# Independent assessment of issues relating to the Gouldian Finch in the Draft Environmental Impact Statement Mt Todd Gold Project.

**Report to the Northern Territory Environment Protection Authority**

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## Summary


- The Yinberrie Hills is recognised at Territory, national and international levels as significant for biodiversity conservation, primarily because of its importance as supporting the largest known population of the endangered Gouldian Finch. The draft EIS does not acknowledge the international significance.

- It is highly likely that the total population size of Gouldian Finches in the Yinberrie Hills area is substantially >1000 individuals, rather than the 150-250 individuals asserted by the draft EIS. This renders the site more important for the conservation of this threatened species than implied by the draft EIS.

- There is little or no evidence to support the assertion in the draft EIS that the population size of Gouldian Finches in the Yinberrie Hills area is stable, or that it has been unaffected by previous mining activity, or that the proposed mining activity will (likewise) have no impact on this population size or viability.

- The proportional loss (due to previous development and that proposed in the draft EIS) of suitable habitat in the known Gouldian Finch breeding area is appreciably greater than the values given in the draft EIS (0.85%), because the given values are relative to a very extensive area in which no Gouldian Finch nesting has been reported. The actual value may be between 5 and 17% of suitable habitat lost from the known core breeding area (with about half of this attributable to previous development and half due to proposed development).

- Clearing for the proposed development will reduce the availability of foraging areas for Gouldian Finches in lowland woodlands, possibly including some areas with substantial abundance of the key food species *Alloteropsis semialata*. This may compound impacts due to clearing of breeding habitat alone.

- Most relevant risks are under-assessed in the draft EIS. The proposed development will have a significant detrimental impact on this population of Gouldian Finch, and there is Extreme risk that the proposed development will (i) result in long-term decrease in the size of the population; (ii) adversely affect habitat critical to the survival of the species; (iii) disrupt the breeding cycle of a population; (iv) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline and, hence, (v) interfere with the recovery of the species.

- For some factors, the available information is inadequate to allow a reliable assessment of risk. Sampling for the draft EIS provided little information relative to such data deficiencies, although some key parameters (e.g. the number of breeding Gouldian Finches in areas proposed for clearing) were not explicitly factored into the assessment guidelines. The draft EIS did not consider a substantial body of relevant literature.

- Five recommendations are made:

1. Substantial further intensive survey work is required in order to adequately assess impact in relation to risk of this proposed development upon the largest known population of this endangered species. That work should document the number of Gouldian Finches breeding in the habitat area proposed to be cleared or otherwise subject to substantial disturbance.

2. Further intensive sampling is required to assess the use of the lowland habitat in the proposed development area by Gouldian Finches for foraging and access to water, with such study designed to allow an adequately informed assessment of risks associated with clearing of lowland habitat and of use of contaminated water sources.

3. Notwithstanding much uncertainty about extent of impacts, the proposed development is expected to have a significant impact upon this population. A far more specific set of effective mitigation measures is required to be developed and implemented in order to minimise that impact.

4. Previous monitoring programs have been statistically inadequate to detect changes in population size at this site, and should not be used to conclude that (i) the population size has been stable, (ii) previous mining activity has had no impact; and hence (iii) the proposed mining activity will also have no impact.

5. Should the proposed mining developments proceed, a consolidated package of linked monitoring programs is required that will assess trends in Gouldian Finch population size, define impacts of the development, and measure the efficacy of mitigation and other management actions. Such a monitoring program must have substantially more statistical power than existing monitoring, must have an adequate pre-impact baseline (preferably of at least two years), and must have clear thresholds and trigger points that are linked to effective remedial actions.

## Preface

Data and its interpretation presented in the draft EIS, and in this assessment, is constrained by significant limitations in available information. Although the general area of the proposed mine development has been subject to intensive studies of Gouldian Finches extending intermittently from the mid-1980s – including some previous considerations of the likely impacts of mining development and some limited monitoring of that impact – much of the information deriving from these studies has not been formally published. Much of the 'grey' literature describing this work is difficult to access, and some studies have not been reported even to the grey literature. The most relevant studies relating to monitoring of population trends in the Yinberrie Hills area, and to the impacts of previous mining activities (the precursors of the current proposal), are substantially constrained by weak statistical power or compromised by shortcomings in design. Unsurprisingly, the draft EIS does not include information from some of these previously unpublished studies, but it also overlooks some important published sources.

Furthermore, there is contradictory information within (and outside) the available literature on the total population size of Gouldian Finches in the Yinberrie Hills area and some divergent views on the most appropriate conservation status of the Gouldian Finch. This context complicates (but does not subvert) assessment of the likely impact of the proposed development upon the status of this population, and hence of the significance of that impact in relation to the conservation of the species as a whole. New information resulting from studies for this draft EIS adds little clarification or resolution to this situation, and does not substantially advance the ability to assess impacts upon this species.

## Introduction: the structure of this assessment

This report first considers the significance of the Yinberrie Hills area for Gouldian Finches and provides some information on population size and trends, and of ecology relevant to impact assessment; it next evaluates the potential risks and impacts to this population from the proposed development; it then provides a brief assessment of the proposed mitigation and monitoring responses; and concludes with a series of recommendations. An Appendix assesses the extent of compliance relative to the guidelines stipulated for this EIS process.

## Population size and significance of the Yinberrie Hills area to Gouldian Finch

*Significance of Yinberrie Hills for Gouldian Finch*

The Yinberrie Hills area (in which the proposed development is nestled) is a significant site for the Gouldian Finch, as acknowledged in the draft EIS. As recognised in the national recovery plan for the Gouldian Finch (O'Malley 2006a) and recognised in the draft EIS (e.g. p. 14-9), it is a key site for, and contains the largest known breeding population of, this endangered species. At national level, the importance of the Yinberrie Hills area for the Gouldian Finch provided the primary basis for the inclusion of the area on the Interim List for the Register of National Estate.

The importance of this area for Gouldian Finches is the primary basis for the recognition of the site as one of the Northern Territory's Sites of Conservation Significance (Harrison *et al*. 2009; Ward and Harrison 2009: http://lrm.nt.gov.au/__data/assets/pdf_file/0015/13911/30_yinberrie.pdf), as recognised in the draft EIS.

But the site is also recognised as outstanding for biodiversity conservation at international scale, as an Important Bird Area (through Birdlife International: see http://www.birdlife.org/datazone/sitefactsheet.php?id=24456), primarily because of its significance for the threatened Gouldian Finch. These sites 'are amongst the Earth's most exceptional places for birds and are priority sites for bird conservation' (Dutson *et al*. 2009). This

attribution of international significance, although without legislative relevance, is not acknowledged in the draft EIS.

Thus, the Yinberrie Hills area (including the proposed mine development area) is recognised explicitly as significant for biodiversity conservation at the Territory, national and international scale, primarily because of its importance to the threatened Gouldian Finch.

**Conclusion 1. The Yinberrie Hills is recognised at Territory, national and international levels as significant for biodiversity conservation, primarily because of its importance for Gouldian Finches. The draft EIS does not acknowledge the international significance.**

*Population size of Gouldian Finches in the Yinberrie Hills*

Largely following O'Malley (2006a), the population size of Gouldian Finches at Yinberrie Hills is typically reported as 150-250 individuals (e.g. IBA, SOCS), and this figure is that used in the draft EIS (e.g. Draft EIS Appendix N pp. v,5,75). O'Malley's population estimate is apparently based on the number of individuals seen at a series of local waterhole counts. However, O'Malley's estimate is explicitly of the number of *adult* individuals. Given that Gouldian Finches may reproduce 2-3 times per year, with clutch sizes of 3-8 (Tidemann *et al*. 1999), at some times of the year, juvenile Gouldian Finches very substantially outnumber adults. Garnett *et al*. (2011) considered that juveniles may comprise >80% of total population at some times of year. A more specific assessment of the proportion of adults and juveniles in the population can be obtained from age information recorded at the time of banding of all Gouldian Finches banded in the Yinberrie Hills over the period 1986 to 2000 (a tally of >6000 birds, with sampling across most months of the year: unpublished banding data held by the NT Department of Land Resource Management): this indicates that across months and years, adults comprise 40.1% of the known-age population and juveniles 59.9%: hence, if total number of individual Gouldian Finches in the Yinberrie Hills is considered, then based on the O'Malley (2006a) estimate, this is c. 375-625.

But the O'Malley (2006a) estimate is unreliable. In an unpublished manuscript, Price *et al*. reported population estimates from systematic monitoring *for a series of 12 waterholes in the Yinberrie Hills* (i.e. not for the entire Yinberrie Hills area) varying between about 100 to 250 adults and about 90 to 500 juveniles (c. 200 to 720 total birds, with a total annual mean of 420 birds) across the years 1996 to 2004 (O'Malley 2006b: reproduced as Figure 1 below).

Across much of the period 1986 to 2000, a series of studies have examined the ecology of the Gouldian Finch in the Yinberrie Hills area. Capture of finches and the application of individual bands has been a component of some of these studies. Over a 4-year period in the early 1990s, Lewis (2007) reported that 5376 Gouldian Finches were captured (and released) in the Yinberrie

Hills, of which 457 were recaptures (i.e. 4919 different individual Gouldian Finches were captured in the Yinberrie Hills over 4 years, an average of >1200 individuals per year). These tallies are clearly impossible to reconcile with population estimates of a total of 150-250 adult individuals present in the Yinberrie Hills area. Furthermore, Lewis' study did not aim to capture all Gouldian Finches present and the very low recapture rate (8.5%) suggests that the total population size is probably at least an order of magnitude greater than the number of captured individuals in any year (i.e. the population size – at the time of Lewis' studies – may most plausibly have been at least 10,000 individuals).

In another banding study based at four trapping sites up to 3 km apart in the Yinberrie Hills, over a 4-week period, Woinarski and Tidemann (1992) captured 576 individual Gouldian Finches and used mark-recapture analysis to derive an estimate of 1368 individuals for the area spanned by those trapping sites, albeit with very wide 95% confidence limits of 732 to 10,477 individuals (with that uncertainty mostly due to low numbers of recaptures).

A different approach to estimating the number of Gouldian Finches is possible through extrapolation from the detailed assessment of bird communities across a range of vegetation types (Bowman *et al*. 1991) in the Yinberrie Hills area reported by Woinarski and Tidemann (1991), a particularly relevant study not considered in the draft EIS. In that study (located <1 km from the proposed Mt Todd Gold Mine), birds were censused at 140 quadrats (each of 50 m x 50 m) three times per month over a 13 month study period. This allows for a population density estimate across breeding and non-breeding seasons and independent of the substantial variability and constraints associated with censusing at water-holes or at nest sites. Based on the 5460 censuses at these quadrats over this period, Woinarski and Tidemann (1991) calculated that the average density of Gouldian Finches in their 35 ha Yinberrie Hills study area was 0.28 birds/ha.

With some caveats[1], this density estimate can be extrapolated to estimate a total Gouldian Finch population size in the Yinberrie Hills. However, the spatial circumscription of the Yinberrie Hills has been reported variably. Collins and McNee (1992) and Dostine *et al*. (2005) report the area of hill woodland (approximately the known area occupied by breeding Gouldian Finches) as c. 54 $km^2$. Price *et al*. (unpublished) give the Yinberrie Hills area as 191 $km^2$, with this area including some lowland foraging areas as well as breeding areas. The 'Yinberrie Hills' area included in the Northern Territory Site of Conservation Significance mapping (Harrison *et al*. 2009) encompasses a substantially larger (c. 1025 $km^2$) and more mixed environment beyond the principal area occupied by Gouldian Finches, as evident in their mapping which reveals substantial extension of the boundaries of their area beyond the concentration of Gouldian Finch records in a core area (Figure 1). The Birdlife International Important Bird Area site largely follows that of the Northern Territory Site of Conservation Significance mapping, and is of comparable extent (1050 $km^2$), and hence encompasses large areas in which no Gouldian Finches have been recorded. The most

[1] The original Woinarski and Tidemann (1991) study was not designed to assess total population size of this or other species across the Hills region, and the contiguity of the sampling quadrats reduces their independence and spatial representativeness, so this extrapolation has some constraints, but should not have any particular bias.

appropriate areas to be considered for population estimation are the core breeding area[2] (as described by Collins and McNee (1992) and Dostine *et al*. (2005)) and that area and the immediate lowland surrounds (the wet season foraging area) as described by Price *et al*. (unpublished). Extrapolation of the densities reported in Woinarski and Tidemann (1991) to these two areas suggest total population sizes of c. 1500 to c 5500 individual Gouldian Finches in the Yinberrie Hills.

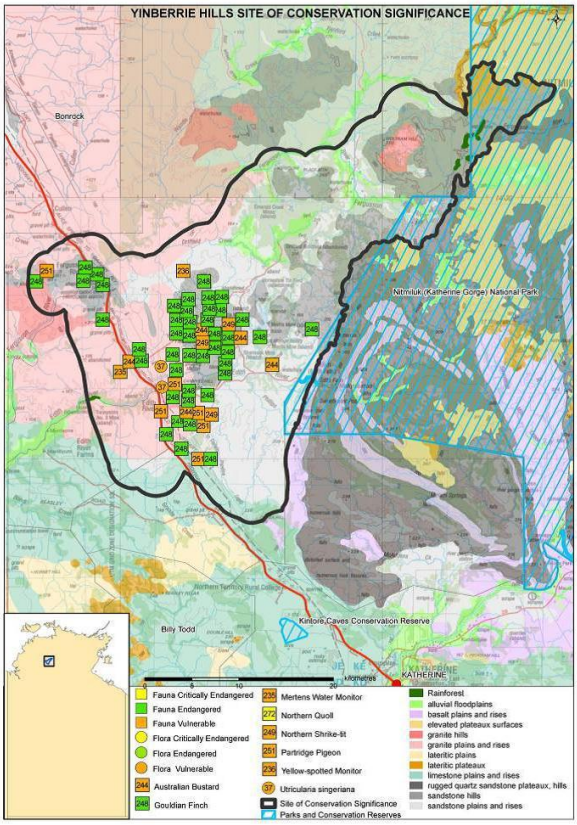


**Figure 1. Spatial delineation of the Yinberrie Hills Site of Conservation Significance showing known records of Gouldian Finch (green squares).** [From Harrison *et al*. (2007)] Note that many of the Gouldian Finch records are of non-breeding birds in the lowlands. Note also that the Site delineation extends well beyond the area occupied by Gouldian Finch (largely to encompass other conservation values).

On this basis, the estimate for population size of Gouldian Finches in the Yinberrie Hills given by O'Malley (2006a) (and subsequently) is untenable. Furthermore, it has been misinterpreted in the draft EIS (and elsewhere) as being for the total number of individuals rather than the number of mature individuals. Based on two very different approaches and data sets (i.e. Woinarski and Tidemann 1991; and Woinarski and Tidemann 1992 and Lewis 2007), it is likely that the total population of Gouldian Finches in the Yinberrie Hills area instead is at least an order of magnitude larger, and lies in the range of 1500 to 10,000 individuals (and hence adult population probably c. 600 to 4000 individuals) – or at least the population lay in that range in the period from the mid-1980s into the 1990s, when those studies were conducted.

[2] the stony hills in which the preferred nest tree *Eucalyptus tintinnans* is a dominant or co-dominant species (Tidemann *et al*. 1992; Lewis 2007)

What are the implications of this population estimate being markedly different to that given in the draft EIS? There are two components to this question: (i) does it make a difference to the significance of the Yinberrie Hills area vis-à-vis the Australian population of Gouldian Finches?; and (ii) does it make a difference to assessment of the potential impacts of the mine on the Yinberrie Hills population?

At face value, a higher population estimate for Yinberrie Hills than that given in the draft EIS implies that the Yinberrie Hills area is even more important (i.e. constituting a higher proportion of the total population) for the overall conservation of this species than previously recognised. With respect to total Australian population size, O'Malley (2006b) noted that it was plausible that the total population size was >2500 mature individuals rather than <2500 mature individuals as previously considered (e.g. Garnett and Crowley 2000). More recently (for the 2012 review of the conservation status of this species in the Northern Territory), Palmer *et al*. (2012) considered that the number of mature individuals in the Northern Territory was >1000, but that because of particular social, genetic and demographic factors (i.e. uneven sex ratios and low levels of genetic compatibility between different colour morphs: Pryke and Griffiths 2009), the effective adult population of Gouldian Finches in the Northern Territory was fewer than 1000 individuals. In a national review for the 2010 Bird Action Plan, a panel of independent experts considered that a best guess for the total number of mature individuals across Australia was 2400 (Garnett *et al*. 2011).

These data are frustratingly imprecise and of limited reliability, but it is reasonable to conclude that the Yinberrie Hills site comprises a very high proportion of the total Australian population, with this proportion higher than that previously recognised (and than that accorded it in the draft EIS).

With respect to the potential impacts of the mine development on the viability of the Yinberrie Hills population itself, it may be that the absolute population size is immaterial, with the proportion of Gouldian Finches directly and indirectly affected by the mine development more or less the same regardless of the total population size in the Yinberrie Hills. If, for example, a mine impact upon the population was directly related to the extent of native vegetation cleared (say, x% of the Yinberrie Hills area) then it may make little or no difference to population viability if there was a consequential x% decline from a total Yinberrie Hills population of 1000 birds or an x% decline from a total population of 10,000 birds. However, if impacts are measured more directly in terms of the actual number of birds affected (e.g. a flock of 20 finches known to be killed by road traffic or from drinking at a contaminated source), then the relative consequences of that impact will differ substantially depending upon the estimate of the Yinberrie Hills population size.

**Conclusion 2. It is highly likely that the total population size of Gouldian Finches in the Yinberrie Hills area is substantially >1000 individuals, rather than the 150-250 individuals asserted by the draft EIS. This renders the site more important for the conservation of this threatened species than implied by the draft EIS.**

*Population trends at Yinberrie Hills*

The draft EIS notes that (i) the population size of Gouldian Finches in the Yinberrie Hills is stable; and (ii) this stability indicates that the previous mining activities have had no impact (e.g. Draft EIS Executive Summmary xvi; Appendix N, pp. ix,87,88,90: 'the Gouldian Finch population in the Yinberrie Hills does not appear to have declined as a result of clearing during earlier development of the Mt Todd Mine' and 'The Gouldian finch population appears to have been unaffected by the previous mining' and 'The only threatened species to undergo a decline in the mine area during previous mining were [monitors and quolls]' and 'The population as a whole remained relatively stable during the previous mining'); and (iii) this lack of previous mining impacts indicates that future mining will have no population-level consequences (e.g. Draft EIS Appendix N, p. 87: 'Clearing seems unlikely to have any significant direct impact on any of the threatened species and populations … Any impact would likely be negligible, and not amenable to detection at the population level').

Each of these three suppositions is contestable.

Several references note that ongoing monitoring has indicated that the population size of Gouldian Finches at the Yinberrie Hills is stable (e.g. O'Malley 2006b; Woinarski *et al*. 2007; Garnett *et al*. 2011). This conclusion is based mostly on a report by Price *et al*. (unpublished), that considered monitoring results based on counts of finches at water-holes over the period 1996-2004, with subsequent counting (for the years 2005, 2006, 2007 and 2009) reported by Ward and Voukolos (2009), and with the initial monitoring design described by Forrester and Wood (1999). Price *et al*. (unpublished) is explicit that the counts do not provide an absolute measure of the population size in the Yinberrie Hills, for various reasons. They also acknowledge that the counts are highly variable between days, years and sites, rendering the monitoring program of low statistical power. Based on data collected to 2004, Price *et al*. (unpublished) calculated that it would take 16 years for that monitoring program to detect an actual decline in population size of 10% per year, and that by the time that the monitoring program would have demonstrated such statistical significance the population size would have declined to 20% of its initial level. So, that current monitoring program is extremely insensitive to even substantial real changes, and cannot readily be used to assume population stability.

The draft EIS claims that this ostensible population stability demonstrates a lack of impact by previous mining. At the establishment of the initial mining activity in the Mt Todd area, an attempt was made to directly monitor the impacts of that mining development at the site, through assessment of use by Gouldian Finches of potential breeding sites at increasing distances from the mine. This program ran over a 4-year period (Collins *et al*. 1993; Smith *et al*. 1995; Bamford and Bamford 1996), after which the program was abandoned. However, as the draft EIS notes (at Appendix N), 'there were statistical problems with the sample design' and the results have never been formally published. Indeed, that nest count monitoring program had very substantial limitations: 'no relevant pre-impact data baseline data were collected; the power of the programme to detect any change was very low (and never quantified); just one part of the life history and resource requirements of the species was considered; the programme

measured impact on an annual basis such that rapid remedial response may have been foreclosed; the threshold changes required to trigger remedial action were not specified, and remedial actions were not defined' (Woinarski and Dawson 1991).

The water-hole based monitoring program reported by Price *et al*. (unpublished) initially included 25 waterholes, but three of these (and their adjacent habitat) were destroyed by mining in the period 1996 to 2000, and the data relating to these sites to that point were excluded from subsequent analysis: that is, the trends reported in Price *et al*. (unpublished) relate only to the area not directly affected by mining, and the birds formerly occurring in the area destroyed by mining were effectively considered lost from the monitored population[3]. Subsequently, and as reported in Price *et* al. (unpublished), analysis of monitoring considered only 12 sites that were sampled throughout the monitoring period. At risk of over-labouring the point, the monitoring regime is represented schematically in Figure 2 below

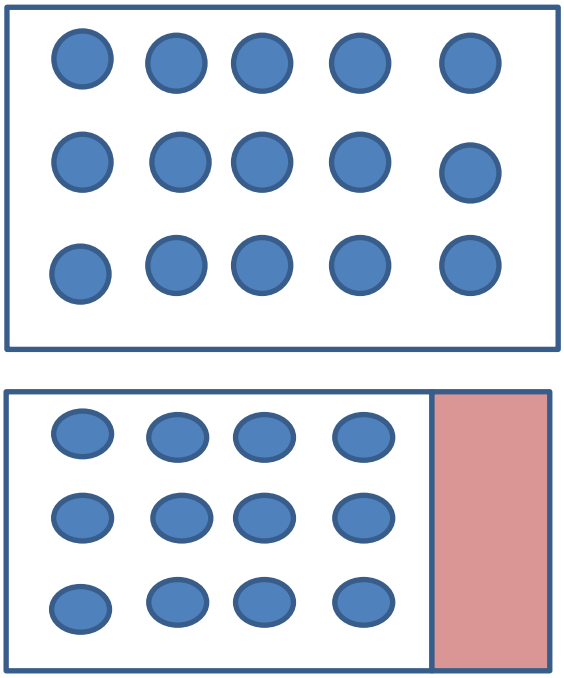

**Figure 2. Diagrammatic representation of monitoring protocol used by Price *et al*. (unpublished)**. In the initial set up (schematically in the first diagram) a group of sites are monitored across the area. Subsequently a section of the area was destroyed (along with three monitoring sites) for mining development. With the loss of these monitoring sites (in this schematic case 20% of the original sampling, which for simplicity's sake I'll consider held 20% of the population), the monitoring scheme and results (as given in Price *et al*. (unpublished)) were restricted to only comparison of trends at the 12 monitoring sites sampled throughout the period, so that it doesn't account for or consider the 20% loss of overall population size. [Or at risk of insensitivity, if a study initially monitored population in every Darwin suburb, but after year 2, all suburbs beginning with 'A' were vaporised, ongoing monitoring that was thence

[3] An alternative hypothesis to them not being lost from the population is that the birds formerly occurring in the cleared area may have moved to other parts of the Hills. However, if that was the case, then the population size in the uncleared monitoring sites may have been expected to increase; but it did not do so.

restricted to surviving suburbs (which were unaffected) should not be used to conclude that the vaporisation had no impact on Darwin's population size.]

Nonetheless, the data for Gouldian Finch numbers in the unmined sampled area may indicate (albeit not statistically significantly, given the small sample size and highly 'noisy' data) some tendency for decrease over the period in which mining occurred (1996 to 2000) and some recovery at cessation of mining (2000 to 2004) (Figure 3, modified from Price *et al*. (unpubl.)).

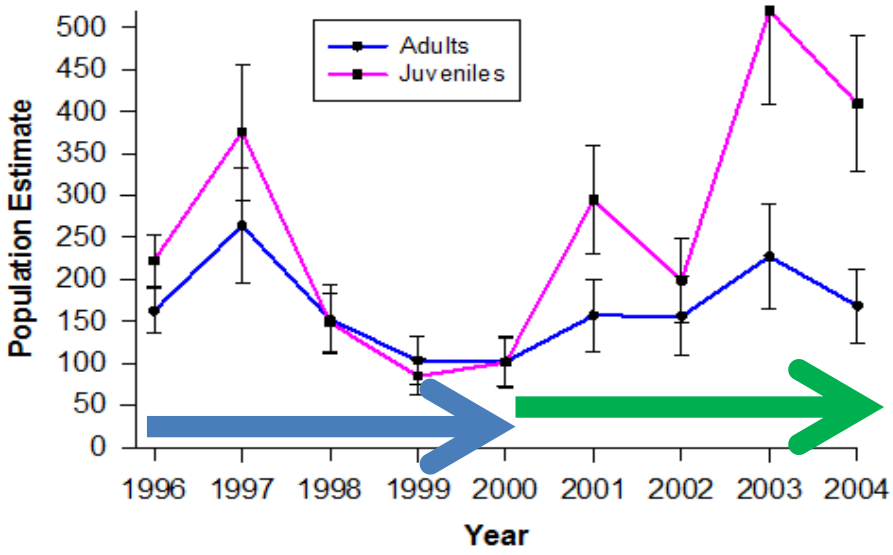


**Figure 3. A Gouldian Finch population index (based on 12 sampled waterholes) in the Yinberrie Hills for the period 1996 to 2004 (from Price *et al*. (unpublished)). As noted by Price *et al*., mining occurred (not directly at these monitoring sites) in the period up to 2000 (blue arrow), but not thereafter (green arrow).**

Results from continuation of this water-hole based monitoring program subsequent to 2004 have not yet been rigorously analysed (Ward and Voukolos 2009).

So, previous and ongoing monitoring programs provide very little evidence to assess the impacts upon Gouldian Finch populations of previous mining activity. Water-hole based monitoring assumed that birds were lost from mined areas with consequential reduction in the total population size, and provide a weak and non-significant indication that the remaining population size in the unmined parts of the Yinberrie Hills may have fallen during mining operations and recovered at cessation of previous mining. An assumption that previous mining activity has had no impact, as reported in the draft EIS, is unjustified.

At various points, the draft EIS implies or explicitly states that because previous mining activity in the area has ostensibly had no impact on the Gouldian Finch population size, therefor the currently proposed mining activity will also be expected to have no impact on population size. Setting aside the previous discussion about whether or not the population size has been stable

and about whether the previous mining may have had an impact on that population size, the claim is contestable for two main reasons: (i) it does not account for cumulative impacts; and (ii) the scale of the proposed mining activity and infrastructural development is different to its predecessor, and the overall package of disturbance activities is different.

The cumulative impact argument is straightforward: if an initial disturbance activity affected 10% of the habitat for a threatened bird species but caused no observed statistically significant reduction in population size, then it doesn't follow that the next nine developments each affecting 10% of the original habitat will also cause no significant reduction in population size: there'll be no habitat left. In less extreme argument, it is likely that population-level impacts of cumulative disturbance are not likely to be linear because:

(i) there is likely to be some threshold level of habitat extent and population size beyond which small losses will cause more substantial impacts on population viability (and this may be particularly the case for the Gouldian Finch in which effective population size may be much lower than total population size because of uneven sex ratios and low levels of genetic compatibility between different colour morphs: Pryke and Griffiths 2009); and
(ii) the ecology of the Gouldian Finch is dependent upon the juxtaposition of a series of dissimilar habitat types within a landscape mosaic (Dostine *et al*. 2001; Lewis 2007; Liedloff *et al*. 2008). It is unlikely that successive developments will affect each of these landscape units in the same proportions, and the small patches that uniquely provide particular resources that the birds depend upon at a particular time of year may be especially likely to be inconsistently retained or lost in different development scenarios.

**Conclusion 3. There is little or no evidence to support the assertion in the draft EIS that the population size of Gouldian Finches in the Yinberrie Hills area is stable, or that it has been unaffected by previous mining activity, or that the proposed mining activity will (likewise) have no impact on this population size or viability.**

*Breeding distribution of Gouldian Finches in the Yinberrie Hills area*

In the Yinberrie Hills area, Gouldian Finches breed in the stony hill woodlands dominated by *Eucalyptus tintinnans* and disperse locally in the post-breeding season (late dry season and early wet season) to the surrounding lowlands to feed (Tidemann *et al*. 1992a, 1999; Collins and McNee 1992; Dostine *et al*. 2001; Lewis 2007; Liedloff *et al*. 2008).

Much of the Yinberrie Hills Site of Conservation Significance includes areas unused by Gouldian Finches (or at least areas in which no Gouldian Finches have ever been reported) (see Figure 3 below from Harrison *et al*. 2009): i.e. the site boundaries are defined in part by features additional to Gouldian Finches. Thus it is inappropriate to use the Sites of Conservation Significance extent as a denominator in the proportional assessment of the impact of proposed clearing, because it includes very large tracts of area in which no Gouldian Finches have been

reported[4]. But this is the procedure adopted in the draft EIS: for example Table 14.3 in the draft EIS notes that the extent of woodlands co-dominated by *Eucalyptus tintinnans* in the entire Site of Conservation Significance is 34,650 ha of which the proposed mine development will clear 140.3 ha and the cumulative extent cleared will be 295.7 ha (or 0.85%[5] of the extent of *E. tintinnans* woodland across the entire Site of Conservation Significance). In terms of impacts upon the Gouldian Finch population, this is a misleading reference point, as it does not relate to the area in which breeding is known to occur.

The locations of all known breeding sites in the Yinberrie Hills area were collated by Liedloff *et al* (2008), another pertinent source not considered in the draft EIS. These sites are concentrated in a much smaller area than the Yinberrie Hills Site of Conservation Significance, abutting and to the immediate west of the existing disturbance area from previous mining and overlapping parts of the proposed new mining development (Figure 4).

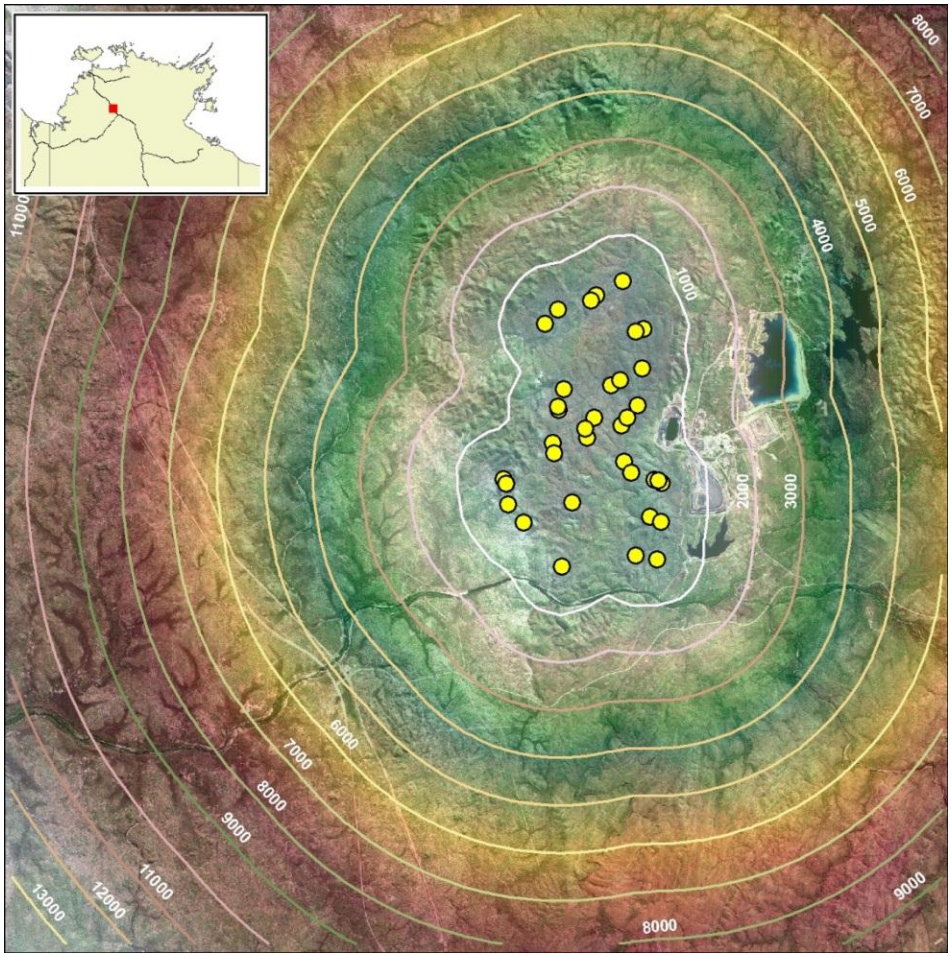


**Figure 4. Location of known Gouldian Finch nest sites (yellow dots) in the Yinberrie Hills area; contour lines show distance to nearest known nest site (in m.) [From Liedloff *et al*. (2008)]** Note residue structures from previous mining operations to the immediate east of the core area.

[4] It is possible that Gouldian Finches breed more widely across the entire Site of Conservation Significance, but that is conjecture, and should not be assumed.

[5] Note that this 0.85% is then apparently erroneously reduced to 0.75% in the text of the draft EIS: e.g. Appendix N, p. 86, and main report p. 14-16.

It is this breeding aggregation area (of about 30[6]-53[7] km$^2$) which most appropriately should be used as the reference point for the assessment of proportionate loss of nesting habitat. I don't have GIS coverages of the proposed clearing, or of vegetation mapping, and how these intersect with this core breeding area, but clearing for the proposed pit and proposed waste rock storage facility appears to intrude within this area, possibly to c. 5-10%.

The clearing extent of *Eucalyptus tintinnans* woodlands (the draft EIS' vegetation types 4 and 6, based on 1:50 000 scale vegetation mapping) within the mining lease area may give a reasonable measure of the likely loss of habitat in this core breeding area, because MLN1070 (in particular) and 1071 overlap much of the breeding area. For these lease areas, the Draft EIS Appendix M notes the following extent of clearing of *Eucalyptus tintinnans*-dominated woodlands:

**Table 1. Original extent of *Eucalyptus tintinnans* dominated vegetation in the mineral lease area, its extent of loss due to previous clearing, and proposed loss due to the Mt Todd Gold Project. (a) is directly from Appendix M Table 5.2 p. 47. (b) includes 'degraded' vegetation (types 4B and 6B) considered (footnote to Appendix M Table 5.2 p. 47) to have been types 4 and 6 and cleared by previous mining.**

(a)

| vegetation type | original area (ha) | area (%) cleared by previous mining (ha) | area (%) proposed for clearing (this development) (ha) | cumulative clearing (%) |
|---|---|---|---|---|
| 4 | 1522 | 92.4 (6.1%) | 57.1 (3.8%) | 149.6 (9.8%) |
| 6 | 723 | 63.0 (8.7%) | 83.2 (11.5%) | 146.1 (20.2%) |
| total | 2245 | 155.4 (6.9%) | 140.3 (6.2%) | 295.7 (13.2%) |

(b)

| vegetation type | original area (ha) | area (%) cleared by previous mining (ha) | area (%) proposed for clearing (this development) (ha) | cumulative clearing (%) |
|---|---|---|---|---|
| 4 | 1582 | 152.8 (9.7%) | 57.1 (3.6%) | 209.9 (13.3%) |
| 6 | 773 | 112.8 (14.6%) | 83.2 (10.8%) | 196.0 (25.4%) |
| total | 2355 | 265.6 (11.3%) | 140.3 (6.0%) | 405.9 (17.2%) |

Although the boundaries of the lease areas and the core breeding area do not entirely coincide, this proportional extent of clearing (cumulatively to 13.2% or 17.2% of *Eucalyptus tintinnans* habitat) provides a more realistic assessment of the impact of previous and proposed clearing on the known Gouldian Finch breeding extent in the Yinberrie Hills than does the figure of 0.85% (or 0.75%) given in the Draft EIS for the proportion of cleared (and proposed to be cleared) *Eucalyptus tintinnans* woodland across the entire Site of Conservation Significance extent.

**Conclusion 4. The proportional loss (due to previous development and that proposed in the draft EIS) of suitable habitat in the known Gouldian Finch breeding area is appreciably greater than the values given in the draft EIS (0.85% or 0.75%), because the given values are relative to a very extensive area in which no Gouldian Finch nesting has been reported. The actual value may be between 5 and 17% of suitable habitat lost from the known core breeding area (with about half of this attributable to previous development and half due to proposed development).**

[6] The approximate area encompassed by breeding records collated in Liedloff *et al*. (2008)
[7] The area reported by Collins and McNee (1992) as suitable breeding habitat for this population

*Non-breeding habitat and distribution of Gouldian Finches in the Yinberrie Hills area*

The complex landscape-scale foraging behaviours of Gouldian Finches has been relatively well studied in the Yinberrie Hills area, and the ability of the species to survive a period of food scarcity (typically the late dry season and early wet season) hinges on landscape patchiness and the extent to which the finches can track spatially and temporally variable seed availability (Dostine *et al*. 2001; Woinarski *et al*. 2005; Lewis 2007; Liedloff *et al*. 2008). After the breeding season, Gouldian Finches disperse locally to surrounding lowland areas to seek habitat patches that provide seed resources. These are distributed unevenly across the landscape, with patches that have been exposed to early (typically highly localised) rains and run-on areas most likely to support grasses that seed early, and patches that avoid early rains and/or are run-off areas most likely to have retained ungerminated seed on the ground. Grass species vary in their phenological patterns, with typically early seeding from cockatoo grass *Alloteropsis semialata*, with this species becoming a key food resource for Gouldian Finches at a time of general food scarcity. Fire patchiness imposes a further factor that alters the productivity and timing of grass seed availability.

This foraging ecology means that much or all of the Yinberrie Hills Gouldian Finch population may be dependent upon a particular lowland patch that happens to have seeds available, and that such patches may not necessarily be the same in different weeks or years. Hence, the loss of any particular patch may have population-level consequences that far outweigh the relative area of that patch to the entire landscape. As noted in Dostine *et al*. (2005) in reference to the conservation of the Yinberrie Hills Gouldian Finch population, 'recognition of the breeding site (it has been placed on the list of the National Estate) needs to be matched with appropriate management of other parts of the landscape required by the breeding population. It is imperative to manage these grassy woodlands to create resource patches at sufficient scale and density to ameliorate periods of seed shortages.' Destruction of a large extent of this lowland woodland foraging area does not constitute 'appropriate management'.

The Draft EIS considered one of the important factors in this landscape mosaic ecology, the variation in grass distribution and grass species composition, through recording of dominant grass species present at a set of sixteen 20 m x 20 m quadrats, and a further nineteen 10 m x 10 m quadrats (i.e. a total sampled area of <1 ha) located across the 5400 ha lease area (Draft EIS Appendix M). Based on this sampling, the draft EIS concludes that 'the lowland woodlands (proposed to be cleared) are mostly on the eastern side of the mine and do not have significant areas[8] of grass species providing seed in the wet season (*Alloteropsis semialata*, *Chrysopogon fallax* and *Triodia bitextura*)' (Draft EIS p. 14-16 and Appendix N, p. 86), and hence by implication are not important as foraging sites for Gouldian Finches.

In Liedloff *et al*. (2008) (not referenced in the EIS), the distribution of grass species in the Yinberrie Hills area is modelled at fine scale, based on detailed sampling of the presence-absence of all grass species at a set of c. 22,000 quadrats sampled in the Yinberrie Hills, with abundance values for every grass species calculated for c. 400 segments (each 50 m length) of a set of sampling transects. This

[8] No definition of what constitutes a 'significant area' is given

modelling indicates that there are some substantial areas with relatively abundant *Alloteropsis semialata* (and hence likely areas of importance for foraging Gouldian Finches) in the area proposed for development (Figure 5).

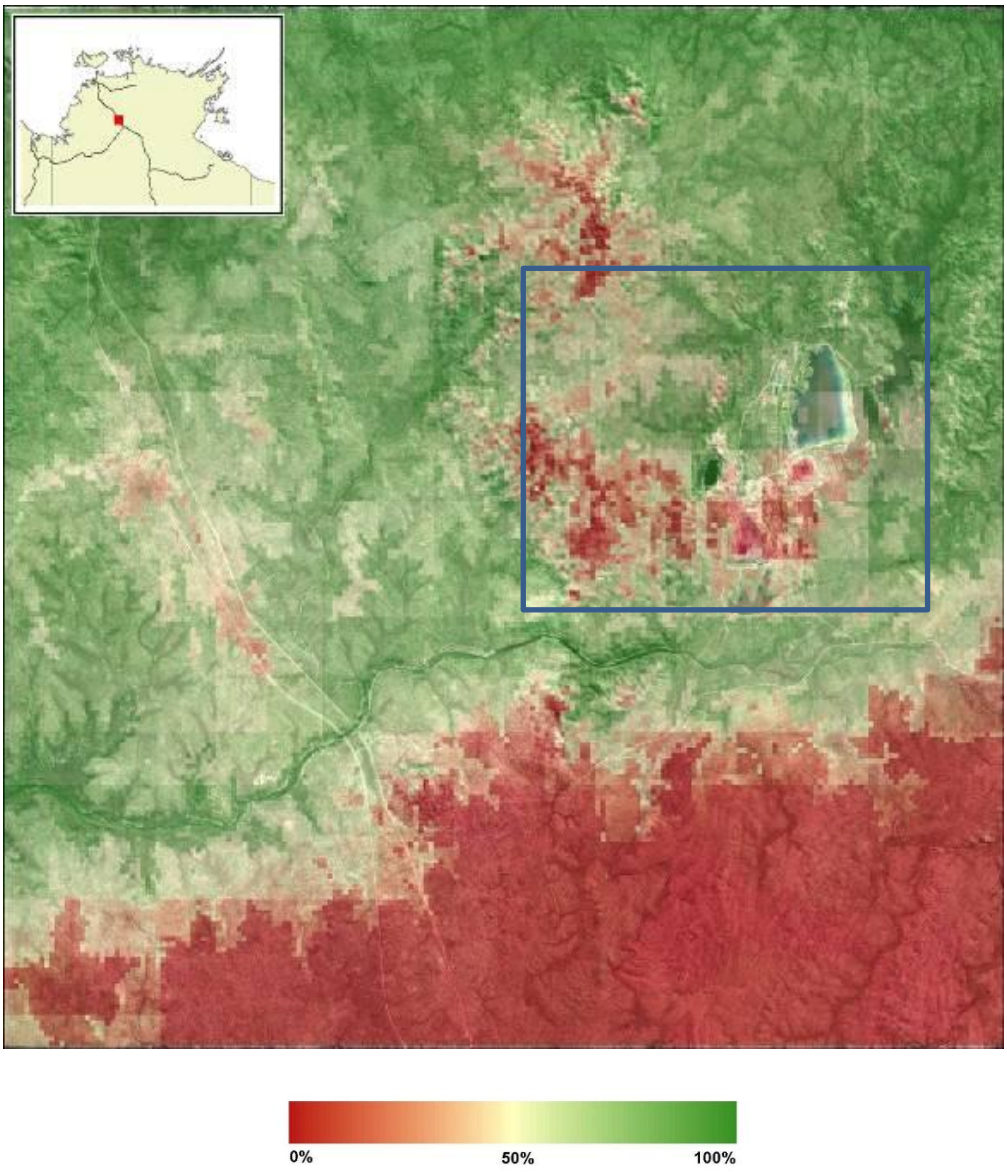


**Figure 5. The likelihood of occurrence of the key seed-producing grass *Alloteropsis semialata* in the Yinberrie Hills area, based on modelling from 22,000 sampling sites (from Liedloff *et al*. 2008).** The area most relevant to the proposed development is highlighted within the blue square.

The area of lowland (foraging) habitat already cleared and proposed for clearing in the lease area (i.e. adjacent to the core breeding area) is substantial (Table 2). Although this represents just one lowland quadrant (i.e. the eastern sector) available for foraging by Yinberrie Hills Gouldian Finches, the loss of >40% of this sector may substantially constrain their foraging options.

**Table 2. Original extent, previous clearing and proposed clearing of lowland habitats (i.e. not rocky woodlands co-dominated by *Eucalyptus tintinnans*) in the mining lease area (derived from Table 5-2 Appendix M, p. 47).**

| vegetation type | original area (ha) | area (%) cleared by previous mining (ha) | area (%) proposed for clearing (this development) (ha) | cumulative clearing (%) |
|---|---|---|---|---|
| 2 | 407.4 | 75.8 (18.6%) | 96.1 (23.6%) | 171.9 (42.2%) |
| 9 | 2088.9 | 526.0 (25.2%) | 294.8 (14.1%) | 820.8 (39.3%) |
| 11 | 284.2 | 104.8 (36.9%) | 77.5 (27.3%) | 182.4 (64.2%) |
| total | 2780.5* | 706.6 (25.4%) | 468.4 (16.8%) | 1175.1 (42.3%) |

* the draft EIS also notes small areas (115 ha) of vegetation types 1, 10 and 16, and that these have not and will not be cleared.

In the early-mid dry season, the availability to Gouldian Finches of the fallen grass seed lying on the ground is compromised by the layer of dense grass, and finches then seek out recently burnt areas in which access to the resource is far easier (e.g. Woinarski 1990). But prior to (or in the absence of) burning, in the Yinberrie Hills area, they also forage for grass seeds on and at the edge of tracks, where they can more readily access fallen seeds (*pers. obs*.). At such times, flocks of 20 or more finches may congregate on and around tracks. This renders them (and other granivorous birds) susceptible to collisions with vehicles, although the typically low rate of current vehicle traffic makes for a low (and unreported) incidence of such mortality. The draft EIS notes a proposed increase in vehicular traffic in areas likely to be used for foraging by finches (see for example, the location of Gouldian Finch records in the Sites of Conservation Significance mapping: Figure 3). This may be particularly problematic to Gouldian Finches along the Edith Falls Road and Jatbula Road, because these are close to foraging areas, are currently relatively little used by traffic and have grassy verges. The draft EIS has unusual estimates of expected increase in traffic flow (executive summary p. xxi), noting that traffic on the Edith Falls Road will increase during the construction period by 65% above current 'peak hour' levels ('from 18 to 51 vehicles') and by 51% ('from 18 to 41 vehicles') during the operations period (although these data are themselves different to what is presented in Table 18-10 of the Draft EIS, where the expected traffic rates are 54 and 43 vehicles respectively). There is clearly something awry with these calculations, with the data suggesting instead increases of at least 283% and 228% above current levels respectively. This implies risks of traffic mortality to flocks of foraging Gouldian Finches will more than double.

**Conclusion 5. Clearing for the proposed development will reduce the availability of foraging areas for Gouldian Finches in lowland woodlands, possibly including some areas with substantial abundance of the key food species *Alloteropsis semialata*. This may compound impacts due to clearing of breeding habitat alone.**

## Risks and level of significance of impacts of the proposed development

The proposed development will have direct and indirect impacts on Gouldian Finches at this site, and – given that this site currently supports the largest known population of this endangered species – may also have impacts on the status of the species as a whole.

Direct impacts include loss of known breeding habitat, and hence most likely, of the number of individuals that formerly bred in those areas. Indirect impacts (i.e. those that are not proportional to measurable extent of clearing) include:

- decrease in quality and extent of wet season foraging habitat due to clearing;
- acute or incremental poisoning when drinking at contaminated water sources or spillages;
- increased risk of road mortality due to increased amounts of traffic;
- mortality or reduced fitness due to inhalation or ingestion of dust;
- reduced habitat quality and continuous availability of food resources due to changed fire regimes;
- reduced breeding success due to continual noise and light;
- increased competition because disturbances have resulted in increased abundance of more disturbance-tolerant granivorous bird species.

Notably, many of these impacts may affect parts of the population during its dispersal from the main breeding area within the hills woodlands (or when birds are dispersing from this area daily to drink at sites beyond the breeding area), such that impacts may affect additional components of the population beyond that lost through clearing of nesting habitat.

Most of these risks were mentioned in the draft EIS (at Chapter 5, Table 5-6, pp. 5-23 to 5-27, and 'Appendix H' within Appendix N), but not subject to rigorous, quantitative and evidence-based evaluation. In some cases (e.g. impacts of dust), this is because there is little or no relevant information: that is, risks cannot be predicted reliably.

*Loss of breeding habitat*

The proposed development will result in the loss of c. 140 ha[9] of preferred breeding habitat (=c. 6% of that available in the lease area), which brings the cumulative loss of such habitat to c. 300-400 ha (c. 13-17%) in the lease area (Table 1 above) (with this lease area substantially overlapping the core breeding area of Yinberrie Hills Gouldian Finches). It is almost certain that Gouldian Finches currently nest in the area proposed for clearing, and there is no evidence (or reasonable proposition) that these affected birds will move to other areas. The draft EIS does not quantify the number of birds that currently nest in the suitable breeding habitat proposed

[9] Although the Draft EIS (p. 5-21) notes that 'over-clearing of vegetation' is 'Likely' (i.e. the event will probably occur in most circumstances).

for clearing. In the absence of any other relevant information provided in the draft EIS, the most reasonable assumption is that the density of breeding birds in the area is as calculated in the nearby site sampled by Woinarski and Tidemann (1991): i.e. 0.28 birds/ha. This suggests that the number of birds that may be lost to the population directly due to the proposed clearing of breeding habitat is c. 39, and that the total number lost due to cumulative development is c. 84 to 112.

The proportionate consequences of this loss are difficult to assess. The Draft EIS minimises the loss of breeding habitat to 0.85% (or possibly in error, 0.75%) (and hence by implication, inconsequential) by relating it to the total area occupied by *Eucalyptus tintinnans* woodlands in the entire Yinberrie Hills Site of Conservation Significance, notwithstanding no evidence that Gouldian Finches breed across this large area. It also claims, without sufficient evidence, that the Yinberrie Hills Gouldian Finch population was unaffected by previous clearing of breeding habitat.

On the basis that the proposed clearing (i) constitutes c. 6% of the available Gouldian Finch breeding habitat in the lease area, (ii) brings cumulatively that amount lost to c. 13-17%, (iii) almost certainly includes areas used for nesting by Gouldian Finches, (iv) currently supports a population that can most reasonably be estimated at c. 39 Gouldian Finches; (v) it is unlikely that these finches will disperse to occupy other areas, and (vi) hence, this will result in reduction in the population size of the most significant known population of this threatened species then an appropriate categorisation for risk from proposed clearing of breeding habitat is that it is 'Almost Certain' that the action will result in long-term decrease in the population size, and that the Severity of Consequences are either Significant or Major: that is, the risk is Extreme.

In contrast, the draft EIS notes ('Appendix H' (no page numbers) within Appendix N) that the likelihood of clearing of breeding/foraging habitat leading to a long-term decrease in the size of the population is 'Unlikely', and that the consequences of such habitat loss are 'Minor', such that the risk is 'Very Low'. Without any explicit assessment of the number of Gouldian Finch breeding sites destroyed by the proposed development, this assessment appears to be untenable. Furthermore, it is mostly based on unvalidated assumptions that previous mining had no impacts, and on an assessment of the proportionate loss of known breeding habitat that is determined in relation to the habitat extent across the whole Yinberrie Hills Site of Conservation Significance, notwithstanding the lack of evidence of Gouldian Finches occurring throughout that site.

*Loss of foraging habitat*

The proposed development will result in the loss of c. 468 ha[10] of foraging habitat (=c. 17% of that available in the lease area), which brings the cumulative loss of such habitat to c. 1175 ha (c. 42%) in the lease area (Table 1 above). It is almost certain that Gouldian Finches from the core

[10] Although the Draft EIS (p. 5-21) notes that 'over-clearing of vegetation' is 'Likely' (i.e. the event will probably occur in most circumstances).

breeding area currently forage in the area proposed for clearing, but the draft EIS provides little or no assessment of the extent of that use. The area proposed for clearing and the cumulative extent of such cleared areas constitutes a substantial proportion of the lowland habitat (adjacent to the core breeding area) required by this population for wet season foraging. On the basis that >400 ha of this foraging habitat is proposed for clearing, the likelihood of this habitat loss is at least 'Likely' or 'Almost Certain' and the consequences of such a high proportional loss of foraging habitat (that may affect birds additional to those whose breeding habitat will be destroyed) upon the largest known population of this threatened species (i.e. of it leading to a long-term decrease in the size of the population) may most reasonably considered to be at least Significant: that is, the risk is High.

In contrast, the draft EIS (at 'Appendix H' (no page numbers) within Appendix N) notes that the likelihood of clearing of breeding/foraging habitat leading to a long-term decrease in the size of the population is 'Unlikely', and that the consequences of such habitat loss are 'Minor', such that the risk is 'Very Low'. Without any explicit assessment of the number of Gouldian Finches foraging in the lowland habitat proposed for clearing, this assessment appears to be untenable or highly conjectural.

*Acute or incremental poisoning when drinking at contaminated water sources or spillages*

Like most other seed-eating birds, Gouldian Finches need to drink at least daily. During much of the breeding season in the Yinberrie Hills, they drink at small natural water-holes in watercourses within the hills. These mostly dry up during the hot late months of the wet season, when the finches (and other seed-eating birds) must then fly to more permanent water sources beyond the hills. Their selection of water sources for drinking is probably based on factors relating to proximity, ease of access, vegetation cover that may reduce predation risks and water quality. Gouldian Finches are known to drink at a wide range of sites, including artificial water sources and dams (e.g. Evans and Bougher 1987; Tidemann 1990), and could reasonably be expected to drink at least occasionally at one or more of the proposed development's varied water-containing facilities in close proximity to their breeding and foraging sites (see e.g. Figure 4 above). They typically drink in large groups (20 or more birds), so any single incident may affect many birds simultaneously.

With respect to water availability and risks associated with the proposed development, Gouldian Finches may be affected by loss (e.g. through watercourse diversion or drawdown of water table) or contamination of existing natural water sources and/or through poisoning when drinking at tailings dams or other sources (e.g. other retention ponds) that temporarily or permanently hold water.

The arguments used in the draft EIS (Appendix N, p. 92) to consider risks of poisoning to be 'unlikely' and 'negligible' are: (i) that 'previous release of tailings water does not seem to be associated with significant decline of fauna in the area, including decline of threatened species'; (ii) previous mining operations have 'not resulted in a decline in the Gouldian finch population', (iii) Gouldian finches prefer to drink at small water sources; and (iv) the majority of birds

reported as mortalities in other tailings dams in the Northern Territory were non-passerines (mostly ducks and shorebirds). These arguments are all contestable. With reference to (i) and (ii) the existing (statistically weak) Gouldian Finch monitoring program should not be used as evidence of population stability or of lack of population reduction associated with previous mining. With reference to (iii) in the late dry season, there are few natural small water sources available in the landscape, and Gouldian Finches may well drink at non-natural permanent water sources (even if these are dams) near breeding and foraging areas. With reference to (iii), the proportion of passerine to non-passerine birds in the total observed kill from tailings dams is relatively immaterial: of more importance is the actual numbers of individuals killed and the likelihood of population-level consequences of even relatively small numbers of deaths for this threatened species. Furthermore, most passerine birds are smaller than non-passerine birds and are more likely to fly away to die after drinking than are ducks and shorebirds (and hence will be more likely to be under-reported). Donato (1999, 2002) and Donato *et al*. (2008) noted substantial mortalities of many bird (and other wildlife) species associated with tailings dams, including in the Northern Territory, and 'serious' under-reporting.

The draft EIS also notes that 'bird mortalities from drinking tailings water may become significant once the level of weak-acid disassociable (WAD) cyanide concentrations are over 100 mg/L' (p. 92). However, most current research and guidelines recommend instead that 50mg/L is an appropriate threshold, beyond which bird mortalities are expected (e.g. Donato *et al*. 2008; Leading Practice Sustainable Development Program for the Mining Industry 2008), and the most relevant recent review and guidelines on cyanide in tailings dams (Leading Practice Sustainable Development Program for the Mining Industry 2008) further notes that 'chronic sub-lethal exposure above the toxic threshold, or repeated low doses, may cause significant irreversible effects' (p. 3). The draft EIS notes (p. 2-20) that residual WAD cyanide target for the final tailings is <10 ppm, but that 'trial treatments have yielded WAD concentrations of 39.8 mg/L' (Draft EIS Appendix N, p. 92).

The draft EIS also notes that 'concentrations of some metals (e.g. arsenic, copper, lead) in trial tailings dam water was higher than the ANZECC & ARMCANZ, (2004) levels recommended for release into the environment' but 'with the Gouldian finch being less likely to drink at the tailings dams than at smaller available sources, it seems unlikely that metal poisoning will be an issue'. (p. 92).

It is difficult to assess risks associated with this factor, because the probability of Gouldian Finches drinking at contaminated water sources cannot readily be estimated and the actual concentration of contaminants is uncertain. My assessment is that the Likelihood is Unlikely but the Consequences (of a population level impact) are Significant, so the risk should be considered Medium (cf. the draft EIS ('Appendix H' (no page numbers) within Appendix N) which considers the Likelihood to be Rare and the Severity of Consequences to be Minor, and hence the Risk to be Very Low).

*Mortality or reduced fitness due to inhalation or ingestion of dust*

The draft EIS notes that the mine will generate large amounts of dust, and that much of the spread and deposition of this dust will occur to the proposed mine's immediate west and north-west (due to the prevalent south-easterly winds in the dry season) (e.g. Appendix N Figure 6-2, p. 89). This coincides or overlaps substantially with the main area used by breeding Gouldian Finches (cf. Fig. 4 above). The draft EIS (e.g. Appendix N p. 88) notes that 'Levels of predicted ground level dust concentration greater than the NSW Office of Environment and Heritage (OEH) criteria (DEC 2005) for Total Suspended Particles (TSP) of 50 $\mu g/m^3$ are predicted to encompass all of the Mineral Leases, extending well to … the west and northwest … The GHD air quality assessment has also found that the Gouldian finch habitat at the Yinberrie Hills has the potential to be exposed to predicted maximum 24-hour ground level concentrations of $PM_{10}$ of greater than 200 $\mu g/m^3$, including background of 20.8 $\mu g/m^3$ (GHD 2013) … The New South Wales Department of Environment and Conservation (DEC) (DEC 2005) sets a dust criterion of 50 $\mu g/m^3$ TSP for human exposure … It would be anticipated that small birds like the Gouldian finch would require a lower dust criterion'. As the draft EIS acknowledges (no page number 'Appendix H' in Appendix N), 'nothing is known of its [dust] effects on the Gouldian finch', but the species may be particularly susceptible given apparently high levels of respiratory compromise due to a high prevalence of infestation with air-sac mites (Tidemann *et al*. 1992b; Bell 1996).

It is also possible that deposition of such high levels of dust will reduce the Gouldian Finch's foraging efficiency on its primary dry season food resource, grass seeds lying on the ground surface. It is also possible that ingestion of large amounts of dust-covered seeds may also have some health impacts. However, there is no evidence to assess the likelihood and severity of any such impacts.

As with some other risk considerations, it is difficult to anticipate impacts of dust pollution, and a reasonable level of precaution may be justified. The draft EIS considered the risk to long-term decrease in the size of the population because of dust levels generated by mining and processing to be High, and this assessment is considered here to be appropriate.

*Increased risk of road mortality due to increased amounts of traffic*

As with the risk of poisoning from contaminated water sources, this risk is difficult to assess, in part because it may involve very occasional instances that lead to multiple deaths. Given that traffic along the currently little-used track network is expected to more than double, the likelihood of such incidence may most reasonably be considered as Possible (i.e. occurring every 2-5 years) and the severity of consequences Moderate, such that the Risk is Medium.

*Reduced habitat quality and continuous availability of food resources due to changed fire regimes*

Gouldian Finch foraging efficiency, food availability and habitat quality are affected by fire (e.g. Woinarski 1990; Dostine *et al*. 2001; Woinarski *et al*. 2005; Brazill-Boast *et al*. 2010; Woinarski and Legge in press). Based again on the contestable interpretation that the Gouldian Finch

monitoring program (Price *et al*. unpublished) has detected no significant change in a population index, the draft EIS asserts that 'the existing fire regime has not had a negative impact on the population of Gouldian finches in recent times', and that 'the proposed operation of the Mt Todd mine is unlikely to alter the current regime' (Appendix N, p. 91), but the draft EIS also asserts (p. 5-11) that the area will be subject to, and benefit from, 'better fire management', and that 'a fire management approach resulting in a patchy mosaic of burned and unburned areas will be investigated' (p. 23-12). This appears to be contradictory, and the detail of fire management needs to be provided before impacts of this critical factor can be assessed appropriately.

*Reduced breeding success due to continual noise and light*

The core breeding area of the Yinberrie Hills Gouldian Finch population lies adjacent to and up to 1 km from the proposed mine development area, and its continuous day and night noise and lights. The draft EIS is unable to provide sufficient evidence to predict impacts of these factors upon the Gouldian Finch population, noting for example (for light): 'The proposed 24 hours per day, seven days per week operations of the Mt Todd Gold Mine has potential to negatively impact on the fauna, and specific species of fauna. The level of ignorance as to what the precise impacts may be precludes valid impact assessment. The valid approach under this circumstance is not to assess the potential impacts, but to implement measures to mitigate the types of impacts that have been recorded for other faunas' (Appendix N, p. 94). As with other impact assessments, the draft EIS interprets the limited previous monitoring to conclude that there were 'no recorded or subsequently detected impacts of fauna from previous mining' and hence that the proposed noise and light pollution will likewise have no impacts. As noted above, this conclusion is insecure.

*Increased competition because disturbances have resulted in increased abundance of more disturbance-tolerant granivorous bird species*

The Gouldian Finch is an ecologically more specialised species than most other co-occurring finches, including the Long-tailed Finch (e.g. Dostine and Franklin 2002). Such other species are more likely to benefit than the Gouldian Finch from the altered habitat of the proposed development area. Long-tailed Finches are aggressive and dominant to Gouldian Finches (and may usurp their breeding sites) (Brazill-Boast *et al*. 2010, 2011, 2013; Brazill-Boast 2013), and any local-scale increase in their abundance may lead to increased competitive pressure on Gouldian Finches for food and nest site resources in nearby unmodified habitats.

*Summary of risk assessment*

As described under EPBC Act guidelines on impact assessment, a significant impact on an endangered species will occur if there is a real chance or possibility that the proposed development will:

- lead to a long-term decrease in the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; or
- interfere with the recovery of the species.

In this context, a *population* is defined as an occurrence of a species in a particular area, or a geographically distinct regional population (e.g. Draft EIS, Appendix N, p. 80). The discrete breeding population in the 30-50 $km^2$ core breeding habitat in the Yinberrie Hills constitutes a *population*. The Gouldian Finch Recovery Plan (O'Malley 2006a) considered that it was not possible to map *habitat critical to the survival of a species*, but that instead the plan identified key areas, of which the first was the Yinberrie Hills.

My assessment of risks from the proposed development associated with relevant parameters is given in Table 3. Note that the proposed development will have a trivial impact on the area of occupancy of the species (as distinct from the population), and is not likely to fragment the population, or to introduce a detrimental invasive species or disease.

**Conclusion 6. Most relevant risks are under-assessed in the draft EIS. It is concluded here that the impacts will be significant, and that there is Extreme risk that the proposed development will (i) result in long-term decrease in the size of the population; (ii) adversely affect habitat critical to the survival of the species; (iii) disrupt the breeding cycle of a population; and (iv) modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.**

**Table 3. Assessment of risks of the proposed development to the Gouldian Finch**. * denotes that the available information to assess this risk is particularly insubstantial.

| Impact | Severity of Consequence | Likelihood | Risk |
|---|---|---|---|
| **long-term decrease in the size of a population** | | | |
| clearing of breeding habitat | Significant to Major | Almost Certain | Extreme |
| clearing of foraging habitat | Significant | Likely to Almost Certain | High |
| poisoning through drinking at contaminated water sources* | Significant | Unlikely | Medium |
| mortality or reduced fitness due to exposure to dust* | Major | Possible | High |
| mortality associated with traffic* | Moderate | Possible | Medium |
| changed fire regimes* | Moderate | Possible | Medium |
| high levels of noise and light* | Moderate | Possible | Medium |
| **adversely affect habitat critical to the survival of a species** | | | |
| clearing of breeding habitat | Significant to Major | Almost Certain | Extreme |
| clearing of foraging habitat | Significant | Likely to Almost Certain | High |
| reduced air quality due to dust* | Major | Possible | High |
| changed fire regimes* | Moderate | Possible | Medium |
| high levels of noise and light* | Moderate | Possible | Medium |
| **disrupt the breeding cycle of a population** | | | |
| clearing of breeding habitat | Significant to Major | Almost Certain | Extreme |
| changed fire regimes* | Moderate | Possible | Medium |
| high levels of noise and light* | Moderate | Possible | Medium |
| **modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline** | | | |
| clearing of breeding habitat | Significant to Major | Almost Certain | Extreme |
| clearing of foraging habitat | Significant | Likely to Almost Certain | High |
| poisoning through drinking at contaminated water sources* | Significant | Unlikely | Medium |
| mortality or reduced fitness due to exposure to dust* | Major | Possible | High |
| changed fire regimes* | Moderate | Possible | Medium |
| high levels of noise and light* | Moderate | Possible | Medium |
| **interfere with the recovery of the species** | | | |
| clearing of breeding habitat | Significant to Major | Almost Certain | Extreme |
| clearing of foraging habitat | Moderate | Possible | Medium |
| poisoning through drinking at contaminated water sources* | Moderate | Unlikely | Low |
| mortality or reduced fitness due to exposure to dust* | Moderate | Possible | Medium |
| changed fire regimes* | Minor | Possible | Low |
| high levels of noise and light* | Minor | Possible | Low |

## Consideration of mitigation and monitoring programs

Notwithstanding (i) a recognition in the draft EIS of at least High risk for some factors, and (ii) a high degree of uncertainty about some potential impacts, the draft EIS provides no substantial strategic mitigation or monitoring program. To the extent that any detail is presented, this is provided on p. 22-8 and in Appendix N, pp. 99-101.

For example, under the heading 'Dust Mitigation' the draft EIS (at Appendix N, p. 99) describes no mitigation measures. The only mitigation measure proposed under 'Land Clearing' (at Appendix N, p. 100) is that clearing of breeding habitat should be undertaken only outside the breeding season 'where practical'. For noise 'standard mitigation should be applied' (at Appendix N, p. 100). For fire, a few speculative measures are discussed, with no commitment or detail. For impacts of continual light, a set of relatively limited actions is mentioned that 'can be' used 'where it is safe to do so', but there is no commitment to a systematic program for mitigation. Of the only three mitigation measures described on p. 22-8, all are monitoring actions rather than mitigation actions, and none link the monitoring programs to remedial responses.

For mitigation of risks associated with poisoning at tailings dams and spillages, there are well established standards and protocols for minimising the attraction of birds to potentially contaminated sites, and of regular and systematic monitoring of bird impacts (e.g. Donato *et al*. 2008; Leading Practice Sustainable Development Program for the Mining Industry 2008), but these are not countenanced in the draft EIS.

The draft EIS provides no acceptable, resolute or considered commitments to mitigate impacts upon Gouldian Finch in relation to serious risk factors. An acceptable mitigation program would provide a detailed description of mitigation measures proposed, evidence that these can be expected to have beneficial effects, a commitment to the instigation and maintenance of those measures, an estimate of the extent to which each mitigation action would reduce the risk, contingency planning that would modify the mitigation measure if it proved insufficient, and clear links to a monitoring program that could measure the benefit of the mitigation. The small collection of speculative and superficial actions mentioned in the draft EIS that may be implemented meets none of these standards.

The approach to monitoring is similarly superficial and inadequate. Without consideration of options, the draft EIS asserts that 'the only practical way of conducting monitoring is the establishment of large numbers of artificial nest boxes' (Appendix N, p. 99), although it also notes that 'the feasibility of using artificial nest boxes needs to be investigated prior to commencement of monitoring' (Appendix N, p. 99). Unreported in the draft EIS, a recent study has demonstrated that Gouldian Finches will use artificial nest boxes (Brazill-Boast *et al*. 2013), although there is also a risk of perverse outcomes if these will instead be used by, and increase the abundance of, the competitively superior and aggressive Long-tailed Finch (Brazill-Boast *et al*. 2010, 2011), and nest-boxes may be useful if and only if other resources are not limiting. As with previous monitoring programs for Gouldian Finches that unsatisfactorily assessed impacts

of the previous mining activity at this site, there is no consideration of statistical power, of triggers or thresholds and consequential responses and remedial actions, of intensity and duration of monitoring, and no explicit linkage back to iterative manipulation of management and mitigation actions. All of these factors should be detailed, with linked monitoring programs relating to fire management, use of tailings dams, impacts of dust, noise and light, and overall population trajectory.

With respect to monitoring, the draft EIS (Appendix N, p. 100) also notes that current monitoring by DLRM 'should be continued, possibly with assistance from the mine'. If that program is to provide an adequate contextual framework for considering population-level changes due to new mining development, then it needs to be substantially enhanced through increase in monitoring intensity, because its existing statistical power is inadequate and because its operation is subject to unpredictable vagaries of rainfall events and timing. Without compelling explanation, the draft EIS advises instead that the program should be expanded geographically to determine presence and population size of Gouldian Finches in other areas beyond the Mt Todd location.

## Recommendations

1. Substantial further intensive survey work is required in order to adequately assess impact in relation to risk of this proposed development upon the largest known population of this threatened species. That work should document the number of Gouldian Finches breeding in the habitat area proposed to be cleared or otherwise subject to substantial disturbance.

2. Further intensive sampling is required to assess the use of the lowland habitat in the proposed development area by Gouldian Finches for foraging and access to water, with such study designed to allow an adequately informed assessment of risks associated with clearing of lowland habitat and of potential use of contaminated water sources.

3. Notwithstanding much uncertainty about extent of impacts, the proposed development is expected to have a significant impact upon this population. A far more specific set of effective mitigation measures is required to be developed and implemented in order to minimise that impact.

4. Previous monitoring programs have been statistically inadequate to detect changes in population size at this site, and should not be used to conclude that (i) the population size has been stable, (ii) previous mining activity has had no impact; and hence (iii) the proposed mining activity will also have no impact.

5. Should the proposed mining developments proceed, a consolidated package of linked monitoring programs is required that will assess trends in Gouldian Finch population size, define impacts of the development, and measure the efficacy of mitigation and other management actions. Such a monitoring program must have substantially more statistical power than existing monitoring, must have an adequate pre-impact baseline (preferably of at least two years), and must have clear thresholds and trigger points that are linked to effective remedial actions.

## Conclusions

This assessment concludes that as described in the draft EIS, the proposed development will have a significant detrimental impact on this largest population of the endangered Gouldian Finch. The draft EIS states or implies that most risks are less significant than assessed here.

For some factors, the available information is inadequate to allow a reliable assessment of risk. Sampling for the draft EIS provided little information relative to such data deficiencies, although some key parameters (e.g. the number of breeding Gouldian Finches in areas proposed for clearing) were not explicitly factored into the assessment guidelines. The draft EIS did not consider a substantial body of relevant literature.

A critique of the assessment of the impacts upon the Gouldian Finch of the previous mining development at this site noted 'The information on which the assessment of the mine's impact was based was insufficient to clarify the bounds of the breeding colony relative to the mine site, the number of breeding birds likely to be affected, the impacts that could be expected on the breeding colony, or the significance of the breeding colony relative to the total population of the species' (Woinarski and Dawson 2001, p. 100). Most of those deficiencies remain.

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## Appendix A: Check-list of compliance with relevant specific *Guidelines for the preparation of an Environmental Impact Statement: Mount Todd Gold Project, Katherine Region, NT*.

In the following text (in bold), I provide an assessment of the extent of compliance of material presented in the draft EIS with the guidelines specified for this draft EIS, in relation only to considerations for the impact upon the Gouldian Finch. The framework text is taken from the September 2011 NRETAS Guidelines.

**6.3 Biodiversity**

The Project falls within a NT Site of Conservation Significance – the Yinberrie Hills. Sufficient information is required regarding the current biodiversity of the Project area to assess and monitor expansion impacts. With reference to the NRETAS biodiversity and natural resource guidelines and Australian Government Survey Guidelines for threatened species (http://www.environment.gov.au/epbc/guidelines-policies.html#threatened):

• Present baseline flora and fauna surveys of areas both within and surrounding the Project area. Identify EPBC and NT listed flora and fauna species that are present, or are potentially present within the Project area, including the Gouldian Finch, and which may be affected by the Project either directly or indirectly;

> **Assessment: The baseline surveys provide an adequate record of the likely presence or absence of species (including EPBC Act and NT listed threatened species), but provide little or no relevant information on the extent to which the impact area is significant for Gouldian Finches (for example, the *number* of Gouldian Finch breeding in the impact area).**

• Conduct a systematic fauna survey targeting EPBC and NT listed species in areas of native vegetation that the Proponent proposes to clear in the proposal; and areas that lie adjacent to cleared areas. This also includes all areas of vegetation or potential habitat that are proposed for clearing in order to accommodate the new road connecting the mine to the limestone quarry;

> **Assessment: Some baseline surveys for Gouldian Finches were conducted, but there was little or no assessment of population size in the impact area.**

• Provide a map of the vegetation communities within the Project and quarry leases and surrounding areas at an appropriate scale such as 1:25 000 or 1:50 000. Surrounding areas must include the area of land where the 20km road connecting the mine to the limestone quarry is

proposed to occur. The map must also identify areas containing significant[11] vegetation communities, including creek lines with associated riparian vegetation or rainforest;

**Assessment: A relevant vegetation map was modified appropriately from a previous map, but this was not adequately contextualised with reference to the surrounding area encompassing the known core breeding area of Gouldian Finches. Consequently, the proportional impacts of clearing are difficult to assess precisely.**

• Conduct targeted surveys for the limestone quarry on the NT listed threatened fauna species including the Victoria's land snail (*Setobaudinia victoriana)* known to be restricted to limestone areas;

**Assessment: not relevant to this report**

• Conduct a targeted survey of the cycad species *Cycas calcicola* and, if present, mapping the distribution of the species within the quarry and adjacent area;

**Assessment: not relevant to this report**

• Describe in detail aquatic fauna (e.g. macro-invertebrates, crustaceans, fish) present in local creeks and rivers in and downstream of the Project area;

**Assessment: not relevant to this report**

• Identify and discuss species of traditional Aboriginal cultural significance (particularly aquatic and terrestrial fauna species), based upon consultation with traditional owners and surveys of the Project area;

• Identify areas requiring clearing of native vegetation for the Project, including potential for edge (degradation) effects and any disturbance to drainage lines. Present alternative configurations where available to minimise clearing requirements. Detail habitat types within areas to be cleared, with focus on significant habitats and habitats supporting species of conservation significance;

**Assessment: the draft EIS includes no substantial consideration of vegetation loss consequences of alternative configurations. It does provide an adequate consideration of the extent of loss of prime breeding habitat of Gouldian Finch (*Eucalyptus tintinnans* co-dominated woodlands), but does not adequately relate this proposed loss to the area of the habitat used in the core breeding area of this species in the Yinberrie Hills. The draft EIS provides inadequate information on the distribution in the impact area of grass species that provide key resources for Gouldian Finches in the wet season.**

[11] Rare, threatened, endangered and regionally restricted species, vegetation types or habitats such as mangroves, rainforest, vine thicket, monsoon vine forest, riparian or closed forest and vegetation containing large trees with hollows suitable for fauna.

• Describe whether the limestone quarry has potential to significantly impact stygofauna. Refer to the Western Australian Guidance notes: (http://www.epa.wa.gov.au/docs/1720_GS54.pdf ) if the quarry does present a significant impact on groundwater levels and quality of subterranean cave and void systems in an environment where stygofauna may be restricted;

**Assessment: not relevant to this report**

• Identify presence and potential presence within the Project area of declared and environmental weeds and feral animals;

**Assessment: not relevant to this report**

• Identify all listed threatened and/or migratory species that could be affected either directly or indirectly as a consequence of the proposal;

**Assessment: not relevant to this report**

• Provide a description of the distribution, ecology and habitat preferences of listed threatened and/or migratory species;

**Assessment: the draft EIS is deficient; it includes an inadequate consideration of the distribution, ecology and habitat preferences of Gouldian Finches. It notably does not consider a series of important relevant studies; and it offers little critical review of the distribution or abundance of Gouldian Finches in the area relevant to this proposed development.**

• The listed threatened and/or migratory species that need to be addressed includes but is not limited to:
- *Gouldian Finch (Erythrura gouldiae)*
- *Northern Quoll (Dasyurus hallucatus)*
- *Crested Shrike-tit (northern)/Northern Shrike-tit (Falcunculus frontatus whitei)*
- *Partridge Pigeon (Geophaps smithii smithii)*
- *Bare-rumped Sheathtail Bat (Saccolaimus saccolaimus nudicluniatus)*
- *Red Goshawk (Erythrotriorchis radiatus)*
- *Masked Owl (Tyto novaehollandiae kimberli)*
- *Northern Brush-tailed Phascogale (Phascogale pirata)*
- *Freshwater Sawfish (Pristis microdon)*
- *Brush-tailed Rabbit-rat (Conilurus penicillatus)*

• Provide appropriate scale maps for listed threatened and/or migratory species showing:

- The location of known records (from databases and all surveys including those described in bullet points 1-2 of Section 6.3);

**Assessment: the draft EIS does not include known breeding records of Gouldian Finches in the relevant area, a feature that should be particularly relevant to this impact assessment**

- All potential habitat for each species within the Project and surrounding area; and

**Assessment: the distribution of preferred breeding habitat of Gouldian Finches is mapped appropriately; but there is limited consideration of important non-breeding habitat**

- Habitat components important for each species such as breeding habitat.

**Assessment: the distribution of preferred breeding habitat of Gouldian Finches is mapped appropriately; but there is limited consideration of important non-breeding habitat**

• Provide calculations of the area (in hectares) of all potential and known habitat of EPBC listed species that will be directly or indirectly impacted.

**Assessment: Inadequate: (i) it is not clear that the draft EIS includes adequate consideration of all clearing (for example, the draft EIS notes possibility of on-site accommodation areas, but these are not included in maps showing areas to be cleared) [e.g. p. 2-25: 'The construction workforce will be housed in a purpose built camp. The location of this camp is still to be determined but is likely to be located within 25 km of the mine. This does not preclude locating the camp on the Mineral Lease. An onsite accommodation camp (i.e. the retention of a residual part of the construction camp) may be included in the long-term on-site project infrastructure. Approval for such a camp would be via a separate approval process']; (ii) the draft EIS indicated area to be cleared of potential nesting habitat of Gouldian Finch, but not the area used by nesting Gouldian Finches or of the number of breeding Gouldian Finches in the impact area.**

**7.6 Biodiversity**

**Key Risks**

• The proposed clearing of approximately 700 ha of native vegetation impacting flora and fauna species of conservation significance; and

• Potential impacts on matters of national environmental significance under the EPBC Act, including listed threatened species and communities (Gouldian Finch) and listed migratory species.

**Environmental Objectives**

• To maintain the abundance, diversity, geographic distribution and productivity of flora and fauna at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge within the Project and surrounding area; and

**Assessment: the proposed development is likely to result in the reduction in population size of the most significant known population of the threatened Gouldian Finch.**

• No net loss of biodiversity consistent with the *Territory 2030 Strategic Plan* requirement that intensive developments operate under a 'no net biodiversity loss principle'.

**Assessment: the proposed development is likely to result in the reduction in population size of the most significant known population of the threatened Gouldian Finch.**

**Outcomes**

• Native flora and fauna species, and significant habitat types, particularly those of conservation and traditional Aboriginal cultural significance, are identified, and protected from impacts from the Project; and

**Assessment: the most significant known population of the threatened Gouldian Finch is not adequately 'protected from impacts'.**

• Surveys of flora and fauna species, and proposed clearing of native vegetation are in accordance with relevant NT Guidelines (section 10.3).

**Assessment: standard surveys were conducted, but no attempt was made to assess the critical variable relevant to assessment of the potential impact of this proposal: the number of breeding Gouldian Finches in the area to be cleared, or of this as a proportion of the total Yinberrie Hills population, or of the total known Australian population**

**Information Requirements**

Sufficient information is required regarding the current biodiversity of the Project area to assess and monitor Project impacts. The following information should be provided:

• Refer to section 6.3 for information requirements of describing existing flora and fauna;

• Detail the extent of clearing required during construction and operation and indicate on a map;

**Assessment: the extent of clearing is adequately mapped, although there appears to be no consideration of possible clearing associated with the option to include a substantial accommodation area on-site.**

• Discuss impacts on species, communities and habitats of local, regional or national significance including sensitivity of species to disturbance;

**Assessment: the discussion of potential impacts on Gouldian Finches is inadequate, and relies almost entirely on misplaced assumptions that the population was unaffected by previous mining activities.**

• Describe impacts such as loss of vegetation, reduction in species abundance, introduction and increase in abundance of pest plants and animals, edge effects, reduced conditions for favourable plant growth, impacts on habitat corridors, habitat loss and fragmentation and visual impacts associated with the vegetation clearing required during the life of the Project;

**Assessment: the discussion of potential impacts on Gouldian Finches is inadequate, and relies almost entirely on misplaced assumptions that the population was unaffected by previous mining activities.**

• Discuss potential impacts on water quality of creeks, streams and ephemeral lakes (habitat for aquatic fauna and drinking water for terrestrial species);

**Assessment: the discussion of potential impacts on Gouldian Finches is inadequate, and assumes without compelling evidence that Gouldian Finches will not drink at contaminated water sources or large tailings dams.**

• The ability of identified stands of vegetation and fauna to withstand any increased pressure resulting from the Project (e.g., increase in dust, light, noise, vibration, traffic and fire) and measures proposed to mitigate impacts;

**Assessment: there is little or no evidence-based assessment of the likely impacts of dust, light, noise, vibration, traffic and fire on the ecology, breeding success, or population size of Gouldian Finches; rather impacts are assumed hopefully to be minimal or benign. The consideration of impacts upon nearby Gouldian Finches of 24-hr lighting and industrial noise is typical: '*The proposed 24-hours a day, seven days a week operation of the mine has potential to impact fauna, and specific species of fauna. The level of ignorance as to what the precise impacts may be precludes valid impact assessment. The valid approach under this circumstance is not to assess the potential impacts, but to implement measures to mitigate the types of impacts that have been recorded for other faunas and species of relevance*' (draft EIS p. 14-21): i.e. it is not possible to assess impacts and no mitigation measures relevant to the impacts are provided.**

• Identify and discuss environmental risks associated with the proposed land clearing. Discuss proposed clearing with regard to issues raised and recommendations contained within the *NT Land Clearing Guidelines* (NRETAS 2009): http://www.nt.gov.au/nreta/natres/natveg/pdf/clearing_guidelines_2009.pdf

**Assessment: mostly appropriate, although the draft EIS is inconsistent with commitments to not clear breeding habitat of Gouldian Finches at times when they are nesting in those areas (i.e. Appendix N, p. 100 notes '*The Gouldian finch habitat, E. tintinnans woodlands adjacent to the pit, should only be cleared during the non-breeding season (i.e. wet***

***season) where practical*.'**, **whereas in Chapter 14 (p. 14-32), the 'where practical' is (appropriately) omitted.**

• Discuss ways in which impacts on species, communities and habitats can be minimised (e.g. timing of works, minimising disturbance catchment);

**Assessment: Inadequate – there is little detailed or evidence-based consideration of the range of possible mitigation measures for any of the potential impact factors or of the likely efficacy of such measures, or of the likelihood of consequential changes to mining project procedures**

• Discuss how visual impacts of land clearing will be minimised;

**Assessment: not relevant to this report**

• A fire, weeds and feral animal management plan as part of the Environmental Management Plan; and

**Assessment: the draft EIS provides little detail of the range of management actions that will be considered in the EMP, the magnitude, extent and duration of such activities, or of their likely effectiveness**

• Demonstrate that appropriate flora and fauna survey methodology has been employed, to define species present on the Project site.

**Assessment: standard surveys were conducted, but no attempt was made to assess the critical variable relevant to assessment of the potential impact of this proposal: the number of breeding Gouldian Finches in the area to be cleared, or of this as a proportion of the total Yinberrie Hills population, or of the total known Australian population**