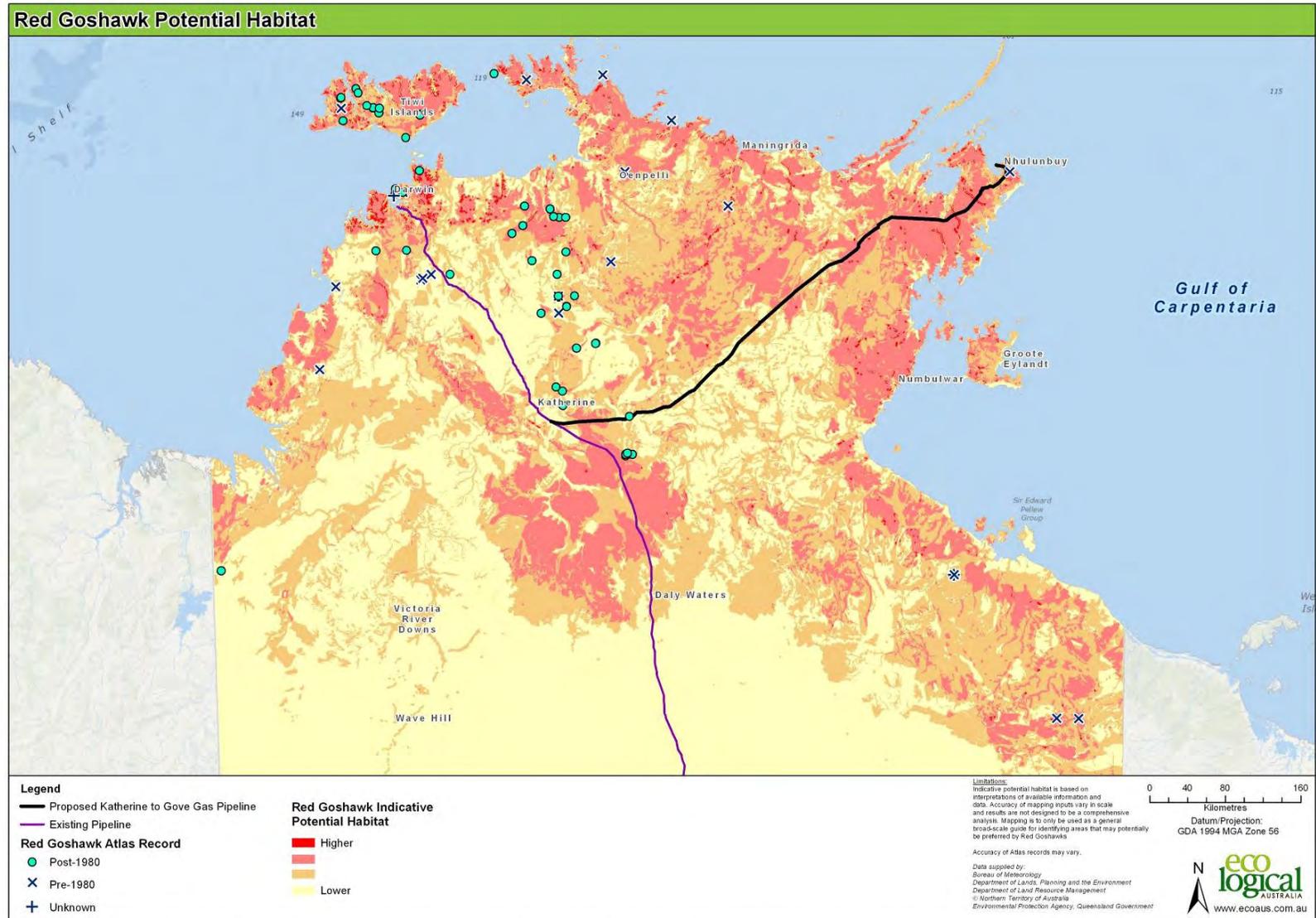


Figure 2: Red Goshawk potential habitat

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2.3 CRESTED SHRIKE-TIT (NORTHERN)

The Crested Shrike-tit (northern) prefers *Eucalypt* open woodlands dominated by Bloodwood, *E. opaca*, *E. Tectifera* and *E. Confertiflora* (DSEWPac, 2013c). They are also found less often in woodland dominated by *E.miniata*, *E. tetradonta* or *Corymbia bleeseri*. They may be found in areas with grassy understorey and sometimes areas with a shrubby understorey. Increased chances of species occurring in suitable areas include presence of flaky-barked bloodwood species and/or ironwood trees, areas not dominated by thick shrub-layer, and areas not prone to being waterlogged seasonally (DSEWPac, 2013c).

Based on this available information, the datasets analysed to draw habitat associations included vegetation and land systems.

Vegetation communities associated with woodlands containing Bloodwood, *E. opaca*, *E. Tectifera*, *E. Confertiflora*, *E.miniata*, *E. tetradonta* and *Corymbia bleeseri* were extracted. The result exhibited a good correlation to known records and was included as an input to the potential habitat extent.

While there is not very clear information available on the topographic preferences of the Crested Shrike-tit (northern), land systems were analysed for any correlations. Over half the records were found to be located on lateritic plains with a good spread over the land system. As a result, this land system was incorporated into the potential habitat extent.

The resulting potential habitat mapping (Figure 3) identifies potential habitat areas that may contain preferences favoured by the Crested Shrike-tit (northern). Approximately 40% of the known records fall within areas mapped as higher probability for potential habitat. Another 44% of the known records fall within areas mapped as moderate to higher probability. With approximately 84% of the records exhibiting a correlation to moderate-higher probability areas, there is a high degree of confidence in the results.

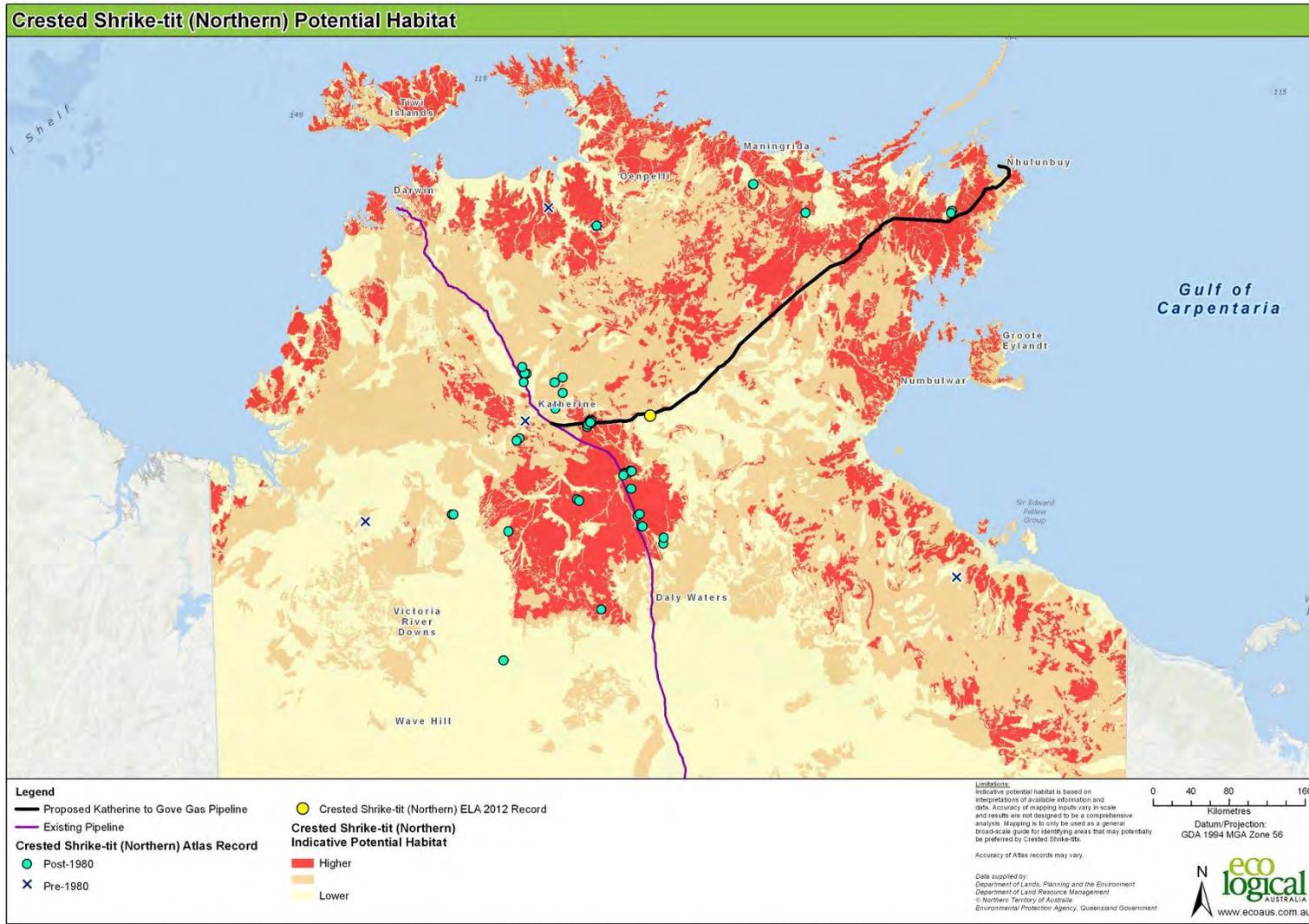


Figure 3: Crested Skrike-tit (Northern) potential habitat

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2.4 PARTRIDGE PIGEON

The Partridge Pigeon prefers primarily open forest and woodland dominated by *E. tetradonta* and *E. miniata* that has a structurally diverse understorey (DSEWPaC, 2013d). The birds feed on seeds taken from bare ground, often amidst sparse grasses, but commonly where the ground layer has been removed by fire. They may travel up to 10km in search of water and food depending on seasonal variations (DSEWPaC, 2013d).

Based on this available information, the datasets analysed to draw habitat associations included vegetation, land systems and drainage.

Any open forest or woodland with *E. tetradonta* and *E. Miniata* were firstly selected. The communities from this selection without a structurally diverse understorey and known species data to suggest it may be utilised were then removed. *Eucalyptus* mid woodland\ *Erythrophleum* low open woodland\ *Sorghum* mid tussock grassland was also included into the potential habitat extent as 1/4 of the known records were found to be located within this community.

While not much information was available on any topographic preferences of this species, land systems was analysed for any potential correlations. Although over half the records were located within lateritic plains, the spread across this land system is only concentrated in certain areas therefore the confidence that there might be a possible correlation is quite low. The land systems data was not included as an input to the potential habitat extent.

Perennial drainage and water bodies were pulled out from drainage data and buffered 10 km in attempt to simulate permanent water and to capture the distance from these areas that Partridge Pigeons may travel to this resource. The results showed a strong correlation with the majority of known records located within these areas and was input into the potential habitat extent.

The resulting potential habitat mapping (

Figure 4) identifies potential habitat areas that may contain preferences favoured by the Partridge Pigeon. Approximately 55% of the known records fall within areas mapped with a higher probability of potential habitat. An additional 42% of the known records are mapped within areas of moderate to higher probability. A high degree of confidence is exhibited by the results with the correlation of about 97% of records to areas mapped as moderate-higher probability of potential habitat.

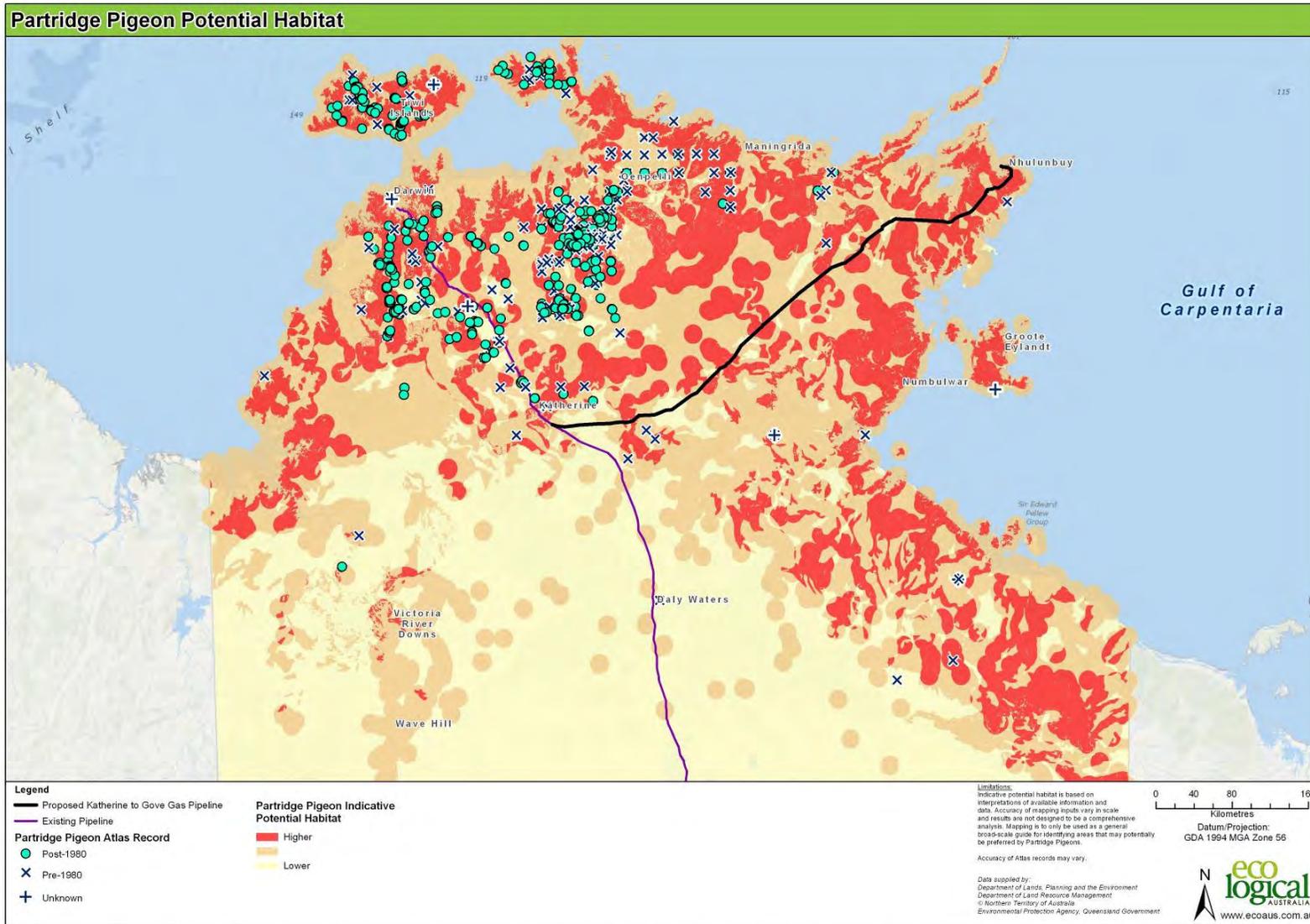


Figure 4: Partridge Pigeon potential habitat

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3 Limitations

The resulting potential habitat maps show areas of the landscape that have the potential to contain elements that may be preferred by each particular species. It must be noted however, that the datasets and process used to generate this mapping have inherent limitations.

The records of known locations of each species were used to help guide the decision of using a specific dataset as an input into the potential habitat extent. The lack of extensive surveys over NT may result in a bias in the locations of known records and give the impression that a particular species may only be found in certain areas and not in others. Being a partially subjective process, any bias can affect how datasets may appear to exhibit correlations to known locations and influence what information is used to associate habitat. The result of this may be that the information used to represent potential habitat may be under or overestimated and in some instances misinterpreted.

The process and resulting potential habitat mapping is limited by the type, accuracy/scale and other characteristics of the available data, specifically in how well the data represents the distribution of potential habitat. Most datasets used were of a 1:250 000 scale or greater and as such, can only be used at a similar scale to broadly identify potential habitat at a regional landscape level. In addition to the potential habitat extents being limited by available data, they were also constrained by information available on the specific habitat preferences of each particular species. The selection and evaluation of data is based on the knowledge of species habitat preferences. Available information on the habitat preferences of the selected species was limited to information on the broad vegetation types, floristic preferences and some substrate/land type information. The lack of coverage of finer scale datasets relating to these themes is noted as a limitation.

Other variables that may influence species distribution such as introduced predators, competition, human influences, temporal and seasonal variance, and fire regimes were not taken into account due to lack of data and/or information. While it is known that factors such as fire regimes may play a role in the distribution of particular species, the process has been constrained by a lack of data and information that could be suitably incorporated as an input into deriving a robust potential habitat extent.

It is further noted that the potential habitat mapping does not take into account the utilisation of the selected species. While parts of the landscape may have been mapped with a higher probability of potential habitat, it is not to say that a particular species will actually use the area even if key preferences have been matched.

While the process utilised for this project resulted in a high degree of confidence in four out of five species, these confidence levels expressed were based directly on the correlation between known records and areas mapped as moderate-higher probability of potential habitat. No other method of cross validation was used to check the validity of the results and the determination of the overall validity of results is limited by the lack of data/information used in the process. Therefore, only broad assumptions can be made on the validity of the results based on the datasets that were able to be utilised.

Overall, the potential habitat maps should be treated as indicative, highlighting parts of the landscape where there is potentially a higher probability of the selected species habitat being present based on available data and current knowledge. Whilst there are limitations in the mapping, the strong correlation of known records to areas mapped as moderate-higher probability of potential habitat for four of the five species still lends itself to being a useful tool in helping guide further survey effort, and in assessment and strategic planning (with appropriate caution).

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