Appendix C: Seven Part Tests

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Jewelled Gecko (Strophurus elderi)

The Jewelled Gecko (*Strophurus elderi*) is listed as vulnerable under Schedule 2 of the New South Wales (NSW) *Threatened Species Conservation Act 1999* (TSC Act). It has a widespread distribution across the arid and semi-arid zones from Western Australia through the southern Northern Territory, South Australia into south-western Queensland, western NSW and north-western Victoria (Wilson and Swan, 2008). In NSW the species is largely confined to south-western areas predominantly between Mildura and Robinvale north to Menindee including Tarawi Nature Reserve and Mallee Cliffs National Park (NSW Scientific Committee, 2004; NSW Office of Environment and Heritage [OEH], 2012a). In addition, there is a single record from Yathong Nature Reserve, north of Griffith in the central-west of the State (NSW Scientific Committee, 2004).

This species is restricted to a wide variety of vegetation communities supporting spinifex (*Triodia* sp.), including mallee, sand desert and stony hills (Cogger, 2000; Wilson and Swan, 2008; Swan *et al*., 2004). In south-western NSW it occurs in chenopod sandplain mallee, deep sand mallee on irregular or linear dunefields, mallee box open woodland and rarely in cypress-pine woodland with a spinifex understorey (OEH, 2012a). Within these habitats the species is entirely dependent on spinifex clumps for shelter and foraging sites (Sadlier *et al*., 1996; Wilson and Swan, 2008).

It is a nocturnal species that feeds predominantly on spiders and a variety of insects, including crickets, caterpillars, termites and cockroaches (OEH, 2012a). Foraging predominantly occurs within or on the exterior of spinifex clumps, with occasional individuals observed on bare ground between spinifex clumps. The species is semi-arboreal with the semi-prehensile tail assisting in movement between the spinifex spikes. During the day individuals shelter inside the spinifex clump, under mats of dead foliage or in burrows beneath clumps (OEH, 2012a; M. Schulz, pers. obs.). The Jewelled Gecko lays a clutch of two eggs throughout the year following suitable weather conditions.

The area of habitat required for this species to persist in a given area is unknown. The fragmented distribution of the Jewelled Gecko increases the likelihood of local populations becoming extinct as a result of stochastic events, such as prolonged drought (NSW Scientific Committee, 2004). The overall population size and population trends in this species are unknown, but it is likely that the species has declined overall within the state, given that large sections of its preferred habitat have been cleared.

This species is threatened by a number of processes, particularly habitat clearance, fire history and habitat degradation by domestic stock and feral goats (*Capra hircus*) through trampling, grazing the seed heads, impacting soil structure and facilitating weed invasion (Masters, 1996; Sadlier *et al*., 1996; NSW Scientific Committee, 2004). It is predominantly found within large, mature spinifex clumps in areas that are infrequently burnt (Sadlier *et al*., 1996). Other threatening processes identified for the species include predation by the European red fox (*Vulpes vulpes*) and the feral cat (NSW Scientific Committee, 2004; OEH, 2012a).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Jewelled Gecko was recorded once within the Campaspe footprint (Figure C-1). At this site, a single individual was located sheltering under a mat of dead spinifex in Linear Dune Mallee. The Jewelled Gecko was recorded at 10 localities during the current surveys outside the Atlas-Campaspe Mine footprint, including eight localities within the proposed offset area (Figure C-1). At one locality in Linear Dune Mallee within the proposed offset area approximately 3 kilometres (km) north-west of the Campaspe footprint, five individuals were located sheltering under dead spinifex, including two juveniles. There are no previous database records from within the Atlas-Campaspe Mine footprint, but there are previous records from nine localities in adjoining areas, including one within the proposed offset area and three in the western part of Mungo National Park (Figure C-1).

The Atlas-Campaspe Mineral Sands Project (the Project) would remove one known locality of the Jewelled Gecko situated in the Campaspe footprint. The majority of locality records in the region (94 percent [%]) were recorded outside the Project area and are connected by continuous suitable habitat that would not be impacted by the Project. Further habitat enhancement in the proposed offset area could provide considerable compensation to the species, with nine localities of this species occurring within the area and a further two localities in Mungo National Park bordering the area.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine footprint would result in the removal of approximately 1,040 hectares (ha) of suitable habitat for the Jewelled Gecko in Linear Dune Mallee. A further 535 ha of Sandplain Mallee would also be removed and portions of this habitat where well developed spinifex are present provide potential habitat for the species. Protection and habitat enhancement of known habitat within the proposed offset area (9,640 ha of suitable habitat and portions of 3,125 ha with spinifex hummocks) would provide considerable compensation for components of the local population outside the Project footprint (Figure C-2).

(ii) The Atlas-Campaspe Mine footprint would not result in fragmentation or isolation of known occurrence localities or potentially suitable habitat due to the extensive areas of similar vegetation communities surrounding the Project footprint. Additionally, all but one known record of the species from the region occur outside the Project boundary area and are linked by continuous vegetation that would not be disrupted by the Project.

(iii) There is one record of the Jewelled Gecko within the Campaspe footprint (Figure C-2). Potential habitat within this area is part of a much larger patchwork of habitat that extends to the other known localities of the species in the region outside the Project area. The localised impacts resulting from the Project would only occur in potential habitat within the Atlas-Campaspe Mine footprint and would therefore not lead to the extinction of the wider population or reduce its viability by a substantial amount.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" for the Jewelled Gecko is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Jewelled Gecko, however OEH (2012a) recommends the following priority actions to assist with the recovery of the species that are of relevance to the Project:

- Implement fox control programmes in conservation reserves and encourage and support (through advice, joint programmes, resources, etc.) the control of feral cats and foxes in other areas of suitable habitat.
- Use management agreements and incentives on private and leasehold land to manage total grazing pressure through such actions as removal of artificial water points and feral and native herbivore control.
- Determine, through research, the ecological requirements of the species, particularly in regard to fire, and incorporate the information into Regional and Local Fire Plans.

The proposed offset area would aim to compensate for potential habitat loss by enhancing the habitat quality and integrity of the offset area, which includes 9,640 ha of Linear Dune Mallee and portions of Sandplain Mallee (3,125 ha) with well developed spinifex hummocks, both of which provide habitat for the Jewelled Gecko. Improved fire management, increased control of feral animals and reduced grazing pressure would give considerable compensation to offset localised habitat loss.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 key threatening processes (KTPs) listed for NSW by the OEH (2012b), the following are relevant to the Project, the location and the species:

1) Clearance of native vegetation.
2) High-frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*).
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.
7) Removal of dead wood and dead trees.

The Project would contribute to KTP1 (as discussed above in the response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions (presence of spinifex) for the species. The Project may also contribute to KTP7 within the Project area due to the removal of large logs during clearing. This KTP is likely to be mitigated during the rehabilitation stage of the Project when selected hollows and large logs that would be salvaged during clearing, are relocated into these areas.

Feral animal management plans would make considerable contributions to reduce KTPs 3, 4, 5 and 6.

Conclusion

The Project would result in the removal of one known locality and progressive removal of approximately 1,040 ha of suitable habitat in Linear Dune Mallee for the Jewelled Gecko. A further 535 ha of Sandplain Mallee would also be removed and portions of this habitat where well developed spinifex is present provide potential habitat for the species. There are numerous records of the Jewelled Gecko outside the Atlas-Campaspe Mine footprint; all of which are connected by continuous vegetation that would not be isolated or fragmented by the Project. The proposed offset area incorporates the majority of locality records of the species that are not in conservation reserves in the region. Further it contains approximately 9,640 ha of suitable habitat in Linear Dune Mallee and 3,125 ha of Sandplain Mallee, of which a small portion represents potential habitat (areas with spinifex hummocks). This area of habitat represents more than eight times that in the development footprint and all of this habitat would be managed to enhance the species' viability in the local context. This would include management of bushfire risk, reduced livestock grazing and control of feral animal populations. In this context the Project would have only limited detrimental impacts on the local population of the Jewelled Gecko that would not lead to the extinction of the population or reduce the species' viability to a substantial extent in the region.

Proposed avoidance, management and mitigation measures would include:

1) Management of 9,640 ha of suitable habitat in Linear Dune Mallee and 3,125 ha of Sandplain Mallee, of which a small portion represents potential habitat (areas with well developed spinifex hummocks) in the proposed offset area to improve their ecological viability.
2) Implementation of feral animal control in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.
3) Implementation of feral animal control in the Project area and proposed offset area to reduce predation of the Jewelled Gecko by the European red foxes and feral cats.
4) Reduced stock grazing in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.
5) Implementation of appropriate fire regimes to promote natural succession and allow a mosaic of unburnt areas to persist.

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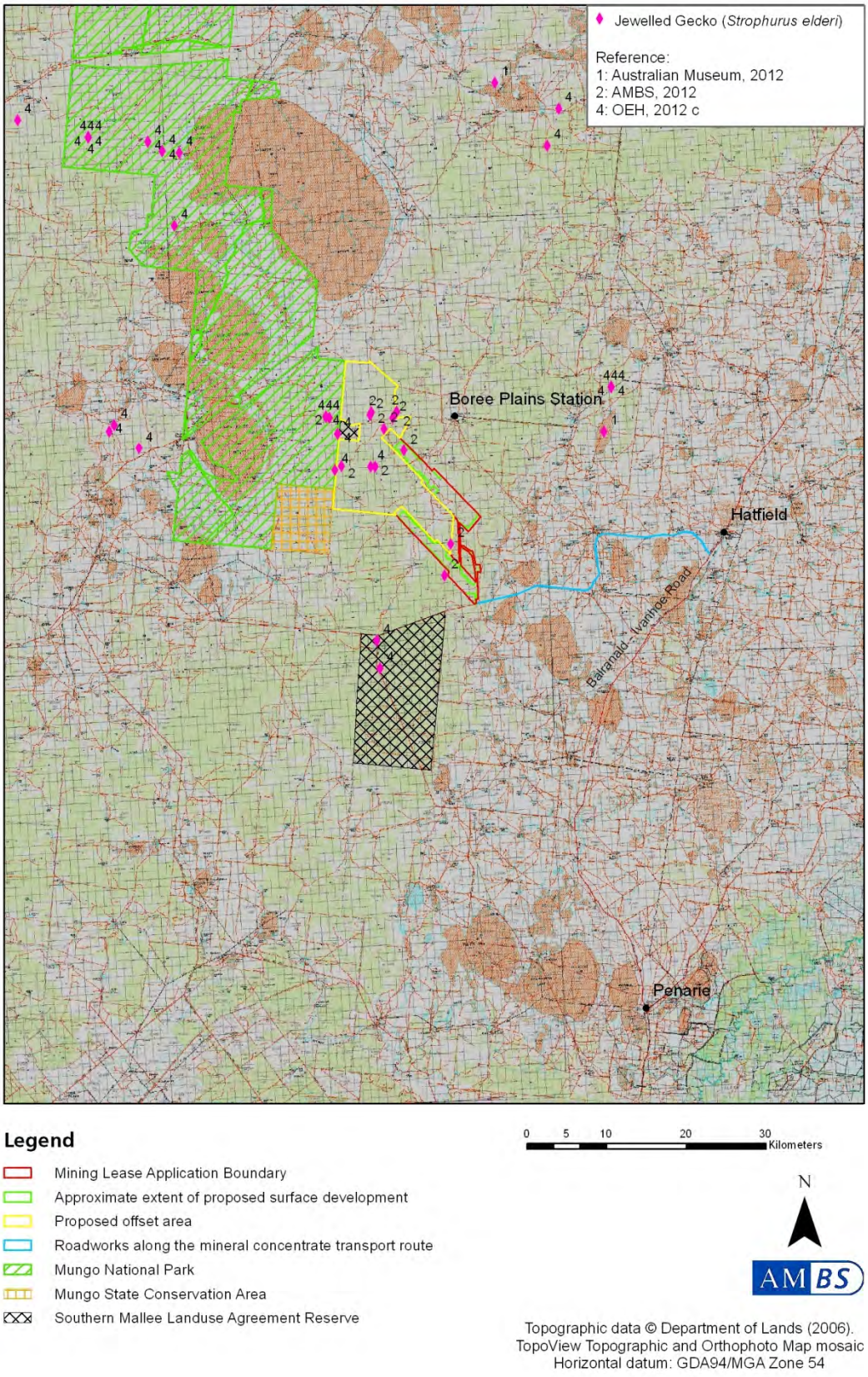

Figure C-1 Jewelled Gecko - Landscape Distribution

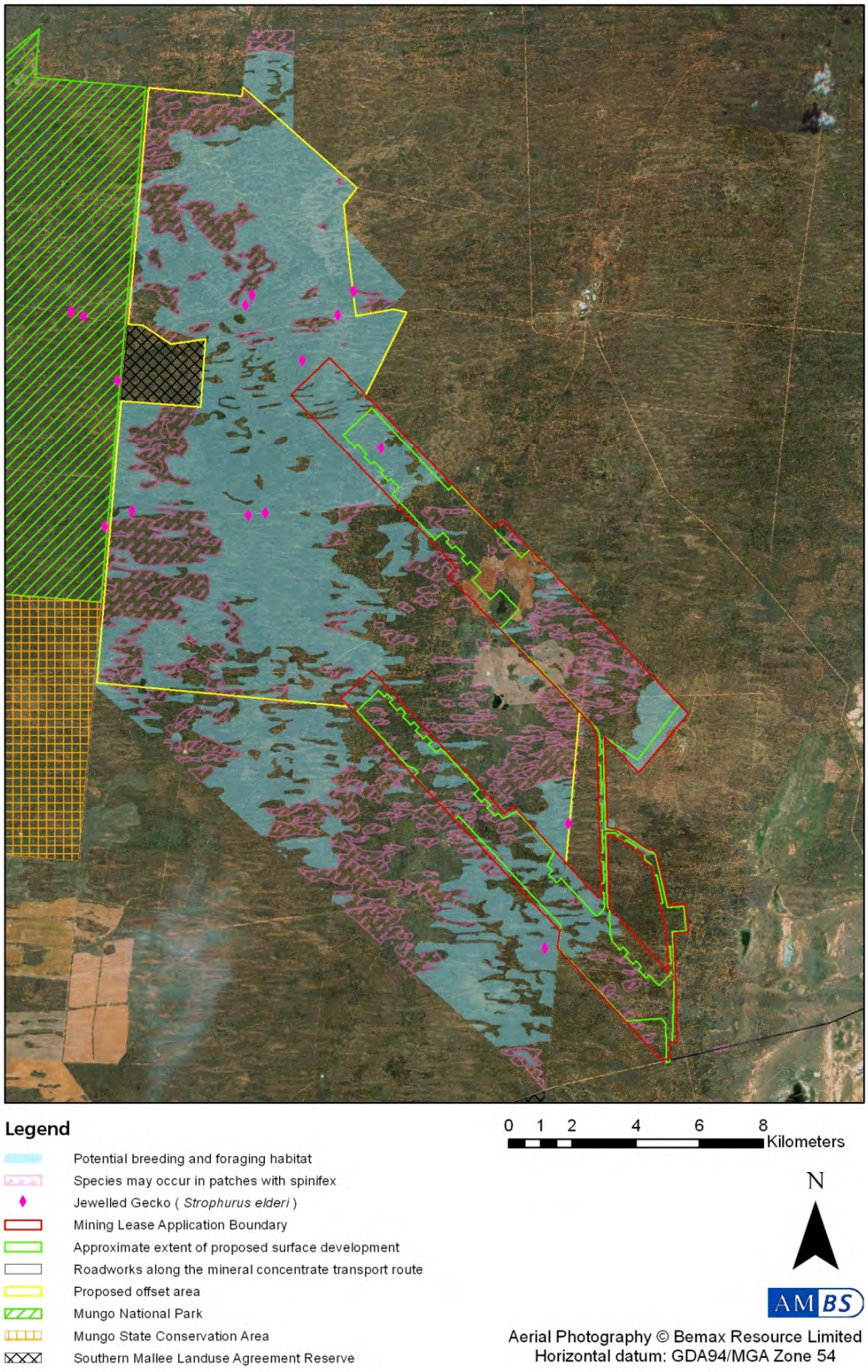

Figure C-2 Jewelled Gecko - Potential Habitat

Mallee Worm-lizard (Aprasia inaurita)

The Mallee Worm-lizard (*Aprasia inaurita*) is listed as endangered under Schedule 1 of the TSC Act. It has a patchy distribution extending from the south-eastern corner of Western Australia through far southern South Australia to north-western Victoria and south-western NSW (Cogger, 2000; Wilson and Swan, 2008). Within NSW the records are primarily restricted to the south-west corner of the state, with two records from the central mallee (Pulletop and Gubbata Nature Reserves) in 1999 (OEH, 2012a). Within south-western NSW the majority of records are from the mallee between Balranald and Gol Gol (e.g. Mallee Cliffs National Park) and at Scotia (OEH, 2012a).

It primarily occurs on red sand plains in semi-arid mallee woodland with a spinifex understorey (Swan *et al.*, 2004). Elsewhere within its range it occurs in various vegetation communities including tall shrubland on pale coastal sands, such as in far south-eastern Western Australia and parts of southern South Australia (Cogger, 2000; Wilson and Swan, 2008). The typically mallee overstorey varies from deep sand mallee on linear or irregular dunefields, chenopod Sandplain Mallee woodland, mallee-smooth-barked coolibah woodland and broombush shrubland in mallee landscapes (OEH, 2012a). The understorey component on a sandy substrate appears to be important for the species, with it displaying a preference for spinifex such as *Triodia scariosa* (Porcupine Grass) in eastern parts of its distribution. It is primarily a burrowing species that rarely comes to the surface, resulting in it being uncommonly captured in pitfall traps. It is occasionally encountered under mallee roots, other surface debris such as decaying leaf litter at the base of trees and in ant nests (Wilson and Swan, 2008).

The area of habitat required for this species to persist in a given area is unknown, but suspected to be small (e.g. <5 ha) and the species has been shown to persist in a fragmented landscape (OEH, 2012a). The overall population size and population trends in this species are unknown, but it is likely that the species has declined overall within the state given that large sections of its preferred habitat have been cleared. There is little biological information on members of this genus, including this species, with members believed to feed primarily on small arthropods, particularly the eggs, larvae and pupae of ants such as the genus *Aphaenogaster* sp. (Myrmicine ants) (Backhouse and Robertson, 1992). It is an oviparous species which is thought to breed in spring (OEH, 2012a).

This species is threatened by a number of processes, particularly habitat clearance and fire history (NSW Department of Environment and Conservation [DEC], 2006). Fire history of a related species, the Legless Lizard (*Aprasia aurita*), in north-western Victoria has been considered a key factor contributing to its restricted distribution (Backhouse and Robertson, 1992). It is likely that the Mallee Worm-lizard may similarly be impacted by frequent wildfires occurring within an area. Although a study in South Australia showed capture rates did not vary significantly based on fire history, it was considered that increased fire frequency may reduce the availability of suitable habitat and impact key prey invertebrate species (Driscoll *et al.*, 2012). Other threatening processes identified for the species include removal of the sand substrate; soil compaction from machinery; heavy grazing and trampling of the soil by domestic stock, feral goats, the European rabbit and feral pigs (*Sus scrofa*) results in understorey loss, soil compaction and impacts on prey species (OEH, 2012a).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Mallee Worm-lizard was not recorded in the Atlas-Campaspe Mine footprint. The only record during the current surveys was in a single location within the proposed offset area, approximately 2 km east of the Mungo National Park boundary (Figure C-3). At this site two individuals and two sloughs were found under mallee roots embedded in loose sand in Linear Dune Mallee. Previous records of the species exist outside the proposed offset area and to the west of the Atlas-Campaspe Mine footprint (Figure C-3).

The Project would not remove any known populations or place the local population at risk of extinction given that all known locality records in the region are located outside the proposed disturbance area (Figure C-3). Further the disturbance area would not disrupt habitat between these known localities since they are connected by continuous suitable habitat located entirely outside the proposed disturbance area boundaries (Figure C-4).

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine footprint would result in the removal of approximately 1,040 ha of Linear Dune Mallee and 535 ha of Sandplain Mallee, which provide potential breeding and foraging habitat for the Mallee Worm-lizard. Protection and habitat enhancement of known habitat within the proposed offset area (12,765 ha) could provide considerable compensation for components of the local population outside the impact footprint (Figure C-4).

(ii) The Atlas-Campaspe Mine footprint would not result in fragmentation or isolation of known occurrence localities or potentially suitable habitat due to the extensive areas of similar habitat surrounding the Project. Additionally, all known records of the species from the region occur outside the Project area and are linked by continuous vegetation that would not be disrupted by the Project.

(iii) The species was not recorded within the Project area, despite intensive pitfall trapping and active reptile searching efforts. However, potential habitat (i.e. Linear Dune Mallee and Sandplain Mallee) occurs within the Project footprint which is part of a much larger patchwork of habitat that extends to all the known records of the species outside of the Project area. The localised impacts resulting from the Project would only occur in potential habitat within the Project boundary and would therefore not lead to the extinction of the wider population or reduce its viability by a substantial amount if it were found to occur in this area.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No “critical habitat” for the Mallee Worm-lizard is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Mallee Worm-lizard, however OEH (2012) recommends the following priority actions to assist with the recovery of the species, of relevance to the Project:

- Implement fox control programmes in conservation reserves and encourage and support (through advice, joint programmes, resources, etc.) the control of feral cats and foxes in other areas of suitable habitat.
- Produce and distribute information and provide technical support on the species to assist land managers and field-based support to implement actions that assist in the species' recovery (grazing strategies, vegetation rehabilitation, etc.).
- Use management agreements and incentives on private and leasehold land to manage total grazing pressure through such actions as removal of artificial water points and feral and native herbivore control.
- Determine, through research, the ecological requirements of the species, particularly in regard to fire, and incorporate the information into Regional and Local Fire Plans.

The proposed offset area would aim to compensate for potential habitat loss by enhancing the habitat quality and integrity of the proposed offset area, which includes 9,640 ha of Linear Dune Mallee and 3,125 ha of Sandplain Mallee which provides habitat for the Mallee Worm-lizard. Fire management, increased control of feral animals and reduced grazing pressure would give considerable compensation to offset localised habitat loss.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by the OEH (2012b), the following are relevant to the location, the Project and the species:

1) Clearance of native vegetation.
2) High-frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.
7) Removal of dead wood and dead trees.

The Project would contribute to KTP1 (as discussed above in the response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions for the species. The Project may also contribute to KTP7 within the Project area due to the removal of large logs during clearing. This KTP is likely to be mitigated during the rehabilitation stage of the Project when selected hollows and large logs that would be salvaged during clearing, are relocated into these areas. Feral animal management plans would make considerable contributions to reduce KTPs 3, 4, 5 and 6.

Conclusion

The Mallee Worm-lizard was not recorded in the Atlas-Campaspe Mine footprint. Further the Project area would not fragment suitable habitat between all known localities of the species as the Project occurs to the east of all known localities of the species in the region. The Project would result in the removal of approximately 1,575 ha of potential habitat for the Mallee Worm-lizard comprising Linear Dune Mallee and Sandplain Mallee. The proposed offset area includes one of the known localities of the species in the region and contains approximately 12,765 ha of potential habitat (more than eight times that in the development footprint) that would be managed to enhance the species' viability. This would include management of bushfire risk, reduced livestock grazing and control of feral animal populations. In this context, the Project would have only limited detrimental impacts on the local population of the Mallee Worm-lizard that would not lead to the extinction of the population or reduce the species' viability to a substantial extent in the region.

Proposed avoidance, management and mitigation measures would include:

1) Management of 12,765 ha of Linear Dune Mallee and Sandplain Mallee habitats in the proposed offset area to improve their ecological viability.
2) Implementation of feral animal control in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.
3) Implementation of feral animal control in the Project area and proposed offset area to reduce predation of the Mallee Worm-lizard by European red foxes and feral cats.
4) Reduced stock grazing in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.
5) Implementation of appropriate fire regimes to promote natural succession and allow a mosaic of unburnt areas to persist.

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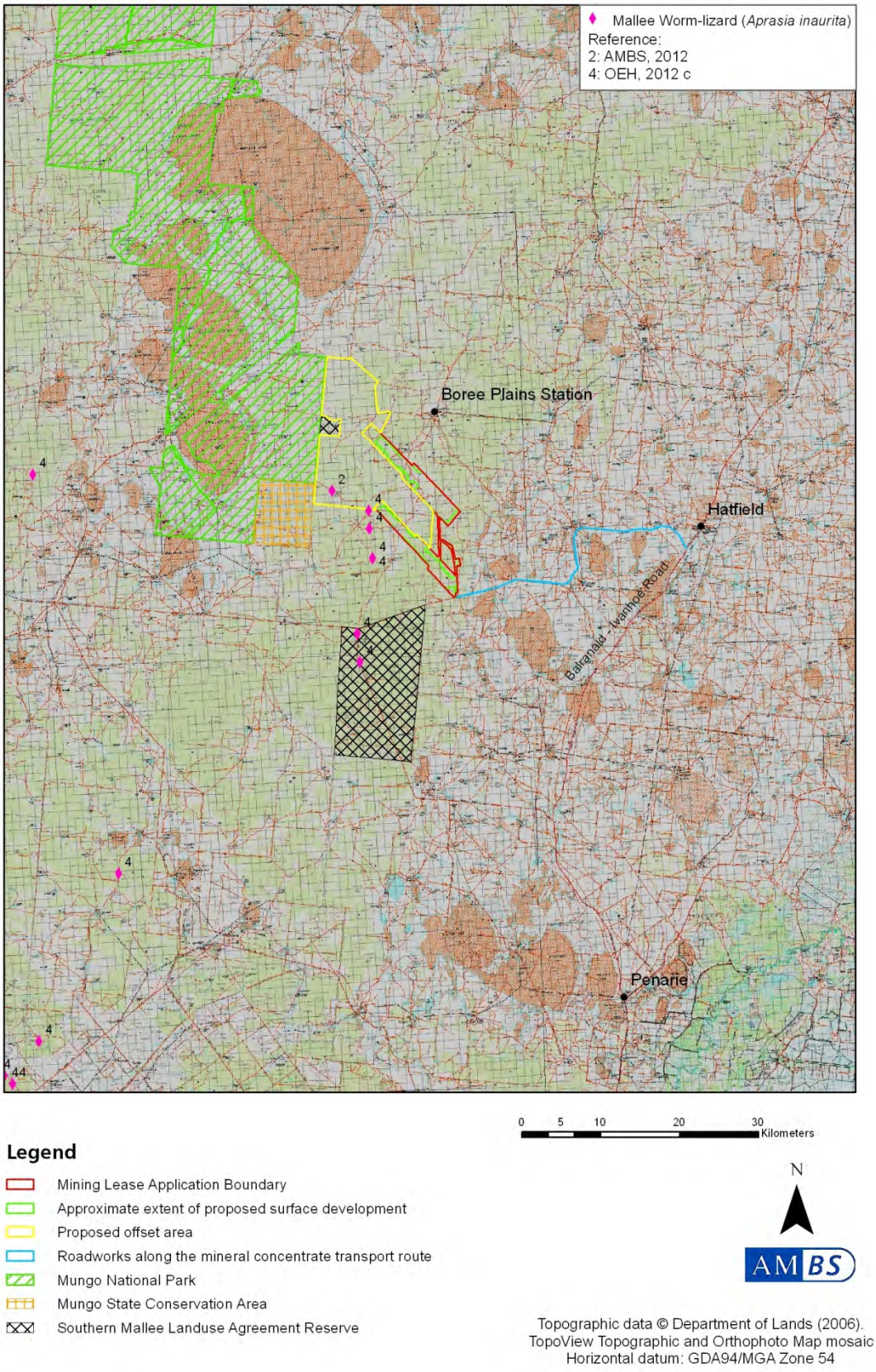

Figure C-3 Mallee Worm-lizard - Landscape Distribution

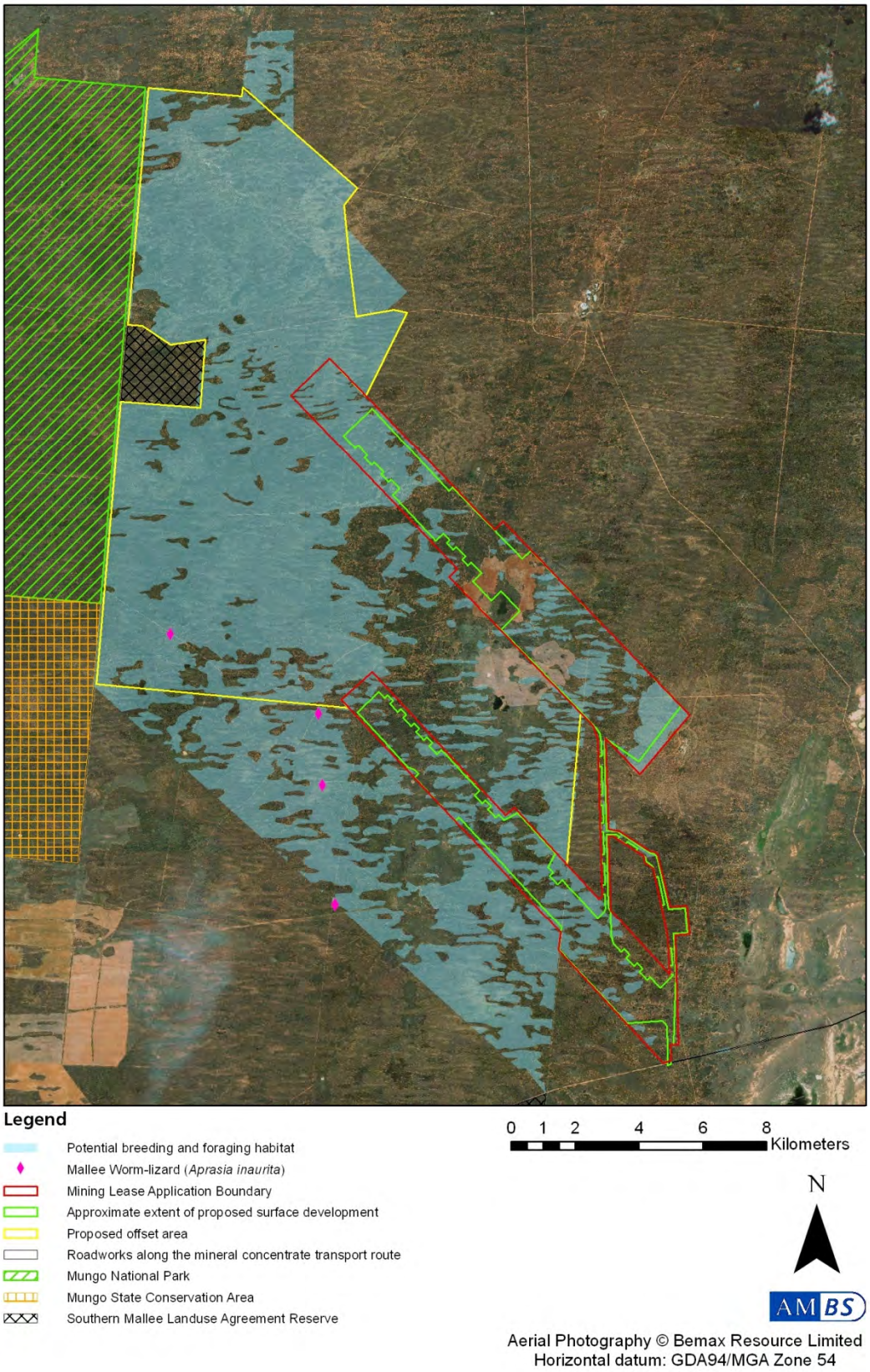

Figure C-4 Mallee Worm-lizard - Potential Habitat

Marble-faced Delma (Delma australis)

The Marble-faced Delma (*Delma australis*) is listed as endangered under Schedule 1 of the TSC Act. It probably represents a complex of species given that it occurs in three disjunct populations across southern Australia, namely, the semi-arid parts of south-western Western Australia; the arid and semi-arid parts of South Australia west of the Flinders Ranges extending north to far southern Northern Territory; and in south to central-western NSW, north-western Victoria and adjoining parts of far eastern South Australia (Wilson and Swan, 2008). Within NSW scattered records occur in two disjunct areas: central-western NSW centred around the Yathong and Nombinnie Nature Reserves and in south-western NSW including Tarawi Nature Reserve, and the Scotia mallee and east of the Darling River north of Wentworth (Sass, 2006; Swan *et al.*, 2004; OEH, 2012a). This species has recently been recorded north-west of Broken Hill, a range extension of over 100 km (OEH, 2012a).

It is primarily restricted to mallee woodland with a spinifex understorey in NSW (Shea, 1991; Sadlier *et al.*, 1996), including deep sand mallee on irregular or linear dunefields, Sandplain Mallee, mallee-smooth-barked Coolibah woodland, mallee box open woodland and Broombush shrubland (OEH, 2012a). However, recently it has been recorded within spinifex on rocky hillsides north-west of Broken Hill (OEH, 2012a). Elsewhere within its range it occurs in chenopod shrublands, heathlands, mallee heath, Buloke (*Allocasuarina leuhmannii*) associated with mallee and eucalypt-lined watercourses (Wilson and Knowles, 1988; OEH, 2012a; M. Schulz, *pers. comm.*). It is primarily a crepuscular and diurnal species, but is occasionally observed active on warm nights. It shelters within spinifex clumps, under fallen timber and in leaf litter, favouring more humid microclimates than other members of the genus (Wilson and Swan, 2008). It is shy species that is rarely observed active.

The area of habitat required for this species to persist in a given area is unknown. The isolation and relative size of occupied conservation reserves within NSW was considered insufficient to ensure the continued survival of the species in the state (NSW Scientific Committee, 2003). The overall population size and population trends in this species are unknown, but it is likely that the species has declined overall within the state given that large sections of its preferred habitat have been cleared. There is little biological information published about this species. It is an oviparous species laying two eggs in early summer (OEH, 2012a). The diet of the Marble-faced Delma comprises primarily insects and spiders (Wilson and Knowles, 1988).

This species is threatened by a number of processes, particularly habitat clearance, fire history and habitat degradation by domestic stock and feral goats through trampling, grazing, impacting soil structure and facilitating weed invasion (NSW Scientific Committee, 2003; OEH, 2012a). It is primarily found in large, mature spinifex clumps in areas that are infrequently burnt (Masters, 1996; Sadlier *et al*., 1996). Other threatening processes identified for the species include the loss of ground litter, particularly fallen timber, and predation by the European red fox and the feral cat (OEH, 2012a).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Marble-faced Delma was not recorded during current surveys or from previous surveys in or adjacent to the Atlas-Campaspe Mine study area. However, since the species is shy, frequently difficult to locate and typically occurs in low densities it may have been overlooked. Therefore, it could potentially occur within and adjacent to the Atlas-Campaspe study area, particularly since it has recently been recorded east of the Darling River north of Wentworth and approximately 100 km south-south west of the Project area (OEH, 2012a).

The Project would not remove any known populations given that the species has not been recorded from within or adjacent to the study area despite intensive survey effort during the current and previous surveys. Further, the Project is unlikely to place a local population at risk of extinction (were it to occur) given the disturbance area would not isolate or fragment potential habitat since it is situated within an extensive patchwork of similar habitat (Figure C-5).

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine footprint would result in the removal of approximately 1,040 ha of suitable habitat for the Marble-faced Delma in Linear Dune Mallee. A further 535 ha of Sandplain Mallee would also be removed and portions of this habitat where well developed spinifex are present provide potential habitat for the species. Protection and habitat enhancement of known habitat within the proposed offset area (9,640 ha of suitable habitat and portions of 3,125 ha with spinifex hummocks) would provide considerable compensation for components of the local population outside the Project footprint. A habitat map for the species has been provided in Figure C-5.

(ii) The Project would not result in fragmentation or isolation of this species since it has not been recorded within or adjacent to the Project area and since it is situated within an extensive patchwork of similar habitat (Figure C-5).

(iii) The Marble-faced Delma has not been recorded within the Atlas-Campaspe Mine footprint or in the surrounding locality despite intensive pitfall trapping and active reptile searching effort in the current and previous surveys. Therefore, it is considered that the Project would not impact on this species.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No “critical habitat” for the Marble-faced Delma is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Marble-faced Delma, however OEH (2012a) recommends the following priority actions to assist with the recovery of the species, of relevance to the Project:

- Implement fox control programmes in conservation reserves and encourage and support (through advice, joint programmes, resources, etc.) the control of feral cats and foxes in other areas of suitable habitat.
- Produce and distribute information and provide technical support on the species to assist land managers and field-based support to implement actions that assist in the species' recovery (grazing strategies, vegetation rehabilitation, etc.).
- Use management agreements and incentives on private and leasehold land to manage total grazing pressure through such actions as removal of artificial water points and feral and native herbivore control.
- Determine, through research, the ecological requirements of the species, particularly in regard to fire, and incorporate the information into Regional and Local Fire Plans.

If a local population were to occur, the proposed offset area would aim to compensate for potential habitat loss by enhancing the habitat quality and integrity of the proposed offset area, which includes 9,640 ha of Linear Dune Mallee and portions of Sandplain Mallee (3,125 ha) with well developed spinifex hummocks, both of which provide habitat for the Marble-faced Delma. Improved fire management, increased control of feral animals and reduced grazing pressure would give considerable compensation to offset localised habitat loss.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012b), the following are relevant to the location, the Project and the species if it were to be located in the study area:

1) Clearance of native vegetation.
2) High-frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.
7) Removal of dead wood and dead trees.

The Project would contribute to KTP1 (as discussed above in response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions (presence of spinifex) for the species. The Project may also contribute to KTP7 within the Project area due to the removal of large logs during clearing. This KTP is likely to be mitigated during the rehabilitation stage of the Project when selected hollows and large logs that would be salvaged during clearing, are relocated into these areas. Feral animal management plans would make considerable contributions to reduce KTPs 3, 4, 5 and 6.

Conclusion

The Marble-faced Delma was not recorded in the Atlas-Campaspe Mine footprint or in the surrounding region despite intensive survey effort during the current and previous surveys. Therefore the Project would not lead to the extinction of a local population since none has been documented. Were the species to be found to occur in the region, the Project would result in the removal of approximately 1,040 ha of suitable habitat in Linear Dune Mallee. A further 535 ha of Sandplain Mallee would also be removed and portions of this habitat where well developed spinifex is present, provide potential habitat for the species.

The proposed offset area contains approximately 9,640 ha of suitable habitat in Linear Dune and 3,125 ha of Sandplain Mallee, of which a small portion represents potential habitat (areas with spinifex hummocks) which is more than eight times that in the Project footprint. Further the proposed offset area would be managed to enhance the species' viability. This would include management of bushfire risk, reduced livestock grazing and control of feral animal populations.

Proposed avoidance, management and mitigation measures would include:

1) Management of 12,765 ha of Linear Dune Mallee and Sandplain Mallee habitats in the proposed offset area to improve their ecological viability.
2) Implementation of feral animal control in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.
3) Implementation of feral animal control in the Project area and proposed offset area to reduce predation of the Marble-faced Delma by European red foxes and feral cats.
4) Reduced stock grazing in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.
5) Implementation of appropriate fire regimes to promote natural succession and allow a mosaic of unburnt areas to persist.

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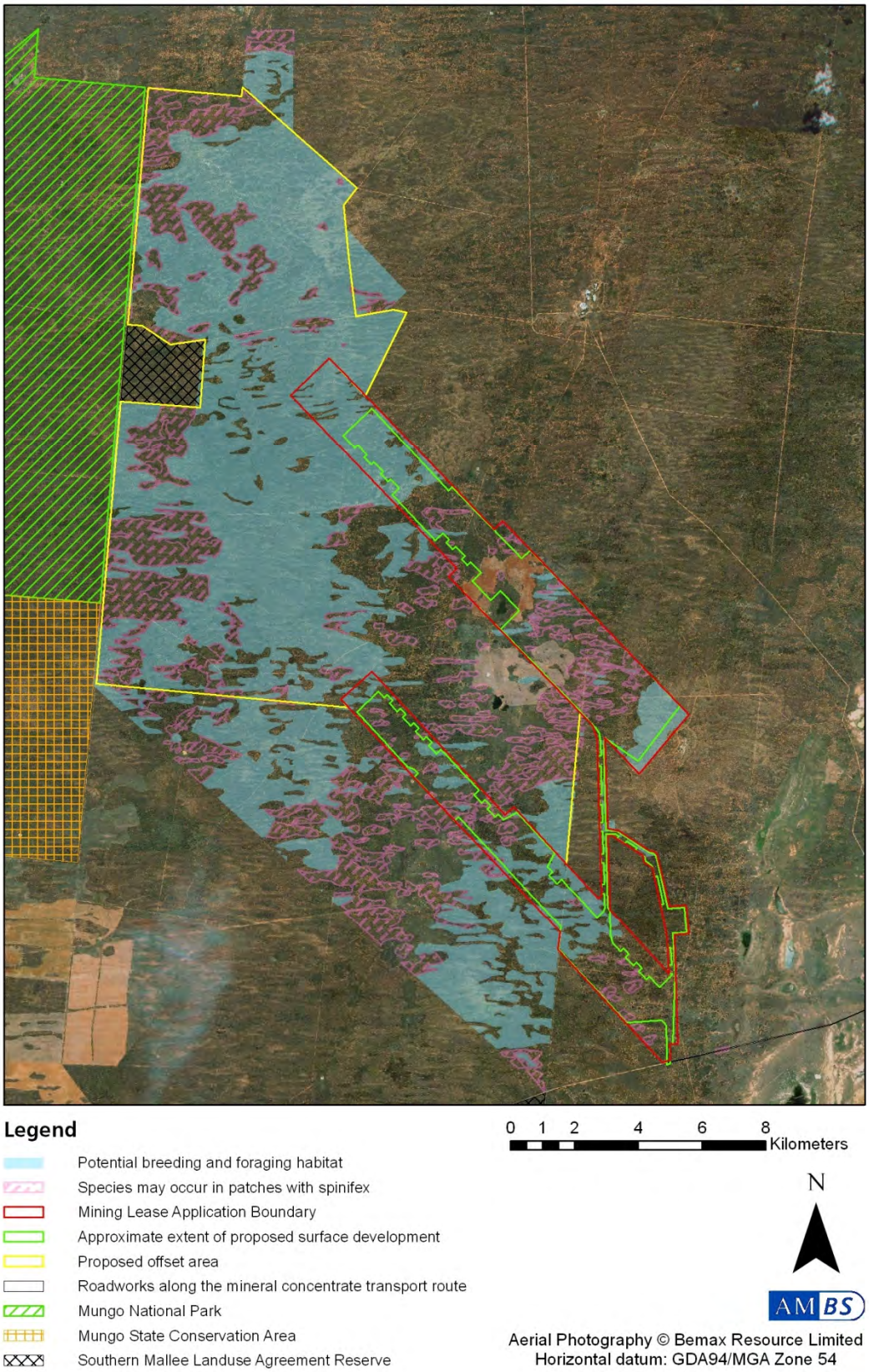

Figure C-5 Marble-faced Delma - Potential Habitat

Spinifex Slender Blue-tongue (Cyclodomorphus melanops elongatus)

The Spinifex Slender Blue-tongue (*Cyclodomorphus melanops elongatus*) is listed as endangered under Schedule 1 of the TSC Act. It has a patchy distribution extending from the southern interior of Western Australia through southern South Australia to the south-western corner of NSW (Wilson and Swan, 2008). Two outlier populations of this subspecies occur in the Northern Territory and northern South Australia, and in central-western Queensland. Within south-western NSW the species is known from few localities, including Tarawi Nature Reserve, Mungo National Park and Mallee Cliffs National Park (OEH, 2012a). This species has recently been recorded north-west of Broken Hill, a range extension of over 100 km (OEH, 2012a).

It is restricted to mallee woodland with a spinifex understorey, comprising deep sand mallee on irregular or linear dunefields (Sadlier *et al.*, 1996; OEH, 2012a). However, recently it is has been recorded within spinifex on rocky hillsides north-west of Broken Hill (OEH, 2012a). It is a crepuscular and nocturnal species that primarily shelters within spinifex clumps and is rarely observed active (Swan *et al*., 2004). It occasionally shelters in fallen timber and leaf litter (OEH, 2012a).

The area of habitat required for this species to persist in a given area is unknown. The isolation and relative size of occupied conservation reserves within NSW was considered insufficient to ensure the continued survival of the species in the state (NSW Scientific Committee, 2003). The overall population size and population trends in this species are unknown, but it is likely that the species has declined overall within the state given that large sections of its preferred habitat has been cleared. There is little biological information published about this species. It is an oviparous species and its diet is likely to consist of spiders, termites, grasshoppers, cockroaches, snails, moths, beetles, small lizards, flowers, fleshy leaves and fruit (OEH, 2012a).

This species is threatened by a number of processes, particularly habitat clearance, fire history and habitat degradation by domestic stock and feral goats through trampling, grazing the seed heads, impacting soil structure and facilitating weed invasion (NSW Scientific Committee, 2003). It is primarily found in large, mature spinifex clumps in areas that are infrequently burnt (Masters, 1996; Sadlier *et al*., 1996). Other threatening processes identified for the species include the loss of ground litter, particularly fallen timber and predation by the European red fox and the feral cat (OEH, 2012a).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Spinifex Slender Blue-tongue was not recorded in the Atlas-Campaspe Mine footprint. The only record during the current surveys was from a single location within the proposed offset area, approximately 3 km north-west of the Campaspe footprint (Figure C-6). At this site one individual was found under a large spinifex clump on deep sand in Linear Dune Mallee. There were no previous records from the vicinity of the Atlas-Campaspe Mine footprint, including in eastern sections of Mungo National Park (Figure C-6). The next closest record of the species is from a single location approximately 40 km to north west in the northern sections of Mungo Nation Park.

The Project would not remove any known populations or place the local population at risk of extinction given that the only known record in the locality is located outside the proposed disturbance area. Further the disturbance area would not isolate or fragment this single locality as it occurs within a patchwork of similar habitat that is located within the proposed offset area.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine footprint would result in the removal of approximately 1,040 ha of potential habitat (i.e. Linear Dune Mallee). Protection and habitat enhancement of known habitat within the proposed offset area (9,640 ha) could provide considerable compensation for components of the known local population outside the impact footprint. A habitat map for the species has been provided in Figure C-7.

(ii) The Atlas-Campaspe Mine footprint would not result in fragmentation or isolation since the only known occurrence in the region occurs in an extensive patchwork of suitable habitat over 3 km away from the development area boundary and therefore would not be disrupted by the Project.

(iii) The locality where the only record of the species has been recorded occurs outside the Atlas-Campaspe Mine footprint and therefore would not be affected. No actual records of this species have been collected from within the Atlas-Campaspe Mine footprint despite intensive pitfall trapping and active reptile searching effort. Since it is a cryptic species that is infrequently encountered as it predominantly shelters and forages within spinifex, it is possible that despite this intensive survey effort the species does occur within the Project area. Potential habitat (i.e. Linear Dune Mallee) occurs within the Atlas-Campaspe Mine footprint which is part of a much larger patchwork of habitat that extends to the only known regional locality of the species occurring outside the Project boundary area. The localised impacts resulting from the Project would only occur in potential habitat within the Project boundary and would therefore not lead to the extinction of the wider population or reduce its viability by a substantial amount if it were found to occur in this area.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No “critical habitat” for the Spinifex Slender Blue-tongue is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Spinifex Slender Blue-tongue, however OEH (2012a) recommends the following priority actions to assist with the recovery of the species, of relevance to the Project:

- Implement fox control programmes in conservation reserves and encourage and support (through advice, joint programmes, resources, etc.) the control of feral cats and foxes in other areas of suitable habitat.
- Produce and distribute information and provide technical support on the species to assist land managers and field-based support to implement actions that assist in the species' recovery (grazing strategies, vegetation rehabilitation, etc.).
- Use management agreements and incentives on private and leasehold land to manage total grazing pressure through such actions as removal of artificial water points and feral and native herbivore control.
- Determine, through research, the ecological requirements of the species, particularly in regard to fire, and incorporate the information into Regional and Local Fire Plans.

The proposed offset area would aim to compensate for habitat loss by enhancing the habitat quality and integrity of the proposed offset area, which includes 9,640 ha of Linear Dune Mallee habitat. Improved fire management, increased control of feral animals and reduced grazing pressure would give considerable compensation to offset localised habitat loss.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012b), the following are relevant to the location, the Project and the species:

1) Clearance of native vegetation.
2) High-frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.
7) Removal of dead wood and dead trees.

The Project would contribute to KTP1 (as discussed above in the response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions (presence of spinifex) for the species. The Project may also contribute to KTP7 within the Project area due to the removal of large logs during clearing. This KTP is likely to be mitigated during the rehabilitation stage of the Project when selected hollows and large logs that would be salvaged during clearing, are relocated into these areas. Feral animal management plans would make considerable contributions to reduce KTPs 3, 4, 5 and 6.

Conclusion

The Spinifex Slender Blue-tongue was not recorded in the Atlas-Campaspe Mine footprint. Further the Project area would not fragment suitable habitat since only a single record is known from the region, which occurs 3 km to the north-west of the Project boundary. Continuous vegetation connects this locality with the Project area and therefore the species may potentially occur within the Atlas-Campaspe Mine footprint (Figure C-7). Therefore the Project would result in the removal of approximately 1,040 ha of potential habitat for this species comprising Linear Dune Mallee. The proposed offset area includes the only known locality of the species in the region and contains approximately 9,640 ha of potential habitat (more than nine times that in the development footprint) that would be managed to enhance the species' viability. This would include management of bushfire risk, reduced livestock grazing and control of feral animal populations. In this context the Project would have only limited detrimental impacts on the local population of the Spinifex Slender Blue-tongue that would not lead to the extinction of the population or reduce the species' viability to a substantial extent in the region.

Proposed avoidance, management and mitigation measures would include:

1) Management of 9,640 ha of Linear Dune Mallee habitats in the proposed offset area to improve their ecological viability.
2) Implementation of feral animal control in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.
3) Implementation of feral animal control in the Project area and proposed offset area to reduce predation of the Spinifex Slender Blue-tongue by European red foxes and feral cats.
4) Reduced stock grazing in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.
5) Implementation of appropriate fire regimes to promote natural succession and allow a mosaic of unburnt areas to persist.

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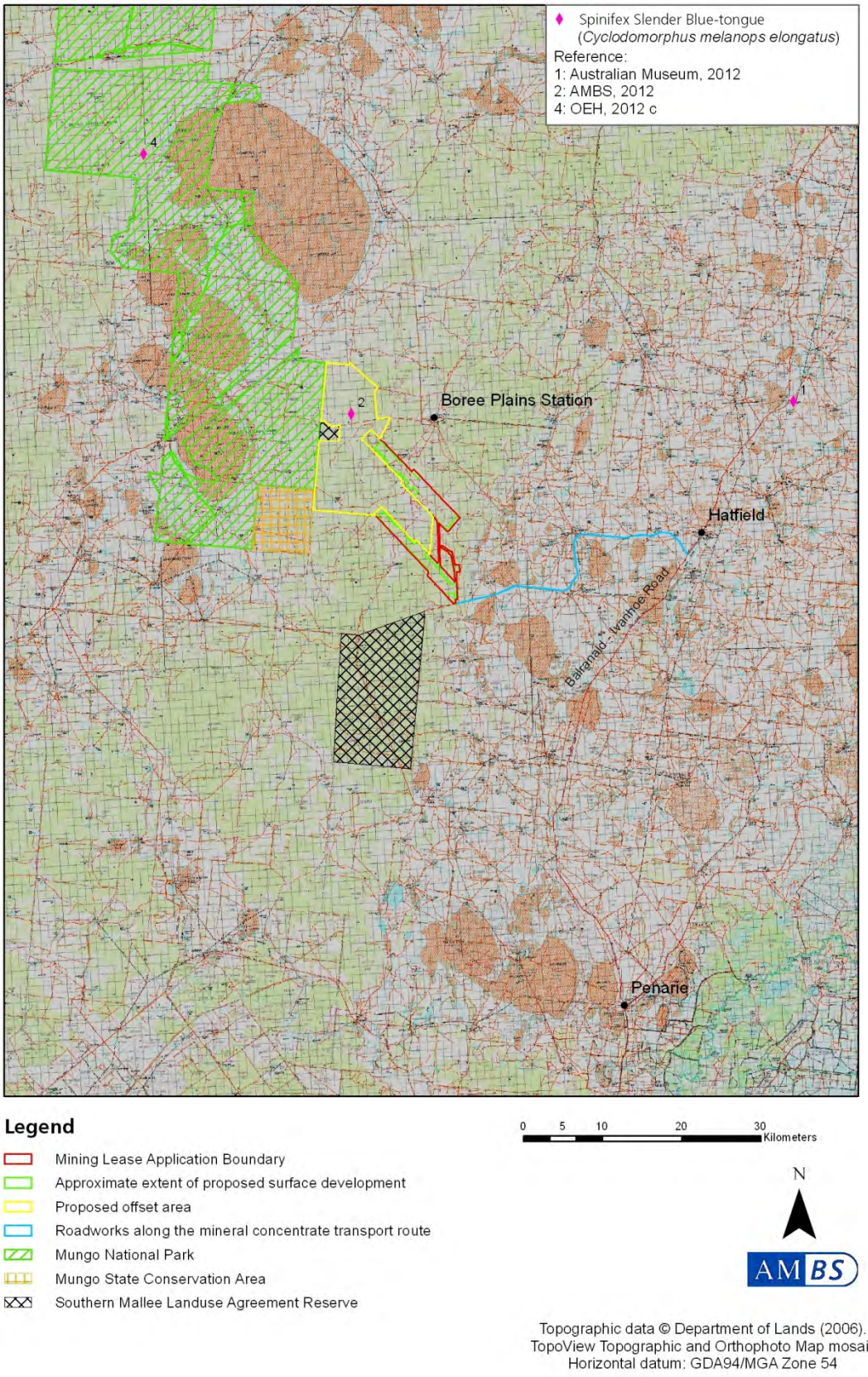

Figure C-6 Spinifex Slender Blue-tongue - Landscape Distribution

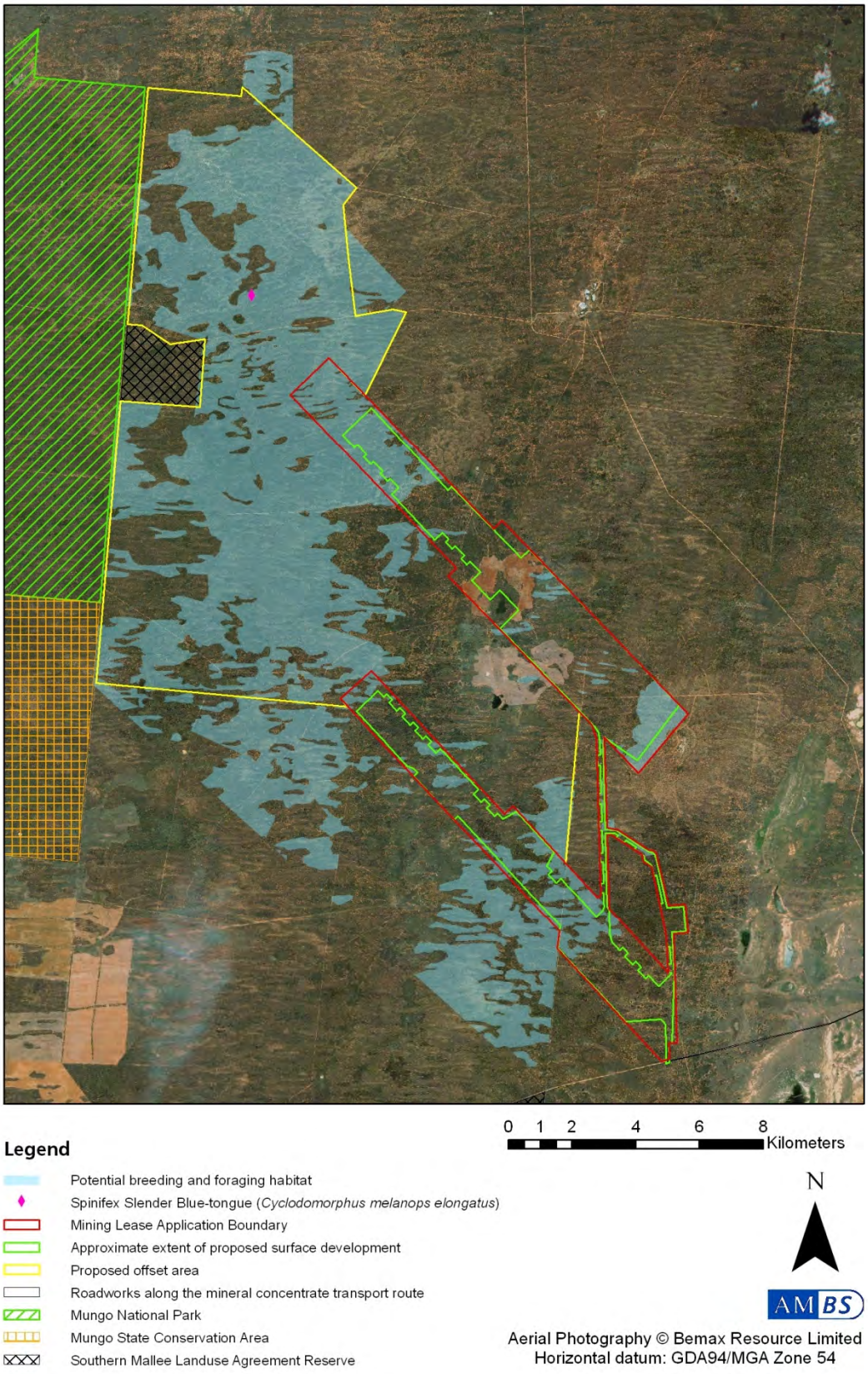

Figure C-7 Spinifex Slender Blue-tongue - Potential Habitat

Western Blue-tongue (Tiliqua occipitalis)

The Western Blue-tongue (*Tiliqua occipitalis*) is listed as vulnerable under Schedule 2 of the TSC Act. It has a widespread distribution across southern Australia from south-western Western Australia through much of South Australia and the far south-west of the Northern Territory into south and central-western NSW and north-western Victoria (Wilson and Swan, 2008). In NSW the species has been recorded from scattered localities in south-western and central-western areas (Swan *et al*., 2004; OEH, 2012a).

This species occurs in a variety of xeric vegetation communities, often associated with mallee and spinifex (Cogger, 2000; OEH, 2012a). In NSW it has been recorded in a wide range of vegetation communities, including chenopod Sandplain Mallee; deep sand mallee on irregular or linear dunefields; mallee-smooth-barked coolibah woodland; chenopod shrubland associated with lunettes and open plains including dominated by Pearl Bluebush (*Maeriana sedifolia*), Old Man Saltbush (*Atriplex nummularia*), Copperburr (*Sclerolaena* spp.), Bladder Saltbush (*Atriplex vesicaria*), Nitre Bush (*Nitraria billardierei*) shrubland; Belah-Rosewood Woodland; cypress-pine woodland/open woodland; Mulga (*Acacia aneura*), Yarran (*Acacia melvillei*) and other Acacia dominated shrublands; mixed-species shrublands dominated by species such as Narrow-leaved Hopbush (*Dodonaea viscose* subsp. *angostissima*) and Cassia (*Senna* spp.); and Broombush (*Melaleuca uncinata*) shrubland (OEH, 2012a).

It is an infrequently encountered diurnal species that feeds on a variety of food dominated by plant material but also including various insects, snails, spiders, scorpions, fungi, and occasionally reptiles, small mammals and birds (Shea, 2006). Foraging occurs in a variety of situations, including out in the open. After rain the species often can be seen drinking water from small temporary pools (M. Schulz pers. obs.). It frequently occurs in sympatry with other *Tiliqua* species, in south-western NSW primarily with the Shingle-back (*Tiliqua rugosa*). The Western Blue-tongue shelters in a variety of situations, such as under logs and other ground debris and also within disused rabbit burrows. It is live-bearing and predominantly gives birth in the spring and summer months.

The area of habitat required for this species to persist in a given area is unknown. The overall population size is unknown and population trends in this species are unknown, but it is likely that the species has declined overall within the state given that large sections of its preferred habitat (mixed mallee/spinifex communities) have been cleared.

This species is threatened by a number of processes, particularly habitat clearance, fire history, predation by the European red fox and habitat degradation by domestic stock and feral goats through trampling, grazing, impacting soil structure and facilitating weed invasion (OEH, 2012a).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Western Blue-tongue was not recorded during current surveys or from previous surveys in or adjacent to the Project area. The closest record to the Atlas-Campaspe Mine footprint is approximately 80 km south-west. The closet record to the Ivanhoe Rail Facility is approximately 70 km north-east. However, the species is shy, frequently difficult to locate and typically occurs in low densities. Therefore, it could potentially occur within and adjacent to the Project area in suitable habitats.

The Project would not remove any known populations or place the local population at risk of extinction given that the species has not been recorded from within or adjacent to the Atlas-Campaspe Mine footprint despite intensive survey effort during the current and previous surveys. Further the disturbance area would not isolate or fragment potential habitat since it is situated within an extensive patchwork of similar habitat (Figure C-8).

Potential habitat for the species at the Ivanhoe Rail Facility occurs, but only a relatively small area would be removed in comparison to the large areas that would remain largely unaffected (Figure C-9). Any local population of the species that could occur would be unlikely to rely on the potential habitat that would be impacted. Higher quality habitat occurs in the nearby surrounds. Known and predicted habitat occurs throughout much of the Darling Depressions (Part B) Catchment Management Authority (CMA) sub-region (OEH, 2012a), so the species is unlikely to be geographically restricted at the Ivanhoe study area.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine footprint would result in the removal of approximately 3,980 ha of potential breeding and foraging habitat consisting of Linear Dune Mallee, Sandplain Mallee, Belah-Rosewood Woodland, Acacia Woodland/Shrubland and Disturbed Shrubland. Protection and habitat enhancement of potential habitat consisting of the same habitat types within the proposed offset area (16,170 ha) could provide considerable compensation for components of the local population (if present) outside the impact footprint. The Ivanhoe Rail Facility would remove approximately 10 ha of potential habitat, in Belah-Rosewood Woodland. Habitat maps for the species have been provided in Figure C-8 and C-9.

(ii) The Atlas-Campaspe Mine footprint would not result in fragmentation or isolation of this species since it has not been recorded within or adjacent to the Atlas-Campaspe Mine footprint. Potential habitat for this species within this area is part of an extensive patchwork of similar habitat that occurs throughout the surrounding area. The Ivanhoe Rail Facility would mostly remove potential habitat adjacent to an existing rail corridor, which would not increase fragmentation or isolation. The access road may marginally increase fragmentation of potential habitat but not to any significant extent, as animals would likely still be able to move across the road.

(iii) The Western Blue-tongue has not been recorded within the Atlas-Campaspe Mine footprint or in the surrounding region despite intensive pitfall/Elliott trapping and active reptile searching effort in the current and previous surveys. Potential habitat for the species occurs throughout the surrounding area. The area of habitat that would be removed at the Ivanhoe Rail Facility is relatively small in comparison to the areas of potential habitat nearby, and unlikely to be important for any local population of the species. Further, the areas of surrounding habitat are in better condition in comparison to the areas that would be impacted.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" for the Western Blue-tongue is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Western Blue-tongue, however OEH (2012a) recommends the following priority actions to assist with the recovery of the species, of relevance to the Project:

- Opportunistically monitor populations after wildfire to determine fire ecology.
- Provide map of known occurrences to Rural Fire Service and Manie State Forest and seek inclusion of mitigative measures on Bush Fire Risk Management Plan(s), risk register and/or operation map(s).
- Ensure fire management plans include mosaic burns in known and potential habitat.
- Support research by Universities into the ecology of this species in mallee parks.
- Control feral goats, pigs and rabbits near known populations (best practice: locally efficient and effective).
- Control foxes and cats (feral and domestic) near selected populations (best practice: locally efficient and effective).
- Encourage management of livestock grazing so as to improve ground cover in vicinity of known populations.
- Develop Environmental Impact Assessment (EIA) guidance for consent and determining authorities with regard to development and other activities, particularly clearing of mallee habitat.
- Prepare guide to augmenting and protecting rock and log ground cover at selected target sites.

If a local population were to occur, the proposed offset area for the Atlas-Campaspe Mine would aim to compensate for potential habitat loss by enhancing the habitat quality and integrity of the proposed offset area, which includes Linear Dune Mallee, Sandplain Mallee, Belah-Rosewood Woodland, Acacia Woodland/Shrubland and Disturbed Shrubland. Improved fire management and appropriate fire regimes for the species, increased control of feral animals and reduced grazing pressure would give considerable compensation to offset localised habitat loss.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 key KTPs for NSW by OEH (2012b), the following are relevant to the location, the Project and the species if it were to be located in the study area:

1) Clearance of native vegetation.
2) High-frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.
7) Removal of dead wood and dead trees.

The Project would contribute to KTP1 (as discussed above in response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area for the Atlas-Campaspe Mine to maintain and enhance suitable habitat conditions for the species. The Project may also contribute to KTP7 within the Project area due to the removal of large logs during clearing. This KTP is likely to be mitigated during the rehabilitation stage of the Project when selected hollows and large logs that would be salvaged during clearing, are relocated into these areas. Feral animal management plans would make considerable contributions to reduce KTPs 3, 4, 5 and 6.

Conclusion

The Western Blue-tongue was not recorded in the Project area despite intensive survey effort during the current and previous surveys in the Atlas-Campaspe Mine footprint. Potential habitat for the species does occur throughout the Atlas-Campaspe Mine footprint in Linear Dune Mallee, Sandplain Mallee, Belah-Rosewood Woodland, Acacia Woodland/Shrubland and Disturbed Shrubland. This potential habitat also occurs extensively throughout the surrounding landscape and region. The area of habitat that would be removed at the Ivanhoe Rail Facility is relatively small in comparison to the areas of available habitat nearby, and unlikely to be important for any local population of the species. Further, the areas of surrounding habitat are in better condition in comparison to the areas that would be impacted. It is therefore considered unlikely that the Project would have a significant impact on this species.

The proposed offset area contains approximately 16,170 ha of potential habitat (almost four times that in the development footprint) that would be managed to enhance the species' viability. This would include management of bushfire so that appropriate fire regimes for the species are maintained or introduced, reduced livestock grazing and control of feral animal populations.

Proposed avoidance, management and mitigation measures would include:

1) Management of 16,170 ha of potential habitats in the proposed offset area to improve their ecological viability.
2) Implementation of feral animal control in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.
3) Implementation of feral animal control in the Project area and proposed offset area to reduce predation of the Western Blue-tongue by European red foxes and feral cats.

4) Reduced stock grazing in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.

5) Implementation of appropriate fire regimes to promote natural succession and allow a mosaic of unburnt areas to persist.

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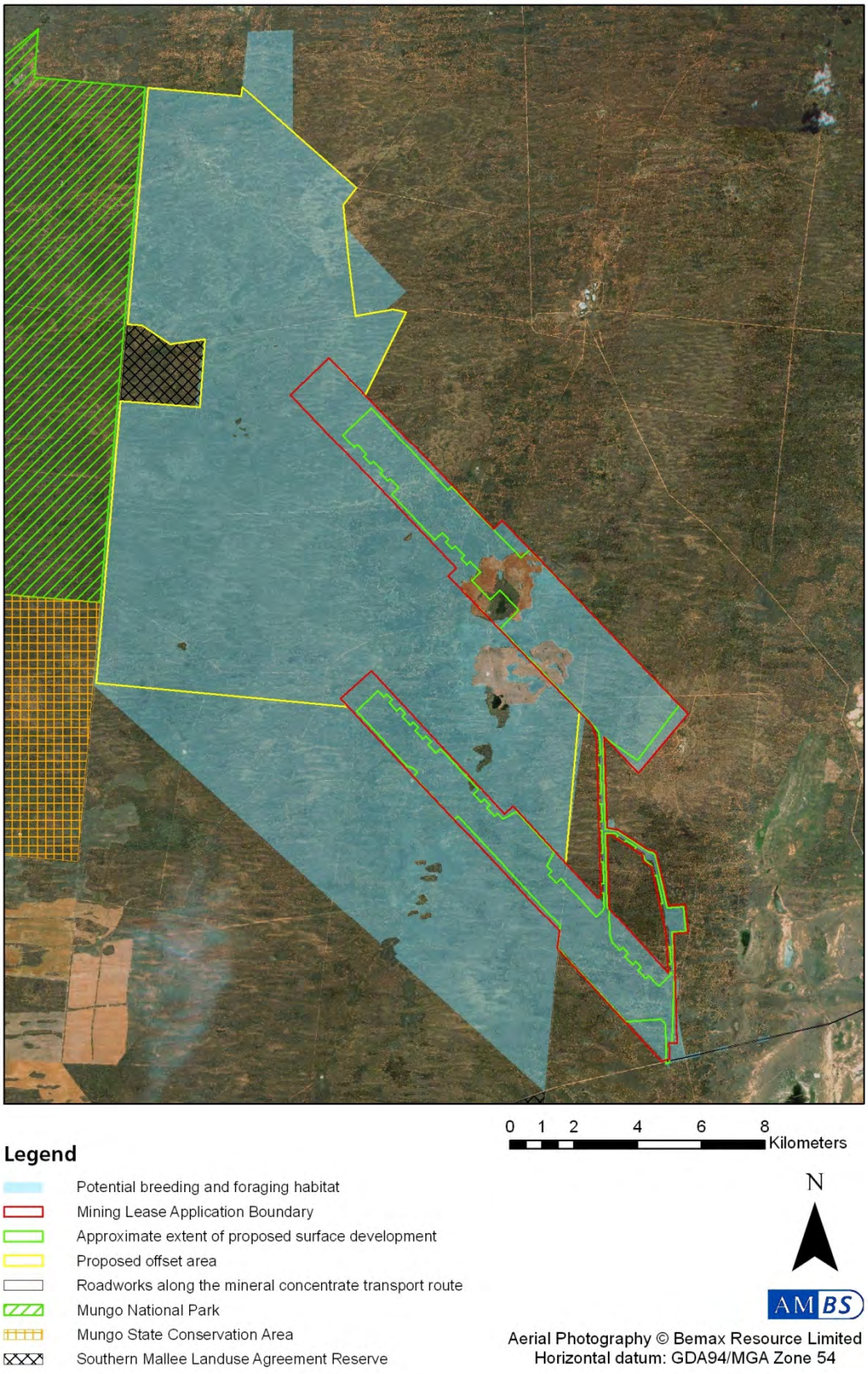

Figure C-8 Western Blue-tongue - Potential Habitat

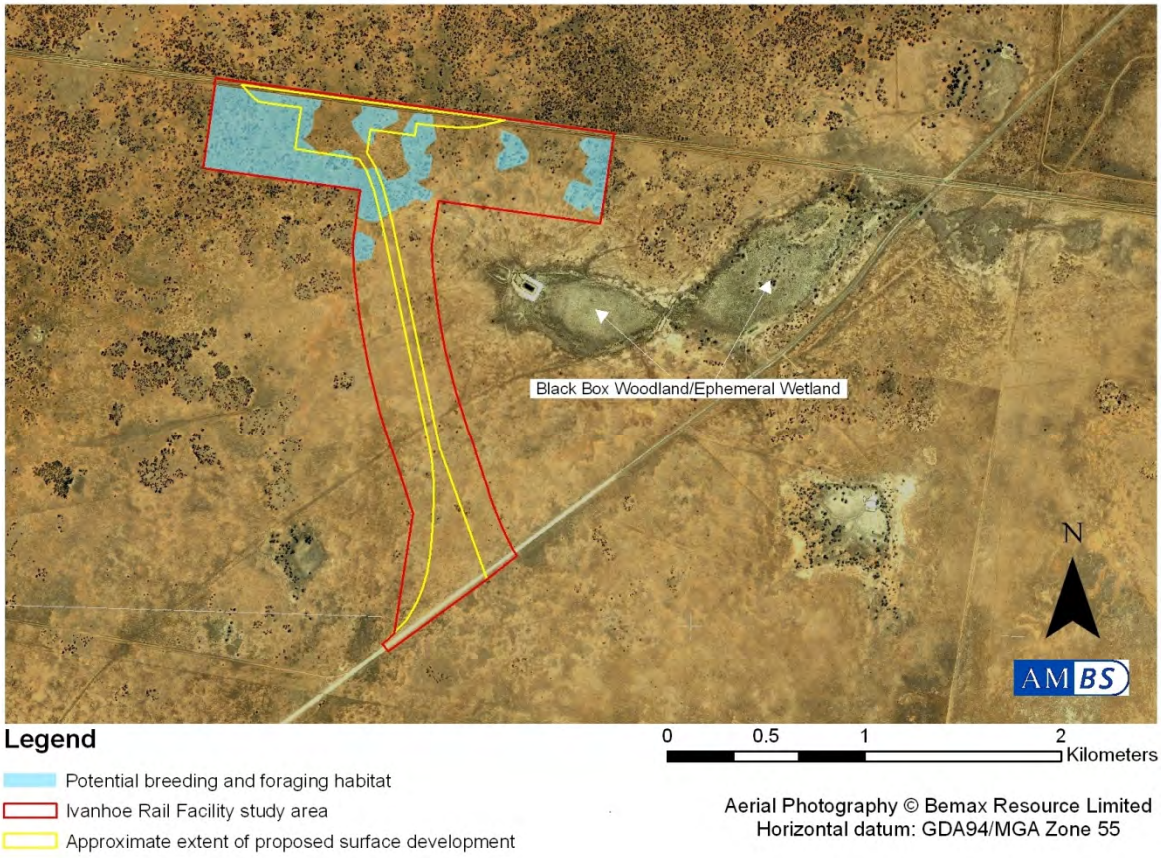

Figure C-9 Western Blue-tongue Lizard - Potential Habitat – Ivanhoe Rail Facility

Bardick (Echiopsis curta)

The Bardick (*Echiopsis curta*), a snake which is listed as endangered under Schedule 1 of the TSC Act. It has a disjunct distribution including south-western Western Australia and three disjunct populations in the eastern part of its range, namely the Eyre Peninsula in South Australia, western Victoria and south-western NSW (Wilson and Swan, 2008). Within south-western NSW there are very few records, an Australian Museum specimen collected in 1974 from the 'Balranald' district (Australian Museum, 2012), a 1983 record from Bidura Station 74 km west of Balranald and an individual captured during pitfall trapping surveys on private property north of Mildura (NSW Scientific Committee, 2003; OEH, 2012a). The species' distribution within NSW appears restricted given that these records occurred within several hundred kilometres of each other (Wilson and Knowles, 1988; Cogger, 2000; OEH, 2012a).

In south-western NSW, this species is restricted to mallee woodland with a spinifex understorey, comprising deep sand mallee on irregular or linear dunefields (NSW Scientific Committee, 2003; OEH, 2012a). In western Victoria it occurs on deep aeolian sands in mallee heath and Broombush heath with scattered spinifex (Menkhorst and Bennett, 1990; N. Clemann, pers. comm.; NSW Scientific Committee, 2003). Within the eastern parts of its range, the species appears to depend on mallee and spinifex (Robertson *et al.*, 1989; Cogger *et al.*, 1993). Elsewhere within its range it occurs in heaths, hummock grasslands, mallee areas and tall shrublands on sandy or loamy soils, usually in association with run-off slopes and drainage from local sites (Wilson and Knowles, 1988; Cogger, 2000). Within these habitats it shelters in a variety of situations including under fallen timber and rocks, dense matted vegetation, leaf litter and beneath grass tussocks including spinifex (Wilson and Knowles, 1988; Swan *et al*., 2004; Cogger *et al*., 1993). It is more commonly encountered in the autumn months and least frequently in the winter (Shine, 1982). It is a partly nocturnal species that given its heavy-bodied appearance, large head and stout body and short tail bears a resemblance to death adders (*Acanthophis* spp.). It shelters under leaf litter or vegetation and feeds primarily on lizards, frogs and small mammals as a sit-and-wait ambush predator (Shine, 1982; OEH, 2012a). The Bardick is live-bearing with litters ranging from three to 14 and are born in the spring and summer months (Shine, 1982).

The area of habitat required for this species to persist in a given area is unknown. The paucity of records despite extensive biodiversity surveys in south-western NSW indicates that the population size of the species is small (Sadlier and Pressey, 1994; NSW Scientific Committee, 2003). The overall population trends in this species are unknown, but it is likely that the species has declined overall within the state given that large sections of its preferred habitat have been cleared.

This species is threatened by a number of processes, particularly habitat clearance, fire history and habitat degradation by domestic stock and feral goats through trampling, grazing the seed heads, impacting soil structure and facilitating weed invasion (Sadlier and Pressey, 1994; NSW Scientific Committee, 2003). It is primarily found in areas that are infrequently burnt, and areas of 'pristine' mallee appear necessary for this species (NSW Scientific Committee, 2003). Other threatening processes identified for the species include the loss of ground litter, particularly fallen timber, heavy grazing and the trampling of habitat by domestic stock and feral goats; and predation by the European red fox (NSW Scientific Committee, 2003; OEH, 2012a). Due to its foraging behaviour as an ambush predator disturbance to feeding patterns causes low rates of prey consumption, limits growth and reproduction, which renders them particularly vulnerable to threatening processes in the long-term (Wilson and Knowles, 1988).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Bardicks that were detected during the current surveys represent the fourth and fifth records for the species in the state (after OEH, 2012a). It was not recorded in the Atlas footprint but was located over 1.5 km north-west of the proposed Campaspe footprint. At this site, a single adult was located sheltering under a mat of dead spinifex in Linear Dune Mallee. The only other record during the current surveys was in a single location on the eastern edge of the proposed offset area, approximately 4 km north of the Campaspe footprint (Figure C-10). At this site one juvenile was found active in the early morning between clumps of small spinifex in a dune swale within Linear Dune Mallee. This site had been recently burnt and more resembled mallee heath sites in north-western Victoria (M. Schulz, pers. obs.). Pitfall trapping at this locality and the adjacent dune crest failed to capture any additional individuals. There were no previous records of this species from the vicinity of the Atlas-Campaspe Mine footprint, including in eastern sections of Mungo National Park and Mungo State Conservation Area (Figure C-10).The nearest database record for the species is approximately 30 km to the south of the Atlas footprint.

The Project would not remove any known populations or place the local population at risk of extinction given that the two known locality records in the study area are connected by continuous suitable habitat located outside the proposed disturbance area, suggesting these two locality records represent a wider local population (Figure C-11). Further, the locality record within the Atlas-Campaspe Mine footprint is located over 1.5 km north-west of the proposed Campaspe footprint. Components of the population north-west of the Campaspe footprint may extend into the proposed footprint and potentially also into the Atlas footprint given that continuous suitable habitat connects these two proposed disturbance areas (Figure C-11). Suitable or potentially suitable habitat for the Bardick is widespread within the Atlas-Campaspe Mine footprint and surrounds, comprising all areas of Linear Dune Mallee with approximately 1,040 ha occurring within the proposed disturbance area. The proposed disturbance would not result in the isolation of the two localities known from the Atlas-Campaspe study area since it would not disrupt the continuous band of vegetation between the two areas (Figure C-11). Prime habitat comprising Linear Dune Mallee with heath elements occurs outside the Atlas-Campaspe Mine footprint to the north and north-west, with significant sections occurring within the proposed offset area. Additionally, long-unburnt Linear Dune Mallee extends from the locality within the proposed disturbance area connecting this locality with Linear Dune mallee with heath elements to the north and also is continuous to the north, west and south of the Project area connecting with similar habitat in Mungo National Park and Mungo State Conservation Area.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine footprint would result in the removal of approximately 1,040 ha of known habitat (i.e. Linear Dune Mallee). Protection and habitat enhancement of known habitat within the proposed offset area (9,640 ha) could provide considerable compensation for components of the local population outside the impact footprint. A habitat map for the species has been provided in Figure C-11.

(ii) The Atlas-Campaspe Mine footprint would not result in fragmentation or isolation of known occurrence localities or potentially suitable habitat due to the extensive areas of similar vegetation communities surrounding the area and the locality for this species on the western edge of the Campaspe footprint occurring over 2 km north-west of the proposed Campaspe footprint.

(iii) The two records of the species were situated outside Atlas-Campaspe Mine footprint, with one just outside Campaspe footprint and another within the north of the proposed offset area (Figure C-11). However, potential habitat extends from this locality into the proposed footprint area and is part of a much larger patchwork of habitat that extends to the other known locality of the species in the study area. The localised impacts resulting from the Project would only occur in potential habitat within the Campaspe footprint and would therefore not lead to the extinction of the wider population or reduce its viability by a substantial amount.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No “critical habitat” for the Bardick is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Bardick, however OEH (2012a) recommends the following priority actions to assist with the recovery of the species, of relevance to the Project:

- Use management agreements and incentives on private and leasehold land to manage total grazing pressure through such actions as removal of artificial water points and feral and native herbivore control.
- Implement fox control programmes in conservation reserves and encourage and support (through advice, joint programmes, resources, etc.) the control of feral cats and foxes in other areas of suitable habitat.
- Produce and distribute information and provide technical support on the species to assist land managers and field-based support to implement actions that assist in the species' recovery (grazing strategies, vegetation rehabilitation, etc.).
- Undertake an annual monitoring programme within identified habitat within both OEH reserves and other tenures, to determine the distribution and abundance of the species, particularly in areas where management actions are being undertaken.
- Determine, through research, the ecological requirements of the species, particularly in regard to fire, and incorporate the information into Regional and Local Fire Plans.

The proposed offset area would aim to compensate for habitat loss by enhancing the habitat quality and integrity of the proposed offset area, which includes 9,640 ha of Linear Dune Mallee habitat. Improved fire management, increased control of feral animals and reduced grazing pressure would give considerable compensation to offset localised habitat loss. The Project would not include monitoring for this species use of the offset area.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 key KTPs for NSW by OEH (2012b), the following are relevant to the location, the Project and the species if it were to be located in the study area:

1) Clearance of native vegetation.
2) High-frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.
7) Removal of dead wood and dead trees.

The Project would contribute to KTP1 (as discussed above in response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions for the species. The Project may also contribute to KTP7 within the Project area due to the removal of large logs during clearing. This KTP is likely to be mitigated during the rehabilitation stage of the Project when selected hollows and large logs that would be salvaged during clearing, are relocated into these areas. Feral animal management plans would make considerable contributions to reduce KTPs 3, 4, 5 and 6.

Conclusion

The Bardick records obtained during the current survey represent the fourth and fifth records for the State (OEH, 2012a). The Project would result in the removal of approximately 1,040 ha of potential habitat for the Bardick but would not fragment suitable habitat between the two known localities of the species. The proposed offset area includes one of the known localities of the species in the region and contains approximately 9,640 ha of Linear Dune Mallee habitats (more than nine times that in the development footprint) that would be managed to enhance the species' viability. This would include management of bushfire risk, reduced livestock grazing and control of feral animal populations. In this context the Project would have only limited detrimental impacts on the regional population of the Bardick that would not lead to the extinction of the population or reduce its viability to a substantial extent in the region.

Proposed avoidance, management and mitigation measures would include:

1) Management of 9,640 ha of Linear Dune Mallee habitats in the proposed offset area to improve their ecological viability.
2) Implementation of feral animal control in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.
3) Implementation of feral animal control in the Project area and proposed offset area to reduce predation of the Bardick by European red foxes and feral cats.

4) Reduced stock grazing in the Project area and proposed offset area to reduce adverse impacts through heavy gazing, soil compaction and the spread of weed species.

5) Implementation of appropriate fire regimes to promote natural succession and allow a mosaic of unburnt areas to persist.

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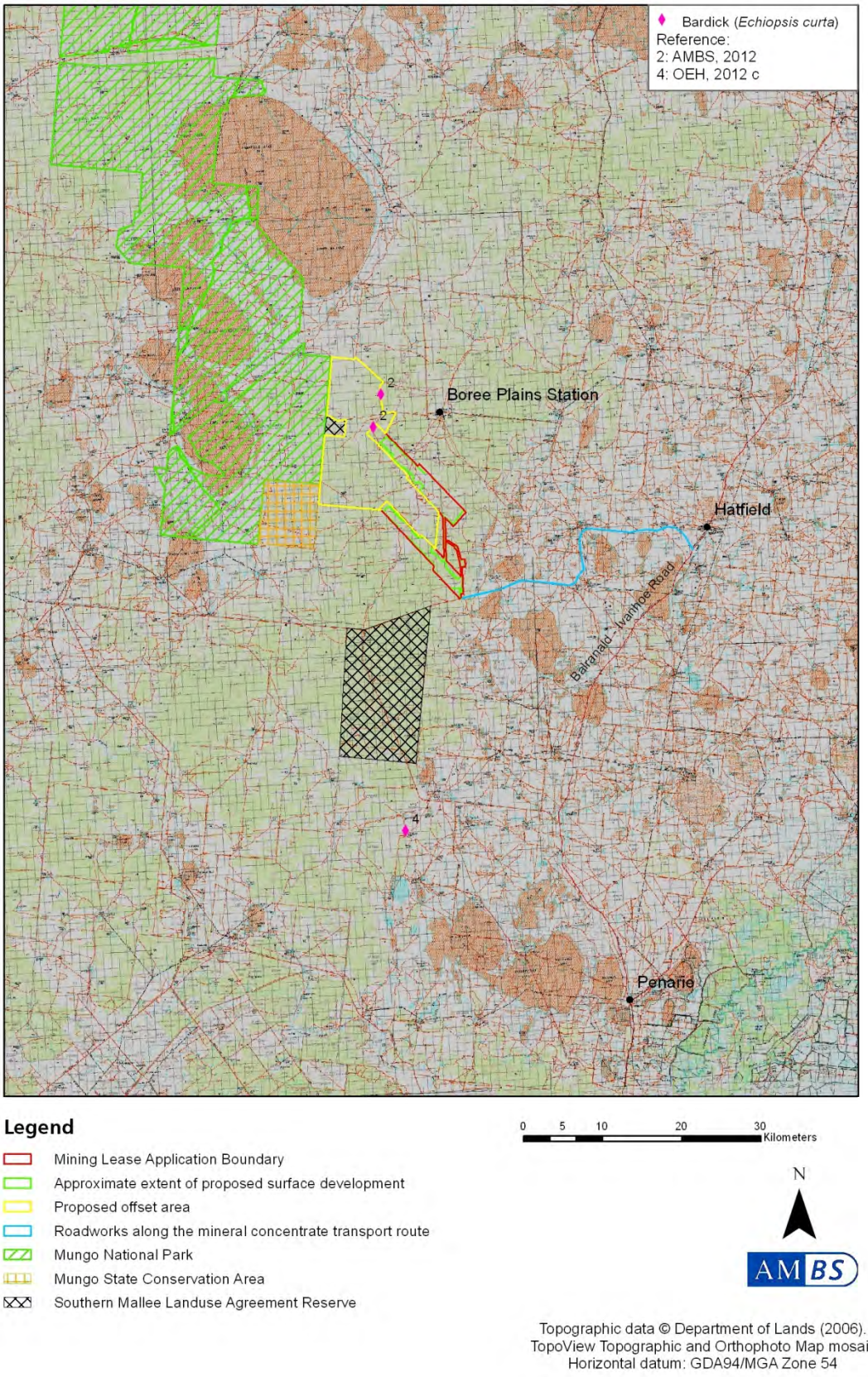

Figure C-10 Bardick - Landscape Distribution

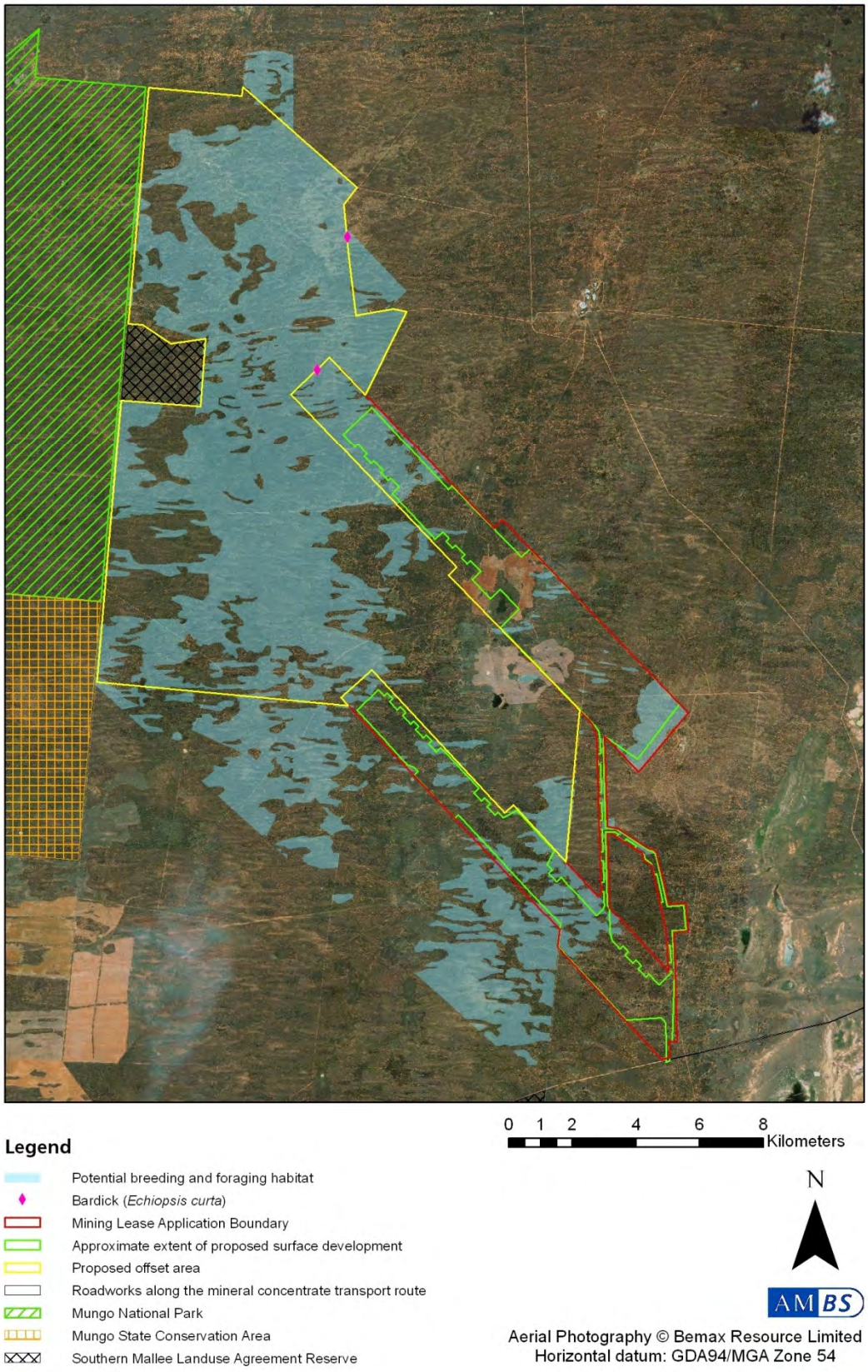

Figure C-11 Bardick - Potential Habitat

Malleefowl (Leipoa ocellata)

The Malleefowl (*Leipoa ocellata*) is listed as endangered under Schedule 1 of the TSC Act (and vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* [EPBC Act]).

The Malleefowl is a large ground-dwelling, pheasant-like bird that occurs across southern Australia in temperate, semi-arid districts where the annual rainfall is 200 to 450 millimetres (mm) (Marchant and Higgins, 1993). In NSW it occurs west of the Great Dividing Range, from the Pilliga scrub south-west towards the districts of Griffith, Wellington, Balranald, and continuously into north-western Victoria and south-eastern South Australia (Morris *et al*., 1981; Marchant and Higgins, 1993; OEH, 2012a). The species is mostly sedentary and established pairs tend to stay in the same area year-round. Local movements do occur between seasons in some areas, and larger movements can occur in response to drought and fire (Marchant and Higgins, 1993). Chicks and juveniles disperse only a short distance (rarely more than 20 km or so) from their incubation mound (Marchant and Higgins, 1993).

The Malleefowl occurs mostly in mallee woodlands, but sometimes ranges into surrounding woodlands or shrublands of other sorts (Marchant and Higgins, 1993; OEH, 2012a). The Malleefowl prefers taller mallee with a dense but discontinuous canopy (to provide abundant leaf-litter for mounds) and floristically rich shrub and herb layers to provide food plants (e.g. *Acacia*, *Cassia*, *Bossiaea* and *Beyeria* spp.). It tends to be less common in short or open mallee woodlands with a *Triodia spp.* understorey, but still occurs in such habitats. Lighter sandy or loamy soils are preferred because they provide drainage, rather than ease of digging (Marchant and Higgins, 1993).

The home range size is not well known and there is often considerable overlap between the home ranges of different pairs. During the breeding season males stay close to the mound and use a much reduced area (Benshemesh, 2007). Based on the area of potential primary habitat (1,575 ha) and an estimate of the density of breeding pairs (one pair per 100 ha), the theoretical conservative estimate is up to 15 breeding pairs could potentially be impacted by the Project. Two mounds were found in the proposed surface area and will be avoided through revision of the mine general arrangement.[1] Home range and density of breeding pairs may vary according to a range of factors including climate (i.e. rainfall), vegetation type, season, recent conditions (e.g. drought) and condition of habitat (e.g. whether grazed or not).

The Malleefowl builds a large mound of sand (with loam and pebbles) incorporating a litter of leaves, bark, twigs and small branches, in which they incubate their eggs with the heat of fermenting vegetation. The organic content varies considerably. Organic material is usually collected from June to August and then mixed following spring rains to begin the fermentation process. Eggs are laid any time from mid September to early February, but usually in the spring through the early summer. The average size recorded for 34 clutches was 15 eggs (ranging from 3 to 33) (Marchant and Higgins, 1993).

The species is mainly granivorous but berries, invertebrates, herbage (especially buds) and bulbs contribute to the diet. *Acacia* seeds are particularly important. Small congregations have been reported feeding on crop stubble, such as barley. A source of surface water is not needed, but individuals will drink readily when water is available (Marchant and Higgins, 1993).

[1] The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.

Habitat loss and degradation have caused extensive declines in Malleefowl abundance and distribution throughout its range (Benshemesh, 2007; Garnett *et al*., 2011). Higher rainfall (300-450 mm) mallee with the most diverse understory has been extensively cleared for agriculture or grazed by stock.

Competition with grazing stock (sheep and cattle) and feral animals (rabbits and goats) reduces habitat viability because grazed mallee offers much less herbage and seed for Malleefowl to feed on. Large fires also probably kill most Malleefowl in their wake, as the birds are poor fliers. Fire in mallee has the affect of preventing or reducing breeding for up to 20 or 30 years, although in some instances breeding will resume after 6 years. Predation by European red foxes is often high, particularly for eggs, chicks, juveniles and even adults (Marchant and Higgins, 1993; NSW National Parks and Wildlife Service (NPWS), 1999; Benshemesh, 2007; Garnett *et al.*, 2011).

Known breeding and foraging habitats of the Malleefowl that occur in the Project area include Linear Dune Mallee and Sandplain Mallee. Potential habitats (supplementary habitats that might be used on occasions for foraging or dispersal), include Belah-Rosewood Woodland, Acacia Woodland/Shrubland, Disturbed Shrubland and Cleared Land during seeding and harvesting of crops.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

A number of records of Malleefowl were collected during fauna surveys (Figure C-12), ranging from observations of tracks and mounds to sightings of individuals. In the north-western edge of the Campaspe footprint, several observations of tracks were made and a nesting mound found. At another location outside the Campaspe footprint but within the Mining Lease Application boundary tracks were recorded. At one location in the footprint of the Atlas Mine a nesting mound was found. Records, including footprints, mounds and a sighting, of Malleefowl were made throughout the proposed offset area. Two records made during the field survey and three contained in the Atlas of NSW Wildlife Database came from further afield in the general vicinity of the study area (Figure C-12). The Malleefowl was also recorded in recent surveys by Ecotone Ecological Consultants for the Balranald Mineral Sands Project in the West Balranald Deposit and Nepean Deposit located approximately 45 km and 10 km south of the Atlas-Campaspe Mine, respectively (Ecotone Ecological Consultants 2012a, 2012b). One Malleefowl was observed in the study area for the West Balranald Deposit and two active Malleefowl mounds were recorded in the study area for the Nepean Deposit (Ecotone Ecological Consultants, 2012a, 2012b).

Based on the area of potential primary habitat (1,575 ha) and an estimate of the density of breeding pairs (on per 100 ha), the theoretical conservative estimate is up to 15 mounds could potentially be impacted by the Project. Two mounds were found in the proposed surface area and will be avoided through revision of the mine general arrangement.[2]

The population in and around the Atlas-Campaspe Mine study area is part of a broader population occurring on leasehold land in the vicinity, containing some 300 pairs (Ewin, 2007). This population may be reduced to a limited extent by the Project, due to the probable loss of a proportion of those individuals. Habitat fragmentation may lead to reduced habitat viability and reduced breeding success for other Malleefowl pairs should they exist close to the Atlas-Campaspe Mine footprint. The active mine site might reduce or impair dispersal by young birds from mounds located close to the Atlas-Campaspe Mine footprint.

[2] The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.

The presence of other birds in the surrounding area (particularly the proposed offset area) would mean that interruption to the life cycle of a few pairs would not lead to the extinction of the local population. Appropriate habitat enhancement in the proposed offset area (feral animal control, removal of stock, fire management) could provide considerable compensation to the impacted pairs and other pairs outside the impact footprint.

No mounds, tracks or individuals were observed within the Ivanhoe Rail Facility study area and there are no database records within 20 km of the study area. Some secondary or supplementary foraging habitat exists within the Ivanhoe Rail Facility footprint. However, there is no primary mallee habitat in close vicinity to the Ivanhoe study area, as such a local population of the species is not expected to occur within the area. Therefore, the Project is not considered likely to impact a viable local population in relation to the works proposed for the Ivanhoe Rail Facility.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed; and

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Project would remove approximately 1,575 ha of known (primary) breeding and foraging habitat in the Atlas-Campaspe Mine footprint. Proposed clearing in the Atlas-Campaspe Mine footprint would include 1,040 ha of Linear Dune Mallee and 530 ha of Sandplain Mallee. In this location, the Project also includes the clearing of 2,705 ha of potential foraging (or supplementary habitats) which might be used on occasions by Malleefowl, where they adjoin suitable mallee habitat. This includes 2,035 ha of Belah-Rosewood Woodlands, 200 ha of Acacia Woodland/Shrubland, 170 ha of Disturbed Shrubland and 300 ha of Cleared Land when grasses are seeding or crops are harvested. A habitat map for the species has been provided in Figure C-13.

Based on the area of potential primary habitat (1,575 ha) and an estimate of the potential density of breeding pairs, a theoretical conservative estimate is up to 15 breeding pairs could potentially be impacted by the Project. Two mounds were found in the Project area and these will be avoided through revision of the mine general arrangement[3]; however, there is potential for indirect impacts on individuals that use these mounds.

The Project would remove 40 ha of supplementary foraging habitat (Belah-Rosewood Woodland and Native Grassland) within the Ivanhoe Rail Facility footprint (Figure C-14). No breeding pairs are expected to occur within the Ivanhoe Rail facility study area, given no mounds, tracks, or individuals were recorded during survey, there are no records of the species within 20 km of the area and there is no primary habitat (mallee woodland) in close vicinity to the area.

The Project would involve the clearing of the vegetation in the Atlas-Campaspe footprint. This would be cleared progressively over 20 years and rehabilitated after mining. The rehabilitated post-mine landforms would contain habitat features potentially suitable for the dispersal of Malleefowl across the post-mine landforms including the establishment of species representative of Linear Dune Mallee and Sandplain Mallee such as *Eucalyptus socialis*, *E. dumosa* and *Callitris* sp. The habitat between the footprints would remain undisturbed, as would most of the surrounding landscape. The Project would temporarily isolate individuals on either side of the active mine area and would result in diminished connectivity across the mine area; however, large and contiguous areas of habitat for this species would remain in the area surrounding the mine footprints. Therefore no areas of habitat for this species would become isolated from other areas of habitat.

Only a small area of secondary habitat would be removed in the Ivanhoe Rail Facility footprint and this habitat is not likely to become isolated, given the vegetation the surrounding areas of vegetation would still be connected to the north, west and south-west.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" for the Malleefowl is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The approved recovery plan for the Malleefowl (Benshemesh, 2007) contains 18 objectives:

1) Reduce permanent habitat loss.
2) Reduce the threat of grazing pressure on Malleefowl populations.
3) Reduce fire threats.
4) Reduce predation.
5) Reduce isolation of fragmented populations.
6) Promote Malleefowl-friendly agricultural practices.
7) Reduce Malleefowl mortality on roads.
8) Provide information for regional planning.

[3] The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.

9) Monitor Malleefowl and develop an adaptive management framework.
10) Determine the current distribution of Malleefowl.
11) Examine population dynamics: longevity, recruitment and parentage.
12) Describe habitat requirements that determine Malleefowl abundance.
13) Define appropriate genetic units for management of Malleefowl.
14) Assess captive breeding and re-introduction of Malleefowl.
15) Investigate infertility and agrochemicals.
16) Facilitate communication between groups.
17) Raise public awareness through education and publicity.
18) Manage the recovery process.

The Project would be inconsistent with objectives 1 and 5. The loss and fragmentation of habitats are considered in response to question d. The Project could potentially be inconsistent with objective 3. Mining activities carry the risk of causing accidental fires and changing (increasing) the fire regime.

However, a fire management plan would be developed that aims to minimise fire outbreaks within the Project area and manages appropriate fire regimes within the proposed offset area that would benefit the Malleefowl and other wildlife species.

The proposed offset would aim to compensate for fragmentation by enhancing the habitat quality and integrity of the proposed offset area, which includes 12,765 ha of primary mallee habitats and 3,675 ha of potential foraging habitat. Improved fire management, integrated pest management and reduced grazing pressure would give considerable compensation to offset localised fragmentation. In these ways, the Project would assist with the implementation and success of the recovery plan.

The Project would not be inconsistent with the objectives of any relevant threat abatement plan.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by the OEH (2012b), the following are relevant to the location, the Project and the species:

1) Clearance of native vegetation.
2) High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.

The Project would contribute to KTP 1 (as discussed above in response to question d). There may also be some potential to contribute to KTP 2, but only if fire management measures are inadequate. Conversely, integrated pest management and reduced grazing pressure within the proposed offset area associated with the Atlas-Campaspe Mine would make considerable contributions to reduce KTPs 3, 4, 5 and 6.

Conclusion

The Atlas-Campaspe Mine footprint would result in the removal of approximately 1,575 ha of good quality habitat for the Malleefowl as well as 2,705 ha of potential foraging or supplementary habitats Based on the area of potential primary habitat (1,575 ha) and an estimate of the density of breeding pairs (one per 100 ha), the theoretical conservative estimate is up to 15 mounds could potentially be impacted by the Project. Two mounds were found in the proposed surface area and will be avoided through revision of the mine general arrangement[4]. The Project would have a significant impact on the Malleefowl. However, the Malleefowl that occupy the Project area are part of a broader population in the region and the species and larger amounts of potential habitat would be conserved in the proposed offset area The Project would not lead to the extinction of the local population.

The proposed offset area associated with the Atlas-Campaspe Mine, would contain approximately 12,765 ha of mallee habitats (more than eight times that in the development footprint) and 3,675 ha of potential foraging or supplementary habitats that would be managed to enhance their viability. This would include management of bushfire risk, reduced livestock grazing and integrated pest management control.

The Project would remove 40 ha of supplementary foraging habitat (Belah-Rosewood Woodland and Native Grassland) within the Ivanhoe Rail Facility footprint. No breeding pairs are expected to occur within the Ivanhoe Rail facility study area given no mounds, tracks, or individuals were recorded during survey, there are no records of the species within 20 km of the area, and there is no primary habitat (mallee woodland) in close vicinity to the area. Consequently, the Ivanhoe Rail Facility is not likely to have a significant impact on local populations of the species (if they occur).

The Project would remove 40 ha of supplementary foraging habitat (Belah-Rosewood Woodland and Native Grassland) within the Ivanhoe Rail Facility footprint. No breeding pairs are expected to occur within the Ivanhoe Rail facility study area given no mounds, tracks, or individuals were recorded during survey, there are no records of the species within 20 km of the area, and there is no primary habitat (mallee woodland) in close vicinity to the area. Consequently, the Ivanhoe Rail Facility is not likely to have a significant impact on local populations of the species (if they occur).

Proposed avoidance, mitigation and management measures would include:

1) Management of 12,765 ha of primary mallee habitats and 3,675 ha of potential foraging or supplementary habitats in the proposed offset area to improve their ecological viability.
2) Implementation of feral animal control in the Project area and proposed offset area to reduce competition for Malleefowl from herbivores.
3) Implementation of feral animal control in the Project area and proposed offset area to reduce predation of Malleefowl from European red foxes and feral cats.
4) Removal of stock from the Project area and proposed offset area to reduce competition for Malleefowl from herbivores.
5) Implementation of fire management measures to maintain a low frequency fire regime that favours the Malleefowl.

[4] The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.

6) Revision of the mine general arrangement to avoid direct impacts to two Malleefowl nesting mounds (Figure 15)[5].
7) Inclusion of the risk of vehicle strike to fauna in inductions to increase awareness.
8) Installing road signs that increase awareness of fauna vehicle strike.
9) Adopting vegetation clearance procedures.
10) Speed limits to minimise the risk of vehicle strike on native fauna.

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[5] The mine plan has been refined to avoid a Malleefowl nesting mound and two Cobar Greenhood Orchid locations recorded during surveys. Given this commitment was made immediately prior to the finalisation of this report, and resulted in a change to the proposed surface development area, figures within the main body of this report (such as Figure 15) were amended to reflect this change. It should be noted however, that the figures in Appendix C of this report (Seven Part Tests) have not been updated, on the basis that at the scale presented, the relevant changes would have been immaterial. For clarity, the figures in the main body of this report provide the accurate representation of the proposed mine plan.

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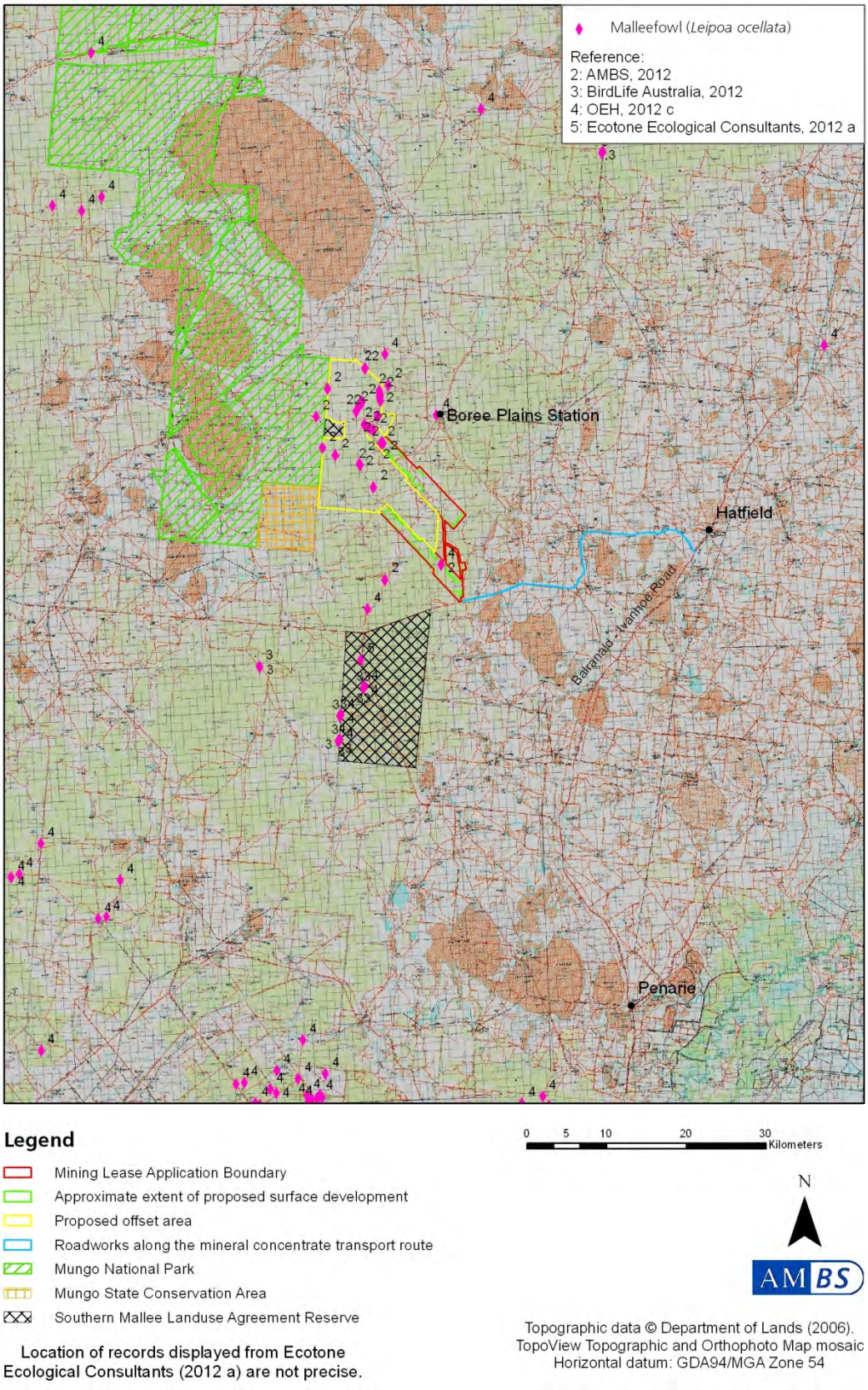

Figure C-12 Malleefowl - Landscape Distribution

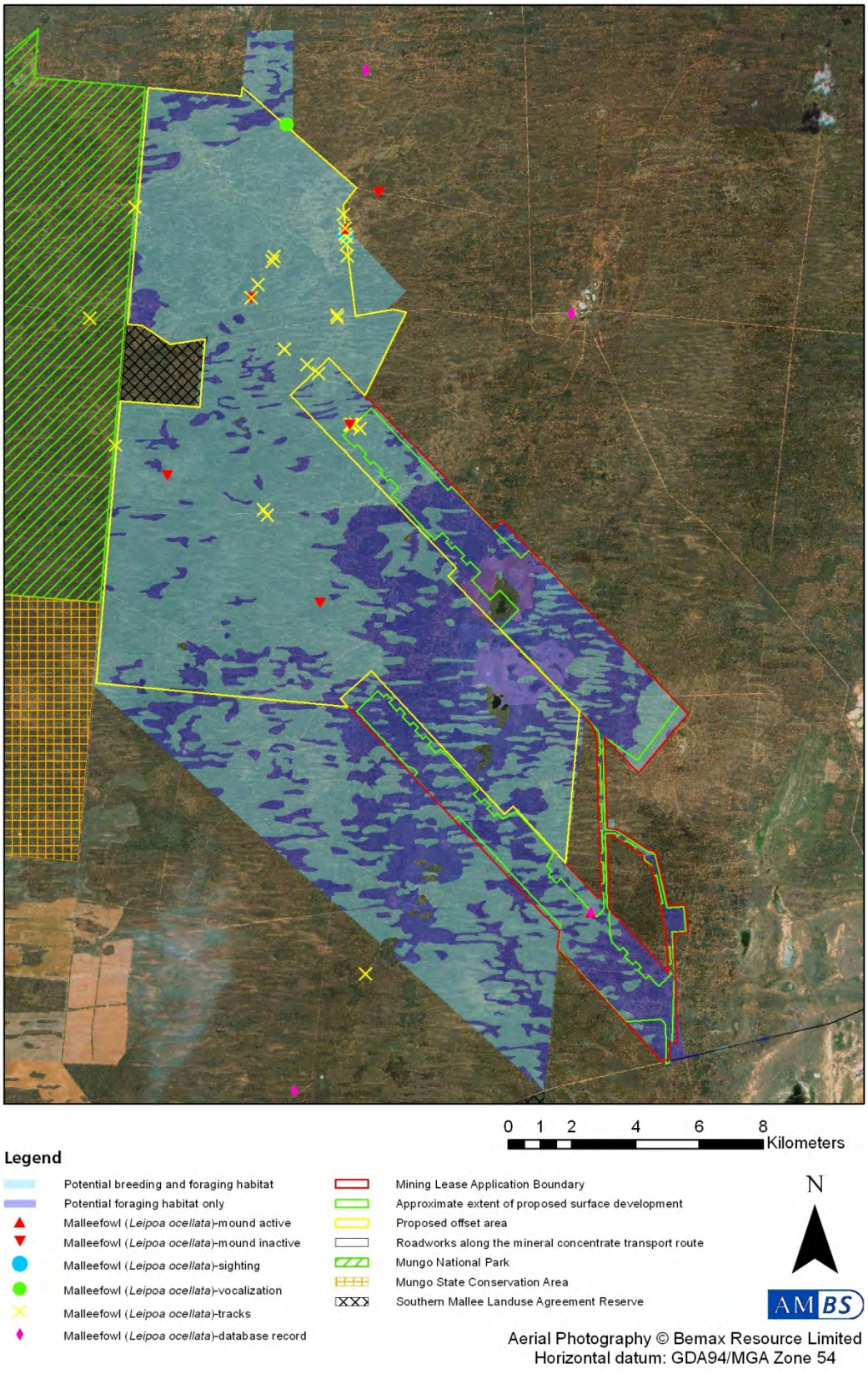

Figure C-13 Malleefowl - Potential Habitat

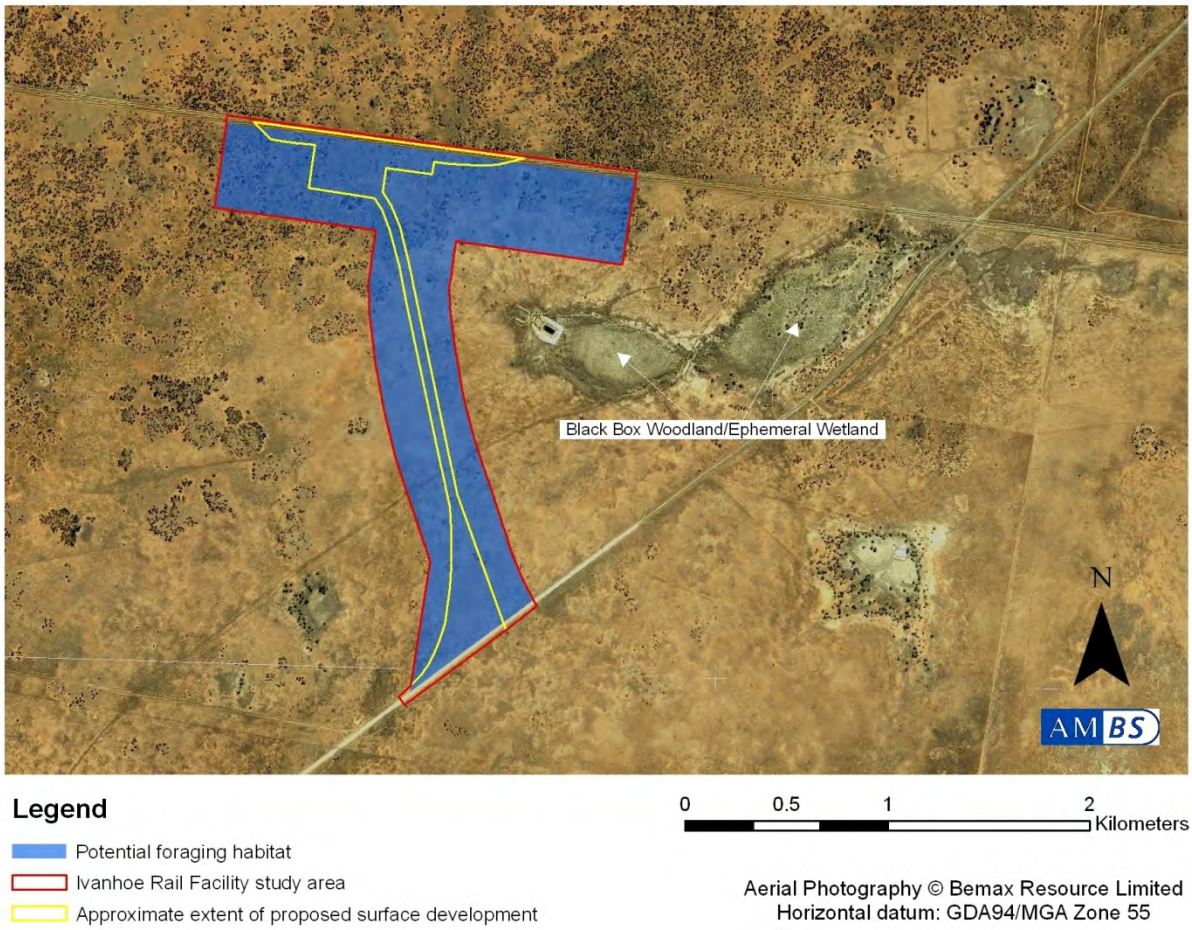

Figure C-14 Malleefowl - Potential Habitat – Ivanhoe Rail Facility

Freckled Duck (Stictonetta naevosa)

The Freckled Duck (*Stictonetta naevosa*) is listed as vulnerable under Schedule 2 of the TSC Act. This species is found primarily in south-eastern and south-western Australia. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. The Freckled Duck is forced to disperse during extensive inland droughts when wetlands in the Murray River basin provide important habitat (OEH, 2012a). The species is typically gregarious and regularly forms congregations of 10 to 100 birds. In wet years the species is largely sedentary, although it becomes irregularly dispersive in dry seasons, usually moving towards coastal habitats (Pizzey, 1991; Marchant and Higgins, 1993). The population of Freckled Ducks has thought to have severely declined in recent years (OEH, 2012a).

Freckled Ducks generally rest in dense cover during the day, usually in deep water. They feed at dawn and dusk and at night on algae, seeds and vegetative parts of aquatic grasses and sedges and small invertebrates (OEH, 2012a).

Nesting usually occurs between October and December but can take place at other times when conditions are favourable. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds. Nests are usually located in dense vegetation at or near water level (OEH, 2012a).

Threats to Freckled Ducks include hydrological changes, altering flood patterns through river regulation, water harvesting and other water conservation schemes. Loss of habitat and potential breeding sites through grazing and trampling by livestock and clearing of vegetation in wetlands and lakebeds that intermittently flood also pose a threat to this species (OEH, 2012a).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

A total of 64 Freckled Ducks on three occasions were recorded during surveys of the Atlas-Campaspe Mine in the Ephemeral Wetland near the Campaspe footprint (Figure C-15). The largest number of Freckled Ducks recorded at any moment in time was 30. There are also numerous records for this species in the Lower Murray Darling CMA (OEH, 2012a). There is potential foraging and breeding habitat for this species in Ephemeral Wetlands and farm dams. The main potential habitat for this species is located within two patches of Black Box Woodland; one patch occurs in the south-eastern section of the proposed offset area and the other near the Campaspe footprint (Figure C-16). Additionally, a small amount of breeding and foraging habitat associated with dams (less than 1 ha) exists. The Ephemeral Wetland in the proposed offset area contains potential habitat in the form of ground vegetation on the western side. The Ephemeral Wetland close to the Campaspe footprint lacks ground and mid-layer vegetation closest to the water on all sides of the waterbody, presumably due to the movement of cattle. Some shelter resources occur close to the water's edge in the form of fallen logs and grassy vegetation.

The proposed mining at Atlas and Campaspe is expected to have a limited, localised and temporary effects on areas where temporary surface ponding occurs at the Atlas Campaspe Mine site (i.e. through excavation) (GEO-ENG, 2013). This applies to depressions located beside and 2.5 km to the south of the Campaspe footprint.

There are two Ephemeral Wetlands associated with Black Box Woodland with potential to be indirectly impacted by changes to hydrology. The initial mine design was refined to avoid as much of the Black Box Woodland and the associated Ephemeral Wetland in these locations as practicable. However, mining of the Campaspe deposit (between Years 11 to 13) would remove an area of woodland and part of the clay associated with the water holding capacity in this depression. The total water holding capacity of the depression may be affected if the clay material to be removed was replaced with overburden and process waste after mining. To minimise this, Cristal Mining Australia Limited (Cristal Mining) would selectively place clay material in low-lying portions of the re-profiled landform within the mine path to reinstate run-on to adjacent depressions. The Campaspe footprint would also temporarily prevent surface runoff from flowing into these wetlands from the north for the duration of the mining of the Campaspe deposit. Cristal Mining would partly restore the local catchment to this Ephemeral Wetland by designing the rehabilitated mine landform to maximise the surface water flow to this area.

While a small area of potential habitat (less than 1 ha) for this species would be removed by the Project and there is a chance that further potential habitat would be impacted by hydrological changes and through disturbance associated with mining operations, it is considered that the Project is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction given that:

- Only a relatively small area of potential breeding and foraging habitat (less than 1 ha) associated with dams would be directly impacted by the Project. No potential breeding and foraging habitat in the form of Ephemeral Wetland would be directly impacted by the proposed Project.
- Only 9 ha of potential breeding and foraging habitat would be indirectly impacted by hydrological changes in the region and through disturbance associated with mining operations.
- A small area of potential breeding and foraging habitat (less than 1 ha) associated with dams and 11 ha of Ephemeral Wetland habitat would be conserved in the proposed offset area.
- Better quality habitat exists in the surrounding area, including in the wetlands of the Willandra Creek and Willandra Lakes Region World Heritage Area, which are considered to be significant in the Murray Darling Depression Bioregion (NPWS, 2003).

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine footprint would remove only a small amount of breeding and foraging habitat associated with dams (less than 1 ha). A further 9 ha of potential breeding and foraging habitat for the Freckled Duck in Ephemeral Wetland may be indirectly impacted by changes to hydrological regimes in the area and through disturbance caused by mining operations. For example mining of the Campaspe deposit would temporarily prevent run-off from the north entering the Ephemeral Wetland adjacent to the Campaspe footprint. A habitat map for the species has been provided in Figure C-16.

(ii) The Atlas-Campaspe Mine footprint would not result in fragmentation or isolation of known habitat for this species.

(iii) Given that only a small amount of breeding and foraging habitat associated with dams (less than 1 ha) would be removed and only 9 ha of ephemeral breeding and foraging habitat may be indirectly impacted by changes to hydrological regimes in the area and through disturbance, the importance of habitat to removed is considered relatively low. Particularly given that 11 ha of similar wetland habitat would be conserved in the proposed offset area. Better quality habitat also exists in the surrounding area, including in the Willandra Creek and Willandra Lakes Region World Heritage Area (NPWS, 2003). Based on all of the above, it is considered that the habitat to be removed is not likely to be important for the long-term survival of the species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No “critical habitat” for the Freckled Duck is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Freckled Duck, however OEH (2012a) recommends the following priority actions to assist with the recovery of the species, of relevance to the Project:

- Ensure that water flows to the important 'breeding' wetlands are maintained to an extent that will support a vegetation structure that will provide nest sites for the Freckled Duck and allow time to raise at least one brood.
- Ensure appropriate management of hydrological changes to ensure minimal effects (NPWS, 1999).
- Protect key vegetation, particularly Lignum, in important 'breeding' wetlands by restricting grazing and/or burning of vegetation in and around the wetlands.
- Control feral predators in known and potential habitat of the species.
- Control feral pigs and goats in order to reduce habitat destruction in potential and known habitat of the species.

The Project would be inconsistent with the first two priority actions as there is a chance that the 9 ha Ephemeral Wetland nearby to the Campaspe footprint may be impacted indirectly by changes to hydrological regimes in the area and through disturbance. A similar indirect impact on the wetland in the proposed offset area of 11 ha is possible through changes in hydrological regimes in the area as a result of the Campaspe footprint, which may reduce the amount of water entering these areas.

The proposed offset area would aim to compensate for the potential indirect impact on the Ephemeral Wetland near the Campaspe footprint by enhancing the habitat quality and integrity of similar types in the proposed offset area. Improved fire management, increased control of feral animals and reduced grazing pressure would give considerable compensation to offset localised habitat impact.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012b), the following are relevant to the location, the proposed Project and the species:

1) Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
2) High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.

The Project would contribute to KTP1 (as discussed above in response to question a). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions for the species. Feral animal management plans would make considerable contributions to reduce KTPs 3 to 7 and would allow regeneration of wetland vegetation.

Conclusion

A total of 64 Freckled Ducks were recorded on three occasions at the Ephemeral Wetland near the Campaspe footprint. The maximum number of Freckled Ducks seen at any moment in time was 30. Potential breeding and foraging habitat for this species occurs in Ephemeral Wetland and in farm dams.

The Project is not expected to have a significant impact on the Freckled Duck given that:

1) The potential breeding and foraging habitat for the Freckled Duck that is directly impacted is small (less than 1 ha) and associated with dams. A similar area of breeding and foraging habitat associated with dams (less than 1 ha) and 11 ha of potential breeding and foraging habitat associated with Ephemeral Wetlands would be conserved in the proposed offset area.
2) While potential hydrological changes and disturbance could impact the Ephemeral Wetland adjacent the Campaspe deposit for the duration of the mine operations, these wetlands are ephemeral and while they are important in the local context given it is a limited resource, in a regional context they are not identified as a significant or key breeding areas for the species. Therefore these impacts are not considered likely to affect the long-term survival of the species in the region, and
3) Better quality habitat exists in the surrounding area, including in the Ephemeral Wetlands of the Willandra Creek and Willandra Lakes Region World Heritage Area, which are considered to be significant in the Murray Darling Depression Bioregion (NPWS, 2003)

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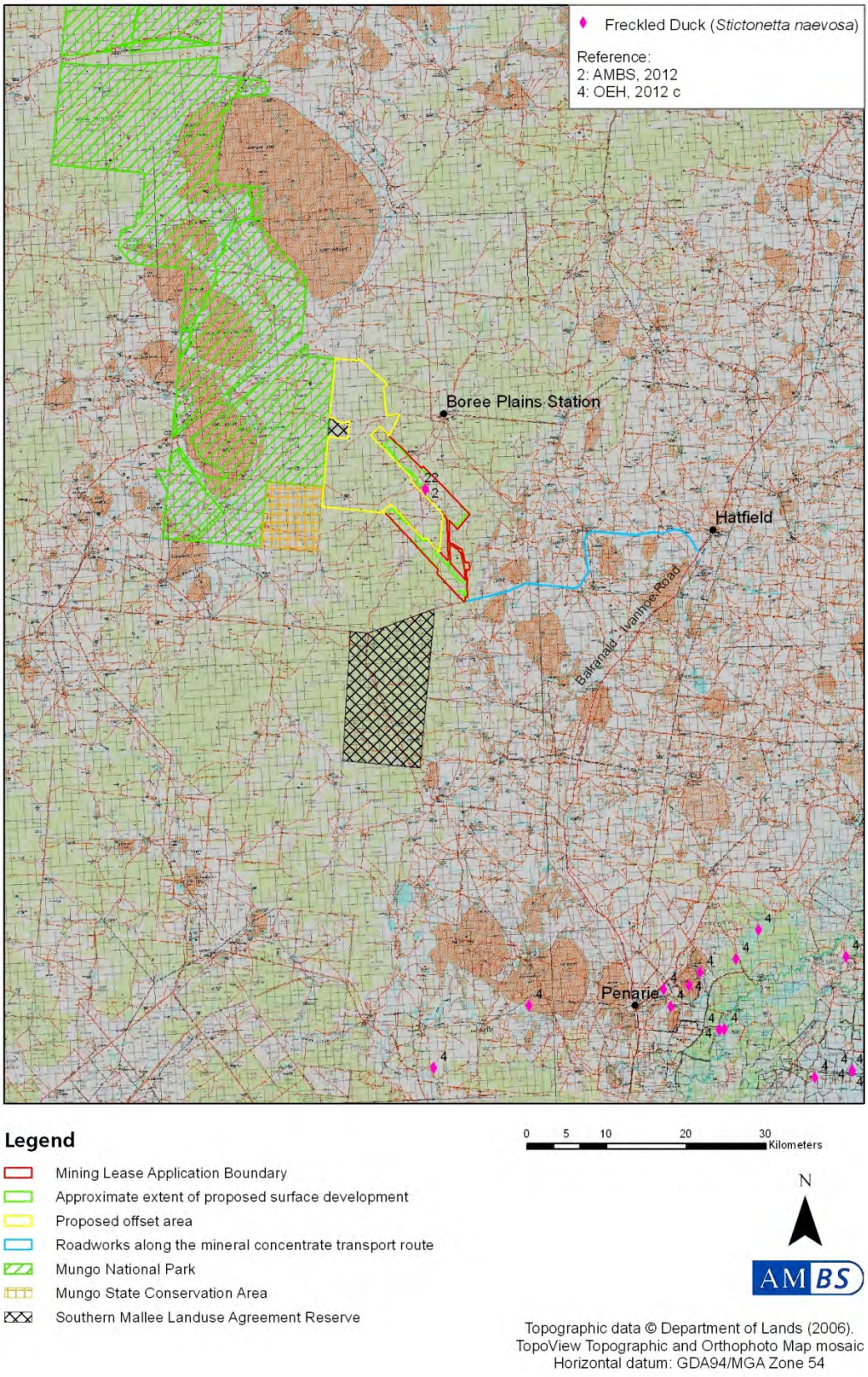

Figure C-15 Freckled Duck - Landscape Distribution

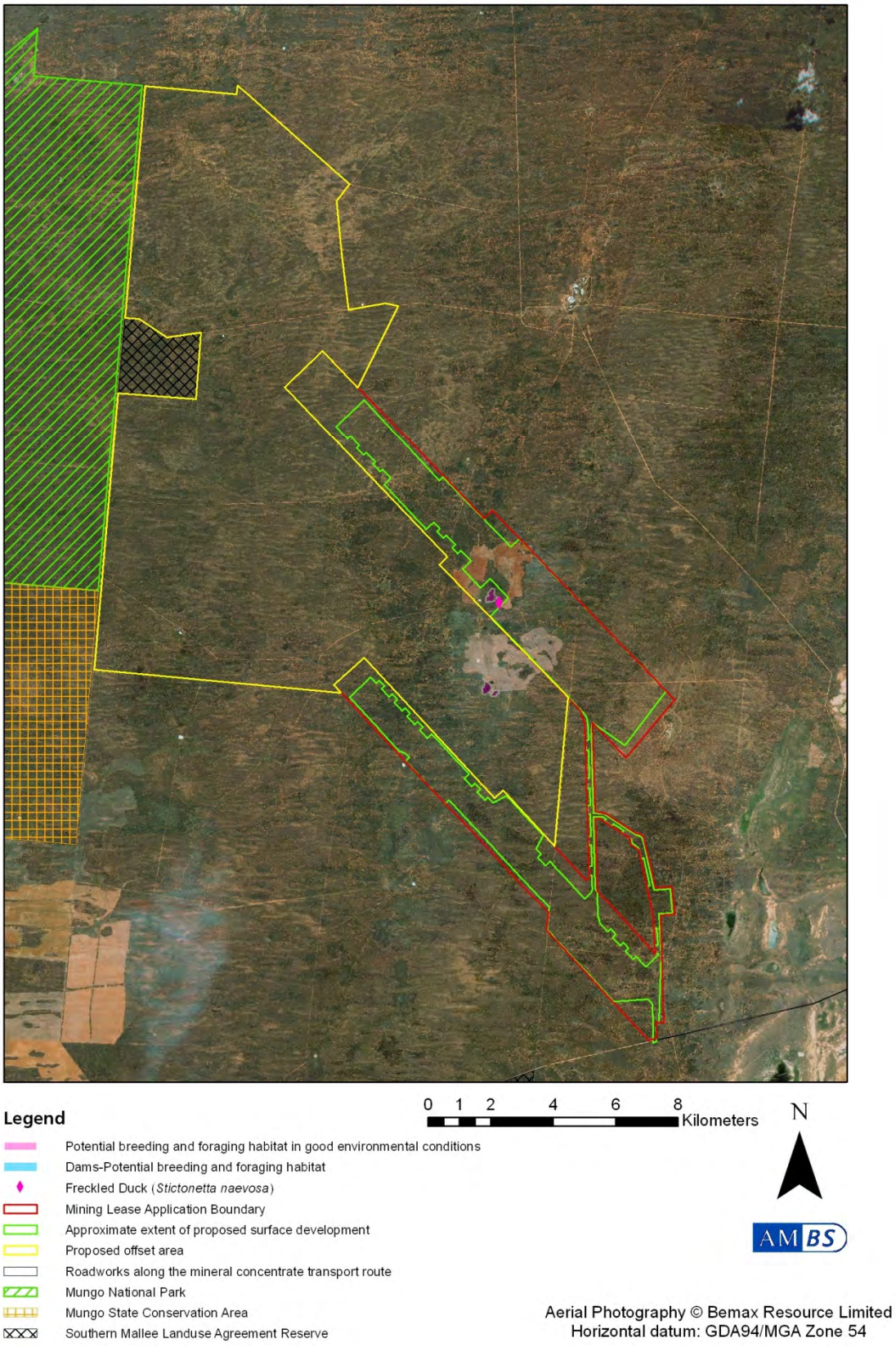

Figure C-16 Freckled Duck - Potential Habitat

Blue-billed Duck (Oxyura australis)

The Blue-billed Duck (*Oxyura australis*) is listed as vulnerable under Schedule 2 of the TSC Act. This species is endemic to Australia, being found in the temperate wetlands of the south-east and south-west parts of the continent (Australian Museum, 2012). The species is found particularly in the Murray-Darling basin and southern Victoria. Blue-billed Ducks are found on both natural and artificial wetlands that can be freshwater to saline. During autumn and winter the species aggregates in large flocks but disperses to smaller waterbodies when breeding. Aggregations also occur during drought (Birdlife International, 2012).

The Blue-billed Duck feeds on a variety of foods on the surface of the water or by diving. The species' diet comprises of aquatic insects including chironomid fly larvae, caddis flies, dragonflies, flies and water beetle larvae. They may also eat the seeds, buds, stems, leaves and fruit of a wide variety of plants.

The Blue-billed Duck is seasonally nomadic. Young birds disperse each year from their natal swamps on inland NSW to non-breeding areas on the Murray River system and coastal lakes of Victoria and South Australia where they moult. Experienced breeders tend to be sedentary (Australian Museum, 2012). Blue-billed Ducks breed in secluded, densely vegetated areas. They generally construct their nest over water in cumbungi (*Typha* spp.) beds or other vegetation. Nests are usually constructed from dead *Typha spp.* leaves, and are sometimes thinly lined with down. Blue-billed Ducks are polygamous, and pair-bonds are short-term i.e. for the duration of copulation and laying of the eggs.

The Australian population of Blue-billed Ducks has been estimated at about 12,000 mature individuals and is thought to be stable (Birdlife International, 2012). Threats to this species include destruction or modification of habitat, particularly by drainage works, clearing, cropping or burning and activities that may cause increases in salinity and groundwater extraction (NPWS, 1999).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Blue-billed Duck was not recorded in the Project Area or within a 20 km radius of the Project area but it is known to occur in the Lower Murray/Darling - South Olary Plain, Murray Basin Sands CMA sub-region, the closest record is from the Atlas of NSW Wildlife Database and approximately 55 km south-east of the Project Area (Figure C-17). There is potential foraging habitat for this species in the ephemeral Black Box Woodland Wetlands and farm dams. The main potential habitat for this species is located within two patches of Ephemeral Wetland; one patch occurs in the south-eastern section of the proposed offset area and the other near the Campaspe footprint (Figure C-18). The Ephemeral Wetland in the proposed offset area contains potential habitat in the form of ground vegetation on the western side. The Ephemeral Wetland close to the Campaspe footprint lacks ground and mid-layer vegetation closest to the water on all sides of the waterbody, presumably due to the movement of cattle. Some shelter resources occur close to the water's edge in the form of fallen logs and grassy vegetation.

The proposed mining at Atlas and Campaspe is expected to have a limited, localised and temporary effects on areas where temporary surface ponding occurs at the Atlas Campaspe Mine site (i.e. through excavation) (GEO-ENG 2013). This applies to depressions located beside and 2.5 km to the south of the Campaspe footprint.

There are two Ephemeral Wetlands associated with Black Box Woodland with potential to be indirectly impacted by changes to hydrology. The initial mine design was refined to avoid as much of the Black Box Woodland and the associated Ephemeral Wetland in these locations as practicable. However, mining of the Campaspe deposit (between Years 11 to 13) would remove an area of woodland and part of the clay associated with the water holding capacity in this depression. The total water holding capacity of the depression may be affected if the clay material to be removed was replaced with overburden and process waste after mining. To minimise this, Cristal Mining would selectively place clay material in low-lying portions of the re-profiled landform within the mine path to reinstate run-on to adjacent depressions. The Campaspe footprint would also temporarily prevent surface runoff from flowing into these wetlands from the north for the duration of the mining of the Campaspe deposit. Cristal Mining would partly restore the local catchment to this Ephemeral Wetland by designing the rehabilitated mine landform to maximise the surface water flow to this area.

While potential habitat for this species would be removed by the Project and there is a chance that further potential habitat would be impacted by hydrological changes and through disturbance associated with mining operations, it is considered that the Project is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction given that:

- Only a relatively small area of potential foraging habitat (less than 1 ha) associated with dams would be directly impacted by the Project. No potential breeding and foraging habitat in the form of Ephemeral Wetland would be directly impacted by the proposed Project.
- Only nine ha of potential foraging habitat would be indirectly impacted by hydrological changes in the region and through disturbance associated with mining operations.
- A small area of potential foraging habitat (less than 1 ha) associated with dams and 11 ha of Ephemeral Wetland habitat would be conserved in the proposed offset area.
- Better quality habitat exists in the surrounding area, including in the wetlands of the Willandra Creek and Willandra Lakes Region World Heritage Area, which are considered to be significant in the Murray Darling Depression Bioregion (NPWS, 2003).

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine footprint would remove a small amount of potential foraging habitat associated with dams (less than 1 ha) for the Blue-billed Duck. In addition the Ephemeral Wetland habitat that represents potential foraging habitat for the Blue-billed Duck (9 ha), may be indirectly impacted by changes to hydrological regimes in the area and through disturbance caused by mining operations. For example the Campaspe footprint may temporarily prevent run-off from the north entering the Ephemeral Wetland adjacent to and 'downstream' of the Campaspe footprint. A habitat map for the species has been provided in Figure C-18.

(ii) The Atlas-Campaspe Mine footprint would not result in fragmentation or isolation of known habitat for this species.

(iii) Given that only a small amount of potential foraging habitat would be removed (less than 1 ha associated with dams) and 9 ha of potential foraging habitat in ephemeral Wetlands may be indirectly impacted and that similar areas of habitat including those associated with dams and 11 ha of similar Ephemeral Wetland habitat would be conserved in the proposed offset area and that better quality habitat exists in the surrounding area, including in the Willandra Creek and Willandra Lakes Region World Heritage Area (NPWS, 2003), it is considered that the habitat to be removed is not likely to be important for the long-term survival of the species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" for the Blue-billed Duck is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Blue-billed Duck, however OEH (2012a) recommends the following priority actions to assist with the recovery of the species that are of relevance to the Project:

- Assess wetland health and threats, including frequency of inundation, condition of and threats to key plant species such as Lignum, degree of alteration to water flows and appropriate flow regimes (frequency & extent) to sustain breeding.
- Ensure that water flows to the important 'breeding' wetlands are maintained to an extent that will support a vegetation structure that will provide nest sites for the Blue-billed Duck and allow time to raise at least one brood.
- Protect key vegetation, particularly Lignum, in important 'breeding' wetlands by restricting grazing and/or burning of vegetation in and around the wetlands.
- Control foxes.

The Ephemeral Wetland habitat adjacent to the Campaspe footprint and in the proposed offset area are unlikely to provide suitable breeding habitat for the Blue-billed Duck however not all their breeding habits are known. Thus, the Project may possibly be inconsistent with the first three priority actions as there is a chance that the 9 ha of Ephemeral Wetland near the Campaspe footprint may be impacted indirectly by changes to hydrological regimes in the area and through disturbance.

The proposed offset area would conserve 11 ha of Ephemeral Wetland. Improved fire management, increased control of feral animals and reduced grazing pressure in the proposed offset area would give considerable compensation to offset localised habitat impact.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012b), the following are relevant to the location, the Project and the species:

1) Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
2) High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.

The Project would contribute to KTP1 (as discussed above in response to question a). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions for the species. Feral animal management plans would make considerable contributions to reduce KTPs 3 to 6.

Conclusion

The Blue-billed Duck was not recorded in the Project Area or within a 20 km radius of the Project area but it is known to occur in the Lower Murray/Darling - South Olary Plain, Murray Basin Sands CMA sub-region, the closest record is from the Atlas of NSW Wildlife Database and approximately 55 km south-east of the Project Area (OEH, 2012c). Potential foraging habitat for this species occurs in the study area in Ephemeral Wetlands and in farm dams.

The Project is not expected to have a significant impact on the Blue-billed Duck given that:

1) The potential foraging habitat for the Blue-billed Duck that is directly impacted is small (less than 1 ha) and associated with dams. A similar area of breeding and foraging habitat associated with dams (less than 1 ha) and 11 ha of potential breeding and foraging habitat associated with Ephemeral Wetlands would be conserved in the proposed offset area.
2) While potential hydrological changes and disturbance could impact the Ephemeral Wetland adjacent to the Campaspe footprint for the duration of the mine operations, these wetlands are ephemeral and whilst they are important in the local context given it is a limited resource, in a regional context they are not identified as a significant or key breeding areas for the species. Therefore these impacts are not considered likely to affect the long-term survival of the species in the region.
3) Better quality habitat exists in the surrounding area, including in the Ephemeral Wetlands of the Willandra Creek and Willandra Lakes Region World Heritage Area, which are considered to be significant in the Murray Darling Depression Bioregion (NPWS, 2003)

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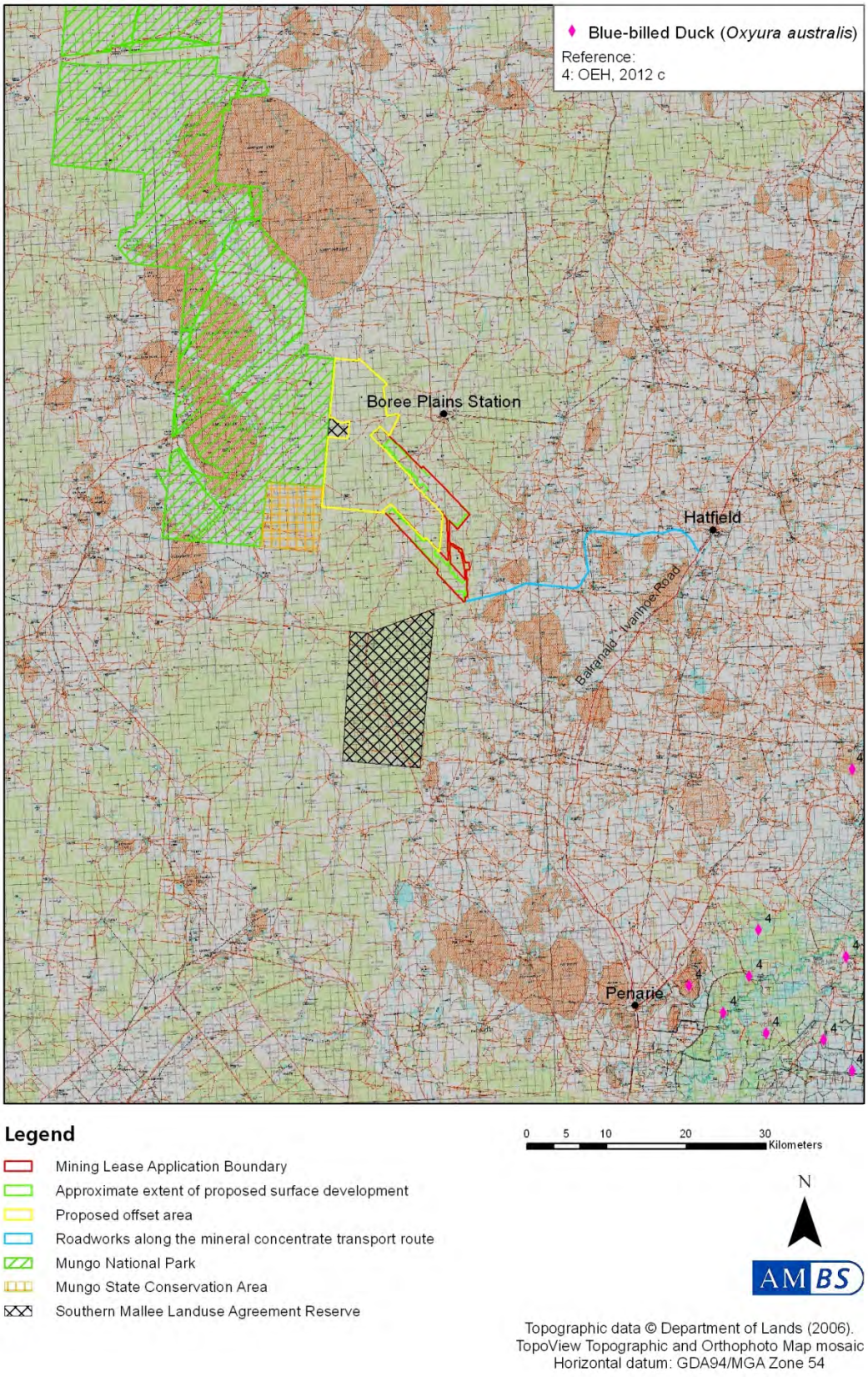

Figure C-17 Blue-Billed Duck - Landscape Distribution

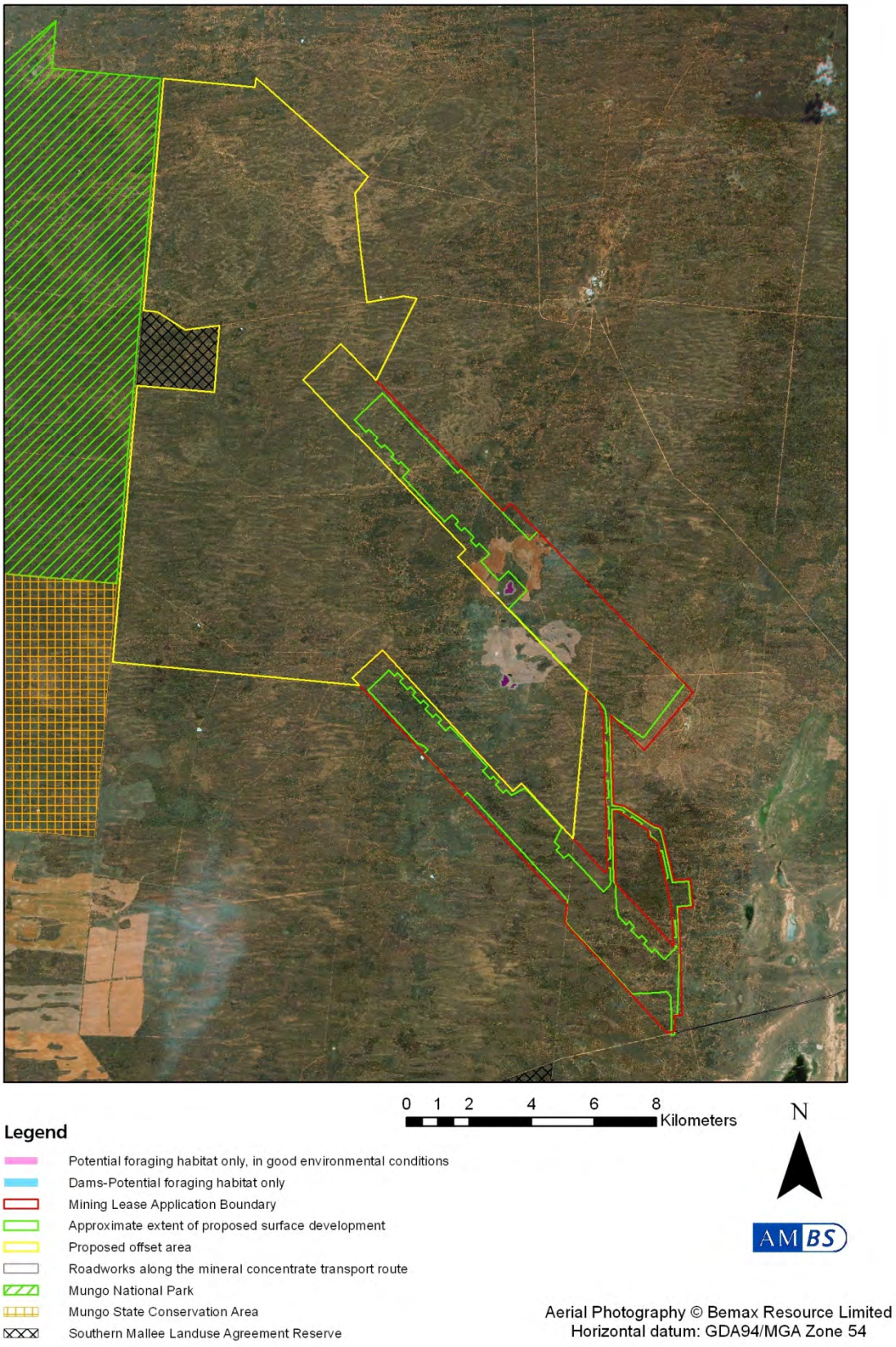

Figure C-18 Blue-billed Duck - Potential Habitat

Australasian Bittern (Botaurus poiciloptilus)

The Australasian Bittern (*Botaurus poiciloptilus*) is listed as endangered under Schedule 1 of the TSC Act and the EPBC Act. While this species has a wide distribution over south-eastern Australia it is considered to be uncommon. In NSW, Australasian Bitterns are a part of one of three Australian sub-populations, the south-eastern subpopulation, which is found in the riparian and wetland areas in the east and south of the state (NSW Scientific Committee, 2011). Australasian Bitterns favour permanent freshwater wetlands where there is tall, dense vegetation, particularly *Typha* spp. and *Eleocharis* spp.. However, temporary open wetlands may be used when population density is high or during relocation (Commonwealth Department of Sustainability, Environment, Water, Population and Communities [SEWPaC], 2012). They are secretive during the day, hiding amongst dense reeds or rushes. They feed mainly at night on a variety of prey including frogs, fish, yabbies, spiders, insects and snails. Australasian Bitterns may construct feeding platforms over deeper water. Platforms are constructed from reeds that the bird tramples and are often littered with remains of prey. Breeding occurs in summer from October to January. Nests are built in secluded places in densely-vegetated wetlands on a platform of reeds and there are usually six olive-brown eggs to a clutch. Breeding pairs of Australasian Bitterns are solitary and territorial. They occupy relatively large home ranges of 40 to 50 ha and occur at low densities. Generation length is estimated as five years (Garnett and Crowley, 2000).

Based on evidence from broad scale surveys, the Australasian Bittern is believed to have undergone a reduction in population size in NSW. This reduction is believed to have resulted from the loss of suitable wetland habitat over a number of years. Birdlife International (2012) estimates the Australian population to be between 247 and 796 individuals and the NSW population to be between 82 and 162 individuals. In 2000, the area of occupancy for Australasian Bitterns in NSW was estimated to be between 600 and 800 square kilometres (km^2). However, as a result of loss of wetland habitat since that time, it is likely that this figure is now lower (NSW Scientific Committee, 2011).

Breeding sites, foraging habitat and food for Australasian Bitterns are threatened by drainage of wetlands and alteration of natural flow regimes (OEH, 2012a). The inland habitat of the Australasian Bittern is subject to diversion of water, salinisation and the drainage of permanent swamps (Garnett and Crowley, 2000). Grazing and burning of wetland habitats and predation by European red foxes and feral cats may also threaten the Australasian Bittern. Other threats include reduced water quality as a result of siltation and pollution and the use of pesticides and other chemicals near wetland areas (OEH, 2011b).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Australasian Bittern has been recorded in the Lower Murray-Darling CMA including in the Willandra Lakes Region World Heritage Area (NPWS, 2003) and Kinchega National Park (OEH, 2012a), closest to the Project area is a record from the Atlas of NSW Wildlife Database located approximately 63 km to the south-east (Figure C-19). While the species was not recorded in the Project area or surrounds and there are no records within a 20 km radius of the study area, potential foraging habitat may be impacted by the Project. In addition, this species often occurs together with the Australian Painted Snipe (*Rostratula australis*) (SEWPaC, 2012), which has been recorded in the locality. Potential foraging habitat for this species in the Project area and surrounds is located within and around two patches of Ephemeral Wetland; one patch occurs in the south-eastern section of the proposed offset area and the other adjacent to the Campaspe footprint. Additional foraging habitat occurs in form of Grass and Herbland Depressions in the proposed offset area and Chenopod Depressions along the MCTR (Figures C-20 and C-21).

The Ephemeral Wetland in the proposed offset area contains potential habitat in the form of ground vegetation on the western side. The wetland close to the Campaspe footprint lacks ground and mid-layer vegetation closest to the water on all sides of the waterbody, presumably due to the movement of cattle. Some shelter resources occur close to the water's edge in the form of fallen logs and grassy vegetation. The edges of Grass and Herbland Depressions as well as Chenopod Depressions are surrounded by quite dense ground vegetation.

The Project would result in the loss of 5 ha of potential foraging habitat that this species could use during wetter periods.

The proposed mining at Atlas and Campaspe is expected to have a limited, localised and temporary effects on areas where temporary surface ponding occurs at the Atlas Campaspe Mine site (i.e. through excavation) (GEO-ENG, 2013). This applies to depressions located beside and 2.5 km to the south of the Campaspe footprint.

There are two Ephemeral Wetlands associated with Black Box Woodland with potential to be indirectly impacted by changes to hydrology. The initial mine design was refined to avoid as much of the Black Box Woodland and the associated Ephemeral Wetland in these locations as practicable. However, mining of the Campaspe deposit (between Years 11 to 13) would remove an area of woodland and part of the clay associated with the water holding capacity in this depression. The total water holding capacity of the depression may be affected if the clay material to be removed was replaced with overburden and process waste after mining. To minimise this, Cristal Mining would selectively place clay material in low-lying portions of the re-profiled landform within the mine path to reinstate run-on to adjacent depressions. The Campaspe footprint would also temporarily prevent surface runoff from flowing into these wetlands from the north for the duration of the mining of the Campaspe deposit. Cristal Mining would partly restore the local catchment to this Ephemeral Wetland by designing the rehabilitated mine landform to maximise the surface water flow to this area.

While potential habitat (5 ha) for this species would be removed by the Project and there is a chance that further potential habitat would be impacted by temporary hydrological changes and disturbance from mining operations, it is considered that the Project is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species (if one were to exist) is likely to be placed at risk of extinction given that:

- Only a relatively small area (5 ha) of potential habitat in Chenopod Depression habitat would be directly impacted by the proposed Project.
- A total of 21 ha of similar potential habitat, including Ephemeral Wetland and Grassland Herbland Depression habitat would be conserved in the proposed offset area.
- Better quality habitat exists in the surrounding area, including in the wetlands of the Willandra Creek and Willandra Lakes Region World Heritage Area, which are considered to be significant in the Murray Darling Depression Bioregion (NPWS, 2003)

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Project would result in the loss of 5 ha of potential foraging habitat that this species could use during wetter periods. While there would be no direct impact on Ephemeral Wetland habitat, there is potential for the Ephemeral Wetland adjacent to the Campaspe deposit to be indirectly impacted by changes in hydrological regimes in the area and from disturbance due to mining operations. The Campaspe footprint would temporarily prevent surface runoff from flowing into these wetlands from the north for the duration of the operation of the Campaspe section of the mine. Cristal Mining would partly restore the local catchment to this Ephemeral Wetland by designing the rehabilitated mine landform to maximise the surface water flow to this area.

Changes to the hydrology in the area can, potentially, reduce the amount of water entering the Ephemeral Wetlands. Changes to water levels and time periods between inundation can potentially have flow-on effects on all water-dependent biota including aquatic, semi-aquatic and fringing vegetation, aquatic invertebrates, amphibians and more (OEH, 2011b). A habitat map for the species has been provided in Figure C-20 and C-21.

(ii) The Atlas-Campaspe Mine footprint would not result in fragmentation or isolation of known habitat for this species.

(iii) Given that the area of potential habitat to be removed is only small (5 ha), that 21 ha of similar habitat, including an Ephemeral Wetland would be conserved in the proposed offset area and that better quality habitat exists in the surrounding area, including in the Willandra Creek and Willandra Lakes Region World Heritage Area (NPWS, 2003), it is considered that the habitat to be removed is not likely to be important for the long-term survival of the species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No “critical habitat” for the Australasian Bittern is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011a).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Australasian Bittern, however OEH (2012a) recommends the following priority actions to assist with the recovery of the species, of relevance to the Project:

- Rehabilitate former key breeding wetlands where known and practical, to enhance habitat availability.
- As an adjunct to habitat protection, use fencing and/or signage to minimise damage to priority breeding sites (when known) from trampling by livestock, feral animals and/or human disturbance.
- Undertake targeted fox control at identified priority sites in accordance with the Fox Threat Abatement Plan.

The Ephemeral Wetlands in the area surrounding the Project area are currently unlikely to be breeding habitat for the Australasian Bittern. Given former breeding habitats are not always known, the Project may be inconsistent with the first priority action. The Ephemeral Wetland near the Campaspe footprint (9 ha) may be impacted indirectly by changes to hydrological regimes in the area and through disturbance.

The proposed offset area would conserve 21 ha of potential foraging habitat. Improved fire management, increased control of feral animals and reduced grazing pressure would allow regeneration of vegetation in the proposed offset area and give considerable compensation to offset localised habitat impact.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012b), the following are relevant to the location, the Project and the species:

1) Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
2) High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.

The Project would contribute to KTP1. There is the potential that flow regimes in the local area would be temporarily altered for the duration of the mine operations. Cristal Mining would partly restore the local catchment to this Ephemeral Wetland by designing the rehabilitated mine landform to maximise the surface water flow to this area. The Project is likely to contribute to this key threatening process, however these wetlands are ephemeral and whilst they are important in the local context given it is a limited resource, in a regional context they are not identified as a significant or key breeding areas for the species. In addition, Ephemeral Wetland habitat within the proposed offset area would be conserved and potentially enhanced through the removal of stock. There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks.

Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions for the species. Feral animal management plans would make considerable contributions to reduce KTPs 3 to 6.

Conclusion

The Australasian Bittern has been recorded in the Lower Murray-Darling CMA including in the Willandra Lakes Region World Heritage Area (NPWS, 2003) and Kinchega National Park (OEH 2012a). The closest record to the Project Area is a record from the Atlas of NSW Wildlife Database located approximately 63 km to the south-east. While the species was not recorded in the Project Area or surrounds and there are no records within a 20 km radius of the Project area, potential foraging habitat (Ephemeral Wetlands and Chenopod Depressions) may be impacted by the Project. In addition, the Australian Painted Snipe, which this species is known to be associated with, was recorded during the field surveys of the Project area.

The Project would result in the removal of 5 ha of potential foraging habitat for this species. In addition, potential changes to hydrological regimes and disturbance caused by the mining of the Campaspe deposit could have indirect impacts on Ephemeral Wetlands habitat, particularly 9 ha adjacent to the Campaspe footprint. However, the Project is not expected to have a significant impact on the Australasian Bittern given that:

1) This species was not recorded in the Project area and there are no records within a 20 km radius of the Project area.
2) The area of potential foraging habitat that would be removed is only small (5 ha).
3) A total of 21 ha of potential foraging habitat, including an Ephemeral Wetland would be conserved in the proposed offset area.
4) While potential hydrological changes and disturbance could impact Ephemeral Wetland habitat adjacent to the Campaspe footprint during mine operations, these wetlands are ephemeral and whilst they are important in the local context given it is a limited resource, in a regional context they are not identified as a significant or key breeding areas for the species. Therefore these impacts are not considered likely to affect the long-term survival of the species in the region.

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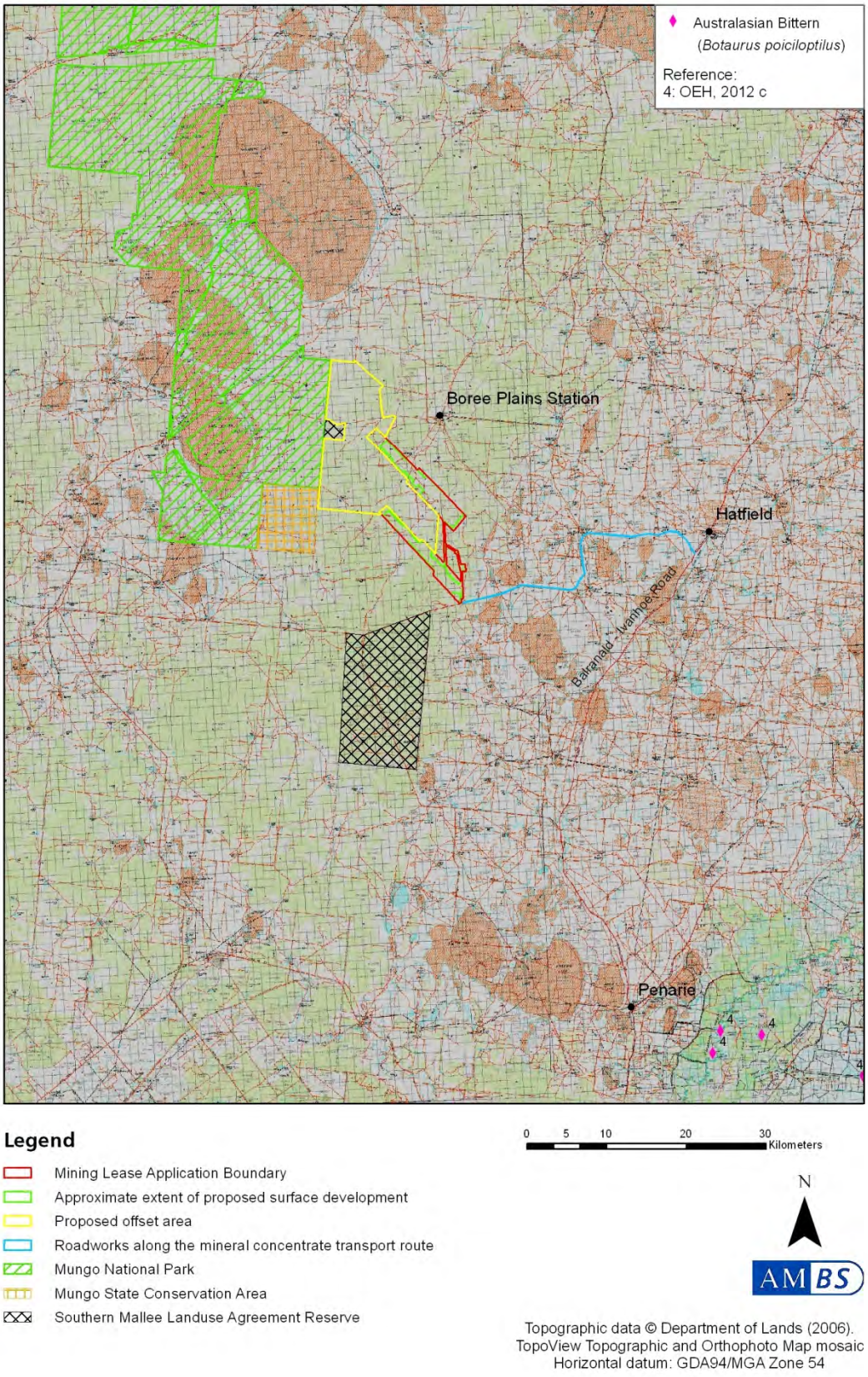

Figure C-19 Australasian Bittern - Landscape Distribution

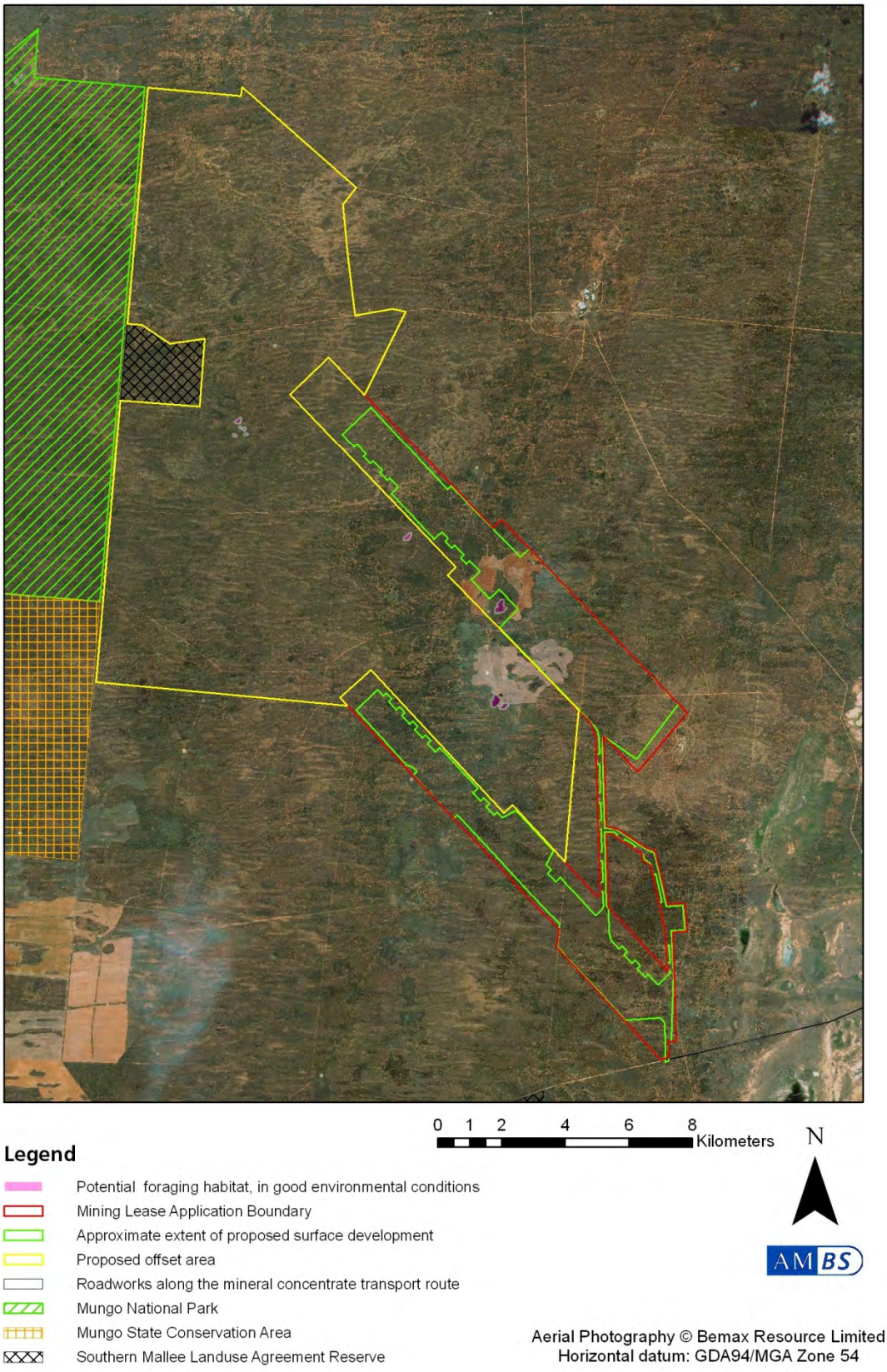

Figure C-20 Australasian Bittern - Potential Habitat

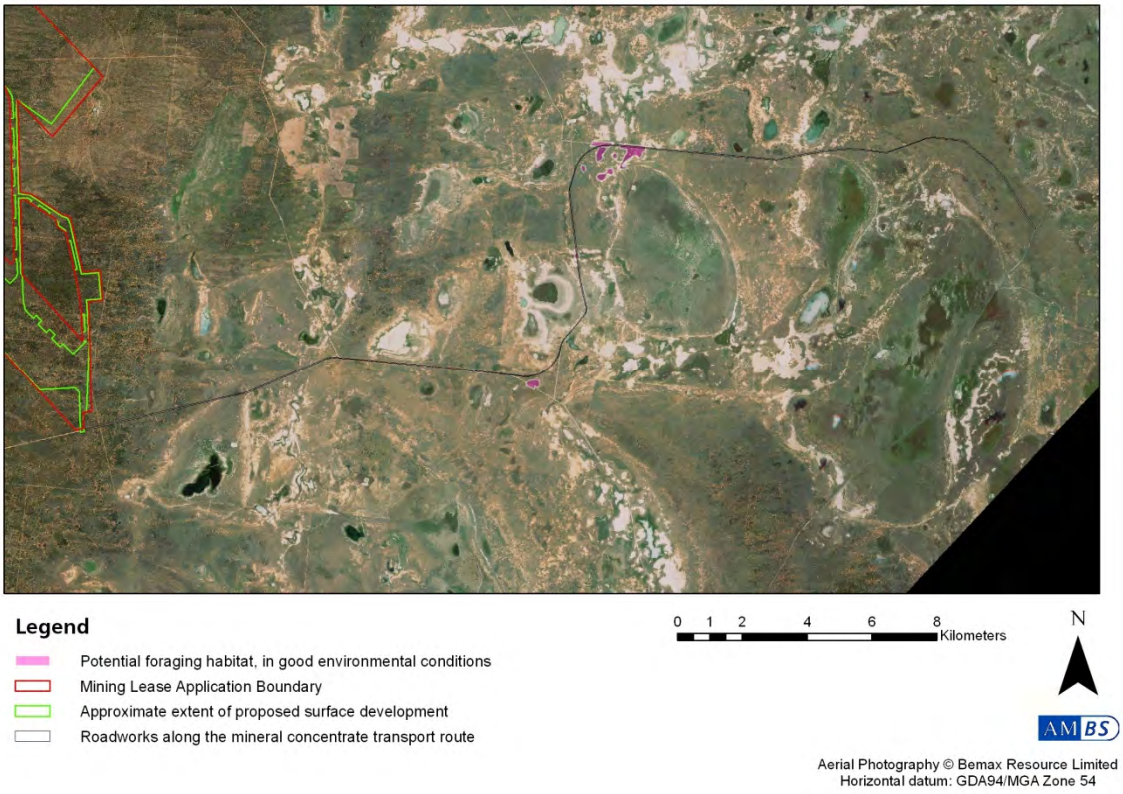

Figure C-21 Australasian Bittern - Potential Habitat - Mineral Concentrate Transport Route

Grey Falcon (Falco hypoleucos)

The Grey Falcon (*Falco hypoleucos*) is listed as endangered under Schedule 1 of the TSC Act. It is widely but sparsely distributed in woodland, shrubland and grassland in arid and semi-arid regions of mainland Australia (Olsen and Olsen, 1986; Marchant and Higgins, 1993; Thomas *et al.*, 2011; OEH, 2012a) where rainfall is less than 500 mm (Olsen, 1992). In NSW it is widely but sparsely distributed, occurring predominately throughout the Murray-Darling Basin and west of the Darling River (NSW Scientific Committee, 2009; OEH, 2012a). On occasion it is nomadic east of the Great Dividing Range (Marchant and Higgins, 1993; OEH, 2012a). They are associated with lightly timbered plains particularly acacia shrublands crossed by tree-lined watercourses, wetlands and rocky gorges and gullies (Olsen and Olsen, 1986; Olsen, 1992; Thomas *et al.*, 2011; OEH, 2012a). They are also frequently found in spinifex and tussock grassland (Olsen and Olsen, 1986). The Grey Falcon is occasionally found in open woodlands near the coast (OEH, 2012a). While the breeding biology of this species is not well known (Marchant and Higgins, 1993; Aumann, 2001a) anecdotal observations indicate that they use old stick nests previously build by crows, ravens or other raptor species (NSW Scientific Committee, 2009; 2011). They generally lay between 2 and 3 eggs in late winter and early spring (Marchant and Higgins, 1993; OEH, 2012a) and generally fail to breed during severe drought (Olsen and Olsen, 1986). Their generation length is estimated at 10 years (Garnett and Crowley, 2000). The nests are usually found high up in emergent trees of riparian woodlands (Olsen and Olsen, 1986; Aumann, 2001b; NSW Scientific Committee, 2011), particularly in *Eucalyptus camaldulensis* (River Gum) along watercourses (Marchant and Higgins, 1993). Grey Falcons are highly mobile species and commonly travel over hundreds of kilometres (Marchant and Higgins, 1993). They use standing dead trees as lookout posts for targeting prey which are primarily birds such as parrots and pigeons, but also reptiles and mammals (Olsen and Olsen, 1986; Marchant and Higgins, 1993; OEH, 2012a) and occasionally carrion (Olsen and Olsen, 1986).

In NSW the breeding range of the Grey Falcon has contracted since the 1950's and is now confined to arid parts of their range (OEH, 2012a). Woodland has been cleared extensively in the sheep-wheat belt with much of the Grey Falcon's habitat degraded by overgrazing (e.g. Brigalow Belt South, NSW south western Slopes, Darling Riverine Plains, Riverina) (Barrett *et al*., 2007; NSW Scientific Committee, 2009). In particular, they may be threatened due to a limited supply of nesting trees for which they interspecifically and intraspecifically compete for (NSW Scientific Committee, 2009). This problem is exacerbated where grazing prevents tree regeneration (Marchant and Higgins, 1993). Continued overgrazing of arid rangelands may also affect their prey abundance (Marchant and Higgins, 1993). It is suggested that there could be less than 5,000 individuals left in NSW but population trends are unclear (OEH, 2012a). They are also suggested to be extinct in areas with greater than 500 mm of rainfall in NSW (OEH, 2012a). Other potential threats are from human disturbance and include secondary poisoning through mouse and locust control programmes, robbery of eggs and chicks, hunting and collision hazards with human structures such as powerlines, fences and wind turbines (NSW Scientific Committee, 2009; 2011; OEH, 2012a).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Grey Falcon has not been recorded in the Project area or surrounding area within a 20 km radius. The closest record is from the Atlas of NSW Wildlife Database for the Atlas-Campaspe Mine study area is more than 100 km to the north-east of the Project Area (OEH, 2012b). In relation the Ivanhoe Rail Facility, the species is known to occur within the Darling Depression (Part B) CMA sub-region without any geographical restrictions (OEH, 2012a).

The Project would not remove any known populations or place a local population at risk of extinction given that few records exist in the region and are located further than 100 km outside the Project area.

The Project would not impact directly on any aspect of the life cycle of this species (e.g. breeding, migration and dispersion, gene flow, etc.). It may impact indirectly through the removal of potential nesting trees in the Black Box Woodland habitat associated with the Campaspe footprint, which is addressed in response to question d. No Black Box Woodland would be directly or indirectly impacted by the Project in the Ivanhoe Rail Facility footprint.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) Approximately 50 ha of potential breeding and foraging habitat would be removed as a result of the Project (i.e. Black Box Woodland) and 4,368 ha of potential foraging habitat in relation to the Atlas-Campaspe Mine footprints. This includes 80 ha Chenopod Shrubland, 5 ha Chenopod Shrubland Depression, 3 ha Sandhill Pine Woodland, 200 ha Acacia Woodland/Shrubland, 1,040 ha Linear Dune Mallee, 535 ha Sandplain Mallee, 2,035 ha Belah-Rosewood Woodland, 170 ha Disturbed Shrubland and 300 ha Cleared Land) (Figure C-22 and C-23). A further 45 ha of suitable foraging habitat comprised of Belah-Rosewood Woodland, Native Grassland and Cleared Land would be removed as a result of the Project in the Ivanhoe Rail Facility footprint (Figure C-24). No breeding habitat for the species is likely to be impacted in the Ivanhoe Rail Facility study area.

(ii) Potential habitat in both Ivanhoe Rail Facility and Atlas-Campaspe Mine footprints would become further fragmented, but in both cases these areas would not become isolated as they remain connected to continuous tracts of vegetation to the north, west and south in relation to the Atlas-Campaspe Mine, and to the west and south in relation to the Ivanhoe Rail Facility. This fragmentation is not likely to impact the species given they are a highly mobile and wide ranging species.

(iii) The habitat to be removed is not likely to be integral to the survival of the Grey Falcon considering that it has not been recorded in the Project area or surrounds. The species is highly mobile and habitat conserved in the proposed offset area extends to 16,540 ha of which 90 ha is potential habitat for breeding (which would assist with the maintenance of potential nesting trees in the local area) as well as foraging. Only a small amount of potential foraging habitat would be removed in relation to the Ivanhoe Rail Facility and no breeding habitat would be removed in this area. Further, potential impacts relating to the Ivanhoe Rail Facility may be compensated for through the protection and enhancement of potential foraging habitat within the Vegetation Management Area.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" for the Grey Falcon is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Grey Falcon, however OEH (2012a) recommends the following priority actions to assist with the recovery of the species, of relevance to the Project:

- Educate and encourage landholders to protect and rehabilitate riparian habitat and implement grazing regimes that create or protect large areas of good quality habitat to enhance the prey biomass.

The Project is consistent with the above recovery action in that the management of the proposed offset area would include the removal of livestock, feral animal control and implement appropriate fire regimes to promote natural succession and allow a mosaic of unburnt areas to persist. All these actions are likely to assist with the increase in the biomass of native prey animals and therefore food resources for the Grey Falcon.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by the OEH (2012c), the following are relevant to the location, the Project and the species:

1) Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands.
2) Clearing of native vegetation.
3) High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
4) Competition and grazing by the feral European rabbit.
5) Competition and habitat degradation by feral goats.
6) Predation by the European red fox.
7) Predation by the feral cat.

The Project would contribute to KTP1 (as discussed above in response to question d) and KTP2. The Grey Falcon may be affected particularly by the loss of large trees associated with the Black Box Woodland habitat which may represent suitable nest trees. While the Project would result in the clearing of 50 ha of potential breeding and foraging habitat and 4,368 ha of potential foraging habitat within the Atlas-Campaspe Mine footprint, and 45 ha of potential foraging habitat in the Ivanhoe Rail Facility footprint, substantial habitat exists in the surrounding area including 90 ha of potential breeding and foraging habitat as well as 16,540 ha of potential foraging habitat would be conserved and improved in the proposed offset area associated with the Atlas-Campaspe Mine. There may also be some potential to contribute to KTP3, however a fire management strategy would be developed for the Project to minimise the potential for fire outbreaks.

Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions for the species and its prey species. Feral animal management plans would make considerable contributions to reduce KTPs 4 to 7 and would allow regeneration of vegetation and potentially enhance prey biomass for the Grey Falcon.

Conclusion

The Grey Falcon has not been recorded in the Project area or surrounding area within a 20 km radius. The closest record is an Atlas of NSW Wildlife Database record more than 100 km to the north-east of the Atlas-Campaspe Mine footprint. No database records exist in the close surrounds to the Ivanhoe Rail Facility study area.

The Atlas-Campaspe Mine footprint would result in the removal of 50 ha of potential breeding and foraging habitat and 4,368 ha foraging habitat, and there is potential for 9 ha of Ephemeral Wetland to be indirectly impacted by changes in hydrological regimes in the area and from disturbance due to mining operations. An additional 45 ha of potential foraging habitat would be removed in the Ivanhoe Rail Facility footprint.

However, the Project is not expected to have a significant impact on the Grey Falcon given that:

1) The species has not been recorded in the Project area or surrounds.
2) The potential breeding and foraging habitat for the Grey Falcon that is directly impacted is relatively small (50 ha) and a similar area of breeding and foraging habitat (90 ha) would be conserved in the proposed offset area associated with the Atlas-Campaspe Mine. No breeding habitat would be removed in relation to the Ivanhoe Rail Facility.
3) A relatively small amount of potential foraging habitat (4,368 ha) that would be removed compared to the amount of potential habitat (16,540 ha) conserved and enhanced in the proposed offset area.
4) Any potential habitat that would be fragmented or isolated is unlikely to have more than a negligible impact for this highly mobile species.

Post-mining landforms would be rehabilitated and revegetated, and a considerable amount of native potential habitat would be conserved and enhanced in the proposed offset areas.

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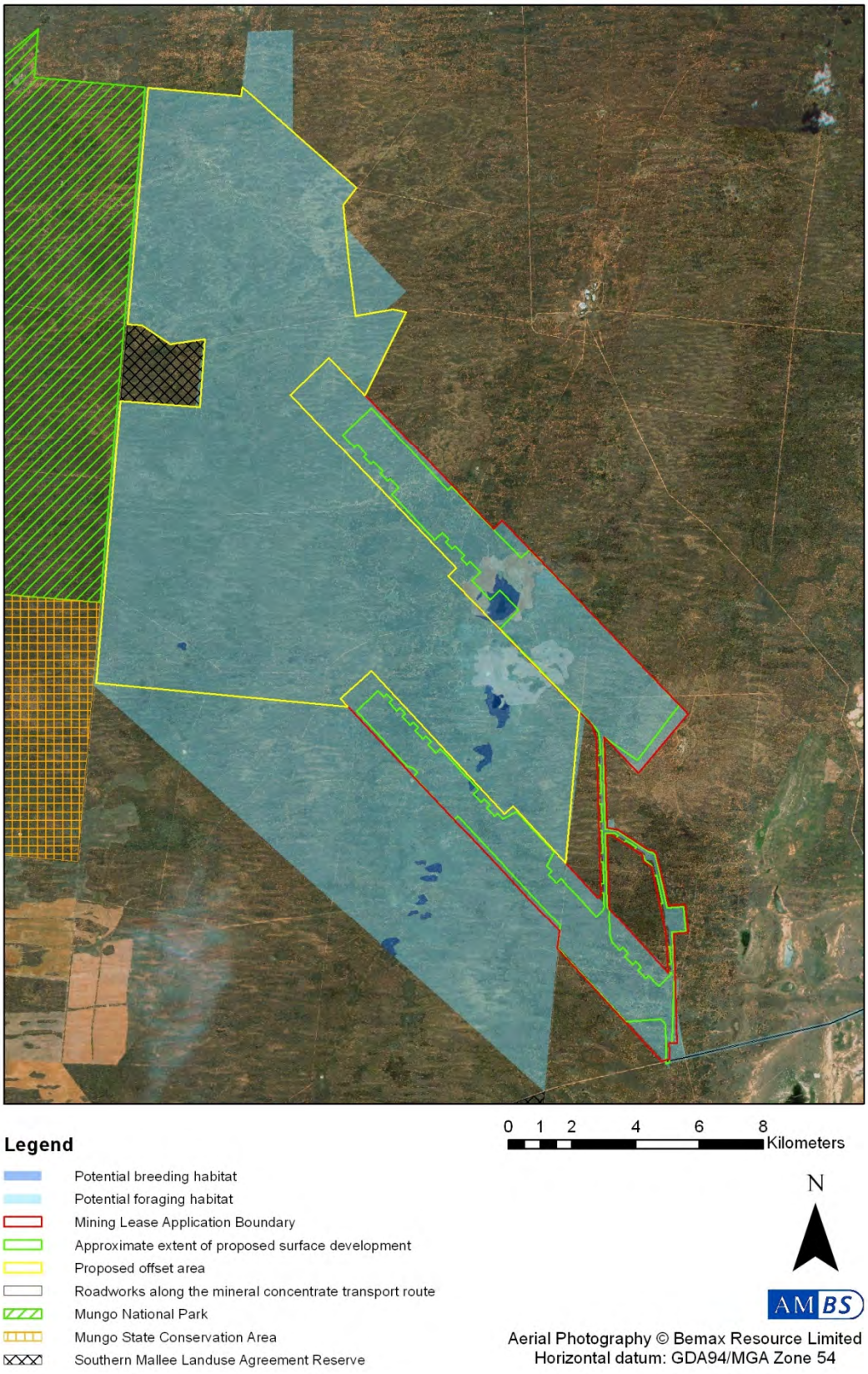

Figure C-22 Grey Falcon - Potential Habitat

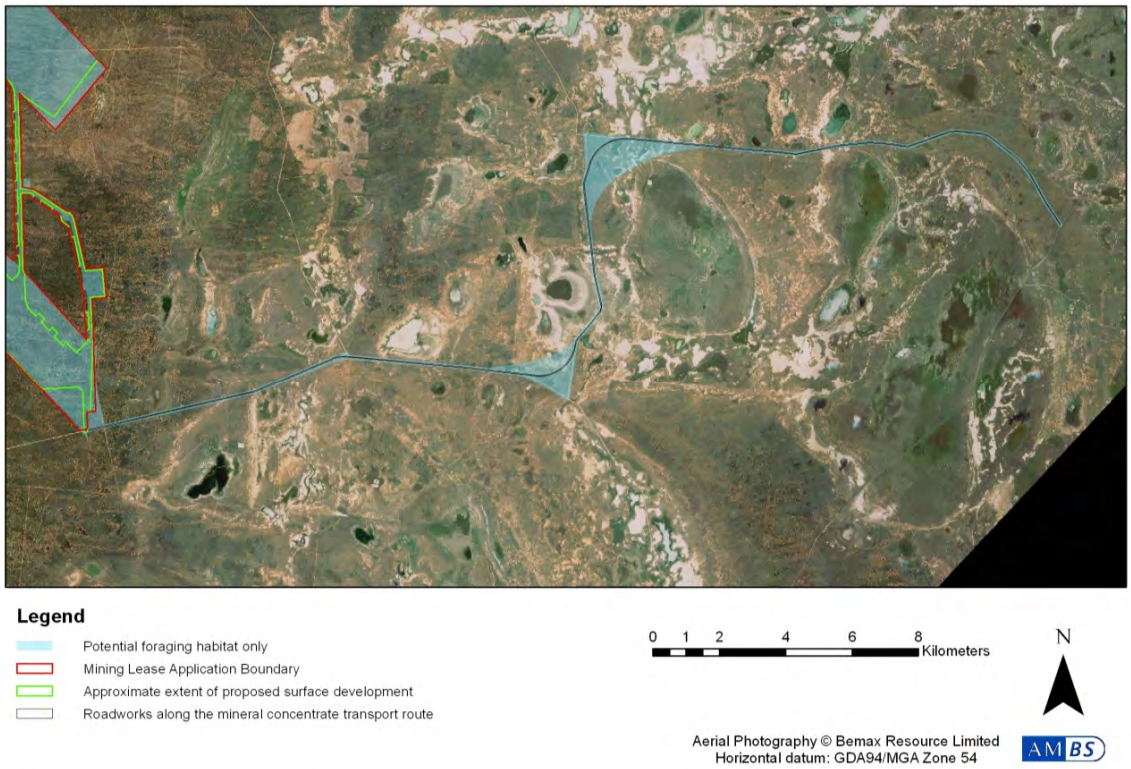

Figure C-23 Grey Falcon - Potential Habitat - Mineral Concentrate Transport Route

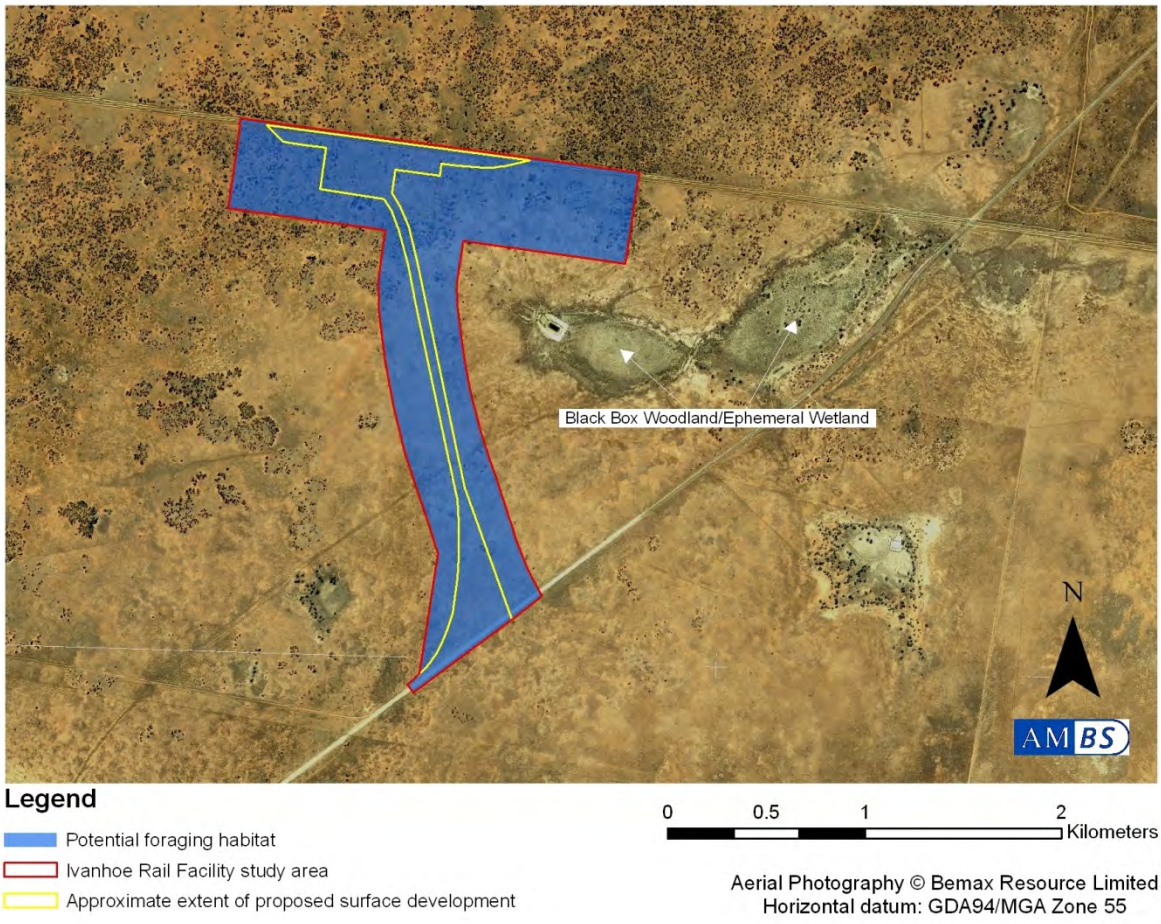

Figure C-24 Grey Falcon - Potential Habitat - Ivanhoe Rail Facility

Square-tailed Kite (Lophoictinia isura)

The Square-tailed Kite (*Lophoictinia isura*) has been listed as vulnerable under Schedule 2 of the TSC Act. It is endemic to Australia, widespread but sparsely distributed throughout the mainland (Debus and Czechura, 1989; Marchant and Higgins, 1993). Its range occurs predominately within 250 km of the coast from south Western Australia, the Pilbara and Kimberley regions, the Top End, eastern Queensland, and NSW to Victoria (Debus and Czechura, 1989; OEH, 2012a). In NSW they are recorded throughout the state and are common residents in the north, north-east and along the major west-flowing river systems (i.e. Darling and Murray rivers) (Ayers *et al.*, 1996; OEH, 2012a). They inhabit a variety of habitats from eucalypt open forest, dry woodlands, open forests, and pasture of tropical and temperate Australia particularly in the vicinity of timbered watercourses (Debus and Czechura, 1989; Marchant and Higgins, 1993; OEH, 2012a). In NSW it particularly favours box-ironbark-gum woodlands on the inland slopes, productive forests on the coastal plain and Coolibah/River Red Gum on the inland plains (Marchant and Higgins. 1993). They are a breeding migrant in south-eastern Australia from July to February and nest sites are located generally along or near watercourses (Debus and Czechura, 1989; OEH, 2012a). Large stick platform nests are placed in open forest, woodland and near edges or openings in forest and in non-coastal situations within riparian woodland (Debus and Czechura, 1989; NSW Scientific Committee, 2009). They attempt only one clutch per season laying one to two eggs in winter (Cameron, 1992; NSW Scientific Committee, 2009). Their generation length is estimated at 10 years (Garnett and Crowley, 2000). It hunts over open forests, woodland and mallee communities, coastal heathlands, often near the openings and forest edges, around suburban trees and shrubs (Garnett and Crowley, 2000; NSW Scientific Committee, 2009). They feed predominately on small birds and their nest contents in addition to large insects, reptiles and on occasion small mammals (NSW Scientific Committee, 2009).

The population level trends are currently unclear but the number of breeding animals in NSW is suggested to be between 100 and 1,000 birds (NSW Scientific Committee, 2009). Currently there is no evidence to suggest a decline in this species, but a non-significant trend towards a population level increase is evident in NSW (Barrett *et al.*, 2007). There is also no evidence of extreme population level fluctuations and the populations throughout NSW appear to be stable (NSW Scientific Committee, 2009). However, population level recovery is suggested to be slow due to low recruitment rates in this species (Jolly, 1989). It is unclear how human disturbance influences this species. The species has been suggested to tolerate routine human disturbance (Bischoff *et al.*, 2000), but also may be threatened by expanding coastal cities that may affect the foraging and breeding habits of this species (NSW Scientific Committee, 2009). Regardless, currently identified threats include the clearing of native vegetation through logging, burning and grazing which may result in a reduction of nesting and feeding sites for this species (NSW Scientific Committee, 2009; OEH, 2012a). In particular the removal of nest trees near watercourses is particularly threatening (OEH, 2012a), as is the need to breed in species rich patches of woodland (Olsen, 1998). For example, up to 84% of "potential breeding sites for the Square-tailed Kite" situated on the NSW tablelands and western slopes have been cleared (Morgan, 2000; Barrett *et al.*, 2007; NSW Scientific Committee, 2009). Other NSW bioregions including the Riverina, Darling Riverine Plains and coastal plains are also stressed environments due to clearing up to 40% of the land (Morgan, 2000; Barrett, *et al.*, 2007; NSW Scientific Committee, 2009). Most of the native vegetation in the south and east of the species range has been cleared for agriculture (Olsen, 1998; NSW Scientific Committee, 2009). Other threats include illegal egg collection, hunting, and collision hazards with windfarms (OEH, 2012a).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Square-tailed Kite has not been recorded in the Project area or within a 20 km radius of the Project area. The closest record is from the Atlas of NSW Wildlife Database for the Atlas-Campaspe Mine footprint is a record approximately 50 km to the south-east of the Project area (Figure C-25; OEH, 2012b). No database records are located within the close surrounds to the Ivanhoe Rail Facility study area.

The Project would not remove any known populations or place the local population at risk of extinction given that few known localities exist in the region and are located further than 50 km from the Project area. Further no suitable breeding habitat would be removed in the Project area.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine footprint would progressively remove approximately 4,418 ha of potential foraging habitat for this species. This includes 2,035 ha Belah-Rosewood Woodland, 1,040 ha Linear Dune Mallee, 535 ha Sandplain Mallee, 300 ha Cleared Land, 200 ha Acacia Woodland/Shrubland, 170 ha Disturbed Area Shrubland, 80 ha Chenopod Shrubland, 50 ha Black Box Woodland, 5 ha Chenopod Shrubland Depression and 3 ha Sandhill Pine Woodland. Protection and habitat enhancement of foraging habitat within the proposed offset area (16,540 ha) could provide considerable compensation (Figure C-26 and C-27). A further 45 ha of suitable foraging habitat comprised of Belah-Rosewood Woodland, Native Grassland and Cleared Land would be removed as a result of the Project in the Ivanhoe Rail Facility footprint (Figure C-28). No breeding habitat for the species is likely to be impacted in the Ivanhoe area.

(ii) Potential habitat in both Ivanhoe Rail Facility and Atlas-Campaspe Mine footprints would become further fragmented, but in both cases these areas would not become isolated as they remain connected to continuous tracts of vegetation to the north, west and south in relation to the Atlas-Campaspe Mine, and to the west and south in relation to the Ivanhoe Rail Facility. Further, fragmentation impacts are not likely to impact this species given they are a highly mobile and dispersive.

(iii) The habitat to be removed is not likely to be integral to the survival of the Square-tailed Kite considering that it has not been recorded in the Project area or surrounds. The species is highly mobile and habitat conserved in the proposed offset area extends to 16,540 ha of similar habitat to the Atlas-Campaspe Mine (Figure C-26). Only a small amount of potential foraging habitat would be removed in relation to the Ivanhoe Rail Facility and no breeding habitat would be removed in this area.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" for the Square-tailed Kite is listed in the Register of Critical Habitat kept by the Director General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Square-tailed Kite and none of the recommended recovery actions to assist with the recovery of the species OEH (2012a) are of relevance to the Project.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by the OEH (2012c), the following are relevant to the location, the Project and the species:

1) Clearing of native vegetation.
2) High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.

The Project would contribute to KTP1 (as discussed in response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions for the species and its prey species. Feral animal management plans would make considerable contributions to reduce KTPs 3 to 7 and would allow regeneration of vegetation and potentially enhance prey biomass for the Square-tailed Kite.

Conclusion

The Square-tailed Kite has not been recorded in the Atlas-Campaspe Mine footprint or within a 20 km radius of the Project area. The closest locality is an Atlas of NSW Wildlife Database record approximately 50 km to the south-east of the Atlas-Campaspe Mine footprint (OEH, 2012b).

The Project would progressively remove approximately 4,418 ha of potential foraging habitat for this species in relation to the Atlas-Campaspe Mine. A further 45 ha of suitable foraging habitat would be removed as a result of the Project in the Ivanhoe Rail Facility footprint. Protection and habitat enhancement of known habitat within the proposed offset area (16,540 ha) could provide considerable compensation.

The Project is unlikely to have a significant impact on the Square-tailed Kite such that a local viable population would be placed at risk of extinction given that:

1) The species has not been recorded in the Project area or surrounding region;
2) A relatively small amount of potential foraging habitat would be cleared (4,418 ha within the Atlas-Campaspe Mine footprint and 45 ha within the Ivanhoe Rail Facility footprint, compared to the amount of potential foraging habitat conserved and enhanced in the proposed offset Area associated with the mine [16,540 ha]).
3) Any potential habitat that would be fragmented or isolated is unlikely to have more than a negligible impact for this highly mobile species.

Post-mining landforms would be rehabilitated and revegetated within the Atlas-Campaspe Mine footprint, and a considerable amount of native potential habitat would be conserved and enhanced in the proposed offset areas.

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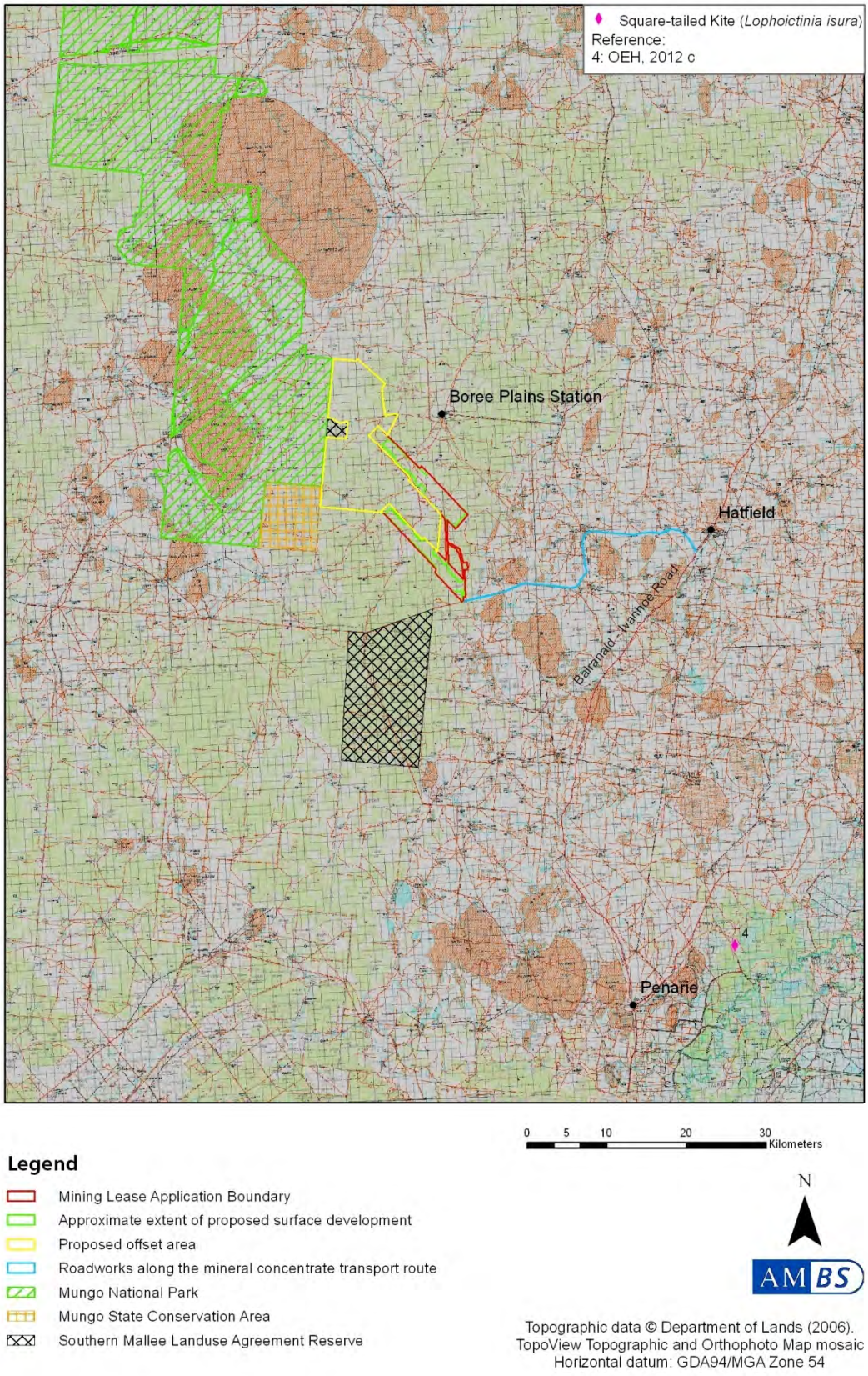

Figure C-25 Square-tailed Kite - Landscape Distribution

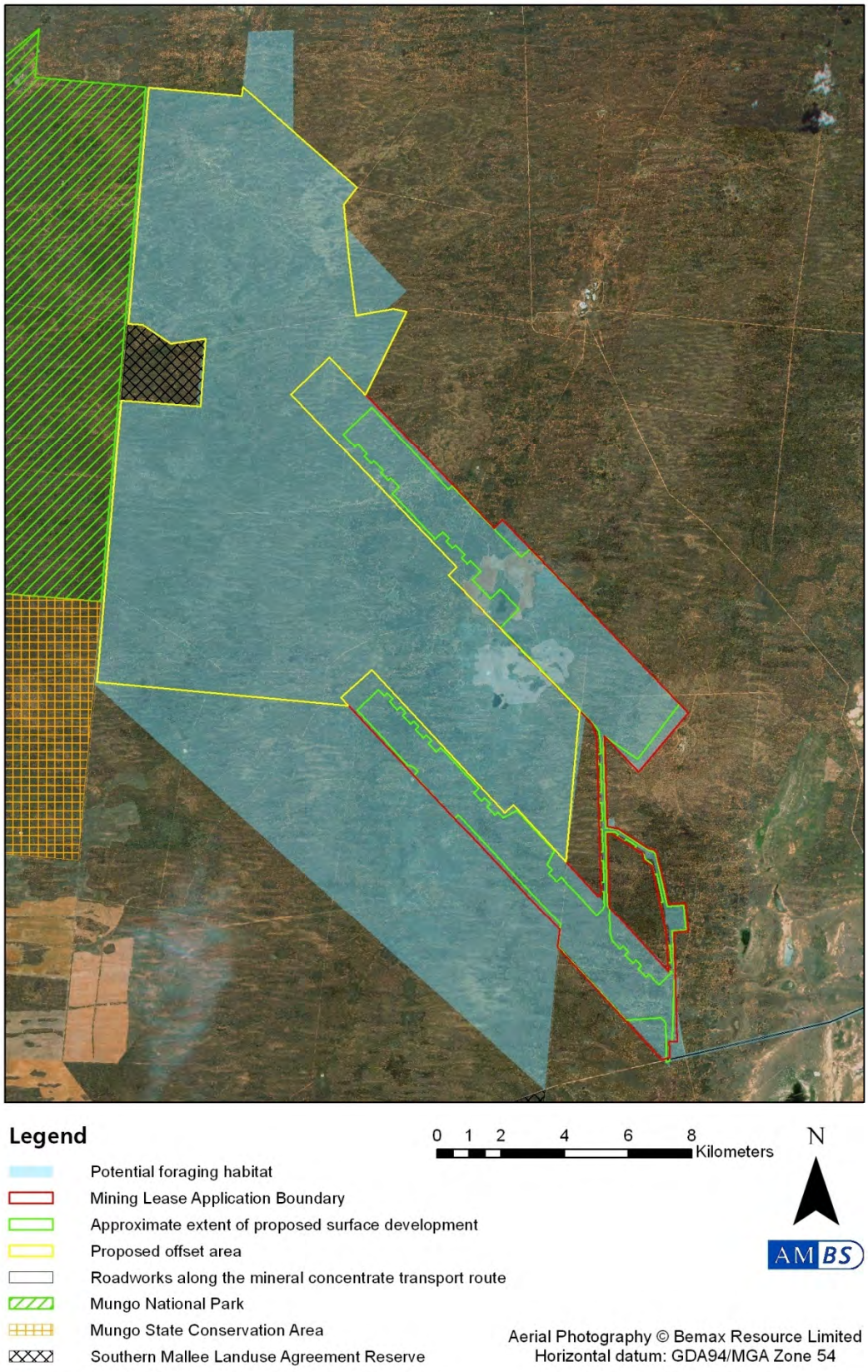

Figure C-26 Square-tailed Kite - Potential Habitat

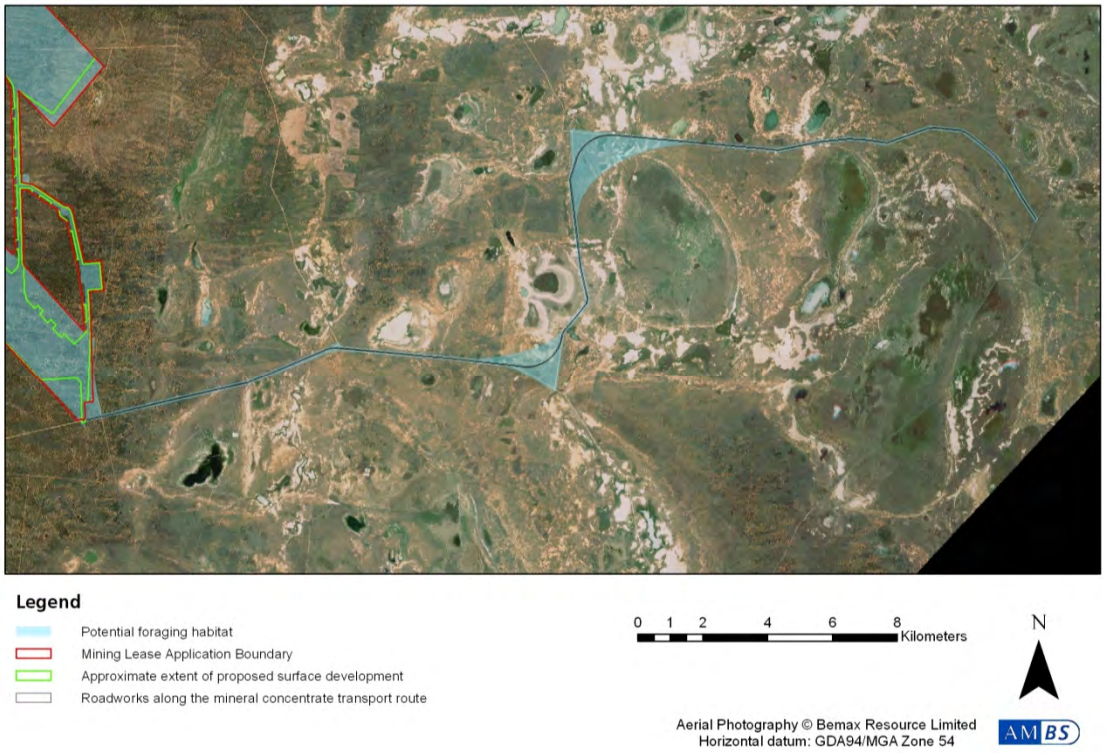

Figure C-27 Square-tailed Kite - Potential Habitat - Mineral Concentrate Transport Route

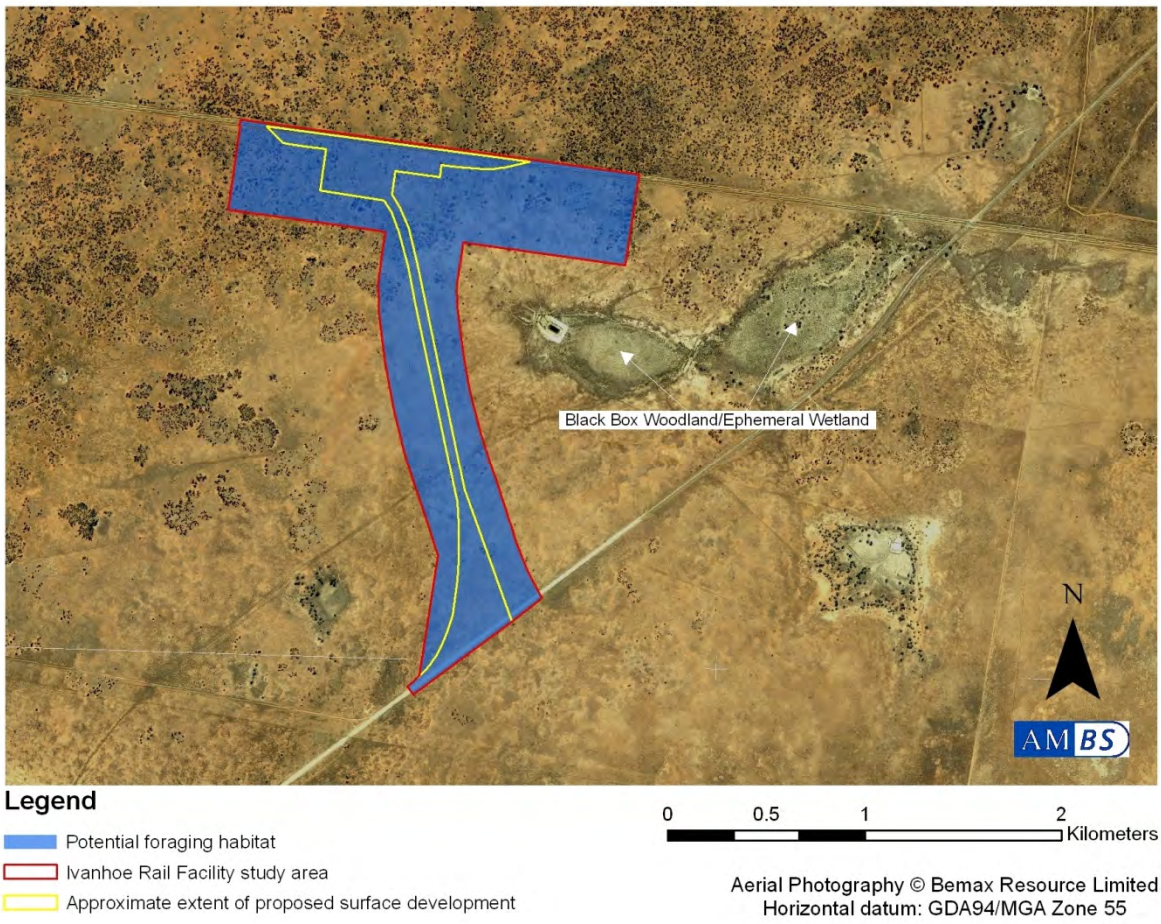

Figure C-28 Square-tailed Kite - Potential Habitat - Ivanhoe Rail Facility

Black-breasted Buzzard (Hamirostra melanosternon)

The Black-breasted Buzzard (*Hamirostra melanosternon*) has been listed as vulnerable under Schedule 2 of the TSC Act. It is endemic to Australia, occurring sparsely in the north and in semi-arid central regions. It is rare in eastern, southern coastal or near-coastal mainland (Australian Museum, 2010; OEH, 2012a). They are partially migratory in northern Australia (rainfall dependent) but sedentary in south-eastern Australia. They favour habitats along timbered watercourses such as riparian river red gum complexes in lightly timbered plains and also occur in open country (Aumann, 2001a; Australian Museum, 2010; OEH, 2012a). They nest throughout the year when rainfall is plenty but generally breed from August to October and nest in tall trees. During drought years they may not breed and they rarely breed east of the Great Dividing Range (Australian Museum, 2010; OEH, 2012a). Black-breasted Buzzards feed on small mammals such as rabbits, birds including nestlings, carrion and lizards (Aumann, 2001a; Australian Museum, 2010; OEH, 2012a). It also specialises on feeding on emu eggs where they are reported to crack them on rocks (Aumann, 1990). They forage low over a diversity of mid-dense and or dense shrubland habitats (Aumann, 2001b).

Throughout the southern Australian region extensive clearing of native vegetation is leading to a decline in the population levels of the Black-breasted Buzzard. Extensive tree clearing along inland watercourses, grazing, illegal egg collection and shooting are responsible for the vulnerability of this species (OEH, 2012a). Removal of nesting trees may have affected numbers in NSW. While they are widespread they are uncommon (Marchant and Higgins, 1993).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Black-breasted Buzzard has not been recorded in the Project area or within a radius of 20 km of the Project area. The nearest record is from the Atlas of NSW Wildlife in a locality approximately 55 km to the south-west of the Atlas-Campaspe Mine Project area (Figure C-29). The species is known, however, to occur within the Darling Depression (Part B) CMA sub-region without any geographical restrictions (OEH, 2012a).

The Project would not remove any known populations or place the local population at risk of extinction given that few known localities exist in the region and the closest record is located further than 50 km outside the Atlas-Campaspe Mine footprint. The Project would not impact directly on any aspect of the life cycle of this species (e.g. breeding, migration and dispersion, gene flow etc.). It may impact indirectly through the removal of potential habitat, which is addressed in response to question d.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine would progressively remove approximately 3,660 ha of potential breeding and foraging habitat for this species. This includes 2,035 ha Belah-Rosewood Woodland, 1,040 ha Linear Dune Mallee, 535 ha Sandplain Mallee and 50 ha Black Box Woodland. An additional 758 ha of foraging habitat would also be removed. This includes 300 ha of Cleared Land, 200 ha Acacia Woodland/Shrubland, 170 ha of Disturbed Shrubland, 80 ha Chenopod Shrubland, 5 ha Chenopod Shrubland Depressions and 3 ha Sandhill Pine Woodland (Figures C-30 and C-31). This level of clearing is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction, due to an absence of sightings within the Atlas Campaspe Mine footprint and surrounds, the wide ranging nature of the species and their relatively small amount of habitat that would be removed. Protection and habitat enhancement of known breeding and foraging habitat within the proposed offset area (16,540 ha) could provide considerable compensation (Figure C-30 and C-31).A further 10 ha of potential breeding and foraging habitat in Belah-Rosewood Woodland and 30 ha of foraging habitat in Native Grassland would be removed in relation to the Ivanhoe Rail Facility (Figure C-32). This level of clearing is also considered to be minor in relation to the viability of a local population (if one exists).

(ii) Potential habitat in both Ivanhoe Rail Facility and Atlas-Campaspe Mine footprints would become further fragmented, but in both cases these areas would not become isolated as they remain connected to continuous tracts of vegetation to the north, west and south in relation to the Atlas-Campaspe Mine, and to the west and south in relation to the Ivanhoe Rail Facility. Further, this scale of fragmentation is not likely to impact this species given they are a highly mobile and wide ranging species

(iii) The habitat to be removed is not likely to be integral to the survival of the Black-breasted Buzzard considering that it has not been recorded in the Project area and the species is highly mobile. In addition, substantial areas of breeding and foraging habitat (9,640 ha Linear Dune Mallee, 3,125 ha Sandplain Mallee, 2,560 ha Belah-Rosewood and 90 ha Black Box Woodland) as well as foraging only habitat (430 ha Disturbed Area Shrubland, 415 ha Acacia Woodland/Shrubland, 270 ha Cleared Land, and 10 ha Grass and Herbland Depressions) would be conserved and enhanced in the proposed offset area. In relation to the Ivanhoe Rail Facility, any local population of the species would be unlikely to rely on the potential habitat that would be impacted. Higher quality habitat occurs in the nearby surrounds.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No “critical habitat” for the Black-breasted Buzzard is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Black-breasted Buzzard, however OEH (2012a) recommends the following priority actions to assist with the recovery of the species, of relevance to the Project:

- Educate and encourage landholders to protect and rehabilitate riparian habitat and implement grazing regimes that create or protect large areas of good quality habitat to enhance the prey biomass.

The Project is consistent with the above recovery action in that the management of the proposed offset area would include the removal of livestock, feral animal control and implement appropriate fire regimes to promote natural succession and allow a mosaic of unburnt areas to persist. All these actions are likely to assist with the increase in the biomass of native prey animals and therefore food resources for the Black-breasted Buzzard.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012b), the following are relevant to the location, the Project and the species:

1) Clearing of native vegetation.
2) High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.

The Project would contribute to KTP1 (as discussed in response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions for the species and its prey species. Feral animal management plans would make considerable contributions to reduce KTPs 3 to 6 and would allow regeneration of vegetation and potentially enhance prey biomass for the Black-breasted Buzzard.

Conclusion

The Black-breasted Buzzard has not been recorded in the Project area or within a radius of 20 km of the Project area. The nearest record is from the Atlas of NSW Wildlife in a locality approximately 55 km to the south-west of the Atlas-Campaspe Mine footprint (Figure C-29). The Project would progressively remove approximately 3,660 ha of potential breeding and foraging habitat, and an additional 758 ha of foraging only habitat in the Atlas-Campaspe Mine footprint. Impacts associated with the Ivanhoe Rail Facility footprint include loss of 10 ha of potential breeding and foraging habitat and an additional 30 ha of foraging only habitat. Protection and habitat enhancement of known habitat within the proposed offset area (16,540 ha) could provide considerable compensation.

The Project is unlikely to have a significant impact on the Black-breasted Buzzard such that a local viable population would be placed at risk of extinction given that:

1) The species has not been recorded in the Project area or surrounding region.
2) A relatively small amount of potential habitat in the Atlas-Campaspe Mine footprint would be cleared (4,418 ha) compared to the amount of potential habitat conserved and enhanced in the proposed offset area (16,540 ha).
3) Only a small amount of habitat 45 ha of potential habitat would be removed in the Ivanhoe Rail Facility footprint.
4) Any potential habitat that would be fragmented or isolated is unlikely to have more than a negligible impact for this highly mobile species.

Post-mining landforms would be rehabilitated and revegetated in the Atlas-Campaspe Mine footprint, and a considerable amount of native potential habitat would be conserved and enhanced in the proposed offset areas.

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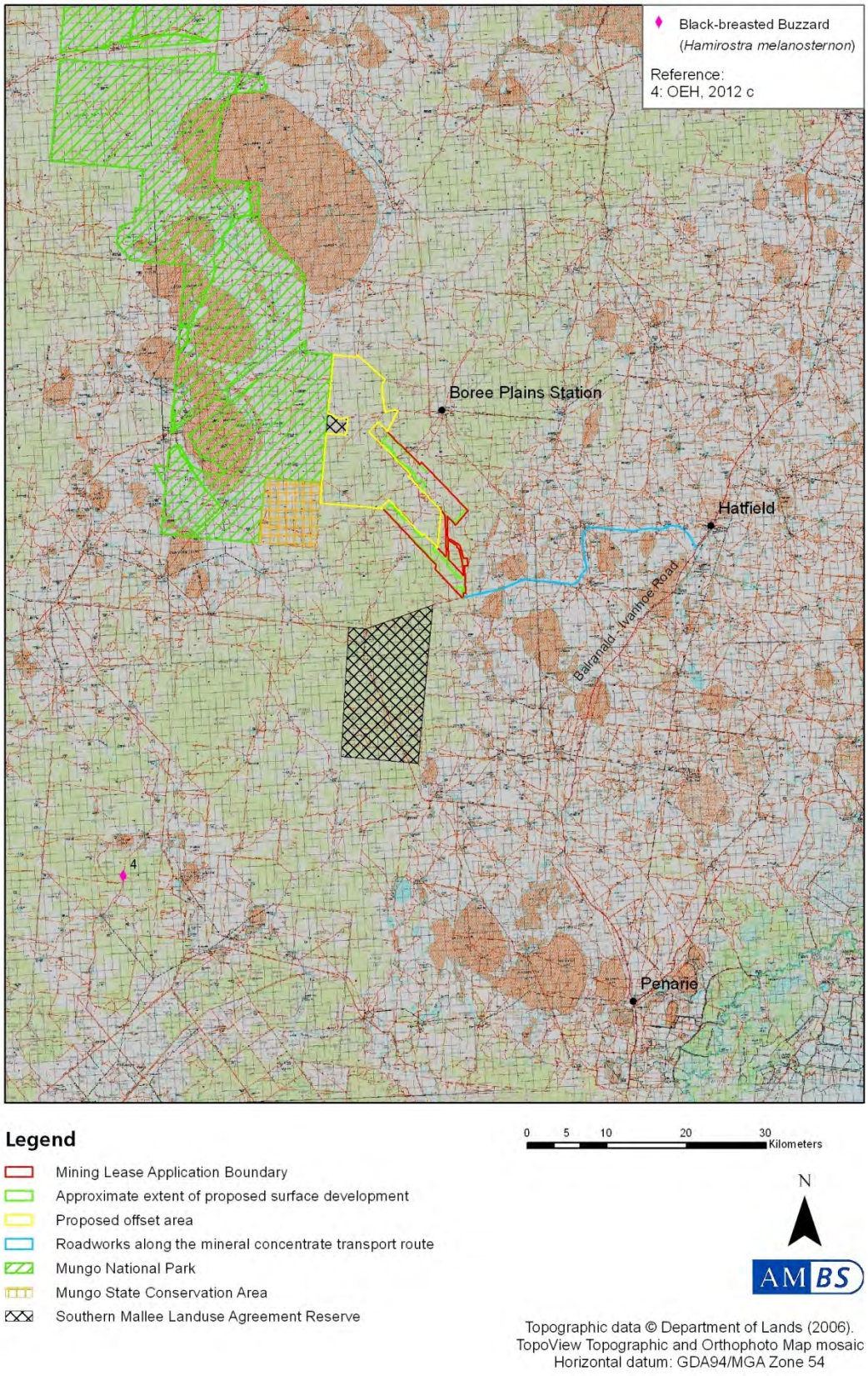

Figure C-29 Black-breasted Buzzard – Landscape Distribution

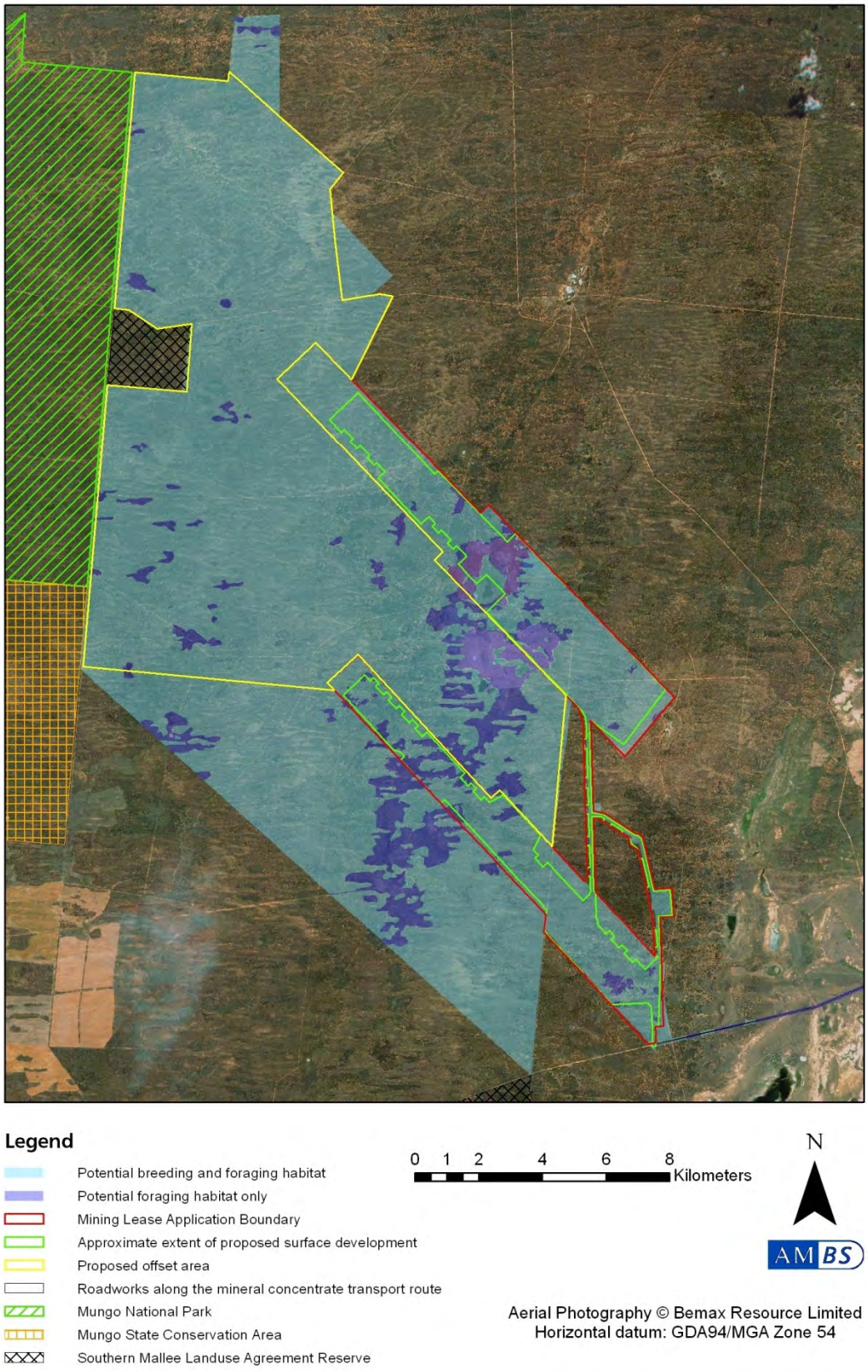

Figure C-30 Black-breasted Buzzard - Potential Habitat

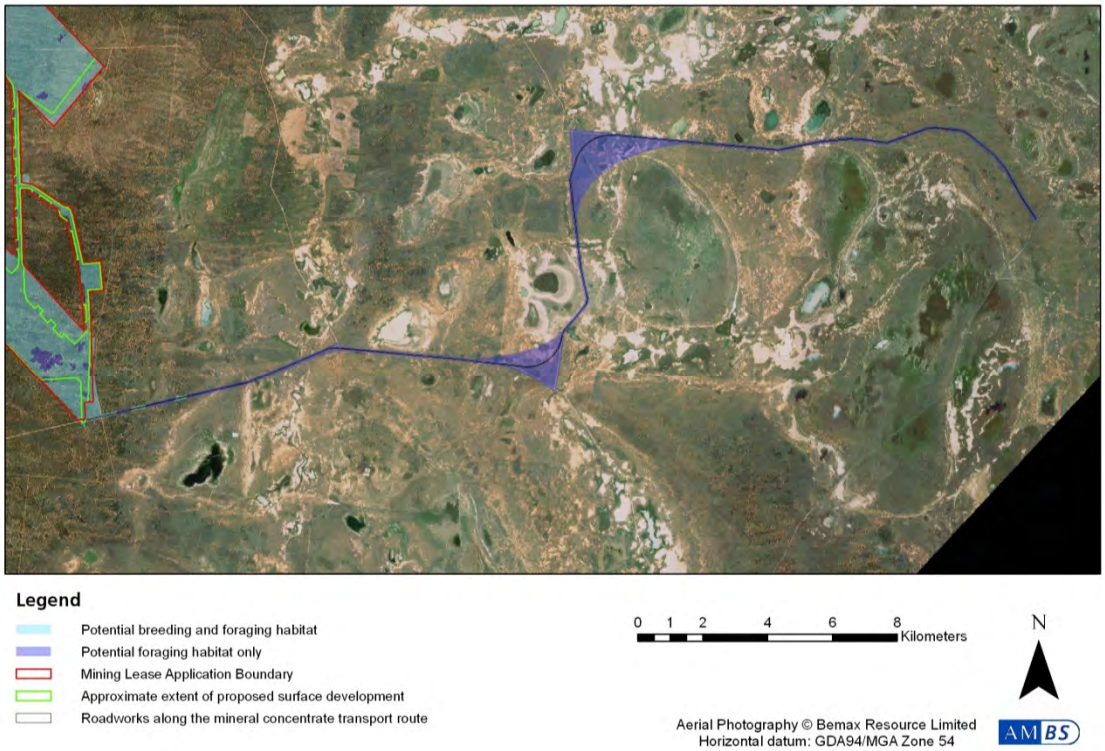

Figure C-31 Black-breasted Buzzard - Potential Habitat - Mineral Concentrate Transport Route

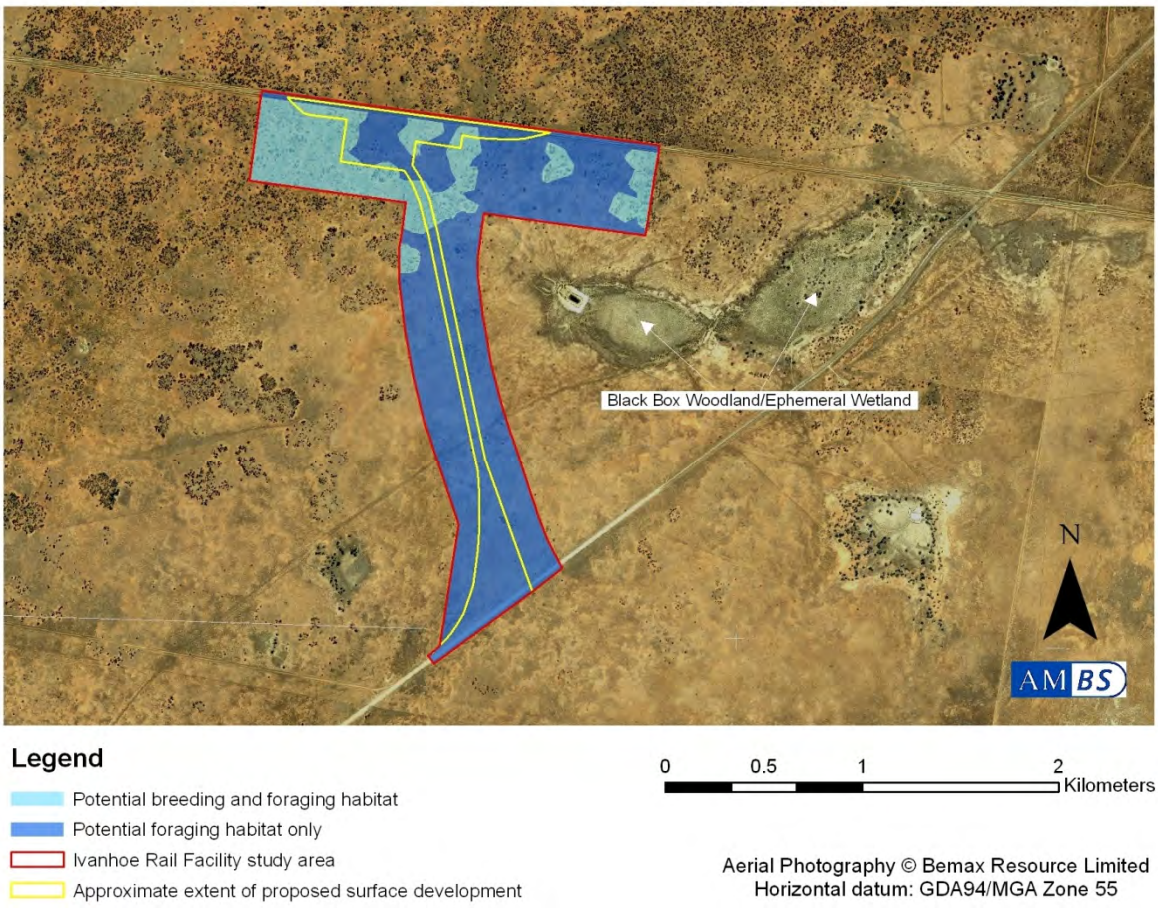

Figure C-32 Black-breasted Buzzard - Potential Habitat - Ivanhoe Rail Facility

Spotted Harrier (Circus assimilis)

The Spotted Harrier (*Circus assimilis*) is listed as vulnerable under Schedule 2 of the TSC Act. It occurs sparsely throughout the mainland of Australia and Indonesia, particularly in arid and semiarid regions (Barrett *et al.*, 2003). It is widespread in NSW occurring in grassy open woodland including eucalypt forest, *Acacia* and mallee remnants, but absent from heavily forested areas (Aumann, 2001; Marchant and Higgins, 1993; NSW Scientific Committee, 2011). In response to local seasonal conditions they can be partly nomadic (Marchant and Higgins, 1993). They build their nests using a platform of twigs in open or remnant woodland that are generally hidden by several trees and shrubs (Debus and Soderquist. 2008). The breeding season is from July to October and their generation time may potentially extend to 10 years. The Spotted Harrier is a diurnal hunter of ground birds including quail, pipits; terrestrial mammals including rabbits, rodents, bandicoots, and bettongs and reptiles such as lizards. They occasionally eat large insects but rarely carrion (Marchant and Higgins, 1993; Van Dyck and Strahan, 2008).

According to Australian National Bird Atlas Data, there is a moderate 30% (approximate) reduction over recent decades in the population of the Spotted Harrier throughout Australia (Barrett *et al.*, 2007). The population decline observed in NSW and indeed throughout Australia may be due to several factors including (1) the demise of rabbits, following the spread of rabbit calicivirus disease; (2) a decline of its other main prey species including Richard's Pipit (*Anthus novaeseelandiae*), Singing Bushlark (*Mirafra javanica*) and Brown Songlark (*Cincloramphus cruralis*) within NSW; (3) the clearing and degradation of foraging and breeding habitat which particularly affects the density of its prey; and (4) secondary poisoning from rodenticides (Barrett *et al.* 2007; NSW Scientific Committee, 2011; OEH, 2012a). The NSW western slopes and plains are important breeding and foraging grounds for the Spotted Harrier, which since the 1980's have been extensively cleared for grazing (Barrett *et al.*, 2007).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Spotted Harrier has been recorded at three localities in the Atlas Campaspe Mine footprint and surrounds (Figure C-33). One record locality is near the Ephemeral Wetland habitat close to the Campaspe footprint, a second locality slightly to the west of the first one just in the proposed offset area and the third locality is located approximately 2 km south-west of the central section of the Atlas footprint (Figure C-33). Previous database records exist from at least five localities within a radius of 20 km of the Atlas-Campaspe Mine. No individuals were observed during surveys of the Ivanhoe Rail Facility study area and neither are there any database records for the species in the same area.

All three records of the species were outside the Atlas-Campaspe Mine footprint; therefore the Project would not be removing any known localities of the species. The Spotted Harrier is very mobile it is unlikely that any individuals would be directly affected by the Project unless nest sites were to occur, although none were recorded during the surveys. The majority of locality records in the region were recorded outside the Project Area and the areas of habitat are connected by continuous suitable habitat that would not be impacted by the Project. The Spotted Harrier was also recorded in recent surveys by Ecotone Ecological Consultants for the Balranald Mineral Sands Project in the West Balranald Deposit and Nepean Deposit located approximately 45 km and 10 km south of the Atlas-Campaspe Mine, respectively (Ecotone Ecological Consultants 2012a; 2012b).

The action proposed is therefore unlikely to have an adverse impact on the life cycle of the Spotted Harrier such that a viable local population is likely to be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine would progressively remove approximately 3,660 ha of potential breeding and foraging habitat. Potential breeding and foraging habitat includes those area where large trees are prevalent for nesting and includes 50 ha Black Box Woodland, 535 ha Sandplain Mallee and 1,040 ha Linear Dune Mallee and 2,035 ha Belah-Rosewood Woodland. A further 758 ha of potential habitat used for foraging only would be cleared including 200 ha Acacia Woodland/Shrubland, 300 ha Cleared Land, 170 ha Disturbed Area Shrubland, 80 ha Chenopod Shrubland, 5 ha Chenopod Shrubland Depression, and 3 ha Sandhill Pine Woodland (Figures C-34 and C-35). A further 10 ha of potential breeding and foraging habitat in Belah-Rosewood Woodland and 30 ha of foraging habitat in Native Grassland would be removed in relation to the Ivanhoe Rail Facility (Figure C-36). This level of clearing is also considered to be minor in relation to the viability of a local population (if one exists).

(ii) Potential habitat in both Ivanhoe Rail Facility and Atlas-Campaspe Mine footprints would become further fragmented, but in both cases these areas would not become isolated as they remain connected to continuous tracts of vegetation to the north, west and south in relation to the Atlas-Campaspe Mine, and to the west and south in relation to the Ivanhoe Rail Facility. Further, this scale of fragmentation is not likely to impact this species given they are a highly mobile and wide ranging species.

(iii) The habitat to be removed is not likely to be integral to the survival of the Spotted Harrier. The species has an extremely large range and habitat conserved in the proposed offset area nearly extends to 16,540 ha of which approximately 15,415 ha is potential breeding and foraging habitat (Figures C-34 and C-35). The species is unlikely to rely on the habitats that would be removed at the Ivanhoe Rail Facility (Figure C-36).

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No “critical habitat” for the Spotted Harrier is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Spotted Harrier and no recovery actions are recommended to assist with the recovery of the species OEH (2012a).

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by the OEH (2012b), the following are relevant to the location, the Project and the species:

1) Clearing of native vegetation.
2) High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.

The Project would contribute to KTP1 (as discussed in response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions for the species and its prey species. Feral animal management plans would make considerable contributions to reduce KTP's 3 to 6 and would allow regeneration of vegetation and potentially enhance prey biomass for the Spotted Harrier.

Conclusion

The Spotted Harrier been recorded at three localities during the field surveys of the Atlas-Campaspe Mine study area. Two are close to but none are in the Atlas-Campaspe Mine footprint (Figure C-33). Several localities exist outside the mine Project Area. No records exist from the Ivanhoe Rail Facility study area or surrounds. The Atlas-Campaspe Mine would progressively remove approximately 3,660 ha of potential breeding and foraging habitat and a further 758 ha of potential habitat used for foraging only would also be cleared. A further 40 ha of potential habitat would be removed in relation to the Ivanhoe Rail Facility.

The Project is unlikely to have a significant impact on the Spotted Harrier such that a local viable population would be placed at risk of extinction given that:

1) The species has been recorded nearby but not in the Atlas-Campaspe Mine footprint, and not at all in the Ivanhoe Rail Facility.
2) A relatively small amount of potential habitat would be cleared at the Atlas-Campaspe Mine footprint (total area of 4,418 ha) compared to the amount of potential habitat conserved and enhanced in the proposed offset area (16,540 ha).
3) Only a small amount of habitat 45 ha of potential habitat would be removed in the Ivanhoe Rail Facility footprint.
4) Any potential habitat that would be fragmented or isolated is unlikely to have more than a negligible impact for this highly mobile species.

Post-mining landforms would be rehabilitated and revegetated in the Atlas-Campaspe Mine, and a considerable amount of native potential habitat would be conserved and enhanced in the proposed offset area.

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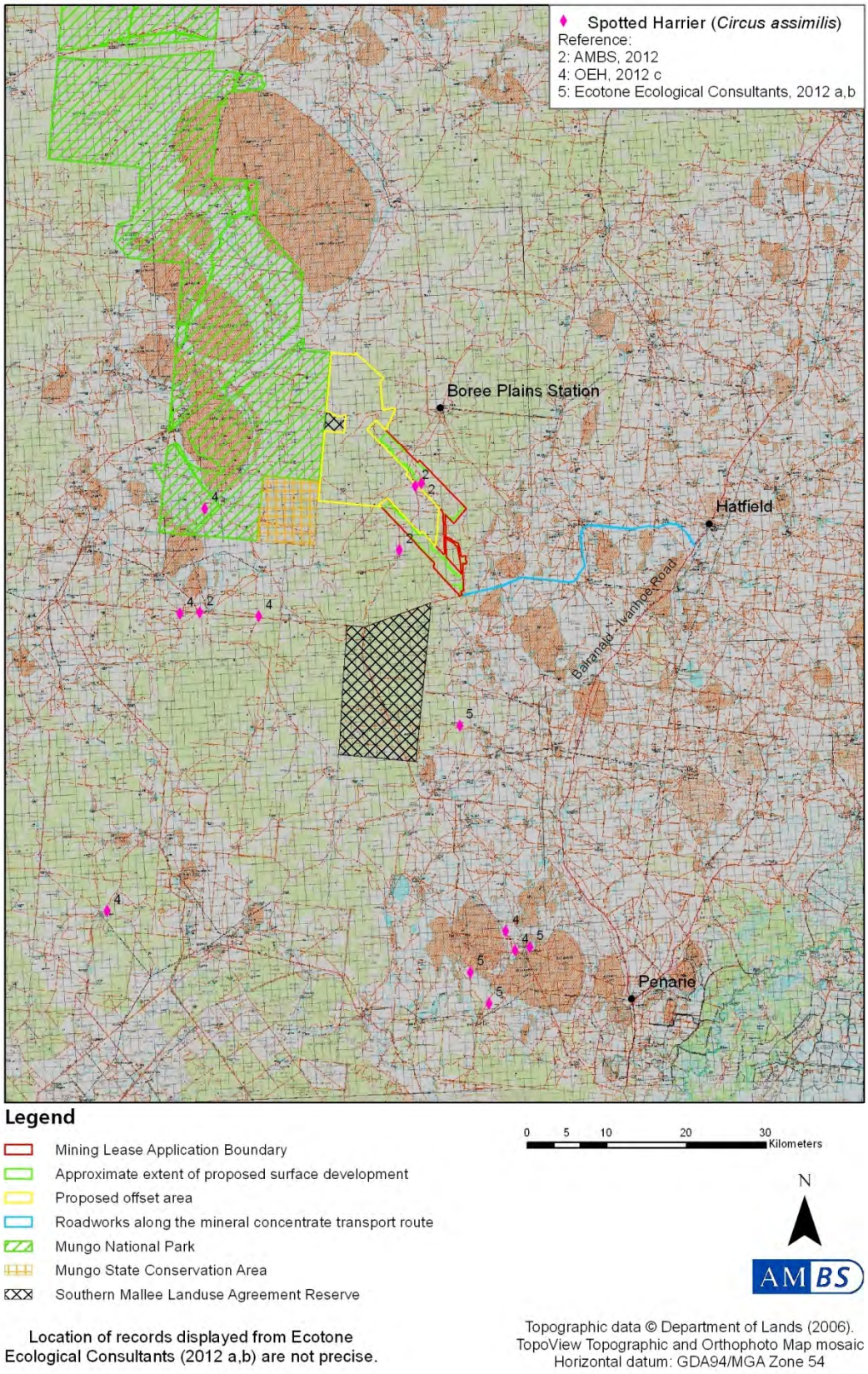

Figure C-33 Spotted Harrier - Landscape Distribution

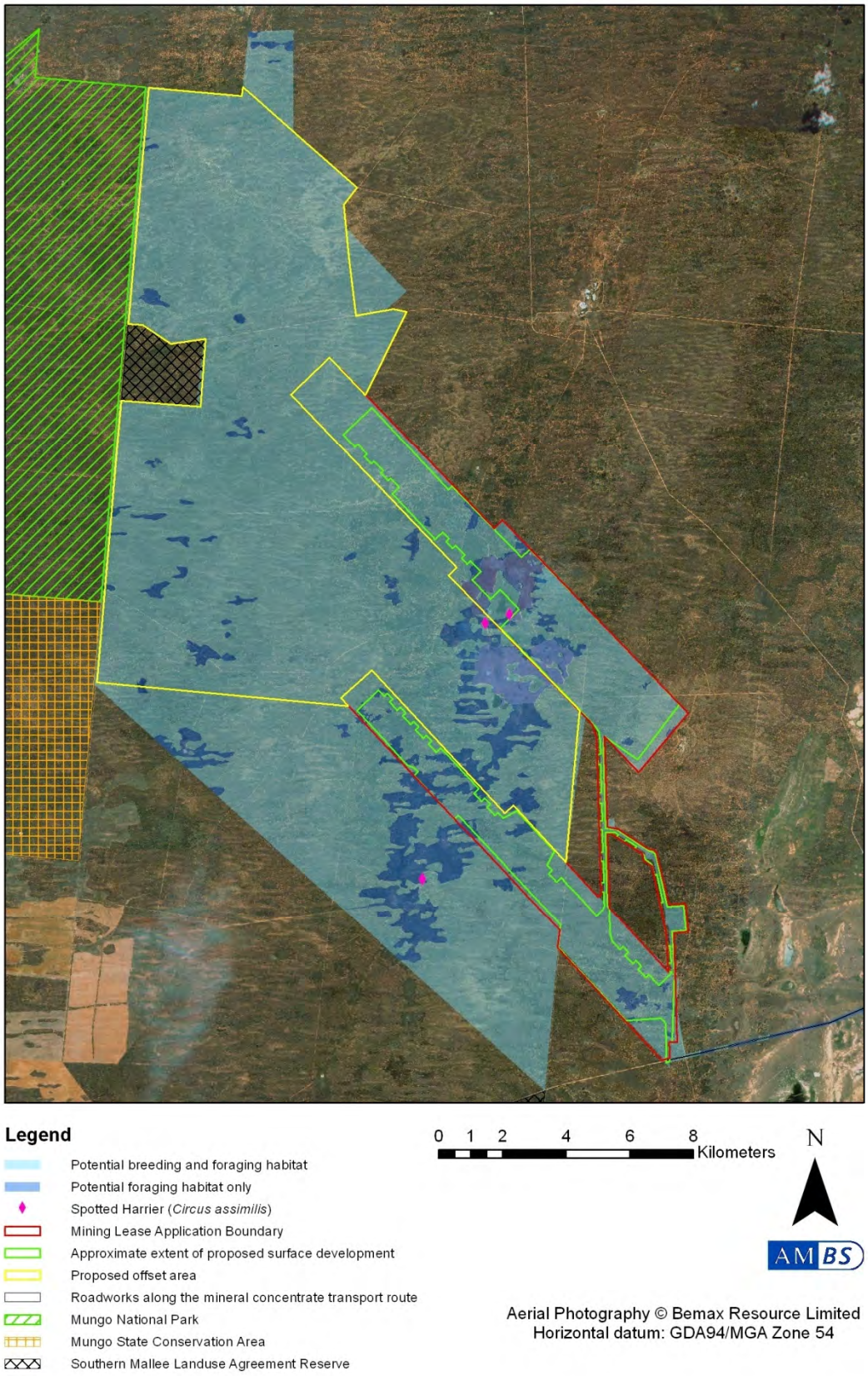

Figure C-34 Spotted Harrier - Potential Habitat

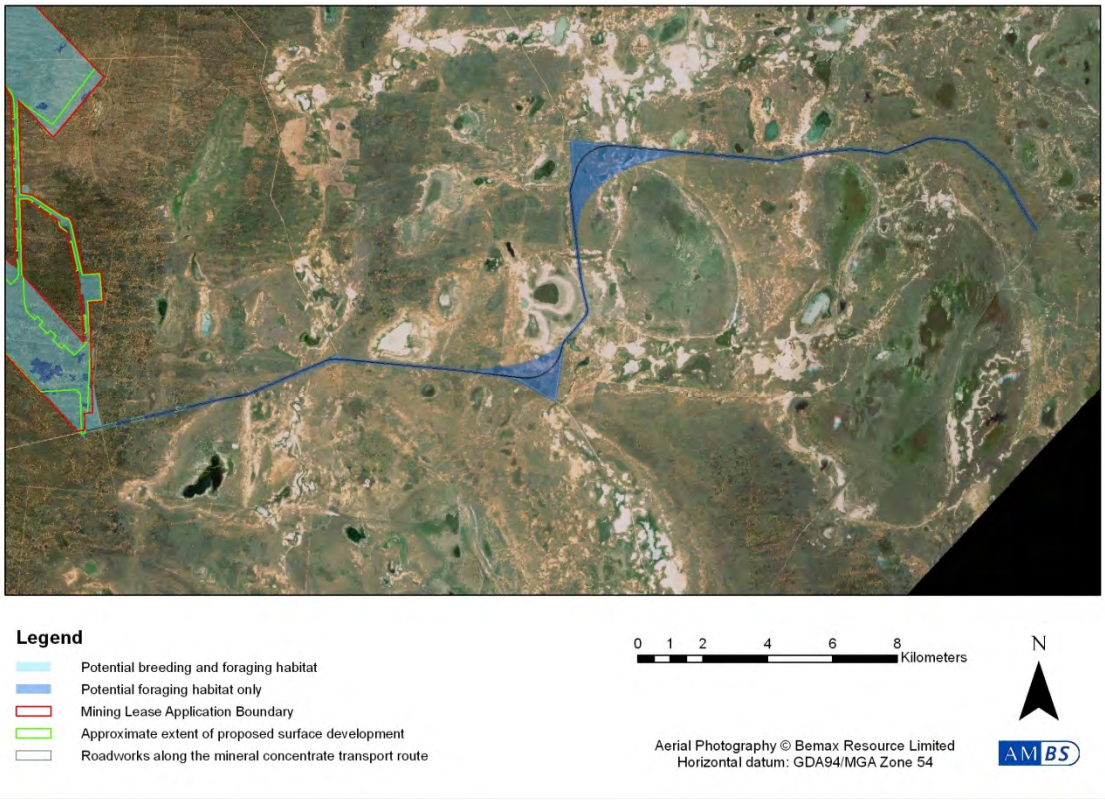

Figure C-35 Spotted Harrier - Potential Habitat - Mineral Concentrate Transport Route

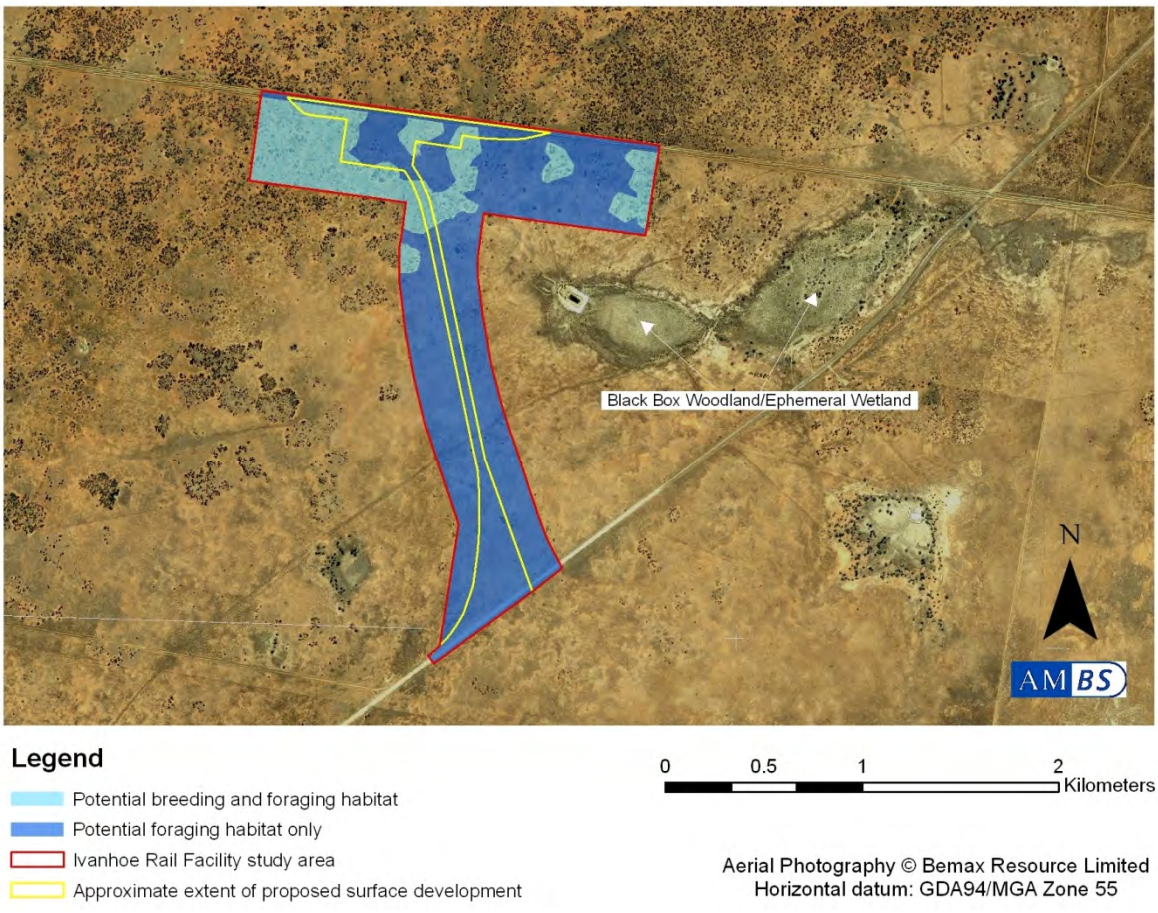

Figure C-36 Spotted Harrier - Potential Habitat - Ivanhoe Rail Facility

Little Eagle (Hieraaetus morphnoides)

The Little Eagle (*Hieraaetus morphnoides*) is listed as vulnerable under Schedule 2 of the TSC Act. The Little Eagle occurs as a single population throughout NSW. It is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment (Marchant and Higgins, 1993). It occurs in habitats that have abundant prey within open eucalypt forest, woodland or open woodland. The species also uses Sheoak (*Casuarina spp.*) or acacia woodlands and riparian woodlands of interior NSW (Marchant and Higgins, 1993). Little Eagles nest in tall living trees within a remnant patch. They build a large stick nest in winter and eggs are laid in early spring, with young fledging in early summer. Generation length has been estimated as 10 years. Little Eagles occupy large hunting ranges (> 100 km^2). They eat other birds, reptiles and mammals and on occasion eat large insects and carrion (Debus *et al.*, 2007; Marchant and Higgins, 1993; Aumann, 2001). Formerly, this species was heavily dependent on rabbits, but following the spread of rabbit calicivirus disease, and consequent decline in rabbit numbers in the arid and semi-arid zones, the Little Eagle is increasingly dependent on native prey. Most of its former native mammalian prey species in inland NSW are, however, extinct (terrestrial mammals of rabbit size or smaller e.g. large rodents, juvenile hare-wallabies and wallabies) (Van Dyck and Strahan, 2008).

In the 1990s, the Little Eagle was estimated to occur globally in the tens of thousands to as many as 100,000 birds (NSW Scientific Committee, 2011). While accurate figures are not available, the species is now thought to have declined greatly. In NSW, evidence from localised and broad scale surveys suggests that the species has undergone a moderate reduction in population size in recent decades. For example, there has been a long-term decline in reporting rate of about 50% in south-eastern NSW since the 1970s, with an accelerating trend since the 1990s. While reductions in Little Eagle numbers have coincided with the calicivirus disease induced reduction in rabbits, there may be multiple factors involved in their decline. Other species of raptors that eat rabbits showed no consistent decrease in their survey rate between 1986-1990 and 1996-2000, whereas observations of some other raptors that are not rabbit predators decreased over this period (NSW Scientific Committee, 2011). The Little Eagle is a resident, territorial species that is long-lived with low breeding productivity, and formerly had a low and stable density, its recent decline may be a long-term process that tracks habitat quality and overall prey biomass rather than temporary fluctuations in climate or prey availability.

Land clearing and degradation of foraging and breeding habitat are thought to be the main threats to the Little Eagle. Over 50% of forest and woodland has been cleared in NSW and important habitat on the NSW tablelands and western slopes, which contained relatively high eagle breeding densities until the 1980s, are mostly cleared and moderately to highly stressed. Direct human threats to habitat are most evident around expanding provincial cities, where urbanisation and rural-residential expansion are displacing breeding pairs. Loss of breeding sites may bring the Little Eagle into increasing interspecific competition with the larger, dominant Wedge-tailed Eagle (*Aquila audax*). Secondary poisoning from pindone used to control rabbits is listed as a possible threat (NSW Scientific Committee, 2011).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Little Eagle was recorded in three localities in the Atlas-Campaspe Mine study area. One locality is located within the Atlas footprint and two localities in the proposed offset area. A further seven localities exist outside the Atlas-Campaspe Mine footprint where the Little Eagle has been recorded previously and data records exist (Figure C-37).

The Little Eagle was also recorded in several locations during recent surveys by Ecotone Ecological Consultants for the Balranald Mineral Sands Project in the West Balranald Deposit and Nepean Deposit located approximately 45 km and 10 km south of the Atlas-Campaspe Mine, respectively (Ecotone Ecological Consultants 2012a, 2012b).The Little Eagle was also recorded during surveys of the Ivanhoe Rail Facility, approximately 2 km north-east of the study area (Figure C-38).

The Project would remove one known locality of the Little Eagle which is situated in the Atlas footprint. However as the Little Eagle is very mobile it is unlikely that any individuals would be directly affected. The majority of records in the region were recorded outside the Project area and are connected by continuous suitable habitat that would not be impacted by the Project. The action proposed is therefore unlikely to have an adverse impact on the life cycle of the Little Eagle such that a viable local population is likely to be placed at risk of extinction.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) A total of 3,660 of potential breeding and foraging habitat would be removed as a result of the Project in the Atlas-Campaspe Mine footprint. This includes 50 ha of Black Box Woodland, 535 ha Sandplain Mallee and 1,040 ha Linear Dune Mallee and 2,035 ha of Belah-Rosewood Woodland. A further 758 ha of potential foraging habitat would be removed in the same area. This includes 200 ha of Acacia Woodland/Shrubland, 300 ha Cleared Land, 170 ha Disturbed Shrubland, 80 ha Chenopod Shrubland, 5 ha Chenopod Shrubland Depression and 3 ha Sandhill Pine Woodland (Figures C-39 and C-40). A further 10 ha of potential breeding and foraging habitat in Belah-Rosewood Woodland and 30 ha of potential foraging habitat in Native Grasslands would be removed as a result of the Ivanhoe Rail Facility (Figure C-38). Habitat may become degraded due to edge effects, but the impacts from this are expected to be minor in comparison to the direct habitat loss.

(ii) Potential habitat in both Ivanhoe Rail Facility and Atlas-Campaspe Mine footprints would become further fragmented, but in both cases these areas would not become isolated as they remain connected to continuous tracts of vegetation to the north, west and south in relation to the Atlas-Campaspe Mine and to the west and south in relation to the Ivanhoe Rail Facility. Further, fragmentation impacts are not likely to impact this species given they are a highly mobile and wide ranging species.

(iii) The potential habitat to be removed in the Atlas-Campaspe Mine is not likely to be detrimental for the survival of the species in the locality considering there is substantial habitat in the surrounding area and 15,415 ha of potential foraging and breeding habitat and a further 1,125 ha of potential foraging habitat only would be conserved and enhanced in the proposed offset area (Figures C-39 and C-40). Similarly the habitat to be removed in the Ivanhoe Rail Facility footprint is not likely to be detrimental for the survival of the species in the locality, as the area of potential habitat to be impacted is only small and higher quality habitat exists in the surrounding area (Figure C-38).

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" for the Little Eagle is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Little Eagle and no recovery actions are recommended to assist with the recovery of the species (OEH, 2012a).

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012b), the following are relevant to the location, the Project and the species:

1) Clearing of native vegetation.
2) High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.
4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.

The Project would contribute to KTP1 (as discussed in response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area associated with the Atlas-Campaspe Mine to maintain and enhance suitable habitat conditions for the species and its prey species. Feral animal management plans would make considerable contributions to reduce KTPs 3 to 6 and would allow regeneration of vegetation and potentially enhance prey biomass for the Little Eagle.

Conclusion

The Little Eagle was recorded in three localities during the surveys of the Atlas-Campaspe Mine Project area and surrounds. One locality is located within the Atlas footprint and two localities in the proposed offset area. A further seven localities exist outside the Project Area where the Little Eagle has been recorded previously and data records exist. The Little Eagle was also recorded during surveys of the Ivanhoe Rail Facility, approximately 2 km north-east of the study area.

A total of 3,660 ha of potential breeding and foraging habitat would be removed as a result of the Project in the Atlas-Campaspe Mine footprint as well as a further 758 ha of potential foraging habitat. A further 10 ha of potential breeding and foraging and 30 ha of potential foraging habitat would be removed as a result of the Project in the Ivanhoe Rail Facility.

Overall, the Project is unlikely to have a significant impact on the Little Eagle such that a local viable population would be placed at risk of extinction given:

1) A relatively small amount of potential habitat would be cleared in relation to the Atlas-Campaspe Mine (a total of 4,418 ha) and 40 ha in the Ivanhoe Rail Facility compared to the amount of potential habitat (16,540 ha) that would be conserved in the proposed offset area.
2) The species is highly mobile and occupy a large hunting range.
3) Any potential habitat that would be fragmented or isolated is unlikely to have more than a negligible impact for this highly mobile and wide-ranging species.

Further to the above, post-mining landforms would be rehabilitated and revegetated within the Atlas-Campaspe Mine footprint, and a considerable amount of potential habitat would be conserved and enhanced in the proposed offset area. Additional potential habitat would be created through revegetation of cleared land in offsets and post-mining landforms.

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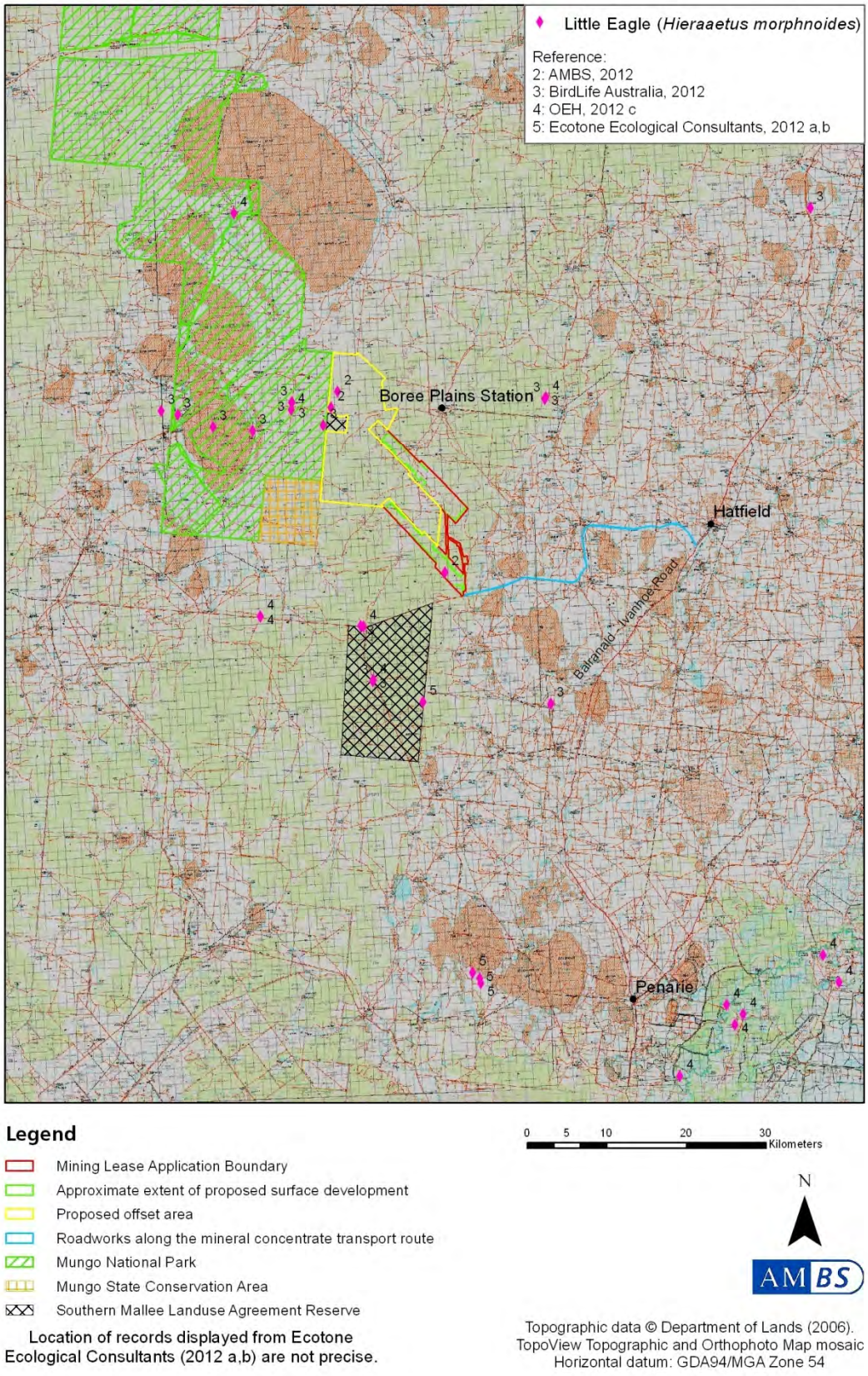

Figure C-37 Little Eagle – Landscape Distribution

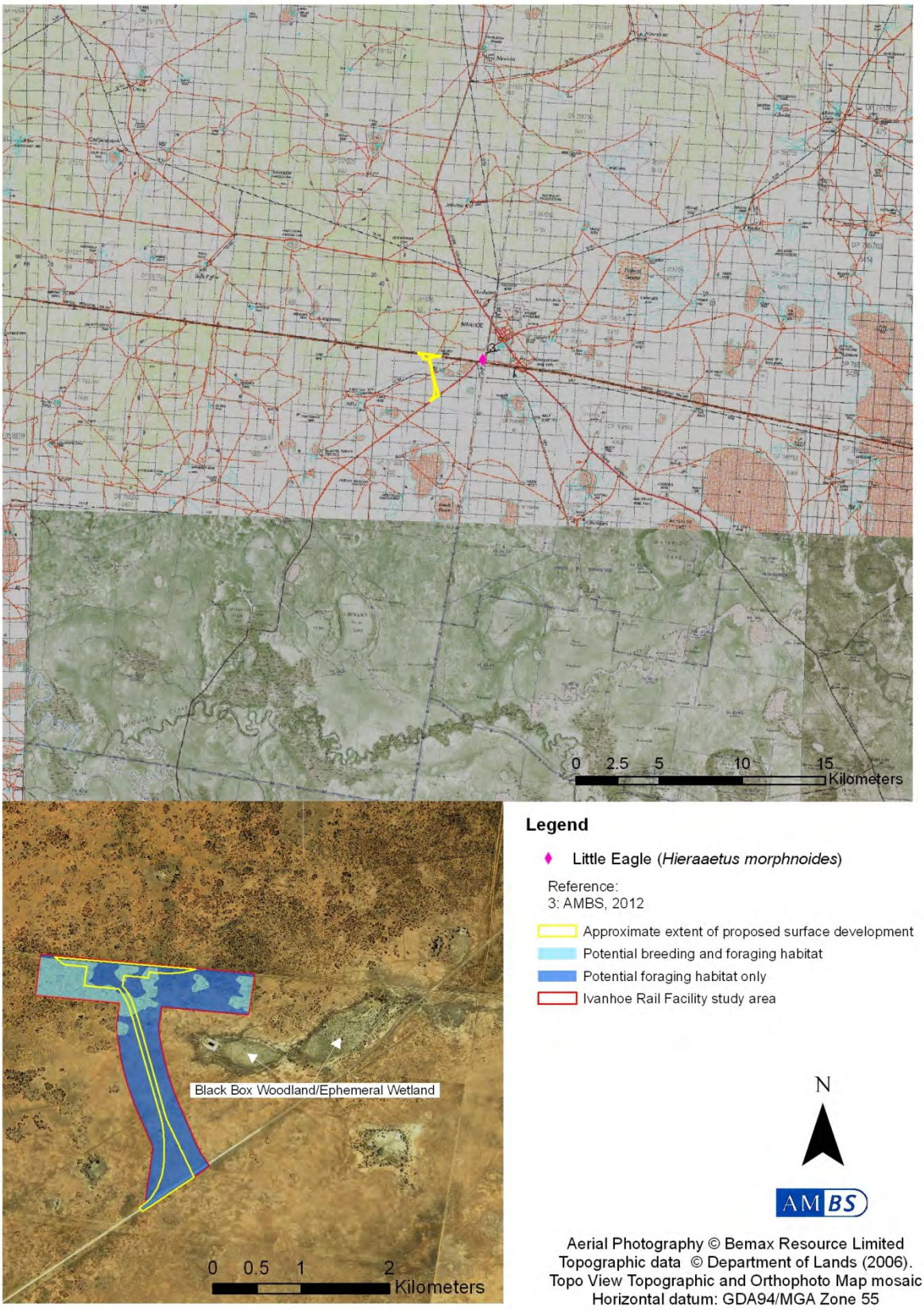

Figure C-38 Little Eagle - Potential Habitat - Ivanhoe Rail Facility

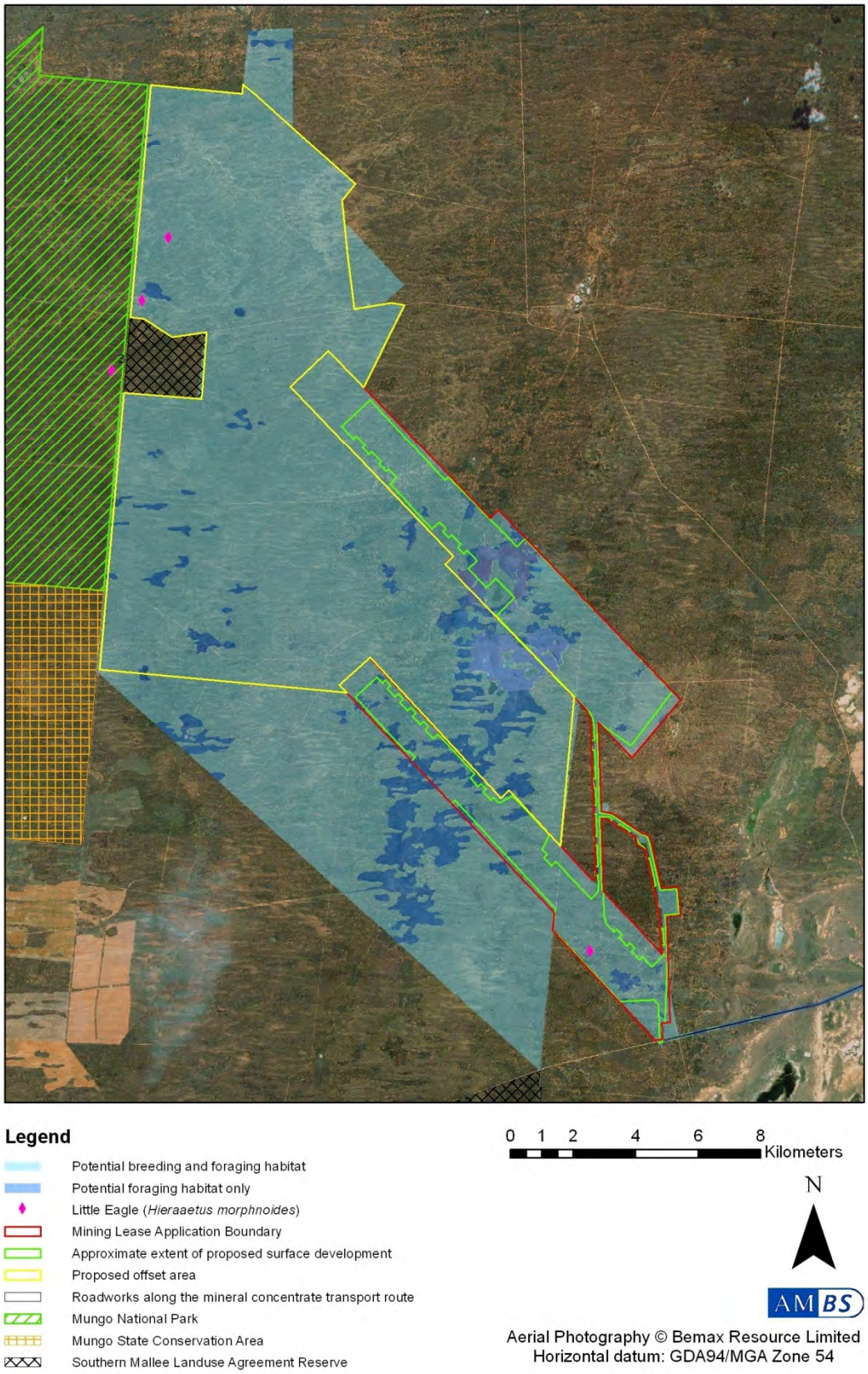

Figure C-39 Little Eagle - Potential Habitat

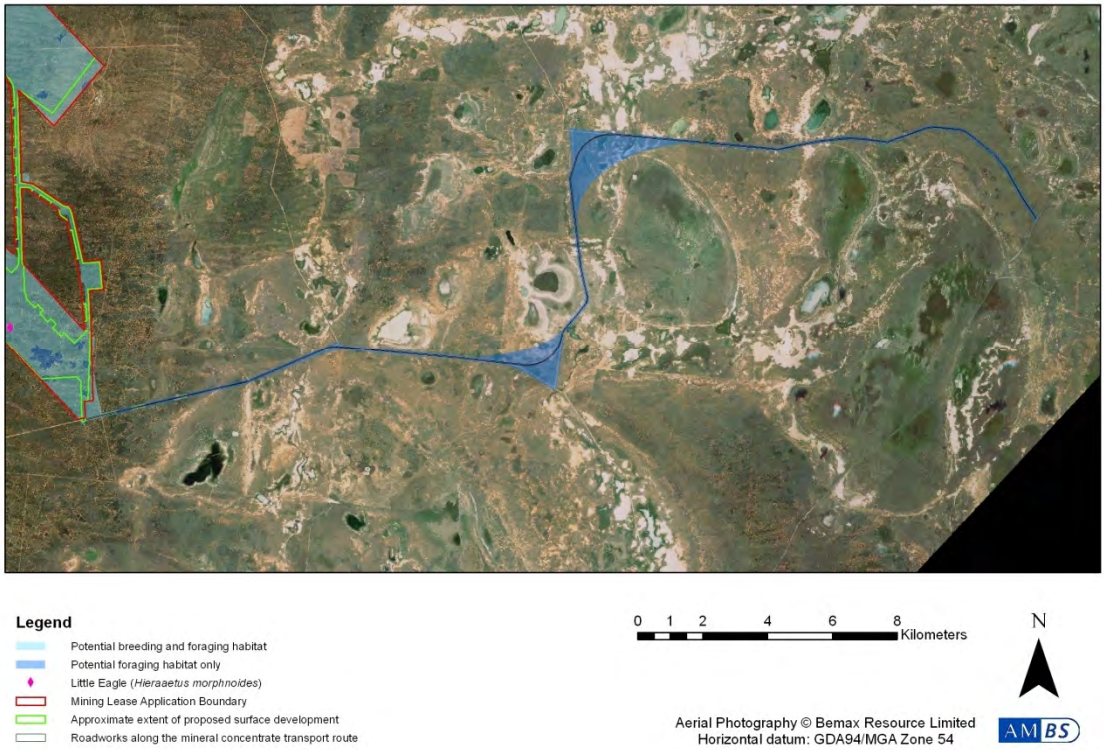

Figure C-40 Little Eagle - Potential Habitat - Mineral Concentrate Transport Route

Australian Bustard (Ardeotis australis)

The Australian Bustard (*Ardeotis australis*) is listed as endangered under Schedule 1 of the TSC Act. It is a large ground bird of the open plains of in inland Australia, occurring more in the north than the south. It is now scarce or absent from southern and south-eastern Australia. In NSW, the species is mainly found in the north-west corner with occasional records in the in the lower western and central west plains regions. Occasional vagrants are recorded east to the western slopes and Riverina plain. However, in NSW breeding only occurs in the north-west region, but it was formerly more widespread (e.g. a flock of over 1,000 was recorded near Hay NSW in 1897; and it formerly bred in the Liverpool Plains and the Upper Hunter Valley). The only recent breeding record for NSW was from near Bourke in 1995. The Australian Bustard is dispersive, with irregular, widespread movements over long distances, apparently in response to habitat and climatic conditions (Morris *et al.*, 1981; Blakers *et al*., 1984; Marchant and Higgins, 1993; NPWS, 1999; Garnet and Crowley, 2000; OEH, 2012a).

A bird of grassland plains, the Australian Bustard mainly inhabits tussock and hummock grasslands, though it prefers tussock grasses to hummock grasses. It also occurs in low shrublands and low open grassy woodlands, pastoral and cropping country, golf courses, aerodromes. It is often associated with wetlands including water courses, swamps, waterholes, dams and bores. Where it occurs in woodlands these are lightly timbered. It sometimes occurs in sparse chenopod shrublands, but in NSW. It nests on bare ground, typically on low sandy ridges or stony rises in ecotones between grassland and protective shrubland cover. It roosts on the ground among shrubs and long grasses or under trees. It eats insects, young birds, lizards, mice, leaves, seeds and fruit. It will converge on areas with mice plagues or in recently burnt areas (Blakers *et al*., 1984; Marchant and Higgins, 1993; NPWS, 1999; Garnet and Crowley, 2000; OEH, 2012a).

Declines in southern Australia have been attributed to hunting, feral predators, secondary poisoning, human disturbance during breeding, high livestock stocking rates and invasion of woody weeds in grasslands (Blakers *et al*., 1984; Marchant and Higgins, 1993; Garnet and Crowley, 2000). NPWS (1999) and OEH (2012a) list the following seven threats to the species:

1) Alteration (reduction of ground cover) to tussock grasslands through overgrazing.
2) Predation by foxes and cats.
3) Illegal hunting.
4) Loss, fragmentation and degradation of semi-arid open grassy woodlands.
5) Secondary poisoning from rabbit baiting.
6) Human disturbance.
7) Low breeding potential.

The Australian Bustard was not recorded during the surveys of the Project area. Historically it has been recorded in Mungo National Park, where it can be considered a vagrant. The Project area is outside the known breeding distribution of the Australian Bustard. In the Project area potential foraging habitat is likely to include Black Box Floodplain Woodland and the cleared land near these wetlands. The woodlands are likely to be too heavily timbered. The disturbed area shrublands occasionally might attract the species were they in the core of the Australian Bustard's range, but not at the edge of its normal distribution.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Australian Bustard was not recorded in the Atlas-Campaspe Mine footprint, in the proposed offset area or in the Ivanhoe Rail Facility footprint. A single record within 20 km of the Project area exists, which is an Atlas of NSW Wildlife from a locality 17 km to the west of the Atlas-Campaspe Mine footprint within Mungo National Park (Figure C-41).

The Project would not impact directly on any aspect of the life cycle of this species (e.g. breeding, migration and dispersion, gene flow etc.). It may impact indirectly through the removal of habitat, which is addressed in response to question d.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed; and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Project; and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

(i) The Atlas-Campaspe and MCTR footprints would progressively remove up to 3,075 ha of potential breeding and foraging habitat for the Australian Bustard. This includes 50 ha Black Box Woodland, 200 ha of Acacia Woodland/Shrubland, 2,035 ha Belah-Rosewood Woodland, 535 ha Sandplain Mallee, 80 ha Chenopod Shrubland, 5 ha Chenopod Depressions and 170 ha Disturbed Area Shrubland. A further 300 ha of potential foraging habitat consisting of Cleared Land would be removed (Figures C-42 and C-43). The Ivanhoe Rail Facility footprint would remove up to 40 ha of potential breeding and foraging habitat for the species (Figure C-44). This includes 10 ha of Belah-Rosewood Woodland and 30 ha of Native Grassland. Any local population of the species would be unlikely to rely on the potential habitat that would be impacted. Higher quality habitat occurs in the nearby surrounds, so the species is unlikely to be geographically restricted at the Ivanhoe study area.

(ii) The Atlas-Campaspe and MCTR footprints would involve the progressive clearance of vegetation over 20 years. This habitat would be rehabilitated after mining. The habitat between the footprints would remain undisturbed, as would the habitats of the surrounding landscape. The Atlas-Campaspe footprint would temporarily isolate potential habitat on either side of the active mine area and may result in permanently diminished connectivity across the mine area; however, large and contiguous areas of potential habitat for this species would remain in the area surrounding the mine footprints. The Ivanhoe Rail Facility would mostly remove potential habitat adjacent to an existing rail corridor, which would not increase fragmentation or isolation. The access road may marginally increase fragmentation of potential habitat but not to any significant extent, as animals would likely still be able to move across the road. Therefore, no areas of potential habitat for this species would become isolated from other areas of potential habitat.

(iii) The potential foraging habitat to be cleared as a result of the Atlas-Campaspe footprint and the Ivanhoe Rail Facility is very small considering the enormous Australian range of the Australian Bustard. The species is not resident in the area or the region, and it is unlikely that the habitat would be used by the species (Figures C-42, C-43 and C-44).

The proposed offset would aim to compensate for any habitat loss and fragmentation by enhancing the habitat quality and integrity of the proposed offset area. Improved fire management, integrated pest management and reduced livestock grazing in the offset area would give considerable compensation to offset habitat loss.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No “critical habitat” for the Australian Bustard is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Australian Bustard, however the following priority actions are recommended by OEH (2012a) to assist with the recovery of the species:

- Undertake an ecological burn at selected locations where required.
- Conduct fox control throughout the species range.
- Educate landholders to not spread poison baits for rabbits when Australian Bustards are present in an area.

A fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area to maintain and enhance suitable habitat conditions for the species. The control of feral animals in the Project area and proposed offset area would make considerable contributions to reduce fox numbers. When controlling rabbits, poison baits should not be used if Australian Bustards are known to be in the area. This should not be a problem in the Project area or proposed offset area as there are no previous records of the Australian Bustard.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012b), the following are relevant to the location, the Project and the species:

1) Clearance of native vegetation.
2) Competition and grazing by the feral European rabbit.
3) Competition and habitat degradation by feral goats.
4) Predation by the European red fox.

The Project would contribute to KTP 1 to a very small extent (as discussed above in response to question d). Conversely, integrated pest management would likely make a significant contribution towards abating KTPs 2 to 4.

Conclusion

The Australian Bustard was not recorded in the Atlas-Campaspe Mine footprint, in the proposed offset area, or at the Ivanhoe Rail Facility. A single record exists from the Atlas of NSW Wildlife Database from a locality 17 km to the west of the Atlas-Campaspe Mine footprint within Mungo National Park (OEH, 2012c). The Atlas-Campaspe Mine footprint would progressively remove up to 3,075 ha of potential breeding and foraging habitat and a further 300 ha of potential foraging habitat for the Australian Bustard, and the Ivanhoe Rail Facility would remove an additional 40 ha of potential breeding and foraging habitat for the species

The Project is unlikely to have a direct impact on the Australian Bustard because the species is not resident in the area and only occurs as a rare vagrant. The loss of a total of 3,415 ha of habitat is unlikely to have a significant impact on the Australian Bustard.

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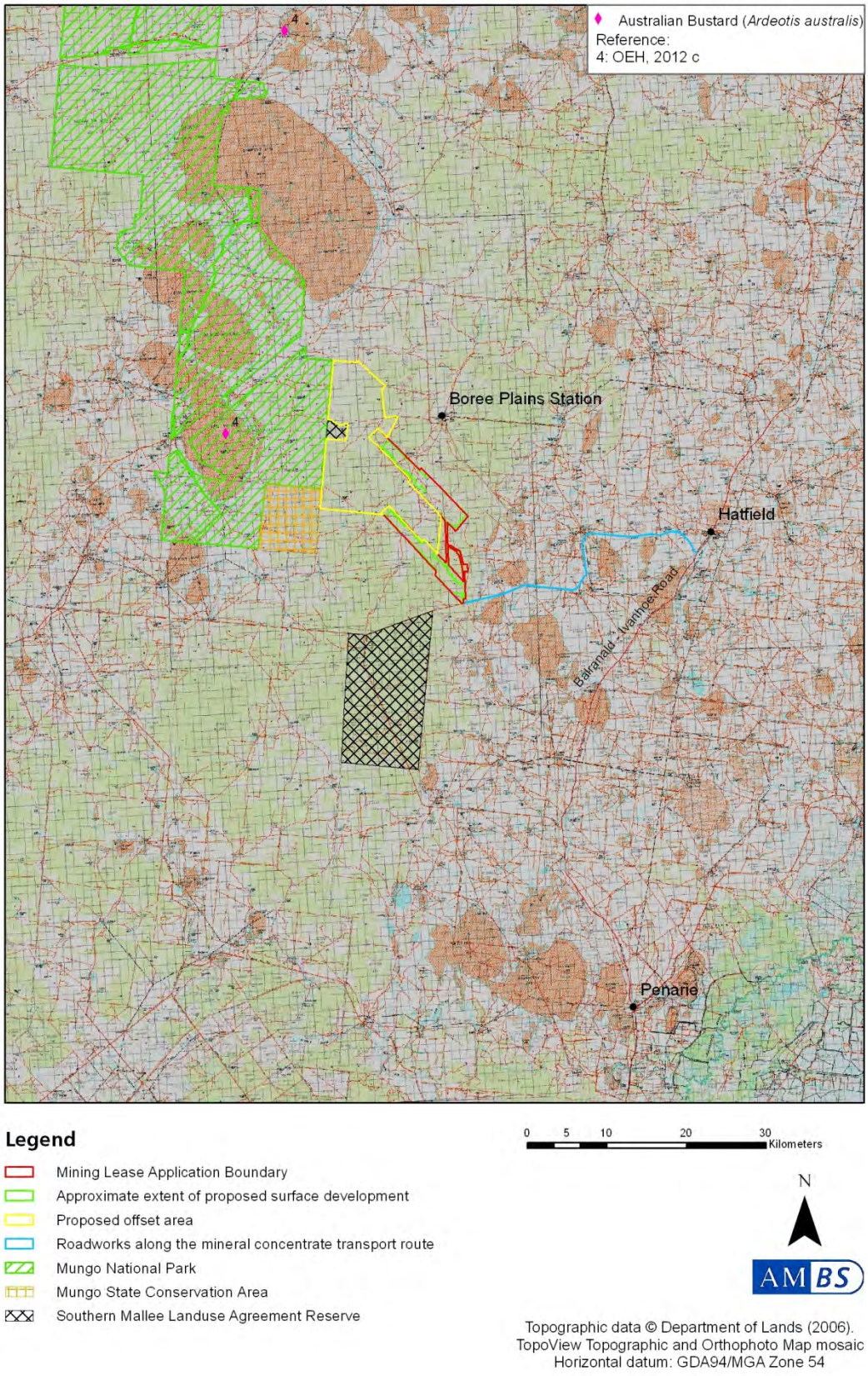

Figure C-41 Australian Bustard - Landscape Distribution

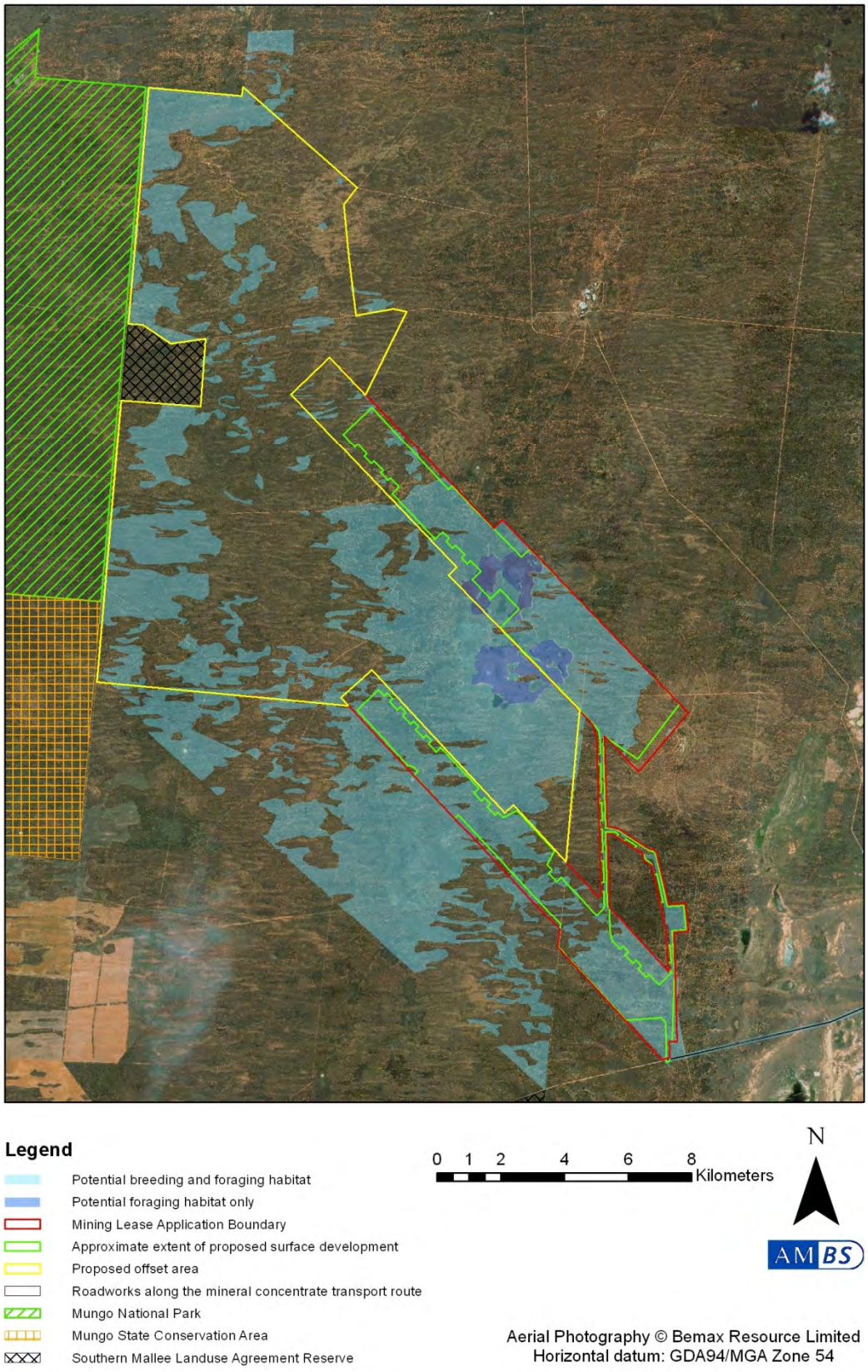

Figure C-42 Australian Bustard - Potential Habitat

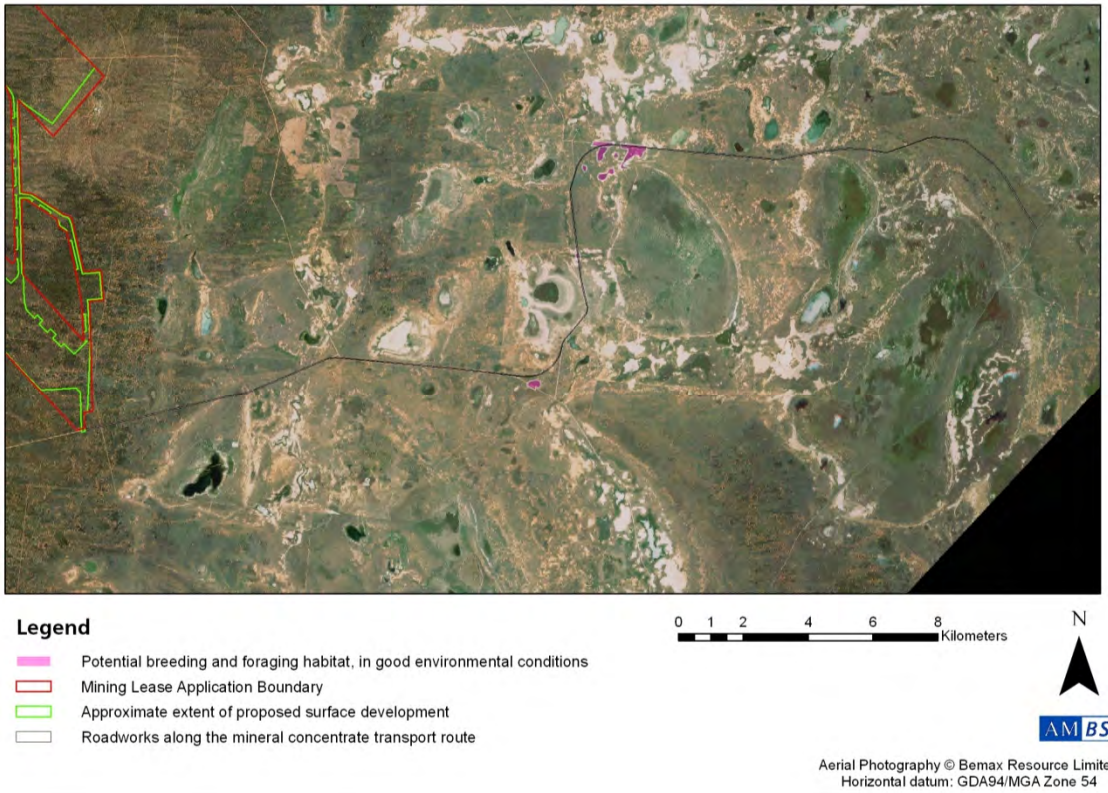

Figure C-43 Australian Bustard - Potential Habitat - Mineral Concentrate Transport Route

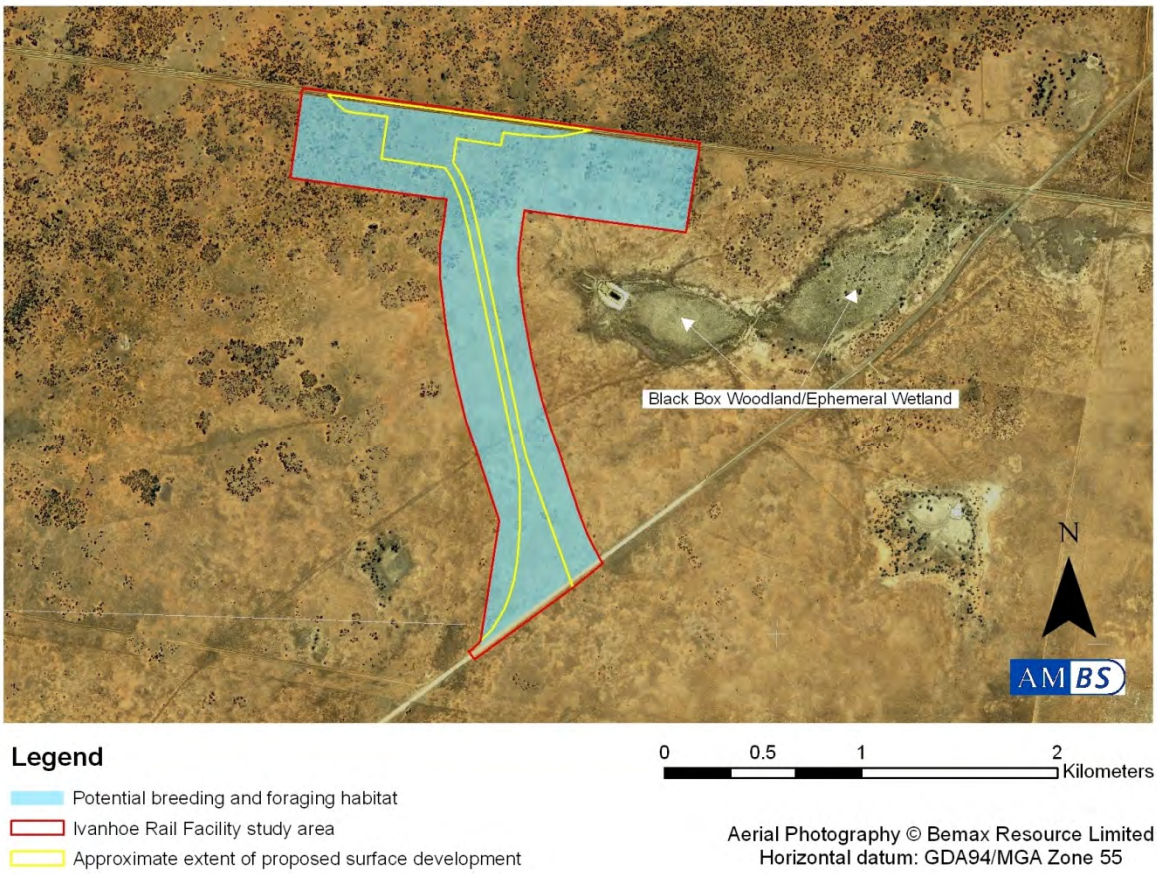

Figure C-44 Australian Bustard - Potential Habitat - Ivanhoe Rail Facility

Bush Stone-curlew (Burhinus grallarius)

The Bush Stone-curlew (*Burhinus grallarius*) is listed as endangered under Schedule 1 of the TSC Act. It is found right around the Australian east, north and west coasts (but not the south coast) well inland to semi-arid districts. It is largely absent from the arid interior, although it does occur beyond the 300 mm rainfall areas in some circumstances, usually in association with ranges, waterways or lakes. However, it has disappeared from the far south-east mainland (coastal NSW and Victoria) and Tasmania, and from urban Perth in Western Australia. It remains common only in northern Australia from central Queensland to the Kimberly. In the south, it is either rare or extinct throughout much of its former range. It is largely sedentary and territorial. There are some local movements and flocking after breeding but no evidence of large scale movements or migration. Site fidelity is generally rather high (Morris *et al*., 1981; Blakers *et al*., 1984; Marchant and Higgins, 1993; Barret *et al*., 2003; Garnett and Crowley, 2000; Garnett *et al*., 2011; OEH, 2012a).

The current NSW distribution is patchy and scattered. Current records suggest that all catchment management areas in NSW support Bush Stone-curlews, but there is limited knowledge of local distribution and abundance for most areas. The area bounded roughly by Albury, Wagga Wagga, Hay and Wentworth is regarded as the stronghold for the species in NSW (Barrett *et al*., 2003; DEC, 2006), with small and scattered populations occurring throughout the central west of the state, e.g. around Forbes-Caragabal, Gulargambone-Collie and Mungindi (DEC, 2006). The NSW population of the Bush Stone-curlew is thought to be probably around 1,000 breeding pairs and declining (DEC, 2006).

This ground-dwelling bird inhabits lightly timbered open forests and woodlands, but avoids thick forest. It mostly occurs at low elevations (< 300 metres [m]) (DEC, 2006), but it is plentiful at much higher altitudes on the Atherton Tablelands in Queensland and formerly occurred in the Southern Highlands and at elevation on the Western Slopes (Blakers *et al*. 1984; Marchant and Higgins, 2003). It can persist in partly cleared farmlands or similar with remnant woodland patches, sometimes nests beneath isolated trees on agricultural plains. Casuarina woodlands are often favoured but Eucalyptus, Acacia, Melaleuca and other woodland types are also used. The understory characteristics of habitat are generally more important than the over story vegetation. Favoured habitats frequently have few if any shrubs, a short (<15 centimetres [cm]) sparse ground layer of native grasses, a well-structured litter layer and scattered fallen timber. However, it also occurs on cropped grasslands, golf courses and park lawns. The species nests on the ground in a scrape or small bare patch, during spring and early summer. On Kangaroo Island in South Australia, breeding territories are about 40 ha, while in northern Victoria they are about 10-25 ha. Non-breeding birds have larger home ranges covering up to 340 ha (Blakers *et al*., 1984; Marchant and Higgins, 1993; Garnett and Crowley, 2000; DEC, 2006; Garnett *et al*., 2011; OEH, 2012a).

In western NSW the important structural elements of Bush Stone-curlew habitat includes (DEC, 2006):

- a low sparse ground cover;
- some fallen timber and leaf litter;
- a general lack of a shrubby understory; and
- open woodlands.

In western NSW, the following areas support small numbers of Bush Stone-curlews (DEC, 2006):

- River Red Gum (*Eucalyptus camaldulensis*) and Black Box (*E. largiflorens*) woodlands adjoining Weeping Myall (*Acacia pendula*) country.
- Conargo – Deniliquin – Barham – Wakool – Oaklands.
- River Red Gum (*E. camaldulensis*) and Boree (*A. pendula*) country along the Murrumbidgee River around Darlington Point.

- Travelling Stock Routes and grassy woodlands of the Warren – Gilgandra – Coonamble – Gularganbone – Baradine area.
- Remaining grassy woodlands of Moree, Mungindi and Cubberoo.
- Bimble Box woodland and very open Coolibah woodland between Walgett and Collarenebri.
- Poplar Box–Wilga woodland and Baradine Gum-White Cypress woodland in the central west.
- Along the Bogan River and Narran River.
- River flat areas, Belah woodland and Belah-Rosewood-mallee vegetation around Buronga and Mildura.
- Mixed Coolibah – Poplar Box – cypress vegetation (i.e. Lightning Ridge Woodlands).

It forages on the ground and is largely nocturnal, being especially active on moonlit nights. The main food is insects (such as insects, centipedes, snails, and spiders) and small vertebrates (such as frogs, lizards and snakes). They may supplement this with some leaves, seeds and tubers (Marchant and Higgins, 1993; OEH, 2012a).

OEH (2012a) identifies the main threats to the Bush Stone-curlew as follows:

- Predation by foxes and cats.
- Trampling of eggs by cattle.
- Clearance of woodland habitat for agricultural and residential development.
- Modification and destruction of ground habitat through removal of litter and fallen timber, introduction of exotic pasture grasses, grazing and frequent fires.
- Disturbance in the vicinity of nest sites.

Considerable circumstantial evidence links predation by the European red fox to the decline of the ground-nesting Bush Stone-curlew in the southern half of Australia (Ford, 1979; Reid and Fleming, 1992; Saunders and Ingram, 1995; Reid, 1999; Garnett and Crowley, 2000; Garnett *et al*., 2011). However, in some situations the Bush Stone-curlew has survived in the presence of high densities of foxes. It is also though that widespread habitat clearance and fragmentation of woodlands, and urbanisation have played a major role in the decline of the Bush Stone-curlew (Blakers *et al*., 1984; Marchant and Higgins, 1993; Garnett and Crowley, 2000; Garnett *et al*., 2011). It seems likely that both habitat loss and fox predation are serious threats and they probably interact as well.

The Bush Stone-curlew was recorded once during the field survey in (or nearby) the proposed Atlas footprint. It was heard calling in the distance during nocturnal surveys, but the exact location of the bird was not determined. No historical records for the study site or the local vicinity were found in the wildlife database searches. The nearest historical record mapped in the recovery plan (DEC, 2006) is from Balranald (>90 km south of the Project area) and predates 1988.

In the Project area, potential breeding and foraging habitat for the Bush Stone-curlew is likely to include Belah-Rosewood Woodland, Black Box Woodland and Acacia Woodland/Shrubland. Other potential foraging habitats may include Disturbed Area Shrubland and Cleared Land, mainly where these abut more structured woodlands.

Linear Dune Mallee and Sandplain Mallee Woodland are apparently not suitable habitat for the Bush Stone-curlew. Mallee and spinifex are not listed as a habitat type used by the species in most authoritative references (Blakers *et al*., 1984; Marchant and Higgins, 1993; Reid, 1999; Garnett and Crowley, 2000; DEC, 2006; Garnett *et al*., 2011; OEH, 2012a) except around the edges of non-mallee woodlands. Pizzey and Knight (1997) do list “sandplains with spinifex and mallee”, but it is not clear that this is an authoritative statement and the original source is not identified. It is possible that stem density is too high in mallee and/or spinifex is not tolerated.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The field survey made only one record of the Bush Stone-curlew, either in or nearby the Atlas footprint. The record came from a response to nocturnal call play-back in January 2012. There were no historical records in the region found in the wildlife databases (Figure C-45). With only a single record in the Project area, it is unclear if the record represents a resident population or a dispersing bird, i.e. it is not certain that the species is resident in the area. It is very vocal with distinctive calls that are loud and far-carrying, so more records would have been expected during the nocturnal surveys of the field survey if the species had a substantial population in the area.

If the species is resident in the vicinity, is unlikely to be limited by the availability of habitat in the locality and most likely is limited by predators such as foxes and cats. The removal of habitat might displace the birds to surrounding habitats, which in turn, might make them more vulnerable to predation or other threats. The Project includes the control of foxes and other predators and it is considered unlikely that the Project would have an adverse effect on the life cycle of this species such that a viable local population would be placed at risk of extinction.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed; and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action; and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

(i) The Atlas-Campaspe Mine footprint would progressively remove 2,285 ha of potential breeding and foraging habitat for the Bush Stone-curlew. This includes 2,035 ha of Belah-Rosewood Woodland, 200 ha of Acacia Woodland/Shrubland, 50 ha of Black Box Woodland. A further 470 ha of potential foraging habitat would be removed as well, including 170 ha of Disturbed Area Shrubland and 300 ha of Cleared Land), mainly where these abut more structured woodlands (Figure C-46). The Ivanhoe Rail Facility would remove 10 ha of breeding and foraging habitat and a further 30 ha foraging habitat (Figure C-47).

(ii) The Atlas-Campaspe Mine footprint would involve the progressive clearance of habitat for the Bush Stone-curlew over 20 years. This habitat would be rehabilitated after mining. The habitat between the Atlas-Campaspe Mine would remain undisturbed, as would most of the surrounding landscape. The Project would temporarily isolate individuals on either side of the active mine area and may result in diminished connectivity; however, large and contiguous areas of habitat for this species would remain in the area surrounding the Atlas-Campaspe Mine footprint. Therefore no areas of habitat for this species would become isolated from other areas of habitat. The habitat that would be removed as a result of the Ivanhoe Rail Facility is mostly adjacent to an existing rail corridor and thus fragmentation or isolation would not increase substantially as a result. The access road may marginally increase fragmentation of potential habitat but not to any significant extent, as animals would likely still be able to move across the road.

(iii) The potential breeding and foraging habitat to be cleared as a result of the Atlas-Campaspe Mine footprint might be important to any local resident members of the species, and the potential foraging habitat may also be important. However, this is part of a very extensive regional mosaic of woodland vegetation across south-western NSW that is fragmented to varying degrees. The proposed clearing involves only a very small proportion of the species' potential habitats in the CMA. If the species is resident in the vicinity, is unlikely to be limited by the availability of habitat in the locality. Similarly, the area of habitat that would be removed at the Ivanhoe Rail Facility is relatively small in comparison to the areas of potential habitat nearby, and unlikely to be important for any local population of the species. Further, the areas of surrounding habitat are in better condition in comparison to the areas that would be impacted.

The proposed offset would aim to compensate for any habitat loss and fragmentation by enhancing the habitat quality and integrity of the proposed offset area. The proposed offset area includes 3,054 ha of potential breeding and foraging habitat for the Bush Stone-curlew and a further 700 ha of potential foraging habitat (Figure C-46). Improved fire management and feral animal control would give considerable compensation to offset localised fragmentation.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" has been declared for the Bush Stone-curlew (DEC, 2006; OEH, 2011). The declaration of critical habitat is not considered to be a priority for the species given its sparse and widespread distribution (DEC, 2006).

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

The recovery plan for the Bush Stone-curlew (DEC, 2006) lists the following 10 objectives to achieve the recovery of the species in NSW:

- Expand existing Bush Stone-curlew community conservation programmes.
- Raise community recognition of the Bush Stone-curlew and interest in the recovery programme.
- Increase the total area of Bush Stone-curlew habitat protected and managed for conservation on public and private lands by 25% in each CMA.
- Supplement declining wild populations with a robust and well-funded captive-breeding and translocation programme.
- Ensure the conservation status of the Bush Stone-curlew is adequately recognised under NSW and Commonwealth legislation.

- Ensure that impacts on Bush Stone-curlews and their habitat are accurately assessed during planning and environmental assessment processes.
- Increase understanding of the ecology of the Bush Stone-curlew.
- Increase understanding of threatening processes affecting Bush Stone-curlews.
- Integrate the recovery plan with other conservation plans and programmes to maximise the efficient use of resources and benefits to biodiversity.
- Implement a well-funded and coordinated recovery programme across NSW.

The Project would not be inconsistent with any of the above objectives. The proposed offset would contribute to objective 3. The Project would not be inconsistent with the objectives of any relevant threat abatement plan.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012b), the following are relevant to the location, the proposed Project and the species:

1) Clearance of native vegetation.
2) Removal of dead wood and dead trees.
3) High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
4) Competition and grazing by the feral European rabbit.
5) Competition and habitat degradation by feral goats.
6) Predation by the European red fox.

The Project would contribute to KTP 1 and KTP 2 (as discussed in response to question d). There may also be some potential to contribute to KTP 3. A fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Appropriate fire management regimes (i.e. ecological and/or mosaic burns) would be implemented in the proposed offset area for the Atlas-Campaspe Mine to maintain and enhance suitable habitat conditions for the species. In addition, feral animal control would likely make a significant contribution towards abating KTPs 4, 5 and 6.

Conclusion

The field surveys made only one record of the Bush Stone-curlew, either in or near the Atlas footprint. The record came from a response to nocturnal call play-back. There were no historical records in the region found in the wildlife databases. The Project would have a direct impact on the Bush Stone-curlew through the removal of a total of 2,755 ha of potential habitat at the Atlas-Campaspe Mine footprint and a further 40 ha of potential habitat at the Ivanhoe Rail Facility. However, this would only impact a small proportion of the regional habitat and the regional population of the species. It is unlikely that there would be any significant impacts from habitat fragmentation. The Project is unlikely to have a significant impact on the Bush Stone-curlew given:

- Habitat clearance would not lead to fragmentation of habitats that creates a barrier to dispersal or isolates a part of the population.
- Compensation for any impacts through loss of habitat in the Atlas-Campaspe Mine footprint and the MCTR roadworks would include:
  - Management of 3,754 ha of potential Bush Stone-curlew habitat in the proposed offset area to improve their ecological viability.

- Feral animal control in the Project area and proposed offset area would aim to alleviate predation, competition and habitat degradation for the Bush Stone-curlew caused by feral animals.
- Reduced stock grazing in the Project area and proposed offset area with the potential to reduce competition and habitat degradation for the Bush Stone-curlew from herbivores.
- Implementation of a fire management strategy to maintain a low frequency fire regime that favours the Bush Stone-curlew in the proposed offset area.

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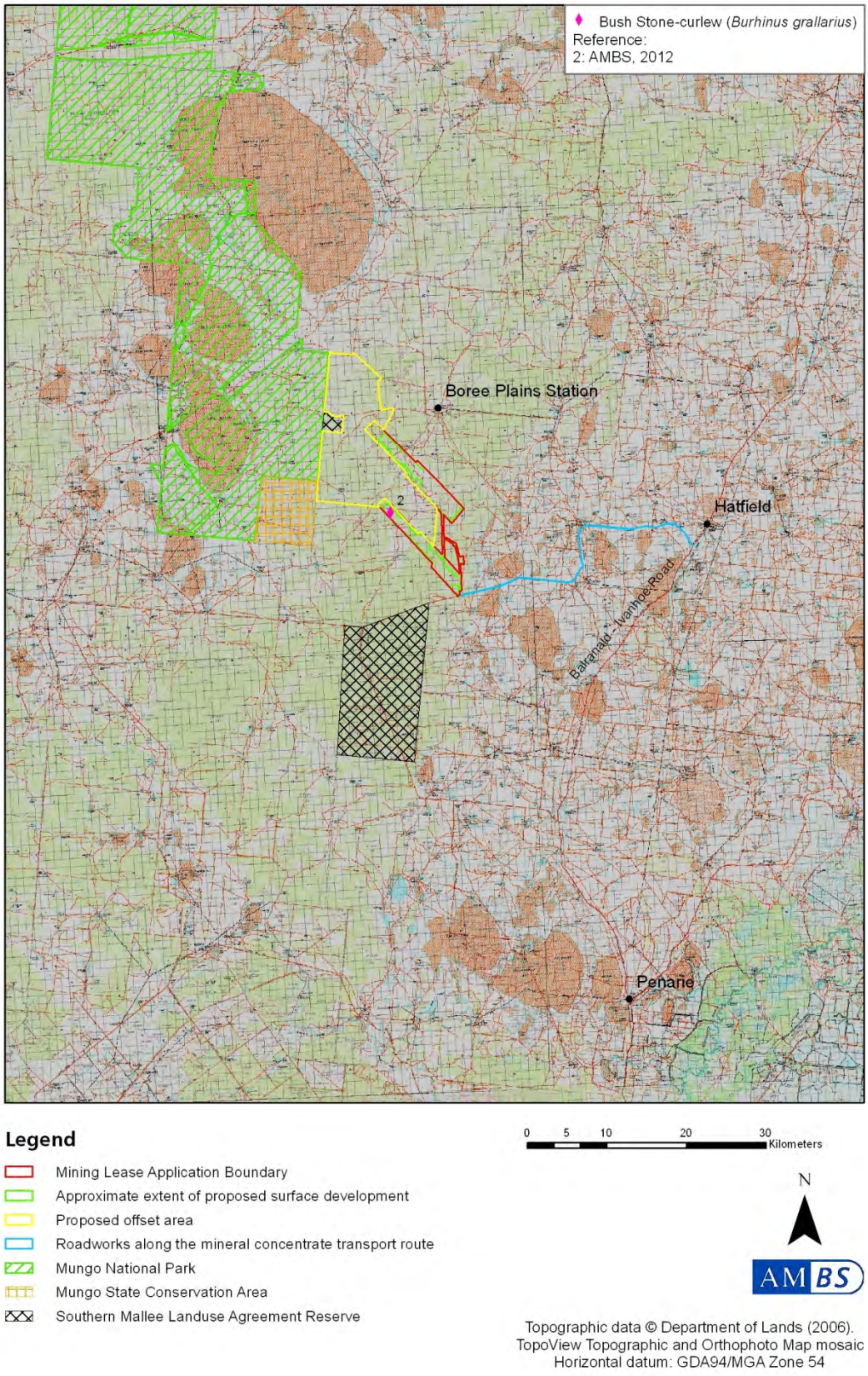

Figure C-45 Bush Stone-curlew - Landscape Distribution

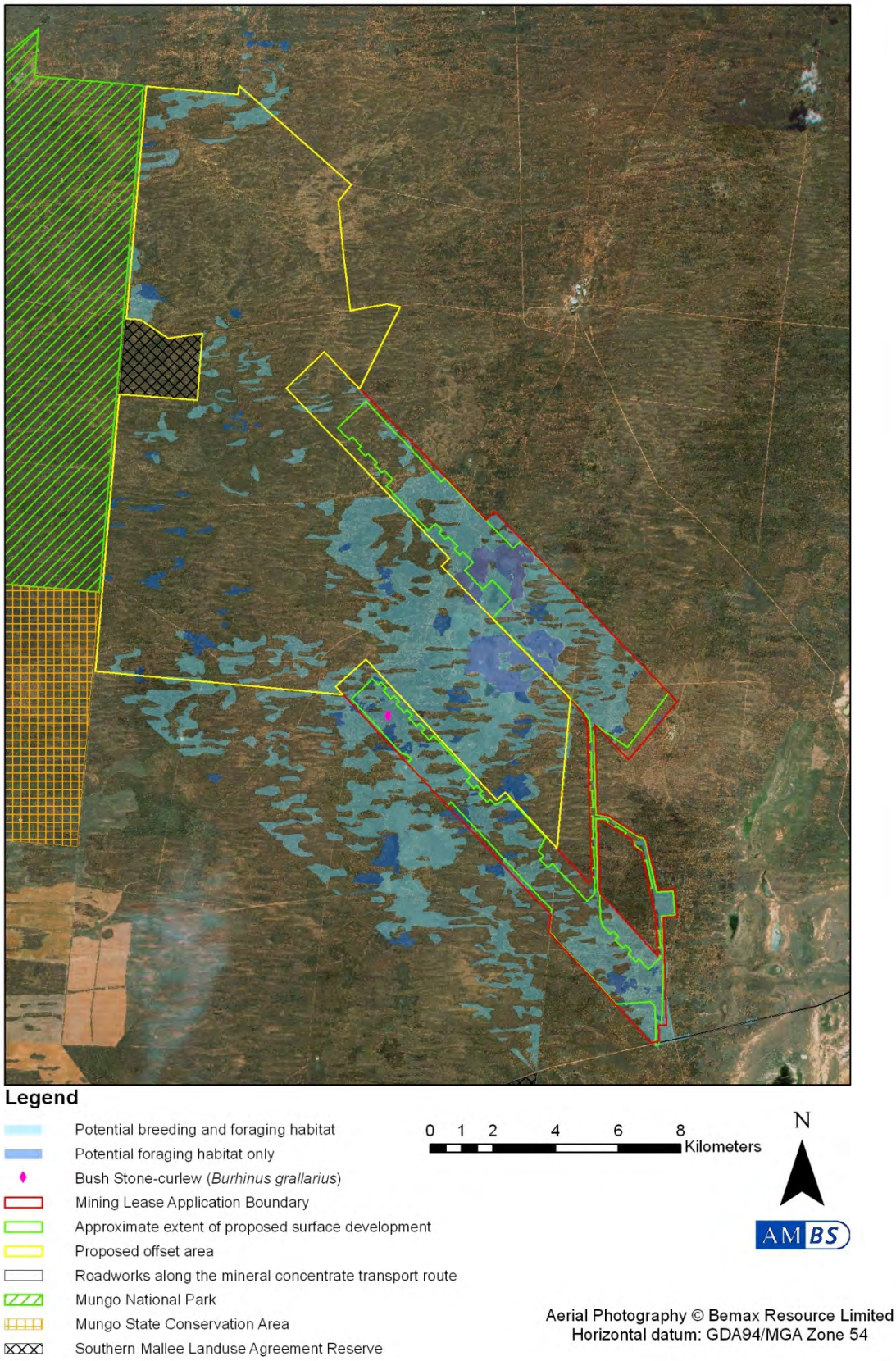

Figure C-46 Bush Stone-curlew - Potential Habitat

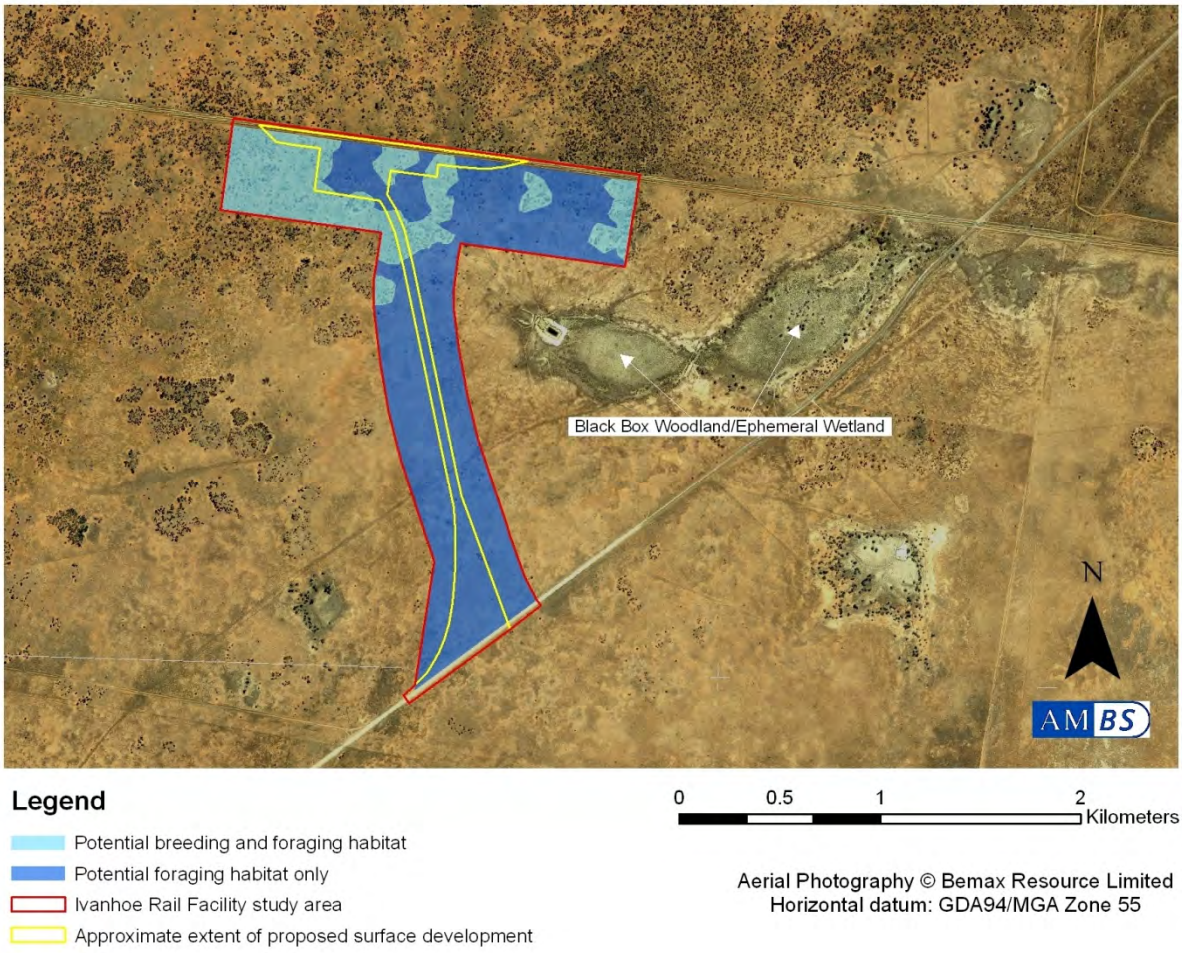

Figure C-47 Bush Stone-curlew - Potential Habitat - Ivanhoe Rail Facility

Australian Painted Snipe (Rostratula australis)

The Australian Painted Snipe (*Rostratula australis*) is listed as endangered under Schedule 1 of the TSC Act and as vulnerable under the EPBC Act. This species occurs in wetlands in all states of Australia but it is most common in eastern Australia. The Murray-Darling Basin appears to be an important area for this species (Birdlife International, 2012). The Australian Painted Snipe generally inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans (SEWPaC, 2012). They also use inundated grassland, dams, rice crops, sewage farms and bore drains. Sites where this species typically occurs include those with emergent grass tussocks, sedges, rushes or reeds. The Australian Painted Snipe also occurs in areas that are lined with trees, or that have some fallen timber (Marchant and Higgins, 1993). This species breeds in shallow wetlands with areas of bare wet mud and canopy cover nearby. Most breeding records are on or near small islands in freshwater wetlands (SEWPaC, 2012) but they have also been recorded nesting in and near swamps, flooded areas, grazing land, sedges, grasses, salt water couch (*Paspalum vaginatum*), saltbush (*Halosarcia* spp.) and grass (Marchant and Higgins, 1993).

It is estimated that the population of the Australian Painted Snipe has declined by more than 30% over the last 26 years (Birdlife International, 2012). Population estimates suggest that the population is currently unlikely to exceed 2,500 individuals and may be as few as 1,000 individuals (Birdlife International, 2012).

Loss and alteration of wetland habitat is probably the primary factor in the decline of the Australian Painted Snipe (SEWPaC, 2012). This loss and alteration is primarily due to the drainage of wetlands and the diversion of water to agriculture and reservoirs, which reduces flooding and precludes the formation of temporary shallow wetlands (Garnett and Crowley, 2000; SEWPaC, 2012). A decline in water quality because of increased nutrient and saline content has probably also contributed to the decline of the Australian Painted Snipe. Clearing of wetland vegetation and grazing, both of which degrade Australian Painted Snipe habitat, and predation by European red foxes and cats pose additional threats (NSW Scientific Committee, 2011).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

This Australian Painted Snipe was recorded in the Ephemeral Wetland nearby the Campaspe footprint. There are also additional records for this species in the Lower Murray Darling CMA (Figure C-48). There is potential breeding and foraging habitat for this species in Ephemeral Wetlands, Chenopod Shrubland Depression and Grass and Herbland Depressions. The potential habitat for this species is located within two patches of Ephemeral Wetland; one patch occurs in the south-eastern section of the proposed offset area and the other adjacent to the Campaspe footprint (Figure C-49). The Ephemeral Wetland in the proposed offset area contains potential habitat in the form of ground vegetation on the western side. The Ephemeral Wetland close to the Campaspe footprint lacks ground and mid-layer vegetation closest to the water on all sides of the waterbody, presumably due to the movement of cattle. Some shelter resources occur close to the water's edge in the form of fallen logs and grassy vegetation.

The Project would result in the direct loss of 5 ha of potential breeding and foraging habitat in the Chenopod Shrubland Depression along the MCTR that the Australian Painted Snipe could use during wetter periods.

The proposed mining at Atlas and Campaspe is expected to have a limited, localised and temporary effect on areas where temporary surface ponding occurs at the Atlas Campaspe Mine site (i.e. through excavation) (GEO-ENG 2013). This applies to depressions located beside and 2.5 km to the south of the Campaspe footprint.

There are two Ephemeral Wetlands associated with Black Box Woodland with potential to be indirectly impacted by changes to hydrology. The initial mine design was refined to avoid as much of the Black Box Woodland and the associated Ephemeral Wetland in these locations as practicable. However, mining of the Campaspe deposit (between Years 11 to 13) would remove an area of woodland and part of the clay associated with the water holding capacity in this depression. The total water holding capacity of the depression may be affected if the clay material to be removed was replaced with overburden and process waste after mining. To minimise this, Cristal Mining would selectively place clay material in low-lying portions of the re-profiled landform within the mine path to reinstate run-on to adjacent depressions. The Campaspe footprint would also temporarily prevent surface runoff from flowing into these wetlands from the north for the duration of the mining of the Campaspe deposit. Cristal Mining would partly restore the local catchment to this Ephemeral Wetland by designing the rehabilitated mine landform to maximise the surface water flow to this area. This may also provide suitable conditions for species representative of Black Box Woodland (e.g. *Eucalyptus largiflorens*) to re-establish in the disturbed areas adjacent to the wetland.

While potential habitat for this species would be removed by the Project and there is a chance that further potential habitat would be impacted by hydrological changes and through disturbance associated with mining operations, it is considered that the Project is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction given that:

- Only a relatively small area (5 ha) of potential breeding and foraging habitat in Chenopod Shrubland Depressions along the MCTR would be directly impacted by the proposed Project.
- Only a small area (9 ha) of breeding and foraging habitat in the Ephemeral Wetland would be indirectly impacted by the proposed Project.
- A total of 21 ha of similar potential habitat (Ephemeral Wetland and would be conserved in the proposed offset area.
- Better quality habitat exists in the surrounding area, including in the Ephemeral Wetlands of the Willandra Creek and Willandra Lakes Region, which are considered to be significant in the Murray Darling Depression Bioregion (NPWS, 2003).

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Atlas-Campaspe Mine footprint would result in the removal of a relatively small area of potential habitat (5 ha of Chenopod Shrubland Depressions). Additional potential habitat in the Ephemeral Wetland (9 ha) close to the footprint may be indirectly impacted by changes to hydrological regimes in the area and through disturbance caused by mining operations. For example the Campaspe footprint would prevent surface run-off from the north entering the Ephemeral Wetland adjacent to the Campaspe footprint. A habitat map for the species is provided in Figures C-49 and C-50.

(ii) The Atlas-Campaspe Mine footprint would not result in fragmentation or isolation of known habitat for this species.

(iii) Given that the area of potential habitat to be removed is only small (5 ha) and the habitat likely to be modified through indirect impacts (9 ha), that 21 ha of similar habitat would be conserved in the proposed offset area, and that better quality habitat (Ephemeral Wetlands) exists in the surrounding area, including in the Willandra Creek and Willandra Lakes Region World Heritage Area (NPWS, 2003), it is considered that the habitat to be removed is not likely to be important for the long-term survival of the species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" for the Australian Painted Snipe is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no recovery plan or threat abatement plan for the Australian Painted Snipe. Actions that are recommended to facilitate the conservation and recovery of the species include protecting and managing habitat at principal breeding and wintering sites and protecting any habitat that has been used by the Australian Painted Snipe in the last 10 years. Initiating control programmes for feral animals, erecting fencing to prevent grazing and trampling of wetlands by cattle, and limiting the use of pesticides and other chemicals at or near suitable wetlands is also recommended (SEWPaC, 2012; OEH, 2012a). Thus it is considered that the Project is not inconsistent with the suggested management actions for Australian Painted Snipes.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Key Threatening Processes listed under the TSC Act of relevance to the Australian Painted Snipe as a result of the action include '*Alteration to the natural flow regimes of rivers, streams, floodplains and wetlands*', '*Competition and grazing by the feral European rabbit* (*Oryctolagus cuniculus*)','*Competition and habitat degradation by feral goats (Capra hircus)' and 'Predation by the European red fox* (*Vulpes vulpes*)' (OEH, 2012b) There is the potential that flow regimes in the local area would be altered for the duration of the mine operations. The Project is likely to contribute to this key threatening process, however these wetlands are ephemeral and whilst they are important in the local context given it is a limited resource, from a regional context they are not identified as a significant or key breeding area for the species. In addition, the Ephemeral Wetland within the proposed offset area would be conserved and potentially enhanced through the removal of stock. Moreover, fox and other invasive species (e.g. rabbits, goats, feral cats, dogs) control programmes would be implemented, which should decrease the impact of these key threatening process.

Conclusion

The Australian Painted Snipe was recorded in the area surrounding the Project area in the Ephemeral Wetland close to the Campaspe footprint. Potential habitat for this species occurs in the study area in Ephemeral Wetlands, Chenopod Shrubland Depression and Grass and Herbland Depressions.

The Project area would result in the removal of 5 ha of potential breeding and foraging habitat for this species. In addition, potential changes to hydrological regimes as a result of the Campaspe footprint and disturbance due to mining operations could have indirect impacts on habitat for this species, particularly in the Ephemeral Wetland of 9 ha close to the Campaspe footprint. However, the Project is not expected to have a significant impact on the Australian Painted Snipe given that:

1) The area of potential habitat that would be removed is only small (5 ha).
2) A total of 21 ha of similar potential habitat would be conserved in the proposed offset area.
3) While potential hydrological changes and disturbance could impact the Ephemeral Wetlands in the study area for the duration of the mine operations and post operation if the reinstated landforms are not appropriate, these wetlands are ephemeral and whilst they are important in the local context given it is a limited resource, in a regional context they are not identified as a significant or key breeding areas for the species. Therefore these impacts are not considered likely to affect the long-term survival of the species in the region.
4) Better quality habitat exists in the surrounding area, including in the wetlands of the Willandra Creek and Willandra Lakes Region World Heritage Area, which are considered to be significant in the Murray Darling Depression Bioregion (NPWS, 2003).

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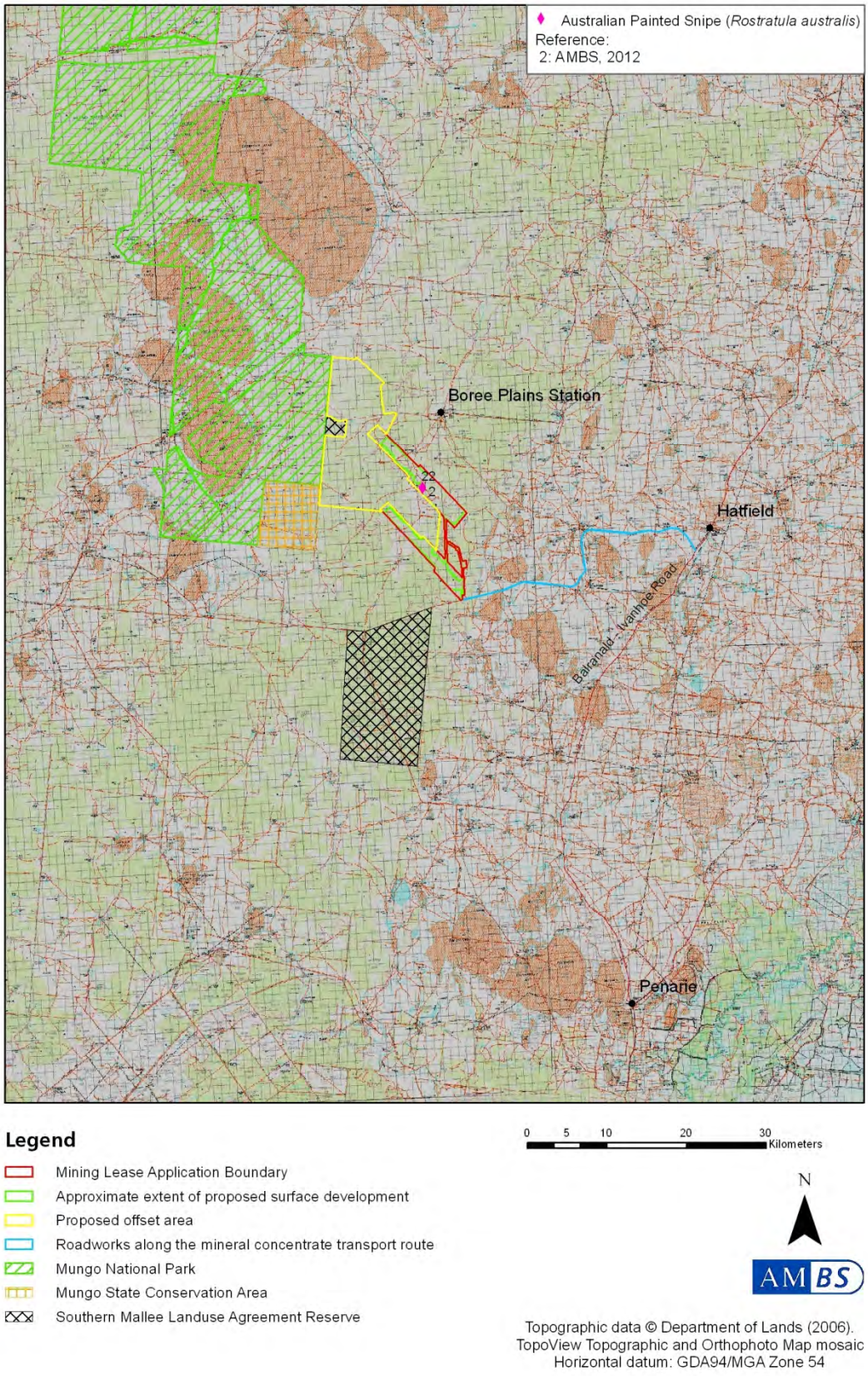

Figure C-48 Australian Painted Snipe - Landscape Distribution

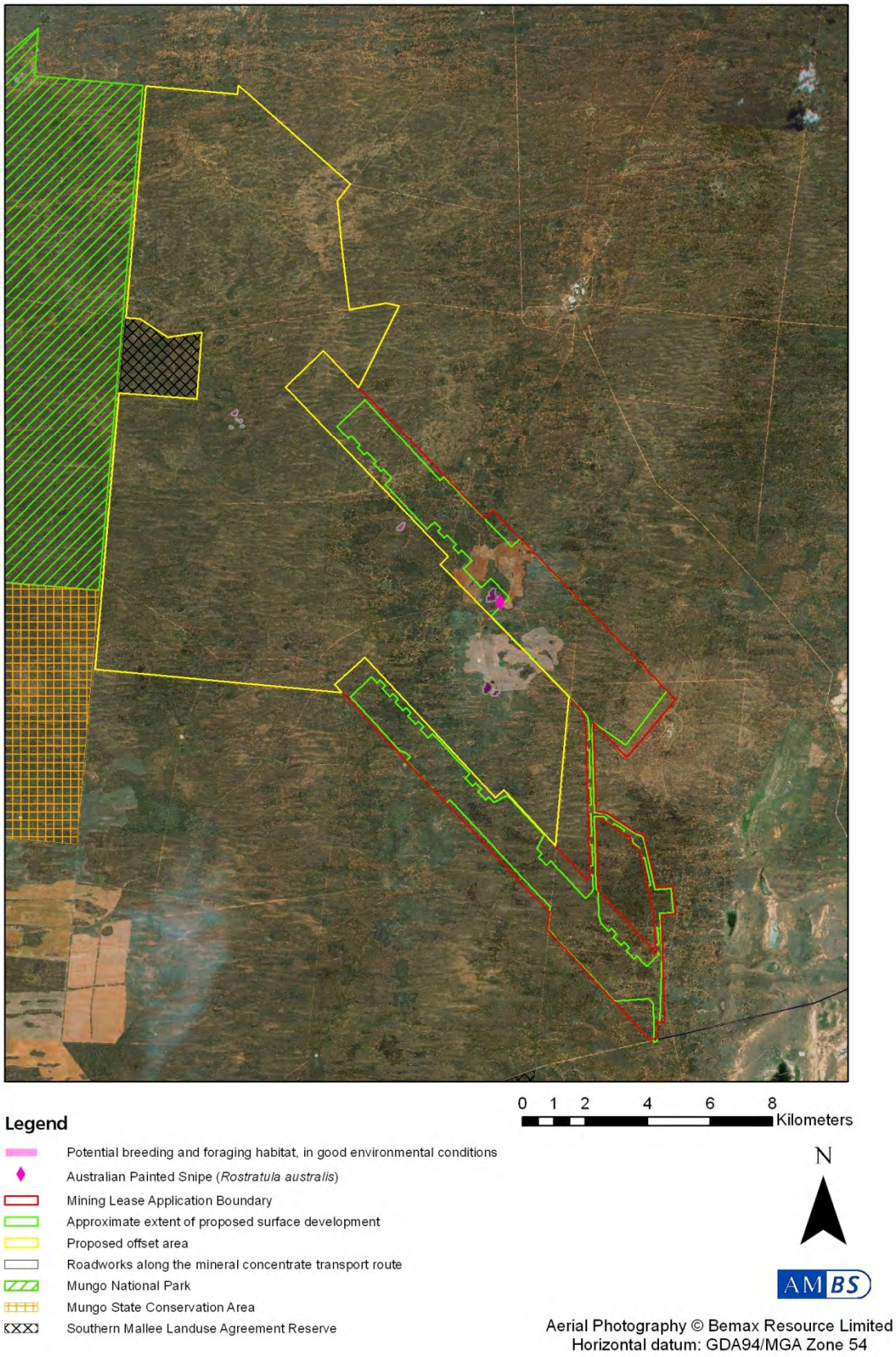

Figure C-49 Australian Painted Snipe - Potential Habitat

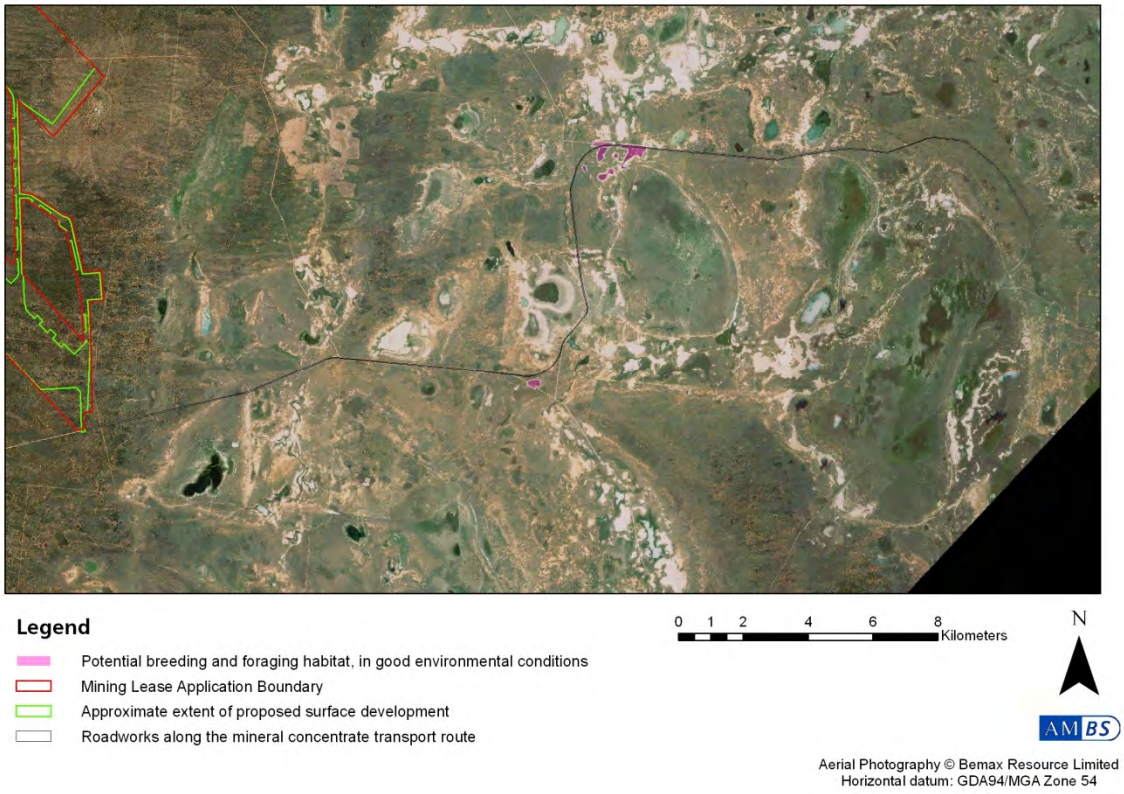

Figure C-50 Australian Painted Snipe - Potential Habitat - Mineral Concentrate Transport Route

Flock Bronzewing (*Phaps histrionica*)

The Flock Bronzewing (*Phaps histrionica*) is listed as an endangered species in NSW under Schedule 1 of the TSC Act. This species is patchily distributed and only rarely observed in NSW (OEH, 2012a). They are mainly found north of Broken Hill and west of Cobar but there are records of this species occurring as far south as Ivanhoe, NSW (OEH, 2012b).

Flock Bronzewings occur in a variety of vegetation types, including grassy plains, saltbush, spinifex and open mulga. It's preferred habitat is tussock grassland, particularly Mitchell grassland. This highly nomadic species needs to drink daily and may be seen adjacent to water (e.g. at stock tanks, bore drains and pools in water courses).

This species rests on the ground during the day and nests in a simple scrape on the ground in the cover of a bush, low branch, grass tussock, or in dust on bare ground around bores, often in close proximity to many others of the same species.

Threats to the species include grazing, which removes the grass bulk that provides habitat (cover) and potential food sources. It also allows herbaceous prickly weeds to dominate. Trampling of nests by stock when the species is nesting near watering points can be a problem. Cultivation removes tussock grasses thus destroying any potential habitat of this species. Predation by cats and foxes is likely at all times but particularly when nesting (OEH, 2012a).

(a) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

This species is not likely to occur near the Atlas-Campaspe footprint. The Flock Bronzewing was not recorded in the Ivanhoe Rail Facility footprint or study area during surveys; however, there is one record of the species within a 20 km radius (OEH, 2012b) (Figure C-51). In the Ivanhoe Rail Facility study area, 30 ha of suitable breeding and foraging habitat for the species occurs in Native Grassland and 10 ha of suitable foraging habitat occurs in the Belah-Rosewood Woodland.

The Project would not place the local population at risk of extinction given that only a relative small area of potential habitat would be removed within the Ivanhoe Rail Facility footprint and there is considerable suitable breeding and foraging habitat in the surrounding area (Figure C-51). Further, Ivanhoe would be close to the edge of the known range of the species, and individuals are only likely to occur as occasional vagrants under suitable conditions.

(b) in the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:
(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable.

(d) in relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed, and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality

(i) The Ivanhoe Rail Facility footprint would result in the removal of approximately 40 ha of potential habitat for the Flock Bronzewing in Native Grassland (30 ha) and Belah-Rosewood Woodland (10 ha). The impact of the loss of this habitat is expected to be minor considering the availability of habitat in the wider locality (Figures C-51).

(ii) The Ivanhoe Rail Facility footprint would not result in fragmentation or isolation of this nomadic species since it has not been directly recorded within study area, and all areas of suitable habitat would remain connected to other areas of habitat to the west of the footprint.

(iii) The Flock Bronzewing has not been recorded within the Ivanhoe Rail Facility footprint but has been recorded within a 20 km radius. This species is highly nomadic so it may occur at times within the Ivanhoe Project area. Suitable habitat occurs both within the Ivanhoe Rail Facility footprint and as a much larger continuous patchwork of habitat that extends throughout much of the surrounding area. Higher quality habitat exists in the surrounding area, and the loss of the small area of potential habitat is not considered important for long-term survival of the species in the locality.

(e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" for the Flock Bronzewing is listed in the Register of Critical Habitat kept by the Director General of the OEH (OEH, 2011).

(f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is currently no approved recovery plan prepared for the Flock Bronzewing (OEH, 2012a). However, OEH (2012a) has listed 14 priority actions to assist with the recovery of the species, three of which are relevant to the Project. These include:

- Encourage management of livestock grazing so as to maintain or improve habitat grass cover and seed production.
- Control feral goats, rabbits and pigs near known foraging habitat.
- Control foxes and cats (domestic and feral) near flocks of breeding birds.

(g) whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012c), the following are relevant to the location, the Project and the species:

1) Clearance of native vegetation.
2) High-frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition.
3) Competition and grazing by the feral European rabbit.

4) Competition and habitat degradation by feral goats.
5) Predation by the European red fox.
6) Predation by the feral cat.

The Project would contribute to KTP1 (as discussed above under response to question d). There may also be some potential to contribute to KTP2, however a fire management strategy would be developed for the Project area to minimise the potential for fire outbreaks. Feral animal management would make considerable contributions to reduce KTPs 3, 4, 5 and 6.

Conclusion

Overall, the Project is not likely to have a significant impact on the Flock Bronzewing. The Flock Bronzewing was not recorded in the Ivanhoe Rail Facility footprint; however, there is a record for this species within a 20 km radius of the Project area. Based on habitat assessments undertaken throughout the study area, the Project would remove approximately 40 ha of potential habitat. However, this would only impact a small proportion of the regional habitat and the regional population of the species. It is unlikely that there would be any significant impacts from habitat fragmentation. The Project is unlikely to have a significant impact on the Flock Bronzewing that would cause a local viable population to be placed at risk of extinction given:

1) The species is highly nomadic.
2) Potential habitat within the Ivanhoe Rail Facility is surrounded by continuous vegetation, some of which is higher quality.
3) From a regional perspective, the Project would remove a comparatively small area (40 ha) of potential habitat.
4) Habitat clearance would not lead to fragmentation of habitats that creates a barrier to dispersal or isolates a part of a population of this species.

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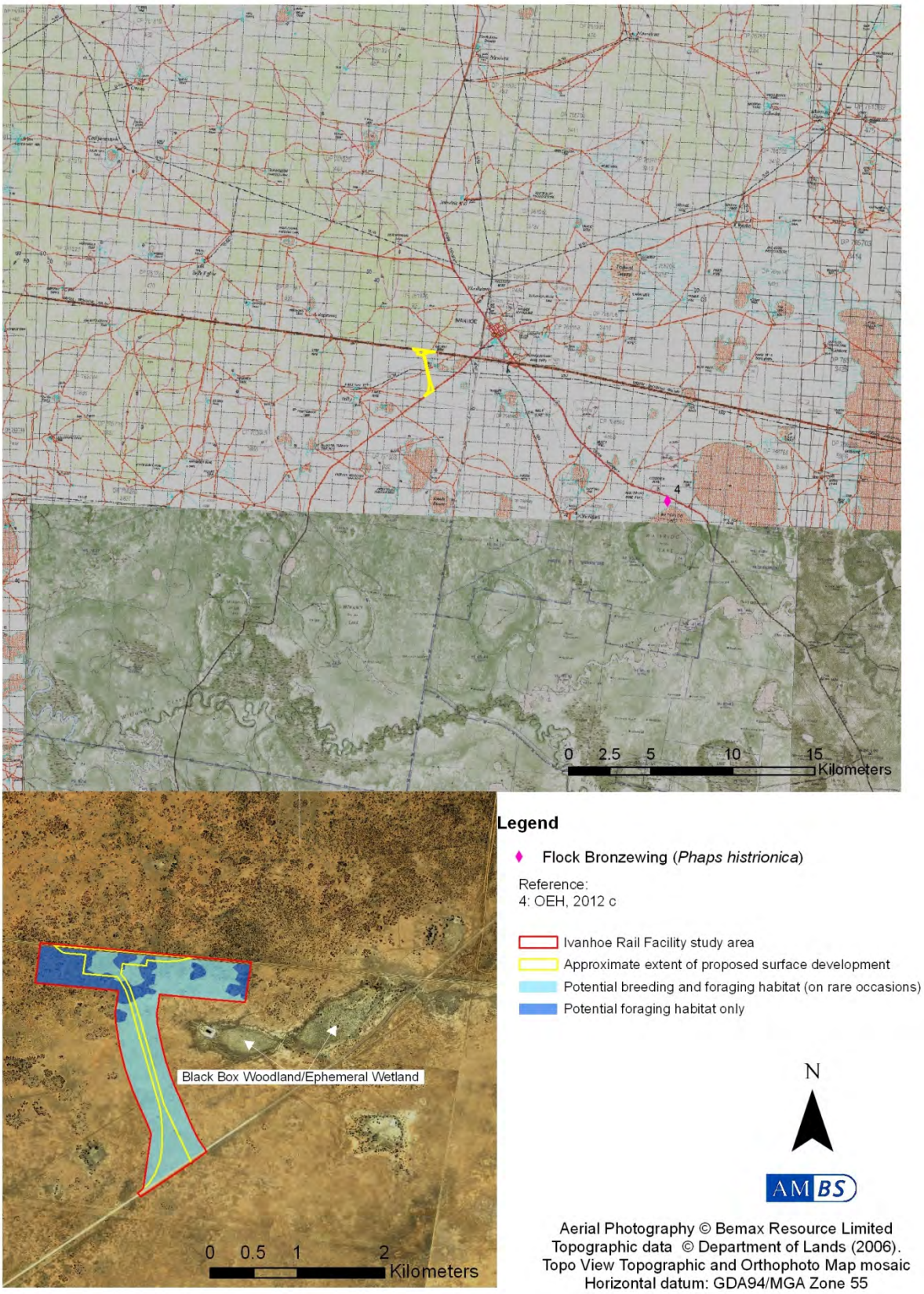

Figure C-51 Flock Bronzewing - Potential Habitat - Ivanhoe Rail Facility

Major Mitchell's Cockatoo (Lophochroa leadbeateri)

The Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) is listed as vulnerable under Schedule 2 of the TSC Act. An unmistakable cockatoo of the dry inland, Major Mitchell's Cockatoo is found across Australia's arid and semi-arid inland, from south-western Queensland south to north-western Victoria, through most of South Australia, north into the south-western Northern Territory and across to the west coast between Shark Bay and about Jurien. In NSW it is found regularly as far east as about Bourke and Griffith, and sporadically further east than that (Morris *et al*., 1981; Blakers *et al*., 1984; Higgins, 1999; Barret *et al*., 2003; OEH, 2012a).

It inhabits a wide range of treed and treeless inland habitats, always within easy reach of water. It most frequently occurs in dry woodlands, particularly woodland assemblages of Eucalyptus mallee, Callitris pine and Casuarina she-oak. It also frequents riparian habitats including River Red Gum and/or Black Box Woodlands. It sometimes occurs in Acacia shrublands, chenopod shrublands or cleared farmland, and sometimes persists in woodland remnants surrounded by cleared land. However, local declines have also been reported following the clearing of woodlands. It feeds mostly on the ground, especially on the seeds of native and exotic melons and on the seeds of chenopods, wattles and Callitris pines. Surface water is important and numbers may congregate at swamps, rivers and farm dams to drink. Although it normally occurs in pairs or small groups, flocks of hundreds may congregate where food is abundant. It is generally sedentary, but may move in response to food shortages or gluts (Blakers *et al*., 1984; Higgins, 1999; OEH, 2012a).

The nest is in a large hollow stump, trunk or near horizontal limb, usually in a large Eucalyptus trees. Other species such as *Callitris* sp. are sometimes used. Nests are spaced at least 1 km apart and often more than 6 km apart, with probably no more than one pair every 30 km^2. However, feeding flocks or groups of non-breeding birds may occur within the breeding territories. It is a rather social species forming complex social bonds with local breeding and non-breeding birds in flocks (Higgins, 1999).

OEH (2012a) lists the following four threats to the species:

1) Clearing of woodlands.
2) Heavy grazing of feeding areas resulting in the removal of seeding grasses and preventing regeneration of food plants.
3) Loss of existing and future hollow-bearing trees.
4) Illegal nest-robbing and trapping.

The Major Mitchell's Cockatoo was recorded frequently in the Atlas-Campaspe Mine footprints and surrounds during the field surveys and there are also numerous records in the wildlife databases (Figure C-52). Nine records were made during the field surveys in the Atlas-Campaspe footprint. Nineteen field survey records were made in the proposed offset area. There are numerous records from Mungo National Park and the surrounding areas. Many of the field survey records were from cleared land (where the species was probably feeding on the seeds of Paddymelons) or from water points.

In the Atlas-Campaspe Mine footprint suitable breeding habitat for the Major Mitchell's Cockatoo is likely to include Black Box Woodland and portions of the Linear Dune Mallee and Sandplain Mallee, where medium sized hollows exist. Foraging habitat is also available in these habitats as well as in the Sandhill Pine Woodland, Acacia Woodland/Shrubland, Belah-Rosewood Woodland, Chenopod Shrubland, Chenopod Shrubland Depression, Disturbed Shrubland and Cleared Land. In the Ivanhoe Rail Facility study area, potential foraging habitat is likely to include Belah-Rosewood Woodland and Native Grassland. Breeding habitat is limited but may occur in the nearby Black Box Woodland where medium or large hollow exist.

(a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

The Major Mitchell's Cockatoo was recorded during the current surveys at nine localities in the Atlas-Campaspe Mine footprint, with two localities within the Atlas footprint, six localities within the Campaspe footprint and one location along the internal access road. A further three localities were close to the edge of the Campaspe footprint (Figure C-52). This species was recorded from outside the Atlas-Campaspe Mine footprint in the current survey, including 19 localities within or on the edge of the proposed offset area. There are no previous database records from within the Atlas-Campaspe Mine footprint, but previous records are in high abundance in adjoining areas, including Mungo National Park, Boree Station Homestead and in the Southern Mallee Landuse Agreement Reserve to the south of the Atlas-Campaspe Mine (Figure C-52). The species has been recorded three times in recent surveys by Ecotone Ecological Consultants for the Balranald Mineral Sands Project, including two small flocks of 3 to 5 birds in the Nepean Deposit approximately 10 km south of the Atlas-Campaspe Mine and another two records in the West Balranald Deposit approximately 45 km south of the Atlas-Campaspe Mine (Ecotone Ecological Consultants, 2012a; 2012b). The species was recorded from one location near the Black Box Woodland, to the east of the Ivanhoe Rail Facility footprint.

The Project would only impact directly on the life cycle of this species if a traditional nest tree was removed during the clearing of vegetation. Nest trees are located at least 1 km apart. Suitable nest trees would only be present in Black Box Woodland, and potentially in Linear Dune Mallee and Sandplain Mallee where medium sized hollows exist in the Atlas-Campaspe Mine footprints. Since the patches of Black Box Woodland proposed to be cleared are small (at the Atlas-Campaspe Mine footprint), each would support one nesting tree at most, which is a maximum of two in the entire Project area. Thus the breeding cycle of two pairs might be disrupted by the loss of nest trees. This would be a very small proportion of the regional population of the species in south-western NSW, so any disruption would not have a significant impact on the population.

No medium or large tree hollows are likely to be impacted at the Ivanhoe Rail Facility, and therefore would not disrupt the life cycle of the species in this area.

Aspects of the life cycle may be impacted indirectly through the removal of habitat, which is addressed in response to question d.

(b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.

Not applicable.

(c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction; or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.

Not applicable.

(d) In relation to the habitat of a threatened species, population or ecological community:
(i) the extent to which habitat is likely to be removed or modified as a result of the action proposed; and
(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the Project; and
(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.

The Project would progressively remove up to 50 ha of suitable breeding and foraging habitat, 1,575 ha of potential habitat where medium size hollows exist and 2,793 ha of suitable foraging habitat for the Major Mitchell's Cockatoo, at the Atlas-Campaspe and MCTR footprints. This includes breeding and foraging habitat in Black Box Woodland (50 ha); and potential breeding and known foraging habitat in Linear Dune Mallee (1,040 ha) and Sandplain Mallee Woodland (535 ha) where medium sized hollows exist. As well as foraging only habitat in Sandhill Pine Woodland (3 ha), Acacia Woodland/Shrubland (200 ha), Chenopod Shrubland (80 ha), Chenopod Shrubland Depression (5 ha), Belah-Rosewood Woodland (2,035 ha), Disturbed Shrubland (170 ha) and Cleared Land when grasses are seeding or during harvesting of crops (300 ha). The total area is less than the size of two breeding and feeding territories. A habitat map for the species has been provided in Figures C-53 and C-54.

The mining of the Atlas-Campaspe deposits would involve the progressive clearance of habitat for the Major Mitchell's Cockatoo over 20 years which would be rehabilitated after mining. The habitat between the footprints would remain undisturbed, as would most of the surrounding landscape. The Project would temporarily isolate individuals on either side of the active mine area and may result in diminished connectivity across the mine area; however, large and contiguous areas of habitat for this species would remain in the area surrounding the Atlas-Campaspe Mine footprint. Therefore no areas of habitat for this species would become isolated from other areas of habitat.

The suitable breeding and foraging habitat to be cleared at the Atlas-Campaspe and MCTR footprints is certainly important to the local resident members of the species, and the supplementary habitat may also be important. However, this is part of a very extensive regional mosaic of woodland vegetation across south-western NSW that is fragmented to varying degrees. The species is likely to have much larger populations spread throughout this mosaic, and the loss of habitat would only impact on a very small proportion of the population. The impact to the regional population would not likely be significant. The proposed pattern of clearing would not leave any habitats isolated. Habitats already exist in a mosaic and the mosaics in the study area would remain contiguous with the wider woodland vegetation mosaic of the region. Major Mitchell's Cockatoo's are highly mobile and capable of flying over the landscape across a wide variety of habitats, including cleared areas. The proposed clearing is therefore not likely to create a barrier to the dispersal or gene flow of Major Mitchell's Cockatoo or lead to the isolation of a portion of the population.

Potential foraging habitat for the species at the Ivanhoe Rail Facility occurs, but only a relatively small area would be removed, including 10 ha of Belah-Rosewood Woodland and 30 ha of Native Grassland (Figure C-55). No breeding habitat is likely to be impacted by the development. Any local population of the species would be unlikely to rely on the potential habitat that would be impacted. Higher quality habitat occurs in the nearby surrounds. Known habitat for the species occurs throughout much of the Darling Depressions (Part B) CMA sub-region (OEH, 2012a), so the species is unlikely to be geographically restricted at the Ivanhoe study area.

The Ivanhoe Rail Facility would mostly remove potential habitat adjacent to an existing rail corridor, which would not increase fragmentation or isolation. The access road may marginally increase fragmentation of potential habitat but this would not affect this highly mobile species to any significant extent.

The proposed offset would aim to compensate for any habitat loss and fragmentation by enhancing the habitat quality and integrity of the proposed offset area. The proposed offset area includes 16,540 ha of suitable breeding and/or foraging habitat for the Major Mitchell's Cockatoo. Improved fire management, increased control of feral animals and reduced grazing pressure would give considerable compensation to offset habitat loss.

A habitat map for the Major Mitchell Cockatoo is provided in Figures C-53 and C-54.

(e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).

No "critical habitat" for the Major Mitchell's Cockatoo is listed in the Register of Critical Habitat kept by the Director-General of the OEH (OEH, 2011).

(f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.

There is no Recovery Plan for the Major Mitchell's Cockatoo, however OEH (2012a) lists four management objectives to assist the species' recovery and that are of relevance to the Project:

- Manage grazing in feeding areas to prevent loss of food resources.
- Fence areas of habitat, exclude stock and control rabbits to assist regeneration of trees, shrubs and native grasses.
- Protect existing and future hollow-bearing trees for nest sites.
- Monitor known nesting sites to deter poachers.

The Project would assist with the implementation of the first two of these objectives and would not be inconsistent with the fourth. Management of the proposed offset area would be consistent with the third objective, but habitat clearance for the Projects sites would not be. The Ivanhoe Rail Facility avoids impacting on medium and large hollow bearing trees, which is consistent with objective three.

(g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.

Of the 36 KTPs listed for NSW by OEH (2012b), the following are relevant to the location, the proposed Project and the species:

1) Clearance of native vegetation.
2) Loss of hollow-bearing trees.
3) Removal of dead wood and dead trees.
4) Competition and grazing by the feral European rabbit.
5) Competition and habitat degradation by feral goats.

The Project would contribute to KTP 1 (as discussed above in response to question d). It would also contribute KTP 2 and KTP 3 to a lesser extent. Feral animal control in the Project area and proposed offset would likely make a significant contribution towards abating KTPs 4 and 5.

Conclusion

The Project would have a direct impact on the Major Mitchell's Cockatoo through the removal of 4,418 ha of suitable breeding and/or foraging habitat at the Atlas-Campaspe and MCTR footprints. The Ivanhoe Rail Facility would remove approximately 40 ha of potential foraging habitat. However, this would only impact a small proportion of the regional habitat and the regional population of the species. It is unlikely that there would be any significant impacts from habitat fragmentation. The Project is unlikely to have a significant impact on the Major Mitchell's Cockatoo that would cause a local viable population to be placed at risk of extinction given:

1) The species is relatively widespread in and around the Project area and locality.
2) There would be no significant interruption to the species' life cycle that would lead to local declines or extinction of a viable population.
3) From a regional perspective, the proposed Project would remove a comparatively small area (4,418 ha at the Atlas-Campaspe and MCTR footprints; 40 ha at the Ivanhoe Rail Facility) of suitable and potential habitat.
4) Habitat clearance would not lead to fragmentation of habitats that creates a barrier to dispersal or isolates a part of the population of this mobile species.

Proposed avoidance, management and mitigation measures would include:

1) Management of 16,540 ha of Major Mitchell's Cockatoo habitats in the proposed offset area to improve their ecological viability.
2) Implementation of feral animal control in the Project area to reduce the pressures of competition and habitat degradation from herbivores.
3) Reduced stock grazing in the Project area to reduce the pressures of competition and habitat degradation from herbivores.
4) Implementation of fire management measures to maintain a low frequency fire regime that favours the Major Mitchell's Cockatoo.

Overall the proposed Project is not likely to have a significant impact on the regional population of the Major Mitchell's Cockatoo.

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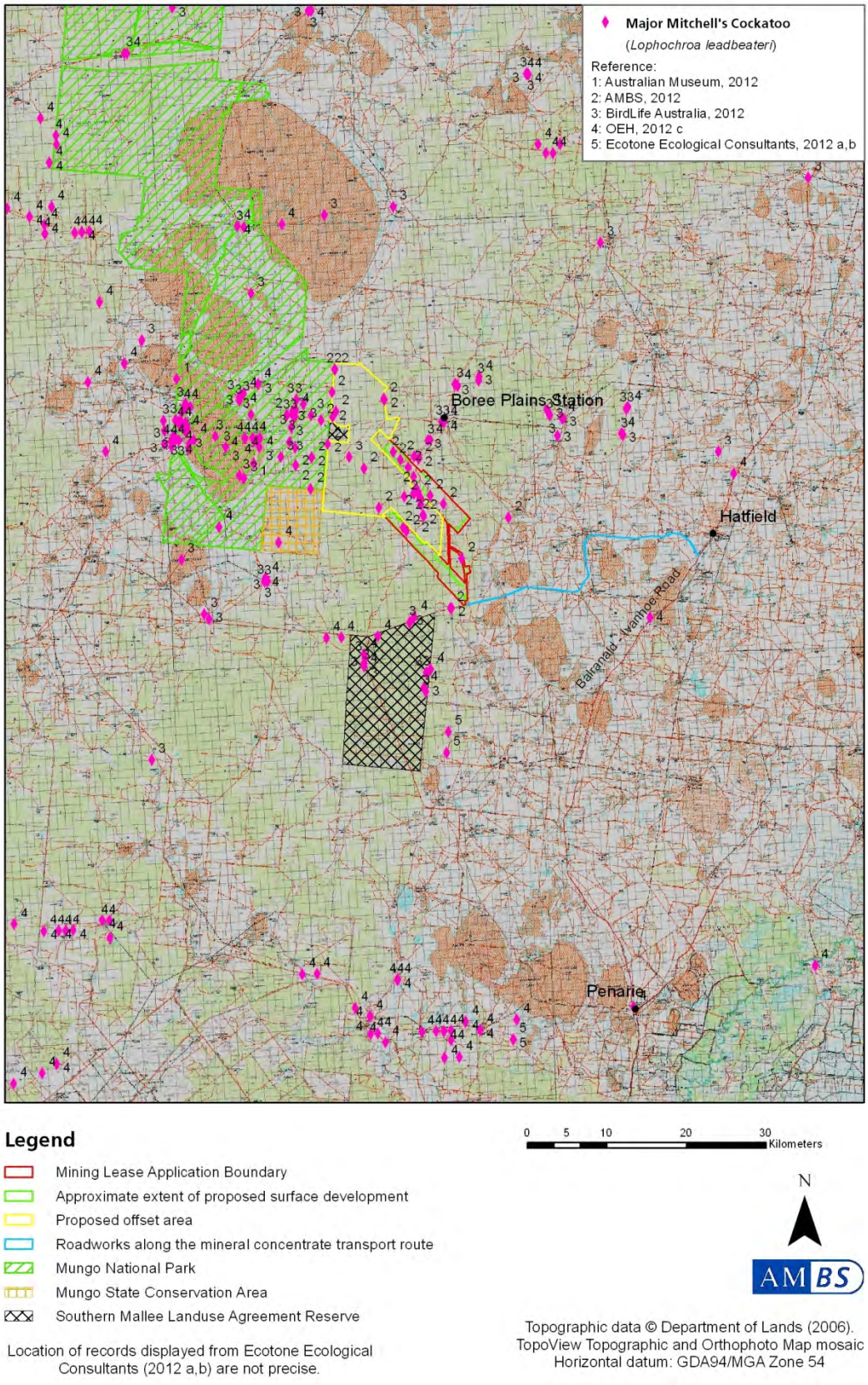

Figure C-52 Major Mitchell's Cockatoo – Landscape Distribution

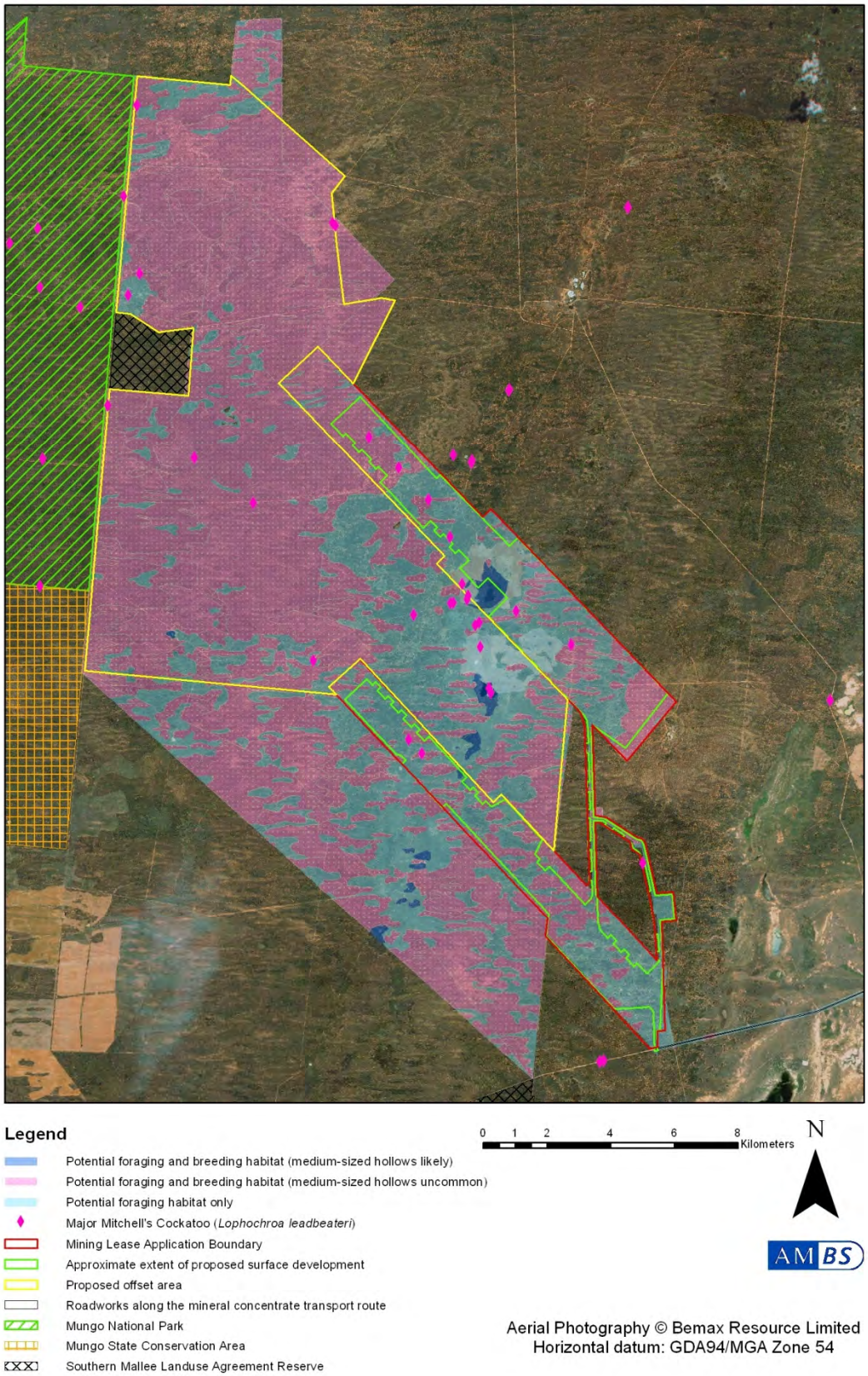

Figure C-53 Major Mitchell's Cockatoo - Potential Habitat

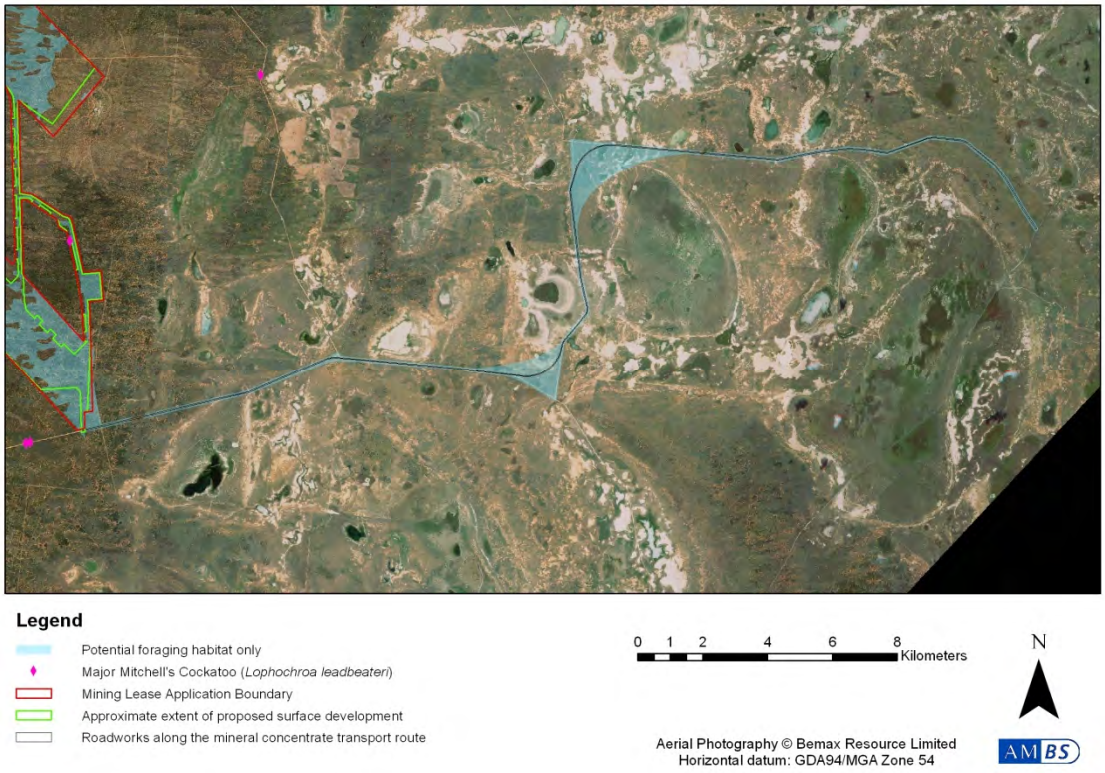

Figure C-54 Major Mitchell's Cockatoo - Potential Habitat - Mineral Concentrate Transport Route

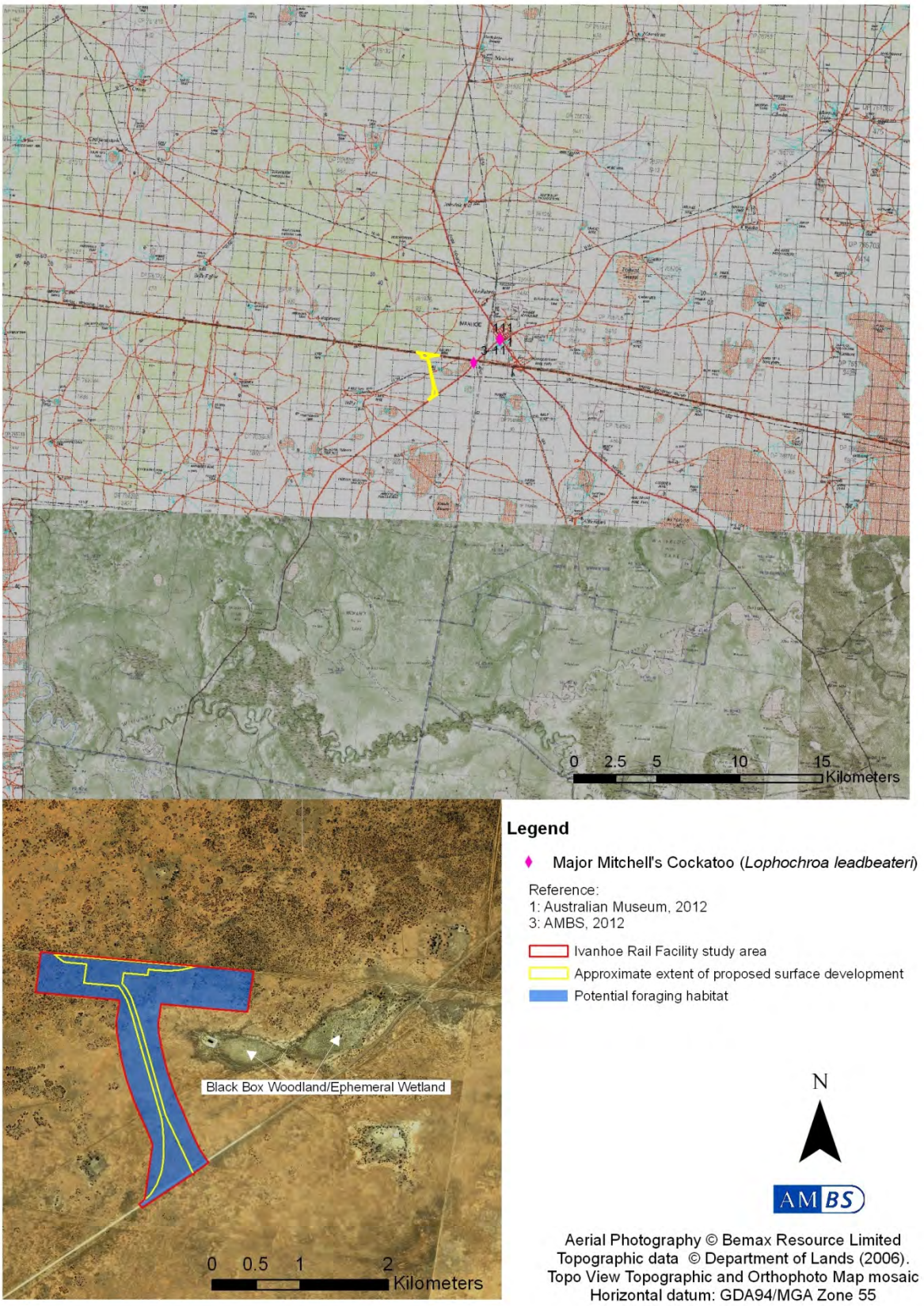

Figure C-55 Major Mitchell's Cockatoo - Potential Habitat - Ivanhoe Rail Facility