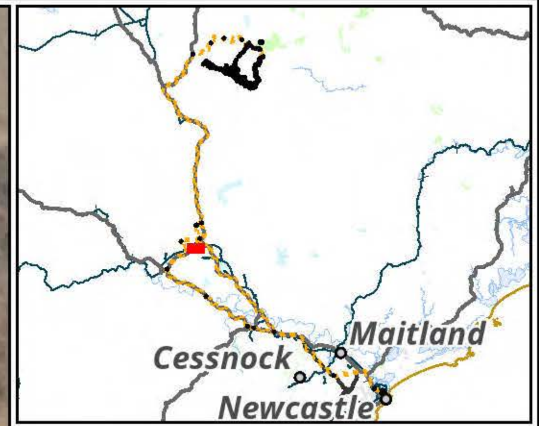
APPENDIX E.5 UPDATED BDAR

Acknowledgements: Basemap © Land and Property Information 2016; Imagery © Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community



Legend

- Infrastructure footprint
- Transport haul routes
- Southern Myotis

Figure 18 Southern Myotis habitat polygons, Page 7

0 20 40 60 80
Meters
Scale: 1:2,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F18_SouthernMyotis
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

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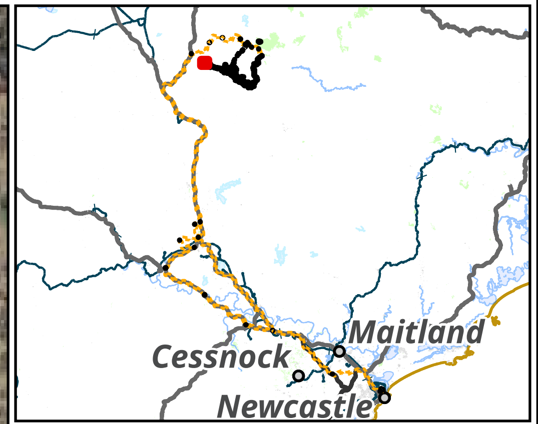


Legend

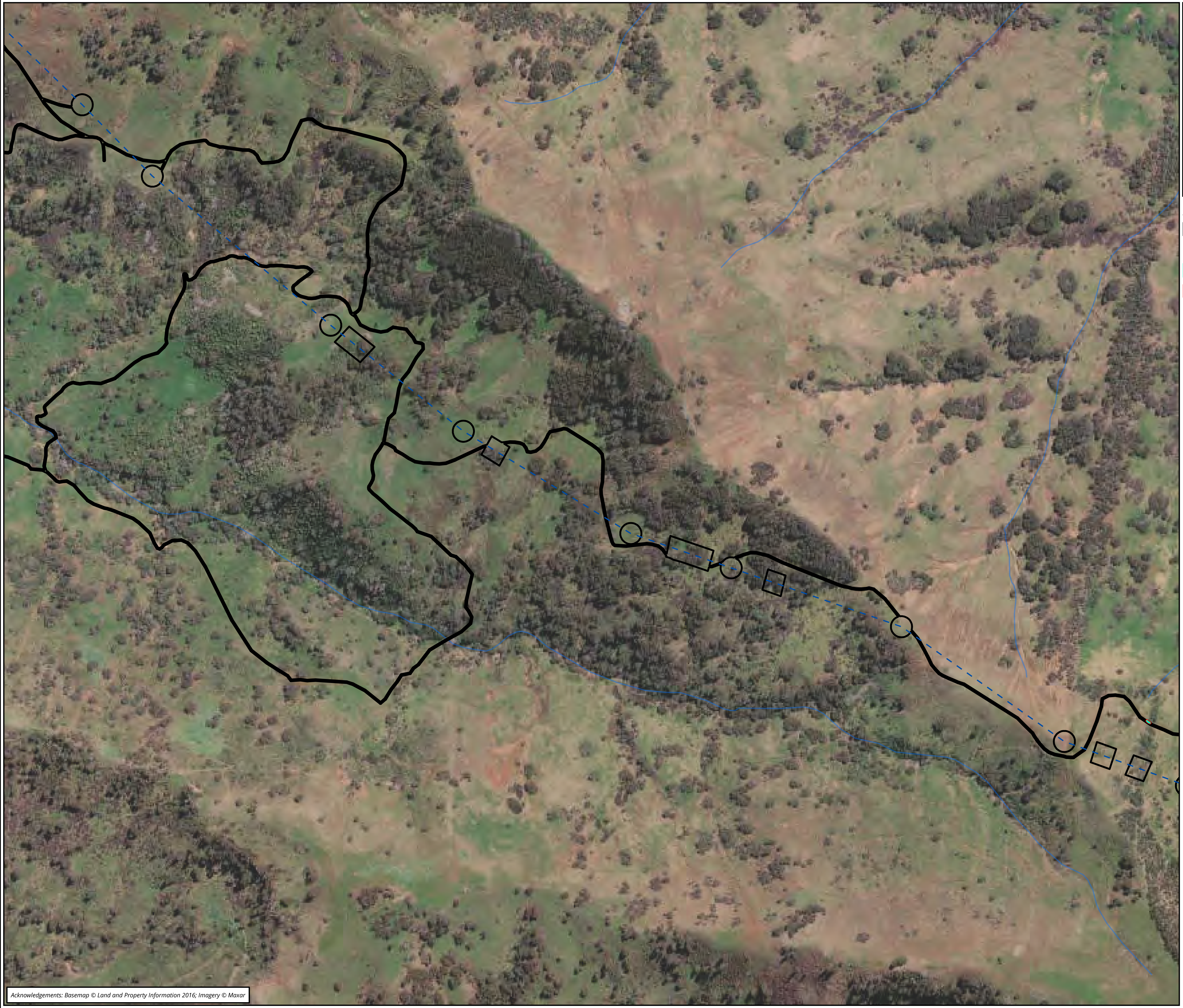
- Infrastructure footprint
- Transmission line
- Koala

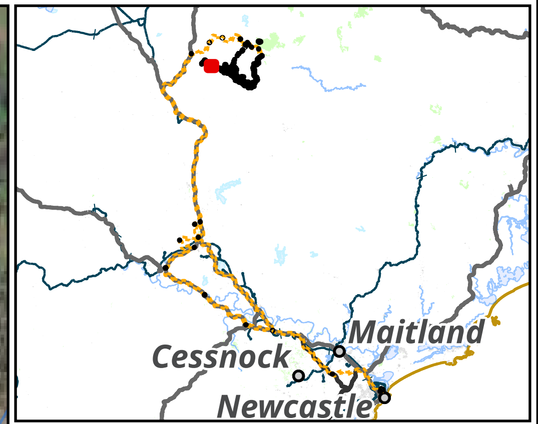
Figure 19 Arboreal mammals habitat polygons, Page 2

0 100 200 300 400
Meters
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

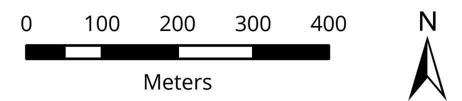




Legend

- Infrastructure footprint
- Transmission line
- Squirrel Glider
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 3

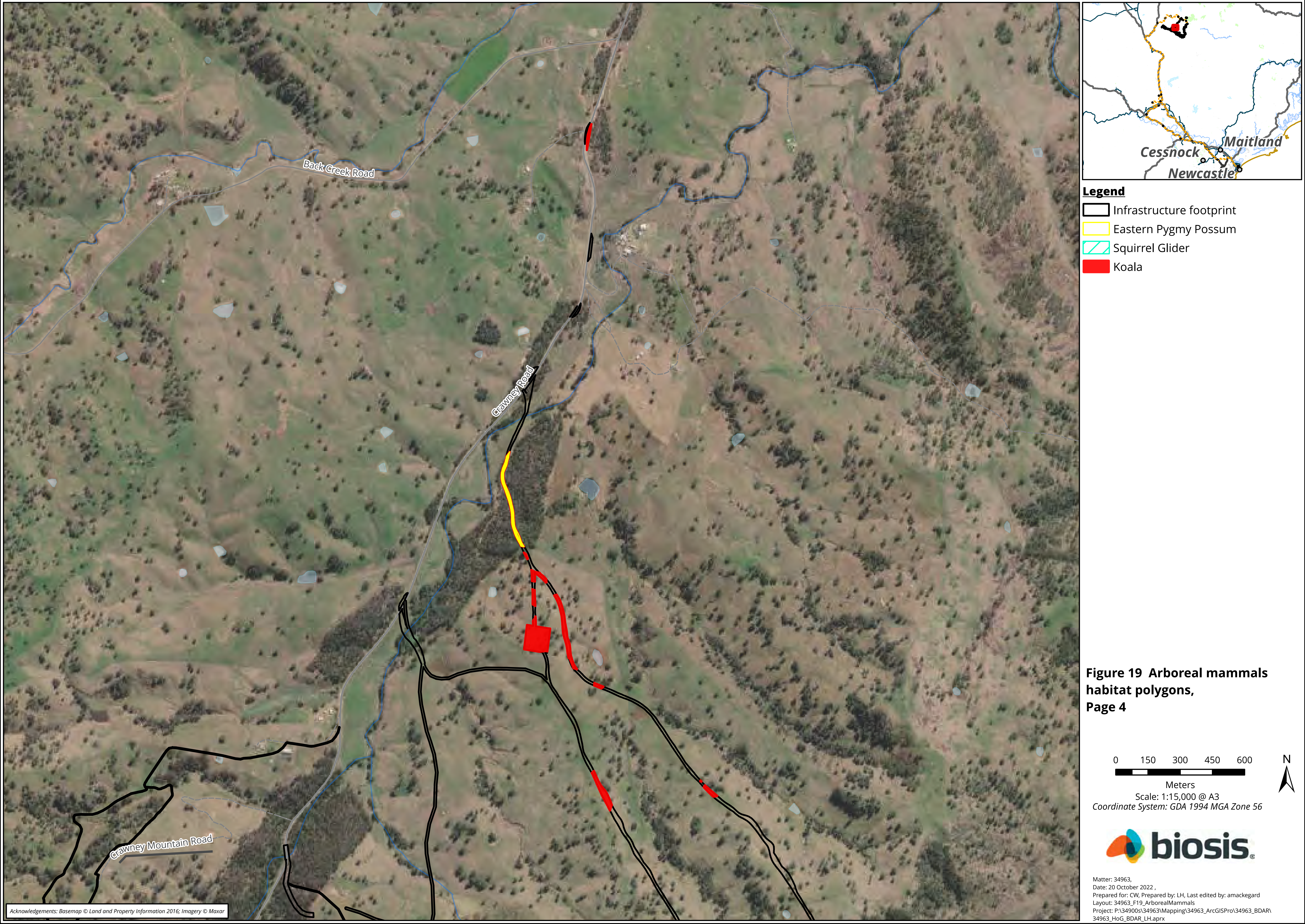


Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis.

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Acknowledgements: Basemap © Land and Property Information 2016; Imagery © Maxar

Legend

- Infrastructure footprint
- Eastern Pygmy Possum
- Squirrel Glider
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 4

0 150 300 450 600

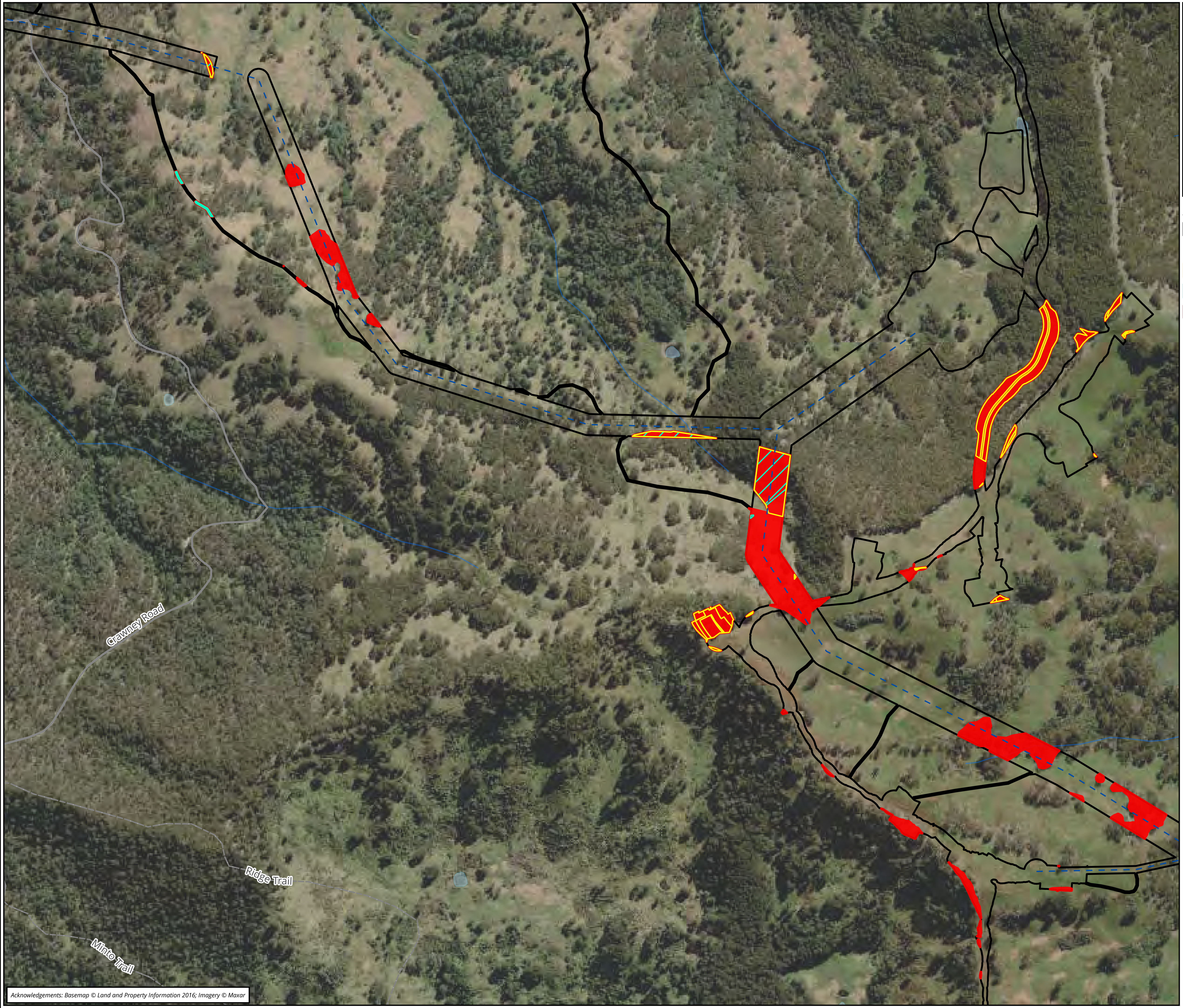
Meters

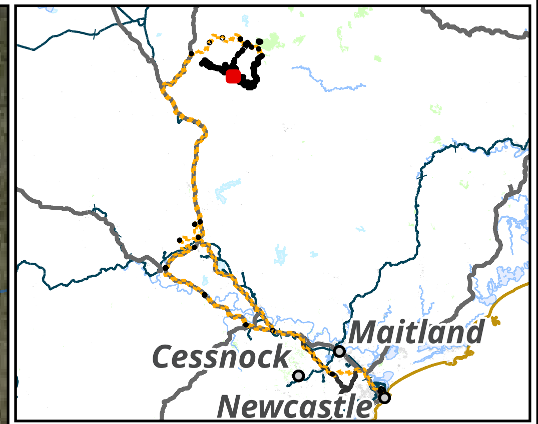
Scale: 1:15,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx





Legend

- Infrastructure footprint
- Transmission line
- Eastern Pygmy Possum
- Squirrel Glider
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 4

0 100 200 300 400

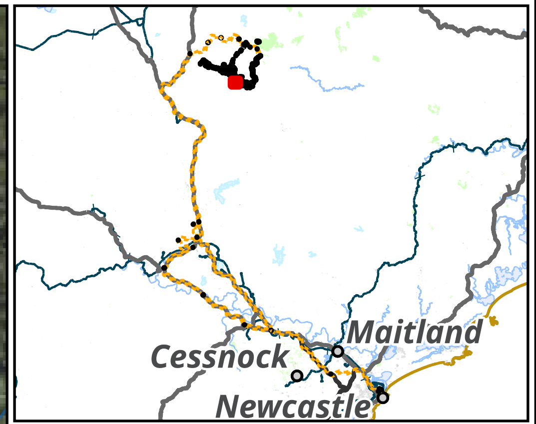
Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis.

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

- Infrastructure footprint
- Eastern Pygmy Possum
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 5

0 100 200 300 400

Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

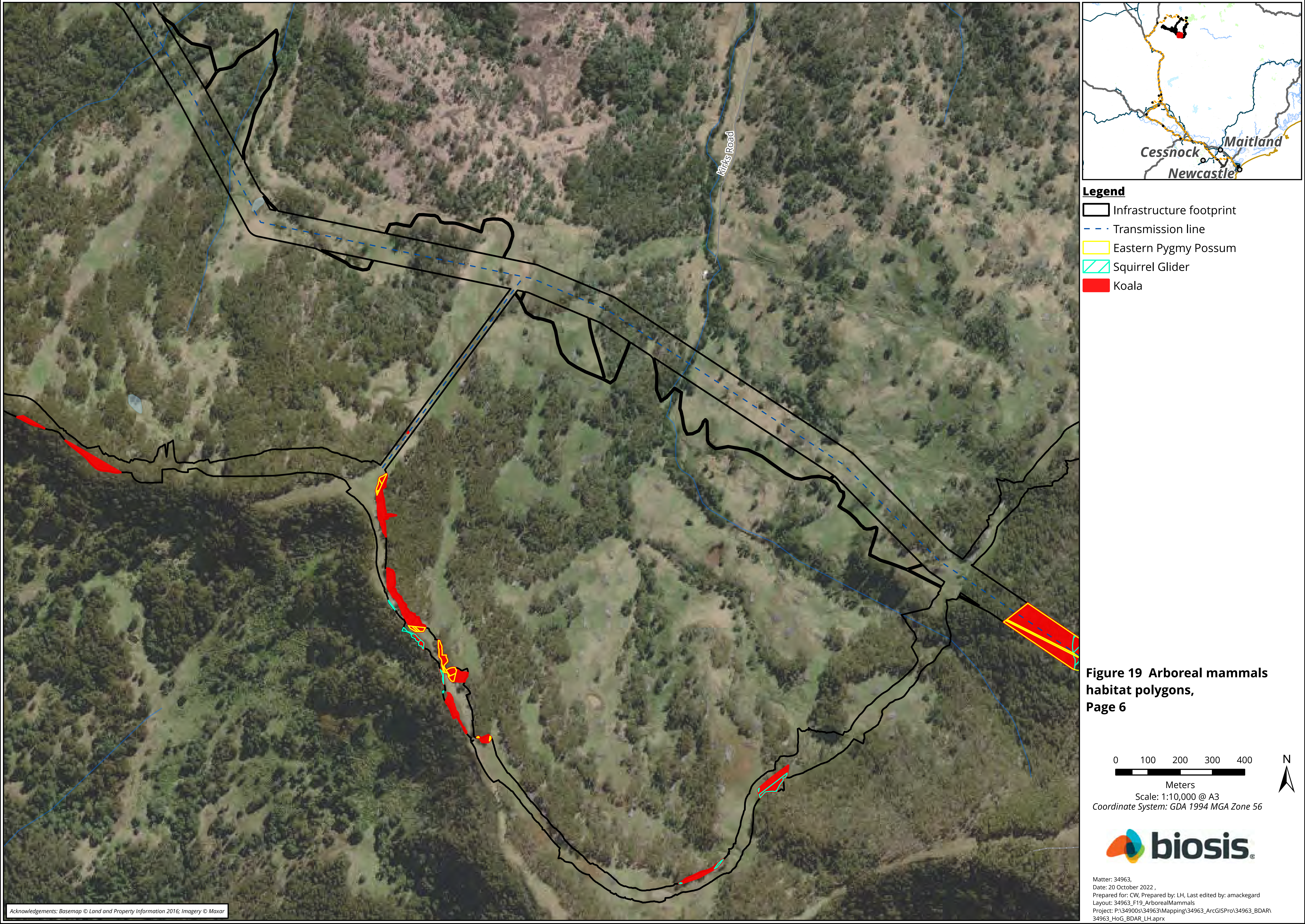


Figure 19 Arboreal mammals habitat polygons, Page 6

Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis.

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

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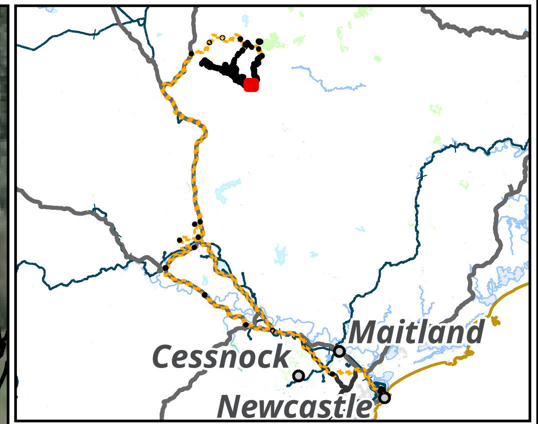


Legend

- Infrastructure footprint
- Transmission line
- Eastern Pygmy Possum
- Squirrel Glider
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 7

0 100 200 300 400

Meters

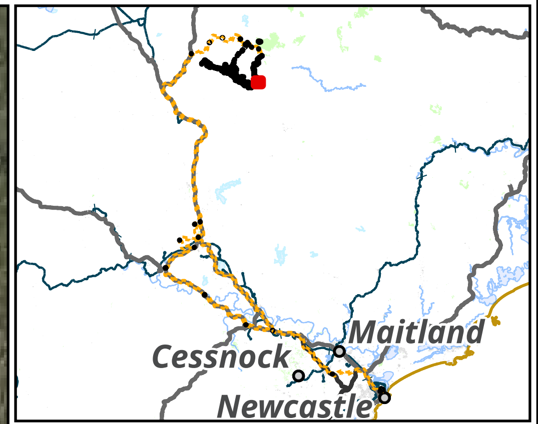
Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

- Infrastructure footprint
- Eastern Pygmy Possum
- Squirrel Glider
- Koala

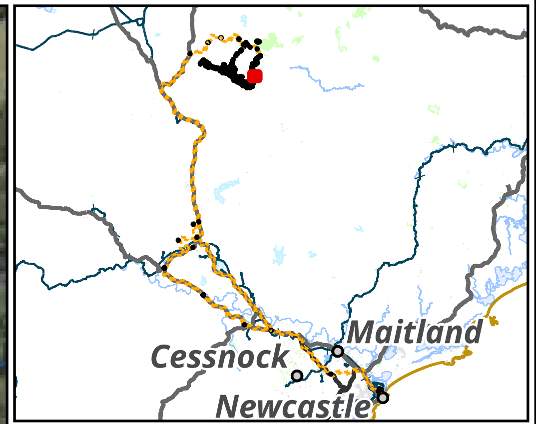
Figure 19 Arboreal mammals habitat polygons, Page 8

0 100 200 300 400
Meters
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis.

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

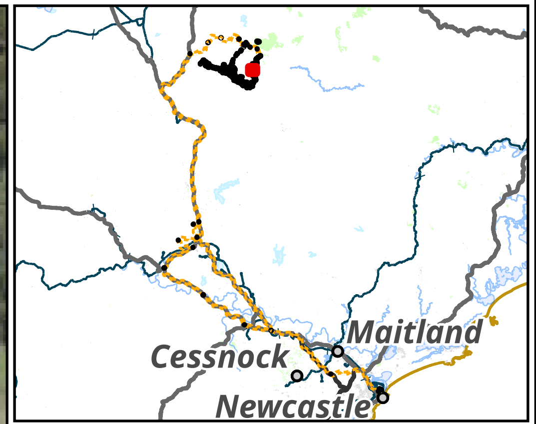
- Infrastructure footprint
- Eastern Pygmy Possum
- Squirrel Glider
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 9

0 100 200 300 400
Meters
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis.

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

- Infrastructure footprint
- Eastern Pygmy Possum
- Squirrel Glider
- Koala

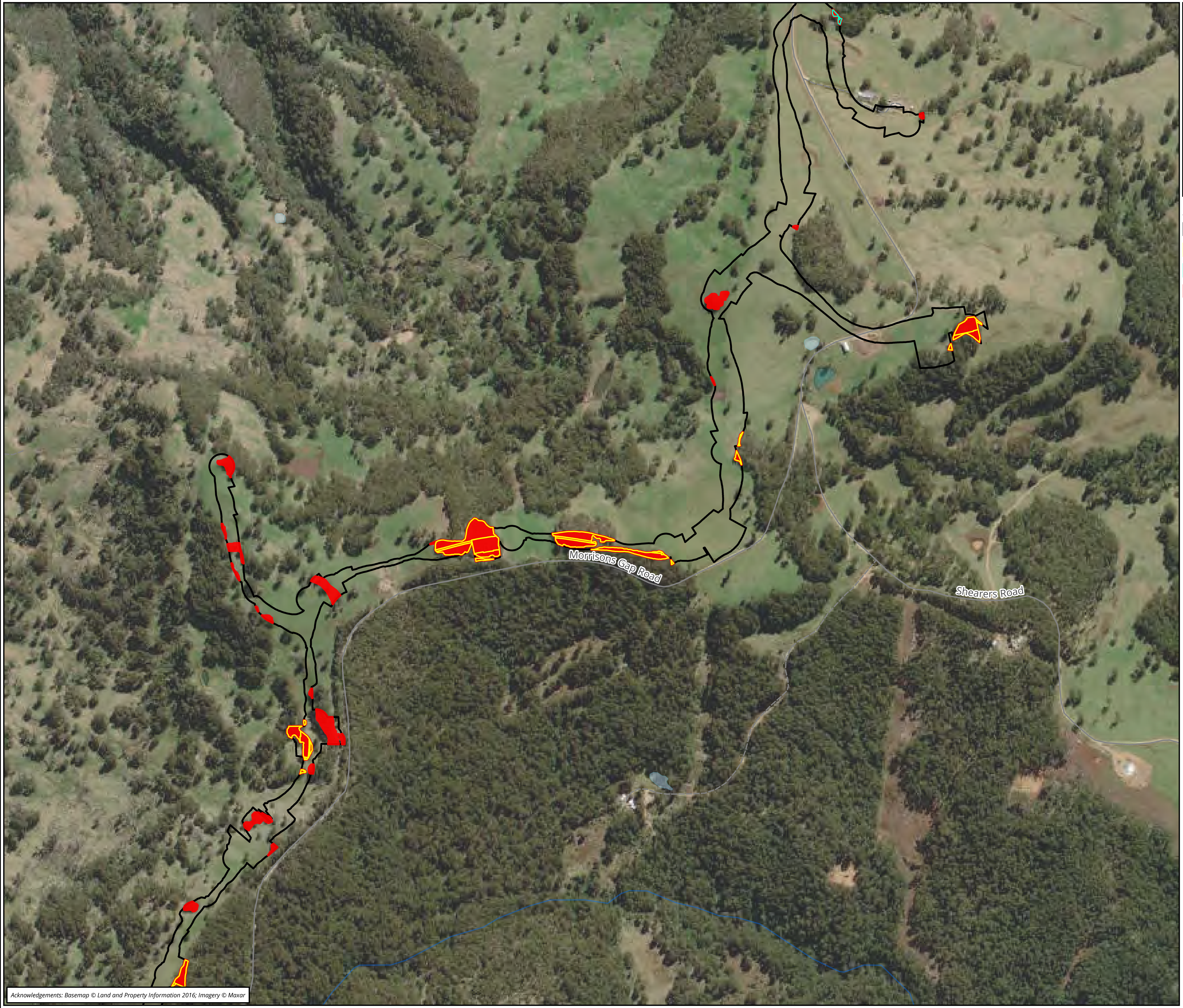
Figure 19 Arboreal mammals habitat polygons, Page 10

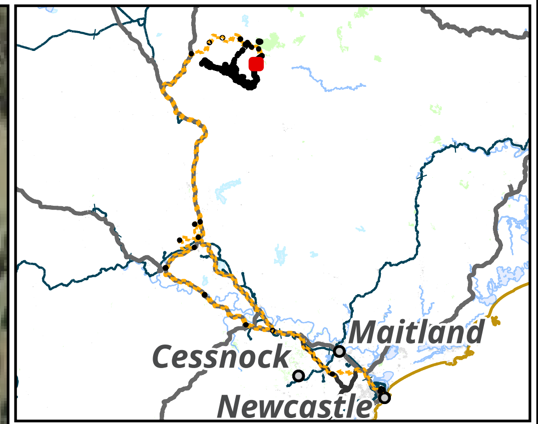
0 100 200 300 400
Meters
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis.

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx





Legend

- Infrastructure footprint
- Eastern Pygmy Possum
- Squirrel Glider
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 11

0 100 200 300 400

Meters

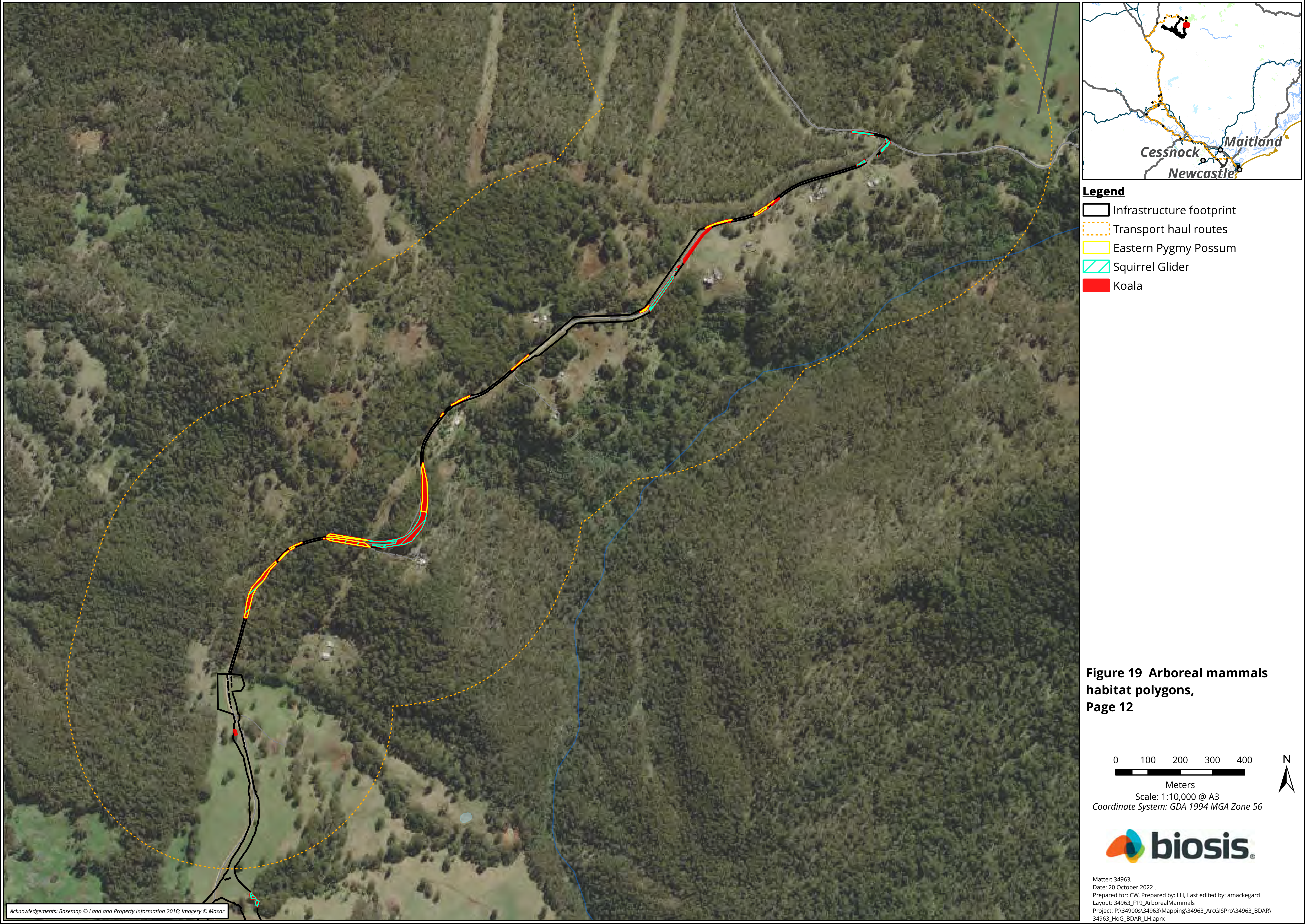
Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

- Infrastructure footprint
- Transport haul routes
- Eastern Pygmy Possum
- Squirrel Glider
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 12

0 100 200 300 400

Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis.

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

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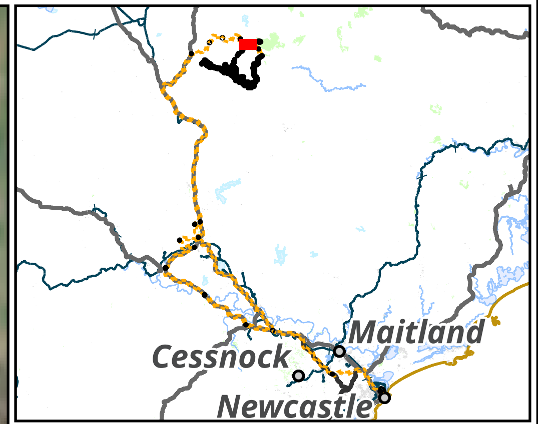


Legend

- Infrastructure footprint
- Transport haul routes
- Squirrel Glider
- Koala

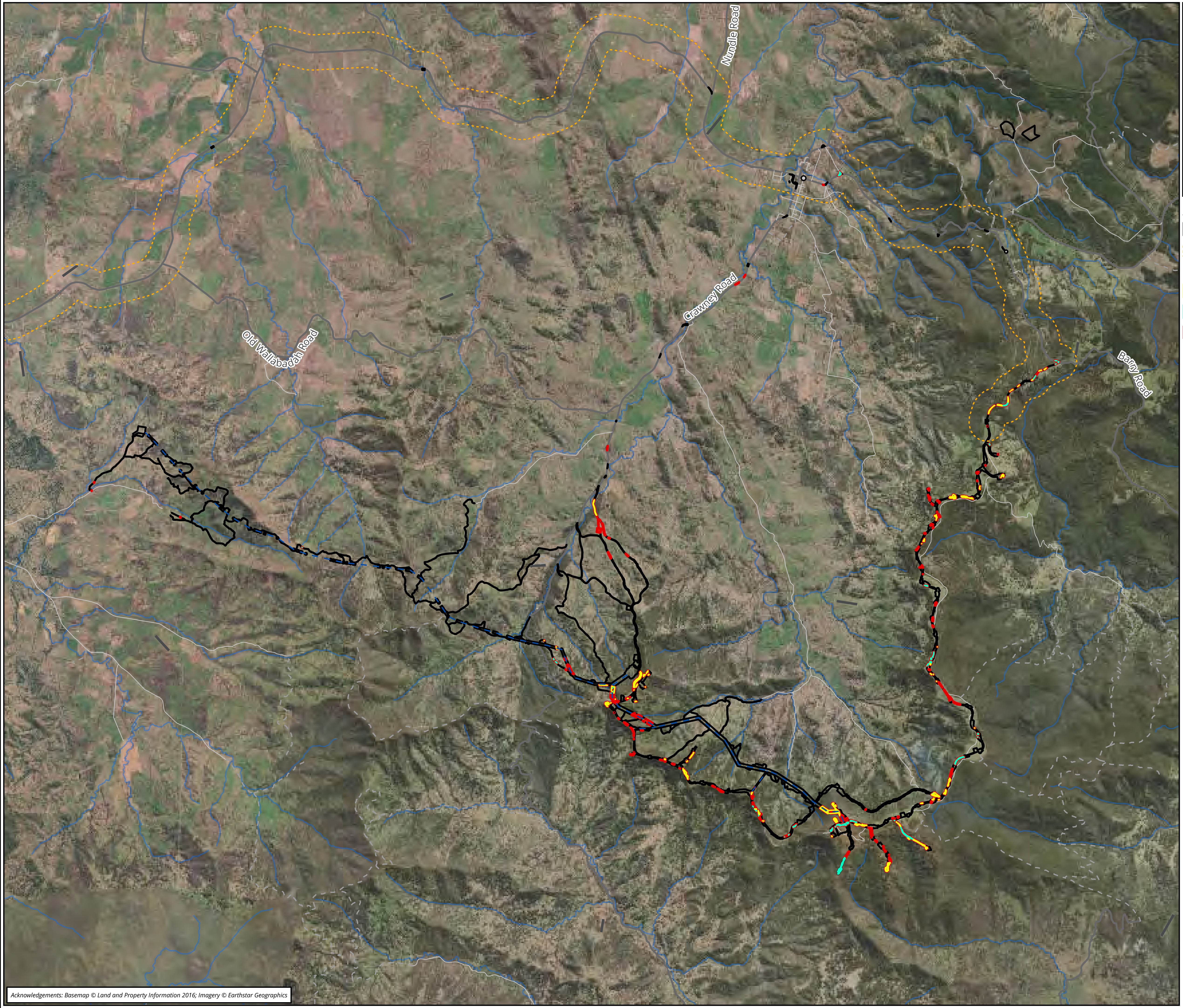
Figure 19 Arboreal mammals habitat polygons, Page 13

0 25 50 75 100
Meters
Scale: 1:2,500 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

- Infrastructure footprint
- Transport haul routes
- Transmission line
- Eastern Pygmy Possum
- Squirrel Glider
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 14

0 1,000 2,000 3,000 4,000

Meters

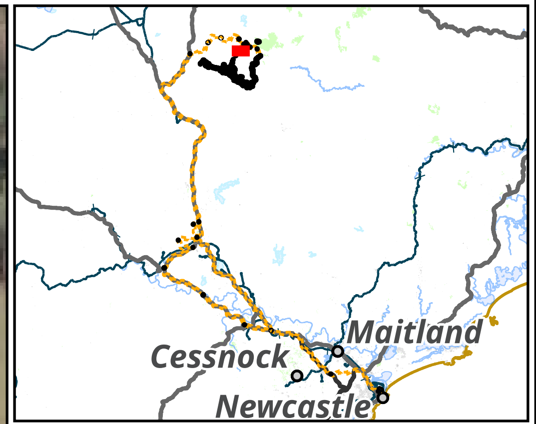
N

Scale: 1:100,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

Infrastructure footprint

Koala

Figure 19 Arboreal mammals habitat polygons, Page 15

0 25 50 75 100

Meters

Scale: 1:2,500 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis.

Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
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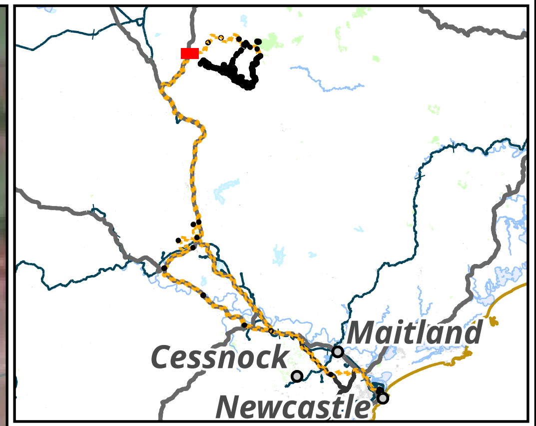


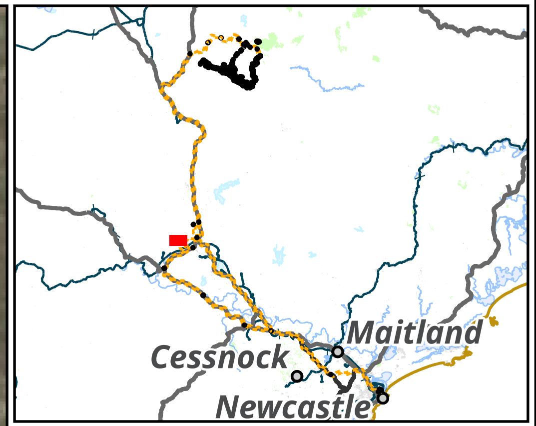
Legend

- Infrastructure footprint
- Transport haul routes
- Squirrel Glider
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 16

0 20 40 60 80
Meters
Scale: 1:2,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56
N

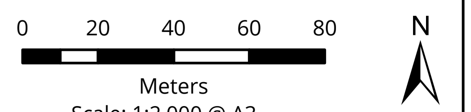
Matter: 34963,
Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

- Infrastructure footprint
- Transport haul routes
- Koala

Figure 19 Arboreal mammals habitat polygons, Page 17



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Date: 20 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F19_ArborealMammals
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

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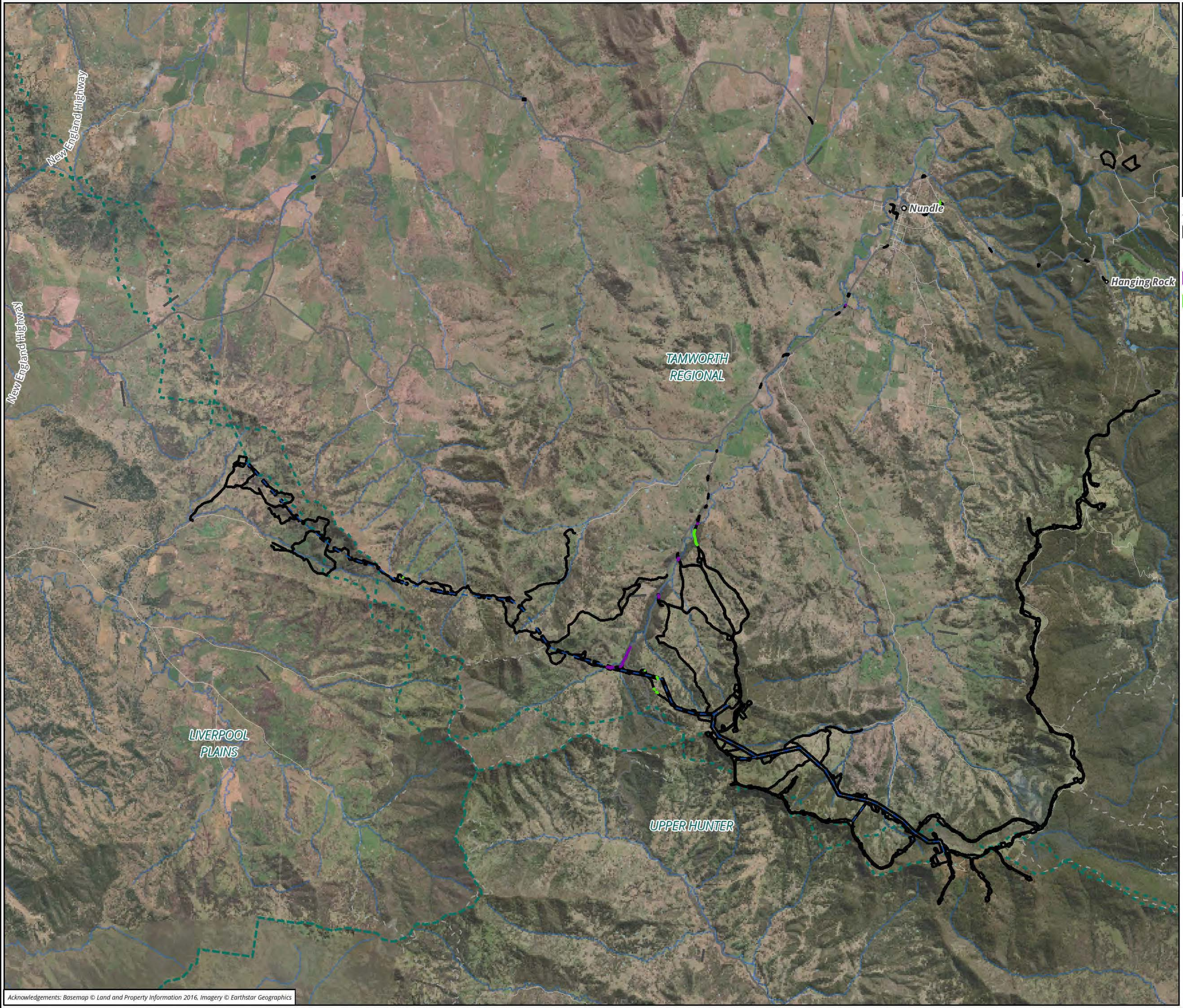
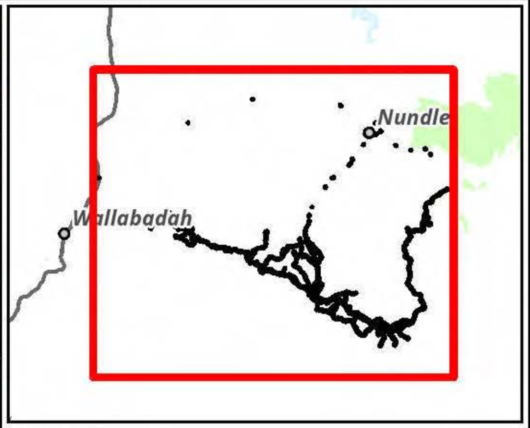




Legend

- Infrastructure footprint
- Transmission line
- Booroolong Frog
- Border Thick-tailed Gecko

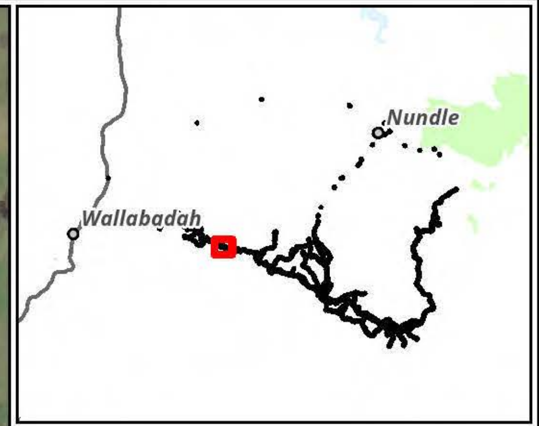
Figure 20 Booroolong frog and Border Thick tailed Gecko habitat polygons, Page 1

0 1,000 2,000 3,000 4,000
Meters
Scale: 1:100,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis®

Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F20_FrogGeckoHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM.aprx



Legend

- Infrastructure footprint
- Transmission line
- Border Thick-tailed Gecko

Figure 20 Booroolong frog and Border Thick tailed Gecko habitat polygons, Page 2

0 50 100 150 200

Meters

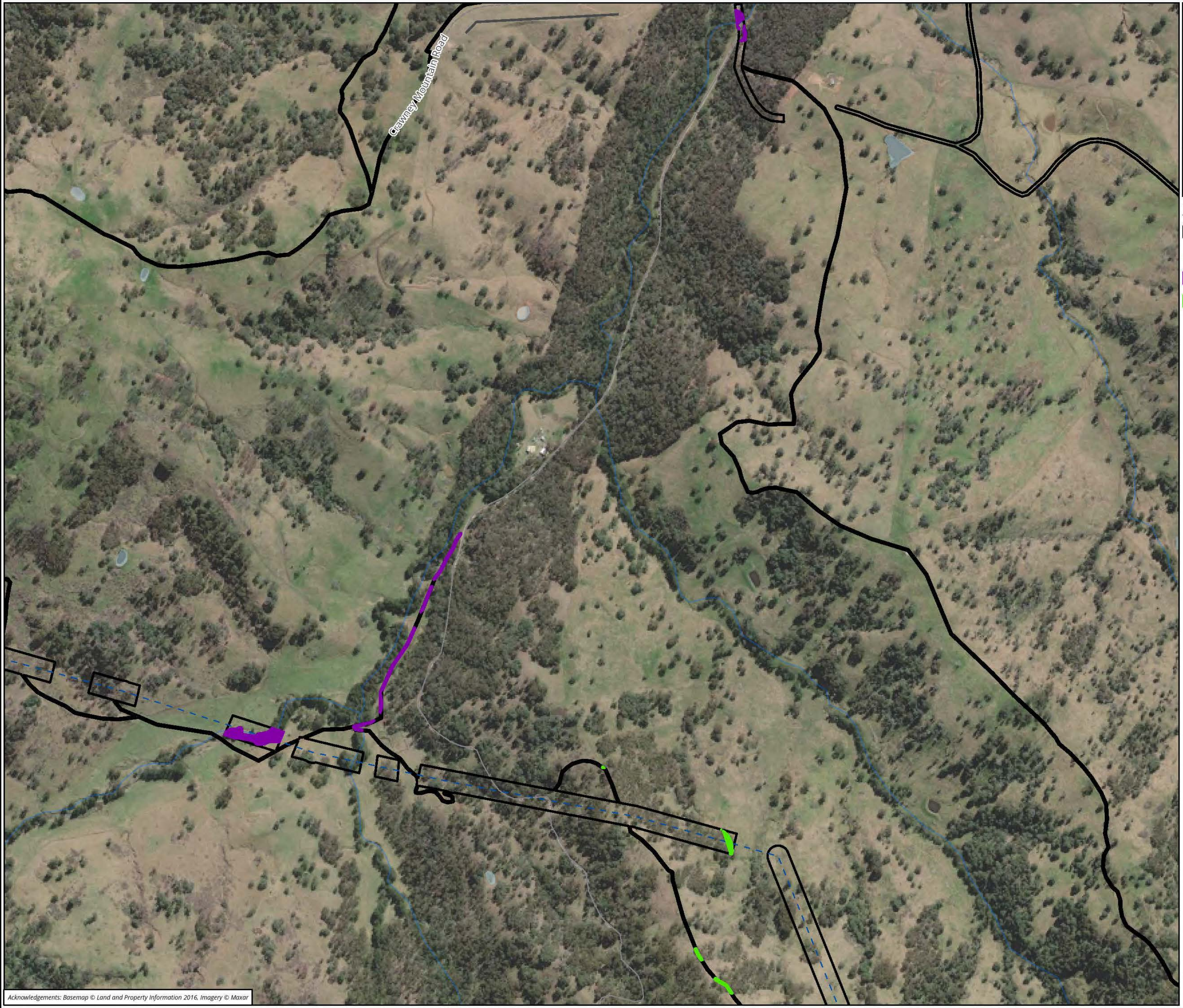
Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis.

Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F20_FrogGeckoHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM.aprx



Legend

- Infrastructure footprint
- Transmission line
- Booroolong Frog
- Border Thick-tailed Gecko

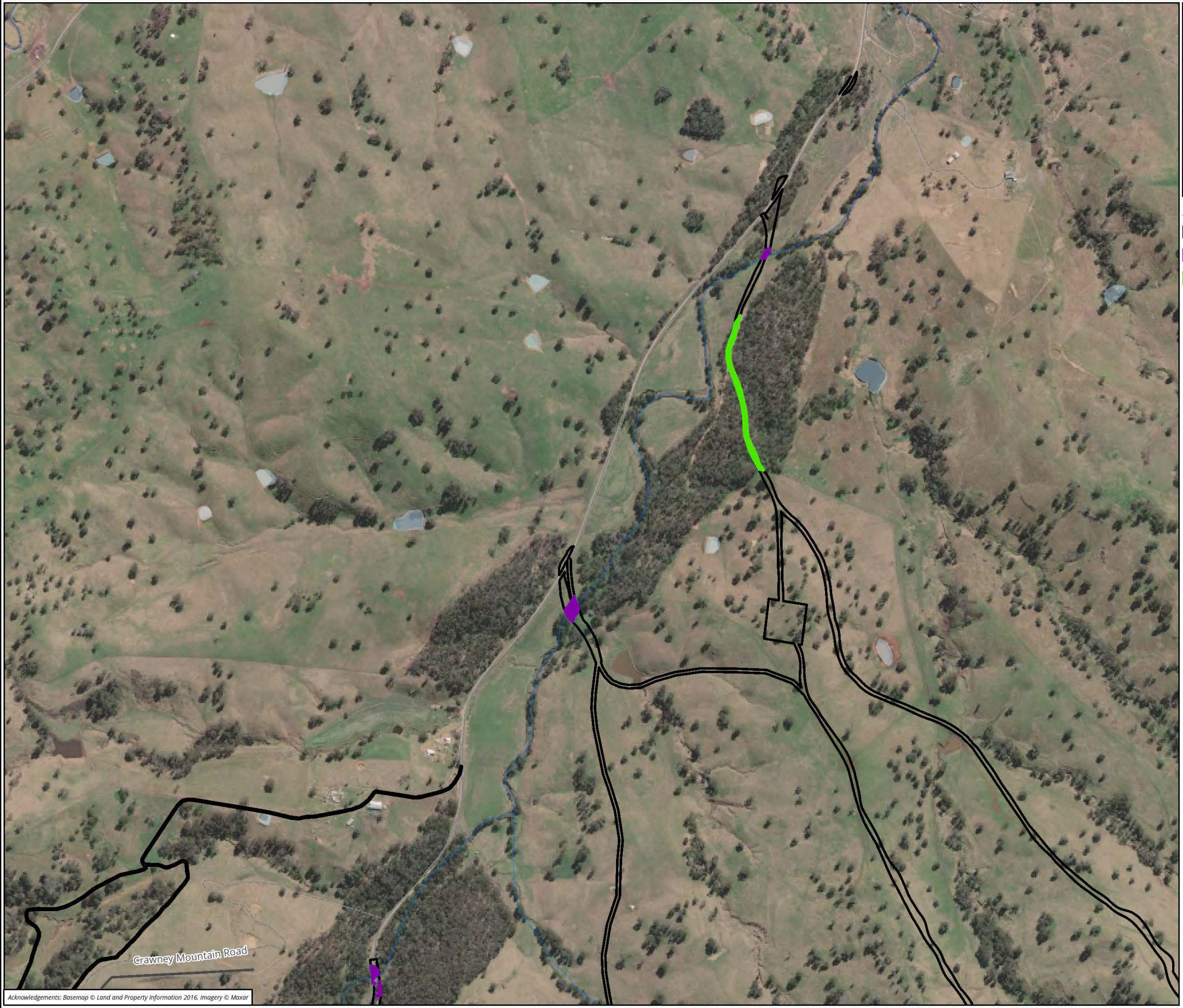
Figure 20 Booroolong frog and Border Thick tailed Gecko habitat polygons, Page 3

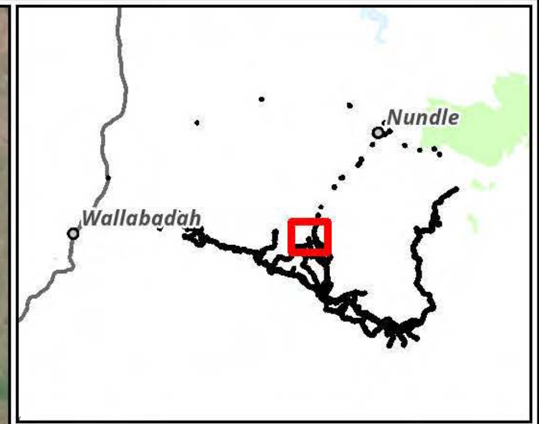
0 100 200 300 400
Meters
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F20_FrogGeckoHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM.aprx





Legend

- Infrastructure footprint
- Booroolong Frog
- Border Thick-tailed Gecko

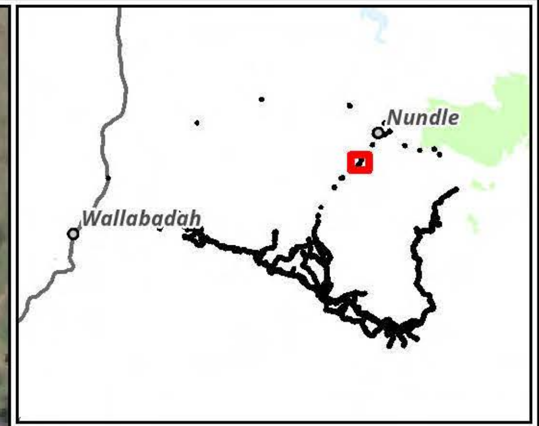
Figure 20 Booroolong frog and Border Thick tailed Gecko habitat polygons, Page 4

0 100 200 300 400
Meters
N

Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis.

Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F20_FrogGeckoHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM.aprx



Legend

- Infrastructure footprint
- Booroolong Frog

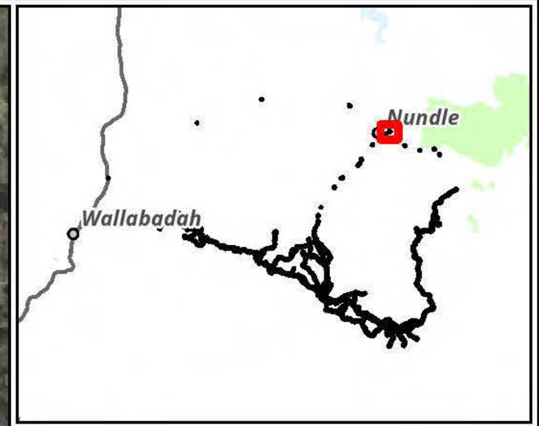
Figure 20 Booroolong frog and Border Thick tailed Gecko habitat polygons, Page 5

0 50 100 150 200
Meters
Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis.

Matter: 34963.
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F20_FrogGeckoHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM.aprx



Legend

- Infrastructure footprint
- Border Thick-tailed Gecko

Figure 20 Booroolong frog and Border Thick tailed Gecko habitat polygons, Page 6

0 50 100 150 200
Meters
Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis.

Matter: 34963.
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F20_FrogGeckoHabitat
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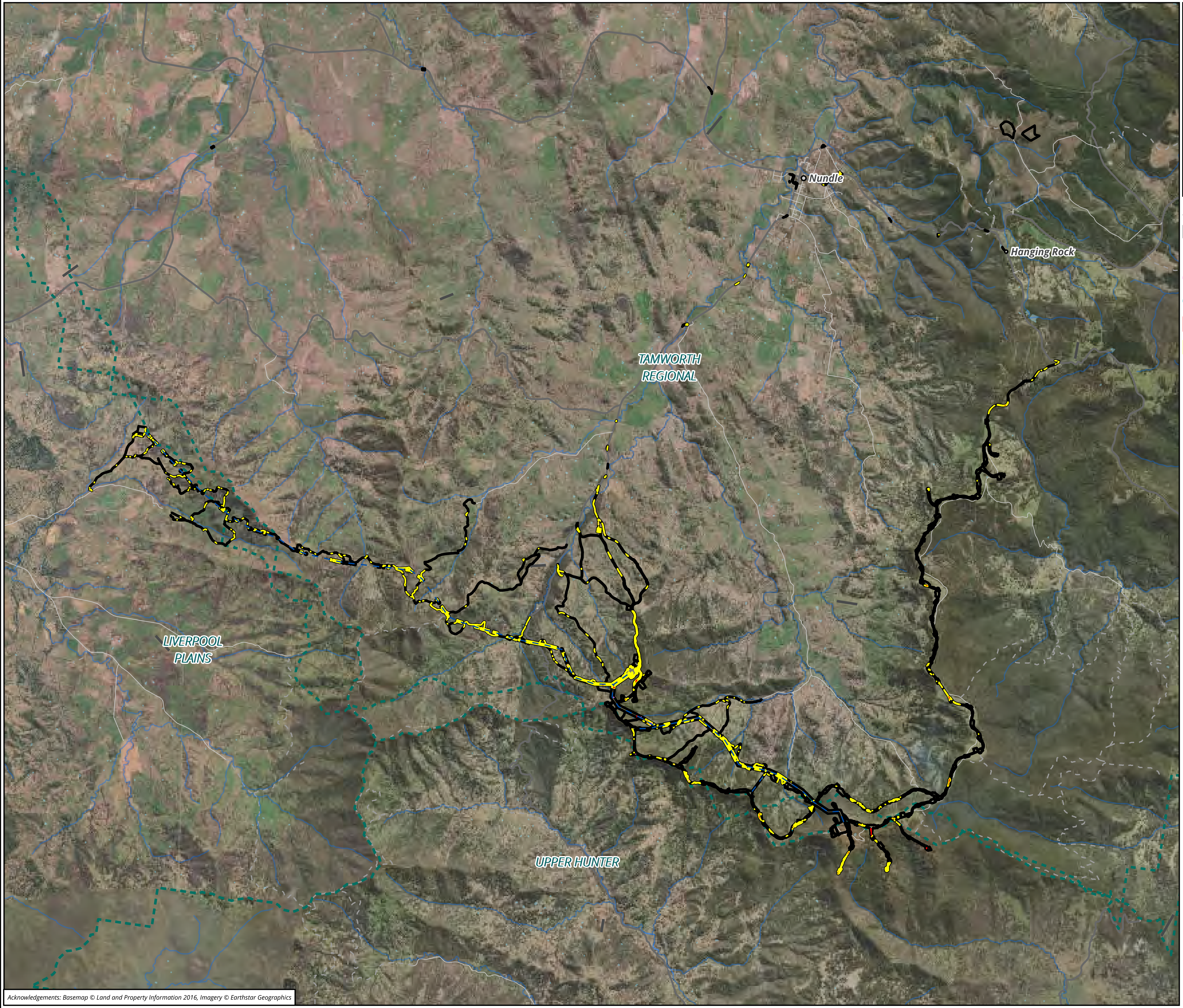
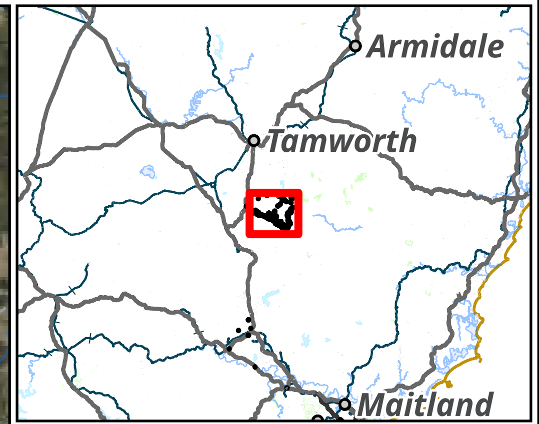




Legend

- Infrastructure footprint
- Transmission line
- Masked Owl
- Sooty Owl
- Powerful Owl
- Barking Owl

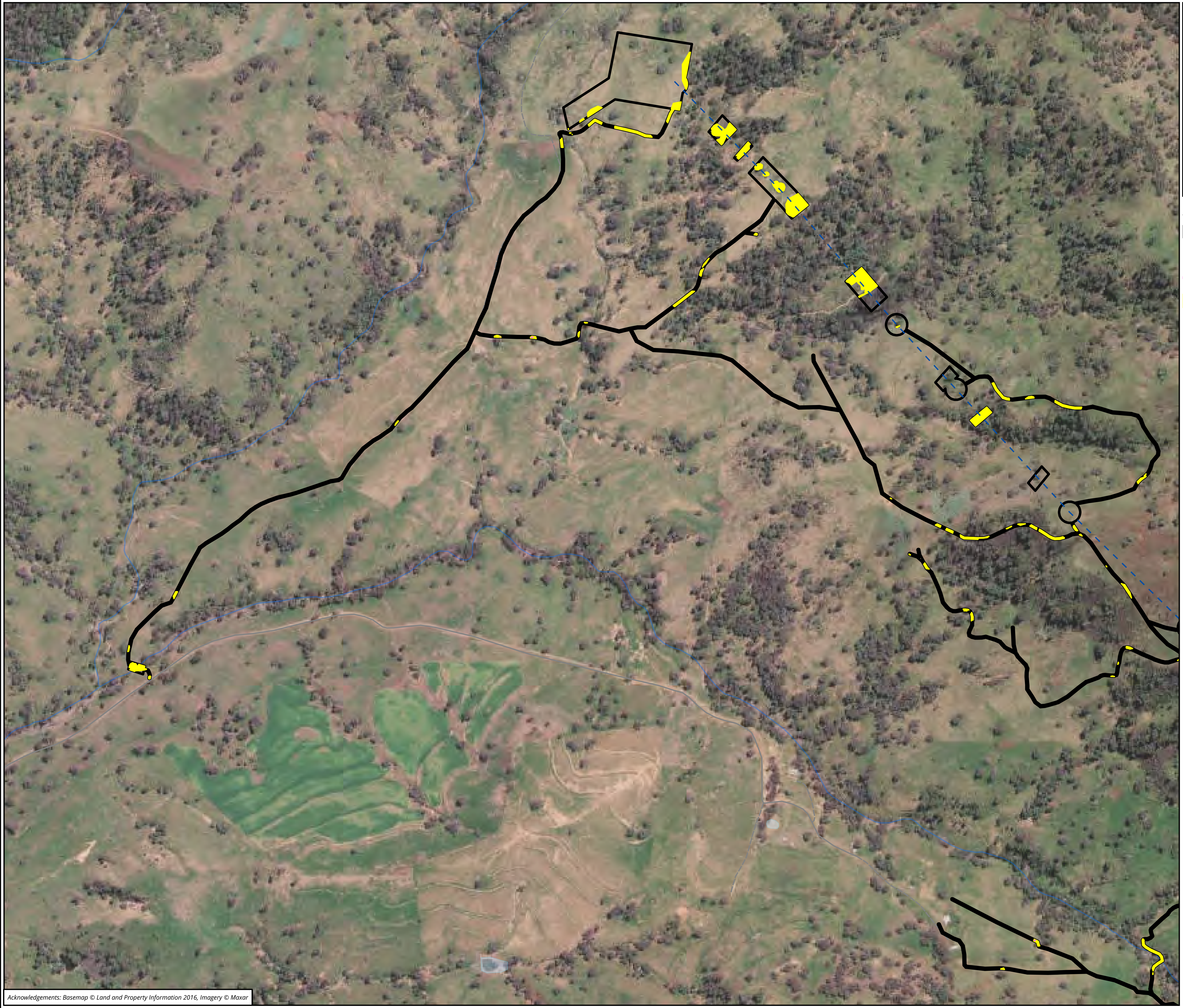
Figure 21 Forest Owls species habitat polygons, Page 1

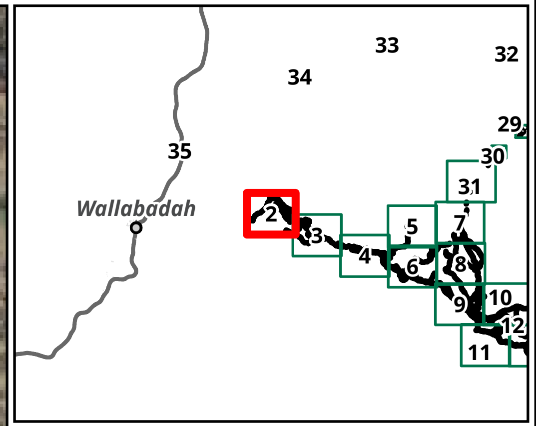
0 1,000 2,000 3,000 4,000
Meters
Scale: 1:100,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx





Legend

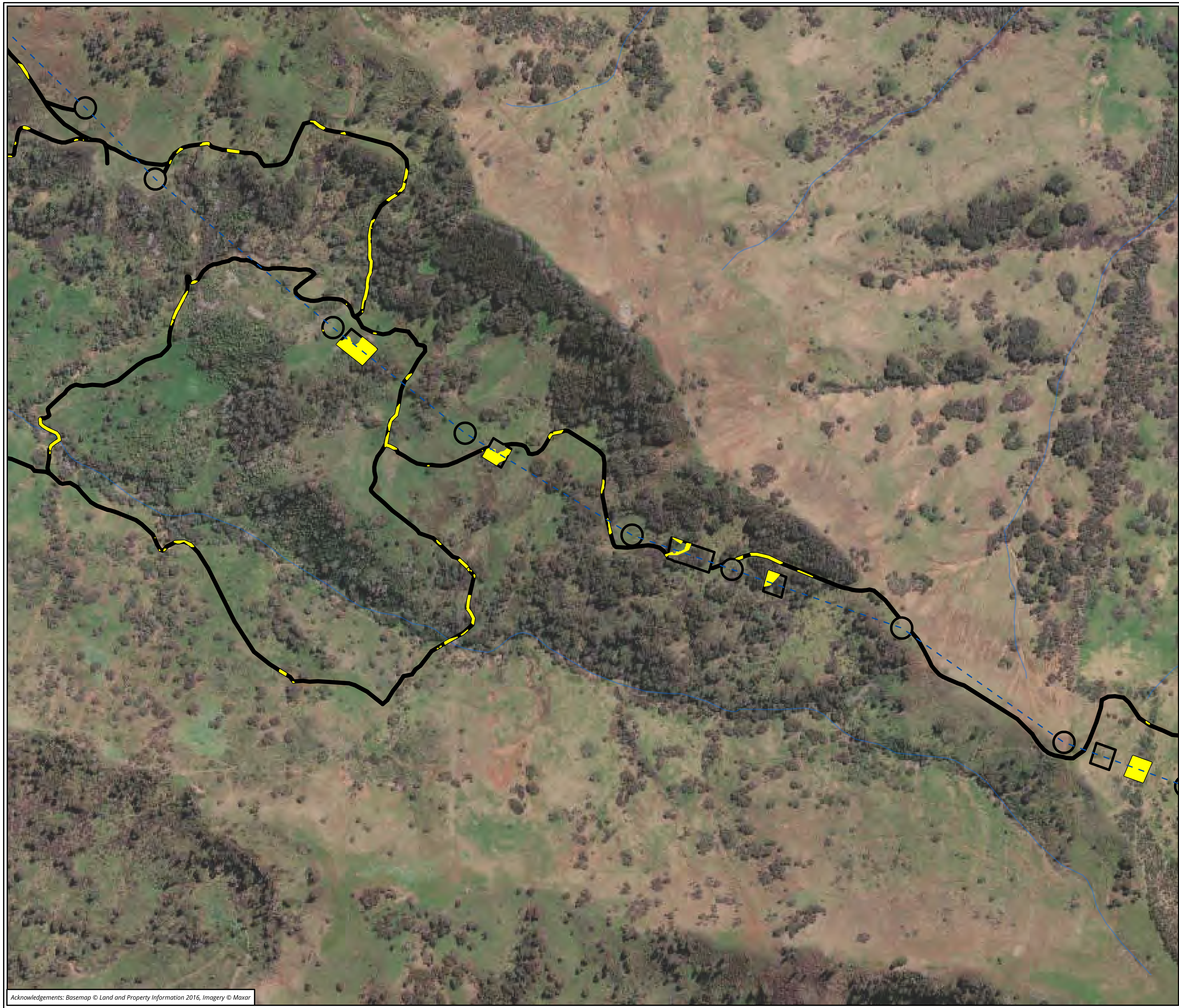
- Infrastructure footprint
- Transmission line
- Masked Owl
- Barking Owl

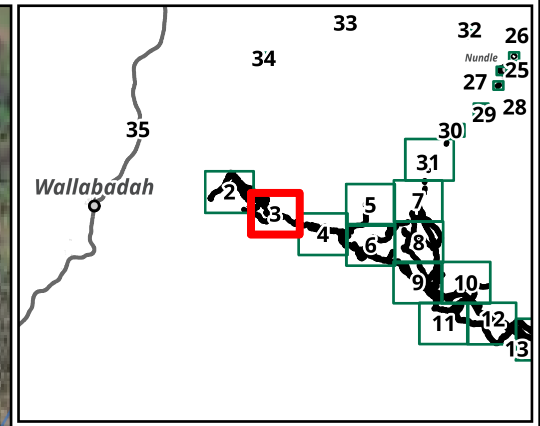
Figure 21 Forest Owls species habitat polygons, Page 2

0 100 200 300 400
Meters
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx





Legend

- Infrastructure footprint
- Transmission line
- Masked Owl
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 3

0 100 200 300 400

Meters

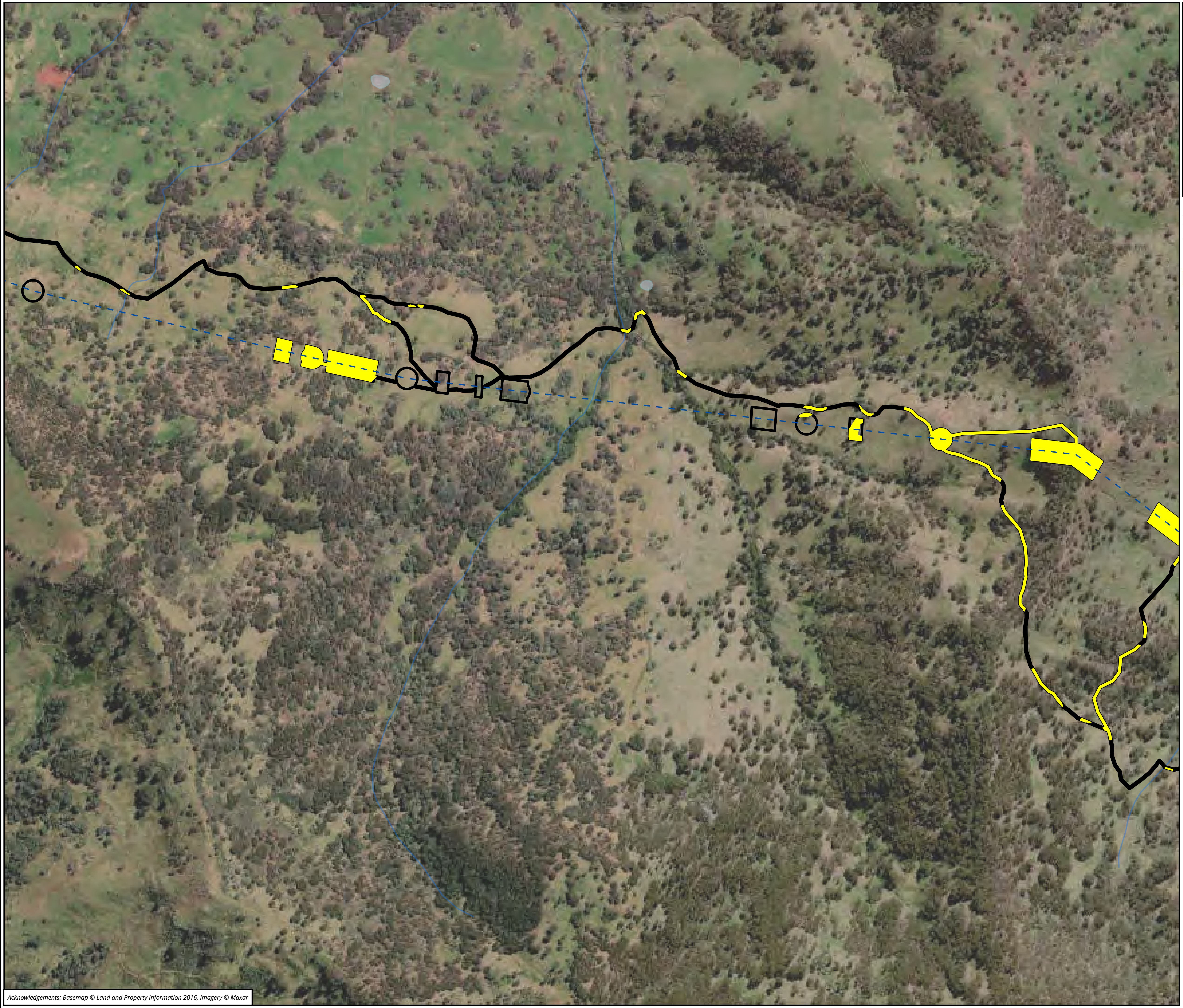
Scale: 1:10,000 @ A3

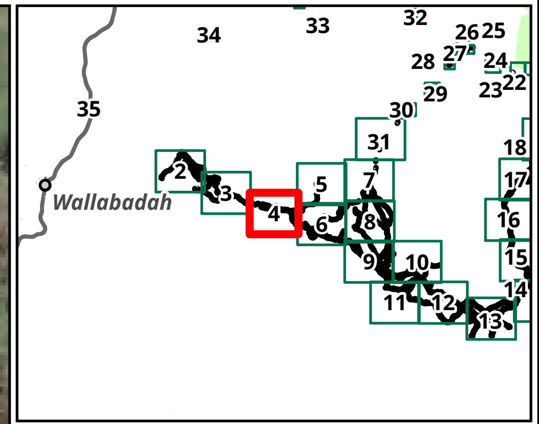
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx





Legend

- Infrastructure footprint
- Transmission line
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 4

0 100 200 300 400

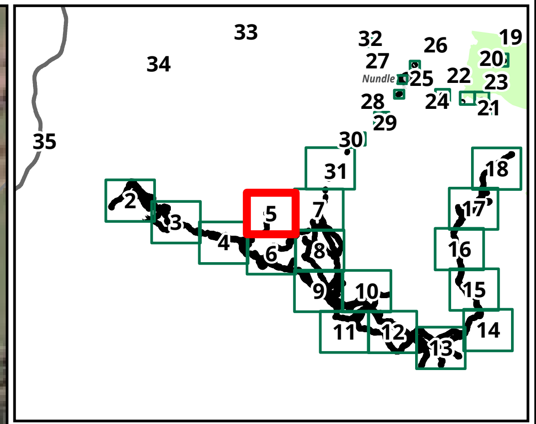
Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx



Legend

Infrastructure footprint

Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 5

0 100 200 300 400

Meters

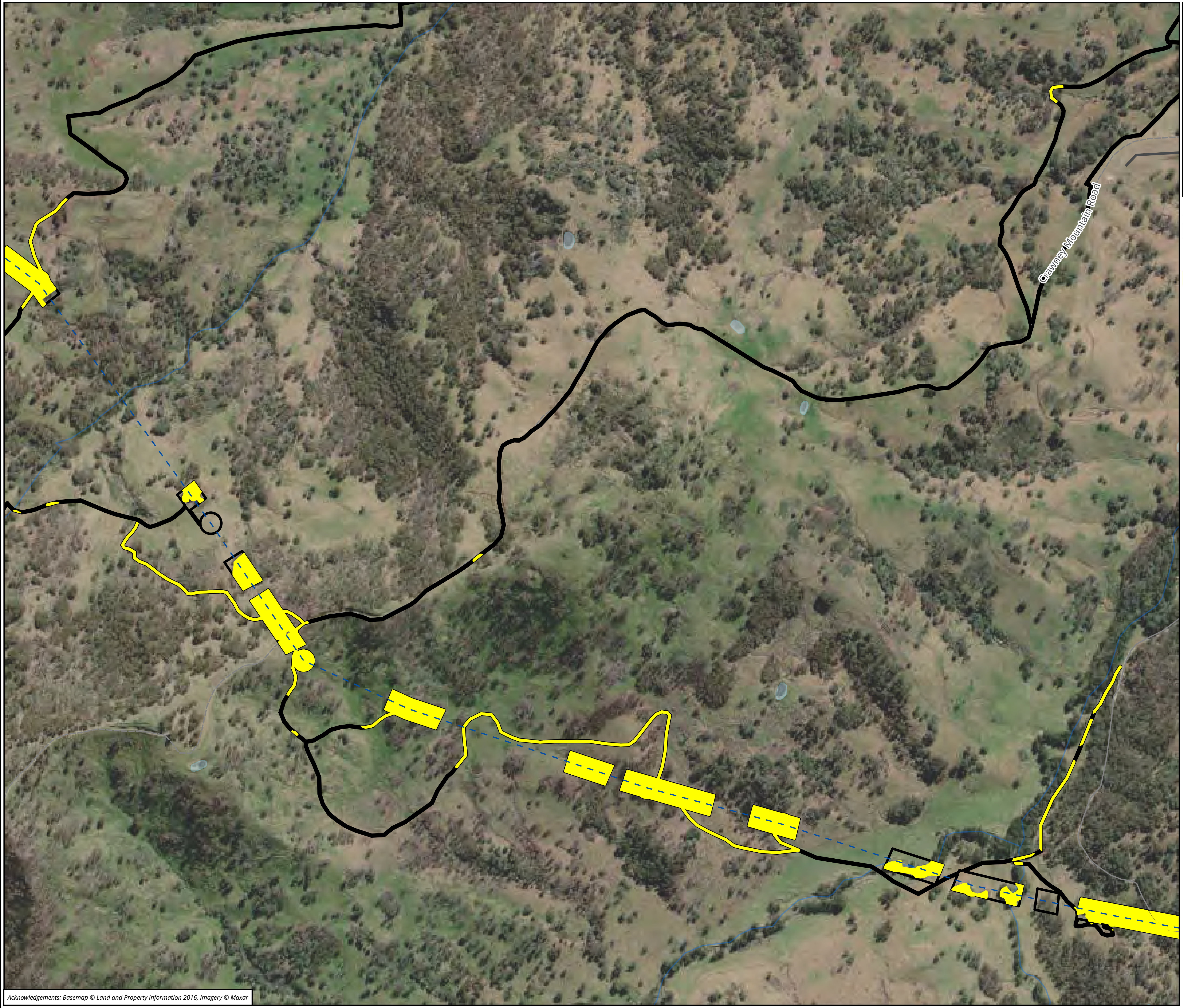
N

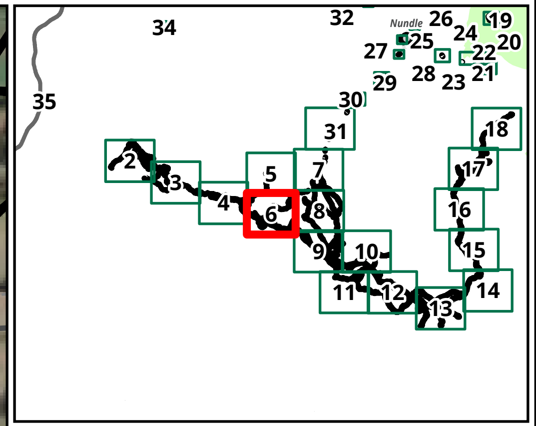
Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis.

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx





Legend

- Infrastructure footprint
- Transmission line
- Barking Owl

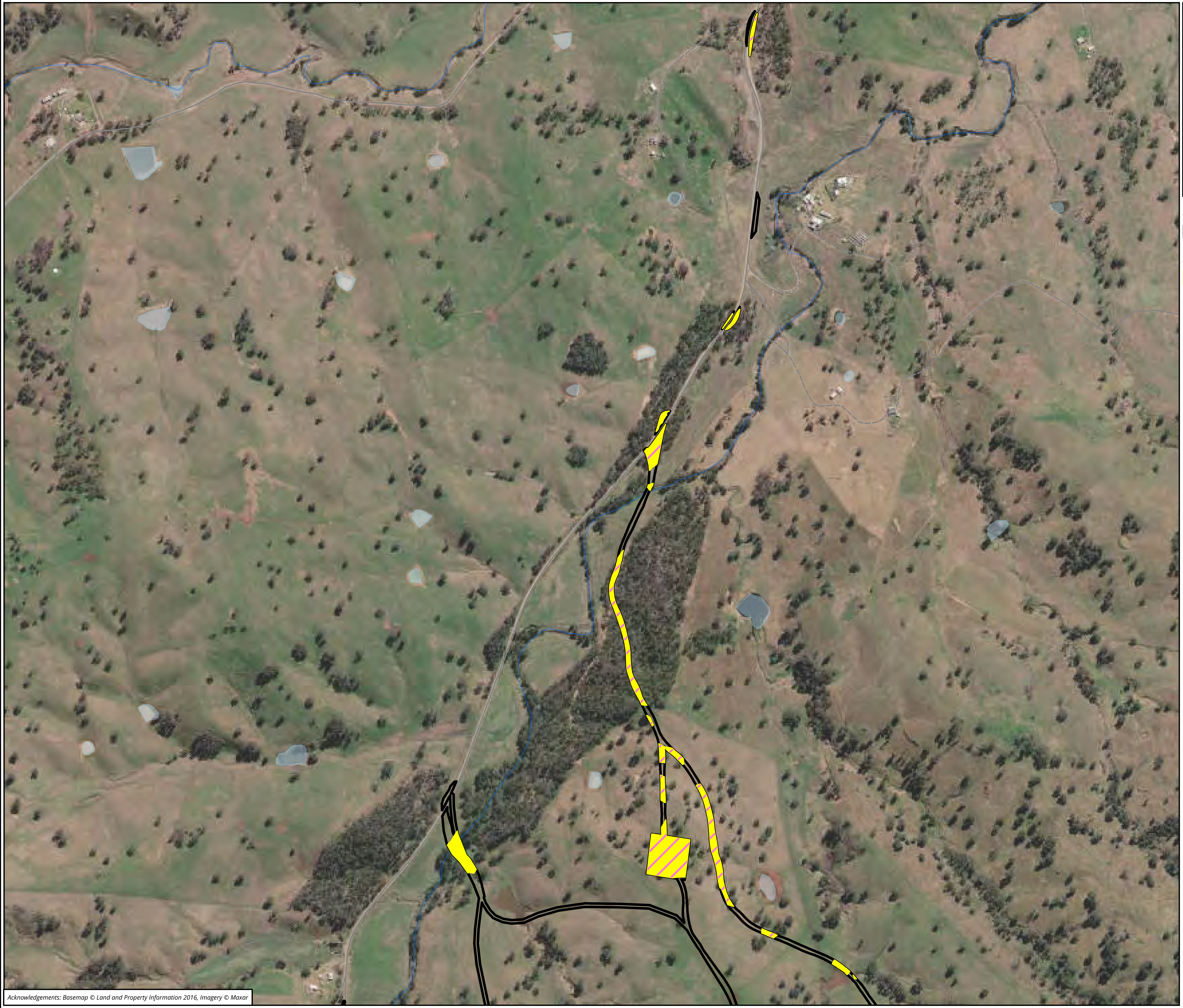
Figure 21 Forest Owls species habitat polygons, Page 6

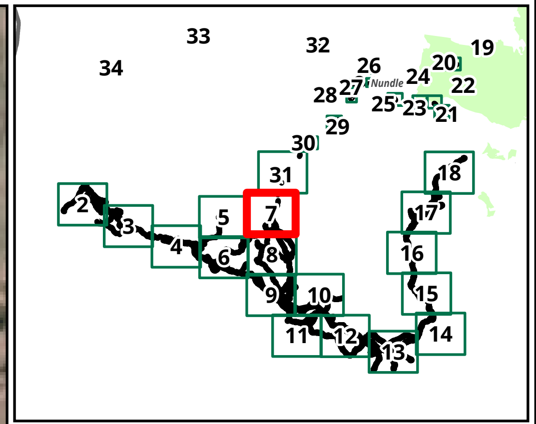
0 100 200 300 400
Meters
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis.

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx





Legend

Infrastructure footprint

Masked Owl

Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 7

0 100 200 300 400

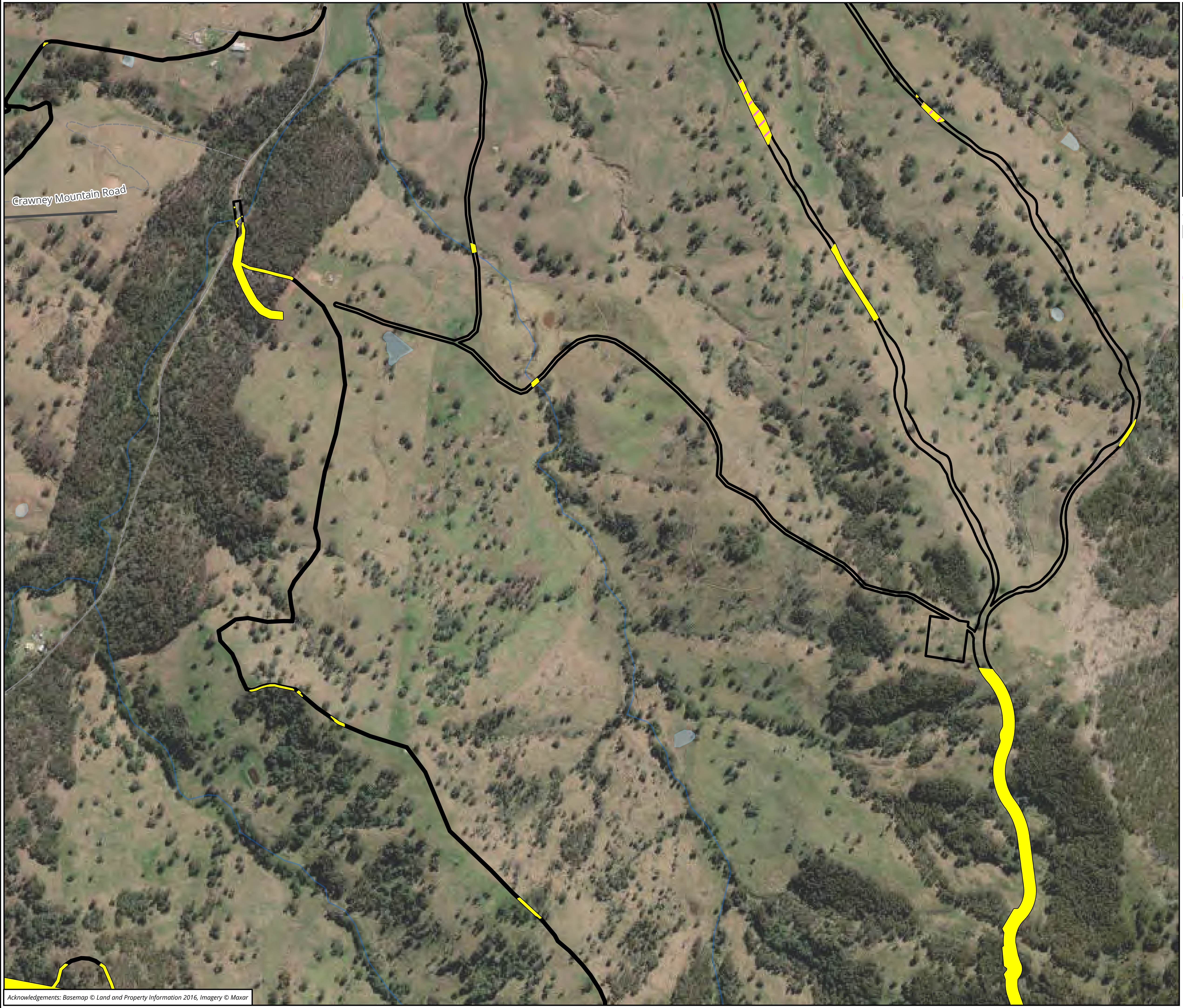
Meters

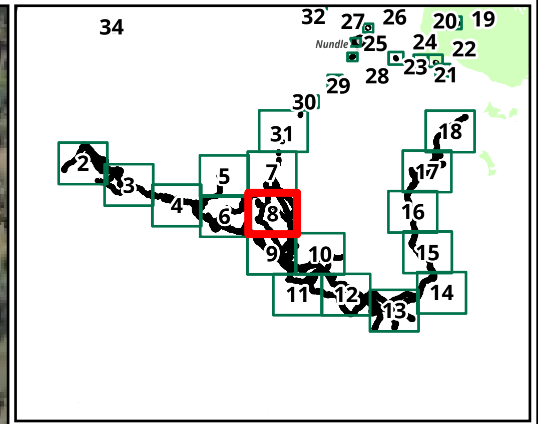
Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx





Legend

- Infrastructure footprint
- Transmission line
- Masked Owl
- Barking Owl

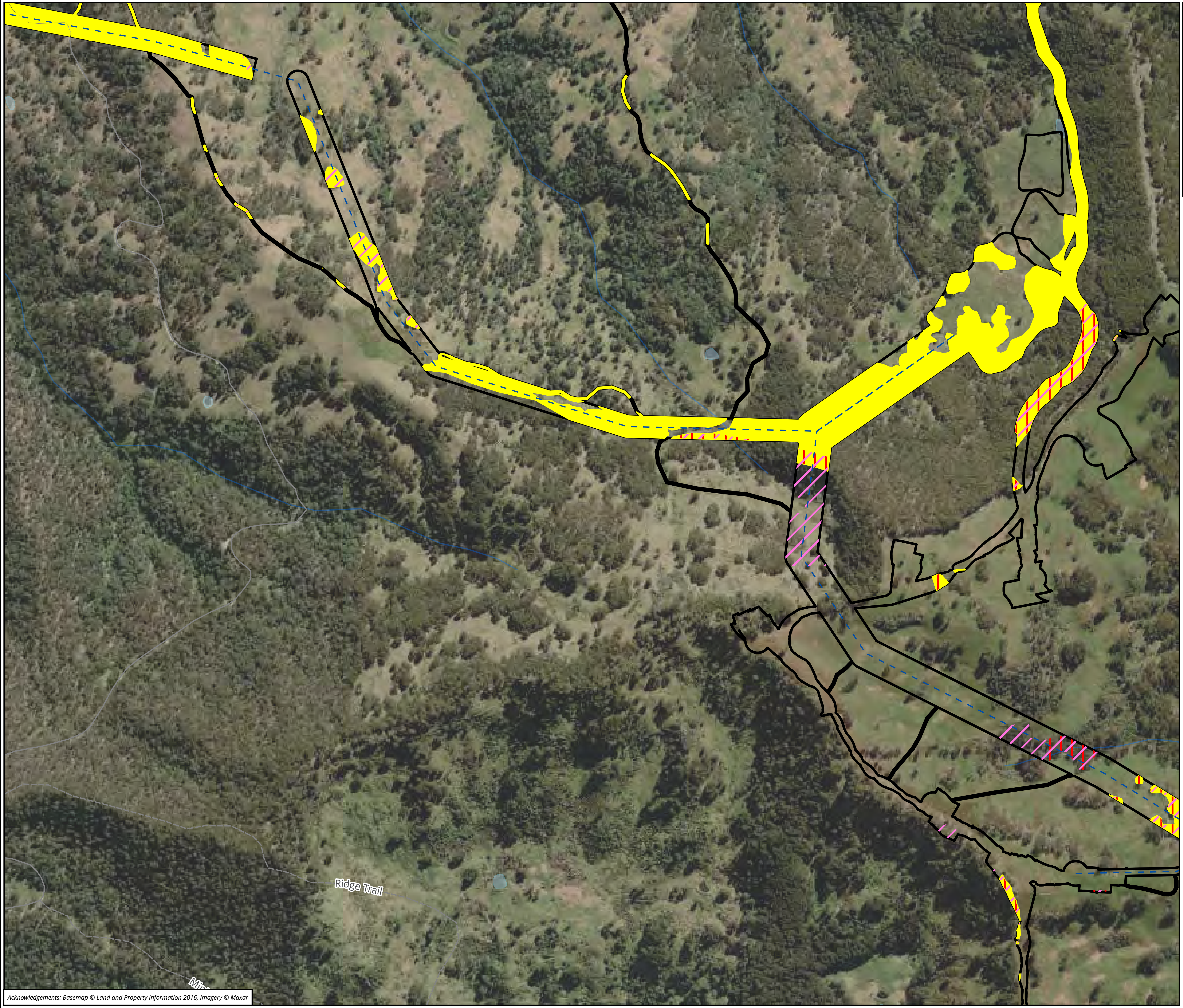
Figure 21 Forest Owls species habitat polygons, Page 8

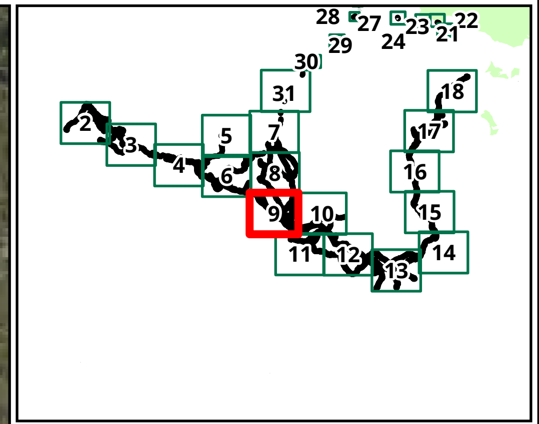
0 100 200 300 400
Meters
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx





Legend

- Infrastructure footprint
- Transmission line
- Masked Owl
- Powerful Owl
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 9

0 100 200 300 400

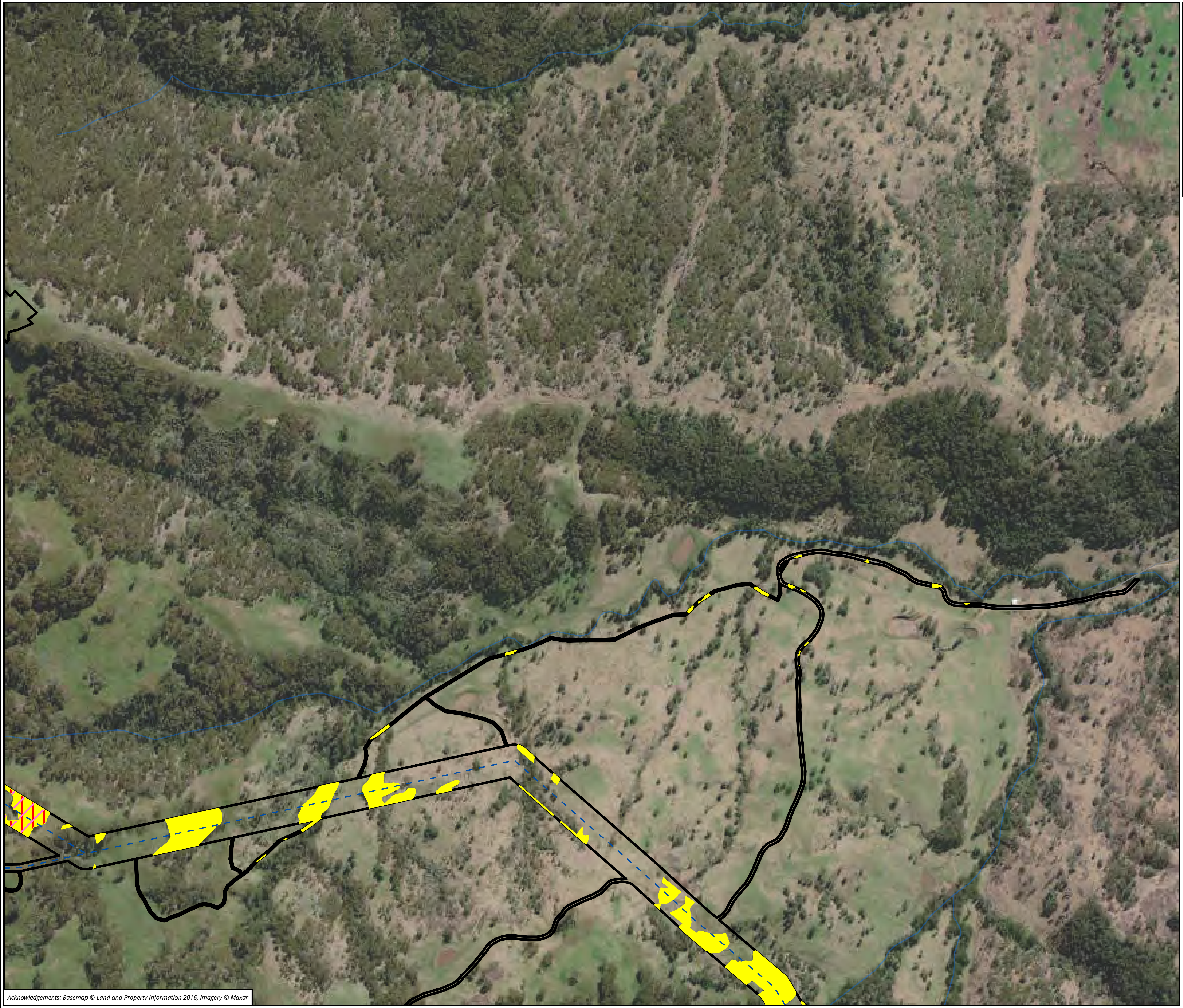
Meters

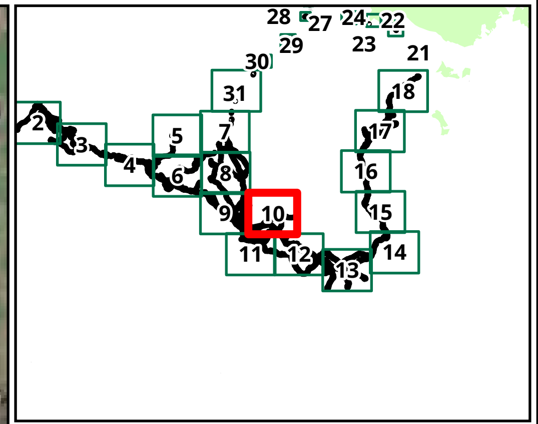
Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx





Legend

- Infrastructure footprint
- Transmission line
- Masked Owl
- Powerful Owl
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 10

0 100 200 300 400

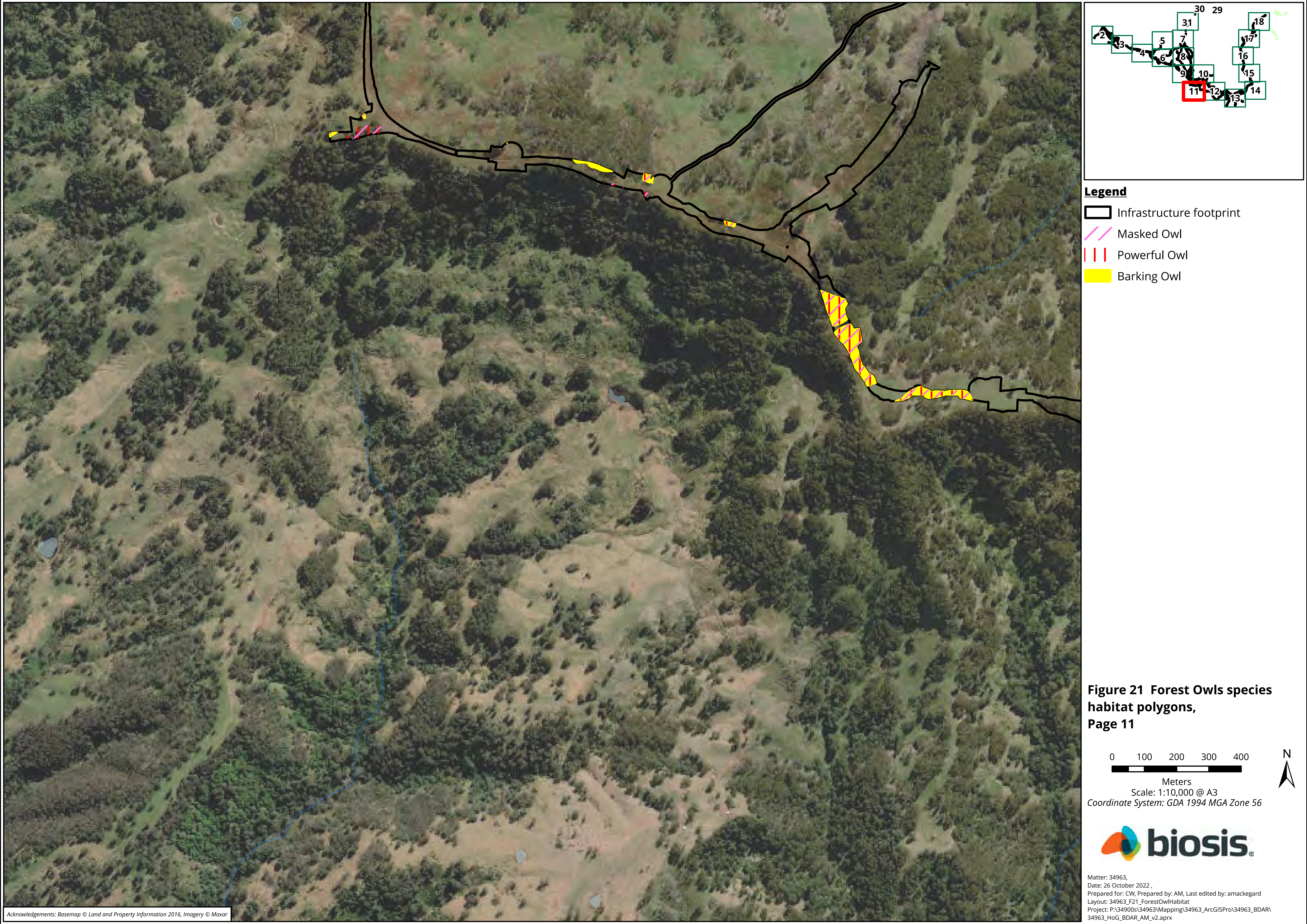
Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx



Legend

- Infrastructure footprint
- Masked Owl
- Powerful Owl
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 11

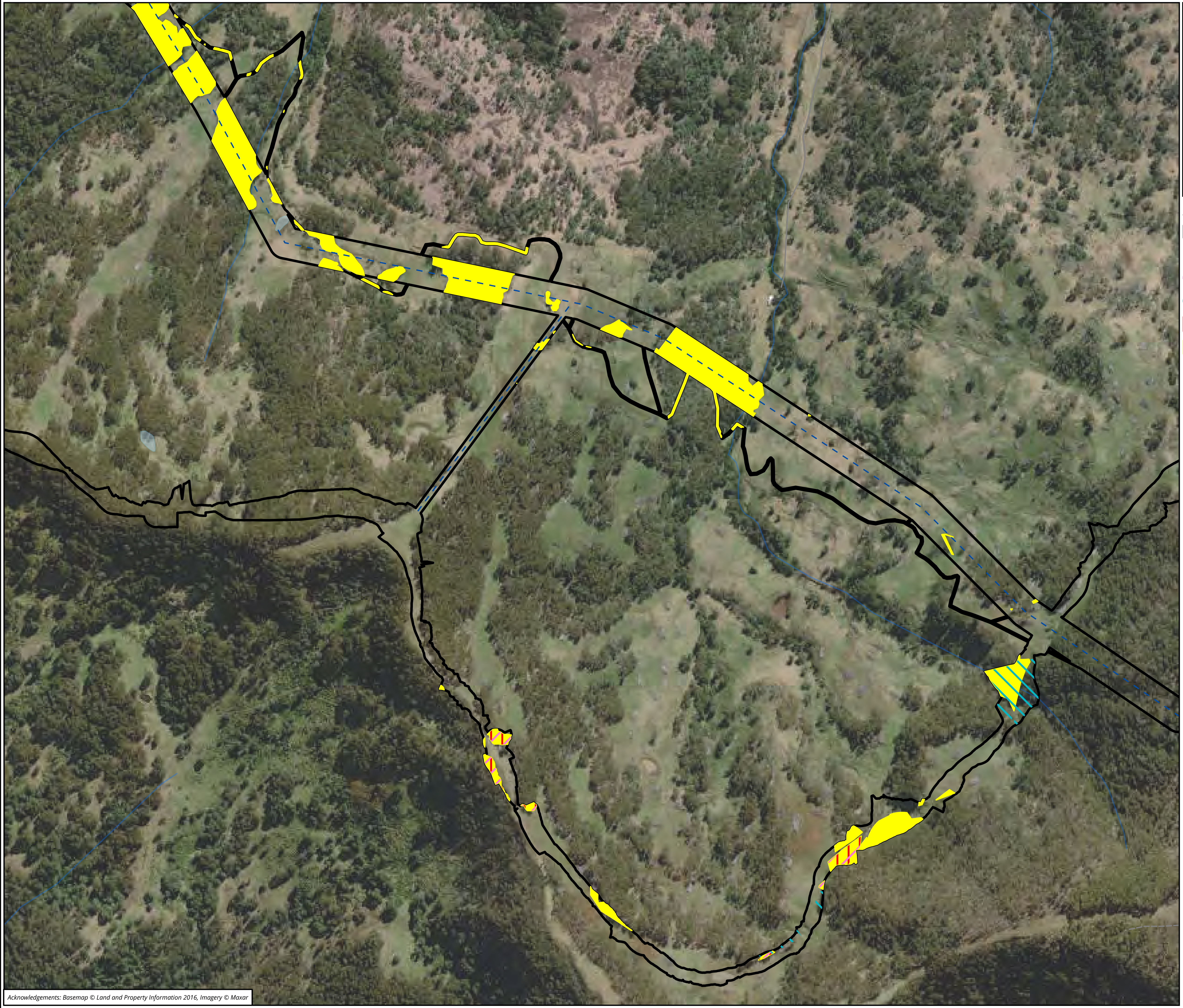
0 100 200 300 400

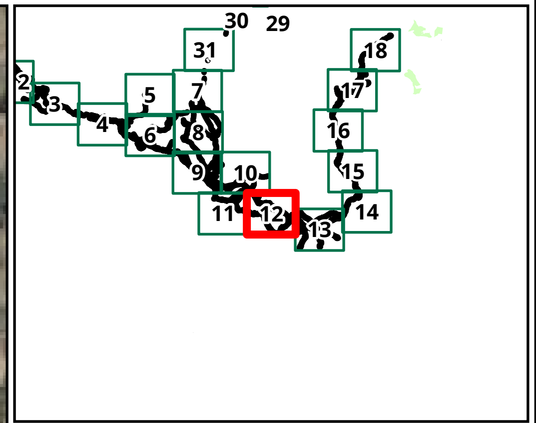
Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx





Legend

- Infrastructure footprint
- Transmission line
- Masked Owl
- Sooty Owl
- Powerful Owl
- Barking Owl

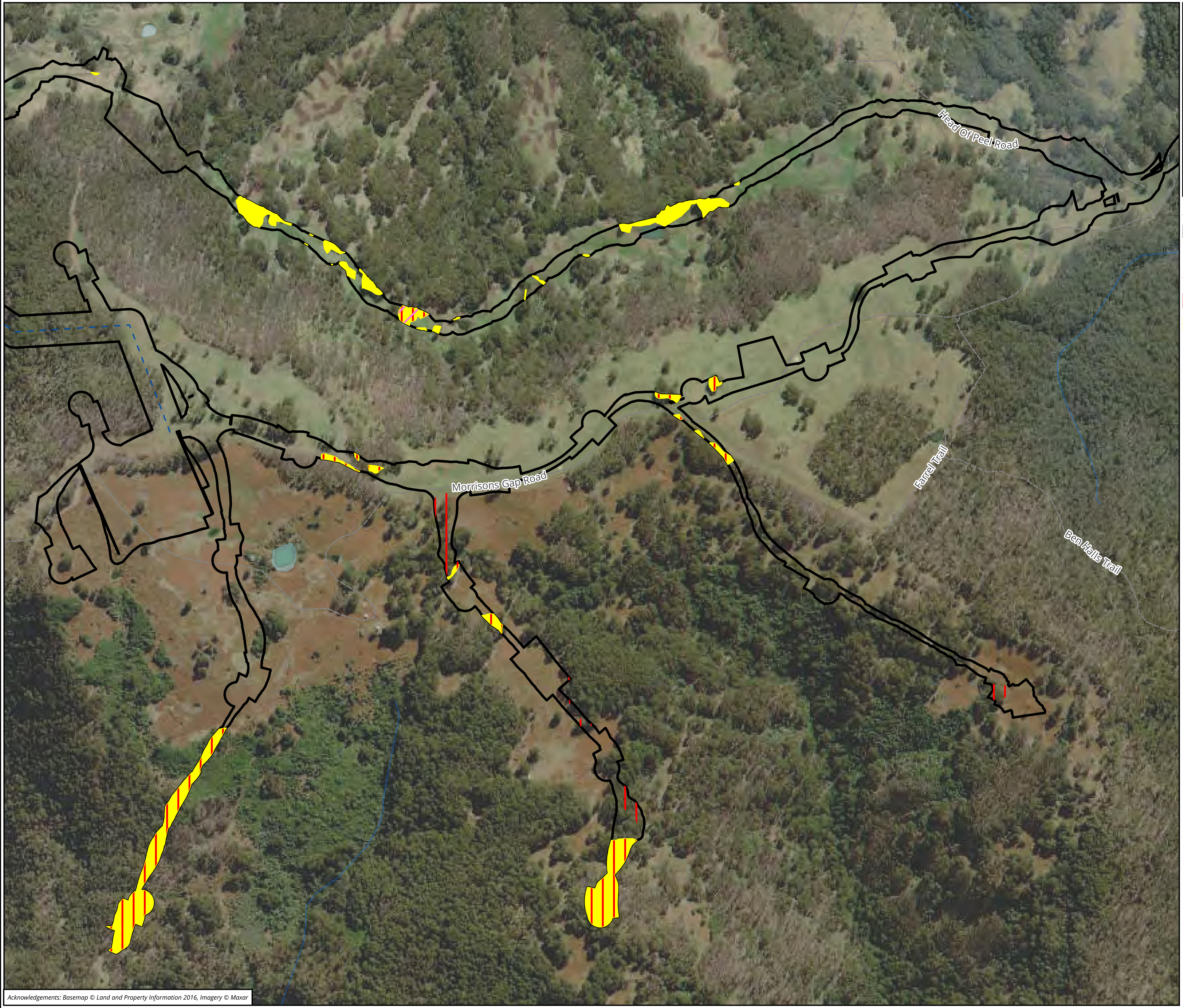
Figure 21 Forest Owls species habitat polygons, Page 12

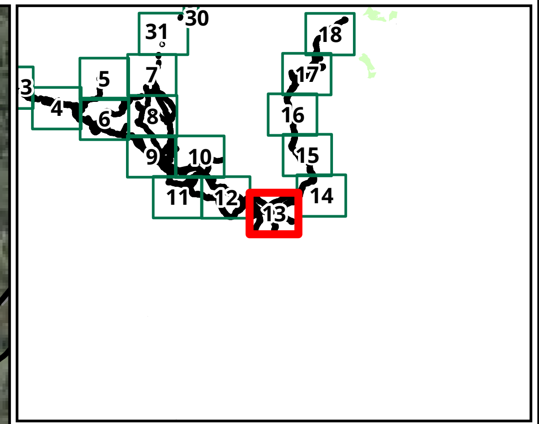
0 100 200 300 400
Meters
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis.

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx





Legend

- Infrastructure footprint
- Transmission line
- Masked Owl
- Powerful Owl
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 13

0 100 200 300 400

Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx

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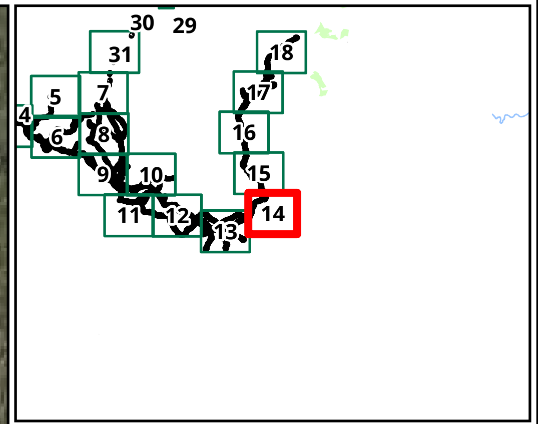


Legend

- Infrastructure footprint
- Powerful Owl
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 14

0 100 200 300 400

Meters

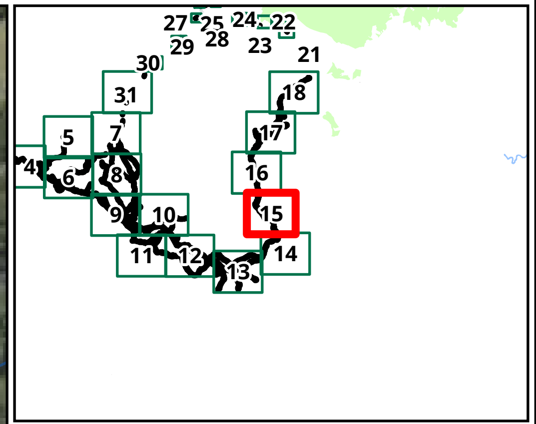
Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx



Legend

Infrastructure footprint

Powerful Owl

Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 15

0 100 200 300 400

Meters

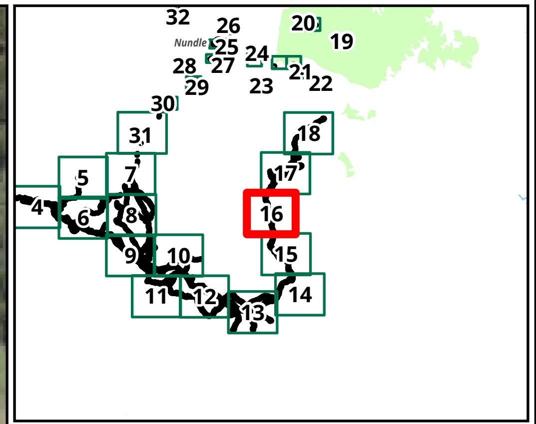
Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx



Legend

- Infrastructure footprint
- Powerful Owl
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 16

0 100 200 300 400

Meters

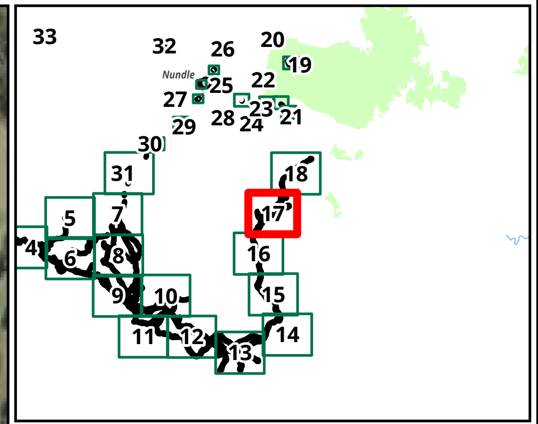
Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx



Legend

Infrastructure footprint

Masked Owl

Powerful Owl

Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 17

0 100 200 300 400

Meters

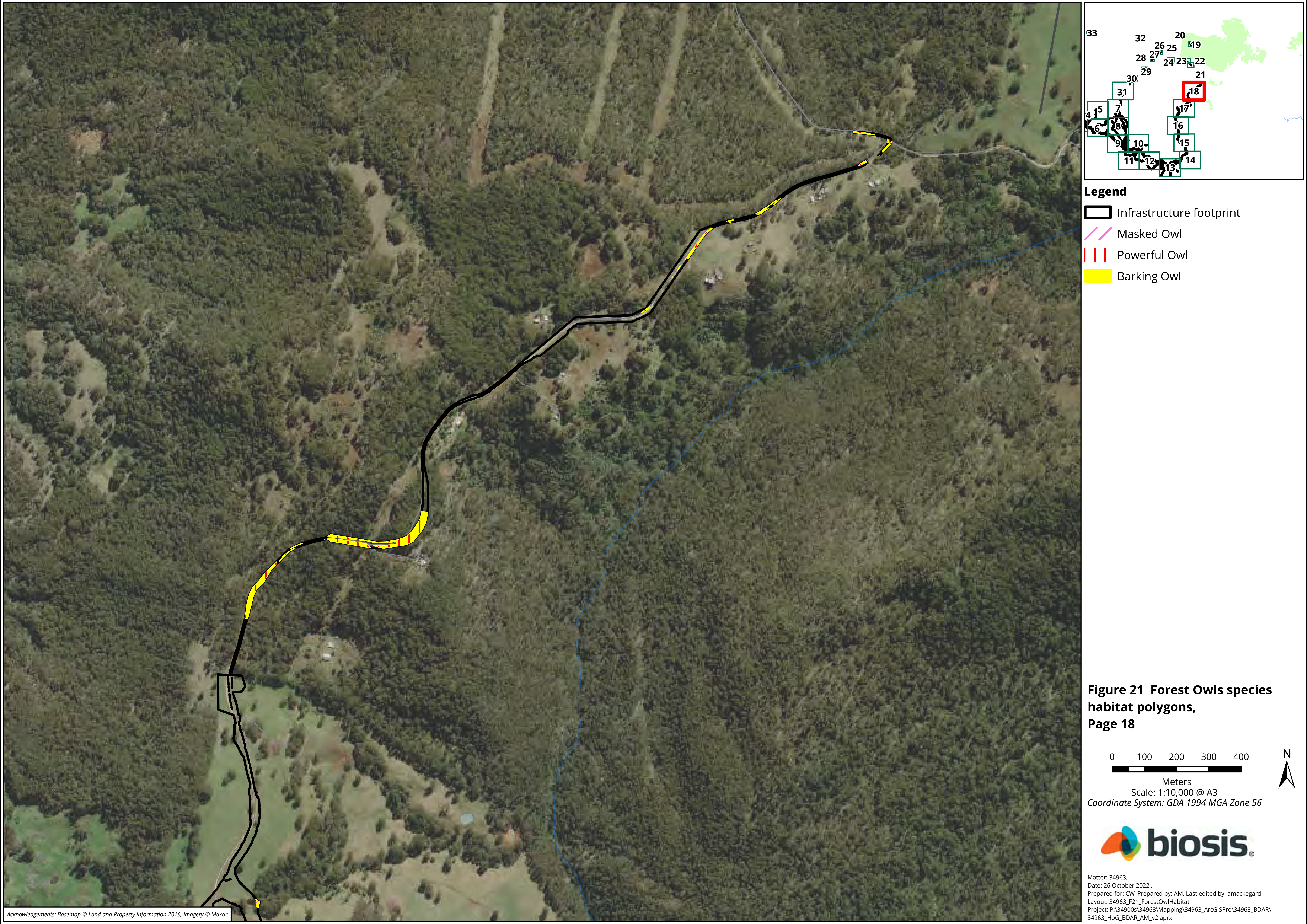
Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx



Legend

- Infrastructure footprint
- Masked Owl
- Powerful Owl
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 18

0 100 200 300 400
Meters
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx

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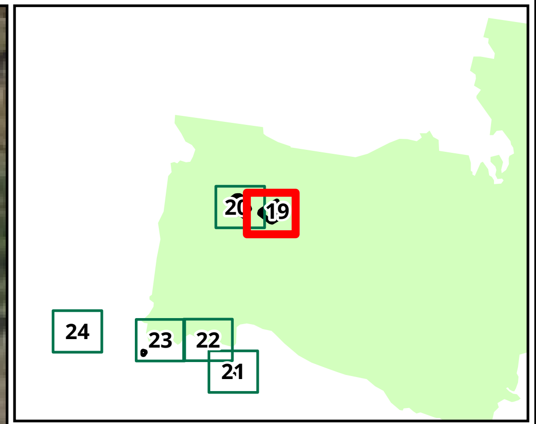

Legend

Infrastructure footprint

Figure 21 Forest Owls species habitat polygons, Page 19

0 30 60 90 120

Meters

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx

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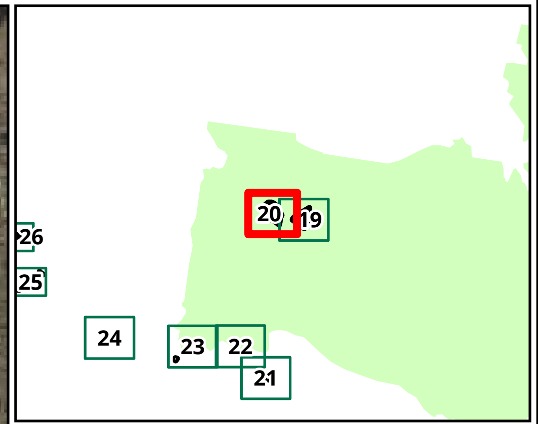

Legend

Infrastructure footprint

Figure 21 Forest Owls species habitat polygons, Page 20

0 30 60 90 120
Meters
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
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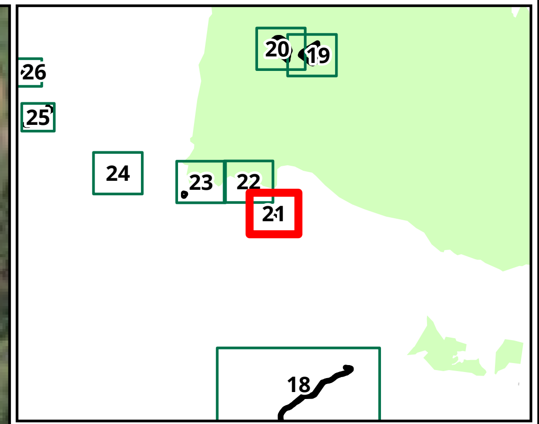

Legend

Infrastructure footprint

Figure 21 Forest Owls species habitat polygons, Page 21

0 30 60 90 120

Meters

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx

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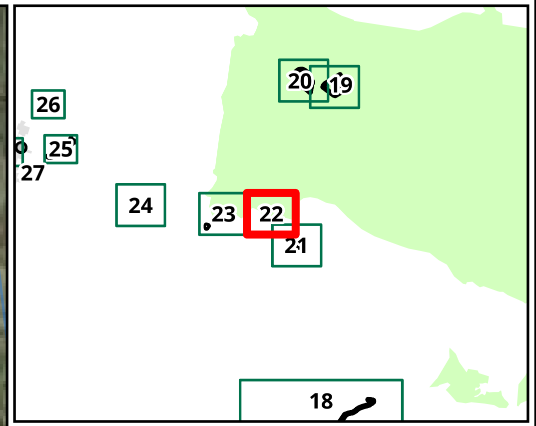


Legend

Infrastructure footprint

Figure 21 Forest Owls species habitat polygons, Page 22

0 30 60 90 120

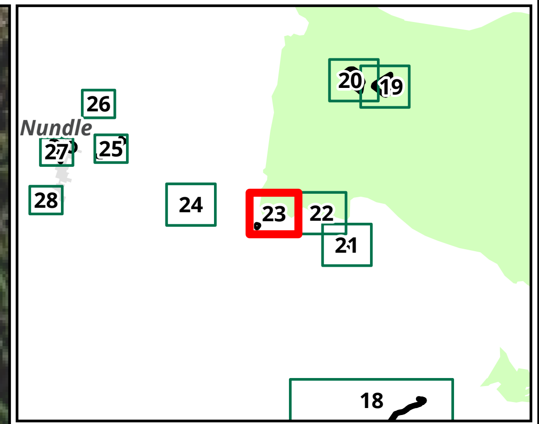
Meters

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx



Legend

- Infrastructure footprint
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 23

0 30 60 90 120

Meters

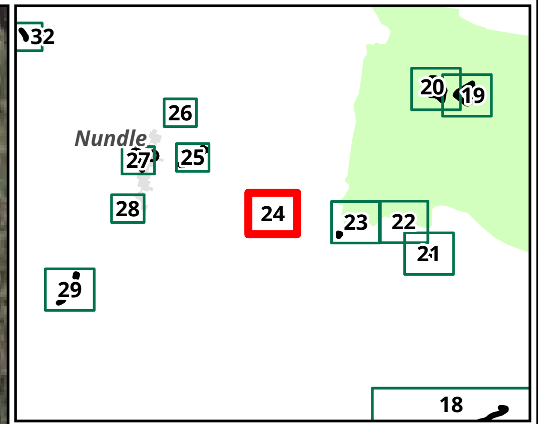
Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx



Legend

Infrastructure footprint

Figure 21 Forest Owls species habitat polygons, Page 24

0 30 60 90 120
Meters
N
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx

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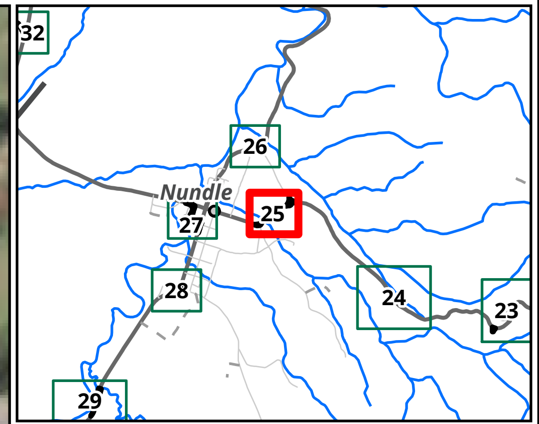

Legend

- Infrastructure footprint
- Masked Owl
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 25

0 20 40 60 80
Meters
Scale: 1:2,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx


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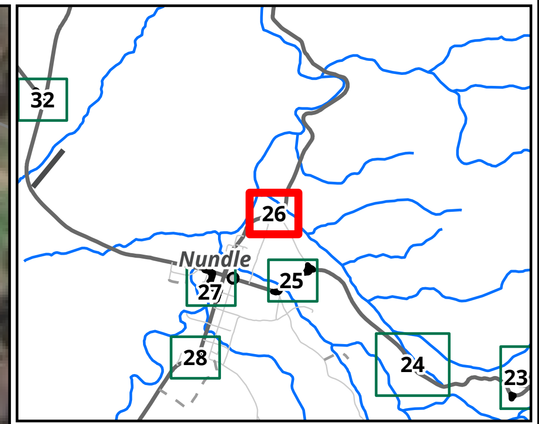


Legend

Infrastructure footprint

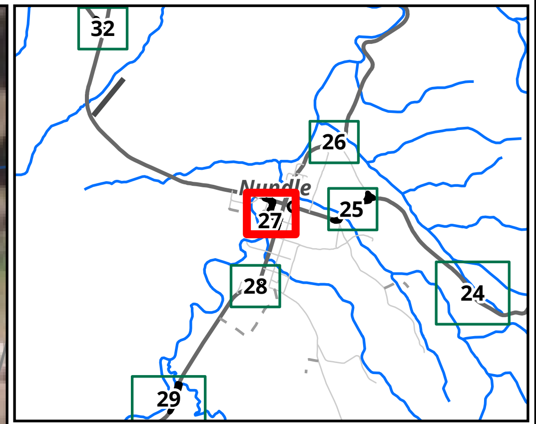
Figure 21 Forest Owls species habitat polygons, Page 26

0 20 40 60 80
Meters
Scale: 1:2,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx



Legend

Infrastructure footprint

Figure 21 Forest Owls species habitat polygons, Page 27

0 20 40 60 80

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx

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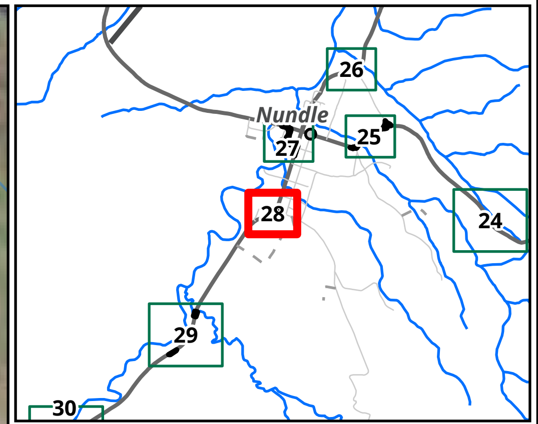


Legend

Infrastructure footprint

Figure 21 Forest Owls species habitat polygons, Page 28

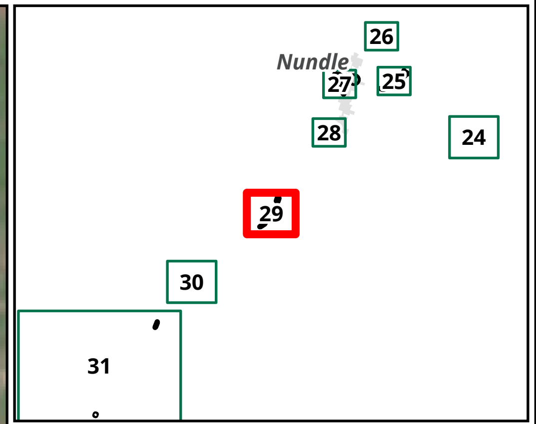
0 20 40 60 80

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx



Legend

- Infrastructure footprint
- Masked Owl
- Barking Owl

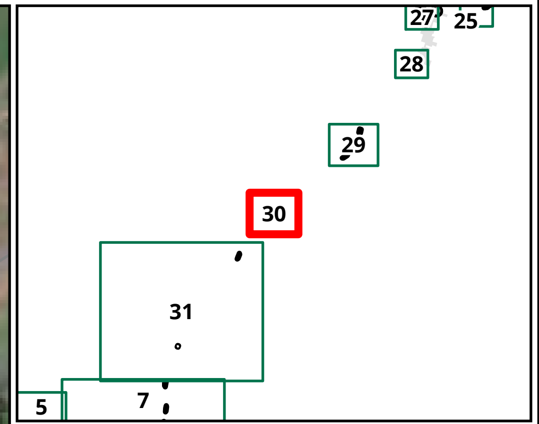
Figure 21 Forest Owls species habitat polygons, Page 29

0 30 60 90 120
Meters
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx

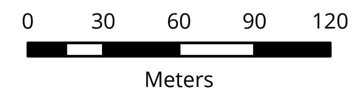


Legend

Infrastructure footprint

Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 30



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Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx

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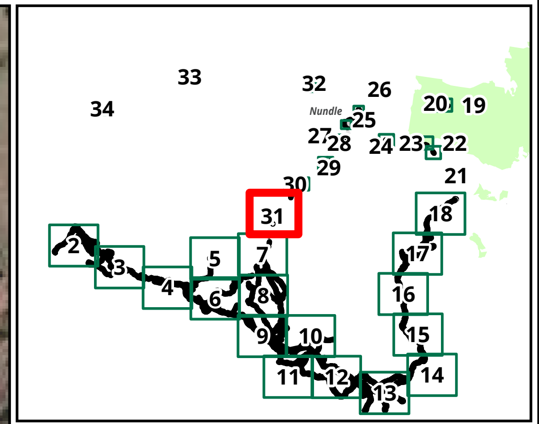


Legend

Infrastructure footprint

Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 31

0 100 200 300 400

Meters

Scale: 1:10,000 @ A3

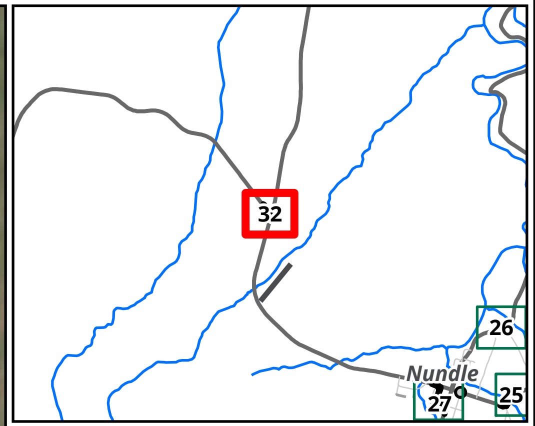
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx

Acknowledgements: Basemap © Land and Property Information 2016, Imagery © Maxar



Legend

Infrastructure footprint

Figure 21 Forest Owls species habitat polygons, Page 32

0 20 40 60 80

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
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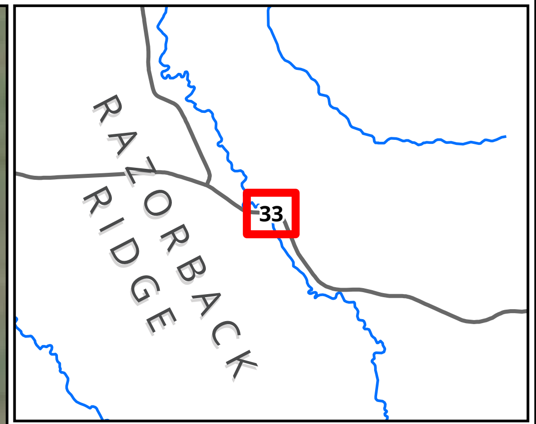
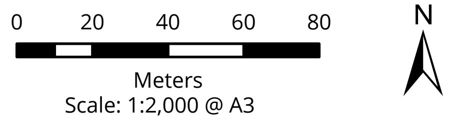


Legend

Infrastructure footprint

Figure 21 Forest Owls species habitat polygons, Page 33



Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F21_ForestOwlHabitat
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM_v2.aprx

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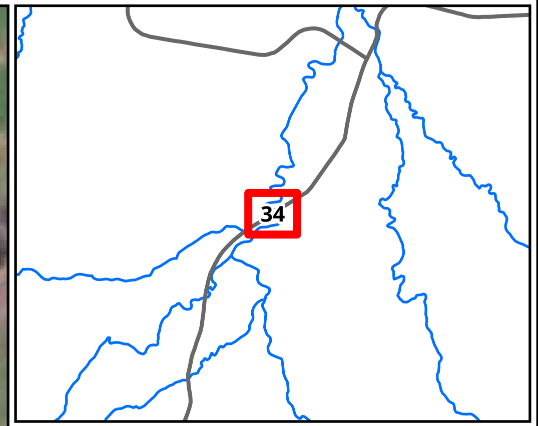

Legend

Infrastructure footprint

Figure 21 Forest Owls species habitat polygons, Page 34

0 20 40 60 80

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
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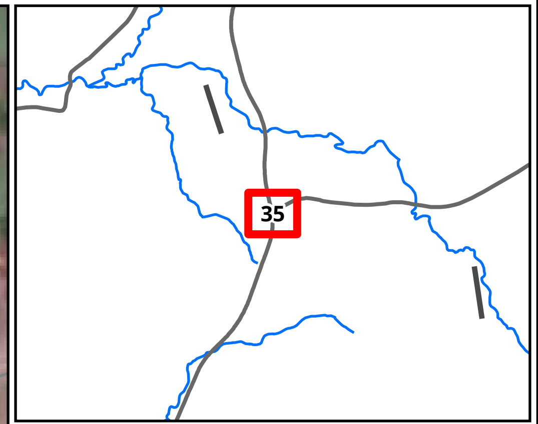

Legend

- Infrastructure footprint
- Masked Owl
- Barking Owl

Figure 21 Forest Owls species habitat polygons, Page 35

0 20 40 60 80

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
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6 Matters of National Environmental Significance

6.1 Commonwealth determination and controlling provisions

In accordance with the EPBC Act, a referral for the Project was submitted to the former Commonwealth Department of Agriculture, Water and Environment, now DCCEEW (EPBC Ref 2019/8535).

On the 23 December 2019, the Commonwealth determined the Project was a controlled action under section 75 of the EPBC Act. Controlling provisions for the proposed action include listed threatened species and communities (section 18 and 18A) and listed migratory species (section 20 and 20A). Based on the referral documentation (EPBC 2019/8535), the Commonwealth determined there was likely to be significant impacts to the following matters:

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC, listed as critically endangered.
- Regent Honeyeater *Anthochaera Phrygia*, listed as critically endangered.
- Swift Parrot *Lathamus discolor*, listed as critically endangered.
- Booroolong Frog *Litoria booroolongensis*, listed as endangered.
- Fork-tailed Swift *Apus pacificus*, which is listed as migratory.

In addition, the Commonwealth identified potential for some risk of significant impacts to the following matters:

- Small Snake Orchid *Diuris pedunculata*, listed as endangered.
- Blackbutt Candlebark *Eucalyptus rubida* subsp*. barbigerorum*, listed as vulnerable.
- Fragrant Pepperbush *Tasmannia glaucifolia*, listed as vulnerable.
- Austral Toadflax *Thesium austral*, listed as vulnerable.
- Spotted-tailed Quoll *Dasyurus maculatus* (SE mainland population), listed as endangered.
- Koala *Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT), listed as vulnerable.
- White-throated Needletail *Hirundapus caudacutus*, listed as vulnerable.
- *Euphrasia arguta*, listed as critically endangered.

Further information was requested by the Commonwealth to determine the extent of potential impacts associated with the transport route road upgrades for the following relevant protected matters:

- New England Peppermint Eucalyptus nova-anglica Grassy Woodlands ecological community, listed as critically endangered.
- Lowland Rainforest of Subtropical Australia TEC, listed as critically endangered.
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC, listed as critically endangered.
- Regent Honeyeater *Anthochaera Phrygia*, listed as critically endangered.
- *Euphrasia arguta*, listed as critically endangered.

- Small Snake Orchid *Diuris pedunculata*, listed as endangered.
- Willi Willi Zieria *Zieria lasiocaulis*, listed as endangered.
- *Diuris eborensis*, listed as endangered.
- White-flowered Wax Plant *Cynanchum elegans*, listed as endangered.
- Milky Silkpod *Parsonsia dorrigoensis*, listed as endangered.
- Guthrie's Grevillea *Grevillea guthrieana*, listed as endangered.
- Craven Grey Box *Eucalyptus largeana*, listed as endangered.
- Manning Yellow Solanum *Solanum sulphureum*, listed as endangered.
- Blackbutt Candlebark *Eucalyptus rubida* subsp*. barbigerorum*, listed as vulnerable.
- Koala *Phascolarctos cinereus* (combined populations of Old, NSW and the ACT), listed as vulnerable.
- Earp's Gum *Eucalyptus parramattensis* subsp*. decadens*, listed as vulnerable.
- Austral Toadflax *Thesium australe*, listed as vulnerable.
- Greater Glider *Petauroides Volans*, listed as vulnerable.
- Leafless Tongue-orchid *Cryptostylis hunteriana*, listed as vulnerable.
- Fragrant Pepperbush *Tasmannia glaucifolia*, listed as vulnerable.
- Narrow-leaved Peppermint *Eucalyptus nicholii*, listed as vulnerable.
- Long-nosed Potoroo (SE Mainland) *Potorous tridactylus*, listed as vulnerable.
- Tall Velvet Sea-berry *Haloragis exalata* subsp*. velutina*, listed as vulnerable.
- Big Nellie Hakea *Hakea archaeoides*, listed as vulnerable.

A summary and assessment of the potential for the above listed MNES to occur within the subject land and/or be impacted by the project is provided in Table 50 below.

Table 50 Summary of relevant EPBC Act threatened species and ecological communities

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (details Section 8.8)
Development footprint – Wind farm and transmission line corridor					
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Likely to be significant impacts (Wind Farm and Transmission Line)	Recorded within development footprint.	Project will remove 8.15 ha of habitat.	The project has successfully avoided and minimised impacts to White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC such that residual direct impacts are expected to be 8.15. This level of impact has been assessed as unlikely to lead to a significant impact to the listed ecological community due to the high proportion of low condition vegetation impacted (67% of the total impacts) and the widespread but fragmented nature of the CEEC in the locality. Detailed assessment is included in Section 8.8.	Project unlikely to result in a significant impact (refer Section 8.8).
Booroolong Frog ***Litoria booroolongensis***	Likely to be significant impacts (Wind Farm and Transmission Line)	Assumed potentially present in the portion of the development footprint proximal to Wombramurra Creek. Not detected during surveys.	Project will remove 0.95 ha of habitat.	Direct impacts to the species habitat as a result of the project are considered minor in nature, and indirect impacts are considered unlikely to be significant providing best practice construction environmental management measures are employed to prevent pollution of adjacent / downstream habitats.	Project unlikely to result in a significant impact (refer Section 8.8).
Fork-tailed Swift ***Apus pacificus***	Likely to be significant impacts (Wind Farm and Transmission Line)	Species not recorded during targeted diurnal bird survey across multiple seasons.	Negligible. Species almost entirely aerial.	The species may forage over the canopy of trees being removed by the project. However in the context of potential forage habitat available to the species within the vicinity of the project , impacts are considered negligible.	Assessment not undertaken. Potential impacts of the project to the species are considered negligible.

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (details Section 8.8)
Regent Honeyeater *Anthochaera Phrygia*	Likely to be significant impacts (Wind Farm and Transmission Line)	Species not recorded during targeted diurnal bird survey across multiple seasons.	Low. Potential impacts to forage habitat.	Regent Honeyeater is endemic to mainland south-eastern Australia where it is now patchily distributed from 100 kilometre north of Brisbane to the Adelaide area. Due to its complex movement patterns typified by migration and local nomadism, the Regent Honeyeater has what is effectively a single national population. The project will not impact upon the species' breeding habitats, nor will it impact upon area mapped by DPE as 'Important Areas' for the species. As such the project is not considered likely to lead to impacts to the population of the species, its habitat, or areas important for the species' recovery, to a level likely to result in a significant impact to the species.	Assessment not undertaken. Potential impacts of the project to the species are considered minor.
Swift Parrot *Lathamus discolour*	Likely to be significant impacts (Wind Farm and Transmission Line)	Species not recorded during targeted diurnal bird survey across multiple seasons.	Low. Potential impacts to forage habitat.	Swift Parrot breed in Tasmania and overwinter in mainland Australia (Saunders and Tzaros 2011). Breeding occurs between September and April, after which they disperse to mainland Australia (Higgins 1999). Swift Parrots occur as a single population that is estimated to be approximately 1000 pairs which is most likely continuing to decline (Garnett et al. 2011; Saunders and Tzaros 2011). The project will not impact upon the species' breeding habitats, nor will it impact upon area mapped by DPE as 'Important Areas' for the species. As such the project is not considered likely to lead to impacts to the population of the species, its habitat, or areas important for the species' recovery, to a level likely to result in a significant impact to the species.	Assessment not undertaken. Potential impacts of the project to the species are considered minor.
Koala *Phascolarctos cinereus*	Some risk of significant impact (Wind Farm and Transmission Line)	Species recorded within the development footprint.	Project will remove 46.28 ha of habitat.	Given the scale of native vegetation removal required for the proposed works (> 20 hectares), the presence of Koala within the development footprint, and the contiguous nature of the development footprint with surrounding National Parks and State Forests, the EPBC Act referral guidelines for the species (DoE 2014) classifies the vegetation within the development footprint as critical to the survival of the species. The referral guidelines, which are applicable to all project types, state that the proposed works has the potential for a significant impact on the species, due to the removal of greater than 20 hectares of habitat.	Project likely to result in a significant impact (refer Section 8.8).

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (details Section 8.8)
Spotted-tailed Quoll *Dasyurus maculatus*	Some risk of significant impact (Wind Farm and Transmission Line)	Species recorded within the development footprint.	Project will remove 45.62 ha of habitat.	The Project has been precautionarily assessed as leading to a potentially significantly impact on habitat of the Spotted-tailed Quoll within the development footprint and wider locality. Habitat within the development footprint is considered to be important habitat, given the Endangered EPBC Act threat status of the species and the direct evidence of occupancy (DAWE 2016). A total of 45.62 hectares of this habitat is proposed to be removed as part of the project, which is likely to adversely impact Spotted-tailed Quoll habitat within the locality.	Project likely to result in a significant impact (refer Section 8.8).
White-throated Needletail *Hirundapus caudacutus*	Some risk of significant impact (Wind Farm and Transmission Line)	Species not recorded during targeted diurnal bird survey across multiple seasons.	Negligible. Species almost entirely aerial.	The species may forage over the canopy of trees being removed by the project. However in the context of potential forage habitat available to the species within the vicinity of the project alignment, impacts are considered negligible.	Assessment not undertaken. Potential impacts of the project to the species are considered negligible.
Austral Toadflax *Thesium australe*	Some risk of significant impact (Wind Farm and Transmission Line)	Species not recorded during flora surveys	Low.	Species not recorded during flora surveys detailed in Section 5.3.	Assessment not undertaken due to low likelihood of this species occurring.
Blackbutt Candlebark *Eucalyptus rubida* subsp. *barbigerorum*	Some risk of significant impact (Wind Farm and Transmission Line)	Species not recorded during flora surveys	Low. Local records based on two records 50 – 110 years old, with poor accuracy.	Species not recorded during flora surveys detailed in Section 5.3. Majority of species records occur 150 – 200 kms to the north of the subject land.	Assessment not undertaken due to low likelihood of this species occurring.

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (details Section 8.8)
Euphrasia arguta	Some risk of significant impact (Wind Farm and Transmission Line)	Species not recorded during flora surveys	Low.	Species not recorded during flora surveys detailed in Section 5.3.	Assessment not undertaken due to low likelihood of this species occurring.
Fragrant Pepperbush *Tasmannia glaucifolia*	Some risk of significant impact (Wind Farm and Transmission Line)	Species not recorded during flora surveys	Low.	Species not recorded during flora surveys detailed in Section 5.3.	Assessment not undertaken due to low likelihood of this species occurring.
Small Snake Orchid *Diuris pedunculata*	Some risk of significant impact (Wind Farm and Transmission Line)	Low. Species microhabitats not present in subject land	Low.	Grows on grassy slopes or flats, often on peaty soils in moist areas, also on shale and trap soils, on fine granite, and among boulders. This habitat is not present within the development footprint. Nearest record occurs approximately 7km to the north of the subject land. However the records is noted as a Royal Botanic Gardens Herbarium Specimen Register (with an “endDate” noted as 29/10/2000), and despite its relatively high level of accuracy (50m) it is located in the centre of a large pine plantation that was recently cleared and is now regrowing, thus puts its accuracy into question. The next neatest records occur >60kms to the north, >115kms to the north-east, and >100kms to the south-east.	Assessment not undertaken due to low likelihood of this species occurring.
Development footprint – Transport route upgrades					
Lowland Rainforest of Subtropical Australia	Extent of impacts to be determined (Transport route upgrades)	Nil.	No impact.	Transport route upgrades do not impact upon areas of Lowland Rainforest of Subtropical Australia.	Assessment not required.

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (details Section 8.8)
New England Peppermint Eucalyptus nova-anglica Grassy Woodlands	Extent of impacts to be determined (Transport route upgrades)	Nil.	No impact.	Transport route upgrades do not impact upon areas of Lowland Rainforest of Subtropical Australia.	Assessment not required.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Extent of impacts to be determined (Transport route upgrades)	Recorded within transport route upgrades around Nundle.	Project will remove 8.15 ha of habitat.	The project has successfully avoided and minimised impacts to White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC such that residual direct impacts are expected to be 8.15. This level of impact has been assessed as unlikely to lead to a significant impact to the listed ecological community due to the high proportion of low condition vegetation impacted (67% of the total impacts) and the widespread but fragmented nature of the CEEC in the locality. Detailed assessment is included in Section 8.8.	Project unlikely to result in a significant impact (refer Section 8.8).
Greater Glider *Petauroides Volans*	Extent of impacts to be determined (Transport route upgrades)	Recorded within the development footprint, however not impacted by the transport route upgrades	Project will remove 36.28 ha of habitat.	Approximately 36.28 hectares of known Greater Glider habitat is proposed to be removed from the development footprint as a part of the current project. However the local population of the species is not considered an Important Population under the EPBC Act Significant Impact guidelines, and as such a significant impact to the species is unlikely to occur.	Project unlikely to result in a significant impact (refer Section 8.8).
Koala *Phascolarctos cinereus*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	Project will remove 46.28 ha of habitat.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only. Habitat for Koala will be impacted by the development footprint associated with the wind farm and transmission line.	Project likely to result in a significant impact (refer Section 8.8).

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (details Section 8.8)
Long-nosed Potoroo *Potorous tridactylus*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Regent Honeyeater *Anthochaera Phrygia*	Extent of impacts to be determined (Transport route upgrades)	Negligible levels of forage habitat impacted by the transport route upgrades.	Negligible impacts to forage habitat.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not undertaken. Potential impacts of the project to the species are considered minor.
Austral Toadflax *Thesium australe*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Big Nellie Hakea *Hakea archaeoides*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Blackbutt Candlebark *Eucalyptus rubida* subsp. *barbigerorum*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Species not recorded in areas impacted around Nundle. Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (details Section 8.8)
Craven Grey Box *Eucalyptus largeana*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Diuris eborensis	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Earp's Gum *Eucalyptus parramattensis* subsp. *decadens*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Euphrasia arguta	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Species not recorded in areas impacted around Nundle. Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Fragrant Pepperbush *Tasmannia glaucifolia*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Species not recorded in areas impacted around Nundle. Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (details Section 8.8)
Guthrie's Grevillea *Grevillea guthrieana*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Leafless Tongue-orchid *Cryptostylis hunteriana*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Manning Yellow Solanum *Solanum sulphureum*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Milky Silkpod *Parsonsia dorrigoensis*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Narrow-leaved Peppermint *Eucalyptus nicholii*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Species not recorded along transport route upgrades. Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.

MNES	DCCEEW consideration	Updated likelihood of occurrence based on assessment	Potential impacts	Rationale	SIC self-assessment undertaken / result (details Section 8.8)
Small Snake Orchid *Diuris pedunculata*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Tall Velvet Sea-berry *Haloragis exalata* subsp. *velutina*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
White-flowered Wax Plant *Cynanchum elegans*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.
Willi Willi Zieria *Zieria lasiocaulis*	Extent of impacts to be determined (Transport route upgrades)	Species' habitat not impacted by transport route upgrades.	No impact.	Native vegetation impacted by the transport route upgrades comprises edges and/or isolated/degraded patches of eucalypt forest/woodland, which does not support habitat for threatened flora, or threatened fauna species on more than a transient basis for forage activities only.	Assessment not required.

6.2 Significant impact assessment

Based on the results of the desktop investigations, field surveys, the likelihood of occurrence assessments (contained in the EPBC assessment prepared by Arup), and the information provided in Table 50 above, significant impact assessments were found to be required for the EPBC Act listed species and TECs that are known to occur or have a 'high' likelihood of occurrence, as listed below, with a detailed significant impact assessment provided in Section 8.8 of this BDAR.

Threatened Ecological Communities

- White Box-Yellow Box-Blakely's Red Gum Grassy TEC Woodland and Derived Native Grassland (critically endangered).

Listed threatened fauna species

- Booroolong Frog *Litoria booroolongensis* (Endangered).
- Large-eared Pied Bat *Chalinolobus dwyeri* (Vulnerable)
- Spotted-tailed Quoll *Dasyurus maculatus* (Endangered).
- Greater Glider *Petauroides volans* (Vulnerable).
- Koala *Phascolarctos cinereus* (Vulnerable).

The significant impact assessment was completed in accordance with the EPBC Act *Significant Impact Guidelines 1.1 Matters of National Environmental Significance* (Commonwealth of Australia 2013). The results of the assessment in this BDAR identified the potential for a significant impact to the following MNES:

- Koala.
- Spotted-tailed Quoll.

As a result targeted field survey and the changes proposed to the project design, significant refinement has been achieved for previously assumed potential roosting / breeding habitat locations for cave dwelling bats including Large-eared Pied Bat within and surrounding the development footprint. The former conclusion of a potential significant impact to Large-eared Pied Bat (in the BDAR exhibited with the EIS) has been updated based on the revised assessment which confirms that the amended project is unlikely to have a significant impact on the Large-eared Pied Bat.

Following re-design of project components and reassessment of impacts to Box Gum Woodland the former conclusion of a potential significant impact (in the BDAR exhibited with the EIS) has also been updated based on the revised assessment which confirms that the amended project is unlikely to have a significant impact on Box Gum Woodland.

Impacts to Koala and Spotted-tailed Quoll have been minimised through project design amendments reducing direct impacts to Koala habitat by approximately 5 hectares and to Spotted-tailed Quoll by approximately 15 hectares (with the species being associated with all areas of moderate and high condition native vegetation in the development footprint). Impacts will be further minimised through construction and operational mitigation measures targeting these species and through the establishment of local offsets aimed to increase local habitat connectivity between the existing reserve network. Despite the efforts made to reduce impacts, the residual impacts to both species have been conservatively considered significant in accordance with the EPBC Act significant impact guidelines, and as such the species will require direct offsets in accordance with the EPBC Act Offsets Policy (Commonwealth of Australia 2016). Required offsets are expected to be achieved via a combination of establishment of local Biodiversity Stewardship Sites and the securing of biodiversity credits.

Further information is provided in Section 8.8.

7 Avoid and minimise impacts

Measures to avoid and minimise impacts have been included throughout the development of the design for the Project, including the selection of wind farm layouts, access roads and the transmission line route.

The preliminary identification and mapping of biodiversity constraints occurred before the development of the wind farm layout and the selection of the preferred transmission line corridor, with preliminary biodiversity fieldwork completed in the wind farm and transmission line area in November 2018 before concept engineering design commenced. By collecting ecological data early, this allowed for consideration of biodiversity constraints during the concept design development.

Measures to minimise impacts associated with construction and operation have also been considered, with further detail on these provided in Section 8.9 and Section 8.10 of this BDAR.

The efforts made by the project to avoidance and minimise impacts to biodiversity are illustrated on Figure 1 and Figure 23.

7.1 Wind farm layout

A first pass technically feasible layout for the Project was produced based on the wind resource and required turbine spacing and resulted in a layout of up to 97 turbines. This layout was made publicly available during in the Preliminary Environmental Assessment to request the SEARs. Subsequent iterations of this layout reduced the layout to 78 turbines, then to up to 70 turbines for the project as assessed in the EIS and original BDAR, the number of turbines was reduced to 65 turbines based on further design changes made in response to submissions, and finally to 64 turbines in the current amended project layout. These updated layouts were derived based on updated turbine technology, the most up to date environmental survey information available, and additional biodiversity impact assessments. Various design rounds were held with civil, wind and biodiversity expertise and also incorporated community, BCS and DPE feedback into the project design process to minimise biodiversity impacts to the greatest extent practicable in light of Project requirements.

A high level review of the reduced impact associated with reducing the number of turbines from 97 to 78 was carried out prior to the development of the detailed engineering concepts. At this stage the area of impact was based on an indicative hardstand area for each turbine, with linking 6 metre wide access tracks only as earthworks modelling was not yet available to quantify the potential extent of cut and fill required for access roads. Based on this initial indicative assessment the 78 turbine layout impacted on 22% less native vegetation than the 97 turbine layout.

During the development of the wind farm layout as part of the preferred 78 turbine option, design workshop was held with the project ecologists, civil engineers and wind modellers to further optimise layout options to avoid impacts to significant biodiversity features, such as fauna habitat and microbat breeding areas. This review resulted in the wind farm layout being further reduced by an additional 8 turbines from a maximum of 78 turbines down to 70 turbines to further minimise biodiversity impacts and limit the clearing required to sensitive vegetation. This further reduction on the number of turbines has contributed to a large reduction in the potential direct and indirect impacts, including potential impacts to habitat connectivity and turbine collision risk, associated with the project.

As part of the design workshops, ecological data from field surveys was overlaid with concept designs and opportunities to amend design elements were assessed. For these workshop, the following ecological data was provided:

- Areas of potential microbat roosts, as mapped using the LiDAR classification process, with a 100m buffer included.
- PCT mapping identifying areas of moderate and high condition vegetation communities to be avoided as much as possible.
- TEC mapping showing the location of the Ribbon Gum-Mountain Gum-Snow Gum community within the wind farm infrastructure corridor.

Key outcomes of this design review included:

- Removal of turbine locations in areas of steep terrain and located within 100 m of identified microbat roosting habitat on rocky outcrops.
- Removal of turbine locations on very steep sections of the site within close proximity to microbat habitat roosts.
- Refinement of the access track along Morrisons Gap Road to avoid required vegetation trimming and clearing.

Accordingly, the exhibited project layout in the EIS avoided all identified microbat roosting habitat and have been optimised to minimise the extent of clearing. An analysis of the wind farm infrastructure layout between the 78 and 70 turbine configurations, shows that this resulted in an approximately 30% reduction in clearing extents (Table 51) to certain PCTs. Following the additional changes made to the Project to further reduce biodiversity impacts in response to the issues identified in submissions, impacts to native vegetation have been further materially reduced as shown below.

Table 51 Review of native vegetation impacts after design refinements to minimise biodiversity impacts

PCT	78 Turbine Layout	70 Turbine Layout	Amended design 70 turbines	65 Turbine Layout	64 Turbine Layout*	Total Change (ha)	Total Change (%)
1194	100.17	75.65	50.80	39.29	43.77	-56.40	-44
507	0.35	0.19	0.09	0.09	0.09	-0.26	-26
927	3.64	0.00	0.00	0.00	0.00	-3.64	-100
931	5.13	6.30	6.20	3.21	4.45	-0.68	-87
934	22.46	17.96	11.87	22.82	24.60	2.14	+10
954	2.15	2.73	1.37	1.23	1.23	-0.92	-57
Total	**133.90**	**102.82**	**70.33**	**66.64**	**74.14**	**-59.76**	**-55**

*Some required design amendments in the 64 turbine layout following ongoing stakeholder consultation have resulted I increased impacts to certain PCTs.

The additional amendments to the design undertaken in response to submissions to further minimise impacts from internal roads, crane hardstands and laydowns/compounds were assisted by the results of the bushfire assessment which confirmed that sufficient fire protection is considered to be able to be achieved by the cleared areas themselves. Commitments for 10 metre APZ buffers from structures associated buildings, and infrastructure have been maintained. During the response to submissions stage the layout was also revised to avoid impacts within the 100 metre (BAM prescribed) buffers on potential microbat habitat to avoid the potential for a Serious and Irreversible Impact associated with direct impacts to breeding habitat.

It should be noted that the increase in impacts to PCT 934 have occurred as a result of detailed reviewed of plot data collected by Biosis, which showed an area mapped in the original BDAR as 'Exotic Grassland' was more representative of a Derived Native Grassland/Shrubland and was re-classified accordingly.

Further avoidance and minimisation of direct and indirect impacts has been achieved through the changes made to the Project in response to the issues raised in submissions and BCS RFIs including the removal and relocation of turbines and hardstands across the subject land. Details of design amendments and impact avoidance are provided in Table 52 below.

Table 52 Design amendments and impact avoidance

Project Amendment	Description	Impact avoidance
Development footprint revision	Exhibited project footprint (EIS) comprised: • Permanent Development Footprint: approximately 242 ha • Temporary Development Footprint: approximately 271 ha • Total development footprint approximately 513 ha. Design revisions have resulted in the amended project footprint now comprising: • Permanent Development Footprint: approximately 144 ha • Temporary Development Footprint: approximately 302 ha • Total development footprint approximately 447 ha	Substantial reduction in direct impacts to biodiversity values have been realised through further ongoing detailed design revision and footprint/infrastructure amendments. This is combines with the indirect benefits through the removal and relocation of turbines as well as a reduction in bulk earthworks and associated project infrastructure.
Removal of WP1	WP1 was the closest turbine to the Crawney Pass National Par and its removal reduces biodiversity impacts, native vegetation removal and the requirement for bulk earthworks. The road required to access the turbine has also been removed, further benefitting biodiversity values in that location.	WP1 was considered a Moderate Risk turbine and its removal benefits locally occurring threatened and non-threatened fauna species including microbats, Koala, Greater Glider, as well as to approximately 2ha of Ribbon Gum TEC vegetation. Removal from the project design has the direct benefit of reducing native vegetation removal, but also reduces potential connectivity impacts as the turbine was acting as an outlier on the south-western extent of the array, and the turbines now occur in a more linear arrangement in that location.
Removal of WP19	WP19 has been removed reducing impacts to biodiversity values in the centre of the wind farm. It will reduce the earthworks and vegetation clearance needed to install the turbine, supporting hardstand area and access road.	The removal of WP19 results in an increase separation gap from 1 – 1.5km between turbines in this location, to approximately 2.1km between turbine WP18 and turbines WP20-22 reducing habitat connectivity impacts in an areas of the wind farm where moderate condition habitats occur on either side of the ridgeline. The removal of WP19 also allows for

Project Amendment	Description	Impact avoidance
		an approximate 600 metre reduction of the intrusion into intact vegetation to the south of the development footprint.
Removal of WP23, 27 and 31	WP23, 27 and 31 have all been removed to reduce risk of direct and indirect impact biodiversity values including potential microbat breeding habitat, modelled owls breeding habitat, and intact vegetation. The removal of these turbines will reduce significant bulk earth works associated with hardstands and associated roads, and reduces the area of impact from the southern-most portion of the wind farm by 400 – 500m at each turbine location.	All three of these turbines were assessed a High Risk turbines (four assessed in total) relating to potential impacts to biodiversity values. WP23 was considered high risk due to its occurrence as southern outlier in high condition intact native vegetation considered likely to support habitat for numerous threatened species, WP27 was located in close proximity to confirmed potential microbat breeding habitat, and WP31 occurred in proximity to modelled large forest ole breeding habitat. The removal of these three turbines will substantially benefit biodiversity values utilising the habitats along this southern portion of the wind farm, both directly through a reduction in vegetation removal, and indirectly through a reduction in potential collision risk, breeding habitat disturbance, and connectivity impacts.
Removal of WP41 and relocation of WP35 – WP47	WP41 has been removed to allow for increased spacing of turbines adjacent to Ben Halls Gap Nature Reserve (WP35 – WP47) to minimise the potential for impacts associated with barrier effect adjacent to the high quality habitats withing the Nature Reserve, and to proportionally reduce the potential for collision risk across the project.	Removal of WP41 and relocation of WP35 – WP47 allowed for turbines adjacent to BHGNR to achieve a minimum 400 metre spacing (WP38-WP47), and create a 1.2 kilometre east-west corridor between turbines WP40 and WP42. This project update is considered to substantially reduce the potential for barrier effect (barriers to species movements) adjacent to BHGNR, considered a higher risk areas, and across the subject land more broadly.
Reorientation of WP2 hardstand	The hardstand for WP2 has been reorientated such that it now occurs largely on exotic grassland.	This reorientation complements the reduction of impacts associated with the removal of WP1 and reduces impacts to Ribbon Gum TEC vegetation by another 0.3 ha (on top of the 1ha reduction highlighted above from WP1).
Relocation of WP47	WP47 has been relocated 209 metres north east of the exhibited location. This is to reduce the extent of vegetation clearance in this location.	Increased buffer distance from retained native vegetation on the escarpment and reduction in clearing native vegetation benefits biodiversity values in that location.
Relocation of WP50	WP50 has been moved approximately 130m to the north-east to avoid indirect impacts to conformed microbat potential	WP50 was the fourth (of four) turbines assessed as High Risk turbine, and has been substantially relocated to avoid indirect

Project Amendment	Description	Impact avoidance
	breeding habitat.	impacts to the conformed microbat potential breeding habitat that occurs to the south-west of the turbine and hardstand location. The turbine, turbine blade and additional zone of disturbance are now all located well outside the 100 m BAM prescribed microbat breeding habitat buffer. The relocation of this turbine will benefit microbats potentially utilising the potential habitat through a reduction of potential collision risk, and potential vibration impacts during construction.
Relocation of WP4, WP11, WP32, WP36, WP64 and WP70	WP4, WP11, WP32, WP36, WP64 and WP70 were relocated within the project layout to maximise separation between the operational turbines and hollow-bearing trees (or clusters of trees) supporting potential breeding habitat for species of threatened owls, and other habitat features which increase the potential for collision risk. Further information is provided in Table 54 below.	Where possible turbines were relocated such that the rotor swept area was >100 m from retained (confirmed) hollow-bearing trees, to minimise the potential for disturbance to nesting birds, should the habitat be utilised for such purposes in the future. A separation distance of 100 m is based on the BAM requirement for species polygons for threatened owls to extend 100 m (radius) from potential/confirmed nest trees. Other turbines were located to maximise the separation distance for tree canopies and other habitat features to ensure they present no more than a 'low risk' of collision.

7.1.1 Turbines along ridge line adjacent to Ben Halls Gap Nature Reserve

Turbines have been sited with the setbacks from the base of the turbine and maximum distance from the tip of the blade to the vegetation canopy within the Ben Halls Gap Nature Reserve (BHGNR) shown in Table 53. Turbines have been sited with consideration for the existing terrain and suitability to install turbines with consideration for constructability, soil erosion, and existing vegetation. Some turbines, in particular WP40-43 are located on a narrow ridgeline. Moving these turbines further from the BHGNR would result in loss of separation between canopy and turbine blade (as the turbines' bases move lower) and more significant earthworks and resulting impact. Turbines have been located to balance the potential impacts as far as practicable. The ridgeline in this area is well oriented to prevailing north-westerly and south-easterly wind direction maximising their exposure, minimising effects of wake and producing significant clean energy. Section 8.3.4 and Section 8.10.2 have been updated to provide further commitments to monitoring of these turbines for potential indirect impacts with commitments for mitigations to be further addressed in the BBAMP.

Table 53 Review of native vegetation impacts after design refinements to minimise biodiversity impacts

Turbine Name	Base Elevation (m ASL)	Setback distance to BHGNR (m)	Distance from blade tip to BHGNR canopy top (m)
WP32	1320	315	257
WP33	1320	262	208
WP38	1340	240	189
WP39	1340	182	139
WP40	1280	136	99
WP41	**Turbine removed from layout**		
WP42	1340	127	97
WP43	1370	128	98
WP44	1380	264	210
WP 45	1380	155	118

Furthermore, and as outlined in Table 52 above, following consultation with BCS around the potential for indirect impacts including habitat sterilisation and barrier effect adjacent to BHGNR, WP41 has been removed from the project. Removal of WP41 has allowed for increased spacing of turbines adjacent to the nature reserve (WP35 – WP47) to minimise the potential for indirect impacts associated with barrier effect adjacent to the high quality habitats withing the Nature Reserve, and to proportionally reduce the potential for collision risk across the project. Removal of WP41 and relocation of WP35 – WP47 has allowed for turbines adjacent to BHGNR to achieve a minimum 400 metre spacing (WP38-WP47), and also creates a 1.2 kilometre east-west corridor between turbines WP40 and WP42.

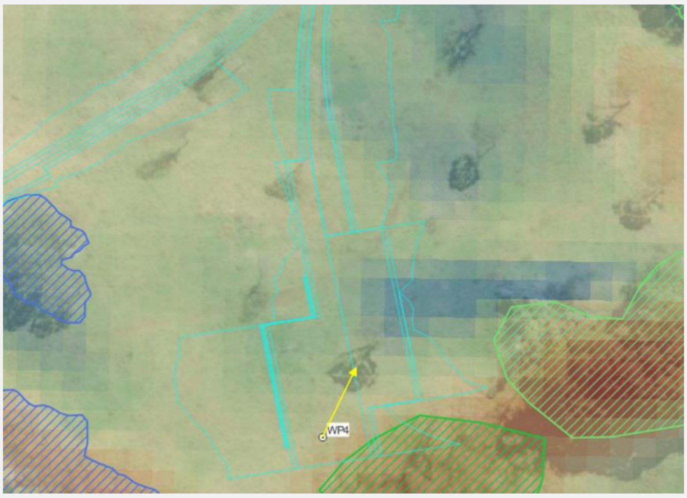
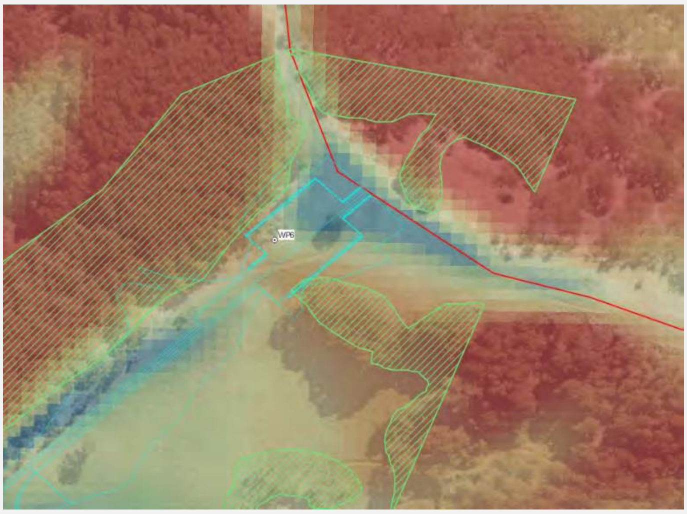
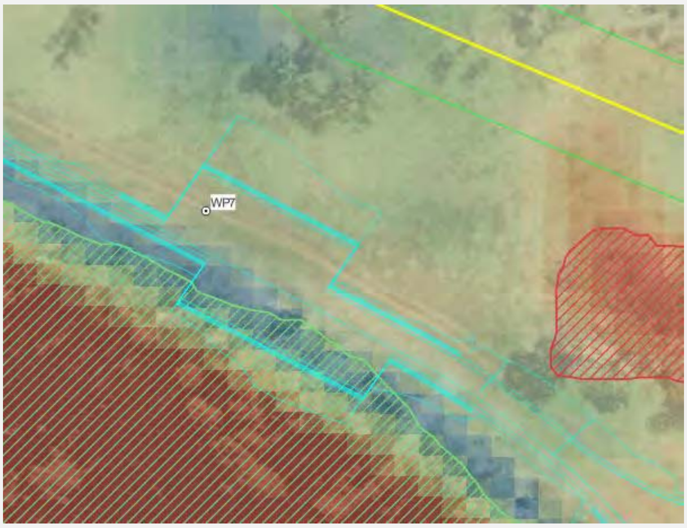
This project update is considered to substantially reduce the potential for barrier effect (barriers to species movements) adjacent to BHGNR, considered a higher risk area, and across the subject land more broadly.

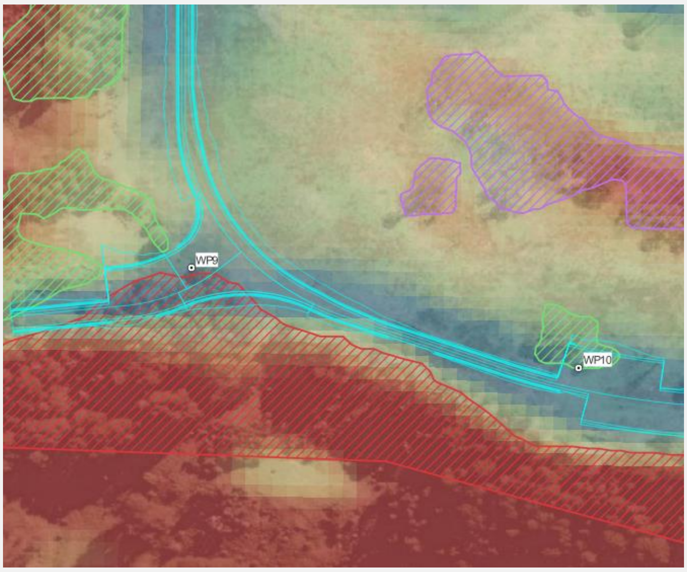
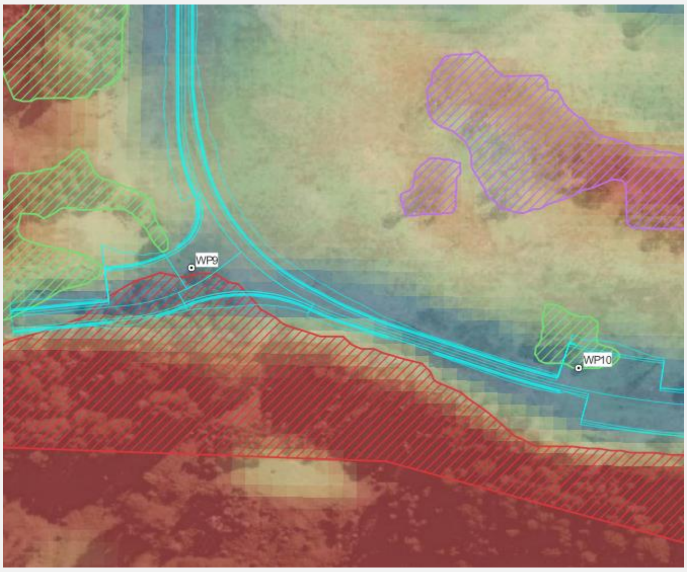
7.1.2 July 2022 impact minimisation workshop

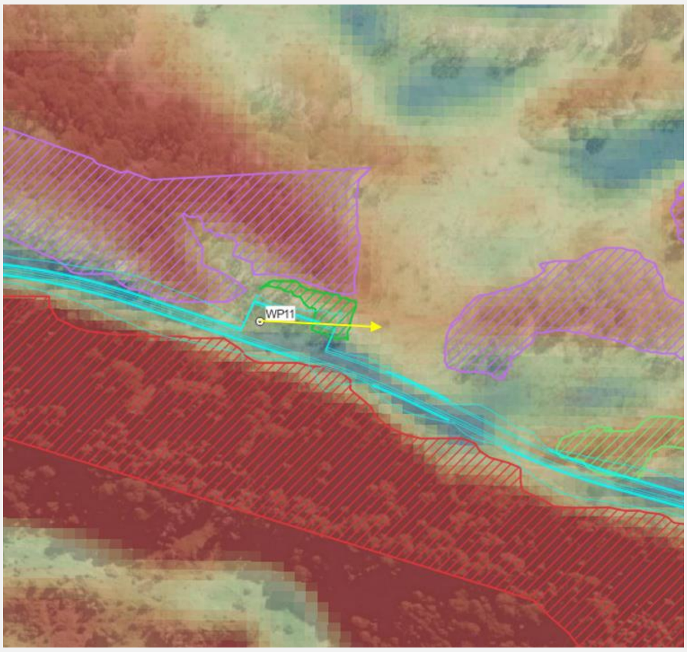
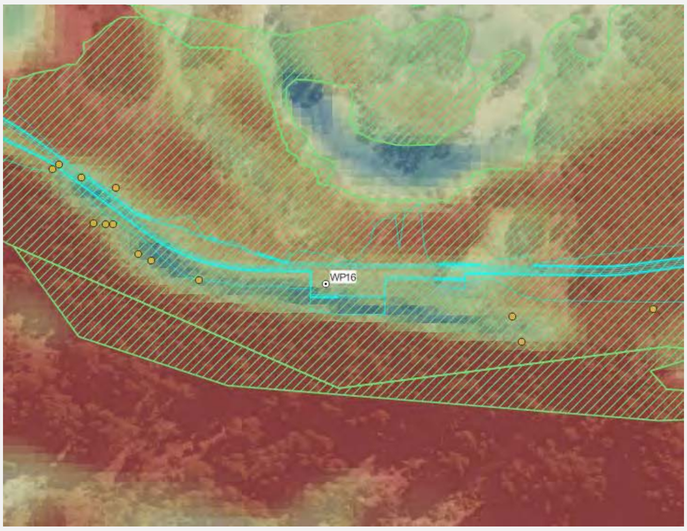
Following consultation with BCS in July 2022, following provision of additional information to address BCS' April RFI, which included the results of the targeted owl breeding habitat surveys (as described in Section 5.3 and Section 5.4), another layout design workshop was held between the Proponent and Biosis. The key focus of this workshop was to maximise the potential for avoidance of direct and indirect impacts to mapped hollow-bearing trees providing potential owl breeding habitat, maximise the potential for separation distanced between turbines' rotor swept area and tree canopies, and to maximise the potential separation distances between turbines and BHGNR. The results of this workshop included adjustments to the location of 20 turbines, and commitments to ensure that future micro-siting of turbines would result in additional minimisation of impacts during detailed design stages of the project.

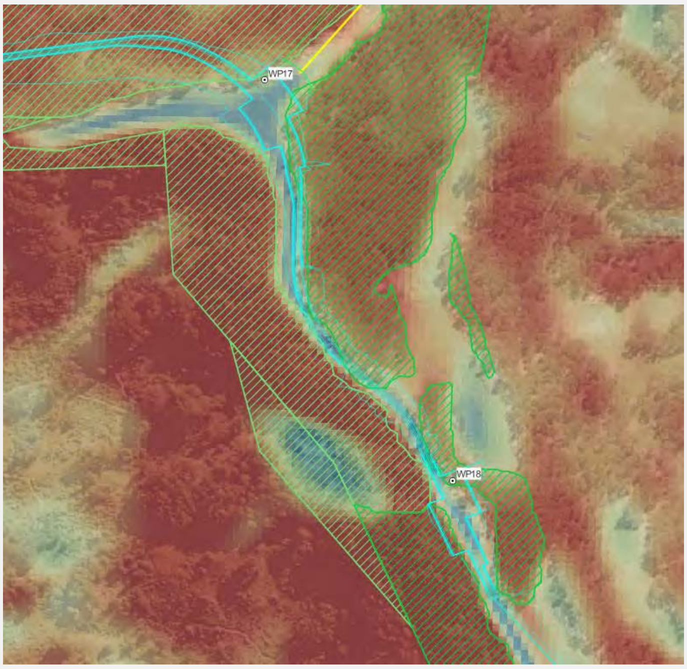
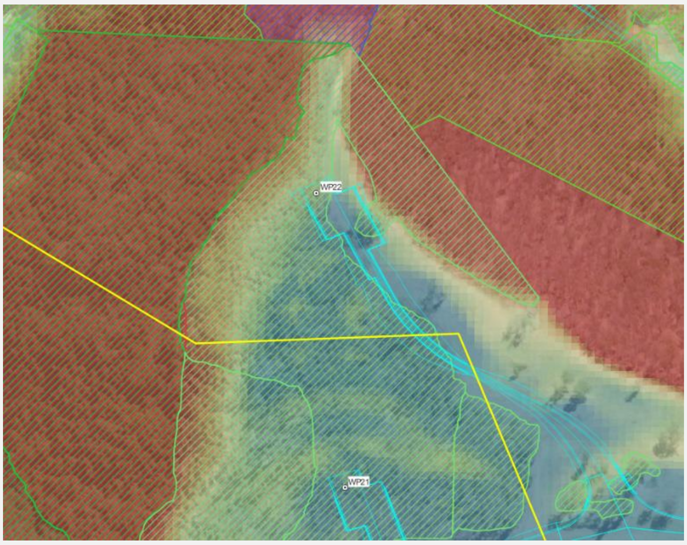
Further detailed information on the layout changes, micro-siting commitments, and justifications for turbine locations not able to be amended is provided in Table 54 below. The colour ramp in the images illustrate topography at each turbine location. Red coloured pixels denote the steepest terrain, yellow is moderately steep terrain and blue is closest to flat. Turbines not listed in the table were not relocated, and no justification of their location was deemed necessary as they are lower risk turbines.

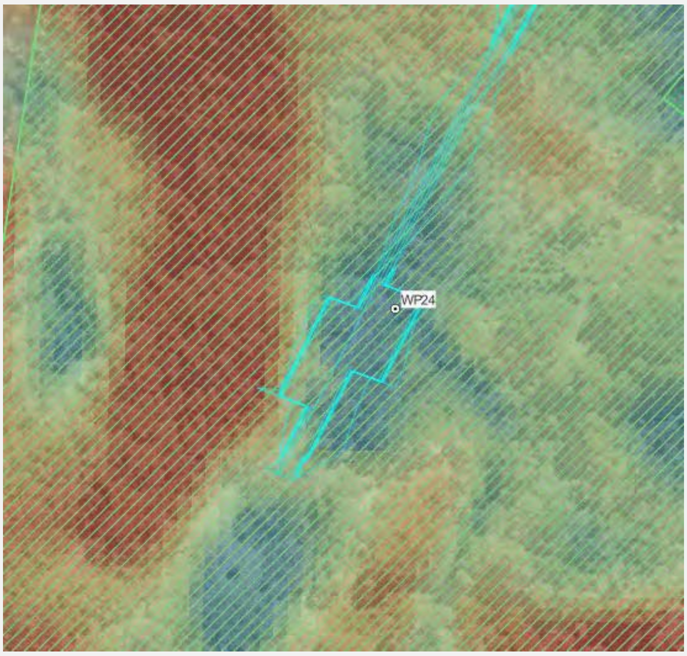
Table 54 Details of July 2022 impact minimisation workshop

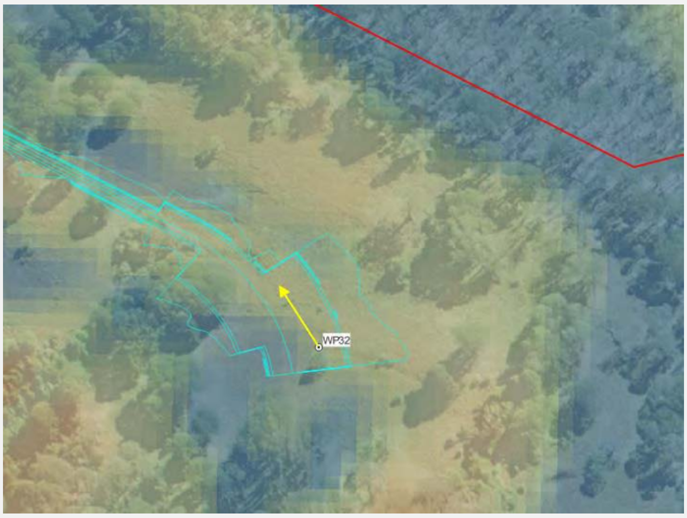
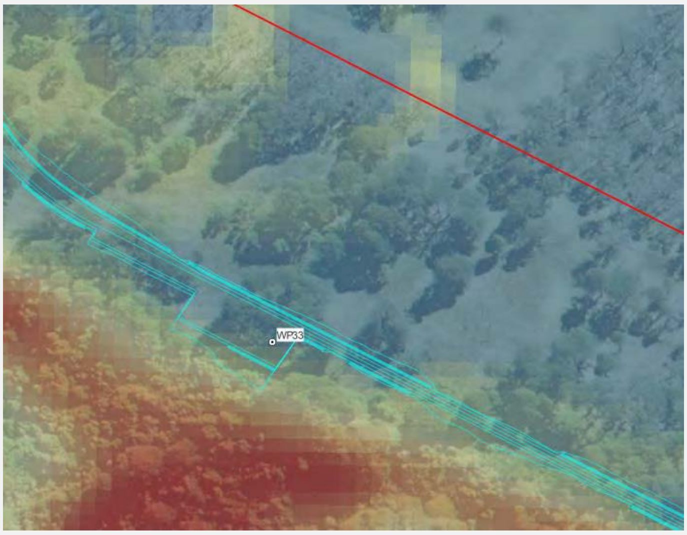
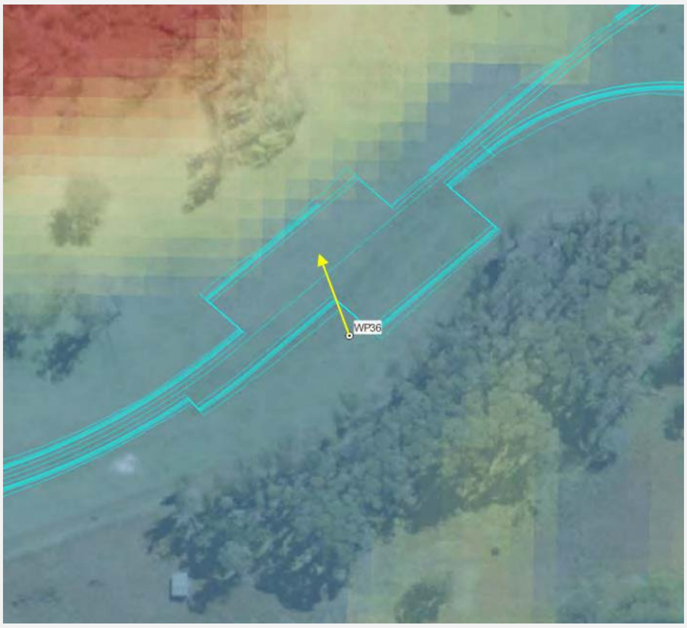
WP#	Notes	Image
4	Turbine relocated. The turbine has been shifted ~60 m NNE away from high condition vegetation to increase the distance to foraging habitat, resulting in a reduction in direct and indirect impact to foraging habitat.	
6	Turbine unable to be relocated. Boundary constraints shown in the red line create a blade tip constraint to the moving the turbine north. Topographic constraints restricting ability to move west and would create greater disturbance footprint. Good condition habitat located to east restricts movement in this direction. Located optimally for impact without further ability to change significantly. Detailed design will aim to support what further impact minimisation. This turbine produces more energy than the average proposed turbine.	
7	Turbine unable to be relocated. This turbine is constrained to movement south due to topography and increases in biodiversity impacts. Movements east and west are constrained by distances between turbines contributing to increased barrier risks. Movement north is possible in detailed design however will be constrained by the final powerline location. The proponent has committed to increasing distance to foraging habitat during detailed design reducing impact. A movement of 30 m would likely result in this turbine being downgraded to a low impact risk.	

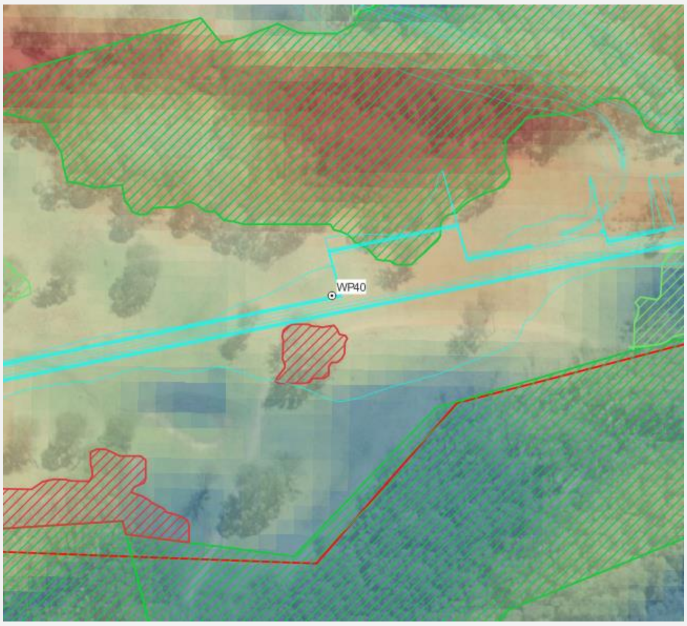
WP#	Notes	Image
9	Turbine unable to be relocated. Topographic constraints restrict ability to move south and would create greater disturbance footprint. Good condition habitat located to west and south restricts movement in this direction. Is rated Moderate impact as a result of proximity to WP10 east of WP9, movement in this direction will increase potential impact. Movement of turbine further north not feasible for the same reason. Located optimally for impact without further ability to change significantly. Detailed design will aim to support further impact minimisation.	
10	Turbine relocated 110m to the east. The proponent has committed to increasing distance to foraging habitat during detailed design reducing impact. Low impact risk and can be achieved within micro-siting allowance and with detailed design.	

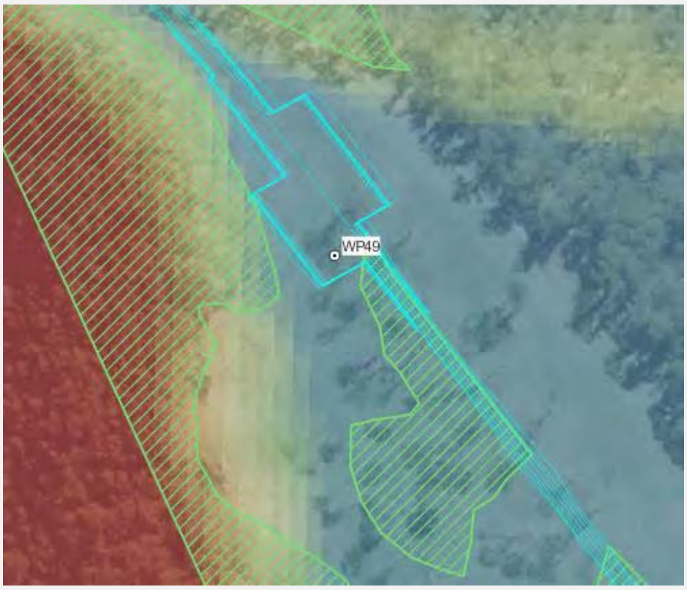
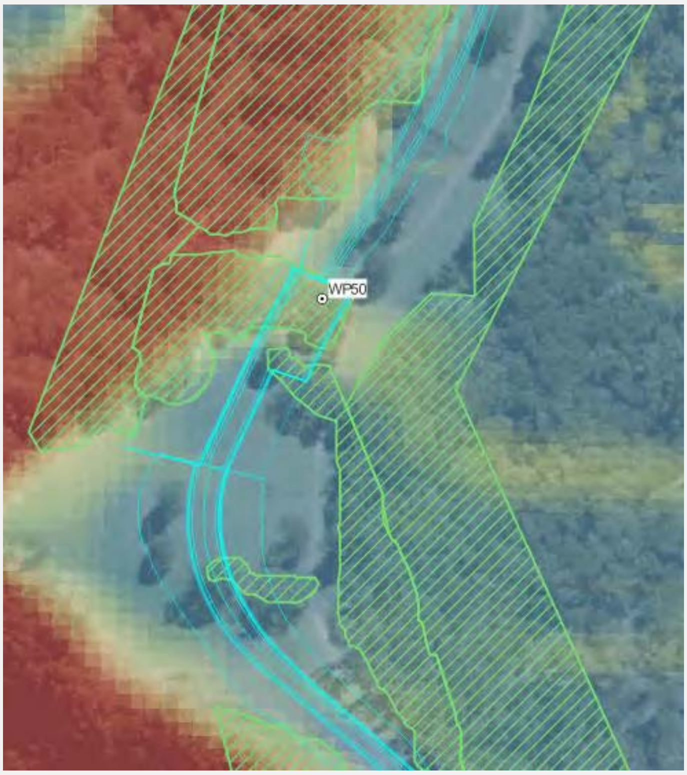
WP#	Notes	Image
11	Turbine relocated. Topographic constraints restrict ability to move south and would create greater disturbance footprint. Good condition habitat located to west and south restricts movement in this direction. Is rated Moderate impact as a result of proximity to WP10 and distance to foraging habitat to North, South and West. The proponent has avoided impact by moving the turbine east 100 m. This reduces the impact potential indirect impact to Low risk.	
16	Turbine unable to be relocated. Vegetation and topographic constraints surrounding turbine placing the turbine on flattest location with optimal footprint for minimisation of direct impact. No further avoidance possible at this location. Best location available to balance impact.	

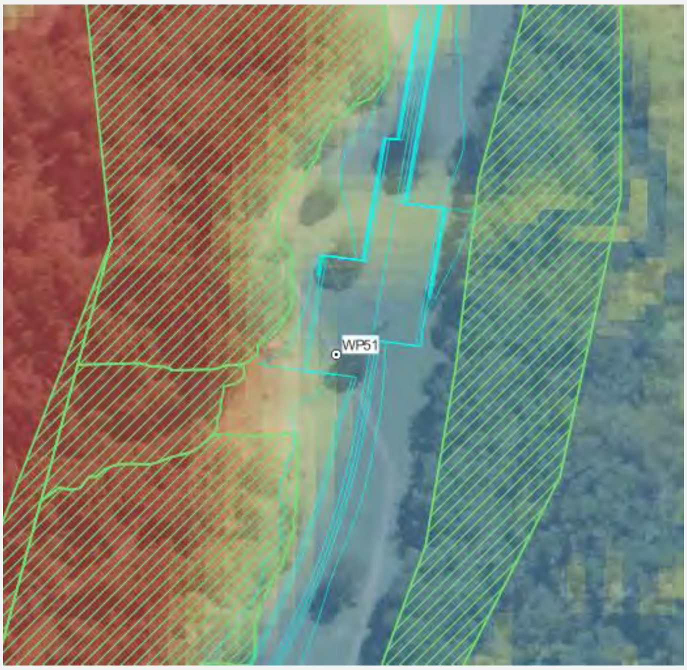
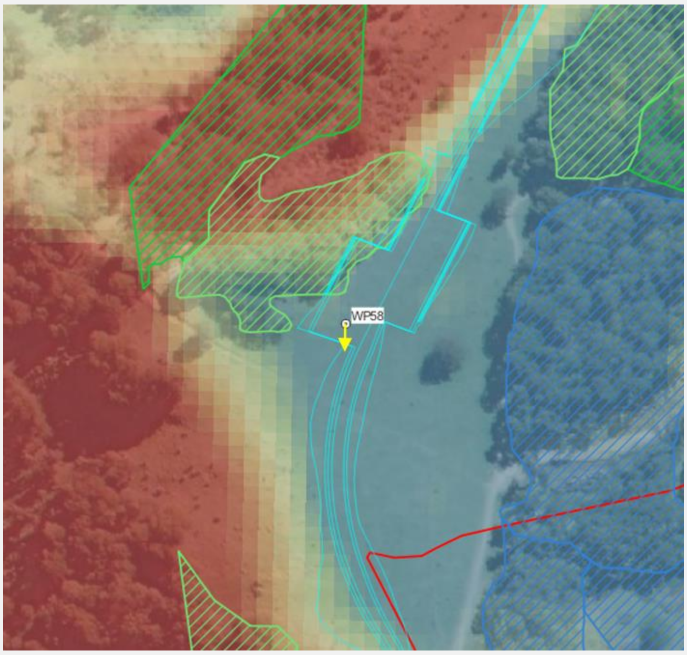
WP#	Notes	Image
18	Turbine unable to be relocated. Vegetation and topographic constraints surrounding turbine placing the turbine on flattest location with optimal footprint for minimisation of direct impact. No further avoidance possible at this location. Best location available to balance impact and turbine produces more energy than average turbine.	
22	Turbine unable to be relocated. Topographic constraints restrict ability to move north and would create greater disturbance footprint. Good condition habitat located to west and east restricts movement in this direction. Movement of turbine further south is possible marginally in detailed design but constrained due to WP 21 and the powerline route. WP 21 and WP22 are high production turbines. Detailed design will aim to support further impact minimisation.	

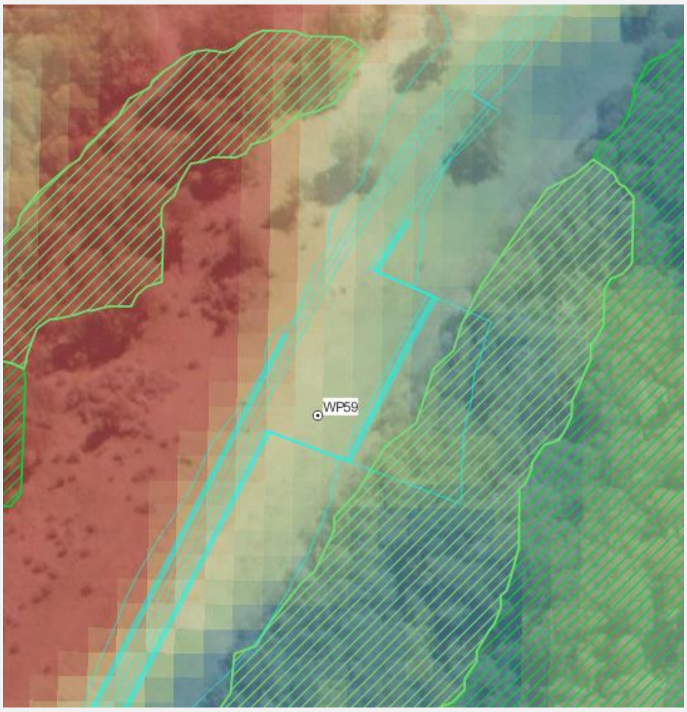
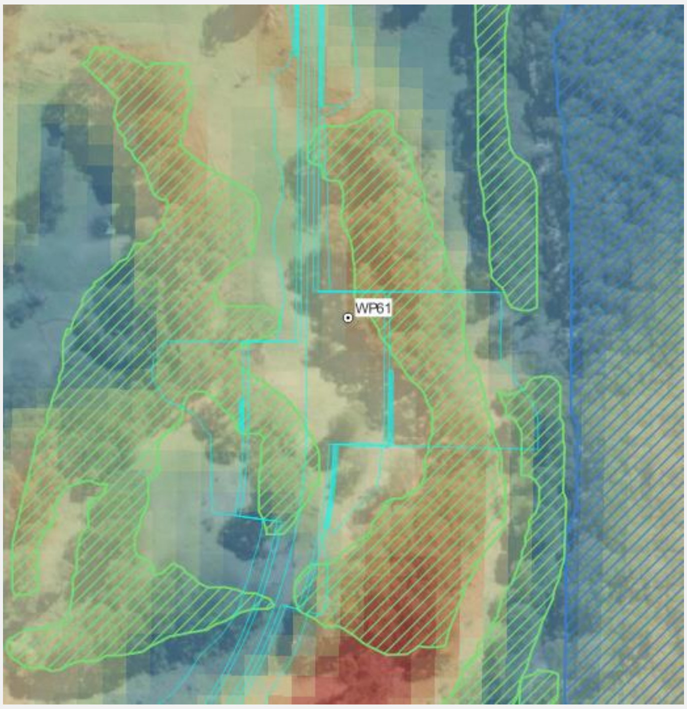
WP#	Notes	Image
24	Turbine unable to be relocated. WP 23 was previously removed to reduce direct impacts and potential for indirect and barrier impacts. Further avoidance at WP 24 is not possible due to vegetation surrounding turbine and narrow ridge restricting ability to maintain low footprint location. Proponent can commit to avoid impact by using a just in time construction methodology which would half the footprint of the hardstand area.	
28	Turbine unable to be relocated. Avoidance has been proposed with Just in Time construction method which reduced the footprint of this turbine. A reduced hardstand has been assessed. Further direct impact avoidance at WP28 is possible in detailed design by locating the road to avoid vegetation where possible.	

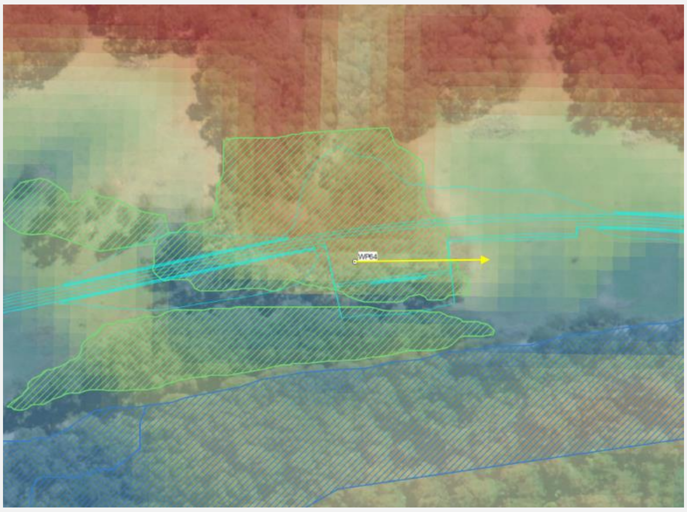
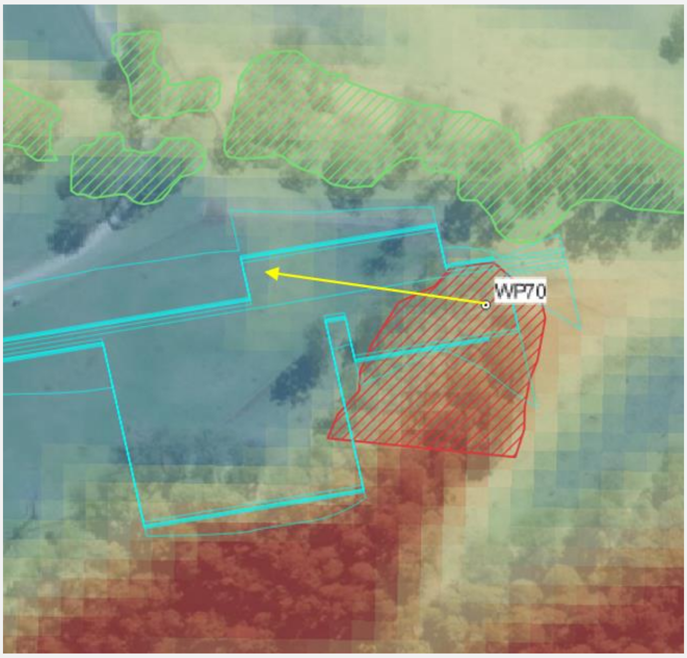
WP#	Notes	Image
32	Turbine relocated. The proponent has reduced indirect impacts to foraging habitat by moving the turbine north while maintaining 200 m setback from the BHGNR. The turbine location has been located to balance distance from BHGNR, foraging habitat and impacts to footprint as a result of local topography. The proponent can commit to Just in Time construction and further avoid direct construction impact as a result of reducing the hardstand area.	
33	Turbine unable to be relocated. Avoidance of direct impact has been achieved through setbacks from the BHGNR of greater than 200 m and use of a Just in Time hardstand. This is a significantly high producing turbine. The turbine can't further avoid due to topography and biodiversity south and the BHGNR north.	
36	Turbine relocated. The proponent has avoided impact by moving the turbine north 60 m. This reduces the indirect potential impact to Low risk. Further avoidance of indirect impact this turbine could be achieved in detailed design. This is a high energy producing turbine.	

WP#	Notes	Image
40	Turbine relocated. This turbine has been relocated to ensure 400 m separation distance to WP39 and 1.2 km separation to WP42 through the removal of WP41. As a precautionary measure and to ensure early mitigation to monitor assumptions, this turbine remains a moderate risk due to proximity to BHGNR and blade tip to BHGNR canopy of <100m	
42	Turbine unable to be relocated. This turbine has been relocated to ensure 400 m separation distance to WP43 and 1.2 km separation to WP40 through the removal of WP41. The turbine doesn't meet the criteria for a moderate risk of indirect impact but has been categorised moderate as a precautionary measure for which high mitigation actions have been committed. Constrained with any further movement due to topography and vegetation to north-south-west and BHGNR to east.	

WP#	Notes	Image
49	The Proponent has flexibility to micro-site within the allowance to achieve a revised Low risk rating. The Proponent has committed to do this in detailed design and resubmit as part of the BBAMP. This turbine is a high energy producing turbine.	
50	Turbine unable to be relocated. This turbine was relocated following feedback during public exhibition. The turbine was relocated to avoid bat habitat and reduce impact risk from high to moderate. Further avoidance is challenging due to proximity of vegetation, complex terrain and boundary constraints. Movements further north and south would result in increased proximity to nearby turbines and increased barrier risk impact.	

WP#	Notes	Image
51	Turbine unable to be relocated. This turbine was relocated following feedback during public exhibition. The turbine was relocated to avoid bat habitat and reduce impact risk from high to moderate. Further avoidance is challenging due to proximity of vegetation, complex terrain and boundary constraints. Movements further north and south would result in increased proximity to nearby turbines and increased barrier risk impact.	
58	The Proponent has flexibility to micro-site 20-30m south within the allowance to achieve a revised Low risk rating. The Proponent has committed to do this in detailed design and resubmit as part of the BBAMP. This turbine is a high energy producing turbine.	

WP#	Notes	Image
59	Turbine unable to be relocated. Vegetation and topographic constraints surrounding turbine placing the turbine on flattest location with optimal footprint for minimisation of direct impact. No further avoidance possible at this location. Best location available to balance impact.	
61	Turbine unable to be relocated. Vegetation and topographic constraints surrounding turbine placing the turbine on flattest location with optimal footprint for minimisation of direct impact. No further avoidance possible at this location also due to noise and visual constraints. Best location available to balance impact. This is a high energy producing turbines.	

WP#	Notes	Image
64	Turbine relocated. Topographic constraints restrict ability to move north and would create greater disturbance footprint in vegetation. Good condition habitat located around turbine to west and south restricts movement in this direction. The Proponent has avoided impact by moving the turbine east 100 m. This reduces the impact potential indirect impact risk to Low.	
70	Turbine relocated. Topographic constraints restrict ability to move south and east and would create greater disturbance footprint in vegetation. Good condition habitat located around turbine to east restricts movement in this direction. The proponent has avoided impact by moving the turbine west 90 m. This reduces the impact potential indirect impact risk to Low.	

7.2 Microbat and bird habitat

7.2.1 Minimisation of direct impacts

The results of the field investigations identified substantial species diversity in threatened and non-threatened microbats using the site, including both cave and hollow-dependent species. Some of these bats are assessed as ecosystem credit species, and their impacts are quantified as part of the impacts to native vegetation. These include Little Pied Bat *Chalinolobus picatus*, Eastern False Pipistrelle *Falsistrellus tasmaniensis* and Eastern Coastal Free-tailed Bat *Micronomus norfolkensis*. The presence of these bats is predicted based on vegetation type and geographic location. The field surveys also confirmed the presence of several species credit bats, where presence cannot be reliably predicted by PCT mapping, including Large-eared Pied Bat, Little Bent-wing Bat, Large Bent-wing Bat and Eastern Cave Bat.

Due to the high level of activity recorded for threatened cave-dwelling bats within, and surrounding the development footprint, additional mapping and assessment was completed to maximise the buffer distances from areas of potential breeding habitat. Using the LDAR data, areas of potential roost habitat was mapped using the method described in Section 5.4.2 of this BDAR. These areas were then subject to ground-truthing to confirm the presence of rocky outcrops where cave-dwelling bats may roost (Figure 15). However, the success of these ground-truthing surveys in February 2020 were significantly hampered by rain and foggy weather making access to these areas, representing the steepest parts of the site, unsafe. As such the potential microbat roost habitat polygons were required to remain highly conservative in nature, with little refinement from ground surveys possible (refer Section 5.4.2). These highly conservative potential bat roost areas were then used to further refine the wind farm layout, allowing for avoidance of direct impacts to all areas of potential habitat, to be considered as part of the design process.

The wind farm layout was initially amended to avoid any direct impacts to areas of roost habitat for cave-dwelling bats and no project related infrastructure is proposed within these important areas. To further avoid impacts, a 100 metre buffer was applied around all identified areas of roosting habitat on steep cliffs, and as much as possible, the placement of turbines was designed to avoid this buffer.

Follow-up desktop assessment and ground-truthing surveys (as described in Section 5.4.2) were able to be completed in March 2021 to further refine the original microbat roost polygons. Direct impacts from all but one of the 70 turbines were found to be outside the 100 metre buffer on high potential microbat roost habitats. Following on from ground-truthing assessments of microbat habitat qualitative risk assessments were completed for potential turbine impacts to microbats and birds, and a risk assessment was also completed on a turbine by turbine basis. As outlined in Sections 8.3.1, 8.3.2 and 8.3.3 a number of microbat and bird species were assessed as being at a moderate risk of impact at both the local site scale and the local population scale, and four turbines were assessed as presenting a high risk of impact to aerial biodiversity values.

Following consultation between Biosis ecologists and project designers and engineers three of the four turbines assessed as 'High Risk' have subsequently been removed from the project layout, and the fourth turbine has been relocated over 100 meters further from the area of confirmed potential microbat habitat (Table 52). This removal and relocation of turbines has resulted in no turbines occurring within 300 metres of confirmed potential microbat habitat, with rotor-swept area and additional zones of disturbance (refer Section 8.5) occurring within >170 metres from the edge of the habitat. This has resulted in potential serious and irreversible impacts to cave roosting bats being avoided be the project. Additionally, one of the high risk turbines was previously located within the 100 metre of high potential owl breeding habitat in a gully modelled as suitable breeding habitat for all four large forest owl species. The removal of this turbine ensured a reduction of impacts to owl habitat.

Detailed assessment of the impacts associated with the location of turbines and confirmed microbat roost habitat are contained in the following sections of this BDAR, and mitigation measures have been developed, to be implemented through a Bird and Bat Adaptive Management Plan to ensure impacts are further minimised through the construction and operational phase of the project.

7.2.2 Minimisation of indirect impacts

The location and siting of turbines also considered including suitable buffers to areas of potential foraging habitat by microbats. The assessment has used the formula for required buffers to areas of vegetation developed in Natural England Technical Information Note TIN051 – Bats and onshore wind turbines interim guidance. This method takes into consideration the hub height and blade length of adjacent turbines and identifies the required horizontal distance a turbine should be placed to maintain a suitable buffer (Figure 22).

$$b = \sqrt{(50 + bl)^2 - (hh - fh)^2}$$

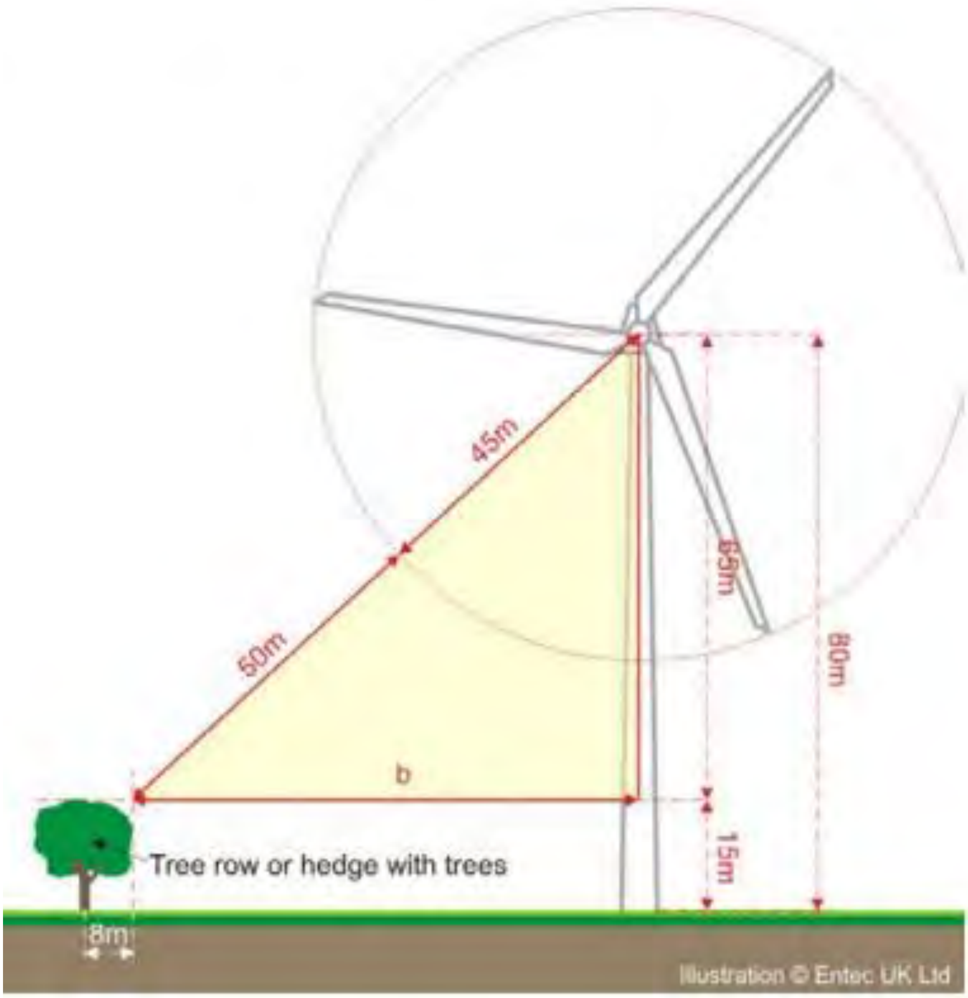


Figure 22 Extract from Technical Information Note TIN051 Bats and onshore wind turbines, showing how buffer distance is determined from top of canopy to blade tip

As field surveys identified a high diversity and relative abundance of threatened microbats across the subject land, further analysis was carried out on each of the turbines to assess the quantum of potential incursion into the required buffer and to determine the buffers for the Project.

In applying the buffer formula from TIN051, the following site specific parameters were input for the required variables to use for the formula to obtain the buffer:

- Turbine name is a unique identifier for each turbine and the spatial location of each turbine was mapped using GIS so it's position relative to the nearest foraging habitat feature was able to be measured.
- Distance to foraging habitat was determined using the measure tool in GIS to measure the distance from the wind turbine to the nearest patch of native vegetation, ground-truthed as part of the PCT mapping for the development footprint.
- Feature height is an estimate of the canopy height of the nearest patch of PCT assessed to be potential microbat foraging habitat. This tree height was taken to be a median height of the vegetation community type as defined by Walker and Hopkins, 1990.

It is noted that during the updates to the layout, some inaccurate metrics in relation to the distance from the turbine location to foraging habitat for some turbines had been used, stemming from calculations provided originally by Arup (the original BAM Assessor for the project). In some instances, distance from the turbine location to foraging habitat had been calculated to habitat present within the development footprint, instead of habitat that would be remaining following construction of the wind farm. Conversely, updates to vegetation mapping and footprint changes have led to some turbines locations being located closer to foraging habitat. Table 55 has been updated accordingly to reflect the layout changes, recalculated, with more accurate distance to foraging habitat that will remain following commissioning of turbines, as well as the updated hub height (150m) and reduced blade length (82m).

Regarding the buffer assessment using the formula in TIN051, the project wind turbine layout achieves a minimum of 48 metres clearance from top of canopy to blade tip, increased from 38 metres under the previous assessment and turbine design. The assessment shows that:

- 27% of turbines provide a buffer of 40-50 m.
- 42% of WTGs provide a buffer of 50-60 m.
- 31% of WTGs provide a buffer of > 60 m.

Accordingly, the Project provides an average buffer of 59.47 metres from the tip of blades and the closest area of tree canopy. Further detail is provided in Table 55 below.

Table 55 Updated assessment of buffer from blade tip to top of canopy using TIN051

Turbine Name	Distance to foraging habitat (m)	PCTs and condition in 100m buffer	Feature height (m)	Buffer distance (m)
WP1	22.11	1194- high	23.5	46.42
WP2	55.27	1194- high	23.5	56.05
WP3	62	1194- high; 934- mod	23.5	58.88
WP4	54	507-mod	23.5	55.54
WP5	43.07	1194-mod	23.5	51.63
WP6	35.02	1194-high	23.5	49.26
WP7	34.53	1194-high	23.5	49.13
WP8	38.13	931-mod; 934-low	23.5	50.12
WP9	34.22	931-mod; 1194-low	23.5	49.05
WP10	71.12	931; 1194; 934-mod	23.5	63.12
WP11	49.11	931-mod; 934-high	23.5	53.70
WP12	37.92	934-mod; 1194-high; 954-high	23.5	50.06
WP13	54.16	954-high	23.5	55.61
WP14	59.23	931-mod; 1194-DNG; 954-high	23.5	57.68
WP15	43.27	1194-DNG&Mod; 954-High	23.5	51.70
WP16	34.7	1194-mod	23.5	49.17
WP17	33.47	1194-mod; 934-high	13.5	58.54
WP18	34.84	1194-mod; 934-mod&high	23.5	49.21
WP19	30.8	934-high	13.5	57.93
WP20	38.02	1194-high; 934-low	23.5	50.09

Turbine Name	Distance to foraging habitat (m)	PCTs and condition in 100m buffer	Feature height (m)	Buffer distance (m)
WP21	34.89	1194-high	23.5	49.22
WP22	34.9	1194; 934-high	23.5	49.23
WP23	23	1194-mod	23.5	46.57
WP24	33.49	1194-mod	23.5	48.86
WP25	93.27	934-low	23.5	75.17
WP26	144.1	NA	23.5	109.75
WP27	22.47	1194-high	23.5	46.48
WP28	34.46	1194-high	23.5	49.11
WP29	43.46	931-mod; 934-DNG&mod	18.5	56.50
WP30	50.89	931-mod; 934-DNG&mod	28.5	54.35
WP31	21.15	931; 1194-high	23.5	46.26
WP32	88	931-high; 1194-DNG&mod	18.5	72.10
WP33	32.74	931-high; 1194-mod	23.5	48.67
WP34	35.18	1194-mod&high	18.5	54.12
WP35	135.02	NA	23.5	103.02
WP36	44	1194-low&mod	23.5	51.93
WP37	38.27	1194-low&high	18.5	54.96
WP38	77.98	1194-high	23.5	66.60
WP39	70.9	1194-mod&high	23.5	63.01
WP40	43.11	931-low; 934-high	18.5	56.39
WP41	39.16	934-high	13.5	60.01
WP42	59.27	1194-low&high	13.5	66.81

Turbine Name	Distance to foraging habitat (m)	PCTs and condition in 100m buffer	Feature height (m)	Buffer distance (m)
WP43	39.1	1194-mod	18.5	50.40
WP44	169.12	NA	23.5	129.20
WP45	41	NA	23.5	55.74
WP46	140.31	1194-mod&high	23.5	106.92
WP47	100.02	1194-low&high	23.5	79.26
WP48	41.29	1194-low&high	23.5	51.07
WP49	34.98	1194-low&high	23.5	49.25
WP50	35.37	1194-low, mod&high	23.5	49.35
WP51	34.6	1194-low&mod	23.5	49.15
WP52	68.19	1194-low	23.5	61.71
WP53	38.23	1194-low&high	18.5	54.94
WP54	36.15	1194-low, mod&high	23.5	49.56
WP55	161.17	NA	23.5	122.89
WP56	93.9	1194-mod	23.5	75.54
WP57	39.46	1194-mod	23.5	50.51
WP58	33.26	1194-mod	23.5	48.80
WP59	35.13	1194-low&high;934-high	23.5	49.29
WP60	50.22	1194-low&mod;934-high	23.5	54.10
WP61	35.01	1194-mod&high; 927-high	23.5	49.26
WP62	55.81	1194-low&mod	23.5	56.26
WP63	38.5	1194-mod	23.5	50.23
WP64	78	1194-high; 927-high	23.5	66.61

Turbine Name	Distance to foraging habitat (m)	PCTs and condition in 100m buffer	Feature height (m)	Buffer distance (m)
WP65	38.24	1194-high	23.5	50.15
WP66	44.98	931-high;1194-mod	23.5	52.26
WP67	113.66	1194-low	23.5	88.06
WP68	51.78	1194-low&mod	23.5	54.69
WP69	54.66	1194-low	23.5	55.80
WP70	64	1194-low; 931-high	23.5	59.77

7.2.3 Minimisation of operational impacts to bird and bat species

It is acknowledged that despite all efforts made to avoid and minimise impacts to bird and bat species the risk of impact via collision with operational turbines remains. This impact risk applies to all protected species of birds and bats with the potential for impacts to species and populations greatest for those species considered threatened under the Commonwealth EPBC Act and/or the NSW BC Act. Those species considered at highest risk of substantial or significant impact include the four species of microbats considered entities potentially susceptible to a serious and irreversible impact (SAII), in accordance with the BAM and BC Act.

Background

Four species of microbats noted in BioNet as entities potentially susceptible to a SAII were recorded within the subject land during targeted microbat survey work undertaken between November 2019 and April 2020. The four species include; Eastern Cave Bat, Large Bent-wing Bat, Large-eared Pied Bat and Little Bent-winged Bat.

Each of these species are listed in BioNet as potentially susceptible to a SAII based on impact to breeding habitat and/or adjacent areas for forage habitat. As such, substantial efforts to avoid impacts to two areas of potential roosting and possible breeding habitat (and the areas within the BAM prescribed 100 metres buffers) were undertaken during the initial Response to Submissions stage of the project. These efforts included the removal / relocation of two turbines such that potential direct impacts associated with the projects are now well outside the BAM prescribed SAII threshold buffer areas. Following this redesign work it was acknowledged by BCS that the potential for a SAII resulting from the projects construction and long term footprint impacts to breeding habitat (as per the standard SAII threshold triggers) had been sufficiently addressed.

Further to potential impacts to breeding habitats, the species have the potential to be impacted as a result of collision with operating turbine blades, and an assessment of this risk and the possible consequences has been undertaken for each species as part of the BDAR. The risk assessment concluded that three of the four species were at a moderate risk of impact as a result of collision with operating turbine blades, but that the quantum of impacts was uncertain. The risk assessment found that there was a low risk of impact from turbine strike to Eastern Cave Bat as the species was not recorded in rotor swept height, was infrequently recorded within the subject land at lower levels of activity than many other species, and the species' fast / agile / manoeuvrable below-canopy flight characteristics.

The April 2022 BCS RFI states: *The upper quantum of blade strike for all microbat species utilizing the projects airspace is uncertain. However, based on the data presented in the BDAR, BCS considers that under a worse-case scenario this impact would contribute to the risk of these populations becoming extinct. As such, the currently proposed operational impacts of the project should be considered by the consent authority to represent a potential SAII impact to the Large-eared Pied Bat, Large Bent-winged Bat and Little Bent-winged Bat.* (BCS 2022)

The updated SAII assessments (Appendix E) focus on the potential for operational impacts, largely relating to potential collision with turbine blades, to result in an impact of sufficient magnitude to be considered a SAII to the local populations of Large Bent-wing Bat, Large-eared Pied Bat and Little Bent-winged Bat.

A key focus of the information presented below is an overview of the efforts undertaken to date to avoid a potential SAII occurring, and additional commitments made by the Proponent to minimise the risk of such an event occurring during the operational phase of the project. Commitments to a proactive low wind speed curtailment strategy are presented, with reference to existing literature as well as further analysis of, and comparison to, project and site specific microbat activity data.

Avoidance and minimisation of operation impacts to SAII microbat species

The Project is considered to have the potential to result in a SAII to Large Bent-winged Bat, Large-eared Pied Bat and/or Little Bent-winged Bat (collectively referred to herein at the 'SAII bats') from the potential operational impacts of turbine strike. As outlined in the April 2022 RFI, a SAII could be considered to have occurred if the project was to result in a significant and/or substantial impact to the local populations of the SAII bat species such that the local population was placed at risk of extinction in the short or longer term.

The Proponent has undertaken impact minimisation activities during the design stages of the project and is committed to a two-staged approach to ensure the risk of a SAII occurring is minimised, which includes a recently introduced precautionary and proactive low wind speed turbine curtailment strategy, combined with a stringent adaptive management strategy. The final details of each strategy will be developed as part of the BBAMP, however the concepts are framework are presented in Section 8.10.2 below to provide the consent authority with the required assurance that an inadvertent SAII would be unlikely to occur, and that sufficient measures are in place to arrest potential unacceptable impacts if they were to occur.

As outlined in Section 5.4.2 and Section 8.3.1 of this BDAR, a range of microbat species have been recorded within the subject land at an elevation that would be considered within the rotor swept area of operational turbines. This data is based on microbat surveys undertaken between February and April 2020 from a total of 25 separate detector units over a total of 257 'trap nights', with nearly 25,000 calls identified containing over 32,000 passes. Of these 25 detectors, six were mounted on meteorological masts at 30 metres elevation (three units) representing approximate canopy height, and at 60 metres elevation (three units) within rotor swept height.

Detailed results of this survey are presented in Section 5.4.2 of this BDAR, with the following points provided as relevant context for how the project has committed to continue to reduce the potential for impacts to microbats, and particularly those subject to the SAII assessments.

It should be noted that since the time that the below data analysis was completed progress towards selection of a final turbine model has been undertaken. This has resulted in the worst case scenario for rotor swept height and area (and thus blade strike impacts) being improved with an increased hub height (from 135 metres to 150 metres) and reduced blade length (85 metres to 82 metres). This has had the effect of both reducing the total areas of potential blade strike for each turbine, and increasing the height of the area of potential strike, both of which will result in a reduced level of impact to microbats.

Three of the four SAII bats recorded during field investigation were done so within approximate rotor swept height (based on detectors at approximately 60 metres elevation), those being Large Bent-winged Bat, Large-eared Pied Bat and Little Bent-winged Bat, and were subsequently assessed as being at moderate risk of impact from collision impacts. It should be noted that this does not mean that Eastern Cave Bat does not, or will not, fly within rotor swept height and therefore would not be subject to turbine strike impacts. However, it does indicate that the species may be less at-risk to turbine strike impacts, which is reflected in the risk assessment completed in Table 67 of this BDAR, and the species' fast / agile / manoeuvrable below-canopy flight characteristics (refer Table 46 above).

As outlined in Section 5.4.2 above, there is a general trend of reduced activity levels with increased elevation, with mean calls per night across all species reducing from 130.3 calls for ground level detector units, to 107.5 calls for canopy level (30 metre) units and 56.0 calls per night recorded on rotor swept height (60 metre) units. Furthermore it should be noted that the non-threatened White-striped Freetail Bat accounts for a substantial portion of all calls detected, and when the species is removed from the analysis the mean number of calls per night reduces by around 50 % for ground and canopy height detectors, and by 70 % for calls at rotor swept height.

Mean activity for the SAII bats was also seen to generally decrease with elevation, with the exception of Little Bent-winged Bat which was recorded at similar activity levels from ground level detectors (16 units) and above canopy height decors (3 units). Table 56 outlines the mean activity levels of each species across the three different elevations surveyed.

Table 56 Mean activity levels by elevation for the four SAII bats recorded within the subject land

Species	Mean calls per night ground level	Mean calls per night canopy height (30m)	Mean calls per night rotor swept height (60m)
Eastern Cave Bat	0.82	0.17	0.00
Large Bent-winged Bat	10.64	6.88	1.09
Large-eared Pied Bat	0.75	0.83	0.08
Little Bent-winged Bat	1.54	0.25	1.53

This data illustrates that Large Bent-winged Bat, Little Bent-winged Bat and to a lesser extent Large-eared Pied Bat, have the potential to interact with operational turbines blades and may be subject to blade strike impacts. As outlined above, Eastern Cave Bat is not considered to be insusceptible to blade strike impacts, however the species has been assessed as at a low risk of overall impact, and therefore the potential for a SAII is also considered low.

Further information and analysis is provided in Appendix E with regards to the potential significance of turbine strike impacts for Large Bent-winged Bat, Large-eared Pied Bat and Little Bent-winged Bat's local populations, and each species overall.

As outlined above in Section 7, substantial efforts have been made to avoid and minimise impacts to the SAII bats during the design phase of the project both prior to, and post EIS exhibition. The most substantial aspects of impact minimisation undertaken to date relate to the removal and relocation of turbines from across the development footprint. A total of six turbines have been removed from the proposed project layout since exhibition of the EIS, which equates to a 9 % reduction in turbines that could present collision risk to the SAII bat species. Of those six turbines removed, one was noted as being of high risk to SAII bats due to its location near an area of potential roost habitat, two more were assessed as high risk of biodiversity impacts generally, and the remaining three presented moderate (two turbines) or low risk (one turbine) of biodiversity impacts, including to the SAII bat species. Re-design of turbine locations has also resulting in substantial impact minimisation to the SAII bats, primarily through the relocation of turbine WP50 over 130 metres north-east, to a location over 300 metres from another area of potential cave roosting habitat. Relocation of another 11 turbines including nine adjacent to Ben Halls Gap Nature Reserve have improved separation distances markedly for the project, with an aim of a minimum gap of 400 metres (rotor hub to rotor hub) between turbines, allowing for increased open air space and reduced opportunities for interactions with operational turbine blades.

Furthermore, and as outlined above, recent refinement of turbine model selection has further reduced the potential for operational impact by ensuring rotor swept area will be higher, and smaller, than the previously assessed worst case scenario.

Whilst the above measures help to avoid the overall potential for turbine strike impacts for the SAII bat species, further operational measures are required to ensure impacts are minimised to the fullest extent possible. As outlined above, the Proponent is committed to implementation of a two-staged approach to ensure the risk of a SAII occurring is minimised. This includes a proactive low wind-speed turbine curtailment strategy, combined with stringent responsive management strategy.

A number of recent studies have been undertaken to examine the effect of programming wind turbines to alter their night-time operation so that their rotors do not turn during periods of specified low wind speed and when many species of bats are most active (Arnett et al. 2009; Arnett 2017; Adams et al. 2021; Bennet et al. 2022). This is practice is termed 'low wind-speed turbine curtailment'.

Curtailment of turbine operations during low wind speeds is recognised as an effective tool for reducing bat deaths at wind energy facilities (Rodrigues et al. 2015, Smallwood and Bell 2020, Adams et al. 2021, Bennet 2022). Bat activity is known to be highest during low wind speeds and progressively tapers off as wind speeds increase. In contrast, power generation increases as wind speed increases meaning there is a window of wind speeds during which collisions occur and power generation is not optimal (Bennet 2022).

There may be two phases to low wind-speed turbine curtailment. They are summarised as follows:

- **Phase 1**. The blades of some turbine models turn, at wind speeds between zero and the turbine's rated cut-in speed (generally around 3m/s). In that situation a turbine 'freewheels' and has potential to kill bats even when no electricity is being generated. In this situation, the rotor blades can be feathered to prevent the rotor from turning until the rated cut-in wind speed is reached. This curtailment involves no loss of electricity generation.
- **Phase 2**. In this phase the turbine rotors are prevented from turning until a specific, pre-determined wind speed above the rated cut-in speed is reached. This curtailment involves loss of electricity generation for wind speeds between the rated cut-in speed and the pre-determined higher wind speed.

The majority of published studies of low wind-speed curtailment intended to protect bats have been undertaken in North America and Europe and the species primarily involved have been migratory, tree roosting bat species with relatively high incidences of collisions. However one recent study has been undertaken at a wind farm in south-west Victoria with a focus on Southern Bent-wing Bat *Miniopterus orianae bassanii* (Bennet et al. 2022), a species closely related to Large Bent-winged Bat and Little Bent-winged Bat subject to this assessment. The results of this are provided within this section.

As an indication of the likely mechanism by which collision risk is influenced by cut-in wind speed, even at quite low wind speeds, Arnett et al. (2013) note that independent of blade length, most of the turbines under full operating conditions, had tip speeds at or above 160 km/h. Almost all turbines undergoing normal operations (i.e. when blades were not feathered) had tip speeds in excess of 80 km/h, even when wind speeds were below the normal cut-in, which suggests that measures such as feathering blades below rated cut-in speed can be taken to reduce tip speeds and consequent hazard to bats, even without increasing turbine cut-in speeds above the manufacturers' set cut-in speed.

Arnett (2017) and Arnett et al. (2013) provide a review of information on a detailed synthesis of ten low wind speed curtailment studies, comparing bat fatality rates at non-curtailed turbines with curtailed turbines. The great majority of the studies demonstrated at least a 50% reduction in bat fatalities when turbine cut-in speed was increased from manufacturers' rated cut-in speed by at least 1.5 m/s.

One study analysed in Arnett et al. (2013) demonstrated equally beneficial reductions with a low-speed idling approach, while another discovered that feathering turbine blades at or below the manufacturer's cut-in speed resulted in up to 72% fewer bats killed when turbines produced no electricity into the power grid (Arnett 2017).

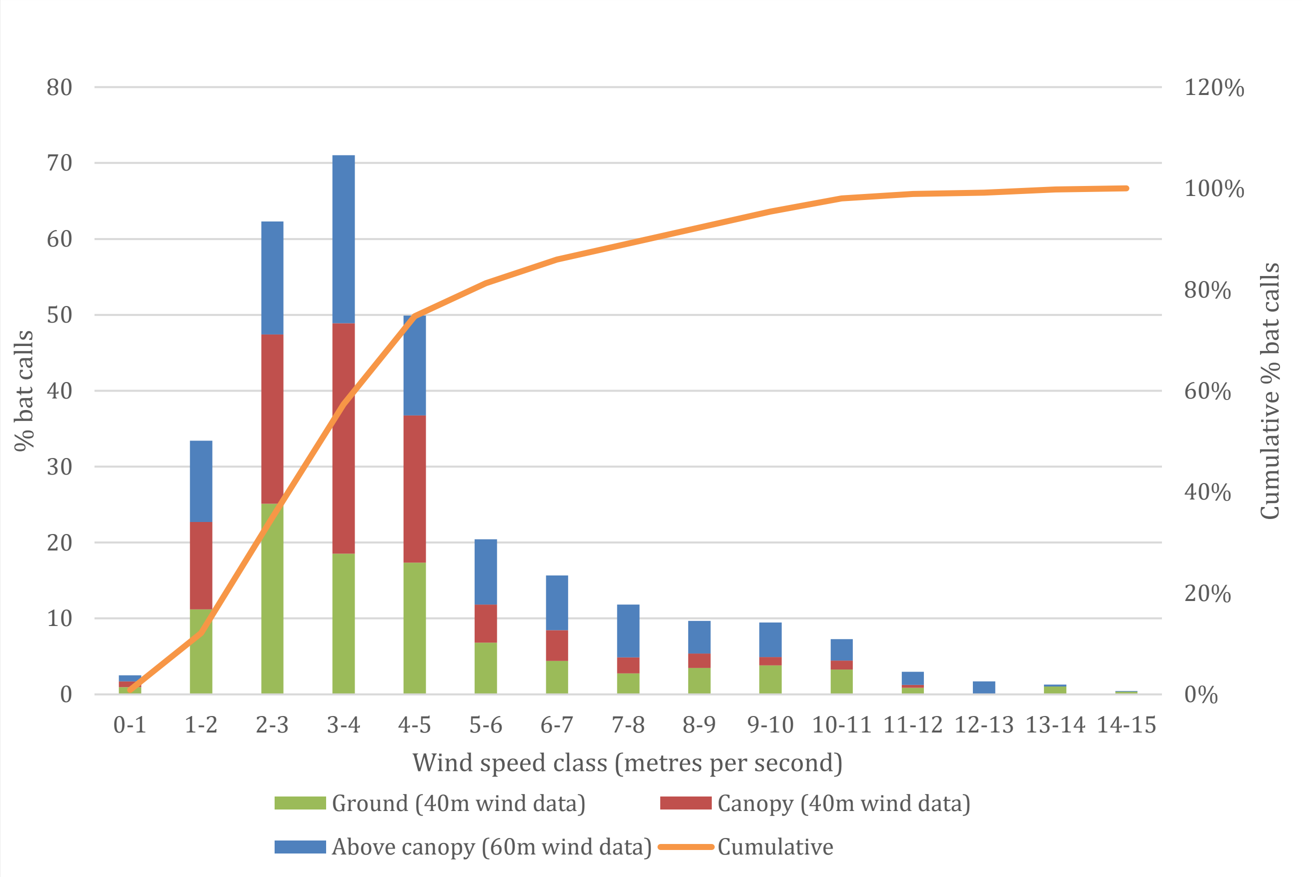
Adams et al (2021) undertook a similar meta-analysis study of low wind speed curtailments and bat fatality data across 17 wind energy projects in the U.S.A. and Canada between 2005 and 2016, over a total of 36 control-treatment pairs. In most studies analysed, the control group's cut in speed was 3.5 m/s (a common cut-in speed set by turbine manufacturers), though values ranged from 3.0 to 5.0 m/s, with experimental increased cut-in speeds varying from 4.0 to 7.0 m/s. Strong evidence was found that turbine curtailment reduces fatality rates of bats at wind farms that have implemented the technique, with estimated fatality ratio across all studies being 0.37 ($p < 0.001$), or a 63% decrease in fatalities, which was supported in the previous review by Arnett et al. (2013) (Adams et al. 2021).

Adams et al (2021) also notes that other concurrent studies examining the efficacy of operational curtailment have also found that increased curtailment speeds significantly affect bat mortality, with meta-analysis by Whitby et al (2021) resulting in an estimated bat fatality reduction between 33–79%.

In Australia, a recent curtailment study at a wind farm in southwest Victoria by Bennett et al (2022) (co-authored by Mark Venosta and Matthew Gibson of Biosis) was undertaken with the cut in speed raised from 3.0 m/s to 4.5 m/s from January to April to coincide with periods of higher activity for the threatened Southern Bent-wing Bat. The study found a 54% reduction in bat fatalities compared to the same period in the previous year. Whilst this reduction in total bat fatalities was noted as a positive result, a Southern Bent-wing Bat death was still recorded during the curtailment period suggesting that curtailment to 4.5 m/s were not adequate to prevent all Southern Bent-wing Bat collisions (Bennett et al 2022). This finding is applicable to the current assessment due to the similarities between Southern, Large (Eastern) and Little Bent-winged Bats.

Analysis has been undertaken of microbat activity data collected for the preparation of the project's BDAR and wind speed data collected by the Proponent, to determine whether the local populations of microbats fit the expected activity profile of reduced activity during period of higher wind speeds.

Graph 15 displays the percentage of total bat calls from all species recorded across the three elevation treatments; ground level, canopy level (30 metre elevation) and rotor swept height (60 metre elevation), plotted against wind speed classes recorded at 40 meters and 60 meters elevation. Wind speed was recorded at two met masts located in the eastern and western portions of the development footprint, and it should be noted that analysis of wind speed at ground level was based on data collected at 40 meters on met masts as it was the closest applicable data.



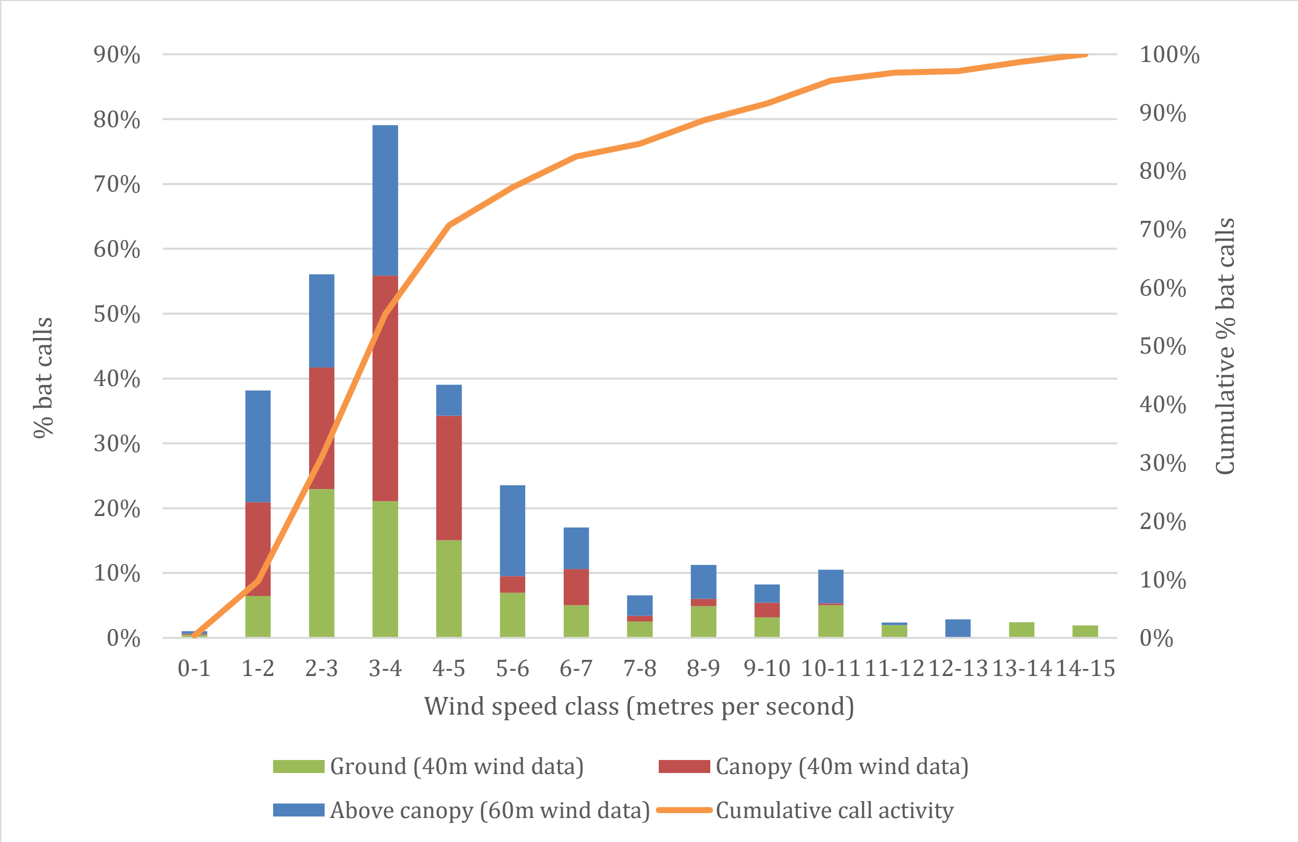
Graph 15 Cumulative microbat activity for all species recorded at ground level, canopy level and rotor swept height per wind speed class

The graph clearly shows a decrease in overall microbat activity once wind speeds reach above 5 m/s, with activity once wind speeds reach over 7 m/s, comprising 16 % of activity at ground level, 6 % of total activity at canopy height, and 22 % of activity at rotor swept height. These findings correlate to those of the studies referenced above, and illustrates that it could be expected that interactions between microbats and operational turbines blades would reduce if cut-in speeds were increased to above the rated cut-in wind speed of the turbines.

It should be noted that the somewhat higher percentage activity levels at higher wind speeds, at rotor swept height, are likely to be related to the high number of nights (40% of total nights) where the wind speed was greater than 7 m/s at that elevation. Further analysis of this data shows that 73 % of the activity recorded at rotor swept height, when wind speeds were greater than 7 m/s, belong to the non-threatened White-striped Freetail Bat.

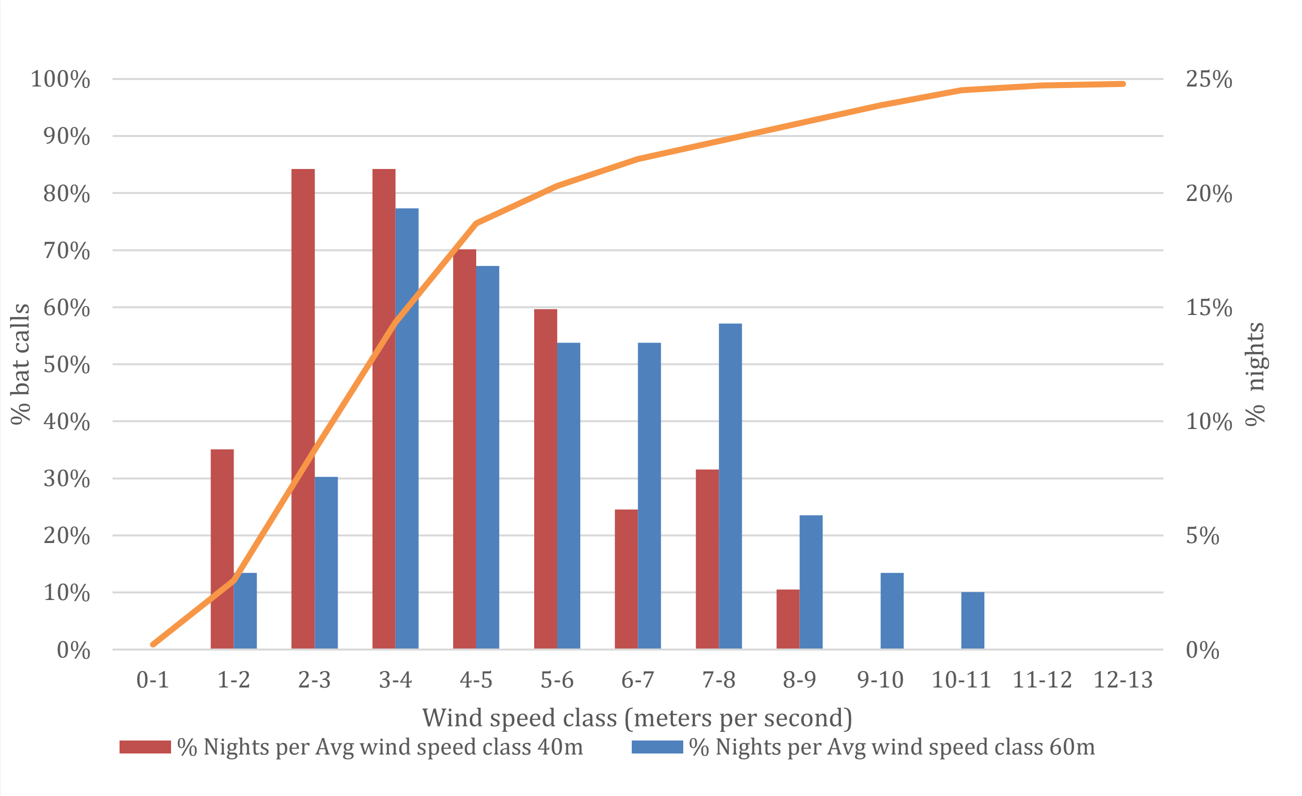
Further investigation will be undertaken into microbat activity levels at higher wind speeds as part of the development of the BBAMP and refinement of the proactive low wind-speed turbine curtailment strategy (outlined further below, and in Section 8.10.2).

Graph 16 presents the percentage of total calls from the three species of microbat potentially subject to a SAII recorded across the three elevation treatments. A similar trend of decreasing activity with increased wind speed can be seen for these species, again suggesting interactions between microbats and operational turbines blades would reduce if cut-in speeds were increased above the rated cut-in wind speed of the turbines.



Graph 16 Cumulative microbat activity for Large Bent-winged Bat, Large-eared Pied Bat and Little Bent-winged Bat recorded at ground level, canopy level and rotor swept height per wind speed class

Graph 17 illustrates the cumulative percentage total of microbat activity plotted against wind speed classes, and the percentage totals of number of nights recorded for each wind speed class (averaged across all data recorded each night). This data shows that average microbat activity starts to decrease at >4 m/s, whilst average wind speeds continue at >5m/s for 36 % of the sample period at canopy height (40 metres) and at >5m/s for 47 % of the sample period at rotor swept height (40 metres). It can also be seen that 80% of microbat activity occurs at <5 m/s. This illustrates that the decrease in microbat activity is true reflection of reduced activity at higher wind speeds, rather than a factor of having a reduced amount of data at higher wind speeds due to a paucity of nights with higher recorded wind speeds.



Graph 17 Cumulative microbat activity for all species recorded per wind speed class and percentage total nights per wind speed class (with wind speed averaged across each night)

Determining the ideal cut in speed to prevent microbat strikes requires an understanding of the effects of weather parameters, especially wind speed on flight activity (Bennet 2022). However wind speed is not the sole driver of microbat activity, and the project's operational curtailment regime will ideally specify, and be designed around the values for the key weather parameters and other factors that are known to influence microbat activity and therefore collision risk. Such factors may include any or all of the following:

- Wind speed in m/s
- Time after sunset
- Month of the year
- Temperature (°C)
- Precipitation (mm/hr) (NatureScot 2021)

Bennet (2022) provides information on "smart curtailment", a concept that provides opportunities to maximise energy production whilst minimising impacts to bats, which is stated as being able to provide up to 50% more turbine operation time than a blanket curtailment approach (Bennet 2022). The principle of smart curtailment is to understand when, and under what conditions, bats are flying and to curtail turbines during those periods of higher activity, whilst allowing normal operations when bats are less active. Plate 1 below provides a heat map demonstrating the distribution of 60,000 bat calls collected over six years at two commercial wind projects in the U.S.A. in relation to wind speed and temperature (Stantec 2022, Bennet 2022).

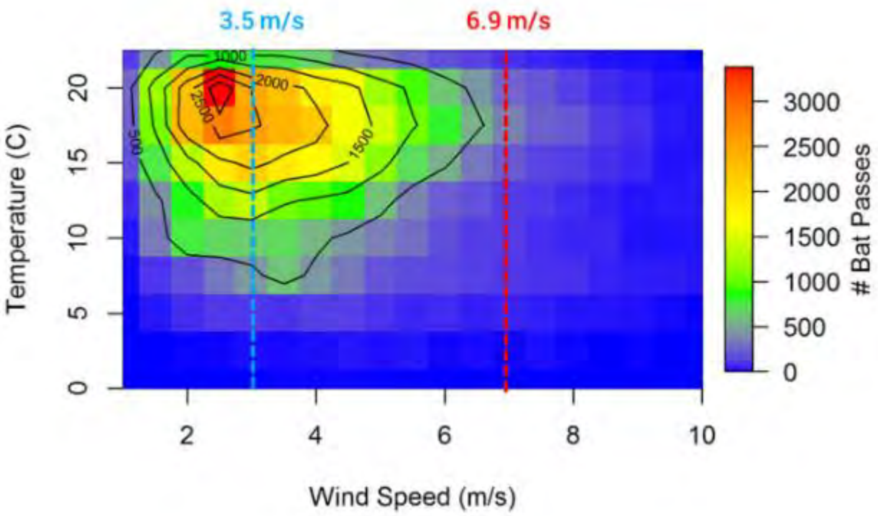


Plate 1 **Distribution of 60,000 bat calls plotted against temperature and wind speed (Stantec 2022)**

It can be seen that bat activity is highest under low wind speeds and during high temperatures (shown in red) and reduces as temperature drops and/or as wind speed increases (shown in blue), and a similar activity pattern could be mapped (Bennet 2022) for microbats within the subject land. Further refinements incorporating variants such as precipitation, time, season and fog may also assist in maximizing operations whilst minimising impacts (Bennet 2022). Developing similar maps of microbat activity could provide opportunities to reduce the time turbines are curtailed whilst ensuring high protection (Bennet 2022) for the bat species considered at risk of a SAII.

These studies show that well researched, smart curtailment strategies can substantially reduce collision risk, minimising impacts to threatened and non-threatened local microbat populations, and not result in a substantial loss of renewable energy from the wind farm.

The proposed proactive low wind-speed turbine curtailment strategy to be implement during the operational phase of the project will be developed in detail during the preparation of the BBAMP. The strategy will develop smart curtailments based on the collection of additional baseline data (at the frequencies outlined in Section 8.10.2 below) on variables including (but not limited to) microbat activity, wind speed, time, month, temperature, and precipitation.

The curtailment strategy will utilise the above variables to minimise the risk of microbat collision with higher risk turbines during times of higher microbat activity. The two-phase curtailment strategy will include:

- All turbines will be feathered to prevent free-wheeling prior to predetermined cut-in speeds (i.e. prior to energy generation).
- All moderate risk turbines (refer Table 72) will be subject to proactive low wind-speed turbine smart curtailment from the outset of the operational phase of the project.

The need for adjustments to the curtailment strategy will be determined through regular monitoring on the efficacy of the current strategy (as prescribed in the BBAMP). Adjustments may include additional curtailment measures if an unacceptable number of strikes are found to occur, however the option to reduce the level of curtailment will also be prescribed, if sufficient evidence can be provided that it is safe to do so. Such evidence may include few, to no, recorded bat strikes at a given turbine, combined with a comparison to the results of a trial period of reduced curtailment. As such, turbines currently assessed as low risk of impact may become curtailed in the future, or those turbines currently considered to present a moderate risk of impacts may be removed from the curtailment strategy, or have curtailment strategies increased. All such changes would be guided by the monitoring and adaptive management processes outlined in the BBAMP.

Detailed monitoring on the efficacy of the smart curtailment strategies, along with responsive management triggers, have been committed to by the Proponent, as is detailed in Section 8.10.2 of the BDAR. This includes a schedule of proposed carcass searches utilising trained sniffer dogs (when available) focusing on an intensive search period over the initial six months of operation (must include the first spring/summer season) whilst animals habituate to the presence of the turbines. This is then followed by regular ongoing searches of all turbines for a period of three to five years, and then ongoing based on the results of the searches. Triggers have been developed and committed to, which based on the results of the carcass searches, will ensure that mitigation strategies (scaled based on the severity of the trigger) are promptly implemented and will arrest the occurrence of any unacceptable events (i.e. strikes). Mitigation strategies include the ongoing opportunities for alternative actions to turbine curtailment such as audible and ultrasonic noise broadcasting to create avoidance behaviour, or the use of radar to induce turbine shutdowns, with such technologies expected to develop greatly over the life of the project. Further effective mitigation strategies include pest animal control to reduce the occurrence of foxes, cats and dogs, likely to scavenge microbat carcasses, potentially skewing the results or searches, establishment of lighting systems that reduce insect (prey) attraction, and annual reporting requiring accounting for all events over the preceding 12 months and reinvestigation the effectiveness of the current mitigation strategy. In the event of trigger level investigations being required the Proponent has committed to increased carcass searches to determine the actual severity of the event, potential temporary turbine shutdowns (while the investigation is underway), re-assessment of existing low-wind speed curtailment strategy, and ultimately greater curtailment of turbines if unacceptable events are found to be re-occurring.

The proposed proactive low wind speed curtailment strategy (to be developed in detail during the preparation of the BBAMP), combined with the ongoing monitoring schedule and responsive management actions committed to by the Proponent, is considered to provide industry best practice and the best possible opportunity for minimising the potential for the project to result in a SAII to the three target species, and minimise impacts to microbats generally. Low wind speed curtailment is known to be an effective means of reducing the risk of blade strike for microbats, and there is a growing body of literature of the topic from Australia and around the world that will continue to be reviewed during regular re-evaluation of the project's current strategy. The Proponent is prepared to work with authorities to share data and continue to contribute to the growing body of literature. When smart curtailments are developed with the implementation of well-considered environmental parameters, it can maximize both the protection level for microbats and the energy generation at the wind farm (Bennet 2002). A smart curtailment strategy will be developed and employed by the project, based on the collection of additional baseline data and in development of the BBAMP. Following the implementation of the project's low wind speed curtailment strategy, operational monitoring and adaptive management will ensure that any unacceptable events that may occur are captured and mitigated, thus providing an ongoing feedback loop to further reduce the potential for the project to result in a SAII from potential operational impacts to the target microbat species.

As outlined in Table 94, the post mitigation collision risk for all remaining turbines, once the above impact avoidance and minimisation strategies have been implemented (including details provided in Section 8.10.2), has been assessed as low. From this, it can be inferred that the risk of impact to the SAII bat species from collision with operational turbines, once implementation of proposed operational mitigation measures have been considered, is also low. Further information is provided in Appendix E regarding to the local populations of each of the SAII species, and each species as a whole, to provide context to any potential impacts should they during the operation phase of the project.

7.3 Transmission line route selection and design optimisation

During the design development phase, a wider landscape assessment area was reviewed for potential transmission line corridor. Seven potential transmission line routes were identified and to understand visual impact and willingness to reach land agreements. Desktop and field validated vegetation and habitat maps where reviewed and transmission line options assessed for likely impacts to significant biodiversity features, with a focus on minimising impacts to TECs. A desktop assessment was undertaken to identify the potential impacts to native vegetation communities for each of the seven options using the State Vegetation Type Mapping for the alignments (Table 57). The initial alignment options are illustrated on Figure 23 below.

Table 57 Transmission line route selection and estimate of native vegetation impacts.

Transmission line option	Estimated area of PCT impacts
Route 1	105.02
Route 2	127.98
Route 3	118.70
Route 4	126.47
Route 5	127.03
Route 6	178.24
Route 7	138.91

Following the review of each of these seven options, two preferred routes were selected and an optimisation consisting of a 200 metre corridor was undertaken to adjust the routes to minimise further impact around mapped PCTs and TECs. The transmission line corridor was then further refined to a single option a 60 metre wide impact areas was determined, resulting in impacts to 31.4 hectares of exotic grassland, and 53.5 hectares of native vegetation, of which 3.1 hectares comprises Box Gum Woodland CEEC. This level of impact included those areas determined as impacted by AECOM (2021) where the vegetation occurs within valleys spanned by the overhead lines (further detailed below).

In March 2021, following exhibition of the EIS, another re-design of the transmission line alignment was completed, relocating approximately 3 kilometres of the transmission line corridor further reducing impacts to a number of patches of high condition native vegetation by locating the footprint now predominantly in areas of exotic grassland, further south and closer to the turbines. This design revision has resulted in materially reduced direct impacts to native vegetation and habits, including mapped habitat for Koala and Spotted-tailed Quoll.

As part of responding to concerns of impact along the transmission line route, AECOM was engaged to prepare a *330 kV Overhead Line vegetation Clearance Report* to further refine the impacts to biodiversity along the transmission line corridor. The scope of the assessment was to:

- Review the Lidar Survey to incorporate the vegetation data for upload into PLS-CADD.
- Prepare the PLS-CADD Maximum design temperature bottom conductor profile with a vegetation clearance line – 3.0 metres plus 1.0 metre regrowth (minimum 4.0 metre required).
- Prepare the structure clearance envelope of 60.0 metres around structure locations.
- Prepare the 50 degree C and 500 pa vegetation clearance envelopes for all spans on the Hills of Gold 330 kV transmission line.

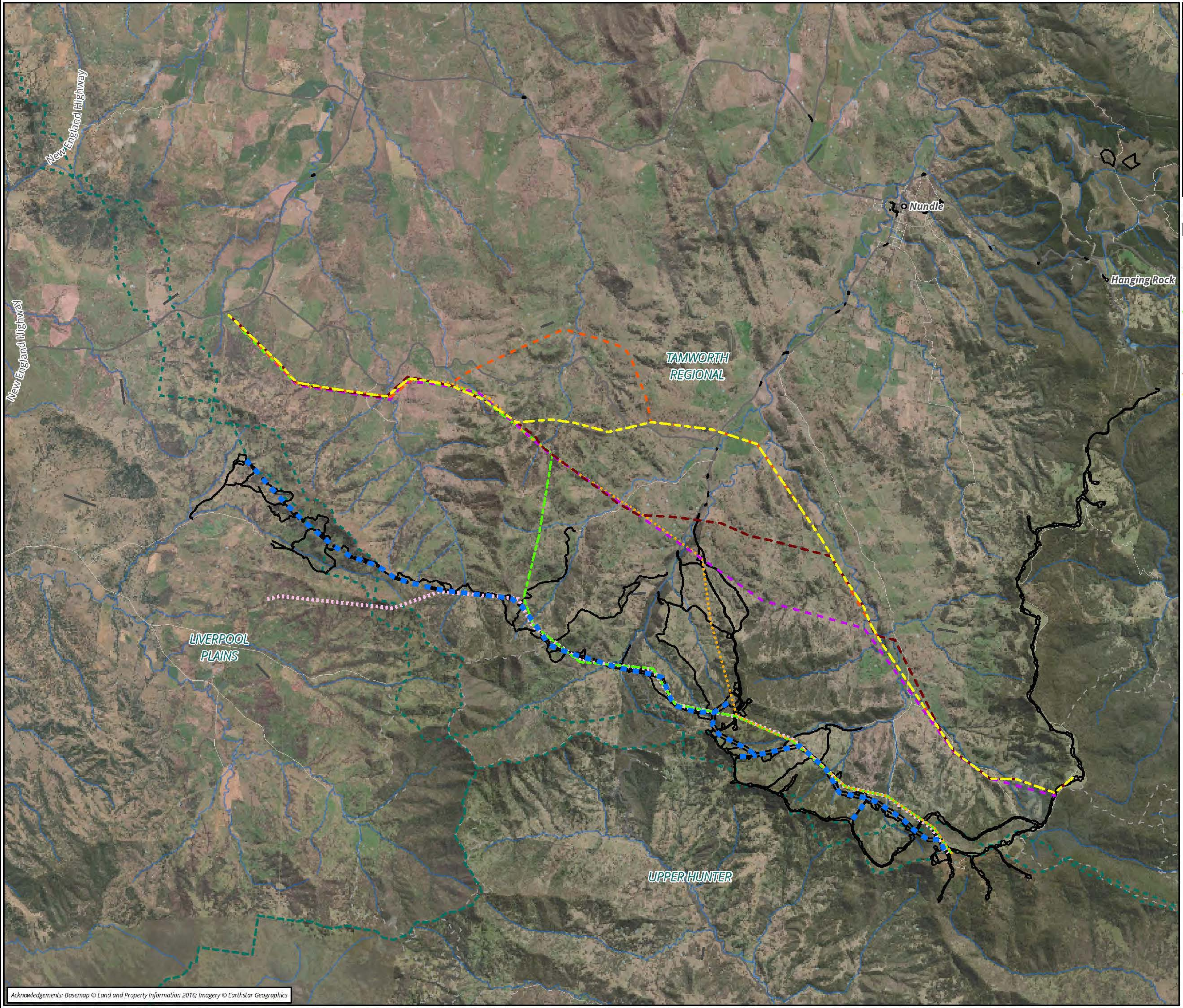
The assessment report (provide as Appendix I) confirms that vegetation occurring within valleys will be sufficiently spanned by the overhead lines so that clearing can be avoided. It should be noted that the AECOM report provided highly refined polygons mapping impacted vegetation to the scale of individual tree canopies, which have been conservatively expanded to the full 60 metre wide transmission line corridor footprint assessed for impacts as part of this BDAR. This has ensured that whilst impacts along the transmission line corridor have been reduced, the impacts assessed remain conservative in nature.

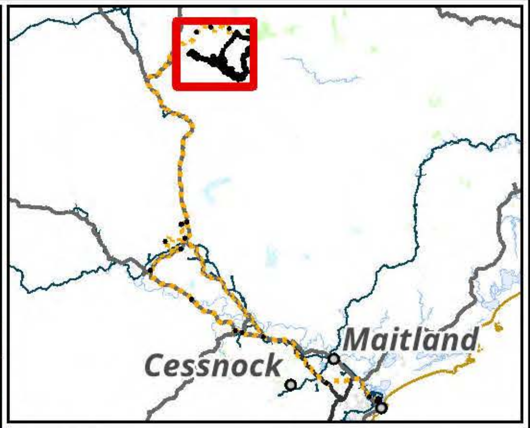
Opportunities to carry out ecological restoration works across the remaining portions of the transmission line corridor which require clearing will be investigated during detailed design, and are committed to in Section 8.9 of this BDAR. At a minimum, this will include native grass seeding, but where appropriate due to operational and safety constraints, planting with native shrubs and trees will be considered.

In September 2022, changes have been proposed following feedback from contractors and Transgrid on required easements for internal lines (33kV) running in parallel with the high voltage 330kV line and to allow for the stringing of internal 33kV lines an extra 9 kilometres to the proposed optional alternate substation location. The increase in easement is proposed for safety and operational efficiency for maintenance to occur without affecting other lines. Additionally, a final update to the transmission line route was undertaken to provide flexibility in the approved project to locate the BESS/Batching/Substation either near WP20 and WP26, or north-west of WP5 and WP6. This has had the effect of increasing the impacts assessed for the transmission line such that a worst case scenario situation has been accounted for in the impact assessment.

In the option whereby the BESS/Batching/Substation are located near WP20 and WP26, the transmission line will consist entirely of a 330 kV overhead line, allowing for all of the spanning assessed in the AECOM (2021) report to be realised. In the option whereby the BESS/Batching/Substation is located near WP5 and WP6 approximately 9 kilometres of the eastern portion of the transmission line will comprise 33 kV overhead lines, which are lower than 330 kV lines, and do not allow for the same span over vegetation and gully areas.

The use of the 33kV line is considered the worst case scenario, and as such the impact assessment has been updated based on this eventuality.





Legend

- Infrastructure footprint
- Transmission line

Transmission line - initial options

- Transmission line - Route 1
- Transmission line - Route 2
- Transmission line - Route 3
- Transmission line - Route 4
- Transmission line - Route 5
- Transmission line - Route 6
- Transmission line - Route 7

Figure 23 Avoid and minimise - Transmission Line options

0 1,000 2,000 3,000 4,000
Meters
Scale: 1:100,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F23_TransmissionLineOptions
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

7.4 Access roads – construction and operation

Existing road infrastructure was prioritised to provide construction access and operational tracks for the Project. This included locating primary construction access routes along the existing public access roads Crawney Road (previously located on Barrys Road) and Morrisons Gap Road. The alignment of the new sections of access tracks within the wind farm corridor largely follows the existing cleared sections of the site, and the development footprint has considered a 5 metre buffer for the majority of the access tracks.

Recent design updates made following preparation of the original BDAR, and previous amended BDAR, have resulted in the following revisions to the project access roads and ancillary facilities and result in materially reduced impacts to biodiversity values.

Table 58 Design amendments and impact / benefit

Project Amendment	Description	Impact/benefit
Traffic Access to Project Area	Project traffic will access the development footprint via Crawney Road, with heavy traffic transporting large infrastructure components accessing the site from Crawney Road only. The Head of Peel Road will not be used for project related construction and operational traffic and will be for emergency use only. As a result, road upgrades previously proposed at Devil's Elbow will not be undertaken	Negate the requirement for the Devil's Elbow bypass road and retaining walls on Morrisons Gap Road. Reduction in number of waterway crossings and impacts to native vegetation and fauna habitat through removing access along Head of the Peel Road. Material reduction of impact to State and Commonwealth listed CEEC Box Gum Woodland (PCT 492) at Devil's Elbow.
Removal and realignment of internal road networks	Removal of the internal road from the development footprint near southern end of Head of Peel Road into western part of the subject land. Sections of track between WP16 to WP17, WP17 to WP18, WP46 to WP47 and WP66 to WP67 and have been reassessed to avoid biodiversity impact and following contractor input on reducing earthworks and required width of footprint.	Redesign of internal roads will directly and indirectly benefit previously impacted biodiversity values due to a reduction in vegetation clearing, bulk earthworks and fragmentation of vegetation and habitats.
Key Intersection, Devil's Elbow and Morrison Gap Road design update	The proposed road upgrades at Devil's Elbow have been removed from the project, and the upgrade to the Barry Road/Morrison Gap Road intersection has been substantially reduced.	Impacts associated with the exhibited project footprint in the EIS at Devil's Elbow comprised approximately 17ha of native vegetation which is generally in high condition. Substantial design revisions and a new bypass reduced the impact assessed in this location down to 2.5 ha of native vegetation. However, following feedback and consultation with Council, the proposed site access via Barry Road/Morrison Gap Road has been removed from the project, along with the proposed upgraded to Devil's Elbow. This has substantially reduced impacts to high condition vegetation, comprising Box Gum Woodland Critically Endangered

Project Amendment	Description	Impact/benefit
		Ecological Community and supporting habitat for threatened fauna species. Changes to the proposed site access have also reduced previously assessed impact to native vegetation and habitats at the corner of Barry Road/Morrison Gap Road to only minor trimming being required.
Transport Route Updates	The transport route for OSOM from the Port of Newcastle to the Project Area has been amended by the following: • Removal of the tower route option via Tamworth; • Removal of the Head of Peel Road route ('Southern Route') (as stated above) and associated alternate routes through Nundle including Happy Valley Road, Jenkins St, Gill St, Innes St; • Inclusion of route optionality in Muswellbrook; • Two additional laybys for OSOM traffic on Lindsay Gap Road and Morrisons Gap Road and one on Crawney Road to allow existing road users to pass slower moving Project traffic. • Access to the site for construction and haulage of large infrastructure components will now be from Crawney Road, to the western extent of the wind farm corridor with three options to access the site as shown on Figure 2	Overall, the refined transport route represents a reduction in biodiversity impacts, particularly with the replacement of access via Devil's Elbow and Barry Road/Morrison Gap Road with the access via Crawney Road with the remaining impacts fully assessed in the updated BDAR. It should be noted that the total Development Footprint assessed as impacted in this BDAR considers an accumulated impact from all these options whereas the proponent has committed to construction of only one option. This will result in a lower level of impact to what has been assessed. Further detail relating to the analysis of options for site access from Crawney Road are provided below in Table 59.
Ancillary Infrastructure Amendments	As a result of the removal of the Head of Peel Road access to the Project Area, the construction laydown area and batching plant at the top of the Head of Peel Road access route has been deleted. The laydown area / batch plant has been relocated to the footprint of the BESS / substation and O&M facility.	Overall design revisions to ancillary areas have been undertaken to avoid and minimise area of high biodiversity value as far as practicable.
	Substation, BESS and O&M configuration has been amended following further substation design works. Two options are provides as outlined above both contributing to the increases in development footprint	
	Relocation of O&M to WP56 based on	

Project Amendment	Description	Impact/benefit
	feedback in the Hazards and Risk Report	
	Laydown Area and Concrete Batching Plant optionality for all laydown areas with the exception of laydowns along Morrisons Gap Road to host concrete batching plants (total number of batching plants for the Project will not increase and will remain as two).	
	An additional temporary construction compounds are proposed adjacent to WTG 56 and at the eastern (downslope) extent of the Devil's Elbow bypass in an existing cleared pullover bay. No impacts to vegetation will occur at the Devil's Elbow compound.	

Table 59 below provides further detail relating to the analysis of options for site access from Crawney Road. The areas and impact considered include only those relevant to each of the three options between Crawney Road, and the location where all three options merge to the single confirmed access footprint, approximately 1.2 kilometres north of the operational and maintenance facility.

Table 59 Options analysis for western site access from Crawney Road

Option	Total native veg impact	PCTs / TECs impacted	% condition impacted	Other considerations
Option A (northern option)	3.80 ha	PCT 486, PCT 541, PCT 599 (Box Gum Woodland CEEC)	High – 20%, Moderate - 2%, Low – 78%	• Includes an existing creek crossing to be improved • Impacts upon high condition Box Gum Woodland • Occurs furthest from known records of Booroolong Frog
Option B (central option)	2.87 ha	PCT 486, PCT 541, PCT 599 (Box Gum Woodland CEEC)	Moderate – 15%, Low – 85%	• Requires construction of a new creek crossing within the area known to support Booroolong Frog records • Only impacts upon low condition Box Gum Woodland
Option C (southern option)	1.38 ha	PCT 486, PCT 541	High – 49%, Moderate - <1%%, Low – 51%	• Requires replacement of an existing creek crossing within the area known to support Booroolong Frog records • Avoids impacts to Box Gum Woodland

In addition to minimising clearing associated with access tracks, it is proposed that upon final design and associated impact, all temporary impacts of this development footprint (considered temporary impacts related to construction) will be rehabilitated with native species mixes. This will compensate for some of the impacts associated with earthworks for road batters. However, in order to ensure an appropriate degree of conservatism, all impacts, including temporary impacts have been fully assessed in this BDAR.

7.5 Overall direct impact reduction resulting from project amendments following the Original BDAR

The following tables highlight the reduction of impacts to native vegetation, TECs and threatened BAM species credit species, based on the additional field investigations and recent design revision undertaken following the preparation of the original BDAR.

Table 60 Revised vegetation impacts

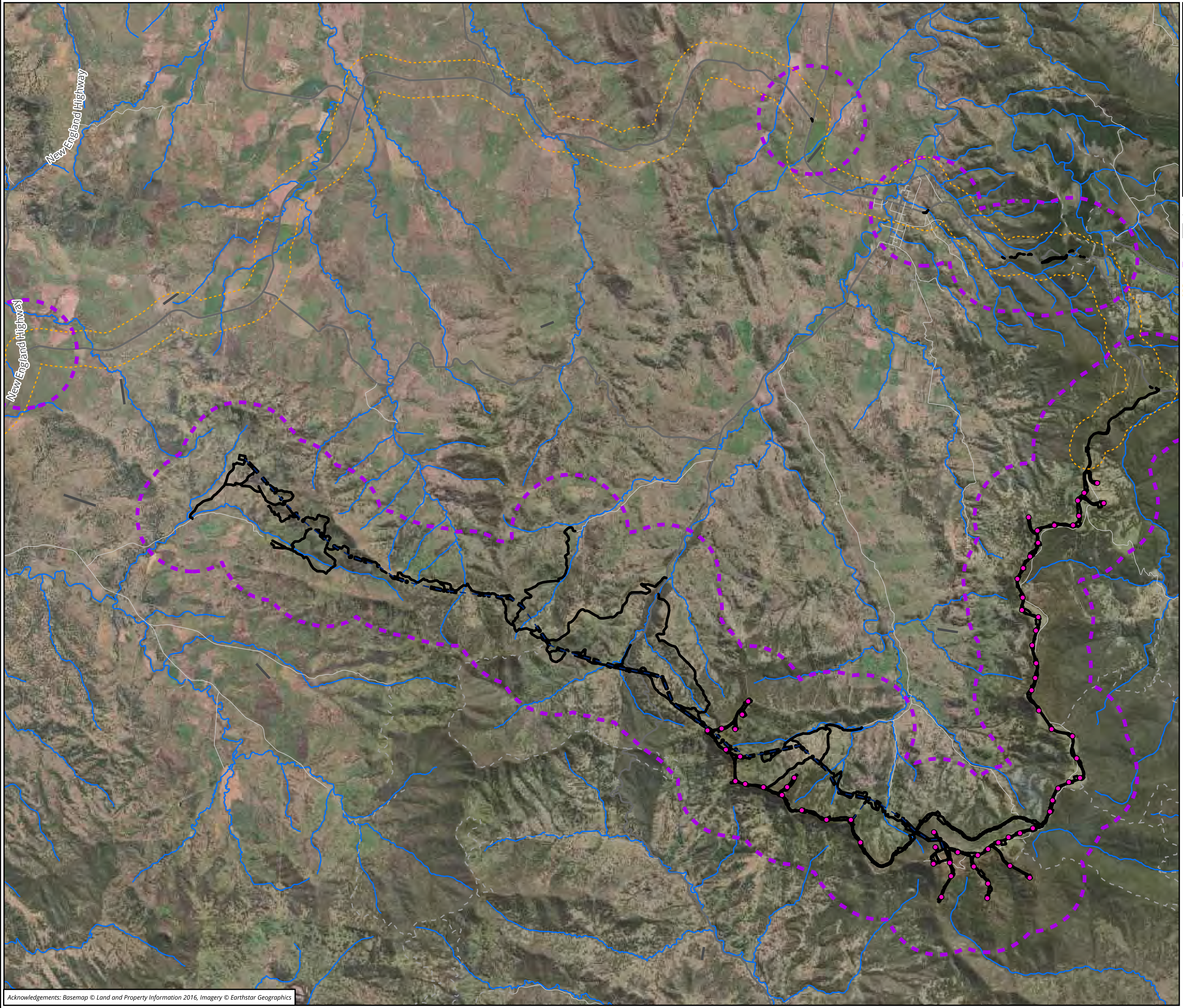
Vegetation condition class	2020 BDAR Area (ha)	Updated BDAR Area (ha)	% Reduction	% of mapped vegetation
Planted or urban vegetation	7.39	0.84	89	0.2
Exotic grassland	272.36	235.78	13	55.2
Derived Native Grasslands	30.91	39.43	-28 (increase)	9.2
Native vegetation – Low condition	37.11	33.64	9	7.9
Native vegetation – Moderate condition	73.8	63.29	14	14.8
Native vegetation – High condition	64.88	54.19	16	12.7
TOTAL	**486.45**	**427.16**	**12%**	**100.0%**

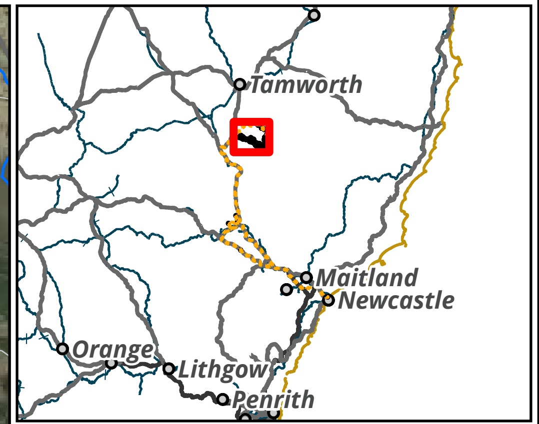
Table 61 Reductions in project refinements

Relevant matter	Details	2020 BDAR Direct impacts	2022 Updated BDAR Direct impacts	Total change
Native vegetation communities and ecosystem credit species habitats.	Direct loss of native vegetation communities associated with site clearing	207.7 ha	190.54 ha	-17.16 ha
Threatened ecological communities	Direct loss of Ribbon Gum—Mountain Gum—Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	57.43 ha	27.24 ha	-27.24 ha
	Direct loss of White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	13.33 ha	8.15 ha	-5.18 ha
Habitat for threatened fauna species – species credit species	Large-eared Pied Bat*	61.08 ha	19.75 ha foraging habitat 0 ha breeding habit	-41.33 ha
	Eastern Cave Bat*	62.49 ha	19.75 ha foraging	-42.74 ha

Relevant matter	Details	2020 BDAR Direct impacts	2022 Updated BDAR Direct impacts	Total change
			habitat 0 ha breeding habitat	
	Large Bent-winged Bat*	23.12 ha	0 ha (breeding habitat)	-23.12 ha
	Little Bent-winged Bat*	23.12 ha	0 ha (breeding habitat)	-23.12 ha
	Southern Myotis	2.21 ha	3.93 ha	1.72 ha
	Eastern Pygmy-possum	30.42 ha	22.36 ha	-8.06 ha
	Koala	50.76 ha	46.28 ha	-4.48 ha
	Squirrel Glider	26.20 ha	17.50 ha	-8.70 ha
	Booroolong Frog	1.59 ha	0.95 ha	-0.64 ha
	Border Thick-tailed Gecko	0.17 ha	0.67 ha	0.50 ha
	Powerful Owl	Assessed as not present as none were observed during surveys	17.26 ha	N/A
	Sooty Owl	As above	1.99	N/A
	Barking Owl	As above	84.57	N/A
	Masked Owl	As above	16.29	N/A
	Greater Glider	N/A	36.28	N/A
	Spotted-tailed Quoll	N/A	45.62	N/A
Habitat for threatened fauna species – ecosystem credit species	State and Commonwealth listed threatened fauna species known or predicted to occur	207.7 ha	190.54 ha	-17.16 ha
Total Reduction				-202.47 ha

Project amendments resulted in a total reduction in impacts to native vegetation of 9%, with a reduction of 7% in areas of high condition native vegetation. A total of 17 hectares of low to high condition native vegetation has been assessed as avoided in this updated layout and BDAR.





Legend

- Infrastructure footprint
- Landscape assessment buffer (study area)
- Transport haul routes
- Transmission line
- Wind turbine locations

Figure 24 Final development footprint, Page 1: Wind farm

0 1,000 2,000 3,000 4,000

Meters

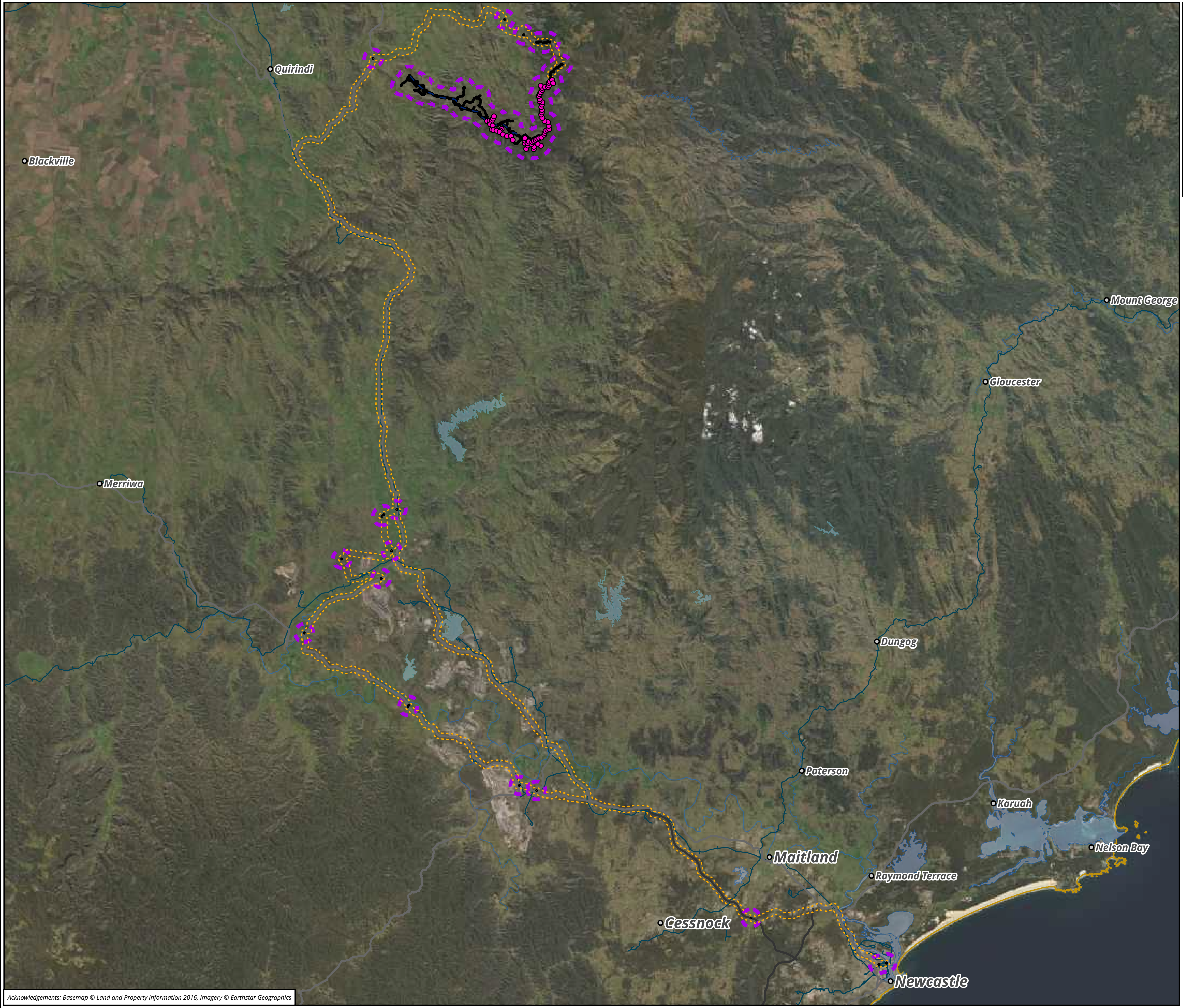
Scale: 1:100,000 @ A3

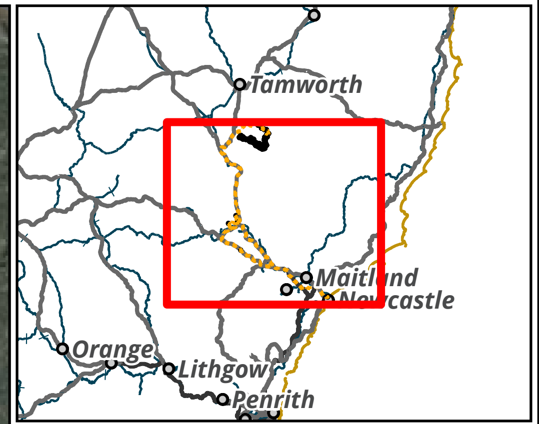
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 05 November 2021 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F24_FinalDevFootprint
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM.aprx





Legend

- Infrastructure footprint
- Landscape assessment buffer (study area)
- Transport haul routes
- Transmission line
- Wind turbine locations

Figure 24 Final development footprint, Page 2: Transport route

0 6,000 12,000 18,000 24,000
Meters
N

Scale: 1:600,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 05 November 2021 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F24_FinalDevFootprint
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM.aprx

8 Assessment of Impacts

8.1 Impact summary

The approach to impact assessment has included assessment of a worst-case scenario covering direct impacts associated with habitat loss and indirect impacts associated with construction and operation of the project.

Table 62 details the impacts of the optimised Project to biodiversity following the implementation of the measures outlined above to avoid and minimise impacts. Where biodiversity impacts are relevant for each proposal phase this has been identified accordingly. These are discussed further in the following sections.

Table 62 Potential impacts to biodiversity

Biodiversity value	Potential impact	Infrastructure type	Proposal phase	
			Construction	Operation
Direct impacts				
Native vegetation and ecosystem credit species habitats	Clearing of 190.54 ha of native vegetation	All	✓	
Threatened Ecological Communities	Clearing of 27.24 ha of Ribbon Gum-Mountain Gum-Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	Wind turbine infrastructure Temporary construction footprint Transmission line Transport route upgrades Internal roads Ancillary	✓	
	Clearing of 8.15 ha of White Box Yellow Box Blakely's Red Gum Woodland	Transmission line Transmission line access tracks Transport route upgrades	✓	
Threatened fauna habitat – Species credit species and MNES	Clearing of 19.75 ha of foraging habitat for Large-eared Pied Bat	Wind farm infrastructure Transmission line Transmission line access tracks Internal roads Ancillary	✓	
	Clearing of 19.75 ha of foraging habitat for Eastern Cave Bat	Wind farm infrastructure Transmission line	✓	

Biodiversity value	Potential impact	Infrastructure type	Proposal phase	
			Construction	Operation
		Transmission line access tracks Internal roads Ancillary		
	Clearing of 22.36 ha of habitat for Eastern Pygmy-possum	Wind farm infrastructure Transmission line Transmission line access tracks Internal roads Ancillary	✓	
	Clearing of 46.28 ha of habitat for Koala	Wind farm infrastructure Transmission line Transmission line access tracks Internal roads Ancillary Haul route upgrades	✓	
	Clearing of 0.67 ha of habitat for Border Thick-tailed Gecko	Transmission line Transport line access tracks Transport route upgrades	✓	
	Clearing of 3.93 ha of breeding habitat for Southern Myotis	Wind turbine infrastructure Transport route upgrades Internal roads	✓	
	Clearing of 36.28 ha of habitat for Greater Glider	Wind farm infrastructure Transmission line Transmission line access tracks Internal roads Ancillary Transport route upgrades	✓	
	Clearing of 45.62 ha of habitat for Spotted-tailed Quoll	Wind farm infrastructure Transmission line Transmission line	✓	

Biodiversity value	Potential impact	Infrastructure type	Proposal phase	
			Construction	Operation
		access tracks Internal roads Ancillary Transport route upgrades		
	Clearing of 17.50 ha of habitat for Squirrel Glider	Wind farm infrastructure Transmission line Transmission line access tracks Internal roads Ancillary Transport route upgrades	✓	
	Clearing of 84.57 ha of habitat for Barking Owl	Internal roads	✓	
	Clearing of 16.29 of habitat for Masked Owl	Internal roads	✓	
	Clearing of 17.26 ha of habitat for Powerful Owl	Internal roads	✓	
	Clearing of 1.99 ha of habitat for Sooty Owl	Internal roads	✓	
	Clearing of 0.95 ha of impact for Booroolong Frog	Transmission line and access tracks	✓	
Indirect impacts				
Threatened fauna	Collision risk for birds and bats	Wind farm infrastructure		✓
Native vegetation, threatened ecological communities and habitat for threatened species	Edge effects and impacts to habitat viability	All lands in proximity of cleared areas	✓	✓
	Disturbance of habitats from noise and light	All land in proximity to operational infrastructure which generates noise or requires night lighting	✓	✓
	Disturbance from weeds, pests and pathogens	Wind farm and transmission line corridor	✓	✓
	Fauna injury/ mortality	All lands	✓	✓

Biodiversity value	Potential impact	Infrastructure type	Proposal phase	
			Construction	Operation
Prescribed impacts				
Native vegetation, threatened ecological communities and habitat for threatened species	Loss of habitat connectivity	Wind farm and transmission line corridor	✓	✓
	Impacts to hydrology and water quality	Wind farm and transmission line corridor	✓	
	Impacts to karst, caves, crevices, cliffs and other geological feature of significance	Low potential for wind farm corridor	✓	
Threatened fauna and migratory species	Impacts of wind turbine strikes on protected animals	Wind farm corridor		✓
	Potential impacts of barrier effect of wind turbine of protected animals	Wind farm corridor		✓
	Potential impacts to flight paths for raptors and resident aerial species	Wind farm corridor		✓
Other impacts				
Aquatic habitats	Impacts to hydrology and downstream water quality	Access/ transport routes	✓	
	Impacts to fish passage	Access/ transport routes	✓	

8.2 Direct impacts

Direct impacts associated with the development are primarily related to the proposed site clearing works. Site clearing will be carried out for the development footprint. As identified in Table 60, the amended Project has resulted in a total reduction in direct impacts to vegetation of 12%, with a reduction of 16% occurring in areas of high condition native vegetation. A total of 16.15 hectares of native vegetation previously proposed to be impacted has now been avoided as a result of the amended layout. It should however also be note that the total impacts area presented and assessed herein comprise an accumulated total for ancillary infrastructure components that include two options for substation and BESS facilities, and three options for operations and maintenance buildings, three options for accessing the site off Crawney Road, and two options for portions of the the transmission line dependent the final locations of the ancillary infrastructure. Only one of each of these options will actually be constructed,

8.2.1 Clearing of native vegetation

The majority of the impacts to vegetation within the development footprint will be to exotic grassland and planted vegetation, with a total of 236.62 hectares of clearing of this vegetation type required.

A total of 190.54 hectares of native vegetation will be cleared from within the development footprint. This includes:

- 29.85 ha for temporary construction footprint.

- 13.40 ha for wind turbine infrastructure.
- 23.15 ha for internal roads.
- 74.45 ha for the transmission line.
- 9.74 ha for the transmission line access tracks.
- 16.56 ha for the transport route upgrades.
- 23.39 ha for ancillary areas.

Again it should be noted that the above totals include acculturated totals for options included for a number of project components.

As described in Section 3 of this BDAR in detail, the condition of the native vegetation is highly variable and patchy, with the majority being derived native grassland, low or moderate condition.

The 190.54 hectares of native vegetation which is contained in the development footprint represents 2.7% of the approximately 7,091 hectares of native vegetation contained within the assessment area buffer of 500m and is an even smaller fraction of the native vegetation which surrounds the assessment area.

To mitigate impacts to native vegetation as a result of temporary impacts, site rehabilitation and ecological restoration works will be completed in areas such as batters for access tracks, temporary construction laydown areas and trenching for underground cabling. A Biodiversity Management Plan for the site will also look at opportunities for revegetation and restoration plans to buffer areas of important habitat, such as the adjacent Ben Halls Gap Nature Reserve and to provide for biodiversity corridors through the development footprint.

Estimates of areas to be subject to rehabilitation works (temporary impacts) through seeding or planting with native species, includes a total of approximately 300 hectares and includes:

- 17.79 hectares within the wind farm infrastructure development footprint.
- 92.23 for bulk earthworks associated with the wind farm development footprint.
- 29.25 hectares for internal access roads development footprint.
- 120.76 hectares for the transmission line development footprint.
- 5.97 hectares for the transmission line access tracks development footprint.
- 14.66 hectares for ancillary infrastructure development footprint.
- 21.43 hectares for the transport haul route development footprint.

These rehabilitation works will materially contribute towards minimising the impacts to native vegetation and fauna habitats within the development footprint. During detailed design, opportunities to include trees and shrubs in the rehabilitation species mix will be considered where site constraints regarding safety and operation permit. Based on these current estimates for areas to be subject to rehabilitation, the loss of 190.54 hectares of native vegetation can be partially compensated by the restoration of up to 300 hectares of vegetation, including seeding areas currently mapped as exotic grasslands with native seeding or planting.

8.2.2 Threatened Ecological Communities

A total of 35.38 hectares of the vegetation which will be impacted by the updated development footprint is associated with two threatened ecological communities being White Box Yellow Box Blakely's Red Gum Woodland and Ribbon Gum-Mountain Gum-Snow Gum open forest or woodland (Table 63).

To provide some context on the significance of impacts to these TECs, an assessment of the potential extent of these communities in the assessment area has been carried out. The White Box-Yellow Box-Blakely's Red Gum Woodland TEC occurs within the transmission line corridor, so the assessment of area impacted considered the investigation area for corridor options. This provides a more focused assessment of the impacts for the local landscape which is considered more representative than looking at a bioregional or sub-bioregional scale where percent impacts would be further diluted.

Table 63 Proposal impacts to threatened ecological communities

TEC	Area impacted (ha)	Area in investigation (ha)	% of investigation area impacted
White Box Yellow Box Blakely's Red Gum Woodland	8.15	1,693.6	0.5%
Ribbon Gum-Mountain Gum-Snow Gum open forest or woodland	27.24	1,059	2.6%

Based on an estimate of the likely extent of these TECs within the assessment area, the project is unlikely to result in a significant local impact to these TECs, as there are substantial areas retained in the area for investigation associated with the wind farm and transmission line easement. The estimate of area of TECs for White-Box-Yellow-Box-Blakely's Red Gum extent was derived from the State Vegetation Map for Border Rivers Gwydir / Namoi Region Version 2.0. VIS_ID 4467 (OEH, 2020a), with associated PCTs that comprise the TEC calculated within the transmission line investigation area.

For the area of Ribbon Gum-Mountain Gum-Snow Gum TEC estimated within the wind farm corridor investigation area, a combination of the State Vegetation Map State Vegetation Type Map: Upper Hunter Version 1.0. VIS_ID 4894 (OEH, 2020 and field survey data was used.

Mitigation measures during detailed design to further reduce impacts to these TECs will be investigated. In particular, the current development footprint considers a 'worst case' clearing footprint for the transmission line easement, assessing complete clearing within the easement. Depending on the height of the towers and the topography of the easement, there will be locations where the existing eucalypt forest can be retained, while still maintaining the required safety and operational clearance to the transmission lines.

8.2.3 Clearing of habitat for threatened fauna species

Direct impacts to threatened fauna habitat within the development footprint has been calculated using the species polygons developed using the methodology described in Section 5.5 of this BDAR. Table 64 presents a summary of estimated impacts to habitat for threatened fauna within the development footprint. In addition to the habitat mapped for species credit species, a number of threatened fauna were directly observed on site. These species, and others considered likely to occur are ecosystem credit species (in accordance with the BAM) and their habitat comprise part or all of the native vegetation to be impacted by the Project. This generally includes forage and potential breeding habitat for species with less specific habitat requirements, that can utilise large amount of the undisturbed habitat present within and surrounding the subject land.

Table 64 Direct impacts to habitat (or potential habitat based on assumed presence) for species credit species

Species	Habitat polygons impacted (ha)							
	Temporary construction footprint	Wind turbine infrastructure	Internal roads	Transmission line	Transmission line access tracks	Transport route upgrades	Ancillary	Total
Barking Owl	5.90	2.23	7.31	45.51	6.00	11.12	6.50	**84.57**
Booroolong Frog	-	-	0.01	0.42	0.27	0.24	-	**0.95**
Border Thick-tailed Gecko	-	-	0.22	0.06	0.05	0.33	-	**0.67**
Eastern Cave Bat	9.98	6.31	1.90	0.21	0.14	-	1.21	**19.75**
Eastern Pygmy-possum	7.30	3.55	2.54	6.15	0.13	2.68	0.01	**22.36**
Greater Glider	16.82	6.43	2.44	8.56	0.19	1.09	0.76	**36.28**
Koala	15.31	6.18	4.78	12.79	0.31	4.93	1.98	**46.28**
Large-eared Pied Bat	9.98	6.31	1.90	0.21	0.14	-	1.21	**19.75**
Powerful Owl	7.22	2.68	2.22	2.33	-	2.71	0.10	**17.26**
Sooty Owl	-	-	1.99	-	-	-	-	**1.99**
Southern Myotis	2.42	1.27	0.24	-	-	-	-	**3.93**
Spotted-tailed Quoll	19.93	6.68	4.85	9.47	0.23	3.70	0.76	**45.62**
Squirrel Glider	6.06	3.55	1.49	4.07	0.06	1.54	0.72	**17.50**
Masked Owl	2.22	0.73	1.68	6.45	0.20	3.77	1.23	**16.29**

8.3 Indirect impacts

This section details potential indirect impacts associated with the construction and operation of the proposal following the implementation of proposed avoidance and minimisation measures. The likely extent and nature of these impacts is discussed in further detail below in relation to each element of the proposal.

Overall, the indirect impacts of the amended Project are materially reduced as compared to the Project as assessed in the original BDAR.

8.3.1 Indirect/uncertain impacts to microbats

By its nature as a wind farm, the project has the potential to cause indirect impacts to identified threatened and non-threatened species of microbats recorded within the development footprint. Direct impacts to loss of breeding and foraging habitat are addressed above, and indirect impacts associated with construction are detailed below, however there are also potential operational phase impacts that are required to be addressed. Indirect impacts, many of which are considered uncertain in relation to microbats, have the potential to occur during the operational phase of the project include:

- Loss of habitat connectivity (barrier effect).
- Avoidance of areas of habitat due to air disturbance surrounding operational turbines (habitat sterilisation).
- Turbine strike (and possibly barotrauma).

Potential impacts to local populations of microbats that could occur as a result of loss of habitat connectivity and as a result of air disturbance around operational turbines are assessed in the prescribed impacts section of this BDAR. The potential for and likely consequences of turbine strike (and possibly barotrauma) are included herein.

It has been confirmed as part of this assessment that a range of microbat species recorded within the project area occur at varying frequencies at elevations that put them at risk of collision with the turbine rotor blades. Based on the specifications of the turbine options being considered for the operational phase of the project, the 'worst case scenario' turbine will result in a rotor swept area of 164 metres diameter occurring between 68 and 2320metres above ground level. As outlined in Section 5.4.2 of this BDAR, 19 out of the total 28 species of microbats recorded during the field surveys were recorded by acoustic detectors mounted at approximately 60 meters elevation on met masts, representing air space within rotor swept area. Of the 19 species recorded at 60 metres elevation, eight are listed as threatened under either or both the NSW BC Act and Commonwealth EPBC Act. These include:

- Eastern Coastal Free-tailed Bat.
- Eastern False Pipistrelle.
- Greater Broad-nosed Bat.
- Large Bent-winged Bat.
- Large-eared Pied Bat.
- Little Bent-winged Bat.
- Little Pied Bat.
- Yellow-bellied Sheath-tailed Bat.

Activity levels for threatened microbats at elevations within rotor swept area range from a mean of 1.8 calls per night for Greater Broad-nosed Bat, 1.5 calls per night for Little Bent-winged Bat and 1.1 calls per night for Eastern False Pipistrelle, down to 0.2 calls per night for Little Pied Bat and 0.1 calls per night for Large-eared Pied Bat (averaged over the three detectors installed). These activity levels are considered low when compared to the White-striped Free-tail Bat, the most commonly recorded bat during the field survey, with an average of 39 calls per night recorded at 60 metres elevation, but activity levels quickly reduce for the remainder of the species in the bat population with only three other species more active than Greater Broad-nosed Bat within the range of rotor swept area.

As outlined in Section 5.4.2 above, rates of impact cannot be quantified for microbats to the same degree they can for birds, as to do so requires the number of individuals present within the project area to be determined, and microbats cannot realistically be counted. As such, assessment of potential impacts to microbats as a result of turbine strike has been undertaken by way of a qualitative risk assessment used to determine the likelihood of impact and the potential consequences of any impact that may occur.

The criteria used to establish likelihood of impact and potential consequences of turbine strike are provided in Table 65 below.

Table 65 Qualitative risk assessment criteria for likelihood and consequences of the impacts of turbine strike for microbats

Likelihood	Criteria	Consequence	Criteria
Rare	An event may occur only in unusual circumstances (<5%).	Negligible	Occasional individuals lost but no impact to the viability of the local or broader population.
Unlikely	An event could occur during some circumstances (>5 - <50%).	Minimal	Repeated loss of small number but no impact to the viability of the local or broader population.
Possible	An event could occur during most circumstances (>50% - <95%).	Moderate	Repeated loss of individuals that may cause changes to the local abundance of a species and affect the viability of the local or broader population.
Probable	An event is expected to occur in most circumstances (>95%).	Significant	Major loss of individuals that may cause changes to the regional or state population and affect the viability of the local or broader population.

The matrix used to qualify the risk associated with of the potential impacts established in accordance with the criteria outlined in Table 65 is provided in below in Table 66, with reference to the information provided in Table 46.

Table 66 Qualitative risk assessment matrix for significance of impacts of potential turbine collisions for microbats

Likelihood	Consequence			
	Negligible	Minimal	Moderate	Significant
Rare	Low	Low	Moderate	High
Unlikely	Low	Low	Moderate	High
Possible	Low	Moderate	High	High
Probable	Moderate	High	High	High

The project specific risk assessment for the potential for turbine strike impacts for microbats is provided below in Table 67. The risk to nine species of bat is confirmed to be moderate, indicating that during the operational phase individual bats are likely to be injured. However, the risk to populations of each species is low as they occur in high densities throughout the Project Area and beyond.

Table 67 **Qualitative risk assessment for potential blade strike impacts to microbats**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
White-striped Free-tailed bat	*Austronomus australis*	-	Recorded via ultrasonic detection in RSA	Prefers open foraging areas above canopy. A very common widespread species recorded in high numbers during site surveys. Recognised as an at risk bat species in relation to wind farm developments due to their foraging and flight behaviour. Due to its poor ability to detect and avoid obstacles, particularly mobile ones, such as turbine blades, White-striped Free-tail Bats are one of the most commonly recorded species in carcass monitoring at Australian windfarms. Highly susceptible to collision mortality regularly, however, populations generally secure and dense to withstand moderate instances of mortality should it occur.	Possible	Minimal	**Moderate**
Large-eared Pied Bat	*Chalinolobus dwyeri*	V - BC Act and V - EPBC Act	Recorded via ultrasonic detection in RSA	Declining species that roosts in caves and recorded onsite. Prefers edge or fringing areas of canopy for foraging, however may forage on occasion within RSH and therefore susceptible to collision risk where distances of RSH to canopy is <30m. Only two identified areas onsite that could potentially consist of breeding/roosting habitat. In the unlikely event that collisions occur, impacts to the local population of the species may eventuate.	Unlikely	Moderate	**Moderate**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Gould's Wattled Bat	*Chalinolobus gouldii*	-	Recorded via ultrasonic detection in RSA	A common and widespread large microbat that is fast, high flier with restricted manoeuvrability. Like the White-striped Freetail Bat, this species has a poor ability to detect and avoid obstacles while pursuing prey, particularly mobile ones such as turbine blades. Highly susceptible to collision mortality regularly, however populations generally secure and dense to withstand moderate instances of mortality should it occur.	Unlikely	Minimal	**Low**
Chocolate Wattled Bat	*Chalinolobus morio*	-	Recorded via ultrasonic detection in RSA	A relatively common and widespread microbat that is fast with increased manoeuvrability than the Gould's Wattled Bat. Generally restricted to canopies and fringing vegetation, may be susceptible to collision mortality on occasion, however populations generally secure and dense to withstand low instances of mortality should it occur.	Unlikely	Minimal	**Low**
Little Pied Bat	*Chalinolobus picatus*	V - BC Act	Recorded via ultrasonic detection in RSA	A declining species that occurs in dry open forest and woodlands. The subject land is within its most easterly distribution limit. Roosts in cave and occasionally within trees hollows and other structures. Relatively confined to canopies and timbered areas but may fly within RSH on occasion. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Rare	Minimal	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V - BC Act	Recorded via ultrasonic detection in RSA	A declining species generally confined to tall forests and woodlands. Generally known to fly below canopies and within RSH, recorded on site in low numbers, but one of the more common threatened species present within RSH. In the unlikely event that collisions occur, impacts to the local population of the species may eventuate.	Rare	Moderate	**Moderate**
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V - BC Act	Recorded via ultrasonic detection in RSA	A declining species found within wide ranging habitats. recorded regularly during site surveys. Known to fly within or above canopies and within RSH, was recorded on site within RSH and therefore at risk of collision. In the unlikely event that collisions occur, impacts to the local population of the species may eventuate.	Rare	Moderate	**Moderate**
Little Bent-winged Bat	*Miniopterus australis*	V - BC Act	Recorded via ultrasonic detection in RSA	Little Bent-wing Bats is a small microbat that roosts in caves and disperse widely through a range of habitats. This species is migratory and are a fast-flying species that often forage beneath canopy height however may fly with RSH. May co-habitat with other cave dwelling microbats. In the unlikely event that collisions occur, impacts to the local population of the species may eventuate.	Rare	Moderate	**Moderate**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V - BC Act	Recorded via ultrasonic detection in RSA	Large Bent-wing Bats roost in caves and disperse widely through a range of habitats. Recorded regularly during site surveys. This species is migratory and are a fast-flying species that often forage above canopy height and may fly with RSH. Nearest maternity site likely to be used by individuals present within the project area is over 250 km to the south of the subject land. In the unlikely event that collisions occur, impacts to the local population of the species may eventuate.	Unlikely	Moderate	**Moderate**
Southern Myotis	*Myotis macropus*	V - BC Act	Recorded onsite	Generally found around riparian areas. Not known to fly within RSH and not considered to be at risk of collision due to their favoured foraging and roosting preferences in gullies and surrounding waterways	Rare	Minimal	**Low**
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	-	Recorded onsite	A relatively common and widespread microbat that is fast with high manoeuvrability. Generally restricted to foraging within or beneath the canopy however may forage within open areas, especially where lights have attracted large insect numbers. Should a collision occur, it is likely only to occur to a very small number of individuals that would be impacted.	Rare	Minimal	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Northern Free-Tailed Bat	*Ozimops lumsdenae*	-	Recorded via ultrasonic detection in RSA	Widespread species of varying habitats, but rare within the locality. Fast and direct fliers of unobstructed air-spaces from just above to well above the canopy as well as above grasslands. Two species were recorded in low numbers within RSH at the site. Should a collision occur, it's likely only to occur to a very small number of individuals that would be impacted.	Rare	Minimal	**Low**
Inland Free-tailed Bat	*Ozimops petersi*	-	Recorded via ultrasonic detection at canopy height		Unlikely	Minimal	**Low**
South-eastern Free-tailed Bat	*Ozimops planiceps*	-	Recorded via ultrasonic detection at canopy height		Rare	Minimal	**Low**
Ride's Free-Tailed Bat	*Ozimops ridei*	-	Recorded via ultrasonic detection in RSA		Rare	Minimal	**Low**
Golden-tipped Bat	*Phoniscus papuensis*	V - BC Act	Recorded onsite	Generally found within wet sclerophyll and rainforest areas and not generally at high altitudes, which makes these observations somewhat unique. However, not known to fly within RSH and not considered to be at risk of collision due to their favoured foraging and roosting preferences.	Rare	Negligible	**Low**
Grey-headed Flying Fox	*Pteropus poliocephalus*	V - BC Act and V-EPBC Act	Sub-optimal habitat onsite and potential to move throughout the broader locality	A declining species that inhabits wide ranging habitats and moves large distances foraging, however generally roosts/breeds close to or near riparian areas. May occur on an intermittent bases transiting through the landscape, however the occurrence of known camps and forage resources mean regular flights through the development footprint are considered unlikely. Recent	Rare	Minimal	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
				instances in Victoria have seen an increased rate of collision mortality. Should a collision occur, it is likely only to occur to a very small number of individuals that would be impacted.			
Smaller Horseshoe Bat	*Rhinolophus megaphyllus*	-	Recorded via ultrasonic detection in RSA	Widespread and common cave dependent species. Often roost together in large numbers. Generally, fly close to the ground and beneath canopies, but on occasion fly with RSH and susceptible to collisions. Should a collision occur, it is likely only to occur to a very small number of individuals that would be impacted.	Rare	Negligible	**Low**
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	V - BC Act	Recorded via ultrasonic detection in RSH	Widespread species within a range of habitats including rainforest, woodland and grassland. High and fast flier over the forest canopy, but lower in more open areas and fringing vegetation. Roosts within tree hollows. Has potential to fly within RSH. In the unlikely event that collisions occur, impacts to the local population of the species may eventuate.	Unlikely	Moderate	**Moderate**
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V - BC Act	Recorded via ultrasonic detection in RSA	A declining species generally confined to timbered gullies and near riparian areas. Not commonly known to fly above canopies or within RSH but was recorded on site within RSH. In the unlikely event that collisions occur, impacts to the local population of the species may eventuate.	Unlikely	Moderate	**Moderate**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Inland Broad-nosed Bat	*Scotorepens balstoni*	-	Recorded via ultrasonic detection at canopy height	A widespread species that generally fly within riparian areas but may also fly above canopies and RSH on occasion. Highly mobile, however, not recorded within RSH and not considered to be at risk of collision due to their favoured foraging and roosting preferences. In the unlikely event a collision occurs, populations generally secure and dense to withstand low instances of mortality should it occur.	Rare	Minimal	**Low**
Little Broad-nosed Bat	*Scotorepens greyii*	-	Recorded via ultrasonic detection in RSA	A common widespread species recorded regularly during site surveys. Generally, fly within riparian areas and woodland along the fringing areas of vegetation, but may also fly above canopies and RSH on occasion. Highly mobile and susceptible to collision mortality, however populations generally secure and dense to withstand moderate instances of mortality should it occur.	Possible	Minimal	**Moderate**
Eastern Broad-nosed Bat	*Scotorepens orion*	-	Recorded via ultrasonic detection at canopy height	A common coastal species, however on its most westerly distribution limit. Generally found within moist forests and woodlands. Generally fly within gullies and riparian areas but may also fly above canopies and RSH on occasion. Highly mobile, however, should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Rare	Negligible	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Large Forest Bat	*Vespadelus darlingtoni*	-	Recorded via ultrasonic detection at canopy height	A large widespread bat with restricted manoeuvrability due to its size. Not known to fly within RSH and not considered to be at risk of collision due to their favoured foraging and roosting preferences. In the unlikely event a collision occurs, populations generally secure and dense to withstand low instances of mortality should it occur.	Unlikely	Minimal	**Low**
Southern Forest Bat	*Vespadelus regulus*	-	Recorded via ultrasonic detection at canopy height	A moderate sized widespread bat. Not known to fly within RSH and not considered to be at risk of collision due to their favoured foraging and roosting preferences. In the unlikely event a collision occurs, populations generally secure and dense to withstand low instances of mortality should it occur.	Rare	Minimal	**Low**
Eastern Cave Bat	*Vespadelus troughtoni*	V - BC Act	Recorded onsite	A cave dependent and uncommon species. Generally confined to forage beneath canopies and fringing vegetation but may make rapid skirmishes across open areas. Not recorded within RSH, however should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Rare	Minimal	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Little Forest Bat	*Vespadelus vulturnus*	-	Recorded via ultrasonic detection in RSA	A small sized, very common and widespread bat. They are highly agile fast fliers with high manoeuvrability. May fly beneath and above canopy height and on occasion within RSH. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Unlikely	Minimal	**Low**

Based on the table above, a total of nine species have been assessed as being subject to a Moderate risk of impact resulting from blade strike. Moderate risks relate to either an expectation for more frequent collisions with turbines due to a species proclivity for flights within rotor swept height, or more substantial impacts to local populations due to individuals comprising a more significant and/or substantial portion of the local population.

The nine species considered to be subject to a moderate risk of impact from turbine strike, include:

- White-striped Free-tailed bat (not listed).
- Large-eared Pied Bat – Vulnerable, BC Act and Vulnerable, EPBC Act.
- Eastern False Pipistrelle – Vulnerable, BC Act.
- Eastern Coastal Free-tailed Bat – Vulnerable, BC Act.
- Little Bent-winged Bat – Vulnerable, BC Act.
- Eastern Bent-winged Bat – Vulnerable, BC Act.
- Yellow-bellied Sheath-tailed Bat – Vulnerable, BC Act – Vulnerable, BC Act.
- Greater Broad-nosed Bat – Vulnerable, BC Act.
- Little Broad-nosed Bat (not listed).

As impacts associated with blade strike to the above species cannot be quantified and are considered uncertain, adaptive management is required through the preparation and implementation of an operational Bird and Bat Adaptive Management Plan (BBAMP) that will be prepared prior to operation of the wind farm. The BBAMP will allow for ongoing monitoring of any bat mortality, continually test the assumptions of this impact assessment and enable adaptive management measures to be implemented, if required, to reduce measured impacts. The plan will include methods for monitoring of bat mortality, provide any acceptable thresholds for mortality and adaptive management regimes if thresholds are exceeded.

Further detail on adaptive management and the likely contents of the BBAMP are provided in Section 8.10.2 below.

Whilst impacts to microbat species may occur as a result of turbine strike, it is considered unlikely that additional impacts will occur as a result of barotrauma. A paper published in December 2020 in the journal PLOS One, by Lawson et al, describes how mortality as a result of barotrauma is unlikely to occur due to the areas where exposure to the level of pressure variation required to cause mortality are present only in the immediately vicinity of the turbine blades, and that flight paths required for bats to be exposed to these areas are highly improbable. As such, even a small change in flight path would result in the bat being hit by the blade or experiencing a much smaller pressure change. Furthermore, the magnitude of the low-pressures bats could experience when flying near wind turbines is approximately 8 times smaller than the pressure that causes mortality in rats, the smallest mammal for which data are available. The magnitude of the high-pressures that bats may experience are approximately 80 times smaller than the exposure level that causes 50% mortality in mice, which have a body mass similar to several bat species that are killed by wind turbines in the United States (Lawson et al 2020).

The study concludes that, if bats have a physiological response to rapid low- and high-pressure exposure similar to that of other mammals, that it is unlikely that barotrauma is responsible for a significant number of turbine-related bat fatalities, and that impact trauma is the likely cause of the majority of wind-turbine-related bat fatalities. (Lawson et al 2020)

The above information is not considered to lessen the overall likelihood or risk of mortality for microbats interacting with turbine blades, it is simply presented to address the potential for barotrauma specifically, to cause potential mortality.

8.3.2 Collision risk (birds)

The SEARs and the BAM require an impact assessment to migratory species and any resident raptors that may be subject to indirect impacts associated with blade strike during the operational phase of the project. The results of the bird utilisation survey and the Collision Risk Model (Appendix D) indicate that there are no migratory bird species at risk of collision with turbines during the operation of the wind farm. Three resident raptors were identified, including Wedge-tailed Eagle, Nankeen Kestrel and Brown Goshawk. It should be noted that this assessment was based on the Project's previous 70 turbine layout, and as such potential impacts are likely to have been reduced.

Using additional site based information from field surveys, as well as literature reviews, population estimates were able to be obtained for Wedge-tailed Eagle and Nankeen Kestrel to inform a more detailed assessment of the significance of impacts to these species. Based on this assessment it is considered unlikely that the project will have a significant impact on the population of resident raptors.

Cherriman (2007) provided an overview of studies that have investigated the size of Wedge-tailed Eagle territories in temperate regions. Territory sizes in studies near Perth (Cherriman 2007); at two other sites in the south-east of Western Australia (Ridpath and Brooker 1987); near Canberra in south- eastern Australia (Leopold and Wolfe 1970); and, in South Australia (Rowe et al. 2017) were all between 31 km^2 and 42 km^2. Foster and Wallis (2010) studied the species west of Melbourne and recorded nearest- neighbour distances averaged 4.7 kilometres. In a study in western NSW, Sharp et al. (2001) found the mean distance to nearest neighbour between Wedge-tailed Eagle nests was in the order of 1 pair per 3–9 km2. They noted this was considerably higher than that noted in other semi-arid zone studies (~1 pair per 40–48 km2).

Using a conservative mean Wedge-tailed Eagle territory size of 30 km^2, the average diameter of a territory would be slightly greater than 12 kilometres. As a consequence, we have based the modelling exercise for Wedge-tailed Eagles on the assumption that the 26 kilometre linear array of the proposed wind farm may intersect with three territories, occupied by six adult birds.

Cherriman (2013) reported that breeding productivity (number of chicks fledged) was 0.73 young per pair, across 15 occupied territory-years. Debus et al. (2007) recorded very similar results with 10 young produced in 12 pair-years, equating to 0.8 young fledged per pair per year. On the basis of those studies, we have conservatively assumed that, on average, three pairs will be accompanied by a total of three flying juveniles, bringing the average site-population of Wedge-tailed Eagles to a total of 9.

During field investigations of the site, field staff documented one instance each in which three, four and five Wedge-tailed Eagles were observed simultaneously.

Informed assumptions were able to be developed and employed for the potential site-population sizes of Nankeen Kestrels and Wedge-tailed Eagles and this permitted the model to provide projections expressed as average numbers of potential collisions per annum for those two species. Depending upon avoidance capacity and all other assumptions used for Nankeen Kestrels the model returned a likely range of between 0.07 and 0.36 collisions for that species per annum. Under the same caveats for Wedge-tailed Eagles, the likely range was between 0.98 and 5.86 collisions per annum.

Further to the quantitative Collision Risk Model undertaken to the project, an additional qualitative risk assessment for the impacts of turbine strike has been prepared for avian species known or considered to have the potential to occur within the project area, as provided above for microbats.

Forest owl species recorded or assumed present within, and/or immediately surrounding, the development footprint (refer Section 5.4.2) are included as part of this risk assessment and have all been assessed as Low risk of impact through blade strike. This is due largely to their behaviour of flying within or just above the canopy, and therefore below rotor swept height.

The criteria used to establish likelihood of impact and potential consequences of turbine strike are provided in Table 68 below.

Table 68 Qualitative risk assessment criteria for likelihood and consequences of the impacts of turbine strike for birds

Likelihood	Criteria	Consequence	Criteria
Rare	An event may occur only in unusual circumstances (<5%).	Negligible	Occasional individuals lost but no impact to the viability of the local or broader population.
Unlikely	An event could occur during some circumstances (>5 - <50%).	Minimal	Repeated loss of small number but no impact to the viability of the local or broader population.
Possible	An event could occur during most circumstances (>50% - <95%).	Moderate	Repeated loss of individuals that may cause changes to the local abundance of a species for up to 5 years.
Probable	An event is expected to occur in most circumstances (>95%).	Significant	Major loss of individuals that may cause changes to the regional or state population of a species for up to 10 years.

The matrix used to qualify the risk associated with of the potential impacts established in accordance with the criteria outlined above is provided in below in Table 69.

Table 69 Qualitative risk assessment matrix for significance of impacts of potential turbine collisions for birds

Likelihood	Consequence			
	Negligible	**Minimal**	**Moderate**	**Significant**
Rare	Low	Low	Moderate	High
Unlikely	Low	Low	Moderate	High
Possible	Low	Moderate	High	High
Probable	Moderate	High	High	High

The project specific risk assessment for the potential for turbine strike impacts for birds is provided below in Table 70.

Table 70 Qualitative risk assessment for potential blade strike impacts to birds

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Australian Magpie	*Cracticus tibicen*	-	Observed in subject land	Common widespread species within varying habitats. Generally prefer more open space and woodlands and not generally found within dense forests. May suffer collision mortality, however populations generally secure and robust to withstand low instances of mortality should it occur.	Rare	Negligible	**Low**
Australian Raven	*Corvus coronoides*	-	Observed in subject land	Common widespread species found within all habitats. Highly disturbance tolerant species. May suffer collision mortality due to unmitigated or opportunistic carcass predation, however populations generally secure and robust to withstand low instances of mortality should it occur.	Rare	Negligible	**Low**
Barking Owl	*Ninox connivens*	V - BC Act	Habitat onsite and potential to occur within the broader locality	Distributed widely but declining and uncommon species within woodlands, fringing forests and rural areas. Roosts often occur near or adjacent to riparian areas. Generally moves throughout or just above canopy, and unlikely to move within the RSH. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Rare	Minimal	**Low**
Black Kite	*Milvus migrans*	-	Habitat onsite and potential to occur within the broader locality	Common widespread species within varying habitats. Highly disturbance tolerant species and may occur in large numbers at times due to other environmental factors i.e. foraging opportunities. Soars on thermals and often undertakes aerobatic displays increasing collision risk. Populations generally secure and robust to withstand low instances of mortality should it occur.	Rare	Negligible	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Brown Falcon	*Falco berigora*	-	Habitat onsite and potential to occur within the broader locality	Common widespread species within varying habitats. May suffer collision mortality regularly due to unmitigated or opportunistic carcass predation. Not known to be deterred by wind turbines, Brown Falcons are been found regularly in carcass searches at Victorian wind farms. Populations generally secure and robust to withstand low instances of mortality should it occur.	Rare	Negligible	**Low**
Brown Goshawk	*Accipiter fasciatus*	-	Observed in subject land	Widespread but uncommon species found within woodland and forest habitats, often nesting near riparian areas. Populations generally secure and robust to withstand low instances of mortality in the unlikely event it should occur.	Unlikely	Minimal	**Low**
Crimson Rosella	*Platycercus elegans*	-	Observed in subject land	Widespread and common species of woodland and forest habitats within the tablelands. Generally occur in small flocks or pairs and move generally within or just above canopy height. Populations generally secure and robust to withstand low instances of mortality in the unlikely event it should occur.	Rare	Negligible	**Low**
Dusky Woodswallow	*Artamus cyanopterus*	V - BC Act	Habitat onsite and potential to occur within the broader locality	Widespread but declining species of open woodlands that can be resident, nomadic or seasonally migratory. Often seen at foraging at varying heights in small to moderate sized flocks, often with other aerial foragers. At risk of collision as may fly within RSH, however, should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Rare	Minimal	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Fork-tailed Swift	*Apus pacificus*	M	Habitat onsite and potential to occur within the broader locality	Widespread however sparsely distributed often following weather events. Soars within and above RSH so at risk of collision. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Unlikely	Minimal	**Low**
Galah	*Eolophus roseicapilla*	-	Observed in subject land	Common widespread species within varying habitats. Generally prefer more open space and woodlands and not generally found within dense forests. May occur in large flocks. May suffer collision mortality on occasion, however populations generally secure and robust to withstand low instances of mortality should it occur.	Rare	Negligible	**Low**
Glossy Black Cockatoo	*Calyptorhynchus lathami*	V - BC Act	Habitat onsite and potential to occur within the broader locality	Widespread but rare species highly dependent on woodland and open forests with substantial distribution of Allocasuarina within the midstorey. Hollow dependent. Moving throughout the landscape more readily due to bushfire impacts, but generally move just above canopy height, and unlikely to fly within RSH regularly. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Rare	Minimal	**Low**
Laughing Kookaburra	*Dacelo novaeguineae*	-	Observed in subject land	Widespread disturbance tolerant species that inhabits most vegetation types. Mostly confined to skirmishes from perched positions but may move throughout the landscape above canopy height. Unlikely to suffer collision mortality regularly, however populations generally secure and robust to withstand low instances of mortality should it occur.	Rare	Negligible	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Little Eagle	*Hieraaetus morphnoides*	-	Habitat onsite and potential to occur within the broader locality	Widespread but rare and declining species of woodlands, open forests and rural areas. When seen, often soaring within thermals above or within RSH. Not recorded during site surveys however may occur in future in low densities and at risk of collision. In the unlikely event that collisions occur, impacts to the local population of the species may eventuate.	Unlikely	Moderate	**Moderate**
Little Lorikeet	*Glossopsitta pusilla*	V - BC Act	Observed in subject land	Uncommon but widespread species within woodland and forest habitats on tablelands and coastal regions. Generally sparse on the tablelands however may suffer collision mortality on occasion. Should a collision occur, it's likely only to occur to a very small number of individuals that would be impacted.	Rare	Minimal	**Low**
Little Wattlebird	*Anthochaera chrysoptera*	-	Observed in subject land	Inhabits varying coastal habitats and on the edge of it is westerly distribution. Prefers dry heathy habitats and woodlands. May suffer collision mortality on occasion, however populations generally secure and robust to withstand low instances of mortality should it occur	Rare	Negligible	**Low**
Masked Owl	*Tyto novaehollandiae*	V - BC Act	Habitat onsite and potential to occur within the broader locality	Distributed widely but declining and uncommon species within woodlands, fringing forests and rural areas. Generally moves throughout or just above canopy, and unlikely to move within the RSH. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Rare	Minimal	**Low**
Nankeen Kestrel	*Falco cenchroides*	-	Observed in subject land	Widespread species often in high densities across varying habitats, but commonly encountered in open woodland and farmland areas. One of the most	Possible	Minimal	**Moderate**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
				commonly encountered species in mortality surveys at established wind farms in Australia. May suffer collision mortality regularly, however populations generally secure and robust to withstand low instances of mortality should it occur.			
Pied Currawong	*Strepera graculina*	-	Observed in subject land	Common altitudinal nomadic species but now more common and widespread within varying habitats. Aggressive and disturbance tolerant species. May suffer collision mortality on occasion, however populations generally secure and robust to withstand low instances of mortality should it occur.	Rare	Negligible	**Low**
Powerful Owl	*Ninox*	V - BC Act	Habitat onsite and potential to occur within the broader locality	Largest of Australia's owls and generally distributed in tall forests east of the Great Dividing Range, and rarely seen in recent times on the western slopes, however this is likely dependent on abundance of suitable hollows and preferred large prey abundance. Generally moves throughout or just above canopy in forested areas, and unlikely to move within the RSH, however some juveniles may disperse further and higher than normal. In the rare event that a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Rare	Minimal	**Low**
Rainbow Lorikeet	*Trichoglossus moluccanus*	-	Observed in subject land	Disturbance tolerant and widespread species within woodland and forest habitats on tablelands and coastal regions. Generally sparse on the tablelands however may suffer collision mortality on occasion. Populations generally secure and robust to withstand low instances of mortality should it occur.	Rare	Negligible	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Red Wattlebird	*Anthochaera carunculata*	-	Observed in subject land	Aggressive honeyeater that inhabits varying coastal habitats and on the edge of it is westerly distribution. Prefers dry forest and woodland habitats. Sparsely distributed throughout the tablelands and unlikely to suffer from collision mortality, however populations generally secure and robust to withstand low instances of mortality should it occur	Rare	Negligible	**Low**
Regent Honeyeater	*Anthochaera phrygia*	CE - BC Act and CE - EPBC Act	Habitat onsite and potential to occur within the broader locality	A highly mobile critically endangered species that is cryptic and nomadic and generally follows blossoming eucalypts and mistletoes through eucalypt forest and woodlands. Associated with the inland/eastern slopes of the Great Dividing Range, particularly Capertee Valley, Bingara/Barraba regions and the Hunter Valley and Central Coast of NSW (Bird Life Australia 2016). Generally sticks to canopies and number of individuals and flights over the turbine locations is likely to be low.	Rare	Minimal	**Low**
Sooty Owl	*Tyto tenebricosa*	V - BC Act	Habitat onsite and potential to occur within the broader locality	Distributed widely but declining and uncommon species within woodlands, fringing forests and rural areas. Generally moves throughout or just above canopy, and unlikely to move within the RSH. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Rare	Minimal	**LOW**
Square-tailed Kite	*Lophoictinia isura*	V - BC Act	Habitat onsite and potential to occur within the broader locality	Uncommon species that inhabits open eucalypt forests and woodlands, often where there is a broken canopy, but it also ranges into nearby open habitats to forage. Generally nests along or near riparian areas. The NSW Scientific Committee (2009) considers that "windfarms may cause occasional collision mortalities of Square-tailed Kites, although this species is a very	Rare	Moderate	**Moderate**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
				manoeuvrable, slow flyer and is probably capable of generally avoiding collisions with turbines blades." Not recorded during site surveys however may occur in future in low densities and at risk of collision. In the unlikely event that collisions occur, impacts to the local population of the species may eventuate.			
Spotted Pardalote	*Pardalotus punctatus*	-	Observed in subject land	Common widespread species within forest canopies and woodlands habitats, that nest within hollows in tunnels on the ground. Unlikely to suffer collision mortality as tends to stick within canopies for foraging and movement, however populations generally secure and robust to withstand low instances of mortality should it occur.	Rare	Negligible	**Low**
Sulphur-crested Cockatoo	*Cacatua galerita*	-	Habitat onsite and potential to occur within the broader locality	Common resident and widespread species within varying timbered habitats. Generally prefer more open space and woodlands and not generally found within dense forests. May occur in large flocks. May suffer collision mortality on occasion, however populations generally secure and robust to withstand low instances of mortality should it occur.	Rare	Negligible	**Low**
Swift Parrot	*Lathamus discolor*	E - BC Act and CE - EPBC Act	Foraging and transient habitat onsite and potential to occur within the broader locality	Highly mobile winter non-breeding migrants to NSW and Vic, Swift Parrots move nomadically through the landscape, using a diversity of foraging habitats within coastal and tableland regions. Generally move along lower slopes and gullies. Likelihood of collision risk is considered very low.	Rare	Minimal	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
Turquoise Parrot	*Neophema pulchella*	V- BC Act	Habitat onsite and potential to occur within the broader locality	Declining species that favours open, grassy woodland with dead trees that fringe large patches of remnant vegetation and near permanent water. A fast flier at a range of heights, this species may be susceptible to collision risk if moving throughout the site. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Rare	Minimal	**Low**
Wedge-tailed Eagle	*Aquila audax*	-	Observed in subject land	Widespread and disturbance tolerant species but most exposed risk of collision due to soaring of thermals whilst foraging. Have been known to be struck at other wind farms in NSW and Vic. Populations generally secure and robust but may suffer collision mortality regularly and therefore, impacts to the local population of the species may eventuate.	Possible	Minimal	**Moderate**
Whistling Kite	*Haliastur sphenurus*	-	Habitat onsite and potential to occur within the broader locality	Widespread species often seen in pairs and commonly encountered in open woodland, farmland areas and wetlands. Generally nests near riparian areas and waterways. May suffer collision mortality on occasion, however populations generally secure and robust to withstand low instances of mortality should it occur.	Unlikely	Minimal	**Low**
White-breasted Woodswallow	*Artamus leucorynchus*	-	Observed in subject land	Widespread species of open woodlands generally close to water. Often seen at foraging at varying heights in small to moderate sized flocks, often with other aerial foragers. At risk of collision as may fly within RSH, however, should a collision occur, its likely only to occur to a very small number of individuals that would be impacted and populations generally	Rare	Negligible	**Low**

Common name	Scientific name	Status	Reasoning	Habitat values and behavioural considerations	Indirect impact - Collision risk		
					Likelihood	Consequence	Risk
				secure and robust to withstand low instances of mortality should it occur.			
White-throated Treecreeper	*Cormobates leucophaea*	-	Observed in subject land	Resident species of forest, woodlands and occasionally rainforest habitats. Generally occurs within low canopy and not at risk of collision.	Rare	Negligible	**Low**
White-throated Needletail	*Hirundapus caudacutus*	V - EPBC Act	Habitat onsite and potential to occur within the broader locality	Widespread non-breeding migratory species within Australia that is an aerial forager, infrequently coming to timbered areas for respite, and therefore often fly within or above RSH. Mortality has been known to occur at other wind farms however is uncommon. Should a collision occur, its likely only to occur to a very small number of individuals that would be impacted	Unlikely	Minimal	**Low**
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	-	Observed in subject land	Common widespread species within a range of eucalyptus and pine dominated woodland and forest habitats. May occur in large flocks and move above around the landscape through RSH. May suffer collision mortality on occasion, however populations generally secure and robust to withstand low instances of mortality should it occur.	Unlikely	Negligible	**Low**

Based on the table above, a total of four species have been assessed as being subject to a Moderate risk of impact resulting from blade strike. Moderate risks relate to either an expectation for more frequent collisions with turbines due to a species proclivity for flights within rotor swept height, or more substantial impacts to local populations due to individuals comprising a more significant and/or substantial portion of the local population.

The four species considered to be subject to a moderate risk of impact from turbine strike, include:

- Little Eagle – Vulnerable, BC Act
- Nankeen Kestrel
- Square-tailed Kite – Vulnerable, BC Act
- Wedge-tailed Eagle

As impacts associated with blade strike are considered somewhat uncertain in accordance with the BAM, and as previously mentioned, adaptive management is required through the preparation and implementation of an operational BBAMP that will be prepared prior to operation of the wind farm.

8.3.3 Updated turbine risk assessment

Following the design changes and the updated layout to reduce the risk of potential operational SAII to certain microbat species, and the impacts of barrier effects adjacent to BHGNR, the potential risk of impact to threatened species associated with turbine placement, barriers to movement and potential collision with turbine blades, has been updated on a per turbine basis (Table 72 below). Factors considered when assessing the risk associated with the turbines prior to any operational mitigation measures and strategies being implemented include:

- Proximity to potential microbat roosts.
- Distance to foraging habitat (<30m, 30-40m, >40m), post construction.
- Connectivity and likely movement pathways.
  - Moderate or high quality movement corridors.
  - Turbines less than, or greater than, 400m apart in context to optimal foraging habitat.
  - Turbine proximity and predicted zone of disturbance (82m blade length plus 50m buffer (132m)).
- Presence of raptor nests.
- Fauna sightings within the development footprint and surrounds.
- Presence of hollow-bearing trees as well as potential owl habitat (assumed and confirmed).
- Proximity to National Park's estate.
- Canopy buffer to rotor swept height (less than, or greater than, 50m).

With the additional, and more detailed hollow bearing tree inventory undertaken to identify an upper quantum of potential impact to candidate owl species credit species (assume present), albeit not for the entire subject land (see Section 5.3.2), it is noted that there are numerous now known hollow bearing trees located within 100 metres of a number turbines. However, as it was assumed a level of hollow bearing trees would likely be present during the original risk assessment, as noted above, the confirmation of the presence of these hollow bearing trees does not alter the turbine risk status by presence alone. A level habitat sterilisation surrounding some turbines had previously been accounted for based on the assumption of presence of hollow-bearing trees. An exception to this, as discussed below, is around turbines is WP7, where a significant cluster of hollow bearing trees, that will be retained, have been confirmed in proximity to this turbines. No evidence was noted during field investigations that these hollows were being utilised currently by common or threatened avifauna. Residual impacts related to this, and other indirect and prescribed impacts, has been accounted for within the generated credit obligation.

A primary objective of the September 2022 targeted owl surveys was to assess the use of clusters of hollow-bearing trees in closer proximity to turbines to determine the potential for impacts to breeding owls. Priority survey locations were predetermined to target the use of hollows by nesting owls in patches of vegetation near the following turbines:

- WP2, WP7, WP8, WP3, WP22, WP30, WP34, WP35, WP40, WP54, WP55, WP57, WP58, WP59, WP61, WP64, WP68, WP70, and along the transverse track.

As outlined in Section 5.4.2, none of the target species were found to be using the surveyed hollows for breeding at the time of survey, and this has been considered in the updated risk assessment included in Table 72 below. Further assessment of the Project's impacts to potential threatened owl breeding habitat is provided in Section 8.3.5 below.

As outlined in Section 7.2.2 above, some previously inaccurate metrics in relation to the distance from the turbine location to foraging habitat for some turbines have been updated. Table 72 has been updated accordingly to reflect the layout changes, recalculated, with more accurate distance to foraging habitat that will remain following commissioning of turbines, as well as the updated hub height (150m) and reduced blade length (82m).

Overall, the updated layout has resulted in a reduction of moderate risk turbines from 29 to 20, and a reduction in overall risk in barrier effects adjacent to BHGNR. As mentioned above, one further turbine (WP7) was upgraded to a moderate risk based on a confirmed hollow bearing tree cluster between 50 and 100 metres from the turbines as a precautionary measure. This enables increased mitigation measures to be implemented at these turbine locations based on the commitments made in Section 8.10.2 below. Opportunities to revise some additional turbines by micro siting during final design will also likely reduce in the reduction in moderate risk turbines further.

Whilst the updated layout and additional field verification of habitats has resulted in an increase in the risk level afforded to one turbine, the overall outcome of the changes to the project layout are considered to be beneficial, and have resulted in additional avoidance and minimisation of impacts to biodiversity values. As outlined above, the removal of turbine WP41 and the relocation of the remaining turbines adjacent to BHGNR (WP35 – WP47) as well as others within the overall project area, have resulted in an increased separation distance between turbines, reducing the potential for barrier effect adjacent to the high condition habitats present within the nature reserve. Furthermore the reduction in total turbine number will have a commensurate benefit to the potential for turbine strike, as will the increased separation distance between the turbines.

Following the implementation of stringent safeguards, including mitigation measures, triggers, curtailment strategies and monitoring periods presented in Section 8.10.2 and Section 7.2.3 of this BDAR, and to be further developed in the Bird and Bat Adaptive Management Plan (BBAMP), it is anticipated that the overall turbine risk for collision and barrier effect impacts will be low. This demonstrated in Table 96 in Section 8.11 below.

Table 93 details the considerations applied when determining risk, in line with multiple parameters stated above, which then determines the level of safeguards required.

Table 71 Qualitative risk consideration for turbines

Risk	Collision Risk	Barrier Effect Risk
Low	Potential unacceptable triggers considered unlikely. Adaptive management and monitoring of impact triggers required within the BBAMP	Negligible impacts on connectivity or for the turbine to influence altered flight behaviour or sterilise habitat for a species
Minimal	Potential unacceptable triggers considered unlikely. Adaptive management and monitoring of impact triggers required within the BBAMP	Minor impacts on connectivity and low potential for turbines to influence altered flight behaviour or sterilise habitat for a species
Moderate	Potential unacceptable triggers considered possible. Stringent mitigation required pending adaptive management to be identified within the BBAMP	Considerable impacts on connectivity and potential for turbines to influence altered flight behaviour or sterilise habitat for a species
High	Potential unacceptable triggers considered probable. Stringent mitigation measures required prior to construction and detailed within BBAMP. Consider relocation or removal of turbines.	Significant impacts on connectivity and likely for turbines to influence altered flight behaviour or sterilise habitat for a species

Table 72 Qualitative risk assessment for turbines for full 70 turbine layout prior to implementation of safeguards

Turbine No.	Dist. to foraging habitat (m)	Feature height (m)	Buffer distance (m)	Original Collison Risk	Original barrier effect risk	Revised Collison Risk	Revised barrier effect risk	Justification
WP1	22.11	23.5	46.42	Moderate	Low	**N/A**	**N/A**	**Removed from project layout**
WP2	55.27	23.5	56.05	Low	Low	Low	Low	Relocated within project layout further away from foraging habitat, increasing buffer.
WP3	62	23.5	58.88	Low	Low	Low	Minimal	Relocated within project layout further away from foraging habitat, increasing buffer distance. Turbine proximity <400m from WP4
WP4	54	23.5	55.54	Moderate	Low	Low	Minimal	Relocated within project layout further away from foraging habitat, increasing buffer distance. Turbine proximity <400m from WP3
WP5	43.07	23.5	51.63	Low	Low	Low	Low	
WP6	35.02	23.5	49.26	Moderate	Low	Moderate	Low	Moderate due to buffer distance <50m and potential movement corridor
WP7	34.53	23.5	49.13	Low	Low	Moderate	Low	Revised to moderate due to number of retained hollow bearing trees and buffer distance <50m. To be considered for relocation 30m NW in final design.
WP8	38.13	23.5	50.12	Low	Low	Low	Low	
WP9	34.22	23.5	49.05	Moderate	Low	Moderate	Low	Moderate due to foraging habitat and buffer distance <50m
WP10	71.12	23.5	63.12	Moderate	Low	Low	Low	Relocated within project layout further away from foraging habitat, increasing buffer distance and turbine proximity
WP11	49.11	23.5	63.70	Moderate	Low	Low	Low	Relocated within project layout further away from foraging habitat, increasing buffer distance and turbine proximity
WP12	37.92	23.5	50.06	Low	Minimal	Low	Minimal	Turbine proximity <400m
WP13	54.16	23.5	55.61	Low	Minimal	Low	Minimal	Turbine proximity <400m
WP14	59.73	23.5	57.68	Low	Minimal	Low	Minimal	Turbine proximity <400m

Turbine No.	Dist. to foraging habitat (m)	Feature height (m)	Buffer distance (m)	Original Collison Risk	Original barrier effect risk	Revised Collison Risk	Revised barrier effect risk	Justification
WP15	43.57	23.5	51.70	Low	Low	Low	Low	
WP16	34.7	23.5	49.17	Moderate	Low	Moderate	Low	Moderate due to buffer distance <50m and potential movement corridor
WP17	33.47	13.5	58.54	Low	Low	Low	Low	
WP18	34.84	23.5	49.21	Moderate	Low	Moderate	Low	Moderate due to buffer distance <50m
WP19	30.8	13.5	57.93	Low	Low	**N/A**	**N/A**	**Removed from project layout**
WP20	38.02	23.5	50.09	Low	Low	Low	Low	
WP21	34.89	23.5	49.22	Moderate	Low	Moderate	Low	Moderate due to buffer distance <50m and potential movement corridor. Within area of thinned vegetation as part approved land management certificate.
WP22	34.9	23.5	49.23	Moderate	Low	Moderate	Low	Moderate due to buffer distance <50m and potential movement corridor
WP23	23	23.5	46.57	High	Low	**N/A**	**N/A**	**Removed from project layout**
WP24	33.49	23.5	48.86	Moderate	Low	Moderate	Low	Moderate due to buffer distance <50m and potential movement corridor
WP25	93.27	23.5	75.17	Low	Low	Low	Low	
WP26	144.10	23.5	109.75	Low	Low	Low	Low	Turbine <400m from WP34 however located in predominantly disturbed landscape reducing risk
WP27	22.47	23.5	46.48	High	Low	**N/A**	**N/A**	**Removed from project layout**
WP28	34.46	23.5	49.11	Moderate	Minimal	Moderate	Minimal	Moderate due to buffer distance <50m and potential movement corridor
WP29	43.46	18.5	56.50	Low	Minimal	Low	Minimal	
WP30	50.89	28.5	54.35	Low	Minimal	Low	Minimal	
WP31	21.15	23.5	46.26	High	Minimal	**N/A**	**N/A**	**Removed from project layout**
WP32	88	18.5	72.10	Moderate	Minimal	Moderate	Minimal	Moderate due to buffer distance <50m and proximity to BHGNR
WP33	32.74	23.5	48.67	Moderate	Minimal	Moderate	Minimal	Moderate due to buffer distance <50m and proximity to BHGNR
WP34	35.18	18.5	54.12	Low	Minimal	Low	Low	Revised due to >400m distance between turbines WP 35 and WP34

Turbine No.	Dist. to foraging habitat (m)	Feature height (m)	Buffer distance (m)	Original Collison Risk	Original barrier effect risk	Revised Collison Risk	Revised barrier effect risk	Justification
WP35	135.02	23.5	103.02	Low	Minimal	Low	Minimal	Relocated within project layout.
WP36	44.22	23.5	51.93	Moderate	Minimal	Low	Minimal	Relocated within project layout further away from foraging habitat, increasing buffer distance. Turbine proximity <400m
WP37	38.27	18.5	54.96	Moderate	Minimal	Low	Minimal	Relocated within project layout. Revised to Low as moving further away from foraging habitat, increased buffer, however <400m spacing
WP38	77.98	23.5	66.60	Moderate	Minimal	Low	Minimal	Relocated within project layout. Revised to Low as moving further away from foraging habitat, increased buffer, however <400m spacing
WP39	70.90	23.5	63.01	Moderate	Minimal	Low	Low	Relocated within project layout. Revised to Low as moving further away from foraging habitat, increased buffer, and >400m spacing
WP40	43.11	18.5	56.39	Moderate	Minimal	Moderate	Minimal	Relocated within project layout. Moving further away from foraging habitat, increased buffer, >400m spacing, and increased gap between WP 42 Remains moderate due to proximity to BHGNR
WP41	39.16	13.5	60.01	Moderate	Minimal	**N/A**	**N/A**	**Removed from project layout**
WP42	59.27	13.5	66.81	Moderate	Minimal	Moderate	Minimal	Relocated within project layout. Remains moderate due to movement corridor. Within 100m of BHGNR (~90m).
WP43	39.1	18.5	50.40	Moderate	Minimal	Moderate	Minimal	Relocated within project layout. Moving further away from foraging habitat, increased buffer, and >400m spacing, and increased gap between WP 42 and WP44. Within 100m of BHGNR (~90m).
WP44	169.12	23.5	129.20	Low	Low	Low	Low	Relocated within project layout.
WP45	41.02	23.5	55.74	Low	Low	Low	Low	Relocated within project layout to ensure >400m spacing and buffer >50m
WP46	140.31	23.5	106.92	Low	Low	Low	Low	Relocated within project layout

Turbine No.	Dist. to foraging habitat (m)	Feature height (m)	Buffer distance (m)	Original Collison Risk	Original barrier effect risk	Revised Collison Risk	Revised barrier effect risk	Justification
WP47	100.02	23.5	79.26	Low	Low	Low	Low	Relocated within project layout
WP48	41.29	23.5	51.07	Low	Low	Low	Low	
WP49	34.98	23.5	49.25	Moderate	Low	Moderate	Low	Moderate due to buffer distance <50m. Will be revised and relocated during final design which may result in a lower risk.
WP50	35.37	23.5	49.35	High	Low	Moderate	Low	**Previously high risk for collision** Relocated within project layout away from potential microbat roost sites
WP51	34.60	23.5	49.15	Moderate	Low	Moderate	Low	Moderate due to buffer distance <50m and turbine proximity <400m
WP52	68.19	23.5	61.71	Low	Low	Low	Low	
WP53	38.23	18.5	54.94	Low	Low	Low	Low	
WP54	36.15	23.5	49.56	Low	Low	Low	Low	
WP55	161.17	23.5	122.89	Low	Low	Low	Low	
WP56	93.9	23.5	75.54	Low	Low	Low	Low	
WP57	39.46	23.5	50.51	Low	Low	Low	Low	
WP58	33.26	23.5	48.80	Moderate	Low	Moderate	Minimal	Moderate due to buffer distance <50m and < 400m spacing. Will be revised and relocated during final design which may result in a lower risk.
WP59	35.13	23.5	49.29	Moderate	Low	Moderate	Minimal	Moderate due to buffer distance <50m and < 400m spacing
WP60	50.22	23.5	54.10	Low	Low	Low	Low	
WP61	35.01	23.5	49.26	Moderate	Low	Moderate	Low	Moderate due to buffer distance <50m
WP62	55.81	23.5	56.26	Low	Low	Low	Low	
WP63	38.50	23.5	50.23	Low	Low	Low	Low	
WP64	78.22	23.5	66.61	Moderate	Low	Low	Low	Relocated within project layout. Moving further away from foraging habitat, increased buffer,
WP65	38.24	23.5	50.15	Low	Low	Low	Low	
WP66	44.98	23.5	52.26	Low	Low	Low	Low	

Turbine No.	Dist. to foraging habitat (m)	Feature height (m)	Buffer distance (m)	Original Collison Risk	Original barrier effect risk	Revised Collison Risk	Revised barrier effect risk	Justification
WP67	113.66	23.5	88.06	Low	Low	Low	Low	
WP68	51.78	23.5	54.69	Low	Low	Low	Low	
WP69	54.66	23.5	55.80	Low	Low	Low	Low	
WP70	64	23.5	59.77	Moderate	Low	Low	Low	Relocated within project layout. Moving further away from foraging habitat, increased buffer,

Based on the table above, a total of four turbines were originally assessed as representing a High risk of impact to threatened species (WP23, WP27, WP31, WP50), based largely on proximity to threatened microbat and potential owl breeding habitat, and also relating to their location, canopy buffer and surrounding intact vegetation. Three of these turbines (WP23, WP27, WP31) have all subsequently been removed from the project due in a large part to the high level of risk to biodiversity values assessed as part of the above analysis. WP50 has also been substantially relocated to ensure no direct or indirect impacts will occur within the 100 metre BAM prescribed microbat breeding habitat buffer on adjacent habitat, reducing its risk to moderate. The removal of these turbine from the Project means that serious and irreversible impacts to microbats are unlikely to occur as a result of development in proximity to confirmed potential breeding habitat. The High risk rating for WP50 has been downgraded to moderate, however a high level of monitoring an additional mitigation will occur from the outset given it is the closest turbine to potential microbat breeding habitat (refer Section 8.10 for further detail).

Three additional turbines (WP1, WP19 and WP41) have also been removed from the Project which has resulted in decreased direct and indirect impacts to biodiversity values, and turbines WP2 and WP47 have also been relocated or re-orientated resulting in reduced impacts to biodiversity values. Removing WP19 creates a gap of over 2 kilometres between turbine WP18 and turbines WP20-22, and the removal of WP19 allows for an approximate 600 metre reduction of the intrusion into intact vegetation to the south of the development footprint, allowing more available airspace for aerial fauna around the southern extent of the wind farm corridor. the removal of WP41 also creates a large 1.2 kilometre gap between WP40 and WP42, adjacent to BHGNR. The removal of turbines WP19, WP23, WP27, WP31 and WP41 have resulted in reduced impacts to habitat connectivity in the southern portion of the development footprint. More information is provided in Section 8.5.

In total, 24 turbines have been assessed as representing a Moderate collisions risk based on current data and assessment (down from a previous 30 turbines prior to layout adjustments). Additional operational mitigation strategies have been developed for higher risk turbines and with tier triggers outlined in Section 8.9 and 8.10 of this BDAR. The remaining 40 turbines have been assessed as Low risk however will also be subject to additional mitigation strategies to reduce potential impacts to threatened species.

8.3.4 Barrier effect risk assessment

In order to predict and account for the uncertainty of the impacts of barrier effects, a precautionary approach was undertaken. The criteria used to establish likelihood of impact and potential consequences of barrier effects and altered flight behaviour at a species level is based largely on;

- Animal behaviour (including forage flight characteristics (refer Table 46 for microbats)).
- Landscape setting (topography, distance to habitat),
- Turbine clusters within zones.
- Individual turbine spacing accounting for blade to blade width and assumed zone of disturbance (maximum of 135m from the rotor hub).

Where individual spacing (<200m) and/or potential zone of disturbance overlap or become in close proximity to each other, this represents identified turbines clusters that may have a slight increase in an inherent risk associated with barrier effects or altered flight behaviour. Some evidence suggests from studies at windfarms abroad that turbines to closely spaced (<200m) did have a mild effect of flight behaviour, with a preference for routes taken between turbines spaced between 200-400m apart (Tulp et al. 1999 and Percival 2001). It should be noted that these studies were based on seabirds and offshore wind farms, however directly comparable data is lacking (i.e. Australian studies). It does however illustrate that birds will fly between turbines where sufficient space exists.

The zoning of turbines represent the western, central and northern zones of the subject land as defined below and shown in Figure 25;

- Western Zone –WT 2 to WT 18
- Central Zone – WT 20 to WT 48
- Northern Zone – WT 49 to WT 70

Table 75 demonstrates the overall risk assessment on individual species that are known or may occur within the subject land is low, taking into account parameters mentioned above. Risk associated with turbine clusters or and individual turbines is demonstrated in Table 72. Although the overall risk of barrier effects and altered flight behaviour based on the information available and literature review is considered low (refer Section 8.5 for further detail), adaptive management, additional mitigation and compensatory measures may be required should a residual impact resulting from barrier effects occur. Following completion of baseline monitoring, and during operational monitoring, if there is a noted discernible statistical reduction or anomaly in abundance of an at risk or threatened species, additional investigations into possible causes would occur. If it is determined that the operational wind farm was a key factor, additional assessment against key relevant Test of Significance criteria or Significant Impact Criteria would be used to quantify or measure the level of impact, and if determined that an event resulting from barrier effects warranted additional mitigation, compensatory measures or species specific offsetting, these would be employed. This detail and decision framework will be provided within the Bird and Bat Adaptive Management Plan (BBAMP).

Furthermore, and as outlined in 7.1.1 above, following consultation with BCS around the potential for indirect impacts including habitat sterilisation and barrier effect adjacent to BHGNR, WP41 has been removed from the project. Removal of WP41 has allowed for increased spacing of turbines adjacent to the nature reserve (WP35 – WP47) to minimise the potential for indirect impacts associated with barrier effect adjacent to the high quality habitats withing the Nature Reserve, and to proportionally reduce the potential for collision risk across the project. Removal of WP41 and relocation of WP35 – WP47 has allowed for turbines adjacent to BHGNR to achieve a minimum 400 metre spacing (WP38-WP47), and also creates a 1.2 kilometre east-west corridor between turbines WP40 and WP42.

This project update is considered to substantially reduce the potential for barrier effect (barriers to species movements) adjacent to BHGNR, considered a higher risk area, and across the subject land more broadly.

Additionally, detailed prescribed impact assessment in relation to connectivity and barrier effects can be found in Sections 8.3.1, 8.3.2 and 8.5.1.

Table 73 Qualitative risk assessment criteria for likelihood and consequences of the impacts associated with barrier effects, connectivity or altered flight behaviour

Likelihood	Criteria	Consequence	Criteria
Rare	An event may occur only in unusual circumstances (<5%).	**Negligible**	Negligible impacts to connectivity or for the potential for altered flight behaviour or habitat sterilisation for a local population.
Unlikely	An event could occur during some circumstances (>5 - <50%).	**Minimal**	Minor impacts to connectivity resulting in the potential for altered flight behaviour or habitat sterilisation for a local population.
Possible	An event could occur during most circumstances (>50% - <95%).	**Moderate**	Considerable impacts to connectivity resulting possible altered flight behaviour or habitat sterilisation for a local population.

Likelihood	Criteria	Consequence	Criteria
Probable	An event is expected to occur in most circumstances (>95%).	**Significant**	Significant loss of connectivity resulting in substantial altered flight behaviour or habitat sterilisation for a local population.

Table 74 Qualitative risk assessment matrix for significance of impacts associated with barrier effects, connectivity or altered flight behaviour

Likelihood	Consequence			
	Negligible	**Minimal**	**Moderate**	**Significant**
Rare	Low	Low	Moderate	High
Unlikely	Low	Low	Moderate	High
Possible	Low	Moderate	High	High
Probable	Moderate	High	High	High

Table 75 Qualitative risk assessment for potential barrier effect impacts to birds and bats

Common name	Scientific name	Status	Western Zone			Central Zone			Northern zone		
			Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk
Australian Magpie	*Cracticus tibicen*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Australian Raven	*Corvus coronoides*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Barking Owl	*Ninox connivens*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Rare	Minimal	**Low**
Black Kite	*Milvus migrans*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**
Brown Falcon	*Falco berigora*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**
Brown Goshawk	*Accipiter fasciatus*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Chocolate Wattled Bat	*Chalinolobus morio*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Crimson Rosella	*Platycercus elegans*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Dusky Woodswallow	*Artamus cyanopterus*	V - BC Act	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
Eastern Bent-winged Bat	*Miniopterus orianae oceanensis*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Rare	Minimal	**Low**
Eastern Broad-nosed Bat	*Scotorepens orion*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
Eastern Cave Bat	*Vespadelus troughtoni*	V - BC Act	Unlikely	Negligible	**Low**	Unlikely	Minimal	**Low**	Unlikely	Negligible	**Low**

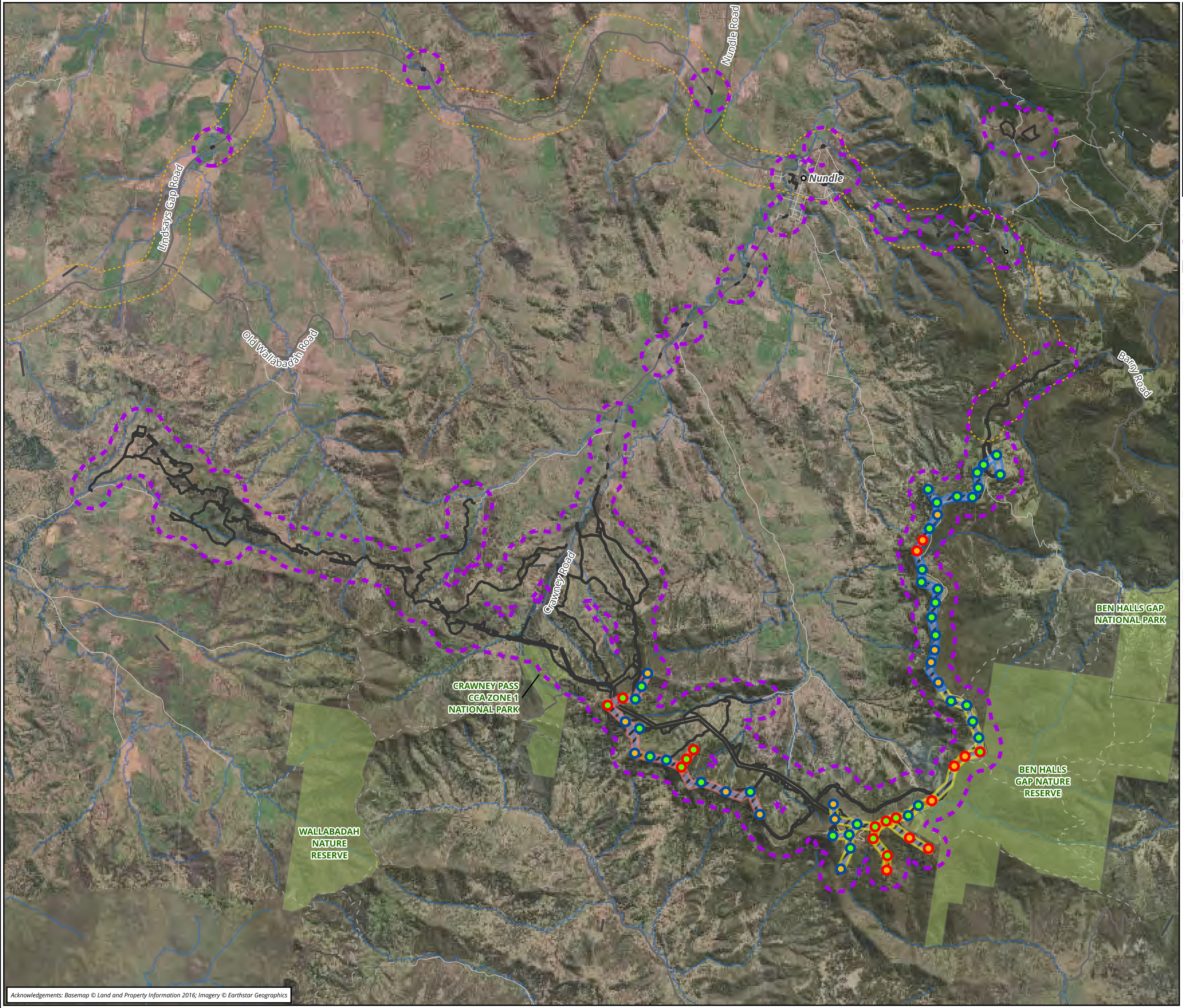
Common name	Scientific name	Status	Western Zone			Central Zone			Northern zone		
			Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Rare	Minimal	**Low**
Fork-tailed Swift	*Apus pacificus*	M	Rare	Minimal	**Low**	Rare	Minimal	**Low**	Rare	Minimal	**Low**
Flame Robin	*Petroica phoenicea*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**
Galah	*Eolophus roseicapilla*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Glossy Black Cockatoo	*Calyptorhynchus lathami*	V - BC Act	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
Golden-tipped Bat	*Phoniscus papuensis*	V - BC Act	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Gould's Wattled Bat	*Chalinolobus gouldii*	-	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V - BC Act	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
Grey-headed Flying Fox	*Pteropus poliocephalus*	V - BC Act and V- EPBC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**
Inland Broad-nosed Bat	*Scotorepens balstoni*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**

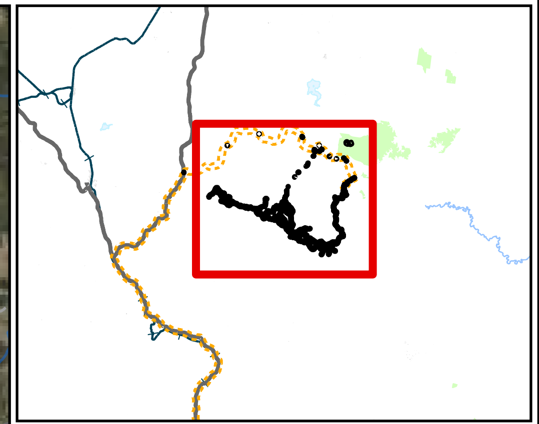
Common name	Scientific name	Status	Western Zone			Central Zone			Northern zone		
			Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk
Inland Free-tailed Bat	*Ozimops petersi*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
Large-eared Pied Bat	*Chalinolobus dwyeri*	V - BC Act and V - EPBC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Rare	Negligible	**Low**
Large Forest Bat	*Vespadelus darlingtoni*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
Laughing Kookaburra	*Dacelo novaeguineae*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Little Broad-nosed Bat	*Scotorepens greyii*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Little Bent-winged Bat	*Miniopterus australis*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Negligible	**Low**
Little Eagle	*Hieraaetus morphnoides*	-	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**
Little Forest Bat	*Vespadelus vulturnus*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
Little Lorikeet	*Glossopsitta pusilla*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**
Little Pied Bat	*Chalinolobus picatus*	V - BC Act	Rare	Minimal	**Low**	Rare	Minimal	**Low**	Rare	Minimal	**Low**

Common name	Scientific name	Status	Western Zone			Central Zone			Northern zone		
			Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk
Little Wattlebird	*Anthochaera chrysoptera*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Masked Owl	*Tyto novaehollandiae*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Rare	Negligible	**Low**
Nankeen Kestrel	*Falco cenchroides*	-	Possible	Negligible	**Low**	Possible	Negligible	**Low**	Possible	Negligible	**Low**
Northern Free-Tailed Bat	*Ozimops lumsdenae*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Pied Currawong	*Strepera graculina*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Powerful Owl	*Ninox*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Rare	Negligible	**Low**
Rainbow Lorikeet	*Trichoglossus moluccanus*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Red Wattlebird	*Anthochaera carunculata*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Regent Honeyeater	*Anthochaera phrygia*	CE - BC Act and CE - EPBC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Rare	Negligible	**Low**
Ride's Free-Tailed Bat	*Ozimops ridei*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**

Common name	Scientific name	Status	Western Zone			Central Zone			Northern zone		
			Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk
Smaller Horseshoe Bat	*Rhinolophus megaphyllus*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Sooty Owl	*Tyto tenebricosa*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Rare	Negligible	**Low**
South-eastern Free-tailed Bat	*Ozimops planiceps*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
Southern Forest Bat	*Vespadelus regulus*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
Southern Myotis	*Myotis macropus*	V - BC Act	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Square-tailed Kite	*Lophoictinia isura*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**
Spotted Pardalote	*Pardalotus punctatus*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Sulphur-crested Cockatoo	*Cacatua galerita*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
Swift Parrot	*Lathamus discolor*	E - BC Act and CE - EPBC Act	Rare	Minimal	**Low**	Rare	Minimal	**Low**	Rare	Negligible	**Low**
Turquoise Parrot	*Neophema pulchella*	V- BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Negligible	**Low**

Common name	Scientific name	Status	Western Zone			Central Zone			Northern zone		
			Likelihood	Consequence	Risk	Likelihood	Consequence	Risk	Likelihood	Consequence	Risk
Wedge-tailed Eagle	*Aquila audax*	-	Possible	Negligible	**Low**	Possible	Negligible	**Low**	Possible	Negligible	**Low**
Whistling Kite	*Haliastur sphenurus*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**
White-breasted Woodswallow	*Artamus leucorynchus*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Rare	Negligible	**Low**
White-striped Free-tailed bat	*Austronomus australis*	-	Possible	Negligible	**Low**	Possible	Negligible	**Low**	Possible	Negligible	**Low**
White-throated Treecreeper	*Cormobates leucophaea*	-	Rare	Negligible	**Low**	Rare	Negligible	**Low**	Rare	Negligible	**Low**
White-throated Needletail	*Hirundapus caudacutus*	V - EPBC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**
Yellow-bellied Sheath-tailed Bat	*Saccolaimus flaviventris*	V - BC Act	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**	Unlikely	Minimal	**Low**
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	-	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**	Unlikely	Negligible	**Low**





Legend

- Landscape assessment buffer (study area)
- Infrastructure footprint
- Transport haul routes
- 85m zone of distrubance
- 135m zone of disturbance

Barrier effect risk

- Low
- Minimal

Collision risk

- Low
- Moderate

Wind turbine barrier effect risk

- Minimal
- Negligible

Zone

- Central
- Northern
- Western

Figure 25 Turbine risk assessment, Page 1

0 1,250 2,500 3,750 5,000

Meters

N

Scale: 1:100,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis.

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F25_BarrierEffects
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

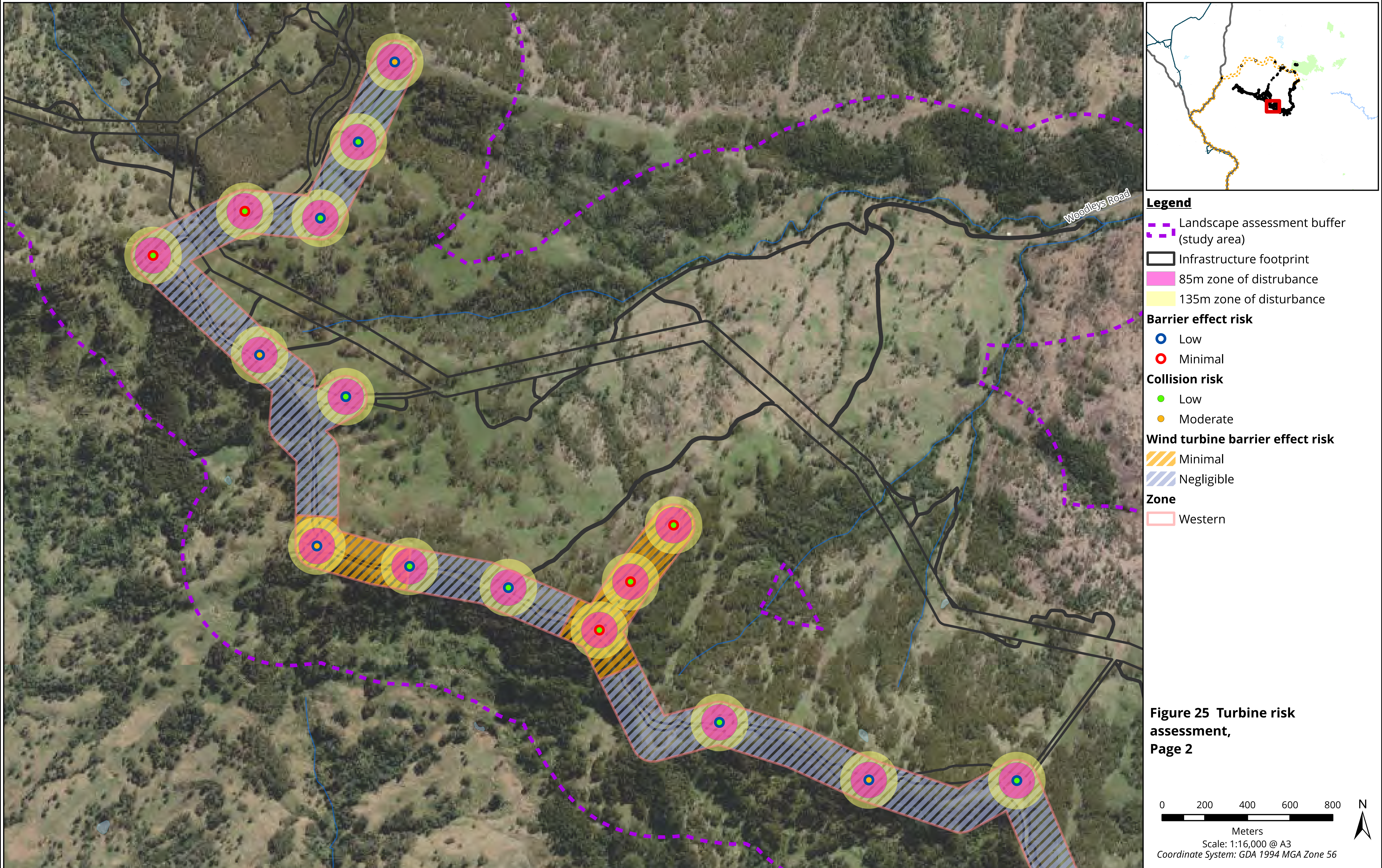


Figure 25 Turbine risk assessment, Page 2

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F25_BarrierEffects
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

Legend

- Landscape assessment buffer (study area)
- Infrastructure footprint
- 85m zone of distrubance
- 135m zone of disturbance

Barrier effect risk

- Low
- Minimal

Collision risk

- Low
- Moderate

Wind turbine barrier effect risk

- Minimal
- Negligible

Zone

- Central

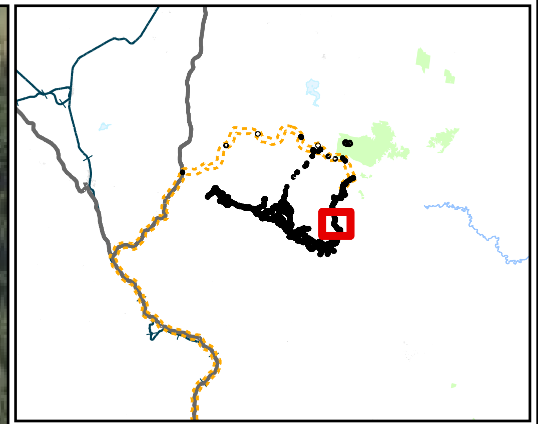
Figure 25 Turbine risk assessment, Page 3

0 200 400 600 800
Meters
Scale: 1:16,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis.

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F25_BarrierEffects
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

- Landscape assessment buffer (study area)
- Infrastructure footprint
- 85m zone of distrubance
- 135m zone of disturbance

Barrier effect risk

- Low

Collision risk

- Low
- Moderate

Wind turbine barrier effect risk

- Negligible

Zone

- Central
- Northern

Figure 25 Turbine risk assessment, Page 4

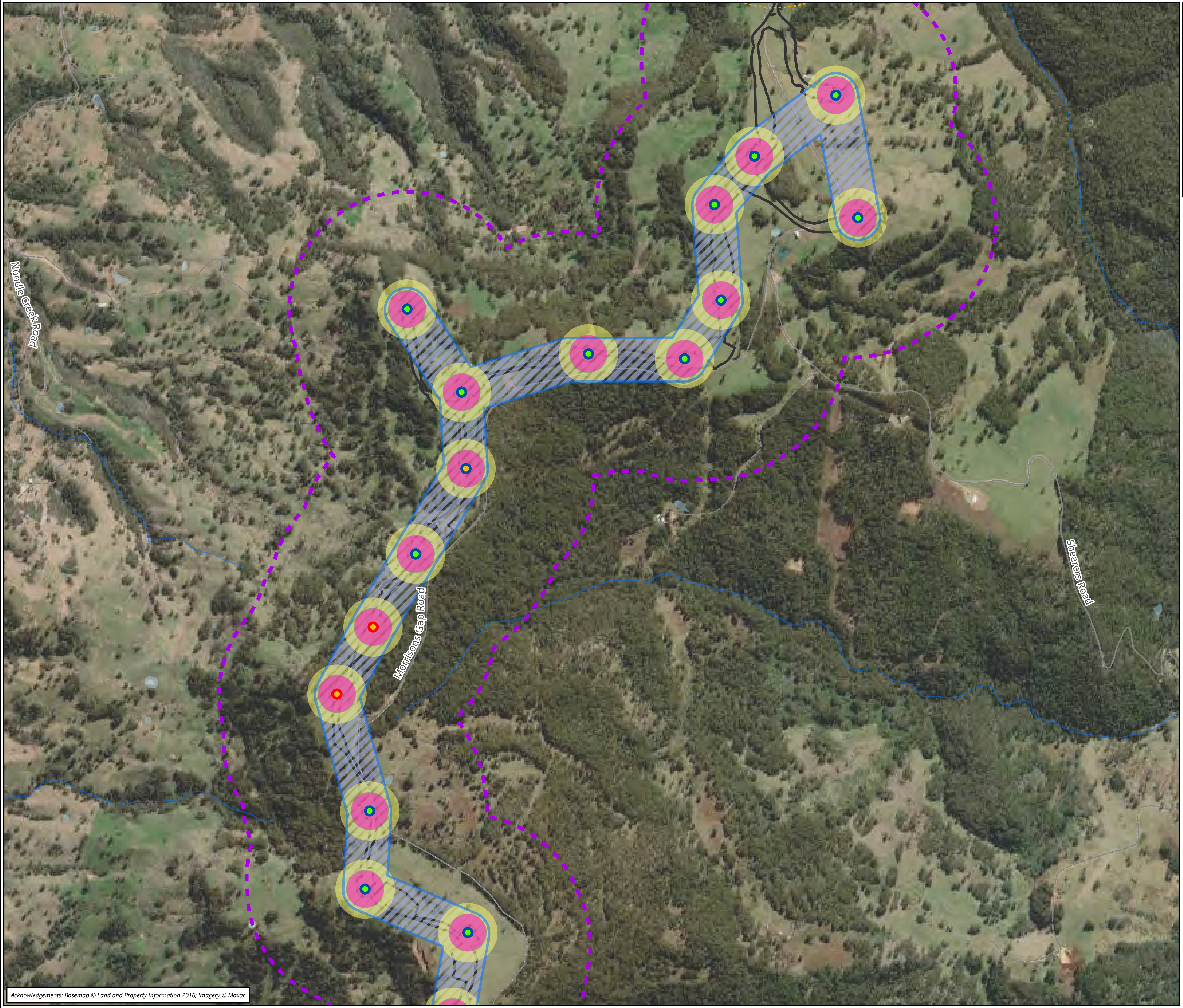
0 200 400 600 800 N

Meters

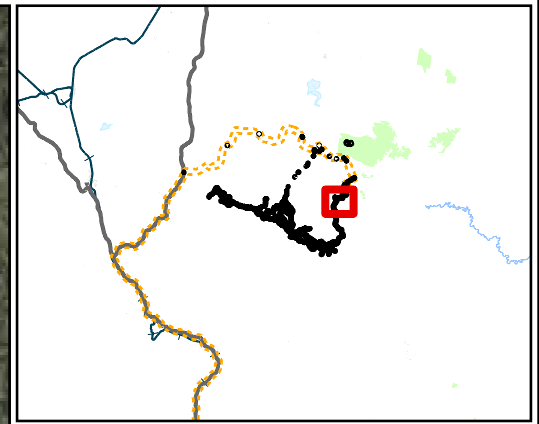
Scale: 1:16,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F25_BarrierEffects
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Acknowledgements: Basemap © Land and Property Information 2016; Imagery © Maxar



Legend

- Landscape assessment buffer (study area)
- Infrastructure footprint
- Transport haul routes
- 85m zone of distrubance
- 135m zone of disturbance

Barrier effect risk

- Low
- Minimal

Collision risk

- Low
- Moderate

Wind turbine barrier effect risk

- Negligible

Zone

- Northern

Figure 25 Turbine risk assessment, Page 5

0 200 400 600 800

Meters

Scale: 1:16,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 26 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F25_BarrierEffects
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

8.3.5 Impact to potential owl breeding habitat

As outlined in Section 5.3.2 and Section 5.4.2 targeted habitat surveys for potential large forest owl breeding habitat was undertaken over a total area of approximately 360 hectares of potential habitat within and surrounding the development footprint, with a total of 157 potential nest trees recorded within the area assessed. Targeted surveys were completed during the course of the major field campaign, and follow-up additional surveys, comprising a total of:

- Eight nights nocturnal surveys within breeding season (across multiple years) for Barking Owl, Powerful Owl, Masked Owl and Sooty Owl, employing a combination of the methods outlined above.
- Five nights outside breeding season (November and March) for Powerful Owl, Masked Owl and Sooty Owl, two of which (November) occur within the breeding season for Barking Owl, employing spotlighting and call-playback.
- Multiple diurnal searches (over approximately 45 days) within and outside breeding season, searching for evidence of owls and hollow utilisation (as described above).

The results of the above survey effort found one record of Masked Owl, heard calling in September 2022, and no other evidence of the target species, other than a handful of areas of whitewash, that were not able to be confirmed in relation to the species that had been present.

As outlined in Section 5.5 and Section 8.1 the Project's impacts to Barking Owl, Masked Owl and Powerful Owl have been assessed as 84.57 hectares (associated with larger numbers of PCTs), 16.29 hectares, and 17.26 hectares respectively, which is considered a substantial overestimation of impacts to actual breeding habitat for the species, due in large to portions of the development footprint not being able to be surveyed to the level required to confirm presence/absence. Where areas could not be surveyed to the level required, either to exclude the presence of hollow-bearing trees, or be subject to nocturnal survey to ascertain the likely use of the hollows, the target species have been assumed present and impacts have been considered to have occurred.

It should be highlighted that the area of potential habitat and assumed impact is much greater than the likely area of habitat actually utilised by the target owl species. Home ranges of breeding individuals have been reported as; 255 hectares for Barking Owl (Taylor et al 2002, NPWS 2003), 350 hectares for Powerful Owl (Kavanagh 1997, DEC 2006), and at least 400 hectares for Masked Owl (DEC 2006), suggesting very few pairs would occur within, and surrounding, the subject land during breeding season. This then suggests that a commensurately low number of potential nest trees would be being used for breeding.

As requested in the September 2022 BCS RFI, targeted nocturnal surveys were undertaken to ascertain the use of mapped tree hollows for breeding purposes by large forest owls, which if confirmed would represent a notable impact if directly removed, or significant constraint to operational turbines during breeding season. September 2022 nocturnal surveys, or any other surveys undertaken during owl breeding season, did not record any hollows being used (or any evidence of hollows being used) for breeding by any of the four target large forest owl species within or surrounding the development footprint. It is acknowledged however that some potential remains due to the large number of potential breeding trees, the large size of the development footprint, and the presence of Masked Owl during breeding season, and as such the Proponent remains committed to undertaking further survey work prior to construction to further assess the presence of owl nest trees. The specifications will be detailed in the BMP or BBAMP and will include mitigation and/or offsetting commitments of a nest tree is discovered and is considered likely to be impacted.

8.3.6 Summary of collision risks and indirect impacts

The following provides a summary and conclusions for impacts relating to possible bird and bat collision with wind turbines.

- The vast majority of bird and bat species recorded or have the potential to utilise the vegetation within or surrounding the subject land are considered to have a low or negligible risk of collision mortality, with no significant broader impacts to regional populations anticipated.
- Nine species of microbats are considered to be subject to a moderate risk of impact from turbine strike, and include:
  - White-striped Free-tailed bat (not listed).
  - Large-eared Pied Bat – Vulnerable, BC Act and Vulnerable, EPBC Act.
  - Eastern False Pipistrelle – Vulnerable, BC Act.
  - Eastern Coastal Free-tailed Bat – Vulnerable, BC Act.
  - Little Bent-winged Bat – Vulnerable, BC Act.
  - Eastern Bent-winged Bat – Vulnerable, BC Act.
  - Yellow-bellied Sheath-tailed Bat – Vulnerable, BC Act – Vulnerable, BC Act.
  - Greater Broad-nosed Bat – Vulnerable, BC Act.
  - Little Broad-nosed Bat (not listed).
- Four species of birds are considered to be subject to a moderate risk of impact from turbine strike, and include:
  - Little Eagle – Vulnerable, BC Act.
  - Nankeen Kestrel.
  - Square-tailed Kite – Vulnerable, BC Act.
  - Wedge-tailed Eagle.
- There are no bird or bat species that are considered to be subject to be a high risk of collision mortality.
- Potential low level impacts to habitat connectivity for migratory bird and bat species, and/or long-range foragers, for species recorded within the development footprint, or considered highly likely to occur.
- All known or predicted bird and bat species within the subject land have low or negligible risk associated with barrier effects or avoidance behaviour resulting from aerial fauna flying near/within the zone of disturbance or from habitat sterilisation surrounding the operational wind turbines.
- However, where individual spacing and potential zone of disturbance overlap or become in close proximity to each other, this represents identified turbines clusters that may have a slight increase in an inherent risk associated with barrier effects or altered flight behaviour in that area.
- No large forest owls have been recorded breeding within hollows to be impacted by the Project. One Masked Owl was recorded during breeding season in September 2022, however it was on top of a large escarpment along the south-western boundary of the development footprint, and a specific hollow being used was unable to be determined.

- The protection, management and enhancement of vegetation and fauna habitat outside the approved disturbance areas within or surrounding the subject land toward a benchmark state will contribute to effectively minimising indirect impacts.

The magnitude of known and expected impacts to threatened species resulting from prescribed and indirect impacts is not considered to be significant enough to warrant additional offsetting. Further offsetting may be considered as part of ongoing adaptive management if trigger levels are realised which are determined to be of a level significant enough to warrant additional offsets. These trigger levels referred to in Section 8.3.4 will be developed in further detail during the preparation of the BBAMP, but are discussed further in Section 8.10.

As outlined in Section 5.4.2 a combination of acoustic call data analysis, desktop/on-ground assessment of potential habitat locations, and geomorphological analysis and advice has been undertaken to determine the likelihood of microbat species roosting and/or potentially breeding within the development footprint or immediate surrounds.

Call data was analysed based on the time each call was recorded relative to sunset/sunrise to assess potential correlations that suggest bats may be roosting within, or in the vicinity of, the development footprint. It could be expected that if bats were roosting within the development footprint, calls would be clustered around sunset when the bats are exiting the roost for nightly forage activity, especially so give the proximity of the majority of the detectors to areas of possible microbat habitat. Furthermore, if bats were roosting elsewhere in the landscape and travelling to the site as part of foraging activity, calls would be expected to be less clustered towards sunset and be spread more throughout the remainder of the night. It could also be expected that if bats were roosting in the immediately vicinity of the development footprint there would be another spike in activity before dawn.

Based on the analysis of the time ranges which species' calls were recorded (refer Section 5.4.2), it is concluded that whilst some species, including Large Bent-winged Bat, Little Bent-winged Bat and White-striped Free-tailed Bat, are arriving on site during the early parts of the night, there is no clear evidence to suggest that regularly utilised roosts are present within the development footprint or immediate surrounds. There are no strong correlations around sunset, and many of the calls are occurring after twilight and later into the night.

Desktop and on-ground assessment of areas of potential microbat cave roosts found two areas to support high potential for roosting and potentially breeding bats within the subject land. These areas comprised a steep cliffline on the southern portion of the development footprint and pillar like outcrop with many deep and vertical fissures in the central/eastern portion of the development footprint, both outside the development footprint. No direct evidence of bats, such as guano or odours, were recorded at either habitat feature, suggesting the features were not currently utilised by microbats, but the potential for their use into the future exists. The Geomorphological assessment found that whilst the development footprint and broader landscape are likely to support a diverse range of rocky terrain forming many opportunities for potential microbat habitat, there were unlikely to be any large caves present proximal to the development footprint, and that the development footprint in no way stood out as supporting particularly higher quality habitat than the surrounding landscape (Environmental Geosurveys 2021).

It is concluded that whilst roosting opportunities may exist for both cave dependent and non-cave dependent microbat species within and immediately surrounding the development footprint, the potential for large roost sites is low, and that roosting opportunities (both rocky and within tree hollows) are unlikely to be limited in the wider landscape. As such, the potential for the development to result in significant or substantial impacts to microbat roosts is considered low.

Limitations of the field investigation relating to microbat trapping surveys to attempt to determine the presence of breeding bats within the development footprint are provided in Section 5.4.2. However, to address the potential for impacts to breeding bats, call data and temporal abundance/activity within the development footprint was analysed for the four BAM species credit bats, which are considered at highest risk from potential impacts to breeding habitat/activity. Each of these four species of microbat; Large-eared Pied Bat, Large Bent-winged Bat, Little Bent-winged Bat and Eastern Cave Bat are known to seasonally migrate to colonial maternity sites, with Large Bent-winged Bat and Little Bent-winged Bat known to travel large distances and congregate in large numbers. Due to this behaviour of communal breeding, activity data can be used to infer whether bats are present or absent from the development footprint during known breeding season, and to determine relative level of activity before during and after these seasons.

Relative abundance of Large-eared Pied Bat indicates that breeding roosts are unlikely to be present within or immediately surrounding the development footprint as higher levels of activity would be expected in November, with activity levels dropping in late March. Neither of these trends were observed for the species. Eastern Cave Bat can be seen to be most active within the project area in April, with low levels of activity recorded in February and March. Little is known about the breeding biology of this species; however, it could be expected that some activity would have been recorded in November if maternity roosts were present. Large Bent-winged Bat activity suggests that individuals occurring within the project area are unlikely to be breeding females, who are known to leave maternity roosts in February, which would lead to a reduction in activity through March and into April. Little Bent-winged Bat activity shows little evidence to suggest breeding behaviour in the immediately vicinity of the development footprint, and that overall activity for the species is comparatively low. Furthermore, Little Bent-winged Bat is known to co-occur in maternity roosts with Large Bent-winged Bat, especially in colder environment, and based on activity data for Large Bent-winged Bat, there is again little evidence to suggest either species is breeding in the area.

Whilst it is acknowledged that without trapping surveys, microbat breeding activity cannot be conclusively ruled out from occurring within and surrounding the project area, however analysis temporal activity patterns do not suggest that this is occurring. It is concluded that based on the low potential for large numbers of bats roosting in the immediate vicinity of the development footprint, combined with the lack of evidence to suggest microbats are congregating within the development footprint during known breeding seasons, that the potential for impacts to breeding microbats as a result of the development are low.

These conclusions are based on the evidence outlined in this BDAR and the trends observed which do not show strong signs of breeding and/or large scale roosting behaviour. Furthermore, the development and implementation of the BBAMP will allow for these conclusions to be tested with stringent adaptive management criteria through the operational phases of the project.

8.3.7 Disturbance of habitats from noise and light

Habitats within and adjacent to the development footprint are likely to be subject to some increased disturbance from noise and light, primarily during the construction phase of the project. Noise and light impacts during operation will be negligible, with limited impacts to native fauna from the operation of the wind turbines. There may be some minor impacts associated with lighting of access tracks, site offices and other ancillary sites during operation, however these can be mitigated through lighting design measures.

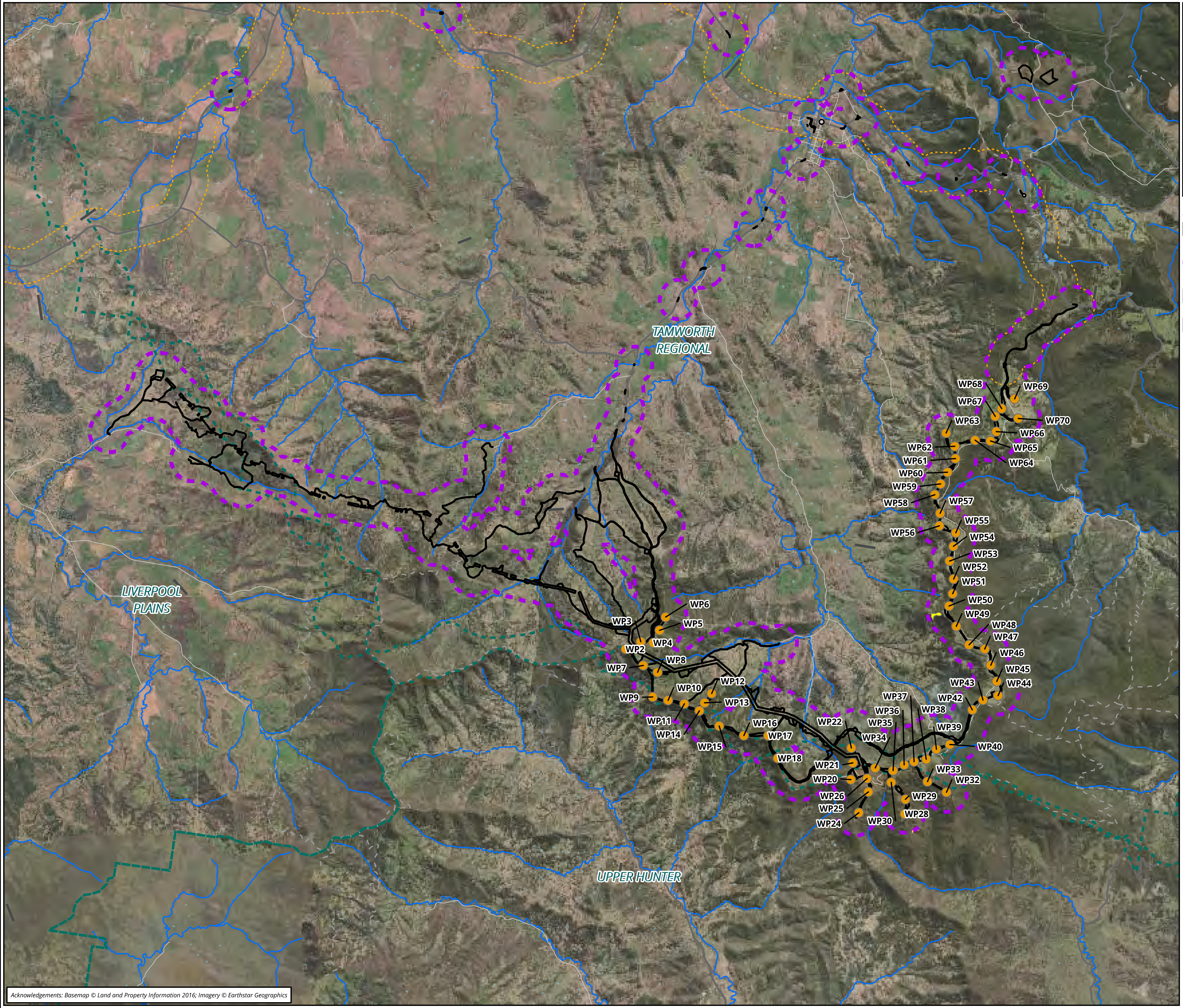
The majority of the threatened fauna that have been identified to be potentially impacted by the project are nocturnal, so measures to manage noise and light from construction at night will be implemented. Aviation hazard lighting is not expected to have an impact on nocturnal fauna using the habitats within and adjacent to the development footprint. Considering the high elevation of the turbines and implementation of shields, any light spill is unlikely to occur below the tree canopy impacting on the behaviour of any terrestrial or arboreal fauna.

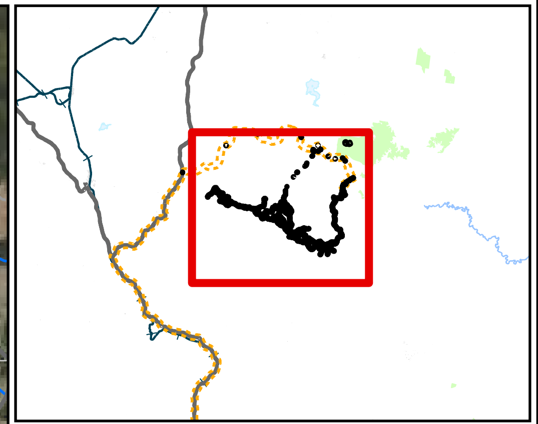
8.3.8 Disturbance from weeds, pests and pathogens

There is the potential for weeds and pathogens to be introduced and spread during construction as a result of machinery movements and increased foot traffic.

Works associated with the proposed road upgrades on the haul route are considered low risk as these will be limited to the road corridor where lands are already subject to disturbance from adjacent transport activities.

Pathogens, including Root Rot *Phytophthora cinnamomi*, Myrtle Rust *Austropuccinia psidii* and Chytrid Fungus *Batrachochytrium dendrobatidis*, have the potential to be introduced to the site during construction and, if so, terrestrial and aquatic habitats within the development footprint could be impacted. Mitigation measures to control the spread of weeds, pests and pathogens will be detailed in a Biodiversity Management Plan.





Legend

- Infrastructure footprint
- Landscape assessment buffer (study area)
- Confirmed potential microbat roost habitat
- Wind turbine zone of disturbance

Figure 26 Estimated zones of indirect impact for the proposal

0 1,000 2,000 3,000 4,000

Meters

Scale: 1:100,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F26_IndirectImpacts
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

8.4 Waterway crossings

A desktop assessment was carried out to identify and map aquatic habitat values and potentially occurring threatened aquatic species for the development footprint. The assessment incorporated the review of relevant spatial datasets and documentation as outlined in Section 1.8 of this document and was supported by general observations of aquatic values during fieldwork.

There is no suitable habitat for any threatened aquatic species within the development footprint and any indirect impacts are not considered likely to results in any impacts to potential habitat downstream.

Streams identified for the assessment area were classified according to the Strahler (1952) stream ordering system. Riparian buffers were identified and mapped for each stream in accordance with Appendix E of the BAM. The majority of the streams within the development footprint for the turbines, internal roads, transmission line and access tracks are first order streams being located high in the catchment. There is limited value for any aquatic threatened species within these environments and no targeted surveys for aquatic species were required under the BAM.

There are 15 locations that require upgrades of creek crossings along the transport haul route. In these locations there is an existing crossing structure that is likely to require upgrading to allow for the safe transport of turbine infrastructure, raising the vertical clearance of the crossing to allow clearance of long elements such as turbine blades.

Where there is an existing bridge that has been identified for upgrades, the works will generally include additional strengthening to accommodate additional weight or widening. This may involve new foundations, piers and carriageway with these works resulting in minimal impacts to the existing waterway channel. A similar approach will be adopted for any existing culverts that are required to be strengthened.

Where there is an existing causeway, additional assessment will be required during detailed design to determine if any upgrade works are required. If the causeway crossing is suitable for the transport requirements no works will be completed. If added vertical clearance is required a culvert will be the likely crossing structure. A summary of the existing crossing locations which may potentially require upgrades subject to further assessment, and the type of fish habitat for each crossing is provided in Table 76.

Table 76 Assessment of fish habitat class at waterway crossings

Crossing location and existing structure type	Stream order	Fish habitat class
Goonoo Goonoo Creek crossing, Lindsay's Gap Road, Garoo Bridge	3	Class 2
Middlebrook Creek crossing, Lindsay's Gap Road, Garoo Bridge	3	Class 2
Wardens Brook, Head of Peel Road, Nundle Causeway	3	Class 2
Back Creek Bridge (all Crawney Road access options)	5	Class 2
Wombramurra Creek bridge near teamsters rest (Crawney Road access option C only)	5	Class 1
Wombramurra Creek new crossings (Crawney Road access options A and B)	5	Class 1

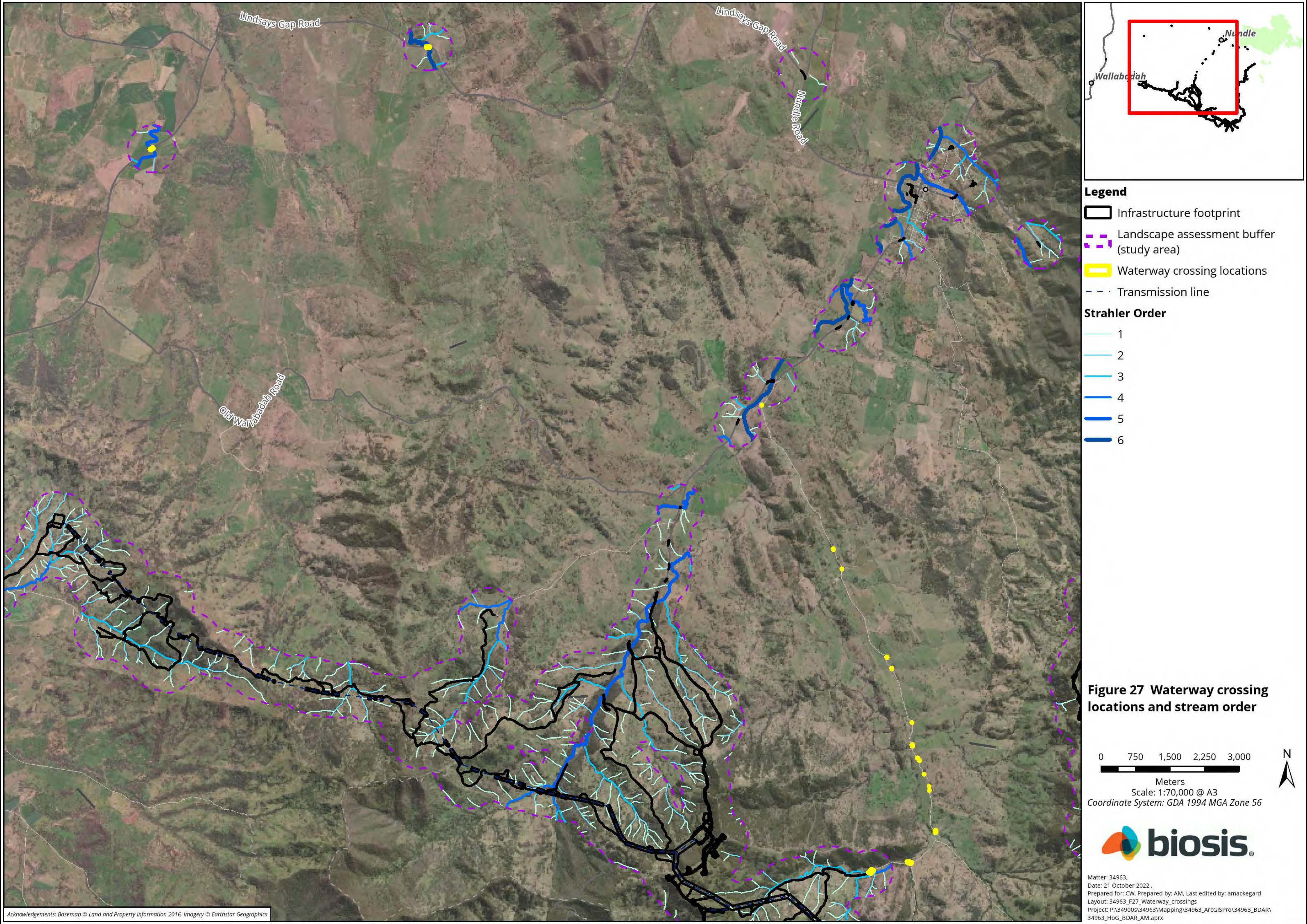


Figure 27 Waterway crossing locations and stream order

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Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: AM, Last edited by: amackegard
Layout: 34963_F27_Waterway_crossings
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_AM.aprx

8.5 Prescribed impacts

The following section provides an assessment of prescribed impacts as required by Section 8.3 of the BAM (DPIE 2020), information is provided in Table 77.

Table 77 Assessment of BAM prescribed biodiversity impacts

Karst, caves, crevices, cliffs, rocks and other geological features of significance
Assessment of the impacts of the proposal on threatened entities associated with karst, caves, crevices, cliffs, rocks and other geological features of significance must:
Predict the nature, extent and duration of short-term and long-term impacts to karst, caves, crevices, cliffs, and other geological features of significance
The project will not directly impact upon any karst, caves, crevices, cliffs, and other geological features of significance. Such features may be utilised as habitat for roosting and possibly breeding for locally occurring cave-dependent microbat species. Potential habitat within and immediately surrounding the development footprint was assessed via desktop and follow-up ground confirmation surveys in February 2020 and again in March 2021. Detailed methods and results of these assessments are provided in Section 5.4.2 of this BDAR, however in summary, two areas supporting geological features suitable for microbat roosting were found to the north-west and south of the development footprint, with other areas targeted during surveys confirmed not to support suitable habitat features. In order to provide additional scientific advice on the likelihood of the project area and surrounding landscape to provide roosting and potential breeding habitat opportunities for microbats, a desktop geomorphological assessment was undertaken by Environmental Geosurveys Pty Ltd (Environmental Geosurveys 2021) (Appendix F). The assessment found that whilst the basalt lithology present at the project area may support opportunities for microbat roosts, no substantial caves were likely to be present, and that no data was found to suggest that the development footprint and immediate surrounds geomorphologically standout from the surrounding landscape in one way or another. Furthermore, it was concluded that the diverse terrain and lithology, and dynamic geomorphology result in high potential for microbat roosting sites to occur across the landscape as a whole, at all elevations within the expected flight range of microbats (estimated to be 50-75 kilometres) that may be present within the project area (Environmental Geosurveys 2021). The assessment notes that the project area lies in the southern margin of the New England Orogen, which comprises a complex geological history resulting in a wide range of rock types and structures in northeast NSW and southeast Queensland. The basement rocks developed from the Cambrian to the Carboniferous, and over time have been altered by multiple episodes of deformation and igneous intrusions, and further sedimentation during the Permian prior to the break-up of Gondwana. The exposed basement geology includes stratified silicic and calcareous sedimentary beds, granitoids and interbedded volcanics previously subjected to and altered by metamorphism, large-scale folding and faulting. Widespread volcanism in the Cenozoic covered much of the surface of the New England Orogen, but the areal extent of volcanics has been reduced by denudation (Environmental Geosurveys 2021). Thus, the diverse geology present in the landscape surrounding the project area continues to the north through the NSW North Coast, Nandewar and New England Tablelands bioregions (which together comprise much of the New England Orogen). Habitats present in the locality of the project area are therefore also likely to occur elsewhere within broader geological landscape and are therefore unlikely to form a substantial portion of the potential habitat available to microbats, or be significant at a bioregional scale. As the project will not result in direct impacts to karst, caves, crevices, cliffs and other features of geological significance, the habitat feature present will remain available to be utilised by microbats into the future, and the project has avoided all impacts in close proximity (<150 metres) the confirmed potential microbat habitat features.

Indirect impacts with the potential to occur during the construction phase of the project are expected to be able to be suitably mitigated such that no substantial consequences would occur to cave bats potentially utilising the areas of high potential bat roosting in the vicinity of the development footprint. Further information on the proposed construction and operational mitigations measures and commitments are provided in Section 8.9 of this BDAR.
Predict the consequences of impacts on the threatened entities potentially present within the subject land associated with karst, caves, crevices, cliffs and other geological features of significance
The project will not result in direct impacts to karst, caves, crevices, cliffs and other features of geological significance suitable to provide roost or breeding habitat for cave dependent bat species. Threatened species known to occur within the project area most likely to use potential habitat provided by geological features of significance include: • Eastern Cave Bat • Eastern False Pipistrelle • Large Bent-winged Bat • Large-eared Pied Bat • Little Bent-winged Bat Indirect impacts to these species have the potential to occur during the construction phase of the project. Impacts may occur via noise and vibration impacts, and vegetation removal within the vicinity of two high potential roost locations, although substantial redesign works have been undertaken to reduce the potential for such impacts, with construction works now occurring no closer than 100 metres and 430 metres from the habitat features. It is difficult to predict how microbats potentially using these habitat features may be impacted by construction impacts as there is limited literature available on vibration impacts to microbats. As such the project has committed to monitoring for the presence of microbats and implementing mitigation measures if bats are found to be present during breeding or winter torpor seasons (refer Section 8.9.1). Further indirect impacts may occur as a result of avoidance and blade strike, with these impacts addressed in Section 8.3 of this BDAR.
Justify predictions with appropriate modelling, relevant literature and other published sources (if available), or advice from experts for impact to species associated with karst, caves, crevices, cliffs and other geological features of significance
The Preliminary Geotechnical and Geophysical Interpretative Report (Tetra Tech Coffey 2021) prepared for the development states that at this stage it is expected that the design preference will be to support each turbine on a single reinforced, or mass concrete block gravity footing. Whilst indicative footing or sizing information have not been supplied, it is expected that such a footing would be square, or hexagonally shaped in plan, at least 20 to 25 metres wide, and 3 to 5 metres deep. With reference to the preliminary project geotechnical models for the Windfarm Ridgelines, it is expected that founding conditions for the majority of Wind Turbine Generator footings would then comprise residual soils and/or extremely weathered basalt. (Tetra Tech Coffey 2021). The report goes on the state that it is understood that earthworks and excavations are proposed to both construct the turbine footings, form laydown areas, and for service roads. Excavation of this material is expected to require a hydraulic rock breaker, blasting, or mechanical splitting to fracture and loosen the in-situ rock. As block sizes in this type of material may be large, there is also a significant potential for overbreak (Tetra Tech Coffey 2021). Based on this advice, and as outlined above it is recommended that disturbance to roosting microbats as a result of ground vibration during breeding season (November to February) or winter torpor season (May to September) will be avoided and minimised as far as practicable, and mitigation measures and project commitments have been made to implement this recommendation (refer Section 8.9.1). It is not expected that direct impacts will occur to the habitat features due to the excavations being no closer than 100 meters from potential habitat.

Predict the nature, extent and duration of short-term and long-term impacts to rocks
As outlined above, additional assessment of the geomorphological characteristics of the project area was undertaken by Geosurveys Pty Ltd (Environmental Geosurveys 2021) (Appendix F), who concluded that there was no data found to suggest that the development footprint and immediate surrounds geomorphologically standout from the surrounding landscape in one way or another, and that similar geomorphological characteristic were likely to occur in the medium distance (50-75 kilometres) and far broader bioregional landscape. Whilst the subject land contains rocky areas, no areas could be said to be significant at the local or bioregional scale, with regards to providing high quality habitat for threatened species, not provided in similar or higher condition elsewhere, such as within the adjacent National Parks estate. As such it is not expected that the project will result in significant of substantial impacts to rocks, or the threatened species associated with rocks, in the short or long term.
Predict the consequences of impacts on the threatened entities potentially present within the subject land associated with rocks
Threatened species considered as part of this assessment, associated with rock, and most likely to use rock as a habitat component include: • Booroolong Frog • Border Thick-tailed Gecko • Brush-tailed Rock-wallaby • Spotted-tailed Quoll Rocks are provide a range of generalist and specific habitat components for these species based on the following information provided in the BioNet Threatened Biodiversity Data Collection: Booroolong Frog • Adults occur on or near cobble banks and other rock structures within stream margins. • Shelter under rocks or amongst vegetation near the ground on the stream edge. • Sometimes bask in the sun on exposed rocks near flowing water during summer. • Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools. Border Thick-tailed Gecko • Species often occurs on steep rocky or scree slopes, especially granite, however, also recorded from areas of basalt and metasediment slopes and flats. • Favours forest and woodland areas with boulders, rock slabs, fallen timber and deep leaf litter. • Shelter by day under rock slabs, in or under logs, and under the bark of standing trees. Brush-tailed Rock-wallaby • Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. • Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night when foraging. • Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Spotted-tailed Quoll • Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites. • Use communal 'latrine sites', often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks. Such sites may be visited by multiple individuals. Targeted surveys were undertaken for all species outlined above as part of the field campaign for this biodiversity assessment. Border Thick-tailed Gecko and Brush-tailed Rock Wallaby were not recorded. Spotted-tailed Quoll was recorded on a remote camera trap and a deceased individual was found. Booroolong Frog was assumed present along Wombramurra Creek, where a known population of the species occurs to the north of the project area, and surveys were undertaken outside the recommended season.

Border Thick-tailed Gecko habitat has also been assumed to be present where suitable habitat was recorded in locations where targeted nocturnal survey was not able to be undertaken, however direct impacts to the species comprise a total of just 0.17 hectares. As such potential impacts to rocks as a result of the project are not considered likely to result in substantial additional impacts to the species. The project is unlikely to impact upon rocky habitat supporting the population of Booroolong Frog as direct impacts will not occur to the creek or creek banks, and indirect impacts will be avoided through mitigation measures outlined in Section 8.9 of this report. Impacts to rocky habitat that has the potential to support Brush-tailed Rock Wallaby are not expected, as the species' presence has been discounted from the subject land. The project will permanently remove rocky habitat likely to be utilised by Spotted-tailed Quoll, however, no den or latrine sites were recorded within the subject land during field surveys. Furthermore, rocky habitat present forms only a small portion of the similar habitat available to individuals present within the development footprint and project area. Areas of higher quality habitat, not impacted by the project, occur in the large areas of intact vegetation to the south and east of the development footprint and these areas are expected to be of higher importance to the local population of the species. The consequences of removal of rocks associated with the project are considered negligible to Booroolong Frog, Border Thick-tailed Gecko and Brush-tailed Rock-wallaby. Consequences of the impacts to rocky habitat for Spotted-tailed Quoll are considered likely to be minor in nature. Whilst habitat likely to be used in some capacity by the species will be impacted, no important den or latrine sites were recorded, and areas of higher quality habitat adjacent other development footprint, much more likely to support dens and latrines, will not be impacted.
Justify predictions with appropriate modelling, relevant literature and other published sources (if available), or advice from experts for impact to species associated with rocks
• As outlined above
Human-made structures or non-native vegetation
No human made structure considered likely to support threatened species will be impacted by the project. Assessment of the impacts of development on the habitat of threatened species or ecological communities associated with human made structures is therefore not required. Non-native vegetation impacted by the project largely comprises areas of exotic grassland, with only minor occurrences of non-native trees and shrubs. The quarry site/s are located within Hanging State Forest, in an active pine (*Pinus radiata*) plantation area, that has recently been highly disturbed, subjected to bushfire impacts in 2019, and subsequently remaining areas salvaged and harvested. Small areas of native vegetation to the south of the eastern operations area would remain and managed at the request of FCNSW. Impacts of the quarry site/s on biodiversity would be negligible. No threatened species potentially impacted by the project are associated with exotic grassland. Assessment of the impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation is therefore not required.
Habitat connectivity
Assessment of the impacts of the proposal on connectivity of habitat of threatened entities must
Describe the nature, extent and duration of short-term and long-term impacts
Areas of highest quality habitats occur to the south, east and north-east of the project area supported by large tracts of intact native vegetation. Areas to the north and west of the project area generally comprise cleared farming land with more densely vegetated areas present along steep ridgelines and gullies, less suitable for agriculture / farming practices. The central portion of the transmission line traverses a north-south running ridgeline, forming part of the Liverpool Range, which supports what appears from aerial imagery to be intact to moderately intact vegetation to the north and south of the project area. The eastern portion of the transmission line and the western extent of the wind farm corridor run along a

north-west to south-east running ridgeline supporting patchy native (partially intact) vegetation to the north and larger tracts of intact vegetation to the south, including Crawney Pass National Park. The central and eastern portions of the windfarm corridor occur along a ridgeline that forms the western extent of very large tracks of intact vegetation to the south and east, with areas of intact vegetation present surrounding the upper catchment of the Peel River adjacent to the development footprint to the north. Access road upgrades will occur along the northern end of Morrisons Gap Road where large areas of intact vegetation occur to the north and south. The development and operation of the wind farm will result in up to 64 turbines operating over an approximate liner distance of 30 kilometres along the ridgelines as described above. This linear alignment has the potential to create an obstacle to movement through the wind farm, impacting upon habitat connectivity in an east to west, and north to south direction within different portions of the development footprint. Habitat connectivity has the potential to be most substantially impacted for those species known to fly within the range of rotor-swept height, rather than those that move under, or potentially over, the turbine blades. It should be noted that impacts to habitat connectivity have been reduced through the removal of turbines WP1, WP19, WP23, WP27, WP31 and WP41 following turbine risk assessments undertaken following agency and public submissions. Removal of these turbines has resulted in a reduced impact to habitat connectivity in the southern and western portions of the development footprint. Removing WP19 creates a gap of over 2 kilometres between turbine WP18 and turbines WP20-22, and the removal of WP19 allows for an approximate 600 metre reduction of the intrusion into intact vegetation to the south of the development footprint, allowing more available airspace for aerial fauna around the southern extent of the wind farm corridor. The remove of WP41 creates a 1.6 km gap between WP40 and WP42, adjacent to BHGNR. Furthermore the redesigned layout of the turbines adjacent to BHGNR has resulted in a minimum spacing of 400 m between turbines, reducing the potential for impacts associated with barrier effect, between the high quality habitats in BHGNR and the more patchy habitats on the western side of the ridge. Removal of WP1 from the project design reduces potential connectivity impacts as the turbine was acting as an outlier on the south-western extent of the array, and the turbines now occur in a more linear arrangement in that location. Removal of WP19, WP23, WP27 and WP31 reduce impacts to connectivity around the southern-most part of the development footprint by reducing the incursion into intact vegetation in that location by between 400 and 500 metres at each turbine location (refer Figure 1). Potential impacts to habitat connectivity will occur for the operational life of the wind farm, expected to be approximately 30 years, which is considered only to be in the short to medium term, following which impacts may be removed if the wind farm is decommissioned. For species that move within the height range where turbine strike is possible, and are likely to move through the operational wind farm corridor for foraging or potentially migratory movements, an associated impact of collision mortality could occur, albeit in rare circumstances. Impact risk assessment for all aerial species has been provided in Section 8.3 of this BDAR. Landscape scale habitat connectivity is mapped on Figure 28.
Predict the consequences of impacts for the persistence of the threatened entities potentially present within the subject land, taking into consideration mobility, abundance, range and other relevant life history factors
All threatened species and ecological communities rely of habitat connectivity to some degree to maintain genetic diversity and to allow for adaption to threatening processes. Threatened species reliant on the habitat connectivity across and surrounding the development footprint have been grouped into categories based on how they utilise habitat connectivity. These include: • Nomadic, migratory or long-range foraging birds and bats. • Sedentary birds and bats. • Small mammals. • Frogs and reptiles. • Flora and TECs. Species with the highest potential to be impacted by changes to habitat connectivity as a result of the project

include species considered nomadic, migratory and/or long-range foragers and were recorded during completed surveys. Such species include:

- Flame Robin
- Grey-headed Flying-fox
- Little Bent-winged Bat
- Little Lorikeet
- Large Bent-winged Bat
- Yellow-bellied Sheathtail-bat

These species are addressed further below in relation to how the project may impact upon habitat connectivity at a population scale.

Flame Robin

- Species known to breed in upland areas and in winter move to the inland slopes and plains, therefore potentially moving through the development footprint.
- However, species is likely to occur beneath or within the canopy and therefore under the turbine's rotor swept height, thus being relatively unaffected by the project.

Grey-headed Flying-fox

- Species is known to fly at higher altitudes and likely within the range of rotor swept height and be capable of travelling up to 50 kilometres from a roost to forage.
- The DCCEEW National Flying-fox monitoring viewer has a number of camps mapped within 50 kilometres of the development footprint including large camps at Murrurindi and Tamworth, each having recorded >50,000 individuals present in the past (2017).
- It is considered unlikely that individual flying-foxes would regularly be flying through the wind farm as these two camps are between approximately 25 kilometres (Murrurindi) and 50 kilometres (Tamworth) from the project area, and would represent long forage efforts over commensurate landscapes providing ample forage opportunities closer to the known roosts.
- Therefore the wind farm is not expected to represent a significant barrier to movement for this species, or substantially impact upon habitat connectivity at a bioregional scale.

Little Bent-winged Bat and Large Bent-winged Bat

- Species are known to occasionally fly at higher altitudes and likely within the range of rotor swept height, and to travel large distances (100s of kilometres) for breeding migrations. Species also known to fly higher during migratory flight, potentially putting them at risk of turbine strike.
- A known non-breeding roost for both species occurs approximately 5 kilometres south of the development footprint at Timor Caves. It is expected that bats would move between this roost and the known breeding roost in Karanga-Boyd NP for Large Bent-winged Bat (approximately 250 kilometres to the south) due to its occurrence in similar topographical and climatic zones, and Little Bent-Winged Bat north-east to the geographically closer breeding roost at Willi Willi NP, in sub-tropical climate to the east of the dividing range in the Kempsey LGA.
- Whilst these species have been recorded foraging within the development footprint, their expected southerly breeding migration means the development is not expected to result in a substantial impact to connectivity, such that the bioregional persistence of the species is under threat.
- Further assessment of potential impacts to Little Bent-winged Bat and Large Bent-winged Bat and provided in Appendix E.

Little Lorikeet

- Species is known to be nomadic in response to flowering eucalypts and other feed tree species.
- The species is most likely to occur in areas of intact forest, woodland or riparian vegetation, however, can also occur in paddock trees.
- The species has the potential to fly within the range of rotor swept height meaning the operational wind farm may impact upon habitat connectivity, however when observed within the development footprint the species was present at approximately 15 metres elevation. The species was not recorded flying in the range of rotor swept area during any bird surveys undertaken for the current assessment.

- As agile flyers moving as part of larger flocks, Little Lorikeets can be expected to have some capacity for avoidance of rotor blades, potentially lessening the project's impacts to habitat connectivity.
- Commensurate habitat occurs within the 50 kilometres surrounding the wind farm (where recent BioNet records of the species occur) that provides the species with habitat connectivity. As such when considered at the scale of bioregional persistence, the project is unlikely to result is significant impact to habitat connectivity for the species.

Yellow-bellied Sheathtail-bat

- Species is considered to migrate from northern parts of Australia and south in summer, which could potentially include through the operational wind farm.
- The species is considered generally to forage above the canopy and has been recorded by detectors mounted at canopy height and 60 metres on met masts during the current study. However, the species is known to fly lower over open spaces and at the forest edge (Churchill 2008).
- Based on the above the operational wind farm may impact upon habitat connectivity for individuals flying within the range of rotor-swept height.
- As the species is hollow-dependent for roosting and breeding, and known to generally forage over the canopy, it is considered more likely that movements may occur over vegetated areas surrounding the development footprint rather than the through the cleared areas of the wind farm potentially lessening the impacts to habitat connectivity for the species.

Potential risks to the species are further assessed in Section 8.3 of this BDAR. Bent-winged-Bat roosts and Grey-headed Flying-fox camps are is mapped on Figure 28.

The project area occurs on the boundary of three IBRA Bioregions, Nandewar, New England Tablelands, and NSW North Coast.

The project area occurs at the southern extent of the Nandewar bioregion, which extents approximately 440 kilometres north into Queensland to the west of the Great Dividing Range. The project area also occur at the southern extent of the New England Tablelands bioregion, which extents approximately 350 kilometres north to the Queensland border, along the Great Dividing Range. The project area occurs near the southern extent of the western edge of the NSW North Coast bioregion. The bioregion extents south-east approximately 150 kilometres to Newcastle, then follows the east coast approximately 420 kilometres north to Yamba, with a portion of the bioregion extending in a north-westerly direction to the Queensland border near Urbenville. Within the NSW North Coast bioregion, habitat connectivity occurs along the coastal escarpments on the eastern side of the Great Dividing Range and the area of connectivity relevant to the project is of negligible importance to the remainder of the bioregion.

The majority of habitat connectivity within the New England Tablelands bioregion occurs along the western and eastern boundaries of the bioregion, with patchy connectivity throughout the central portions. The ridgeline and adjacent vegetated slopes comprising the project area partially supports connectivity from the south into the New England Tablelands bioregion, however substantial areas of habitat connectivity (approximately 50 kilometres wide) will remain following the development.

Connectivity through the Nandewar bioregion occurs along the eastern boundary (with New England Tablelands) of the bioregion, with lower levels of connectivity along the west, from Liverpool Range through hilly country forming the boundary of the Liverpool Plains and Tamworth LGAs, north towards Mount Kaputar NP. As with the New England Tablelands bioregion, the ridgeline supporting the project area forms part of the connectivity into the Nandewar bioregion, however connectivity will remain present post development to the east and west of the wind farm (approximately 15 to 20 kilometres wide either side of the project area).

Whilst the project may have a minor effect on connectivity into the New England Tablelands and Nandewar bioregions, its linear nature and location on the edge of larger areas of intact vegetation mean connectivity will remain present around the operational wind farm through commensurate high ridgetops and vegetated upper and lower slopes.

The project will result in low level or negligible consequences relating to impacts to habitat connectivity for the suite of threatened flora species, TECs, threatened frogs, reptiles, small mammals and other aerial species not addressed above, present or potentially present within the project area, with regards to bioregional persistence of the species. The development and operation of the wind farm and transmission line corridor will not result in a barrier to connectivity for the majority of these species which are likely to preferentially utilise the adjacent areas of higher quality habitat for movement corridors, or will be capable of moving through the operational development. Furthermore, the wind farm and transmission line have largely been located in areas of existing clearing, on vegetated edges, and in more highly disturbed areas, all of which are less suitable for providing habitat connectivity to terrestrial and arboreal species.

Sedentary birds and bats are less likely to fly through the project area, between forage/roosting habitats, due to the areas of highest quality habitat generally located to the south and east. As such, these species are not expected to be substantially impacted by reduced levels of habitat connectivity.

Layout modification comprising turbine relocations and removal undertaken since the EIS was submitted, resulting in the removal of 6 turbines, have all been completed with an aim of reducing the impacts of the wind farm on habitat connectivity in the local area. These modifications have been successful in reducing the potential impacts, and any residual impacts will be further mitigated though habitat restoration and protection in the local Biodiversity Stewardship Sites that will be established to offset the project's unavoidable impacts.

Justify predictions of impacts with relevant literature and other published sources of information

As outlined above.

Water bodies, water quality and hydrological processes

Assessment of the impacts of the proposal on water quality, water bodies and hydrological processes that sustain threatened entities must:

Describe the nature, extent and duration of short-term and long-term impacts

Numerous first order watercourses occur within the project area, characteristic of its ridgeline nature, with the majority flowing north and west off the ridgeline into the Namoi catchment, with the southern portion of the project area flowing to the Hunter catchment. A small portion of the eastern portion of the project area flows into the Manning catchment. There are 12 named tributaries within the development footprint, however, there are no third-order or higher watercourses impacted (ERM 2021). There are numerous farm dams within and surrounding the development footprint, some of which will be removed as a result of the project, others may be utilised for water requirements during construction.

Overland flow and run-off directed by the steep topography of the project area into gullies forming higher order streams and tributaries are the major hydrological process acting upon any potential threatened species habitat present within the development footprint. Man-made dams located along the overland-flow paths have created permanent or semi-permanent dams (pools) also providing habitat for some threatened species. Species most likely to utilise these habitat features within and proximal to the development footprint are Southern Myotis and Booroolong Frog.

As outlined in the project's Soils and Water Assessment (ERM 2021) overall potential risks to water and soils are relatively minor to moderate, with the primary constraints being steep slopes adjacent to the project footprint. This assessment is based on:

- For the most part, pad sites and access road construction occur on relatively low-moderate gradient lands high up in the respective drainage catchments.
- There is generally a very low risk of run-on or run-off of concentrated stormwater flows.
- Construction sites within the development footprint generally present a low to moderate erosion hazard considering factors such as climate, soils and landform.
- Impacts on water flows is not anticipated for the construction of the project, given the localised impacts are located upstream on the top of the ridgeline.
- Potential impacts downstream are able to be effectively managed at the source of works (i.e. velocity controls in areas with steep slopes) through the implementation of a progressive Erosion and Sediment Control Plan (ESCP).
- Additional measures are able to be effectively implemented to appropriately mitigate impacts associated with the identified sensitive locations in the adjacent National Park and waterways supporting populations of Booroolong Frog. Measures are to be included in the progressive ESCP to either:

- Direct disturbed runoff away from the catchment area identified to contain the sensitive location.
- Process runoff through additional sediment controls (e.g. sumps and/or sediment basins) and discharge at a low, non-erosive velocities. (ERM 2021).

Predict the consequences to the threatened entities likely to occur within the subject land

Watercourses and dams within, and adjacent to the development footprint were surveyed during the course of this assessment with results detailed in Sections 5.3 and 5.4 of this BDAR. No threatened frog species were recorded during surveys, however, Booroolong Frog has been assumed present along Wombramura Creek and is known to occur along first order tributaries of Peel River north of the development footprint. Southern Myotis has also been recorded during microbat acoustic detection surveys and is likely to utilise areas of open water, including farm dams, for foraging.

Wombramurra Creek and first order tributaries of Peel River comprise a priority management site, forming a portion of the Peel River catchment Saving Our Species Site for Booroolong Frog, with the transmission line crossing the watercourse approximately 400 meters upstream of the nearest record, and the wind farm corridor occurs approximately 2.4 kilometres upstream of the nearest record of Booroolong Frog along a tributary of the Peel River. The habitats present at the point where the transmission line crosses Wombramurra Creek, and the habitats within the wind farm corridor are all considered degraded. Only minor direct impacts may occur to Wombramurra Creek riparian vegetation which would be unlikely to substantially impact the population of the species, with potential minor impacts also occurring along the edges of Crawney Road (albeit outside the main riparian zone of the creek) if upgrades are required. Indirect impacts however, if not properly managed, could cause more substantial harm to the species and population. If potential impacts to soil and water movement as a result of land clearing and excavation are not adequately managed throughout the project, there is a possibility that Booroolong Frog habitat occurring further downstream within the Peel River or Wombramurra Creek could be adversely affected as a result of increased run off and sedimentation, changes in water flows, and increased pollution of the waterway. In particular, if sediment was to fill rock crevices within the river, the species would no longer be able to use this habitat for oviposition. If poorly managed, this could lead to a long-term decrease in the Peel River Booroolong Frog population, through reduction in breeding habitat. Booroolong Frog records along Wombramurra Creek are is mapped on Figure 28.

In order to minimise such impacts, a Soil and Water Management Plan (SWMP) will be prepared, outlining measures for the management and monitoring of surface water quality and hydrology during construction. The plan would also address any requirements for the management of pollutants or contaminated lands during construction so as to minimise impacts to terrestrial and aquatic habitats. The plan would include the implementation of a construction surface water quality monitoring to minimise impacts to surface water quality. An Erosion and Sediment Control Plan (ESCP) will also be prepared, outlining measures for the prevention of erosion and sedimentation during construction. If adequate soil and water management measures are employed, the indirect impact to Booroolong Frog habitat can be substantially reduced. Implementation and monitoring of the success of this plan would be a key requirement of the Biodiversity Management Plan.

Booroolong Frog is also known to occur within the Barnard River in Ben Halls Gap NP and a tributary to the Isis River in Crawney Pass NP, based on information provided by NSW NPWS during the project's submission process. The presence of the species within these waterways will also need to be considered in any Soil and Water Management Plan to be development for the project if potential run-off to these waterways is likely.

If constructing soil and water are management properly and in accordance with best practice construction environmental management then the project is not expected to result in significant of substantial impacts to Booroolong Frog.

As outline above Southern Myotis was recorded with the subject land and may utilise the existing farm dams for forage opportunities. However the presence of this type of forage habitat is not limited in the landscape and individuals present within the subject land will continue to utilize other forage opportunities following the

decommissioning of dams as a result of the project. As such, significant or substantial impacts to Southern Myotis are not expected to occur as a result of impacts to waterbodies. It is also expected that drainage design and engineering for the project will ensure overland flow patterns are maintained to a practicable level and the project will not result in substantial changes to hydrological patterns or increase erosion downstream potentially impacting downstream habitats. Additional measures are able to be effectively implemented as part of the SWMP, ESCP and BMP to appropriately mitigate potential impacts associated with the identified sensitive location in the adjacent National Park (Sphagnum Moss Cool Temperate Rainforest). Measures are to be included in the progressive Erosion Sediment Control Plan (ESCP) to either: • Direct disturbed runoff away from the catchment area identified to contain the sensitive location. • Process runoff through additional sediment controls (e.g. sumps and/or sediment basins) and discharge at a low, non-erosive velocity (ERM 2021). An updated assessment of site gradients and risk to this TEC is provided in the updated Soil and Water report including project commitments to avoid impact in the EIS (Someva 2021). Based on the above information the project will not result in substantial or significant consequences to the bioregional persistence of threatened species or ecological communities potentially relying on hydrological processes or waterbodies present within the development footprint. Potential risk to soil and water are considered low and able to be successfully managed to prevent downstream impacts.
Justify predictions of impacts with appropriate modelling (if available), relevant literature and other published sources of information, or consultation with species experts.
As outlined above.
Wind farms
Assessment of the impacts of wind turbine strikes on protected animals identified as likely to be present within the subject land must:
Predict the impact on species living in, or likely to fly over, the proposed development site, including bat or bird strike and barotrauma
The likelihood of impact of birds and bats resident in or likely to fly over the project area are presented in Sections 8.3.1, 8.3.2, 8.3.4 and Appendix D of this BDAR.
Predict the rate and timing of impact per turbine per year for species likely to be affected
The predicted rates of impact for birds resident in or likely to fly over the project area are presented in Section 8.3.2 and Appendix D of this BDAR. It is not possible to make such a prediction for bats as individual bats cannot be counted, which is the data required to make such a prediction. A qualitative risk assessment has been undertaken to predict the potential impacts to microbat species and is presented in Section 8.3.1. The project has made commitments to ensure turbine strikes are minimised, particularly for microbats, through both proactive curtailment of turbines and reactive implementation of strict mitigation strategies (including further curtailments) based on rigorous monitoring. Further information is provided in Section 7.2.3 and Section 8.10.2.
Predict the consequences of impacts for the persistence of populations
The consequence of impacts to local populations form a consideration as part of the qualitative risk assessment presented in Section 8.3.1. As outlined above, the project area occurs within, and on the boundary of, three separate bioregions; NSW North Coast, New England Tablelands and Nandewar, which comprise a combined are of approximately 100,000 square kilometres. Each of these bioregions supports substantial areas of habitat of lower, higher and of commensurate quality and value to that which occurs within, and immediately adjacent to, the project area, likely to be directly and indirectly impacted by the project. Whilst it is expected that impacts via blade strike and possibly barotrauma may occur, and further indirect impacts such as loss of habitat opportunities through avoidance of areas surrounding the turbine blades may occur, the scale at which these impacts may be realised is not expected to be such that the bioregional persistence of any species or populations will be subject to substantial or significant consequences.

Indirect impacts associated with potential blade strike to individuals utilising the confirmed potential microbat root habitat features have been minimised through the removal of WP27 from the project design, creating a gap of over 400 metres between the habitat feature and the base of the nearest turbine, which is increased further if habitat height and rotor swept height are considered. Furthermore WP50 has been relocated approximately 130 metres to the north-east, ensuring a separation of over 300 meters from the base of the turbine and the top of the habitat feature. As outlined in Section 5.4.2 of this BDAR, there is potential for blade strike impacts for a number of cave-dwelling threatened microbat species including Eastern False Pipistrelle, Large Bent-winged Bat, Large-eared Pied Bat and Little Bent-winged Bat, which were all recorded by acoustic detectors mounted on met masts at approximately 60 metres above the ground. However, it is not expected that impacts associated with potential blade strike impacts would result in impacts substantial or significant enough to threaten the persistence of any of the these species within the bioregion, given the low level of relative activity recorded for all species at higher elevations (i.e. within the range of rotor blades), the wide ranging nature of the species, and the expected volume of commensurate habitat available in the landscape. It should be noted however that locally, repeated loss could alter populations in the short term, and the potential for this will be monitored through implementation of the BBAMP and mitigated accordingly. Further assessment of the potential for impacts to microbat populations is provided in Section 7.2.3, Section 8.3, and Appendix E.
Predict the cumulative impacts of the proposed development alongside existing wind farms, on species mortality, movement patterns and use of adjacent habitat
As wind farm developments increase in NSW, and Australia, bird and bat species with the potential to move over far ranging distances can be subject to impacts at multiple wind farms (Biosis, 2006). Five existing wind farms (considered to be those currently operating and/or having been approved for development) occur within approximately 200 kilometres of the project area, these include: • Sapphire Wind Farm and White Rock Wind Farm both between Glen Innes and Inverell, approximately 200 kilometres to the north. • Bodangora Wind Farm south-east of Dubbo approximately 200 kilometres to the south-west. • Liverpool Range Wind Farm (yet to be constructed) approximately 120 kilometres to the south west. • Kyoto Wind Farm (yet to be constructed) approximately 50 kilometres to the south-west. • Additionally, Winterbourne and Doughboy Wind Farms, located on the Northern Tablelands near Armidale, as well Bowmans Wind Farm near Muswellbrook, are currently under assessment or EIS stage. These wind farms range in size from 33 turbines at Bodangora, 42 turbines for Kyoto, 70 and 75 turbines at White Rock and Sapphire respectively, and up to 267 turbines at Liverpool Range. Each of these wind farms are considered to potentially result in some level of mortality to wide ranging aerial species, however there would be limited overlap in species populations between four of these five wind farm due to their distal locations. Potential interactions of populations of long-range foragers and/or migrating species may occur between the Hills of Gold wind farm and the Kyoto wind farm, however large expanses of intact native vegetation and open air space occur between the two sites, meaning the likelihood of individuals and/or populations occurring at both sites is considered minimal. Based on the number of turbines operating at the five wind farms within 200 kilometres of the project area, the Hills of Gold wind farm could be expected to contribute to 13 % of potential mortality to aerial species. Detailed and adaptive management plans, such as an Operational Bird and Bat Adaptive Management Plan, will be developed for the project and provide an effective monitoring program and strategy to manage and mitigate operational issues relating to operational and cumulative issues. As only five existing wind farms (include two yet to be built) occur within approximately 200 kilometres of the current project area cumulative impacts to movement patterns and use of adjacent habitat are expected to be minimal. Additional assessment cumulative impacts in provided in Section 8.7 and existing wind farms proximal to the subject land are is mapped on Figure 28.
Predict the likelihood and nature of impacts on aerial species living in, or likely to fly over, the

proposed development site, including barriers to migratory pathways, and breeding, feeding and resting resources
The likelihood of impact of birds and bats resident in or likely to fly over the project area are presented in Sections 8.3.1, 8.3.2, 8.3.4, Appendix D and Appendix E of this BDAR, as well in the relevant prescribed impacts section above. Bent-winged Bat roosts and Grey-headed Flying-fox camps are is mapped on Figure 28. Impacts associated with barrier effect have been reduced through turbine relocations and removal across the development footprint, and have been assessed as likely to be Low to Negligible for all locally occurring species (refer Section 8.3.4).
Predict the impact of avoidance behaviour for migratory species relative to migration distances, and the availability of suitable habitat for breeding, feeding and resting over the migration route
The likelihood of impact of birds and bats, including known or potential migratory species, over the project area are presented in Sections 8.3.1, 8.3.2, 8.3.4 and Appendix D of this BDAR. No species listed as migratory under the EPBC Act were recorded during the field campaign undertaken for the current assessment that extensively targeted the avian fauna present within the subject land during repeat surveys over multiple seasons. Impacts associated with barriers to habitat connectivity are provided above, including an assessment of species recorded that could be considered somewhat migratory, such as bent-winged bats.
Justify predictions with reference to data, collision risk modelling (if available), relevant literature or other published sources including any publications by the Department
Justifications for the likelihood of impacts for birds and bats resident in or likely to fly over the project area are presented in Sections 8.3.1, 8.3.2, 8.3.4 and Appendix D of this BDAR.
Map the disturbance zone around wind turbines, and the significant landscape and habitat features within that zone, for species likely to be affected, e.g. hollow bearing trees and important habitat for migratory species
The predicted zone of disturbance around wind turbines is considered to equate to the area outside (and additional to) the rotor swept area where indirect effects of rotating turbine blades are likely to cause changes in air pressure, and/or other characteristics, that may impact upon aerial fauna which fly into this space. In the case of the current assessment, the rotor swept area is expected to extend 82 meters (reduced from 85 metres) either side of the turbine hub, with an additional 50 meters beyond the blade tip considered as a nominal zone of disturbance. These 50 metres, where effects would dissipate away from the rotor swept area, is estimated as the maximum extent an aerial fauna species would likely be disturbed by fluctuations in the air space around rotating turbines (wake effect). It is expected that smaller species would be more likely to experience disturbance from smaller changes in air pressure (etc), and therefore experience disturbance further from the blade tips, when compared to larger species likely to be more tolerant of smaller changes, and thus experiencing disturbance closer to the tips of the blades. The zone of disturbance therefore is considered to extend to a maximum of 132 metres from the turbine hub. The predicted zone of disturbance around each turbine is mapped on Figure 28. The zone of disturbance can be considered to comprise two separate parts, those being the rotor swept area, and the area of air disturbance extending past the blade tip. Potential impacts to aerial species within the rotors swept area are largely associated with blade strike (and possibly barotrauma), the risk and likelihood of which has been assessed for bird and bat species in Sections 8.3.1, 8.3.2 and Appendix D of this BDAR, with mitigation measures to be implemented described in Section 7.2.3 and Section 8.10.2. Impacts associated with the area of air disturbance, past the end of the blade tips, are less clear but are likely associated with increased avoidance behaviour and barrier effect due to alteration of forces acting on aerial species, potentially leading additional indirect habitat loss due to expected avoidance behaviour. Impacts associated with barrier effect have been reduced through turbine relocations and removal across the development footprint, and have been assessed as likely to be Low to Negligible for all locally occurring species (refer Section 8.3.4). Within the combined zone of disturbance, equating to the rotor swept area and the additional area of air disturbance, habitat features likely to be utilised by aerial fauna include open grassy areas, paddock trees and

intact vegetation supporting numerous hollows, small dams and minor watercourses. All of these features are potentially utilised for foraging, roosting and breeding habitat (for some species). Potential microbat roosting/breeding habitat near (former) WP27 and (relocated) WP50 no longer occur within the zone of disturbance from any turbines. Based on a 135 metre radius buffer around the 70 wind turbines the total area within the zone of disturbance is approximately 365 hectares, comprised of open airspace above 198 hectares of disturbed open areas of exotic grassland, and approximately 167 hectares of forest and woodland vegetation. This 365 hectares of potential airspace habitat could be considered to be a maximum area of possible forage habitat indirectly impacted for smaller aerial species such as microbats at times when the turbines are operational. Furthermore the amended design has reduced this potential impact by approximately 9% (or 31 hectares) as a result of the removal of 6 turbines from the Projects layout. Whilst this potential indirect impact to movement and potential forage habitat due to fauna avoiding areas surrounding operation wind turbines could be considered substantial when considered in isolation, it should be noted that none of the habitats present within the estimated zone of disturbance are limited in the landscape. The areas subject to disturbance comprise only a small fraction of commensurate habitats available to individuals of any local populations of species. Furthermore, as outlined above the removal and relocation of turbines has ensured that there is over 100 metres (and likely much more) between the extent of the zone of disturbance and any potential microbat cave breeding habitat, ensuring substantial areas of undisturbed airspace will occur and allow for entry/exit of these habitat features into the future.

The predicted zone of disturbance overlaps the boundary of BHGNR for four turbines (WP40, WP42, WP43 and WP45), however impacts to the habitats within the nature reserve as a result are expected to be minimal. Overlaps of potential zones of disturbance from the four turbines into the nature reserve boundary range from approximately 0.14 hectares to approximately 0.47 hectares (sum total of approximately 1.26 hectares), and extent into the reserve by no more than 40 metres. This is considered a minimal overlap into the over 3000 hectares nature reserve, almost entirely supporting intact native vegetation. Furthermore the buffer distance for all four of these turbines is over 50 meters (refer Table 55), and as such the predicted zone of disturbance may not impact upon any habitat at or beneath canopy level, minimising the actual likelihood of habitat sterilisation or other potential indirect impacts. It should be noted that there is no overlap of the turbine blades themselves into the nature reserve.

As outlined above, the project has the potential to result in impacts to habitat connectivity for some species potentially flying through the wind farm to access habitats as part of nomadic/migratory movements or long-range foraging. However as noted, habitat connectivity is maintained surrounding the development footprint and the likelihood of regular migratory movements through the wind farm is considered unlikely.

Furthermore, the proposed configuration of the wind farm is a linear row of turbines. In the more usual scattered or 'clustered' array, an aerial fauna species has a high probability of encountering multiple turbines in a given flight. The configuration of turbines for the current project is such that an individual is likely to encounter multiple turbines only in the rare event that it flies directly along the row of turbines, thus somewhat reducing the impacts to habitat connectivity.

The predicted zone of disturbance is illustrated on Figure 15.

Vehicle strikes

Assessment of the impacts of vehicle strikes on threatened fauna or fauna that are part of a TEC identified as potentially occurring within the subject land must:

Predict the likelihood of vehicle strike to each relevant species, considering mobility, abundance, range and other relevant life cycle factors

Terrestrial (and terrestrial/arboreal) mammals are at highest risk of being stuck by vehicles, which for the current assessment includes Koala and Spotted-tailed Quoll.

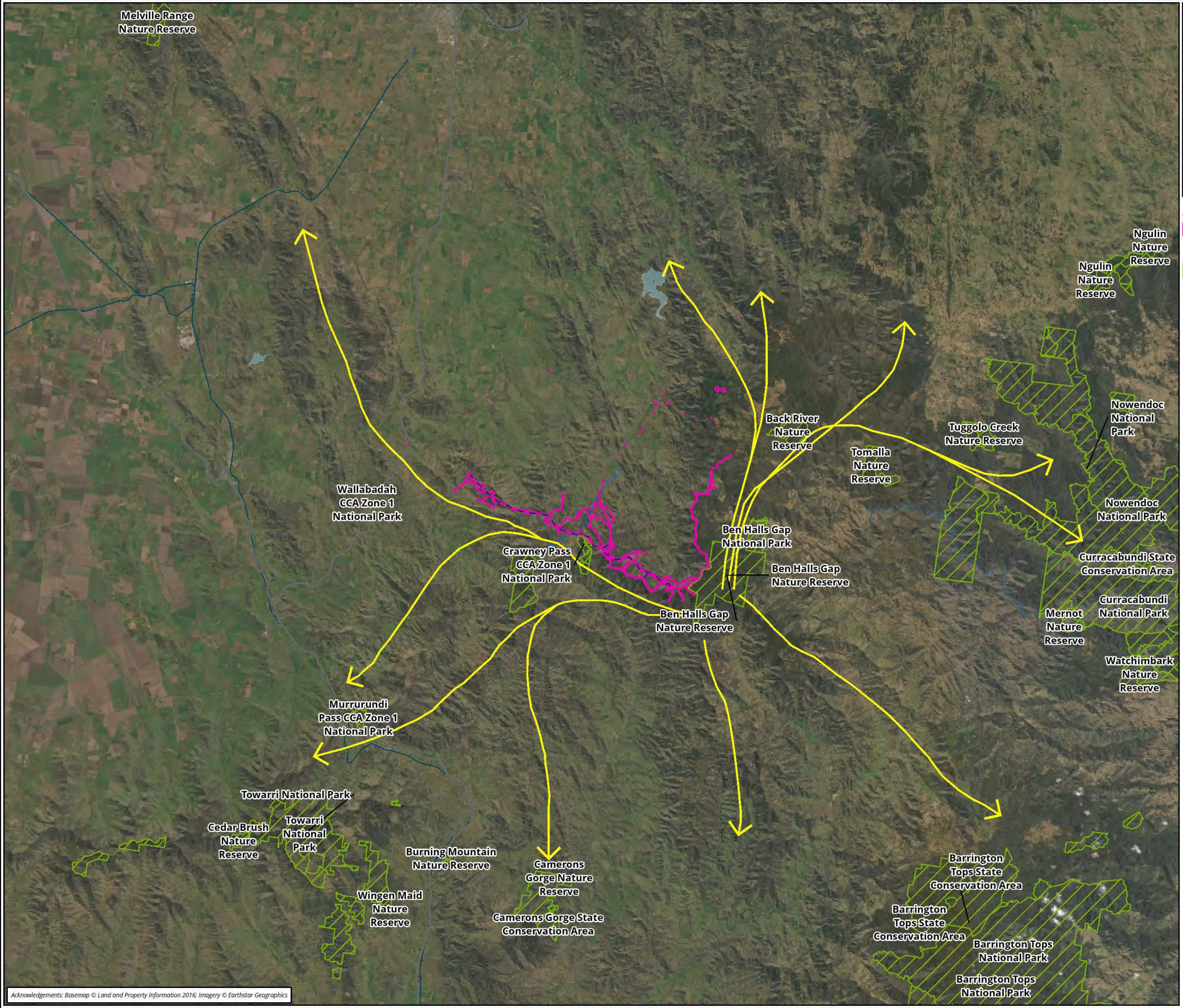
Vehicle strikes are most likely to occur when increased vehicle movements occur across the development footprint, which will be during the construction phase of the project, with mobile plant and machinery moving across the site, and turbine components are being delivered and assembled. However, as both species considered at risk of vehicle strikes are nocturnal, the potential for vehicle strikes during construction is very

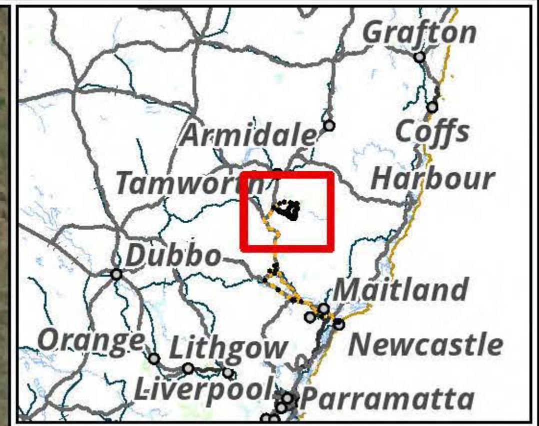
low to negligible. Potential for vehicle strikes is also considered very low during the operational phase of the project and would only occur when vehicles are moving across the site at night. The frequency of this is expected to be low.
Estimate vehicle strike rates with supporting data or literature, where available
Not applicable
Predict the consequences of the impacts for the persistence of the relevant species
Due to the low potential for increased vehicle strikes during the construction and operational phases of the project, as well recommended mitigation measures, there are not expected to be any significance consequences to the local of bioregional populations of Koala or Spotted-tailed Quoll as a result of the project.
Justify predictions of impacts with relevant literature and other published sources of information
Not applicable

8.5.1 Residual prescribed impacts, monitoring, adaptive monitoring and offsetting

As outlined in previous section, some aspects of the impact assessment contained in this BDAR are considered uncertain at the current time due to limited baseline data and the unknowns around the actual incidences of turbine collisions and potential barrier effect impacts. As such an adaptive management strategy has been developed and included in this BDAR, which will be further developed and expanded post approval into a BBAMP and BMP. At the current time there is considered insufficient evidence to justify the need for additional offsets for residual prescribed impacts to threatened species, and no way to quantify what these offsets might be, if deemed necessary.

Proposed methods to quantify residual prescribed impacts, potentially associated with turbine strike and the impacts of barrier effect, have been provided in Sections 8.3.4, 8.10.1 and 8.10.2. In summary, where a tangible and measurable residual impacts occur, offsets will be secured. In the case of the impacts of turbine strike, this will be measured by confirmed and extrapolated collisions based on carcass surveys. In the case of barrier effect impacts, this may be based on statistically significant changes in site/habitat utilisation, that are considered to have the potential to substantially or significantly impact the local population of threatened species. Changes in site utilisation will be monitored through ongoing utilisation surveys, with the effects of any statistically significant changes measured by assessment against the Test of Significance and Significant Impact Criteria assessment guidelines. This further level of assessment is considered warranted to determine whether changes in site utilisation patterns is in fact a negative impact to the species, or simply a shift in habitat and resource use. Further detail will be developed and finalised in the preparation of the BBAMP. Proposed calculation methods for quantum of offsets are provided in Section 8.10.2.





Legend

- Infrastructure footprint
- Habitat connectivity
- NPWS Estate

Figure 28 Prescribed impacts, Page 1: Landscape scale habitat connectivity

0 4 8 12 16

Kilometers

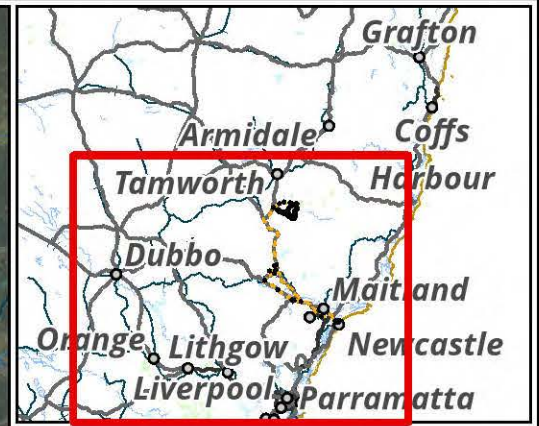
Scale: 1:350,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F28_PrescribedImpacts
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

- Infrastructure footprint
- Bent-winged Bat roosts

Figure 28 Prescribed impacts, Page 2: Bent-winged Bat roosts

0 10 20 30 40

Kilometers

Scale: 1:1,350,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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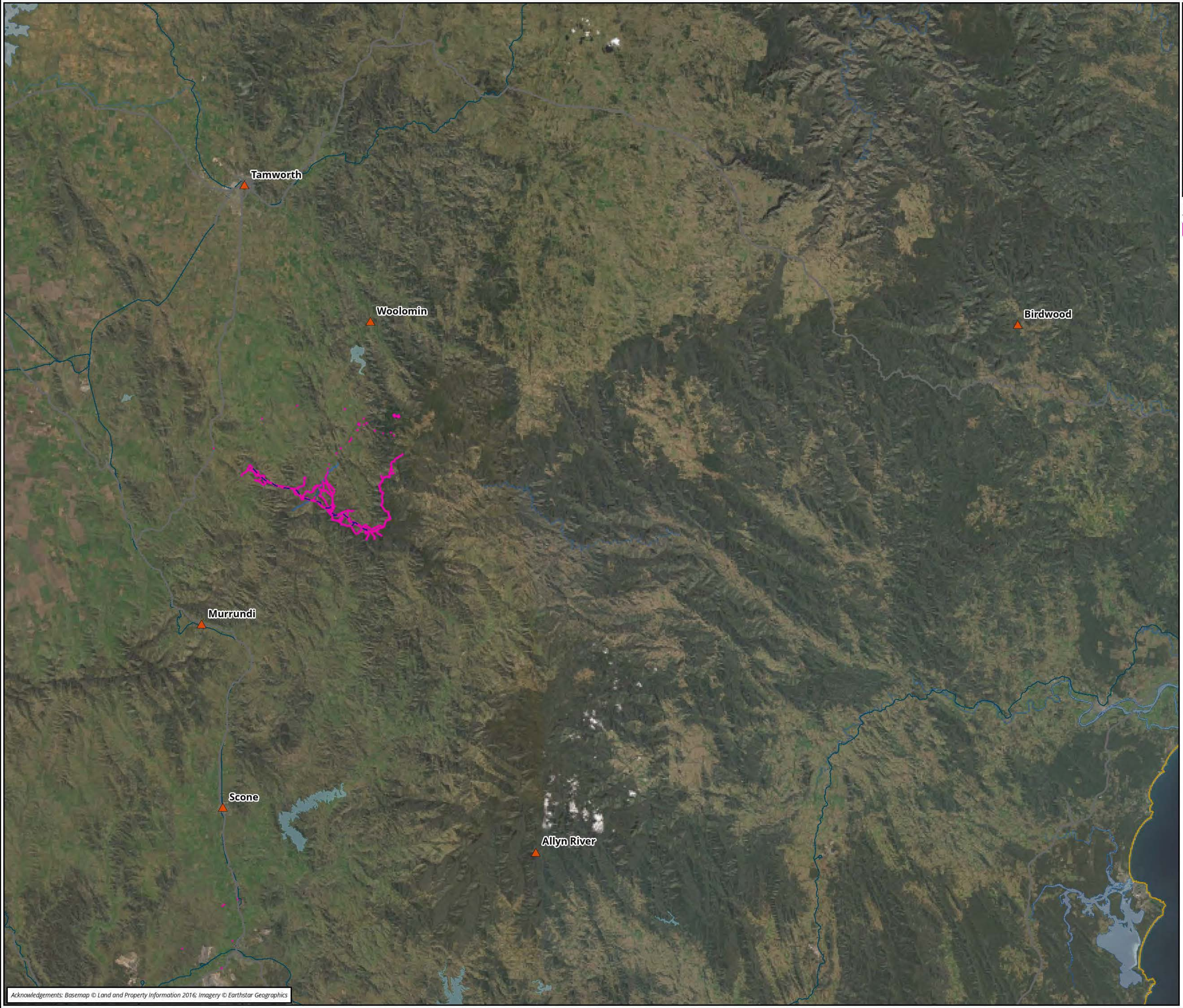

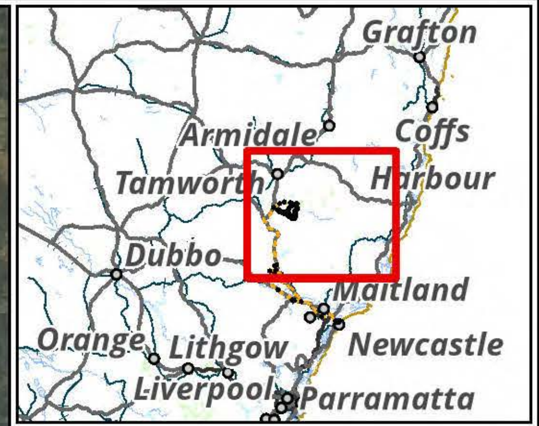

Legend

Infrastructure footprint

Grey-headed Flying-fox camps (EPBC viewer)

Figure 28 Prescribed impacts, Page 3: Grey-headed Flying-fox camps

0 7 14 21 28

Kilometers

Scale: 1:600,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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Date: 21 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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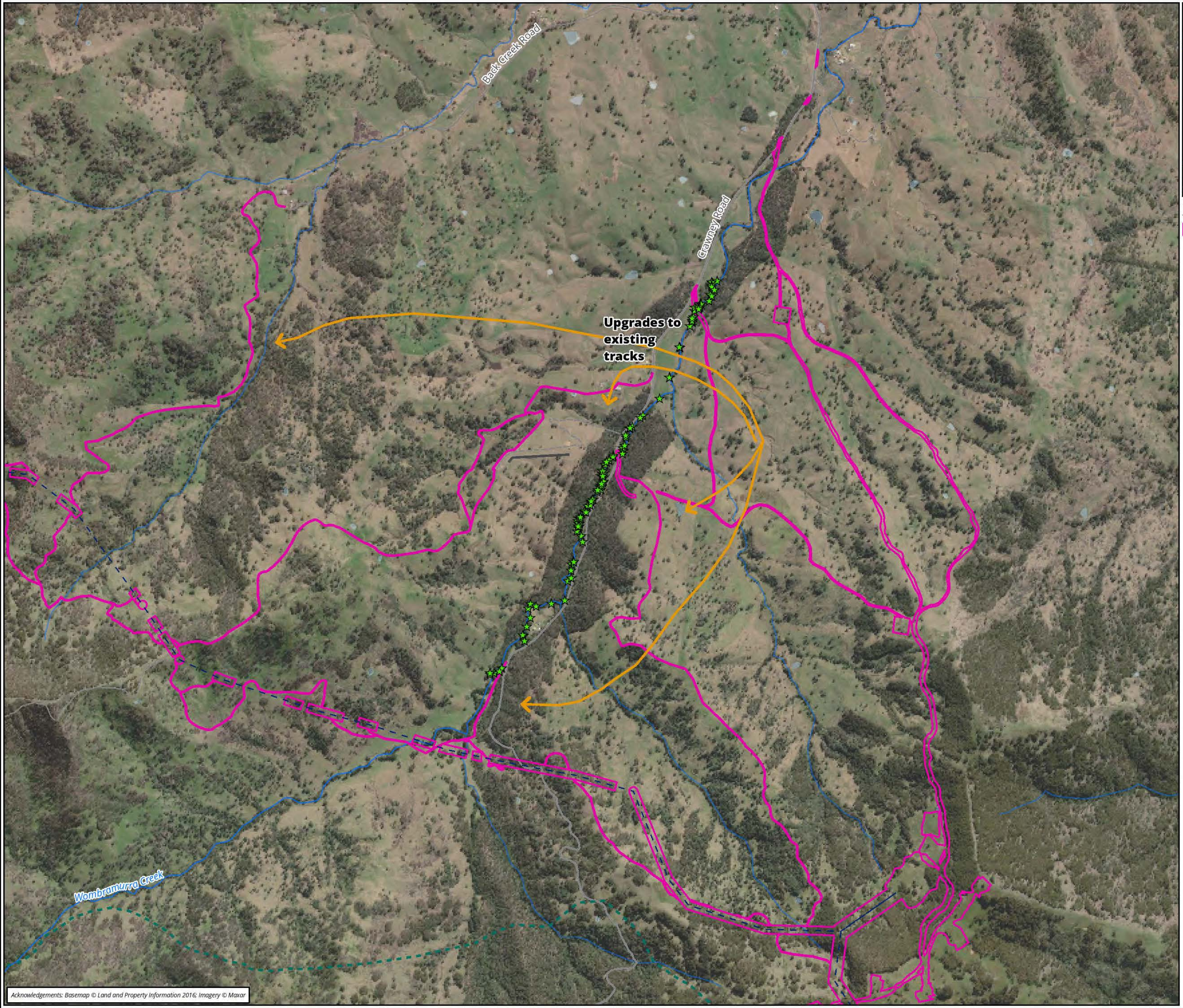

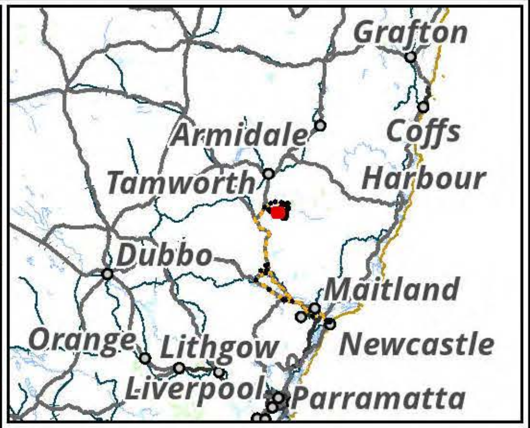

Legend

Infrastructure footprint

Booroolong Frog

Figure 28 Prescribed impacts, Page 4: Booroolong Frog records

0 0.25 0.5 0.75 1

Kilometers

Scale: 1:25,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F28_PrescribedImpacts
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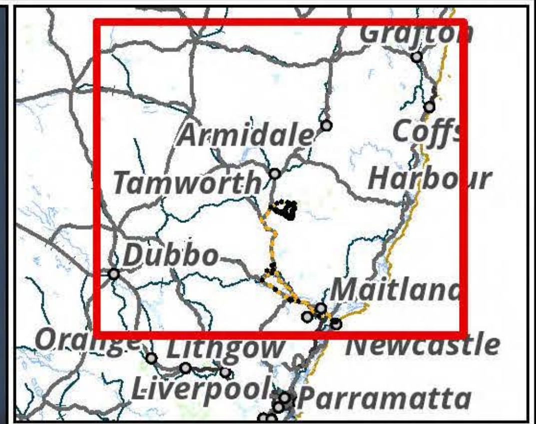


Legend

- Infrastructure footprint
- Existing wind farm

Figure 28 Prescribed impacts, Page 5: Existing wind farms

0 10 20 30 40
Kilometers
Scale: 1:1,480,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 21 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F28_PrescribedImpacts
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

8.6 Serious and irreversible impacts

Threatened species and ecological communities, listed in Appendix 3 of the 'Guidance to assist a decision-maker to determine a serious and irreversible impact and/or the NSW BioNet Threatened Biodiversity Profile Database, as entities potentially subject to SAIIs will be impacted, either directly or indirectly by the project.

Those entities relevant to the Project include:

- Box Gum Woodland TEC
- Large-eared Pied Bat
- Large Bent-winged Bat
- Little Bent-winged Bat
- Eastern Cave Bat

Each of the above listed microbat species are listed in BioNet as potentially susceptible to a SAII based on impact to breeding habitat and/or adjacent areas for forage habitat. As such, substantial efforts to avoid impacts to two areas of potential roosting and possible breeding habitat (and the areas within the BAM prescribed 100 metres buffers) were undertaken during the initial Response to Submissions stage of the project. These efforts included the removal / relocation of two turbines such that potential direct impacts associated with the projects are now well outside the BAM prescribed SAII threshold buffer areas. Following this redesign work it was acknowledged by BCS that the potential for a SAII resulting from the projects construction and long term footprint impacts to breeding habitat (as per the standard SAII threshold triggers) had been sufficiently addressed.

Further to potential impacts to breeding habitats, the species have the potential to be impacted as a result of collision with operating turbine blades, and an assessment of this risk and the possible consequences has been undertaken for each species as part of this BDAR. The risk assessment concluded that three of the four species were at a moderate risk of impact as a result of collision with operating turbine blades, but that the quantum of impacts was uncertain. The risk assessment found that there was a low risk of impact from turbine strike to Eastern Cave Bat as the species was not recorded in rotor swept height, was infrequently recorded within the subject land at lower levels of activity than many other species, and the species' fast / agile / manoeuvrable below-canopy flight characteristics.

The April 2022 BCS RFI states: *The upper quantum of blade strike for all microbat species utilizing the projects airspace is uncertain. However, based on the data presented in the BDAR, BCS considers that under a worse-case scenario this impact would contribute to the risk of these populations becoming extinct. As such, the currently proposed operational impacts of the project should be considered by the consent authority to represent a potential SAII impact to the Large-eared Pied Bat, Large Bent-winged Bat and Little Bent-winged Bat.* (BCS 2022)

The updated SAII assessments (Appendix E) focus on whether the Project is likely to result in a SAII due to the potential for operational impacts, largely relating to potential collision with turbine blades, on the local populations of Large Bent-wing Bat, Large-eared Pied Bat and Little Bent-winged Bat.

In accordance with Clause 6.7 Of the BC Regulation an impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

a) it will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or

b) it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or *c) it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or*

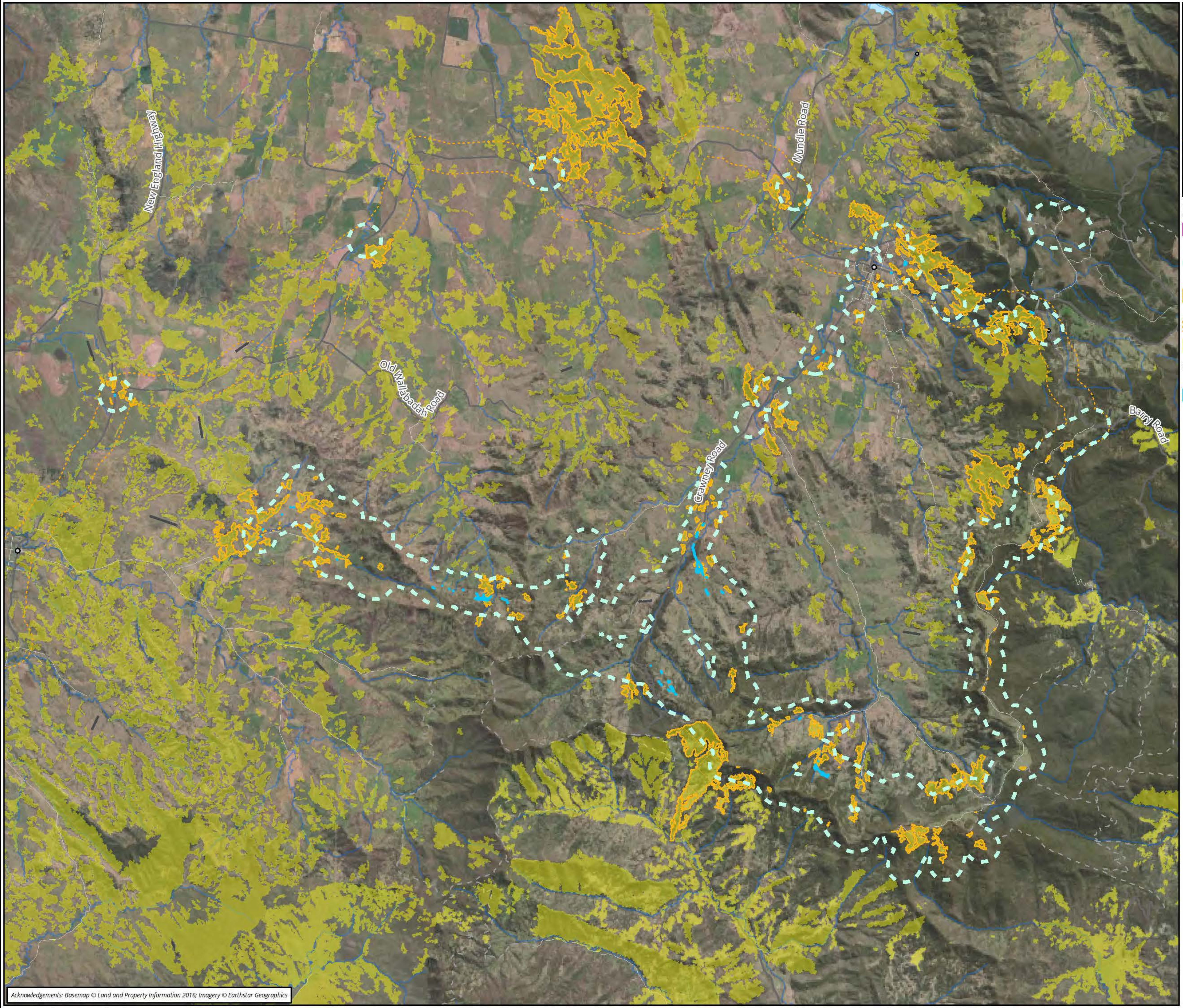
d) the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.

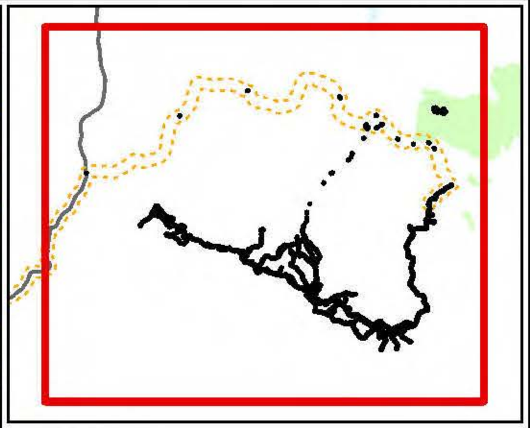
Assessments undertaken in accordance with Section 9.1 of the BAM for the above listed potential SAII entities are included in Appendix E, with a summary provided in Table 78. Impacts to Box Gum Woodland in the context of the SAII assessment are mapped on Figure 29.

Table 78 Summary of SAII assessments

SAII entity	Summary of assessment
Box Gum Woodland	Throughout the development of the project layout, design decisions have been implemented to avoid impacts to Box Gum Woodland. This has included early biodiversity surveys, prior to development of the preferred corridor. Preliminary assessment highlighted areas of key ecological concern and allowed for avoidance of these areas during the wind farm concept design. During the wind farm layout design, workshops were held between project ecologists, civil engineers and wind modellers to further optimise layout options and ensure impacts to the areas of mapped Box Gum Woodland. Overall design refinements undertaken since the exhibited BDAR have resulted in a reduction of impact to Box Gum Woodland CEEC from 13.3 hectares to 8.15 hectares. Approximately 67 % of the impacts to Box Gum Woodland (5.4 hectares) as a result of the project will occur on areas of DNG or that have been assessed as occurring in Low condition. This percentage has increased with the changes to site access, where impacts to Devil's Elbow are no longer required. The Project is not considered likely to reduce the extent of the CEEC at the national, bioregional or local scales, and as such the scale of the impact will not lead to a reduction in the geographic distribution of Box Gum Woodland across its known distribution. Furthermore indirect impacts associated with disruption or abiotic process, the loss of functionally important species, and/or exacerbation of fragmentation and isolation are considered unlikely to be substantial as a result of the Project. Further details are provided in Appendix E, and Figure 29.
Large Bent-winged Bat	Actions to avoid impacts to Large Bent-winged Bat include reduction in the numbers of turbines and changes to project layouts to avoid impacts to roosting/breeding habitat buffers, increased separation distances between turbines, and increase separation distances between blade tip and roost/forage habitats. Ongoing construction and operational phase commitments have also been made to reduce indirect impacts to bats potentially present in roost habitat, and potential blade strike impacts. Turbine removal and relocation have resulted in all direct and indirect impacts previously located within the BAM prescribed 100 metre breeding habitat buffers being removed. The local population of the species is considered to be quite large due to the presence of a known non-maternity roost at Timor Caves, approximately 5 kilometres south of the development footprint. Impacts associated with the project are considered relatively minor in the context of the species' potential forage distance, and also relatively minor to potential breeding habitat. Impacts associated with blade strike may occur, with Large Bent-winged Bat being one of the more frequently recorded bats within rotor swept height. However the project has made commitments to ensure turbine strikes are minimised through both proactive curtailment of turbines and reactive implementation of strict mitigation strategies (including further

SAII entity	Summary of assessment
	curtailments) based on rigorous monitoring. Further information is provided in Section 7.2.3 and Section 8.10.2. These measures will ensure the potential for substantial impacts to Large Bent-winged Bat populations as a result of operation turbined will not occur. Further details are provided in Appendix E.
Little Bent-winged Bat	Actions to avoid impacts to Little Bent-winged Bat and associated residual impacts are generally aligned with Large Bent-winged Bat, as detailed above. This is due to the similarities in the species foraging, roosting and breeding habitats, and life-cycles. Turbine removal and relocation have resulted in all direct and indirect impacts previously located within the BAM prescribed 100 metre breeding habitat buffers being removed. Little Bent-winged Bat was recorded less frequently within rotor swept height than Large Bent-winged Bat, however the potential consequences of blade strike are considered similar, and commitments made to ensure ongoing reduction impacts to the species apply. Commitments made to ensure turbine strikes are minimised through both proactive curtailment of turbines and reactive implementation of strict mitigation strategies (including further curtailments) based on rigorous monitoring will ensure the potential for substantial impacts to Little Bent-winged Bat populations as a result of operation turbined will not occur. Further details are provided in Appendix E.
Large-eared Pied Bat	Actions and commitments to avoid impacts to Large-eared Paid Bat are commensurate with those summarised above. Turbine removal and relocation have resulted in all direct and indirect impacts previously located within the BAM prescribed 100 metre breeding habitat buffers being removed. The size of the local population of Large-eared Pied Bat is considered to be smaller than the bent-winged bat species, and the species is known to generally fly closer to the canopy, hence lower activity levels recorded at all elevations during acoustic surveys are as expected. Impacts to forage habitat are considered relatively minor based on the presence of native vegetation within an estimated 2.5 km forage distance from the development footprint. Impacts to roosting and potential breeding habitat (and 100 m buffers) have been minimised through project design, and commitments have been made to further reduce potential impacts during micro-siting of turbines. Dispersal and movement patterns are not expected to be substantially interrupted due to the linear layout of the turbines and the species' habit of flying closer to the canopy. Commitments made to ensure turbine strikes are minimised through both proactive curtailment of turbines and reactive implementation of strict mitigation strategies (including further curtailments) based on rigorous monitoring will ensure the potential for substantial impacts to Little Bent-winged Bat populations as a result of operation turbined will not occur. Further details are provided in Appendix E.
Eastern Cave Bat	Actions and commitments to avoid impacts to Eastern Cave Bat are commensurate with those summarised above. Turbine removal and relocation have resulted in all direct and indirect impacts previously located within the BAM prescribed 100 metre breeding habitat buffers being removed. it has been acknowledged by BSC that a SAII to Eastern Cave Bat is unlikely to occur as a result of the Project.





Legend

- Infrastructure footprint
- Development footprint 500m buffer
- Box Gum Woodland within 500m of the development footprint
- Transport haul routes
- Mapped BGW PCTs in the locality

Serious and irreversible impacts

- Box Gum Woodland within the development footprint

Figure 29 Serious and irreversible impacts

0 1,000 2,000 3,000 4,000
Meters
N
Scale: 1:116,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis.

Matter: 34963,
Date: 24 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F29_SAII
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

8.7 Cumulative impacts

An assessment of proposed and current wind farm projects within a 200 kilometre buffer of the project site has been carried out to provide a summary of potential cumulative impacts to biodiversity (Table 79). The summary chapters for biodiversity from each of these projects EIS or the scoping report was reviewed to gain an understanding of the main biodiversity impact and how these may contribute to cumulative impacts when considering the development of the Hills of Gold Project. The proximity of these wind farms to the subject land is mapped on Figure 28.

Table 79 Cumulative impacts from wind farms in the region

Project, description and location	Potential biodiversity impacts	Relevance to Hills of Gold
Kyoto Energy Park **47km away** **42 wind turbines, solar photovoltaic array and mini hydro plant** **EIS chapter reviewed.**	• No threatened flora. • 5.9 ha of impact to White Box-Yellow Box-Blakely's Red Gum TEC. • Seven threatened fauna species comprised of birds and microbats with lower terrestrial fauna diversity than the Hills of Gold project. • Potential Koala habitat, but no records or sign of activity during field surveys. • Wedge-tailed Eagle and Nankeen Kestrel identified in collision risk.	A test of significance under the now repealed *Threatened Species Conservation Act 1997* found that the project is unlikely to have a significant impact on threatened species and communities. An additional 5.9 ha of impact to the TEC is not considered to substantially contribute to the impact assessment for impacts to this TEC for the Hills of Gold Project.
Bowmans Creek Wind Farm **59 km away** **Desktop assessment from request for SEARs**	• Nine PCTs mapped as being potentially impacted, with five of these being TECs.	The Bowmans Creek windfarm is in a different soil landscape than the Hills of Gold Project and there is no PCTs that are common to both.
Winterbourne Wind Farm **75km away** **Field assessment from request for SEARs**	• Two threatened fauna species, Scarlet Robin and Spotted-tailed Quoll. • Two TECs, New England Peppermint woodland and Box Gum woodland. • Five non-threatened raptors at risk of blade strike.	The Winterbourne windfarm is in a different soil landscape than the Hills of Gold Project and there are few PCTs that are common to both. Potential impacts to Wedge-tailed Eagle as a results of collision risk, however unlikely to be significant with a similar outcome as assessed for this Hills of Gold project
Liverpool Range Wind Farm **116km away**	• Key impacts are to Box Gum Woodland, woodland birds, forest owls and microchiropteran bats.	Assessment of collision risk for microbats determined that species unlikely to be significantly impacted by blade strike due to foraging heights within or below canopy.

8.8 MNES Significant impact assessment

A detailed assessment against the EPBC Act *Significant Impact Guideline 1.1 – MNES* is included in this section of the BDAR. The outcomes of this assessment indicate that the project has the potential to result in a significant impact to one TEC and two threatened fauna species, summarised in Table 80.

The following sections describe the significant impact assessment for all MNES species known or considered likely to occur in the development footprint.

Table 80 Summary of MNES assessed to have a significant impact under the EPBC Act guidelines

TEC and EPBC Status	Extent and nature of significant impact
White Box Yellow Box Blakely's Red Gum Woodland Critically Endangered	The project has been assessed as resulting in the direct impact and loss of up to 8.15 ha of this TEC within the transmission line, transmission line access tracks, and transport route upgrades (site access) infrastructure areas. Impacts to the largest are of high quality TEC have been avoided with the change in site access no longer requiring impact to the Devil's Elbow area. Measures to avoid and minimise impacts to this TEC have been considered as part of the design, particularly in the selection of the preferred transmission line route. Additional mitigation measures to avoid impacts to the TEC will be considered and implemented where practicable during future design phases and any residual impacts will be offset. The current development footprint considers a 'worst case' clearing footprint for the transmission line easement, assessing complete clearing within the easement. Depending on the height of the towers and the topography of the easement, there will be locations where the existing eucalypt forest can be retained, while still maintaining the required safety and operational clearance to the transmission lines. This presents opportunities to further minimise the extent of clearing of this TEC during detailed design. As well as minimising impacts through design, site restoration and rehabilitation will utilise a species planting list drawn from this TEC where appropriate. Any **impacts to this TEC are considered unlikely to be significant**, as it is listed as critically endangered.
Koala Vulnerable (see Section 8.8.2)	Given the scale of native vegetation removal required for the proposed works (> 20 hectares), the presence of Koala within the development footprint, and the contiguous nature of the development footprint with surrounding National Parks and State Forests, the EPBC Act referral guidelines classifies the vegetation within the development footprint as critical to the survival of the species. The referral guidelines, which are applicable to all project types, states that the proposed works has the **potential for a significant impact** on the species, due to the removal of greater than 20 hectares of habitat. The removal of 46.28 hectares of native vegetation known to support Koala (which has been reduced by 4.48 hectares due to design revisions undertaken for the amended project) has the potential to impact the species due to the removal of habitat available to the local population. It should be noted however that, based on a conservative home range buffer of 20 kilometres (Kavanagh, Stanton, & Brassil 2007, Davies et al. 2013) (further detailed below), up to approximately 116,500 hectares of native vegetation is available to those Koala individuals most likely to utilise the habitat within and directly adjacent to the development footprint. Of this 116,500 hectares of habitat approximately 32,000 hectares (27.5 %) was burnt in the 2019-2020 bushfires (GEEBAM DPIE 2020), which leads to the remaining unburnt habitat becoming a more important resource to the local population. In

TEC and EPBC Status	Extent and nature of significant impact
	consideration of the impacts of the 2019-2020 bushfires, the project will only impact upon approximately 0.4% of the habitat available to the local population, which includes the large areas of intact bushland to the south and east of the project footprint. The federal conservation aim for the Koala includes increased vegetation recovery in regions containing fragmented Koala populations, with the project's Biodiversity Offset Strategy aiming to contribute towards this in the local area through increased habitat connectivity, and in the overall achievement of the 'No Net Loss' standard. The current population in the area is not considered to be fragmented, and the areas of habitat impacted as part of the Project are generally small, isolated patches or areas of edge habitat adjacent to larger contiguous areas of Koala habitat. These impacts are not considered likely to result in a reduction in the size of the Koala population in the region. Measures to avoid and minimise impacts to critical Koala habitat have been considered during the design, especially as part of the design refinements for the wind farm resulting in a reduction of the proposed turbines from 97 to 64 and workshops to site infrastructure within cleared areas where practicable. Impacts to Koala habitat have been reduced by approximately 10% from the 50.76 ha identified in the original BDAR, to 46.28 ha in the current updated BDAR as a result of the project design changes and avoidance initiatives targeted specifically towards Koala habitat. Additional measures will be explored during detailed design phases to reinstate Koala habitat in suitable areas as part of revegetation and landscaping works for rehabilitation of areas subject to temporary impacts. Potential impacts through the construction phase of the Project will be minimised through implementation of the Biodiversity Management Plan that will target management actions specifically towards Koala with details provided in Section 8.9 below.
Large-eared Pied Bat Vulnerable	The proposed works would require the removal of 19.75 hectares of Large-eared Pied Bat habitat that likely forms foraging habitat for the species, based on a 2 km buffer on potential breeding habitat. Previously, potential breeding habitat for this species had been identified within the impact areas, associated with eucalypt forest that is within 100 m of the mapped steep cliffs providing potential roosting/breeding habitat (refer to Section 5.4.2 above). However, following targeted field investigations this potential habitat was greatly refined, and project modifications undertaken to avoid this habitat with the result that no potential breeding and roosting habitat for Large-eared Pied Bat will be impacted by the Project. Based on the above, and further detailed in the significant impact criteria assessment below, this level of impact is **not considered likely to be a significant impact** to the species. This is largely due to the large areas of commensurate habitat available in the locality to this highly mobile species.
Spotted-tailed Quoll Endangered	In consideration of the significant impact criteria, the Project has been precautionarily assessed as leading to a **potentially significantly impact** on habitat of the Spotted-tailed Quoll within the development footprint and wider locality. The Spotted-tailed Quoll habitat within the development footprint is considered to be important habitat, given the Endangered EPBC Act threat status of the Spotted-tailed Quoll and the direct evidence of occupancy by the species (DAWE 2016). A total of 45.62 hectares of this habitat is proposed to be removed as part of the project, which is likely to adversely impact Spotted-tailed Quoll habitat within the locality. However, there is still approximately 84,000ha of unburnt native vegetation present within the expected habitat range for the local population of the species that is considered to be adequate for the population to

TEC and EPBC Status	Extent and nature of significant impact
	persist. Measures to avoid and minimise impacts to important Spotted-tailed Quoll habitat have been implemented where practicable during the design of the Project, especially as part of the re-design work since EIS exhibition. Impacts to high and moderate condition PCTs have been reduced by a total of 21.21 ha as a result of project amendments, and the majority of this avoided native vegetation is considered potential habitat for the species. The removal of Spotted-tailed Quoll habitat from the development footprint may contribute to the threats currently impacting the species (i.e. habitat loss). However, the project's Biodiversity Offset Strategy aiming to contribute towards improvement in the species' habitat in the local area through increased habitat connectivity, and in the overall achievement of the 'No Net Loss' standard. Potential impacts through the construction phase of the Project will be minimised through implementation of the Biodiversity Management Plan that will target management actions specifically towards Spotted-tailed Quoll with details provided in Section 8.9 below.

8.8.1 White Box-Yellow Box-Blakely's Red Gum Woodland

Box Gum Woodland CEEC is strongly associated with more fertile soils on lower elevations across the known range in Queensland, New South Wales and Victoria. Over much of its range, this TEC has been subject to extensive clearing and modification for agriculture and grazing, so it often occurs as derived native grasslands with no overstorey.

To be considered the listed CEEC under the EPBC Act, areas of this community must have a predominantly native understorey (i.e. more than 50% of the perennial vegetative ground layer must comprise native species), and be 0.1 hectare (ha) or greater in size and contain 12 or more native understorey species, (excluding grasses), including one or more identified important species. Or patches can be over 2ha or greater in size and have either natural regeneration of the overstorey species or an average of 20 or more mature trees per ha (DECC, 2010).

Based on an analysis of the plot data collected within PCTs comprising this CEEC, all sampled patched meet these criteria and therefore all patches of the following PCTs, in all condition states are conservatively considered to represent the EPBC Act listed CEEC:

- PCT 433 - White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, Brigalow Belt South Bioregion.
- PCT434 - White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion
- PCT 492 - Silvertop Stringybark - Yellow Box - Apple Box - Rough-barked Apple shrub grass open forest mainly on southern slopes of the Liverpool Range, Brigalow Belt South Bioregion.
- PCT 599- Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion.

It is acknowledged that some areas mapped as the above listed PCTs in Low or DNG condition states may not in fact meet the EPBC Act listing requirements, however based on a lack of plot data in these lower condition patches, this updated BDAR has conservatively assumed that the mapped areas all constitute the CEEC to ensure a worst case assessment of impacts within the development footprint.

Based on this conservative assumption, the project will impact on 8.15 hectares of Box Gum Woodland CEEC, of which approximately 67% occurs in Low or DNG condition states, with impacts to higher condition patches reduced by the removal of the transport route upgrades at Devil's Elbow from the Project.

An assessment of the potential significant of this impact is presented in Table 81 below, with a significant impact to Box Gum Woodland determined to be unlikely.

Table 81 EPBC Act significant impact assessment for Box Gum Woodland

Criteria	Assessment response
Is there a real chance or possibility that the action will reduce the extent of an ecological community	As outlined in the EPBC Act Listing Advice for the CEEC the national extent of Box Gum Woodland occurs in an arc along the western slopes and tablelands of the Great Dividing Range from Southern Queensland through NSW to central Victoria (Beadle 1981). It occurs in the Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes, Victorian Midlands and Riverina Bioregions (Environment Australia 2000). The current extent of the CEEC in NSW is estimated as approximately 250,000 hectares, comprising just 7% of its pre-1750 extent of an estimated 3,700,000 hectares. Of this current estimated extant of 250,000 hectares, approximately 9,000 hectares is estimated to occur within the Nandewar IBRA bioregion, and approximately 39,000 hectares within the NSW North Coast IBRA bioregion (Commonwealth of Australia 2006). The project will impact upon a total of 8.15 hectares of Box Gum Woodland CEEC, the majority of which occurs within the Nandewar IBRA bioregion, with a small portion of the impact occurring in the NSW North Coast IBRA bioregion. These impacts represent a tiny fraction of the extant of Box Gum Woodland CEEC at the National scale, and at the bioregional scale. To assess potential impacts to the CEEC at a more local scale aerial vegetation mapping (DPIE 2019, DPIE 2015) was interrogated to ascertain the extant of PCTs known to represent Box Gum Woodland (NSW BioNet) within a 5 kilometre and 10 kilometres buffer of the development footprint. A total of approximately 10,800 hectares of PCTs known to partially or entirely represent Box Gum Woodland are mapped within the 5 kilometres buffer, and approximately 29,000 hectares are mapped within the 10 kilometre buffer. If only 10% of these mapped vegetation polygons were found to actually represent the EPBC Act listed CEEC, impacts associated with the project would again only represent a small fraction (0.5% and 0.2%) of the CEEC likely to be present in the locality. Based on the above, the project is not considered likely to reduce the extent of the CEEC at the national, bioregional or local scales.
Is there a real chance or possibility that the action will fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Box Gum Woodland occurs within the development footprint in association with the transmission line corridor, transmission line access tracks and road upgraded along Barry Road outside Nundle and the western site access. Along the transmission line and its access tracks, and the westerns site access location, the CEEC occurs in an already highly fragmented landscape, with the impacted patches of the CEEC, and the patches mapped in the surrounding landscape largely occurring as isolated patches of vegetation in an over-cleared landscape. Some larger patches of potential CEEC also occur on steeper slopes in more intact vegetation where the CEEC is associated with PCT 488 Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills, however these areas are mainly south of the development footprint and on the southern side of the ridgeline. Impacts associated with the construction and operation of the project's transmission line (and associated access tracks) will not result in fragmentation of any substantial patches of the CEEC, nor will it increase

Criteria	Assessment response
	fragmentation in the landscape. Near Nundle a number of small isolated patches of Box Gum Woodland will be impacted by the required transport route upgrade works to allow project components to be transported to the site. This impact will occur to roadside vegetation in low condition, and within a landscape of scattered paddock trees, and retained vegetation near creeks. This impact will not fragment or increase fragmentation of the CEEC in this location. More significant road upgrades works are required further east along Barry Road, at Devil's Elbow, have now been removed from the project. Minor clearing of the CEEC is required at the eastern extent of the works area on road edges to widen the corners, and as such no fragmentation impacts will occur in this area. It is therefore considered that the project will not fragment or increase fragmentation of Box Gum Woodland CEEC.
Is there a real chance or possibility that the action will adversely affect habitat critical to the survival of an ecological community	Habitat critical to the survival of Box Gum Woodland is on the moderate to highly fertile soils of the western slopes of NSW, which includes the sections of the transmission line corridor, albeit in generally poor condition (refer Table 29). Critical habitat for the survival of the CEEC also includes areas that contain the floristic structure and patch size requirements listed in the recovery plan for Box Gum Woodlands. The proposed development will impact on 8.15 hectares of this habitat, either a part of an already disturbed landscape or on the edge of a larger patch of the CEEC within intact vegetation. Based on the scale of the impact, and the tiny proportions of existing Box Gum Woodland and its habitat this equates to in the locality, the projects is not considered likely to adversely affect habitat critical to the survival of the CEEC.
Is there a real chance or possibility that the action will modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The construction and operation of the transmission line or section of open road built to the required Australian Standards is unlikely to result in changes to any abiotic factors that are critical to the long term survival of Box Gum Woodland in areas adjacent to the development footprint. The construction of the transmission line will not require substantial earthworks that could impact on surface water or groundwater flow patterns. The current design has also allowed for several access tracks into the transmission line corridor to limit the need for substantial earthworks along the length of the alignment to enable construction.
Is there a real chance or possibility that the action will cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	The impacts to Box Gum Woodland associated with the project are confirmed to generally lower condition vegetation within a fragmented landscape associated with the transmission line and its access racks, and the majority of the western site access, with a small impact to higher condition vegetation adjacent to Crawney Road. Impacts will not result in clearing of vegetation unique to the locality, or to species locally common when compared to elsewhere in the development footprint or broader locality. As such the project is not considered likely to cause a substantial change in the species composition of an occurrence of Box Gum Woodland such that it would continue to decline.

Criteria	Assessment response
Is there a real chance or possibility that the action will cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: • **assisting invasive species, that are harmful to the listed ecological community, to become established, or** • **causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community**	As outlined above impacts to Box Gum Woodland associated with the project are confirmed to generally low condition vegetation within a fragmented landscape associated with the transmission line and its access racks, and to higher condition vegetation near Crawney Road. Box Gum Woodland present along the transmission line and in the surrounding landscape largely occurs as fragmented and isolated patches in an over-cleared landscape. The construction and operation of the transmission line will not result in negative ongoing impacts to the CEEC in the landscape, nor will it increase existing pressures associated with fragmentation, isolation and edge effects. Box Gum Woodland along Barry Road and the western site access mainly occurs on the edges of the extent of the CEEC, and within larger patches of intact grassy and shrub/grass woodland. The construction and operation of the new roadways may result in an increase in edge effects where the new road will occur through an existing patch of intact vegetation, however it is not expected that sources of negative impacts such as weed encroachment will increase above the levels that already existing in the landscape. It cannot be said that the project is likely to cause a substantial reduction in the quality or integrity of an occurrence of an ecological community through vectors such as invasion of weeds, or the increase of chemicals or other pollutants.
Is there a real chance or possibility that the action will interfere with the recovery of an ecological community	Where the CCEC occurs within the subject land, ongoing negative pressures are impacting upon existing patches associated with fragmentation, isolation and edge effects. Landuse in these locations is unlikely to change and as such it can be expected that the condition and overall extant of the CEEC in the locality will continue to decline. There is limited opportunity for recovery of Box Gum Woodland in this landscape with rural pressures likely to continue preventing opportunities for regeneration or rehabilitation of Box Gum Woodland across the majority of the landscape, and steeper/hillier areas less suitable for farming also limited in their capacity to allow for an increase is extent or condition of the CEEC. The project will not result in direct or future ongoing impacts that are likely to interfere with the recovery of Box Gum Woodland, and the seeking of local offset opportunities may actually provide some scope for the CEEC to be rehabilitated in the vicinity of the project area.

8.8.2 Koala

Koala was listed as Vulnerable under the Commonwealth EPBC Act when the Project was declared a Controlled Action in 2019, and in February 2022 it was up-listed to Endangered. As Koala was not listed as Endangered at the time of the controlled action decision, it remains considered as a Vulnerable species as part of the controlling provisions.

Koala occurs from north-east Queensland to South Australia, including parts of NSW. A rapid decline in the number of individuals has been seen since European settlement, primarily due to a reduction in available good quality vegetation with appropriate canopy species suitable for supporting the species (DECC 2008).

The development footprint is located within the Northern Tablelands Koala Management Area (KMA), and the project will require the removal of a total of 190.54 hectares of native vegetation within the development footprint. Of this, 46.28 hectares is considered to be Koala habitat.

Potential impacts of the proposed works include removal of documented Koala feed trees within the Northern Tablelands KMA located within the development footprint, including Snow Gum, Mountain Gum, Mountain Ribbon Gum, Yellow Box and Messmate (OEH 2018).

Within 10 kilometres of the development footprint, the species has been recorded seven times (EES 2020), with an additional two individuals recorded within the development footprint during the current field assessment (consisting of a mother and joey, Biosis 2019). The closest previous records of Koala occur within Ben Halls Gap Nature Reserve, which is east of, and contiguous with, the development footprint. Hanging Rock State Forest, Nundle State Forest, and Tomalla State Forest and Nature Reserve all lie within 20 kilometres of the assessment area, and contain scattered Koala records throughout (EES 2020). For the purposes of this assessment the definition of "the population" encapsulates all contiguous areas of Koala habitat into a singular spatial unit.

Koala populations throughout Australia are currently under increased pressure due to the 2019-2020 summer bushfires that occurred across the southern and eastern states of Australia. An extent of 5.3 million ha of land representing 6.7% of NSW has been impacted by bushfires affecting over 60 threatened fauna species. DCCEEW have provided several resources in response to these fires including analyses of listed species habitat within fire affected areas (DAWE 2020a), as well as provisional lists of fauna that require urgent management intervention (DAWE 2020b). Approximately 13% of the likely and known distribution of the combined Koala population has been identified as occurring within fire affected areas, and Koala has been identified as one of the species requiring urgent management intervention. Given this context, remaining areas of high quality Koala habitat are of key importance in the conservation of the species.

A detailed assessment of impacts to Koala against the significant impact guidelines is provided in Table 82. Impacts to Koala's are considered to be potentially significant due to the loss of habitat critical to the survival of Koala.

Table 82 EPBC Act significant impact assessment for Koala

Criteria	Assessment response
Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of an important population?	The Commonwealth Species Profile and Threats Database (SPRAT) currently states that there is a data deficiency in regard to the delineation of sub-populations throughout the listed Koala's range (DAWE 2020a). Therefore, it is currently difficult to specify important populations and such a proposition must be assessed on a case by case basis, using the information available for a particular location. The extent of a sub-population is likely to be defined by significant natural or anthropogenic barriers. The development footprint lies approximately 100 kilometres south east of Gunnedah, a known Koala hot-spot. In Gunnedah, local records of Koala were particularly high from the 1970s to the 1990s but began declining rapidly after multiple heat waves hit the area around 2009 (Gunnedah Shire Council 2015). Since then, further impacts to Koalas such as clearing of land and vehicle strikes have further contributed to the decline of the Koala population. It is likely that the Gunnedah population would be considered an 'important population' of the species. Conversely, Koala records nearby the current assessment area are much less concentrated, and little is known about the abundance, distribution or movement patterns of Koalas in the broader area. It is unlikely that Koalas inhabiting the development footprint would be considered part of an 'important population' of Koalas. Regardless, Koalas are known to breed in the locality of the development footprint (recent record of mum and joey, Biosis 2019), and the locality is likely to be used by

Criteria	Assessment response
	the species. The proposed works require impacts to 46.28 hectares of native vegetation identified as potential Koala habitat, which has been reduced by 14.32 hectares due to design revisions undertaken for the amended project, these impacts will however reduce the availability of resources within the locality. Given the proposed impacts occur on the edge of an extensive reserve system (greater than 3000 hectares), it is unlikely that the overall size of the existing population will diminish as a result of the works. Impacts to Koala habitats impacted within the development footprint are also to largely fragmented patches located within a matrix of agricultural land. There are no large, intact areas of Koala habitat proposed to be impacted and the project will not cause any permanent barriers to Koala movement within or through the development footprint. Overall, it is unlikely that the proposed works will lead to a long-term decrease in the size of an important population.
Is there a real chance or a possibility that the action will reduce the area of occupancy of an important population?	Koalas occurring in and nearby the development footprint are not considered to form part of an 'important population' of Koalas. The proposed works require impacts to 46.28 hectares of native vegetation identified as potential Koala habitat, which has been reduced by 4.48 hectares due to design revisions undertaken for the amended project, these impacts will however reduce the availability of resources within the locality. Whilst impacts to these areas may restrict the expansion of the existing Koala population, given the proposed impacts occur on the edge of an extensive reserve system (greater than 3,000 hectares), it is unlikely that the overall size of the existing population will diminish as a result of the works. Overall, it is unlikely that the proposed works will significantly reduce the area of occupancy of an important population.
Is there a real chance or a possibility that the action will fragment an existing important population into two or more populations?	Koalas occurring in and nearby the development footprint are not considered to form part of an 'important population' of Koalas. Within the locality of the development footprint, Koala records are scattered throughout the landscape, mostly to the north and east. Koala have been recorded within the wider area surrounding the development footprint, with previous records also occurring within Ben Halls Gap Nature Reserve, Hanging Rock State Forest, Nundle State Forest, and Tomalla State Forest and Nature Reserve, all laying within 20 kilometres of the development footprint (EES 2020). To the west of the development footprint however, land is largely cleared for farming, and large gaps occur between areas of native vegetation. It is likely that the development footprint falls at the western edge of the local Koala population, with Koalas mostly inhabiting the nearby nature reserves to the east. The proposed works require removal of 46.28 hectares of potential Koala habitat (reduced by 4.48 hectares due to design revisions undertaken for the amended project), however, this habitat occurs at the western fringes of Ben Halls Gap Nature Reserve. While removal of this vegetation will reduce resources for Koala in the area, it is unlikely to fragment the local population, which most likely occurs largely east of the development footprint. Overall, it is unlikely that the proposed works will result in the fragmentation of the current existing population into two or more populations.
Is there a real chance or a possibility that the action will	Table 4 of the EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)

Criteria	Assessment response
adversely affect habitat critical to the survival of a species?	(DoE 2014) includes a habitat assessment tool for assessing habitat critical to the survival of the Koala. Impact areas that score five or more are considered to include critical habitat for the species. The area of the proposed works returned a score of 8, and therefore constitutes habitat critical to the survival of Koala. This score was based on the following criteria: • Evidence of one or more Koalas within 2 kilometres of the edge of the impact area within the last 5 years (2 points). • Has forest, woodland or shrubland with emerging trees with two or more known koala food tree species (2 points). • Area is part of a contiguous landscape ≥ 1000 hectares (2 points). • Evidence of infrequent or irregular Koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for Koala occurrence (1 point). • Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context (1 point). The EPBC Act referral guidelines for Koala include assessment criteria under Section 7 for determining whether a proposed action including impacts to critical koala habitat requires an EPBC referral (see Figure 2: assessing adverse effects on habitat critical to the survival of the Koala). As the development footprint contains habitat classed as critical, and the impact to vegetation is more than 20 hectares, the guidelines state that the impact to Koala is most likely to be significant for the purposed of the EPBC Act. Given the patchy spatial arrangement of majority of the native vegetation removal, the presence of Koala within and surrounding the development footprint, the limited barriers to movement and corridors from the project, and the contiguous nature of the development footprint with surrounding National Parks and State Forests, this assessment considers the Project is unlikely to result in impacts that will actually adversely affect habitat critical to the survival of the species in the locality. Regardless, based on the guidance provided in the EPBC Act referral guidelines, the removal of Koala habitat as a result of the project is considered to have the potential result in a significant impact to the species. In addition, large-scale bushfires during the summer of 2019-2020 have reduced the availability of Koala habitat across its distribution by approximately 13 % (DAWE 2020a). Studies have shown that the home ranges of Koalas vary based on foraging resources. One study in north-western NSW found that the home ranges for male Koala's was around 12 hectares, and for female's it was around 9 hectares (Kavanagh, Stanton, & Brassil 2007). A second study in semi-arid landscape of southwest Queensland found that home range size varied significantly with the availability of water, with average home range being around 18 hectares where annual rainfall was in excess of 580 mm per annum, increasing to around 80 hectares where annual rainfall was around 450 mm per annum (Davies et al. 2013). Given the typically high annual rainfall around Hanging Rock (BOM Station 055200) which has ranged from 424.6 mm to 1452.90 mm since 2014 (BOM 2022), a conservative 20 kilometre buffer around the wind farm development footprint is likely to include the home ranges of those individuals most likely to utilise the habitat within and directly adjacent to the development footprint. Within this 20 kilometre buffer area approximately 32,000 hectares (27.5 %) of native vegetation has been burnt, with the area estimated to support a total of

Criteria	Assessment response
	approximately 116,500 hectares of native vegetation. Most (approximately 26,200 hectares or 82 %) of this vegetation has been burnt to a medium or high degree of intensity, in accordance with the burnt area classes outlined in the GEEBAM (DPIE 2021), meaning both the canopy and understorey have either been partially of completely burnt. As such, the native vegetation being removed by the Project is of potentially greater importance than prior to the 2019-2020 bushfires for the species, given it mainly represents unburnt habitat within an areas where a substantial portion of the vegetation as burnt.
Is there a real chance or a possibility that the action will disrupt the breeding cycle of an important population?	Koalas occurring in and nearby the development footprint are not considered to form part of an 'important population' of Koalas. The 46.28 hectares of vegetation being removed (reduced by 4.48 hectares due to design revisions undertaken for the amended project) occurs on the fringes of native vegetation along the western side of Ben Halls Gap Nature Reserve. While Koalas are known to breed in the locality (project record of mother and joey, Biosis 2019), it is also likely that such behaviour occurs throughout the reserve system to the north and east of the development footprint. While the removal of vegetation as part of the proposed works will reduce habitat (including breeding habitat) for Koala in the local area, the local Koalas are not considered an important population and the abundance of habitat available within the nearby reserve system would likely continue to support the breeding and population growth of the species in this area. Overall, it is unlikely that the proposed works will disrupt the population or breeding cycle of an important population of Koala.
Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The proposed works will remove 46.28 hectares of potential Koala habitat from the development footprint, reduced by 4.48 hectares due to design revisions undertaken for the amended project. This includes removal of native trees identified as feed trees for Koala within the Northern Tablelands KMA (OEH 2018). As Koala are known to utilise the development footprint, the removal of this habitat will decrease the availability of habitat for the species within the locality. In addition, large-scale bushfires during the summer of 2019-2020 have reduced the availability of Koala habitat across its distribution by approximately 13 % (DAWE 2020). Approximately 32,000 hectares of native vegetation within a 20 kilometre buffer of the development footprint has been lost due to bushfire. This represents 27.5 % of the 116,500 hectares of native vegetation estimated to occur within this buffer. As such the native vegetation being removed by the Project is of potentially greater importance than usual for the species. However the habitat within the development footprint is located on the edges of vegetation patches, with significant tracts of more in-tact vegetation still available to Koala within the nearby reserve system to the north and east, where the main portion of the koala population is expected to exist. Additionally, protecting and enhancing native vegetation outside of approved disturbance areas and managing the remaining remnant vegetation and habitat within or surrounding the development site toward a benchmark state, would aid in the recovery of Koala habitat locally. Overall, it is unlikely that the proposed works would cause the local population of the species to decline.
Is there a real chance or a possibility that the action will	Invasive species such as the European Fox *Vulpes vulpes* that may predate Koala are considered established within the region. Invasive weeds species are not

Criteria	Assessment response
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	known to directly harm populations of Koala but do have potential to reduce quality of habitat in the adjoining bushland and therefore increase potential to harm the population of Koala. Management measures would be prepared, implemented and audited to avoid and minimise the environmental risks associated with weeds, pests and pathogens. As a minimum, these would include: • Completion of a site weed assessment and development of a Weed Management Plan. The Weed Management Plan would sit as a sub-plan to the Environmental Management Strategy (EMS) • Implementation of appropriate weed control and weed disposal in accordance with Biosecurity protocols. • Any soil or other materials imported to the site for use in restoration or rehabilitation would be certified free from weeds and pathogens or obtained from sources that demonstrate best practice management to minimise weed and pathogen risks. • Appropriate disposal of any weed material.
Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?	The proposed action will result in removal of potential habitat for Koalas within the development footprint. This impact is not likely to results in the introduction of diseases that may cause the species to decline.
Is there a real chance or a possibility that the action will interfere substantially with the recovery of the species?	There is no accepted or adopted national recovery plan for Koala. However, the approved conservation advice (Commonwealth of Australia 2012) gives priority to the following conservation actions: • Develop and implement a development planning protocol to be used in areas of koala populations to prevent loss of important habitat, Koala populations or connectivity options. • Development plans should explicitly address ways to mitigate risk of vehicle strike when development occurs adjacent to, or within, Koala habitat. • Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary. • Identify populations of high conservation priority. • Investigate formal conservation arrangements, management agreements and covenants on private land, and for Crown and private land investigate and/or secure inclusion in reserve tenure if possible. • Manage any other known, potential or emerging threats such a Bell Miner Associated Dieback or Myrtle rust. • Develop and implement options of vegetation recovery and re-connection in regions containing fragmented Koala populations, including inland regions in which Koala populations were diminished by drought and coastal regions where development pressures have isolated Koala populations. • Develop and implement a management plan to control the adverse impacts of predation on Koalas by dogs in urban, peri-urban and rural environments. • Engage with private landholders and land managers responsible for the land on which populations occur and encourage these key stakeholders to contribute to the implementation of conservation management actions. The project cannot be said to be adverse to any of the above conservation actions, and if proposed local biodiversity offsets are secured as planned habitat in the locality surrounding the wind farm will be improved and conserved in perpetuity.

8.8.3 Large-eared Pied Bat

The Large-eared Pied Bat is a medium-sized insectivorous bat measuring a total length of approximately 100 millimetres and weighing 7–12 grams (Hoye and Dwyer 1995). The species is listed as Vulnerable under the BC Act and the EPBC Act. The species' current distribution is poorly known. Records exist from Shoalwater Bay, north of Rockhampton, Queensland, through to the vicinity of Ulladulla, NSW in the south (Hoye 2005). Despite the large range, it has been suggested that the species is far more restricted within the species' range than previously thought (DECC 2007). Much of the known distribution is within NSW. Available records suggest that the largest concentrations of populations appear to be in the sandstone escarpments of the Sydney basin and the north-west slopes (Coolah Tops, Mt Kaputar, Warrumbungle National Park and Pilliga Nature Reserve. Although the species is widely distributed, it is uncommon and patchy within this area (DERM 2011).

The species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging (TSSC 2012). Almost all records have been found within several kilometres of cliff lines or rocky terrain (Hoye 2005). Roosting has also been observed in disused mine shafts, caves, overhangs and disused Fairy Martin *Hirundo arie*l nests (Hoye and Dwyer 1995).

Known breeding locations are extremely limited within NSW. Five locations are known to have been used for breeding within NSW, including:

- A mine tunnel at Copeton which was used for breeding until flooded by dam waters in 1976 (Dwyer 1966).
- A sandstone cave near Coonabarabran, NSW (Pennay 2008).
- Capture of lactating females adjacent to sandstone cliffs in Ulan, NSW (Fly by Night 2005).
- Observations of small groups of females in a disused gold mine near Barraba, NSW (DERM 2011).
- Anecdotal observations of small groups of females and young bats in the sandstone Pilliga region, NSW (DERM 2011).

The maternity site at Barraba lies approximately 150 kilometres north of the current development footprint, while the maternity site at Coonabarabran lies approximately 185 kilometres west. Post-lactating females have also been recorded approximately 16 kilometres south west of the development footprint near Murrurundi.

The structure of maternity roosts appears to be very specific (arch caves with dome roofs). Caves need to be high and deep enough to allow juvenile bats to learn to fly safely inside and have indentations in the roof. Roosting bats cluster in these indentations, presumably to allow the capture of heat. These physical characteristics are very uncommon in the landscape and their scarcity presumably poses an important limiting factor in the distribution of the Large-eared pied bat (Pennay 2008). No maternity roosts were identified within or adjacent to the development footprint or the 1,500m landscape buffer development footprint, as part of the desktop and field investigations completed for this project.

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area (EPBC Act). In relation to vulnerable threatened species, occurrences include but are not limited to:

- A geographically distinct regional population, or collection of local populations.
- A population, or collection of local populations, that occurs within a particular bioregion.

To date, there have been no genetic studies undertaken on the Large-eared Pied Bat. Movement of this species between areas has not been recorded and its dispersal ability and habits are not known (DERM 2011). Thus, it is difficult to define 'populations' of the species.

The closest previous records of Large-eared Pied Bat occur approximately 16 kilometres south west of the development footprint, nearby Murrurundi (EES 2020). These sightings recorded post-lactating females, indicating that breeding of the species likely occurs within the locality. The species was also recorded in 10 different locations on an ultrasonic acoustic device within the development footprint during the current assessment, likely using vegetation within the development footprint for foraging. Further previous records of the species lie 30 kilometres north west of the development footprint, near Quirindi. As the morphology of the species suggests that individuals do not disperse over large distances like similar species (DERM 2011), for the purposes of this assessment individuals occurring within the development footprint and nearby in Murrurundi and Quirindi are considered to make up the local population.

The proposed works will likely result in the loss of 19.75 hectares of potential Large-eared Pied Bat habitat calculated in accordance with the BAM, and comprising vegetation communities that are known to be associated with the foraging requirements for this species, as well as nearby to roosting/breeding habitat features such as caves, cliffs and rocky areas. This area of potential habitat represents the total foraging habitat available to the species.

Previously two high potential roosting/breeding habitats were identified within the development footprint, adjacent to wind turbines WP27 and WP50. Approximately 2,000 square metres (1.8 %) of native vegetation would have been removed from the 100 metre radius buffer area (totalling 108,465 square metres) surrounding the identified habitat adjacent to the WP27 turbine. Removal of vegetation was also to occur approximately 5 metres outside of the 100 metre radius buffer area (totalling 168,036 square metres) surrounding the identified habitat adjacent to WP50. However, following further changes made to the project as part of the ongoing project design, these habitats will no longer be impacted and as such there will be no direct impacts to the roosting/breeding habitats as a result of the proposed works.

It should be noted that although impacts to microbats via blunt force trauma or possibly barotrauma from wind turbines is one of the environmental risks associated with wind farms, Large-eared Pied Bat forage for small flying insects below the forest canopy (OEH 2017), and are considered unlikely to be at high risk of turbine strike due to the lower likelihood of the species foraging nearby the turbines. That being said, this species was recorded within RSH (approximately 60m above canopy height) on the rare occasion. It was previously predicted that in the vicinity of WP27, due to the size of the turbine blades, that there would be some incursion into the air space above the 100 metre radius buffer applied to the high potential roosting/breeding habitat in this area. A distance of approximately 22 metres was been calculated between foraging habitat and the tips of the WP27 turbine blades. Although considered unlikely that a collision event would occur, this turbine has since been removed and as such these risks have been successfully avoided.

The Proponent has undertaken impact minimisation activities during the design stages of the project and is committed to a two-staged approach to ensure the risk of operational impacts to Large-eared Pied Bat occurring are minimised, which includes a recently introduced precautionary and proactive low wind speed turbine curtailment strategy, combined with a stringent adaptive management strategy. The final details of each strategy will be developed as part of the BBAMP, however the concepts and framework are presented in Section 8.10.2 to provide the consent authority with the required assurance that an inadvertent substantial impacts would be unlikely to occur, and that sufficient measures are in place to arrest potential unacceptable impacts if they were to occur.

A detailed assessment of impacts to Large-eared Pied Bat against the significant impact guidelines is provided in Table 83. Impacts to Large-eared Pied Bats are considered unlikely to be significant.

Table 83 EPBC Act significant impact assessment for Large-eared Pied Bat

Criteria	Assessment response
Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of an important population?	Information about the size, distribution and interactions of Large-eared Pied Bat populations is largely unknown. No populations have been defined as 'important populations' for the species. The largest concentration of records for this species appears to be in the sandstone escarpments of the Sydney basin, and northwest slopes of NSW. Important populations are likely to occur at the edge of the species range, for example in the sandstone escarpments of Morton National Park at the southern end of its range (DERM 2011). The local population, defined from nearby records, does not occur at the edge of the species' range in NSW, however it does occur at the eastern edge of the species range in the regional area. While the species has been recorded abundantly within the Pilliga to the west of the development footprint, no records of the species occur from the development footprint east to the coast. Due to the very few known breeding locations of the species, the record of nearby post-lactating females, and the occurrence of the development footprint at the edge of the regional occurrence of individuals, it is likely that the local population of Large-eared Pied Bat is an important population. The species is known to roost in sandstone caves, and travel down to nearby fertile wooded valleys to forage. A geomorphological assessment of the development footprint and surrounding landscape found that the diverse terrain and lithology and dynamic geomorphology within the locality creates a high potential for microbat roosting sites across landscapes at all elevations, within the expected flight range of microbats that may be present within the development footprint (Environmental Geosurveys Pty Ltd 2021). However, whilst the basalt lithology present at the development footprint may support opportunities for microbat roosts, no substantial caves were likely to be present, and that no data was found to suggest that the development footprint and immediate surrounds geomorphologically standout from the surrounding landscape in one way or another (Environmental Geosurveys Pty Ltd 2021). The proposed works are likely to result in direct impact (via removal) of approximately 19.75 hectares of Large-eared Pied Bat habitat in the form of vegetation associated with the species that occurs nearby caves, cliffs and rocky areas, representing the total foraging habitat available to the species. Two high potential roosting/breeding habitats were previously identified within the development footprint, adjacent to wind turbines WP27 and WP50. Approximately 2,000 square metres (1.8 %) of native vegetation would have been removed from the 100 metre radius buffer area (totalling 108,465 square metres) surrounding the identified habitat adjacent to the WP27 turbine. Removal of vegetation would also have occurred approximately 5 metres outside of the 100 metre radius buffer area (totalling 168,036 square metres) surrounding the identified habitat adjacent to WP50. However, due to project modifications which have resulted in the removal of these two turbines, these impacts have been successfully avoided. As such there are no direct impacts to roosting/breeding habitat (or associated buffer areas) for this species as a result of the proposed project. The likelihood of a collisions with the installed turbine infrastructure is considered unlikely due to the species' foraging and movement behaviour. However, if repeated collisions were to occur the consequences are considered to be

Criteria	Assessment response
	moderate as this could lead to a reduction in the local abundance of the species in the shorter-term (up to 5 years). Due to the expected low likelihood of occurrence and the level of high quality forage habitat, and commensurate habitat present in the locality, it is considered unlikely that the Project will lead to a long-term decrease in the size of the current important population of the species.
Is there a real chance or a possibility that the action will reduce the area of occupancy of an important population?	Given the abundance of rocky escarpments and caves in the broader locality, it is likely that Large-eared Pied Bat are breeding within the area. This is supported by nearby records of post-lactating females. Whilst there are no direct impacts to the two high potential breeding/roosting habitats within the development footprint, the Project will remove 19.75 hectares of foraging habitat for the species. This removal of native vegetation will lead to a reduction in the area of occupancy of the current important population. However, vegetation within the development footprint is well connected to surrounding vegetation, with approximately 28,000 hectares of native vegetation within the 2.5 kilometre area surrounding the development footprint, which is likely to represent the maximum dispersal distance of the local population (Williams & Thomson 2018). This area includes large tracts of intact native vegetation within the Ben Halls Gap National Park, Crawney Pass National Park, Wallabadah Nature Reserve and the Nundle and Hanging Rock State Forests. These areas represent prime foraging habitat for the species and are all within 2.5 kilometres of various locations along the development footprint. Given the plentiful natural roosts that are also likely to be available to individuals within 2.5 kilometres of the development footprint, due to the underlying geomorphology (Environmental Geosurveys Pty Ltd 2021), these foraging habitats would be easily accessible to individuals within the local population. The removal of 19. 75 hectares of native vegetation as part of the proposed works represents a tiny portion of the native vegetation within the foraging distance of the species and is therefore not considered to have a significant impact on the species.
Is there a real chance or a possibility that the action will fragment an existing important population into two or more populations?	The native vegetation to be removed and land proposed to be removed as part of the proposed project lies on the western edge of Ben Halls Gap Nature Reserve. Land to the west of the development footprint contains large, cleared areas with scattered remnant vegetation. The removal of 19.75 hectares of potential Large-eared Pied Bat foraging habitat from the development footprint will reduce the availability of resources in the immediate vicinity of the development footprint, it is unlikely to fragment the existing local population of Large-eared Pied Bat, as the species is mobile and would still be able to use habitat located in the Nature Reserve to the east, and on nearby farmland.
Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?	Habitat critical to the survival of the species is defined as (DERM 2011): • Maternity roosts. • Sandstone cliffs and fertile wooded valley habitat within close proximity of each other. The current project proposes the removal of 19.75 hectares of Large-eared Pied Bat habitat, consisting of foraging habitat. No direct impacts will occur to the identified high potential roosting/breeding habitat. As such the removal of this habitat is not considered to adversely affect habitat critical to the survival of Large-

Criteria	Assessment response
	eared Pied Bat.
Is there a real chance or a possibility that the action will disrupt the breeding cycle of an important population?	As above, it is likely that Large-eared Pied Bat are breeding within the broader locality surrounding the development footprint, due to the abundance of rocky escarpment and caves, and nearby records of post-lactating females. However, the impacts associated with the project are restricted to 19.75 hectares of habitat. There are no direct impacts to high potential roosting/breeding habitats for the species. As such the removal of vegetation associated with the project is unlikely to interrupt the species' breeding cycle.
Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The proposed works will likely result in the removal of 19.75 hectares of potential Large-eared Pied Bat habitat in the form of wooded areas nearby sandstone cliffs. There are no direct impacts to the two high potential roosting/breeding habitats. As such it is considered unlikely that the Project would decrease the availability of habitat for the species such that the species would likely decline.
Is there a real chance or a possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	There is potential for the introduction of weeds, pests or pathogens as a result of the proposed works, via movement of vehicles and plant, and increase in foot traffic. However, management measures would be prepared, implemented and audited to avoid and minimise the environmental risks associated with weeds, pests and pathogens. As a minimum, these would include: • Completion of a site weed assessment and development of a Weed Management Plan. The Weed Management Plan would sit as a sub-plan to the EMS. • Implementation of appropriate weed control and weed disposal in accordance with Biosecurity protocols. • Any soil or other materials imported to the site for use in restoration or rehabilitation would be certified free from weeds and pathogens or obtained from sources that demonstrate best practice management to minimise weed and pathogen risks. • Appropriate disposal of any weed material. • Implementation of appropriate hygiene protocols where there are potential or known pathogen risks.
Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?	The IUCN Species Survival Commission released a statement on 19 June 2020 stating that there is a credible risk of human-to-bat transmission of SARS-Cov-2, a virus currently circulating the globe and causing a pandemic of the illness Covid-19 (IUCN SSC 2020). However, introduction of this disease to Large-eared Pied Bats within the development footprint as a result of the proposed works is unlikely for the following reasons: • The project will implement measures to minimise the risk of Covid-19 spread among the workforce as required. • No contact or sharing of closed areas between humans and bats is expected as a result of the proposed works. • If further microbat trapping or survey is undertaken by an ecologist as part of the proposed project, the recommendations provided by the IUCN will be followed, including the wearing of a face mask by the ecologist, and avoidance of handling of any microbats.

Criteria	Assessment response
	• The transmission of SARS-Cov-2 is considered unlikely as a result of the proposed works. One of the main disease threats threatening insectivorous microbats globally is the exotic pathogen White-nose fungus. There have been no cases of White-nose fungus recorded in Australia (Department of Agriculture, Fisheries and Forestry 2019). As such it is unlikely that the proposed development would result in the fungus being spread to the microbats that make up the local population.
Is there a real chance or a possibility that the action will interfere substantially with the recovery of the species?	The following recovery objectives have been specified within the National recovery plan for the Large-eared Pied Bat: • Identify priority roost and maternity sites for protection. • Implement conservation and management strategies for priority sites. • Educate the community and industry to understand and participate in the conservation of the Large-eared Pied Bat. • Research the Large-eared Pied Bat to augment biological and ecological data to enable conservation management. • Determine the meta-population dynamics throughout the distribution of the Large-eared Pied Bat. One of the recovery actions stated under these objectives is the protection of known roosts and associated foraging habitats and management of threats. Approximately 19.75 hectares of potential Large-eared Pied Bat foraging habitat is proposed to be removed as part of the project. As no direct impacts will occur to potential roosting/breeding sites, the proposed works are unlikely to interfere with this recovery action, and the recovery of the species generally.

8.8.4 Spotted-tailed Quoll

The Spotted-tailed Quoll is listed as Endangered under the EPBC Act. The Spotted-tailed Quoll is a nocturnal, cat-sized, carnivorous marsupial with reddish-brown fur and distinctive white spots over its back and tail (OEH 2019).

The species was previously widely distributed from south-east Queensland, eastern NSW, Victoria, south-east South Australia and Tasmania (Jones 2001). The subspecies' mainland range is now considered to have reduced by 50–90% (Jones 2001). However, detailed distribution records and abundance estimates are generally lacking due to the scale and intensity of surveying that is required to detect the species across its entire range (DAWE 2016).

The Spotted-tailed Quoll has a preference for mature wet forest habitat, especially in areas with rainfall 600 mm/year (McKay 2008). Unlogged forest or forest that has been less disturbed by timber harvesting is also preferable. The Spot-tailed Quoll is predominantly nocturnal and rests during the day in dens (Jones 2001). Habitat requirements include suitable den sites such as hollow logs, tree hollows, rock outcrops or caves (OEH 2019). Individuals also require an abundance of food, such as birds and small mammals, and large areas of relatively intact vegetation through which to forage (DAWE 2020c). This subspecies is moderately arboreal and approximately 11% of travelling is done in trees (Jones 2001). The Spotted-tailed Quoll occupy large home ranges, with females occupying 200 – 500 hectares, while males can occupy from 500 to over 4000 hectares (OEH 2019).

The Spotted-tailed Quoll has previously been recorded within and adjacent to the development footprint, including during the current assessment. In 2019 a roadkill individual was located within the Ben Halls Gap State Forest adjacent the development footprint, and another individual was recorded on a camera trap within the development footprint. Hanging Rock State Forest, Nundle State Forest, and Tomalla State Forest and Nature Reserve all lie within 20 kilometres of the development footprint and contain scattered previous Spotted-tailed Quoll records throughout (EES 2020). For the purposes of this assessment the definition of "the local population" encapsulates all contiguous areas of this Spotted-tailed Quoll habitat into a singular spatial unit.

The local population of Spotted-tailed Quolls occurring within and nearby the development footprint is not considered to be an 'important population' of the species. There are currently 10 populations within NSW that are defined as 'important populations' of the species, with the closest populations to the development footprint occurring approximately 40 kilometres south east in Barrington Tops, and 80 kilometres north east in Walcha (DAWE 2016).

Potential Spotted-Quoll habitat occurs throughout the development footprint in the form of eucalypt woodland, rocky outcrops, caves, logs and tree hollows. Approximately 45.62 hectares of Spotted-tailed Quoll habitat will be removed as part of the proposed works. This habitat is comprised of the PCTs identified in Bionet, assessed as having high and moderate condition levels.

Spotted-tailed Quoll populations throughout Australia are currently under increased pressure due to the 2019-2020 summer bushfires that occurred across the southern and eastern states of Australia. An extent of 5.3 million ha of land representing 6.7% of NSW has been impacted by bushfires affecting over 60 threatened fauna species. DCCEEW have provided several resources in response to these fires including analyses of listed species habitat within fire affected areas (DAWE 2020a), as well as provisional lists of fauna that require urgent management intervention (DAWE 2020b). Approximately 29 % of the known distribution for Spotted-tailed Quoll has been identified as occurring within fire affected areas, and the species was identified as requiring urgent management intervention following those fires (DAWE 2020d). Given this context, remaining areas of unburnt Spotted-tailed Quoll habitat are now of higher importance in the conservation of the species.

A detailed assessment of impacts to Spotted-tailed Quoll against the significant impact guidelines is provided in Table 84. Impacts to Quoll's are conservatively considered likely to be significant due to the loss of habitat for the local population, classified as important habitat (DAWE 2016), and considered to be of greater importance as refuge following the loss of habitat in the local area from the 2019-2020 bushfires.

Table 84 EPBC Act significant impact assessment for Spotted-tailed Quoll

Criteria	Assessment response
Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of a population?	The local population of Spotted-tailed Quolls occurring within and nearby the development footprint is not considered to be an 'important population' of the species. Habitat within the development footprint is known to be used by Spotted-tailed Quoll. The removal of 45.62 hectares of potential Spotted-tailed Quoll habitat from the development footprint (reduced by approximately 15 hectares as a result of project design revisions), is unlikely to limit the habitat available to the local population. The species requires large home ranges, with females occupying non-overlapping ranges of approximately 200-500 hectares, and males occupying very large, overlapping home ranges from 500 to over 4,000 hectares, depending on foraging resources (EES 2020). As the impacts associated with the project generally occur on the edges of larger areas of higher quality habitats (with the adjacent reserve system comprising greater than 30,000 hectares), it is considered unlikely that the project will result in long-term decrease in the size of the local population, which will remain supported by the higher quality habitats not impacted by the project..

Criteria	Assessment response
Is there a real chance or a possibility that the action will reduce the area of occupancy of the species?	As above, habitat within the development footprint is known to be used by Spotted-tailed Quoll. The removal of 45.62 hectares of potential Spotted-tailed Quoll habitat from the development footprint (reduced by approximately 15 hectares as a result of project design revisions), is unlikely to reduce the area of occupancy of the species, which is estimated to be 2,512 km^2 (Commonwealth of Australia 2020), as they will still be able to move through and around the relatively narrow linear development footprint.
Is there a real chance or a possibility that the action will fragment an existing population into two or more populations?	As the development footprint occurs on the western edge of Ben Halls Gap Nature Reserve, habitat in the form of eucalypt woodland and rocky outcrops is proposed to be removed mostly along the edges of remnant vegetation. Clearing in this spatial arrangement it will not cause novel fragmentation that would split the local population into two or more populations.
Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?	Habitat that is critical to the survival of the Spotted-tailed Quoll includes large patches of forest with adequate denning resources and relatively high densities of medium-sized mammalian prey (DELWP 2016). However, the threshold densities of these critical components required to support quoll populations are unknown. Consequently, it is currently not possible to define (or map) habitat critical to the survival of the Spotted-tailed Quoll. The Recovery Plan states that given the Endangered threat status of the Spotted-tailed Quoll, all habitats within its current distribution that are known to be occupied are considered important (DELWP 2016). Furthermore, due to the large bushfires that occurred across southern and eastern Australia in the summer of 2019-2020, approximately 29 % of the available habitat across Spotted-tailed Quoll's known range was lost, and the species was identified as requiring urgent management intervention following those fires (DAWE 2020d). Given this context, any remaining areas of Spotted-tailed Quoll habitat are now of increased importance in the conservation of the species. The species requires large home ranges, with females occupying non-overlapping ranges of approximately 200-500 hectares, and males occupying very large, overlapping home ranges from 500 to over 4,000 hectares, depending on foraging resources (EES 2020). In the Marengo State Forest in north-eastern NSW, females were reported to have non-overlapping range of up to 175 hectares, and males have an overlapping range of up to 757 hectares (Glen & Dickman 2006). A 20 kilometre buffer around the wind farm development footprint is likely to include the home ranges of all those individuals most likely to utilise the habitat within and directly adjacent to the development footprint. Within this 20 kilometre buffer area approximately 32,000 hectares (27.5 %) of native vegetation has been burnt, with the area estimated to support a total of approximately 116,500 hectares of native vegetation. Most (82 %) of this vegetation has been burnt to a medium or high degree, in accordance with the burnt area classes outlined in the GEEBAM (DPIE 2021), meaning both the canopy and understorey have either been partially of completely burnt. In spite of the influence of the 2019-2020 bushfires, the removal of approximately 45.62 hectares of Spotted-tailed Quoll habitat as part of the Project, is not expected to be of a magnitude substantial enough to adversely affect habitat critical to the survival of a species as a whole. However, impacts to the local population are conservatively considered to be more

Criteria	Assessment response
	substantial, due to the due to the higher value of unburnt habitat in the locality. Due to the large home ranges required by the species, with female home ranges generally not overlapping, and the loss of approximately 27.55% of estimated native vegetation from the 20 kilometre area surrounding the development footprint in the 2019-2020 bushfires (DPIE 2021), the removal of 45.62 hectares of habitat is considered a moderate loss. This conclusion is conservatively made despite the reduction in impacts the project has been able to achieve, and the largely sub-optimal and edge effected nature of the habitat impacted.
Is there a real chance or a possibility that the action will disrupt the breeding cycle of a population?	Potential Spotted-tailed Quoll breeding habitat may be removed from the development footprint as part of the proposed works, including rocky outcrops, tree hollows and logs. Due to the reserve system directly adjacent the development footprint, encompassing Ben Halls Gap Nature Reserve, Hanging Rock State Forest, Nundle State Forest, and Tomalla State Forest and Nature Reserve, it is likely that adequate den sites are located within the locality such that the breeding cycle of the local population will not be interrupted by the proposed works.
Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	Approximately 45.62 hectares of Spotted-tailed Quoll habitat is proposed to be removed from the development footprint as part of the proposed works, which has been reduced by approximately 15 hectares as a result of project design revisions. However, records of the species are scattered throughout the locality, and encompass the nearby reserve system, including the adjacent Ben Halls Gap Nature Reserve. The proposed works would result in a reduction of habitat available to the local population, and the available habitat within 20 kilometres of the development footprint has been further reduced by approximately 25% as a result of the 2019-2020 bushfires, which is considered substantial. However there is still approximately 84,000 hectares of native vegetation present and unaffected by bushfire. It is therefore considered that there is adequate habitat available in surrounding farmland and nature reserves that the species as a whole is not likely to decline. The local population will however be placed under increased pressure as a result of the removal of areas of unburnt habitat in the locality. Protecting and enhancing native vegetation outside of approved disturbance areas and managing the remaining remnant vegetation and habitat within or surrounding the development site toward a benchmark state, may somewhat mitigate the potential impacts of the Project and aid in the recovery of Spotted-tailed Quoll habitat locally, and will be undertaken as part of the projects Biodiversity Offset Strategy (refer Section 9.1).
Is there a real chance or a possibility that the action will result in invasive species that are harmful to an endangered species becoming established in the species' habitat?	There is potential for the introduction of weeds, pests or pathogens as a result of the proposed works, via movement of vehicles and plant, and increase in foot traffic. However, management measures would be prepared, implemented and audited to avoid and minimise the environmental risks associated with weeds, pests and pathogens. As a minimum, these would include: • Completion of a site weed assessment and development of a Weed Management Plan. The Weed Management Plan would sit as a sub-plan to the EMS. • Implementation of appropriate weed control and weed disposal in accordance with Biosecurity protocols.

Criteria	Assessment response
	• Any soil or other materials imported to the site for use in restoration or rehabilitation would be certified free from weeds and pathogens or obtained from sources that demonstrate best practice management to minimise weed and pathogen risks. • Implementation of appropriate hygiene protocols where there are potential or known pathogen risks. • Appropriate disposal of any weed material.
Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?	The proposed action will result in removal of potential habitat for Spotted-tailed Quoll within the development footprint. This impact is not likely to results in the introduction of diseases that may cause the species to decline.
Is there a real chance or a possibility that the action will interfere substantially with the recovery of the species?	The main threats to Spotted-tailed Quoll include habitat loss and fragmentation, poison baiting, predation by invasive species, deliberate killing, road mortality, poor burning regimes and climate change, among others. The National Recovery Plan for the Spotted-tailed Quoll lists the following management objectives: • Determine the distribution and status of Spotted-tailed Quoll populations throughout the range and identify key threats and implement threat abatement management practices. • Investigate key aspects of the biology and ecology of the Spotted-tailed Quoll to acquire targeted information to aid recovery. • Reduce the rate of habitat loss and fragmentation on private land. • Evaluate and manage the risk posed by silvicultural practices. • Determine and manage the threat posed by introduced predators (foxes, cats, wild dogs) and of predator control practices on Spotted-tailed Quoll populations. • Determine and manage the impact of fire regimes on Spotted-tailed Quoll populations. • Reduce the frequency of Spotted-tailed Quoll road mortality. • Assess the threat Cane Toads pose to Spotted-tailed Quolls and develop threat abatement actions if necessary. • Determine the likely impact of climate change on Spotted-tailed Quoll populations. • Increase community awareness of the Spotted-tailed Quoll and involvement in the Recovery Program. The proposed works would involve the removal of 45.62 hectares of potential Spotted-tailed Quoll habitat, which would contribute to the above listed threat of habitat loss for the species and is somewhat averse to the management objective 'reduce the rate of habitat loss and fragmentation on private land'. However the condition of the majority of habitat impacted is sub-optimal due to its occurrence along vegetated edges between intact vegetation and cleared farmland. Furthermore no important den or latrine sites were recorded during the field instigations, and well vegetation riparian zones, used commonly for movement through an individual's range are not well represented in the development footprint. As impacted habitats are largely considered sub-optimal, and the protection and enhancement of native vegetation outside of approved disturbance areas and management of the remaining remnant vegetation and habitat within or surrounding the development site toward a benchmark state, may aid in the recovery of Spotted-tailed Quoll habitat locally, the project cannot be said to be

Criteria	Assessment response
	likely to interfere substantially with the recovery of the species.

8.8.5 Greater Glider

The Greater Glider is listed as Vulnerable under the EPBC Act. It is the largest gliding possum in Australia, with a head and body length of 35 – 46 centimetres, and a tail measuring 45 – 60 centimetres (Menkhorst & Knight 2011). The species is arboreal and nocturnal and is mostly restricted to eucalypt forests and woodlands. It is typically found in highest abundance in tall, montane and moist eucalypt forests with old trees and abundant hollows. The species favours forests with a diversity of eucalypt species, due to the seasonal variation in its preferred tree species. During the day Greater Glider shelters in tree hollows, particularly those that are in large, old trees (McKay 2008).

The Greater Glider is found throughout eastern Australia, from the Windsor Tableland in north Queensland through to central Victoria. The broad extent of occurrence is unlikely to have changed substantially since European settlement, however the area of occupancy has decreased substantially, mostly due to land clearing (Threatened Species Scientific Committee 2016). This decline is most likely continuing due to further land clearing, fragmentation, fire and forestry activities. The species is considered to be particularly sensitive to forest clearance, logging and fire, and is slow to recover following major disturbance. The species is also considered to be sensitive to fragmentation due to a low dispersal ability, previously showing low persistence in small forest fragments (Threatened Species Scientific Committee 2016).

A total of 25-30 Greater Gliders were recorded within the development footprint during targeted surveys in the current assessment. Previous records of the species are also scattered throughout the adjacent Ben Halls Gap Nature Reserve (EES 2020). As Greater Glider tend to have relatively small home ranges (1 – 4 ha), for the purposes of this assessment, those records throughout the development footprint and adjacent reserves make up the 'local population'. Nationally, there are no officially recognised 'important populations' of Greater Glider. However in NSW, there are three specific populations listed as Endangered under the BC Act (EES 2020). These are the populations of the Eurobodalla LGA, Mount Gibraltar Reserve, and Seven Mile Beach National Park which are remote from the project. It is not considered that the local population addressed in this assessment makes up an important population of the species.

Approximately 36.28 hectares of known Greater Glider habitat is proposed to be removed from the development footprint as a part of the current project. This encompasses high condition eucalypt woodland, on the wind farm and internal roads development footprint.

Greater Glider populations throughout Australia are currently under increased pressure due to the 2019-2020 summer bushfires that occurred across the southern and eastern states of Australia. DCCEEW have provided several resources in response to these fires including analyses of listed species habitat within fire affected areas (DAWE 2020a), as well as provisional lists of fauna that require urgent management intervention (DAWE 2020b). Approximately 29 % of the known distribution for Greater Glider has been identified as occurring within fire affected areas, and the species has been identified as requiring urgent management intervention. Given this context, any remaining areas of high quality Greater Glider habitat are now of key importance in the conservation of the species. Greater Glider is sensitive to wildfire, and it is slow to recover following major bushfire disturbances. (Lunney 1987, Threatened Species Scientific Committee 2016). Home ranges for the species are typically small, ranging from 1-4 hectares (Pope, Lindenmayer, & Cunningham 2004), and thus reoccupation of burnt sites in subsequent years is likely to be slow as a result of the species' limited dispersal capabilities (Threatened Species Scientific Committee 2016).

A detailed assessment of impacts to Greater Glider against the significant impact guidelines is provided in Table 85, with impacts considered unlikely to be significant.

Table 85 EPBC Act significant impact assessment for Greater Glider

Criteria	Assessment response
Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of an important population?	The *Matter of NES Significant impact guidelines 1.1* (Commonwealth of Australia 2013) defines an important population as: *A population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:* • Key source populations either for breeding or dispersal • Populations that are necessary for maintaining genetic diversity, and/or • Population that are near the limit of the species range. There is currently no national recovery plan prepared for Greater Glider(DAWE 2021). Due to the lack of a national recovery plan there are no important populations that have been formally identified for the species at the Commonwealth level. Within NSW there are three endangered populations that have been identified, the Eurobodalla LGA population, the Mount Gibraltar Reserve area population, and the Seven Mile Beach National Park population. All of these populations occur south of Sydney and are thus geographically distant from the Project. No significant populations north of Sydney are identified in the national Conservation Advice for the species (DAWE 2016). According to the *Ben Halls Gap National Park Plan of Management* (NPWS 2002), the park contains one of the highest recorded densities of Greater Glider, due to the high nutrient levels within the eucalypt foliage, as well as the number of suitably sized hollows. The Project will not impact on any of the habitats within the Ben Halls Gap National Park, and most of the development in the vicinity of the park occurs on pre-disturbed, cleared areas that are currently utilised for cattle grazing along its western border. Due to the predominantly linear nature of the development, it is also unlikely to represent a significant dispersal barrier for any individuals moving into or out of the western boundary of the Ben Halls Gap Nature Reserve, beyond that which already exists in the area. Connectivity to the contiguous native vegetation to the north, east and south of the national park will not be impacted by the Project. The species is considered as "widespread and common…particularly in north-eastern NSW" (Kavanagh 2004, DAWE 2016), with multiple records also occurring within the nearby Hanging Rock, Nundle and Tomalla State forests (EES 2020). Given the high level of connectivity between these areas it is highly like that breeding is occurring between individuals in these reserves, and that there is free movement of genes across the landscape. The population within the Ben Halls Gap National Park also does not occur at the limit of the species range. As such the local population of Greater Glider, which is considered to be those individuals that occur within the development footprint and adjacent reserves, is not considered to be an important population key to the long-term survival and recovery of the species. As such the Project is unlikely to result in a long term decrease of an important population of the species.
Is there a real chance or a possibility that the action will reduce the area of occupancy of an important population?	The Project will result in the removal of native vegetation that is likely to be utilised by individuals that comprise the local population of Greater Glider. The local population is likely to include individuals within the development footprint as well as individuals within the large population known to reside in the Ben Halls Gap National Park (NPWS 2002). The development primarily occurs on pre-disturbed,

Criteria	Assessment response
	cleared areas that are currently utilised for cattle grazing, including areas along the western border of the Ben Halls Gap National Park. The clearing of native vegetation is primarily occurred on the edges of vegetation patches, and scattered trees within these pre-disturbed areas. The development is also a predominantly linear design, which is unlikely to represent a significant dispersal barrier for any individuals moving into or out of the western boundary of the Ben Halls Gap Nature Reserve, beyond that which already exists in the area. Whilst the removal of native vegetation within the development footprint will result in localised reductions in species habitat, it is unlikely to result in a significant decrease in the area of occupancy over which the species ranges within the locality. Furthermore, given the local population does not occur at the edge of the species range, with a high occurrence of the species across the locality as represented by records in the Hanging Rock, Nundle and Tomalla State forests (EES 2020), it is not considered that the local population meets the criteria of an important population.
Is there a real chance or a possibility that the action will fragment an existing important population into two or more populations?	The local population is likely to include individuals within the development footprint as well as individuals within the large population known to reside in the Ben Halls Gap National Park (NPWS 2002). The development primarily occurs on pre-disturbed, cleared areas that are currently utilised for cattle grazing, including areas along the western border of the Ben Halls Gap National Park. The clearing of native vegetation is primarily occurred on the edges of vegetation patches, and scattered trees within these pre-disturbed areas. The development is also a predominantly linear design, which is unlikely to represent a significant dispersal barrier for any individuals moving into or out of the western boundary of the Ben Halls Gap Nature Reserve, beyond that which already exists in the area. Connectivity to the contiguous native vegetation to the north, east and south of the national park will not be impacted by the Project. As such it is unlikely that the Project would result in significant modification to dispersal of individuals throughout the area, such that the population would become split into two or more populations. As the local population does not occur at the edge of the species range, with a high occurrence of the species across the locality as represented by records in the Hanging Rock, Nundle and Tomalla State forests (EES 2020), it is not considered that the local population meets the criteria of an important population.
Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?	Habitat critical to the survival of Greater Glider includes large, mature trees with hollows (for sheltering and breeding), and large remnant vegetation patches. Greater Glider are highly sensitive to fragmentation and are generally unable to persist in small vegetation patches. In addition, large-scale bushfires during the summer of 2019-2020 have reduced the availability of Greater Glider habitat across its distribution by approximately 29 % (DAWE 2020). As the species' is known to have a small home range, ranging from 1-4 hectares (Pope, Lindenmayer, & Cunningham 2004), a conservative 20 kilometre buffer around the wind farm development footprint is likely to include the home ranges of all of the individuals that utilise the habitat within to the development footprint, as well as those individuals adjacent to the development footprint that may infrequently disperse through the site. Within this 20 kilometres buffer area approximately 32,000 hectares (27.5 %) of native vegetation has been

Criteria	Assessment response
	burnt, with the area estimated to support a total of approximately 116,500 hectares of native vegetation. Most (82 %) of this vegetation has been burnt to a medium or high degree, in accordance with the burnt area classes outlined in the GEEBAM (DPIE 2021), meaning both the canopy and understorey have either been partially of completely burnt. As such the 36.28 hectares of native vegetation being removed by the Project is of potentially greater importance than usual for the species. The current project proposes the removal of approximately 36.28 hectares of Greater Glider habitat, encompassing eucalypt woodland known to support the species, and the associated hollow-bearing trees throughout. Due to the large number of Greater Glider recorded during the current assessment, this habitat appears to be highly suitable for the species. It is not considered likely that the removal of 36.28 hectares of known habitat for the species would adversely affect habitat critical to the survival of this species. The project footprint avoids areas of higher quality, intact and large patch size vegetation with abundant hollows, which is important habitat for this species.
Is there a real chance or a possibility that the action will disrupt the breeding cycle of an important population?	The local population of Greater Glider addressed in this assessment is not considered to be an important population of the species.
Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The current project proposes the removal of approximately 36.28 hectares of known Greater Glider habitat, encompassing eucalypt woodland known to support the species, and the associated hollow-bearing trees throughout. Due to the large number of Greater Glider recorded during the current assessment, this habitat appears to be highly suitable for the species. In some areas this vegetation occurs in small remnant patches within cleared areas. Removal of this vegetation would make the land unusable to Greater Glider, as they are not able to persist in cleared areas and have limited dispersal ability. In addition, large-scale bushfires during the summer of 2019-2020 have reduced the availability of Greater Glider habitat across its distribution by approximately 29 % (DAWE 2020). Approximately 32,000 hectares of native vegetation within a 20 kilometre buffer of the development footprint has been lost due to bushfire. This represents 27.5 % of the 116,500 hectares of native vegetation estimated to occur within this buffer. As such the 36.28 hectares of native vegetation known to support the species, being removed by the Project is of potentially greater importance than usual for the species. However, protecting and enhancing native vegetation outside of approved disturbance areas and managing the remaining remnant vegetation and habitat within or surrounding the development site toward a benchmark state, would aid in the recovery of Greater Glider habitat locally. Additionally, Ben Halls Gap Nature Reserve occurs directly east of the development footprint, and likely provides large areas of suitable habitat to the species. As Greater Glider require relatively small home ranges (1-4 hectares), it is considered that there is adequate habitat within the nearby reserve and retained within the development footprint to support the local population of Greater Gliders, and that the proposed works would not cause the species to decline.
Is there a real chance or a	Invasive weeds species are not known to directly harm populations of Greater

Criteria	Assessment response
possibility that the action will result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat?	Glider but do have potential to reduce quality of habitat in the adjoining bushland and therefore increase potential to harm the population of the species. Management measures would be prepared, implemented and audited to avoid and minimise the environmental risks associated with weeds, pests and pathogens. As a minimum, these would include: • Completion of a site weed assessment and development of a Weed Management Plan. The Weed Management Plan would sit as a sub-plan to the EMS. • Implementation of appropriate weed control and weed disposal in accordance with Biosecurity protocols. • Any soil or other materials imported to the site for use in restoration or rehabilitation would be certified free from weeds and pathogens or obtained from sources that demonstrate best practice management to minimise weed and pathogen risks. • Appropriate disposal of any weed material at an appropriately licensed facility.
Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?	The proposed action is not likely to results in the introduction of diseases that may cause the species to decline.
Is there a real chance or a possibility that the action will interfere substantially with the recovery of the species?	The national conservation advice for Greater Glider lists the primary conservation objectives for the species as: • Manage threats to secure or increase overall population size. • Maintain viable populations at all known localities. While the proposed removal of 36.28 hectares of Greater Glider habitat will not contribute to the recovery of the species, it is not considered likely to substantially interfere with the recovery of the species for the following reasons: • Ben Halls Gap Nature Reserve occurs directly east of the development footprint, and likely contains large areas of high quality habitat for the species. This habitat is considered adequate such that the loss of 36.28 hectares of habitat within the development footprint would not reduce the local population size or decrease the viability of the local population. There is also large areas of suitable Greater Glider habitat retained within the development footprint. • As part of the project, preclearance assessments would be undertaken and clearing of hollow-bearing trees would be supervised by an ecologist, and any Greater Gliders utilising the habitat being removed from the development footprint would be captured and relocated. Due to the large areas of suitable habitat nearby (i.e. within the reserve system), it is likely that displaced individuals would be successfully relocated, assuring that the local population would not decrease in numbers as a result of the proposed works.

8.8.6 Booroolong Frog

The Booroolong Frog is listed as Endangered under the EPBC Act. The species is an obligate river-breeding frog that was historically found along streams on the western fall of the Great Dividing Range in New South Wales between 200 and 1300 metres above sea level (DAWE 2020d). Several populations were also found along eastern flowing streams in the northern half of the species former range. This species underwent a dramatic decline during the mid-1980s, and the results of recent surveys suggest that declines have occurred throughout its former known range, particularly on the New England Tablelands (OEH 2012). The factors identified as contributing to the historic and continued decline of the Booroolong Frog include disease (Chytridiomycosis) caused by infection with the Amphibian Chytrid Fungus (*Batrachochytrium dendrobatidis*), habitat degradation, altered stream flows, and stream drying associated with recent severe droughts. The introduction of exotic predatory fish is also likely to have impacted on the Booroolong Frog in the wild, and this impact may be continuing.

The Booroolong Frog lives along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. The species shelter under rocks or amongst vegetation near the ground on the stream edge. Eggs are laid in submerged rock crevices and tadpoles grow in slow-flowing connected or isolated pools (Hunter 2007).

Based on habitat connectivity, 28 local populations are currently known across the range of the Booroolong Frog (OEH 2012). For this assessment, the closest population occurs along the Peel River within the Namoi Catchment, with the river occurring less than 500 metres from the development footprint. First order streams connected to the Peel River occur within the development footprint in parts. The closest record of Booroolong Frog to the development footprint occurs approximately 400 metres to the north of the transmission line along Wombramurra Creek, and 2.4 kilometres north west, along the Peel River, with abundant records along the both watercourses heading further north west (EES 2020). The Peel River is currently considered a Key Management Site for conservation of the Booroolong Frog as part of the Saving Our Species program run by the NSW Government (OEH 2020). The Peel River population is considered to be the local population for the purposes of this assessment.

As part of the proposed works, approximately 0.95 hectares of Booroolong Frog habitat will be directly removed in the form of riparian vegetation alongside creeklines, this has been reduced by 0.64 hectares as a result of the project's design revisions. It should also be noted that the 0.95 hectares of impacts includes the accumulated total of the three separate access options from Crawney Road, of which only one will be bult, and is as such a substantial overestimation of the actual impact that will occur. However, due to the location of the development footprint upstream and in close to proximity to the Peel River, the proposed works have some potential to have further indirect impacts to Booroolong Frog habitat as a result of changes in water flows, and increased run off and sedimentation as a result of land clearing, excavation and potentially construction of creek crossings.

In order to minimise such impacts, a Soil and Water Management Plan will be prepared, outlining measures for the management and monitoring of surface water quality and hydrology during construction. The plan would also address any requirements for the management of potential acid sulphate soils or contaminated lands during construction so as to minimise impacts to terrestrial and aquatic habitats. The plan would include the implementation of a construction surface water quality monitoring to minimise impacts to surface water quality. An Erosion and Sediment Control Plan will also be prepared, outlining measures for the prevention of erosion and sedimentation during construction. If adequate soil and water management measures are employed, any indirect impacts to Booroolong Frog habitat will be substantially reduced.

A detailed assessment of impacts to Booroolong Frog against the significant impact guidelines is provided in Table 86, with impacts considered unlikely to be significant providing best practice construction environmental management measures are employed to prevent pollution of adjacent / downstream habitats.

Table 86 EPBC Act significant impact assessment for Booroolong Frog

Criteria	Assessment response
Is there a real chance or a possibility that the action will lead to a long-term decrease in the size of a population?	The direct removal of less than 0.95 hectares of Booroolong Frog habitat is not considered likely to cause a decrease in the size of the Peel River population. The closest records of Booroolong Frog occur immediately adjacent to the development footprint for the southern two site access options from Crawney

Criteria	Assessment response
	Road, and the species was not recorded within the development footprint during the current assessment. However, targeted surveys for Booroolong Frog were not able to discount the presence of the species from the along the transmission line or access options, as surveys were undertaken outside of the recommended survey period. However, if potential impacts to soil and water movement as a result of land clearing and excavation are not adequately managed throughout the project, there is a possibility that Booroolong Frog habitat occurring further downstream within the Peel River could be adversely affected as a result of increased run off and sedimentation, changes in water flows, and increased pollution of the waterway. In particular, if sediment was to fill rock crevices within the river, the species would no longer be able to use this habitat for oviposition. If poorly managed, this could lead to a long-term decrease in the Peel River Booroolong Frog population, through reduction in breeding habitat.
Is there a real chance or a possibility that the action will reduce the area of occupancy of the species?	As above, the direct removal of less than 0.95 hectares of Booroolong Frog habitat is not considered likely to cause a reduction in occupancy of the Peel River population. The closest records of Booroolong Frog occur immediately adjacent to the development footprint for the southern two site access options from Crawney Road, and the species was not recorded within the development footprint during the current assessment. However, targeted surveys for Booroolong Frog were not able to discount the presence of the species from the along the transmission line or access options, as surveys were undertaken outside of the recommended survey period. However, if potential impacts to soil and water movement as a result of land clearing and excavation are not adequately managed throughout the project (in line with legal requirements to avoid water pollution), there is a possibility that Booroolong Frog habitat occurring further downstream within the Peel River could be adversely affected as a result of increased run off and sedimentation, changes in water flows, and increased pollution of the waterway which could lead to a reduction in the area of occupancy of the Peel River Booroolong Frog population, through reduction in available habitat.
Is there a real chance or a possibility that the action will fragment an existing population into two or more populations?	The development footprint will not sever connectivity along Wombramurra Creek and as the development footprint occurs at the outer edge of the local population's range, it is unlikely that loss of habitat in this area would lead to the fragmentation of the Peel River Booroolong Frog population.
Is there a real chance or a possibility that the action will adversely affect habitat critical to the survival of a species?	Habitat critical to the survival of the Booroolong Frog is defined as rocky sections of permanent streams occupied by the species. Any action that reduces stream permanency (e.g. pumping water) or results in loss of rock crevices (e.g. smothering by weeds or sedimentation), is likely to threaten the persistence of local populations of this species. As above, the direct removal of less than 0.95 hectares of Booroolong Frog habitat is not considered likely to adversely affect habitat critical to the survival of the species. The closest records of Booroolong Frog occur immediately adjacent to the development footprint for the southern two site access options from Crawney Road, and the species was not recorded within the development footprint during the current assessment. However, targeted surveys for Booroolong Frog were not

Criteria	Assessment response
	able to discount the presence of the species from the along the transmission line or access options, as surveys were undertaken outside of the recommended survey period. However, if potential impacts to soil and water movement as a result of land clearing and excavation are not adequately managed throughout the project, there is a possibility that Booroolong Frog habitat occurring further downstream within the Peel River could be adversely affected as a result of increased run off and sedimentation, changes in water flows, and increased pollution of the waterway. If water flow was to be affected within the Peel River such that previous areas of habitat no longer contained permanent water, or sedimentation occurred to the extent that rock crevices were filled and unable to be used for oviposition, this would be considered an adverse effect on habitat critical to the survival of the species.
Is there a real chance or a possibility that the action will disrupt the breeding cycle of a population?	As above, the direct removal of less than 0.95 hectares of Booroolong Frog habitat is not considered likely to disrupt the breeding cycle of the species. The closest records of Booroolong Frog occur immediately adjacent to the development footprint for the southern two site access options from Crawney Road, and the species was not recorded within the development footprint during the current assessment. However, targeted surveys for Booroolong Frog were not able to discount the presence of the species from the along the transmission line or access options, as surveys were undertaken outside of the recommended survey period. Booroolong Frogs require rock crevices in shallow slow-medium flowing permanent streams to breed (OEH 2012). If potential impacts to soil and water movement as a result of land clearing and excavation are not adequately managed throughout the project however, there is a possibility that Booroolong Frog habitat occurring further downstream within the Peel River could be adversely affected as a result of increased run off and sedimentation, changes in water flows, and increased pollution of the waterway. If water flow was to be affected within the Peel River such that previous areas of habitat no longer contained permanent water, or sedimentation occurred to the extent that rock crevices were filled and unable to be used for oviposition, this could likely disrupt the breeding cycle of the Peel River population.
Is there a real chance or a possibility that the action will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?	The Booroolong Frog has been previously recorded along 18 kilometres of the Peel River. The direct removal of less than 0.95 hectares of Booroolong Frog habitat is not considered likely to decrease the availability of habitat for the species such that the species is likely to decline. However, if potential impacts to soil and water movement as a result of land clearing and excavation are not adequately managed throughout the project, there is a possibility that Booroolong Frog habitat occurring further downstream within the Peel River could be adversely affected as a result of increased run off and sedimentation, changes in water flows, and increased pollution of the waterway. The Peel River Booroolong Frog population is one of only 28 known populations. If water flow was to be affected within the Peel River such that previous areas of habitat no longer contained permanent water, or sedimentation occurred to the extent that rock crevices were filled and unable to be used for oviposition, this could likely decrease the extent of the species habitat such that the species could

Criteria	Assessment response
	decline.
Is there a real chance or a possibility that the action will result in invasive species that are harmful to a critically endangered or endangered species becoming established in the critically endangered or endangered species' habitat?	There is potential for the introduction of weeds, pests or pathogens as a result of the proposed works, via movement of vehicles and plant, and increase in foot traffic. However, management measures would be prepared, implemented and audited to avoid and minimise the environmental risks associated with weeds, pests and pathogens. As a minimum, these would include: Completion of a site weed assessment and development of a Weed Management Plan. The Weed Management Plan would sit as a sub-plan to the CEMP. Implementation of appropriate weed control and weed disposal in accordance with Biosecurity protocols. Any soil or other materials imported to the site for use in restoration or rehabilitation would be certified free from weeds and pathogens or obtained from sources that demonstrate best practice management to minimise weed and pathogen risks. Disposal of any weed material at an appropriately licensed facility. Implementation of appropriate hygiene protocols where there are potential or known pathogen risks.
Is there a real chance or a possibility that the action will introduce disease that may cause the species to decline?	Pathogens, including the amphibian Chytrid Fungus *Batrachochytrium dendrobatidis*, have the potential to be introduced to the site during construction. The timing and rapid nature of the Booroolong Frogs' decline from the New England Tablelands, which coincided with the disappearance of several other frog species in this region, was likely due to an outbreak of Chytrid Fungus (Mahony 1999). Declines have been recorded from higher altitude sites, where habitat remains intact, compared to persistence at lower altitudes, which is consistent with other Chytrid Fungus induced declines. Sick and dead infected Booroolong Frogs have been observed in the wild on several occasions, and healthy frogs have tested positive for infection. It is currently unclear as to whether Chytrid Fungus is present within the Peel River. However, extensive preventative measures should be undertaken during the construction phase to ensure that the disease is not introduced into the development footprint or the river system. This will be addressed in a project Biodiversity Management Plan.
Is there a real chance or a possibility that the action will interfere substantially with the recovery of the species?	The National Recovery Plan for Booroolong Frog *Litoria booroolongensis* (NSW OEH 2011b) identifies the following recovery actions: • Complete systematic surveys. • Determine the taxonomic status of northern and southern populations. • Identify genetic sub-division across the species range. • Continue and expand riparian protection and restoration. • Regulate the establishment of softwood plantations. • Enforce legislation protecting streams and water flow. • Reduce the transmission of potentially harmful pathogens. • Determine current impacts and prevent impacts from introduced predatory fish. • Implement an effective monitoring program. • Model the influence of predicted climate change. • Develop efficient reintroduction techniques.

Criteria	Assessment response
	• Assess the capacity to use assisted colonisation. • Determine impact of herbicides. • Determine the current impact of Chytridiomycosis. • Determine the influence of reduced water quality. • Increase public awareness and provide specific education and training. • Establish a recovery team. As 0.95 hectares of Booroolong Frog habitat in the form of riparian vegetation is to be removed as a part of the proposed works, the only recovery action that may be interfered with as a result of the project is the continued expansion of riparian protection and restoration. However, removal of less than 0.95 hectares of habitat at the southern edge of the local species population is not considered to be a substantial interference to the recovery of the species.

8.9 Mitigating and managing impacts

Table 87 identifies proposed measures to further mitigate and manage unavoidable impacts to biodiversity, following all efforts to avoid and minimise undertaken to date.

Table 87 Proposed mitigation measures

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
B1	General	Entire development footprint	An Environmental Management Strategy (EMS) will be prepared and implemented, including industry standard measures for the management of soil, surface water and pollutants, weeds, pests and pathogens, as well as site-specific measures and relevant sub-management plans. Relevant sub-plans specific to the management of biodiversity are a Biodiversity Management Plan, Weed Management Plan and Bird and Bat Adaptive Management Plan.	Pre-construction/ construction	Contractor
B2		Entire development footprint	All site workers would be trained to ensure awareness of requirements of the EMS (B1), relevant sub-plans and statutory responsibilities. Site-specific training would be provided when specific work activities were taking place near areas of identified biodiversity value that are to be protected.	Construction	Contractor
B3	Clearing of native vegetation, threatened ecological communities and habitat for threatened flora and fauna	Entire development footprint	Prepare and implement a biodiversity offset strategy, in accordance with the requirements of the BC Act and the EPBC Act Offsets Policy.	Pre-construction	Proponent
B4	Direct impacts to native vegetation	Entire development footprint	Opportunities to further minimise impacts to native vegetation will continue to be explored during the detailed design. This would include measures to minimise the construction footprint and clearing requirements with a particular focus on the protection of hollow bearing trees and fauna movement corridors.	Pre-construction	Proponent

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
B5	Impacts to native vegetation, threatened ecological communities and habitat for threatened species	Entire development footprint	Opportunities to further minimise impacts to native vegetation will continue to be explored during the detailed design. This would include measures to minimise the construction footprint and clearing requirements with a particular focus on the protection of hollow bearing trees and fauna movement corridors. Upon final design and an understanding of detailed impact, a Biodiversity Management Plan would be prepared and implemented. The Biodiversity Management Plan will address terrestrial and aquatic matters by including: • Plans for the development footprint and adjoining area showing updated and current extents of native vegetation, flora and fauna habitat, threatened species and threatened ecological communities and measures to minimise impacts to these features. • Plans showing areas to be cleared and areas to be protected, including exclusion zones and protected habitat features, and areas for native vegetation rehabilitation or re-establishment. This will be key to minimising impacts to Koala and Spotted-tailed Quoll. • Mapping and identification of individual tree hollows and termite mounds and measures to minimise impacts to these features. • Protocols for communicating biodiversity features to the design team during any turbine micro siting and design refinements to minimise and avoid impacts. • Pre-clearing protocols, including pre-clearing inspections, establishment of exclusion zones and on-ground identification of specific habitat features to be retained and/ or relocated. • Pre-clearing requirements for Booroolong Frog prior to works associated with Wombramurra Creek (if required). • Vegetation clearing protocols, including staged habitat removal (including of wombats, Koala, and other fauna) and any specified seasonal limits on clearing activities. • Maintaining areas of habitat connectivity for as long as is practicable through or around the construction area.	Pre-construction/ construction / post-construction	Contractor

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
			• Maintaining isolated paddock trees within the development footprint where possible to provide refuge to locally occurring fauna species (incl. Koala). • Protocols for the salvage and relocation of woody debris, tree hollows and bush rock. • Requirements for temporary deterrent fencing, signage and/or requirements to modify driver behaviour and regular visual inspections to minimise the risk of fauna injury / mortality (particularly Koala and Spotted Tailed Quoll) due to vehicle strike or entrapment in deep excavations, with details to be developed during the preparation of the BMP. • Opportunity for egress to any species that may become trapped in any open excavation in the form of graded exits or tools to support climbing out. • Fauna handling and unexpected threatened species finds procedures. • Procedures detailing the management of pathogens such as chytrid fungus. • Rehabilitation, revegetation, reuse of soils and other habitat management actions. • Limit construction and operational traffic speed limits to minimise the potential for vehicle strike, and include sufficient signage on potential presence of threatened fauna species. • Ensure construction and operation personnel are educated on the presence of fauna such as Koala and Spotted-tailed Quoll in the locality, how to manage potential interactions, and to be aware of the potential for vehicle strikes when driving through the sites (particularly after dark). • Weed, pest and pathogen management requirements. • Monitoring during construction and post-construction. • Adaptive management measures to be applied if monitoring indicates unexpected adverse impacts. Operational measures to minimise the ongoing impact of the project to threatened fauna will be implemented as part of an operational component of the Biodiversity Management Plan, and will include:		

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
			• Revegetation with Koala feed tree species where appropriate. • Design of operational fencing layout to ensure fauna (incl Koala and Spotted-tailed Quoll) can continue to move through the landscape, and if they enter the wind farm are able to self-relocate back into surrounding landscape by providing egress opportunities. Ensure fauna are prevented from accessing higher traffic areas or other potentially hazardous area, and are funnelled towards areas of potential habitat rather than towards the operational wind farm, or into dead-ends and bottle-necks. • Installation of glider poles for glider species in areas where the width of the transmission line easement exceeds minimum requirements for species movement. • Establishment of Biodiversity Stewardship sites on neighbouring properties.		
B6	Impacts to threatened flora	Entire development footprint	A pre-clearing survey is to be carried out to confirm the presence/absence of threatened flora within lands that have not been surveyed within and adjacent to the development footprint. As a part of the survey, the size and extent of confirmed threatened flora populations must be determined. The results of the survey are to provide the updated baseline mapping of the vegetation communities and key fauna habitat on site for inclusion in the Biodiversity Management Plan (B5) and inform specific measures for the protection and management of threatened flora. This is to include at a minimum, specific requirements for the clearing process, any proposed translocation opportunities (for native fauna such as wombats) and associated contingency measures.	Pre-construction	Proponent
B7	Impacts to threatened fauna and karst, caves, crevices, cliffs and other geological feature of significance	Entire development footprint	As a part of the Biodiversity Management Plan, opportunities for the salvage and re-use of important habitat features, including tree-hollows and bush rock, are to be identified. The plan is to include detailed procedures for the implementation of these activities.	Pre-construction and construction	Contractor
B8		Entire development footprint	Opportunities to further minimise any impacts to fauna habitat are to be fully explored through detailed design phase including any	Pre-construction	Proponent

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
			strategies for habitat restoration augmentation post-work. Habitat avoidance should prioritise the retention of karst and caves offering potential habitat for threatened fauna.		
B9	Impacts to National Park estate	Wind farm corridor	An appropriate buffer will be maintained to National Park estate where practicable. Implementing vegetated buffers between the access tracks and wind turbine pads and the National Park estate is to be considered during detailed design. The selection of areas of buffer plantings and species to be planted will be carried out in consultation with the Area Manager, Barrington Tops National Parks and Wildlife Service. The Erosion and Sediment Control Plan will include specific actions to identify sensitive receptors associated with the National Park estate, including waterways and the adjacent Sphagnum Moss TEC The bushfire strategy developed for the development will include measures to minimise risk of bushfire to the Sphagnum Moss TEC and includes • Increase the accessibility of the ridgeline to fire fighters and improve strategic fire advantages that already exist. • Access to water will be maintained such that existing water resources will remain available at all times to support firefighting activities. • Extension of the strategic fire zone from NHPNR • Upgrades to the access road network to RFS fire trail standards • Increased water storage	Pre-construction	Proponent
B10	Edge effects and impacts to habitat viability	Entire development footprint	Restore and rehabilitate all areas within the temporary development footprint. Priority should be given to movement corridors for fauna, significant habitats and threatened ecological communities.	Post-construction	Contractor
B11	Disturbance from weeds, pests and pathogens	Entire development footprint	Management measures would be prepared and implemented to avoid and minimise the environmental risks associated with weeds, pests and pathogens. As a minimum, these would include:	Construction and operation	Contractor and Proponent

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
			• Completion of a site weed assessment and development of a Weed Management Plan, as a sub-plan to the EMS. • Implementation of appropriate weed control and weed disposal in accordance with Biosecurity protocols. • Any soil or other materials imported to the site for use in restoration or rehabilitation would be certified free from weeds and pathogens or obtained from sources that demonstrate best practice management to minimise weed and pathogen risks. • Appropriate disposal of any weed material. • Implementation of appropriate hygiene protocols where there are potential or known pathogen risks including procedures detailing the management of pathogens such as chytrid fungus. • Commitment to ongoing consultation and participation with NPWS and LLS on their annual vertebrate pest baiting programs including a financial contribution capped at $5k per annum to cover any additional costs of aerial baiting programs as a result of rotary aircraft (as opposed to fixed wing) being required to improve safe operating practice. • Encouraging landowners adjoining the BHGNR to coordinate baiting programs to improve the effectiveness of ground-based strategies.		
B12	Habitat disturbance from light	Entire development footprint	Proposal design and construction to minimise light impacts as much as possible through the use of sensor lighting and/ or directional lighting for more heavily utilised parts of the site.	Pre-construction and construction	Contractor/ Proponent
B13	Impacts of wind turbine strikes on protected animals	Wind farm corridor	Operational management measures specific to the wind turbines will be implemented. These are described in Section 8.10.2 of this BDAR. Bird and bat activity within the site is generally concentrated around areas of vegetation. A minimum safe distance of 30m will be maintained from the turbine blade tip to the adjacent tree canopy to minimise any risk of bird or bat strike.	Pre-construction, post-construction	Proponent
B14		Wind farm corridor	Prepare and implement, an operational Biodiversity Management Plan, as part of the project EMS, detailing ongoing measures for the protection and management of flora and fauna during the operational	Post-construction	Proponent

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
			phase of the proposal. The plan is to identify at a minimum: • Target species, important habitats and ecological features to be monitored and managed within the site. • Specific management measures to be implemented during operations including a proposed schedule for implementation, including carrying out revegetation works with native species within the development footprint, including up to 90% of the transmission line corridor, and up to 50% of the transport route upgrades. • Requirements for the monitoring of target species, important habitats and ecological features within the site and processes to be implemented to ensure an adaptive management approach. • Specific requirements for the monitoring and management of bird and bat mortality from blade strike including any considerations for the timing of species seasonal movements and/ or breeding periods. • Performance objectives and proposed contingency measures. • Roles, responsibilities and reporting requirements.		
B15		Wind farm	Prepare and implement a Bird and Bat Adaptive Management Plan (BBAMP), as a sub-plan to the EMS. The BBMP will include: • A description of measures to be implemented on the wind farm site for minimising bird and bat strike. • Suitable measures must be identified for the minimisation and management bird and bat strike risks during operation. • Trigger levels for further investigation and mitigation measures to be implemented. • An adaptive management plan to be implemented if the monitoring determines threatened or at risk species are subject to adverse impacts. • A detailed monitoring and reporting plan to assess the potential impacts and effectiveness of design and operational measures to mitigate bird and bat strike. For example, the plan may contain the following suggested structure: **1 Introduction**	Pre-operation	Proponent

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
			1.1 Background 1.2 Statutory requirements of BBMP 1.3 BBMP Objectives 1.4 Consultation 1.5 Site description **2 Baseline bird and bat information** 2.1 Bird survey methodology 2.2 Bat survey methodology 2.3 Results **3 Risk assessment** 3.1 Species and groups of concern 3.2 Risk assessment methodology 3.3 Risk assessment results 3.4 Conclusions of risk assessment **4 Operational phase surveys** 4.1 Monitoring 'at risk' groups 4.2 Bird utilisation surveys 4.3 Bat surveys 4.4 Carcass searches 4.4.1 Turbine selection 4.4.2 Search protocol 4.4.3 Scavenger rates and trials 4.4.4 Detectability (Observer) trials 4.4.5 Incidental carcass protocol 4.4.6 Analysis of results and mortality estimation 4.5 Personnel involved 4.6 Injured bird and bat protocol 4.7 Reporting and review **5 Mitigation measures to reduce risk** **6 Trigger – Action – Response Plan**		
B16	Impacts to water quality and hydrology and	Entire development footprint	The Biodiversity Management Plan will include measures for the management and monitoring of surface water quality and hydrology	Construction and operation	Contractor/ Proponent

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
	threatened species associated with waterbodies		during construction, as applicable to the protection of biodiversity values. The plan would also address any requirements for the management of potential acid sulphate soils or contaminated lands during construction so as to minimise impacts to terrestrial and aquatic habitats. A Soil and Water Management Plan will be prepared, outlining measures for the management and monitoring of surface water quality and hydrology during construction. The plan would also address any requirements for the management of pollutants or contaminated lands during construction so as to minimise impacts to terrestrial and aquatic habitats. The plan would include the implementation of a construction surface water quality monitoring to minimise impacts to surface water quality. An Erosion and Sediment Control Plan will also be prepared, outlining measures for the prevention of erosion and sedimentation during construction. A targeted focus of this sub-plan will be to prevent indirect impacts to waterways potentially supporting Booroolong Frog surrounding the development footprint, waterways that traverse the National Park estate and the location of the Sphagnum Moss TEC in Ben Halls Gap Nature Reserve. The Soil and Water Management Plan will include procedures detailing the management of pathogens such as chytrid fungus.		
B17		Entire development footprint	Prepare and implement an Erosion and Sediment Control Plan, as a sub-plan within the EMS, outlining measures for the prevention of erosion and sedimentation during construction.		
B18	Impacts to aquatic habitats and fish passage	Access/ transport routes	Proposed waterway crossings associated with access / transport routes are to minimise impacts to aquatic habitat and address Fisheries requirements for maintaining fish passage.	Pre-construction and construction	Contractor/ Proponent
B19	Fauna injury / mortality	Entire development footprint	The Biodiversity Management Plan will include the following to minimise and manage any risk of fauna injury mortality during construction:	Construction	Contractor

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
			• Strategies for fauna management during construction including any identification roles, responsibilities and contingency measures such as temporary stop works and engagement of fauna specialist. • Requirements for temporary deterrent fencing, signage and/or requirements to modify driver behaviour and regular visual inspections to minimise the risk of fauna injury / mortality (particularly Koala and Spotted Tailed Quoll) due to vehicle strike or entrapment in deep excavations, with details to be developed during the preparation of the BMP. • Opportunity for egress to any species that may become trapped in any open excavation in the form of graded exits or tools to support climbing out. • Pre-clearing protocols, including pre-clearing inspections, establishment of exclusion zones and on-ground identification of specific habitat features to be retained and/ or relocated. - For example, occupation surveys for wombat burrows, application of exclusion measures / deterrents prior to vegetation clearing / earthworks, works undertaken in presence of spotter / catcher. • Protocols for fauna handling and management of adverse incidents. • Fauna monitoring and management protocol including identification and reporting of fauna mortalities to the relevant Biodiversity Conservation Division office.		
B20	Impacts to habitat connectivity	Entire development footprint	The following opportunities will be fully explored as a part of the detailed design: • Opportunities to further minimise the disturbance footprint and clearing within important movement corridors for fauna. • Opportunities for post-works restoration of habitat connectivity within important movement corridors for fauna. • Areas subject to temporary disturbance will be rehabilitated using a native species planting schedule as much as practical considering any operational and safety constraints.	Pre-construction	Proponent

ID	Impact	Project component	Mitigation measures	Timing	Responsibility
			• The total area exposed and cleared at any one time will be minimised and planned to allow for fauna movement during construction and periods of temporary disturbance		
B21	Impacts to habitat connectivity	Transmission line	The following measures will be implemented post-construction to minimise impacts to flora and fauna within the transmission line easement: • Promotion of the growth of vegetation under the transmission line to the maximum allowable height to maintain habitat connectivity for fauna. • Management of understorey vegetation in easements should be managed to maintain composition and quality and to prevent weed invasion. • Installation of glider poles for glider species in areas where the width of the transmission line easement exceeds minimum requirements for species movement. • Establishment of Biodiversity Stewardship sites on neighbouring properties.	Post-construction	Proponent
B22	Effectiveness of mitigation and management measures	Entire development footprint	Consistent with any specific requirements of the approved Biodiversity Management Plan (**B1**), a monitoring program would be implemented during construction to assess the effectiveness of mitigation and management measures implemented, to identify any unexpected impacts and appropriate contingency measures necessary for the protection of biodiversity. A register of inspections will be established.	Construction and post-construction	Contractor/ Proponent

8.10 Adaptive management strategy

Construction and operational management plans will all contain an adaptive management component. Adaptive management strategies will be receptive to any new and relevant data that may arise through ongoing assessment and monitoring and is key to the successful implementation of crucial objectives yet also allow flexibility to changing dynamics and ongoing feedback and results. This includes measures to monitor predicted and uncertain impacts which will trigger adaptive management actions and allow for effective and quick responses.

An overall Environmental Management Strategy (EMS) would be developed with site specific sub management plans that will entail an adaptive management strategy component. Those sub management plans in relation to biodiversity include but are not limited to a Biodiversity Management Plan (BMP) and a Bird and Bat Adaptive Management Plan (BBAMP)

8.10.1 Biodiversity Management Plan (BMP)

A BMP would be implemented demonstrating adaptive management strategies to ensure key milestones are achieved including the following project commitments:

- Protecting vegetation and fauna habitat outside the approved disturbance areas and managing the remaining remnant vegetation and fauna habitat within or surrounding the development site toward a benchmark state, minimising indirect impacts, especially to Koala and Spotted-tailed Quoll.
- Fauna monitoring and management protocol including identification and reporting of fauna mortalities to the relevant Biodiversity Conservation Division office.
- Collection of detailed baseline weed data and ensuring no increase of key emerging weeds or invasive pests.
- Commit to ongoing consultation with NPWS on vertebrate pest control baiting programs, including but not limited to;
  - A financial contribution capped at $5k per annum to cover any additional costs of aerial baiting programs as a result of rotary aircraft (as opposed to fixed wing) being required to improve safe operating practice.
  - Encouraging landowners adjoining the Ben Halls Gap Nature Reserve to coordinate baiting programs to improve the effectiveness of ground-based strategies.
  - Engage with NPWS annually on their baiting programs and ensure coordination between NPWS and the Proponent.
- Mapping and identification of individual tree hollows and termite mounds and measures to minimise impacts to these features.
- Pre-clearing protocols, including pre-clearing inspections, establishment of exclusion zones and on-ground identification of specific habitat features to be retained and/ or relocated.
  - For example, occupation surveys for wombat burrows, application of exclusion measures / deterrents prior to vegetation clearing / earthworks, works undertaken in presence of spotter / catcher.
- Monitoring of soil and water controls to prevent indirect impacts associated with water pollution to all waterways potentially supporting populations of Booroolong Frog.
- Clear performance targets and monitoring criteria.

- Corrective actions.
- Timing and responsibilities.

A recommended outline of the BMP is provided below with further details demonstrated within the mitigation measures listed in Table 87.

- Introduction
  - Background
  - Management scope and objectives
- Planning requirements
- Construction and operational activities
- Habitat management
  - Flora and fauna values
  - Soils
  - Weeds and pests (i.e. key emerging weeds and priority weeds)
  - Baseline data
- Environmental mitigation measure
- Site specifics
  - Inductions
  - Erosion /sediment control
  - Retained vegetation and rehabilitation works
- Adaptive management
  - Performance criteria, triggers, and responses
- Compliance management
- Review and Improvement

Additional mitigation measures for turbines proximal to microbat roosting/breeding habitat

- Disturbance to roosting microbats as a result of ground vibration during breeding season (November to February) or winter torpor season (May to September) will be avoided and minimised as far as practicable.
  - As part of baseline monitoring undertaken for the development of the BBAMP and BMP, and prior to any construction requiring earthworks, monitoring will be undertaken of geological features considered to potentially provide microbat roosting habitat at 'fly-out' times to determine if/where further mitigation may be warranted.
  - If construction works likely to result in ground vibration cannot practicably be avoided during the above listed higher risk periods, then monitoring of the presence of microbats within the habitat feature(s) (e.g. near WP50, refer Figure 15) will be undertaken prior to any vibration-causing construction activities where required works coincide with breeding/torpor periods. If microbats are confirmed present prior to construction works commencing (during these

periods), monitoring will continue during and post-construction, and suitable impact mitigation measures will be investigated such as:

- Investigation into a suitable maximum vibration level to prevent disturbance to roosting microbats
- Assessment of what activities or plant may cause this maximum vibration level to be triggered; and
- At what distance (setbacks) unacceptable levels of vibration may be experience at the habitat location.

Further details will be developed in the preparation of the BMP.

Additional commitments regarding the determination of threatened owl breeding habitat

- The presence of breeding habitat for threatened owl species (as relevant to the project, see Section 5.2) will be confirmed during the preparation of the BMP and BBAMP via implementing the following:
  - Mapping of residual tree hollows suitable to support breeding habitat for the target owl species (as described in the TBDC) within 100 m of the development footprint.
  - Follow-up targeted surveys for breeding owls prior to vegetation clearance to ensure direct and indirect impacts to nest trees are avoided and/or minimised.
  - Development of an unexpected finds procedure that triggers additional species specific offsets and/or vegetation clearing seasonal timing requirements if owl breeding habitat is confirmed, and impacted by the project.

8.10.2 Bird and Bat Adaptive Management Plan (BBAMP)

Framework and objectives

The overall objectives of the BBAMP are to provide an effective monitoring program and strategy to manage and mitigate operational issues relating to bird and bat impacts for the wind farm, to monitor and assess for impacts considered uncertain at the time of approval, and prescribe additional compensatory measures for residual prescribed impacts, if required. Additionally, the framework aims to provide certainty to the consent authority and stakeholders prior to approval that measures for minimising biodiversity impacts during operation have been clearly defined that address potential prescribed impacts that cannot be quantified prior to approval.

Guided by the collision risk assessment and turbine risk assessment, and importantly, additional baseline data to be collected from within the subject land, a detailed BBAMP would be developed prior to operation of the wind farm, in conjunction with relevant stakeholders, to confirm adaptive management measures around the potential for collision mortality, barrier effects and behavioural displacement of resident, nomadic and migratory bird and bat species.

The Proponent will commit to mitigation measures that must be underpinned by a rigorous monitoring program involving at least five years of carcass searches by conservation detection dogs and a robust Trigger Action Response Plan (TARP). Therefore, a detailed BBAMP will be developed in consultation with DPE and BCS prior to commissioning of any turbines, however a framework of the key elements of the BBAMP is provided below, with some known specifics detailed within the mitigation measures listed in Section 8.9.

Baseline information

The BBAMP would include baseline data on threatened bird and bat species as well as any non-threatened species considered at moderate or greater risk of collision impacts ('at-risk' species) from the development. One of the key objectives for the collection of detailed baseline data is to gather adequate replicable information on the existing bird and bat species abundance and activity (site utilisation) prior to commencement of operation of the wind farm. This would include the setup of impact zones and control zones that would be monitored pre commissioning of turbines, during construction and during operation for an agreed period of time. The data collected would be utilised to detect changes in the species use of the site (including changes in activity patterns such as avoidance) post-commissioning and during operation of the wind farm, and allow for stringent mitigation measures to be implemented as, and when, they are required.

Investigations of the site utilisation patterns of bird and bat species at the Hills of Gold Wind Farm have been established as a Before-After-Control-Impact (BACI) assessment design. It is important that bird and bat surveys continue once the wind farm becomes operational and that the survey methods used prior to construction are replicated such that results from before and after operation are appropriately comparable. Ideally, baseline data would cover at least four peak seasons (2x spring and 2x summer/autumn) and one off-peak season (winter) within a 24 month period and prior to turbine commissioning. Currently, bird utilisation data has been collected over 3 seasons, across a 7 month period from 2019 to 2020, with bat activity data collected over a four month period during later summer and into autumn in 2020, as part of the development of this BDAR. Wherever possible, and appropriate, this data would be used as part of the baseline data to be collected for development of the BBAMP. Further data is currently being collected and to be incorporated into the BBAMP.

The final locations of all bird utilisation survey points are yet to be determined, but will include a minimum of 7 impact survey points representative and randomised across all associated turbine risks, with a minimum of 3 points associated with moderate risk turbines and the turbine cluster adjacent to Ben Halls Gap National Park (10 in total), with a further 2 control sites located between 500 to 1500m (with at least one potentially within the National Park) from the development (and operational) footprint. Options to include control sites within Ben Halls Gap Nature Reserve and/or locally established Biodiversity Stewardship Sites will be investigated during development of the BBAMP.

Bat utilisation surveys will include a minimum of 10 ultrasonic detectors, replicating existing survey locations in the northern, central and western zones of the development corridor, installed over 4 consecutive nights. Additionally, a further 2 control sites located between 500 to 1500 metres from the development (and operational) footprint would be installed. Detectors would be set up at varying heights, including at canopy and within Rotor Swept Area (RSA). Baseline data collection will also include the recording of environmental variables such as wind speed, time, month, temperature, and precipitation to facilitate the development of 'smart curtailment' strategies for the project.

Following the completion of baseline data collection surveys, adaptive management triggers will be finalised for the initial implementation phase of the operational BBAMP. As part of the adaptive management strategy, a mechanism for review of trigger levels will be included that will allow for consideration of ongoing data collected at the site.

Following the collection of baseline data and following commissioning of all turbines, ongoing monitoring would mirror the baseline surveys, within spring and summer/autumn, when activity of both birds and bats are likely to be at their highest, for three to five years following commissioning of the wind farm.

Proactive low wind speed turbine curtailment to reduce potential microbat strike

Guiding principles for the wind farm in relation to the BBAMP is to operate without any significant impact on the viability of the local and/or overall population of any species of birds or bats. To this end, a proactive low wind-speed turbine curtailment strategy will be implement during the operational phase of the project and will be developed in detail during the preparation of the BBAMP. The strategy will develop smart curtailments based on the collection of additional baseline data on variables including (but not limited to) microbat activity, wind speed, time, month, temperature, and precipitation.

The curtailment strategy will utilise the above environmental variables to minimise the risk of microbat collision with higher risk turbines during times of higher microbat activity. The two-phase curtailment strategy will include:

- All turbines will be feathered to prevent free-wheeling prior to predetermined cut-in speeds (i.e. prior to energy generation).
- All moderate risk turbines (Table 72) will be subject to proactive low wind-speed turbine curtailment from the outset of the operational phase of the project.

The need for adjustments to the curtailment strategy will be determined through regular monitoring (as prescribed in the BBAMP) on the efficacy of the current strategy. Adjustments may include additional curtailments if an unacceptable number of strikes are found to occur, however the option to reduce the level of curtailment will also be prescribed, if sufficient evidence can be provided that it is safe to do so. Such evidence may include few, to no, recorded bat strikes at a given turbine, combined with a comparison to the results of a trial period of reduced curtailment. All such strategies will be developed in the BBAMP.

Trigger-level and unacceptable impacts for further investigation and responsive adaptive management

In order to effectively measure impacts to any at-risk populations or species during the operation phase of the development, and to actively re-assess the suitability of the proactive low wind-speed turbine curtailment strategy the development of alerts, trigger levels and adaptive mitigation response to a potential event is required.

Triggers for responsive management actions will apply where the number of collisions per annum represents a low, but uncertain potential to result in a negative effect on the local population of a species. This is a precautionary objective, as it will be implemented at levels substantially below numbers of collision mortality events that are considered likely to represent a significant impact on the viability of the overall population of any species.

At a minimum, and pending results of detailed baseline data, the following definitions (Table 88) are considered a trigger-level alert and if realised would warrant an increased focus on areas of concern if they were to occur.

Table 88 General investigation and monitoring triggers for Bird and Bat strike

Tier	Type	Trigger	Mitigation
Tier 1 alert	Threatened species	• Where any carcass; feather spot; or injured individual (likely caused as a result of turbine collision) is found under or close to (<120m from) a wind turbine or turbine cluster (adjacent to Ben Halls Gap National Park) during any single mortality search or incidentally by wind farm personnel.	Tier 1 mitigation instigated

Tier	Type	Trigger	Mitigation
	Non threatened 'at-risk' species	• Where more than two carcasses; feather spots; or injured individuals (likely caused as a result of turbine collision) of a single species are found under or close to (<120m from) a wind turbine or turbine cluster (adjacent to Ben Halls Gap National Park) during any single mortality search or incidentally by wind farm personnel.	
	Low risk species	• Where more than two carcasses; feather spots; or injured individuals (likely caused as a result of turbine collision) of a single species are found under or close to (<120m from) a wind turbine during any single mortality search or incidentally by wind farm personnel.	

Pending results of detailed baseline data, the following definitions (Table 89) are considered an unacceptable impact and require detailed investigation and stringent temporary or permanent mitigation should they occur, pending results of the investigation;

Table 89 General investigation and monitoring triggers for bird and bat strike

Tier	Type	Trigger	Mitigation
Tier 2 impact	Non threatened 'at-risk' species	• Where population* numbers are known; – Any impact that is likely to reduce the total species' population by more than 1% over a two year period; or • Where population numbers are not known; – More than four carcasses of one non-threatened at risk species (moderate or greater) identified in the tables in BDAR Sections 8.3.1 and 8.3.2 are found under or close to (<120m from) a wind turbine within a two month cycle** or during incidental searches.	Tier 2 and 3 mitigation instigated
Tier 3 impact	Threatened species	• Where population* numbers are known; – Any impact that is likely to reduce the total species' population by more than 1% over a five year period; or • Where population numbers are not known; – Any impact where more than three carcasses, feather spots; or injured individuals (likely caused as a result of turbine collision) of a single species are found under or close to (<120m from) a wind	

Tier	Type	Trigger	Mitigation
		turbine within a two month cycle** or during incidental searches.	

*'Population' relevant to the operation of the wind farm will be determined (where possible) in consultation with BCS via a detailed monitoring plan, and based on baseline and ongoing utilisation survey data and dependent on species by species basis.

**A two month cycle is the search of all turbines split across a two month period i.e. 35 turbines in one month, the remaining 30 the following month.

A detailed decision framework will be included for triggers and mitigation (in conjunction with the below mitigation framework) associated with both the threatened and non-threatened at-risk species during the development of the BBAMP, finalised prior to commissioning of turbines.

Monitor and report on the effectiveness of impacts and trigger levels

Purpose-trained dogs have been shown to be highly efficient at detecting carcasses (Mathews *et al.* 2013) and have been used for this purpose at a number of wind farms in in Australia. Using purpose-trained dogs obviates the need for formal transects to be established in the search zones as dogs use scent to detect carcasses and are permitted to roam to do so. Every dog will be fitted with a GPS tracking device while undertaking searches. GPS tracks will be downloaded and maintained for future reference and used for analyses of search effort and coverage. GIS maps showing routes taken by dogs will be made available to DPE on request. The use of trained dogs is the preferred method for searches and will be used, provided appropriately trained dogs and handlers are available. Dog handler(s) must have demonstrated capacity to identify bird and bat species of NSW.

However, if the use of dogs is not practicable or are unavailable for the Hills of Gold Wind Farm site the alternative is to engage suitably trained ecologists or environmental officers. Observers will search by walking transects through the search zones, generally a 120 metre radius, and a repeated 60 metre pulse search. Searches will be undertaken by persons with demonstrated capacity to identify bird and bat species of NSW and relevant to the subject land. Transects will be spaced 6 metres apart, or as near to 6 metres as is practical, and observers will thus search the ground for 3 metres either side of each transect. Each observer will carry a hand-held GPS unit and record transects they walk. GPS tracks will be downloaded and maintained for future reference and used for analyses of search effort and coverage. GIS maps showing transects walked will be made available to DPE on request.

It is proposed carcass searches be undertaken in accordance to the schedule in Table 90, pending adaptive management, triggers and introduction or amendments to mitigation measures.

Table 90 Monitoring requirements for carcass searches

Turbines	Monitoring schedule
All	• Monthly for the first six months following commissioning of turbines, however must include the first spring/summer season following commissioning of turbines, and therefore may be extended in duration, including follow up pulse searches*.
Low risk	• Over a two month cycle**, from six months up to five years following commissioning of relevant turbines, monthly searches in a randomised order including: – 120m search area around relevant turbines, with a follow up 60m pulse search from October to March (6 in total). – 120m search area around relevant turbines, with no pulse searches required from April to September (6 in total). • Following three years following commissioning of relevant turbines, a review of sampling frequency will be undertaken to inform adaptive management.
Moderate risk	• Over a two month cycle**, from six months to a minimum of five years following commissioning of relevant turbines, monthly searches in a randomised order including: – 120m search area around relevant turbines, with 60m pulse searches throughout. • From five years following commissioning of relevant turbines, sampling frequency thereafter will be informed by a series of scavenger surveys and adaptive management.

*A 'pulse search' is a secondary search undertaken from three to seven days following the primary search to detect additional mortality of bats and birds.

**A two month cycle is the search of all turbines split across a two month period i.e. 35 turbines in one month, the remaining 30 the following month.

It is likely (but uncertain at present) that carcasses of bats and small birds will be scavenged quickly within the subject land. Carcass persistence trials will be undertaken during the course of the operational monitoring, and prior to its commencement, particularly to inform analyses required to extrapolate from numbers of carcasses detected to estimate total number of collisions. In order for the search regime to accommodate the likelihood of rapid scavenging, a relatively short period between initial searches is important. Trials to determine persistence time of carcasses are required to derive correction factors necessary to estimate total fatalities from the results of the carcass searches. Two persistence trials will be undertaken in each year of the monitoring regime (minimum of three years), one in each of spring and summer/autumn.

Further details on carcass searches/monitoring, persistence trials, incidental finds and data analysis will be included in the detailed BBAMP.

Operational mitigation measures.

It is not feasible to foresee what potential factors might lead to an unexpectedly high level of collisions by any species, and therefore appropriate mitigation measures can be prepared only if a cause, or causes, of ecologically significant impacts on the relevant species is known. Additionally, flexibility in mitigation shall be designed to encourage innovative and new technologies be implemented over the operational life of the wind farm where appropriate.

If a cause is not readily apparent, then investigation of the reason(s) for the impact must be undertaken prior to proposal of a mitigation strategy. Advice from DPE will be sought with regard to design and implementation of any such investigations and of an ultimate mitigation strategy, if required. DPE will be notified within two working days of determination by Engie or the contracted qualified ecologist that a trigger level or unacceptable impact for any species of concern is detected.

The BBAMP will detail considerations of mitigation measures to reduce the number of tier 1, tier 2 and tier 3 impacts. Broadly, these will include general mitigation measures and specific trigger related mitigation, including but not limited to, those demonstrated in Table 91 below.

Table 91 Consideration of likely required mitigation measures

Type	Mitigation considerations and response
General	• All turbines will be feathered to prevent free-wheeling prior to predetermined cut-in speeds (i.e. prior to energy generation). • All moderate risk turbines will be subject to proactive low wind-speed turbine smart curtailment from the outset of the operational phase of the project. • Ongoing reassessment of species risk levels and thus relevant trigger-levels. • Periodic review of the low wind-speed turbine curtailment strategy and monitoring program every two years. • Incorporate any operation mitigation measures developed during the preparation of the BMP relating to monitoring of relevant geological features at 'fly-out' times to determine if/where further mitigation may be warranted. • Encourage habitat use offsite through establishment of BSAs and associated habitat restoration in the area proximal (>200m) to the wind farm and likely to be utilised by the local population of birds and bats. • Minimising availability of raptor perches on infrastructure within close proximity to turbines and overhead powerlines. • Prompt animal carcass removal within the 200m of a turbine (within 24 hrs of discovery) to minimise raptor scavenging opportunities and reviewed annually. • Participation on local (site based) and co-ordinated (LLS and NPWS) feral animal control programs, i.e. rabbits, wild dogs and foxes, and in line with carcass removal protocols. • Investigation of potential deterrents or evolving technologies, such as: – Avoiding or limiting the use of artificial lighting (synchronising flashing red light if required) on turbines and other infrastructure within close proximity to turbines. – Consider novel deterrent techniques related to blade visibility. – Ultrasonic technologies. – Consideration of radar (or optical sensor) or live camera technologies for automatic, reactive and temporary curtailment of turbines for moderate risk turbines, turbine cluster (WP 28-43) or as required (Tier 1 and Tier 2 alerts) adjacent to Ben Halls Gap Nature Reserve. – Use of 'acoustic lighthouse' to deter avian activity by broadcasting, for example, audible frequencies of 4 – 6 kHz in front of turbine towers to encourage avoidance behaviour (as detailed in Boycott et al 2021).

Type	Mitigation considerations and response
	• Annual reporting to include triggers relating to the re-assessment of the mitigation strategies to be implemented over the following year of operation where tier 1 and/or tier 2 and 3 triggers have occurred. – Additional triggers will be developed that consider the actual/extrapolated impacts to bird and bat species calculated across the preceding year, and include associated mitigation measures and potential additional offsets for the following year of operation.
Tier 1 Alert mitigation and response	Initiate rapid assessment framework for tier 1 alerts within the BBAMP to identify the most effective mitigation measures to be implemented, including but not limited to: • Increased monitoring of a relevant turbine(s) for a seven day period following a tier 1 alert to determine a one off event, or a potential ongoing event. • Use of 'acoustic lighthouse' to deter avian activity by broadcasting, for example, audible frequencies of 4 – 6 kHz in front of turbine towers to encourage avoidance behaviour. • Consideration of mobile radar installation for a minimum 7 day period for automatic, reactive and temporary curtailment of turbines relating to a tier 1 alert for medium to large threatened and non-threatened at risk bird species. • In the case of at risk species or threatened species nesting within 200m of a turbine, the nesting event will be allowed to occur, with increased monitoring, potential for temporary curtailment in line with tier 2 and tier 3 recommendations until removal of the nest following the breeding event can be undertaken. Any mitigation is to be consistent with project approval conditions.
Tier 2 and 3 mitigation and response	Initiate rapid assessment framework for tier 2 and tier 3 triggers within the BBAMP to identify the most effective mitigation measures to be implemented. • Cease operation temporarily of a turbine(s) relevant to a trigger event during the rapid investigation. • Increased daily carcass searches for 14 days following discovery of a tier 2 or tier 3 trigger, to be undertaken within the subsequent four weeks of the trigger event by suitable trained ecologist, environmental advisor and/or detector dog services. Pending an investigation into tier 2 and tier 3 impacts being detected, the following may be required in consultation with the Proponent, suitably qualified ecologists, wind farm subject matter experts and DPE; • Temporary turbine shut down during periods of low visibility (Fog). • Immediate reassessment of current low wind speed curtailment strategy being implemented and if required adjustment (or inclusion if not being implemented for the specific turbine) to reduce the potential for reoccurrence of the unacceptable impact. This reassessment may be required on a temporary or permanent basis.

The need for adjustments to the curtailment strategy will be determined through regular monitoring on the efficacy of the current strategy (as prescribed in the BBAMP). Adjustments may include additional curtailment measures if an unacceptable number of strikes are found to occur, however the option to reduce the level of curtailment will also be prescribed, if sufficient evidence can be provided that it is safe to do so. Such evidence may include few, to no, recorded bat strikes at a given turbine, combined with a comparison to the results of a trial period of reduced curtailment. As such, turbines currently assessed as low risk of impact may become curtailed in the future, or those turbines currently considered to present a moderate risk of impacts may be removed from the curtailment strategy, or have curtailment strategies increased. All such changes would be guided by the monitoring and adaptive management processes outlined in the BBAMP.

Detailed monitoring on the efficacy of the smart curtailment strategies, along with responsive management triggers, have been committed to by the Proponent, as is detailed herein. This includes a schedule of proposed carcass searches utilising trained sniffer dogs (when available) focusing on an intensive search period over the initial six months of operation (must include the first spring/summer season) whilst animals habituate to the presence of the turbines. This is then followed by regular ongoing searches of all turbines for a period of three to five years, and then ongoing based on the results of the searches. Triggers have been developed and committed to, which based on the results of the carcass searches, will ensure that mitigation strategies (scaled based on the severity of the trigger) are promptly implemented and will arrest the occurrence of any unacceptable events (i.e. strikes). Mitigation strategies include the ongoing opportunities for alternative actions to turbine curtailment such as audible and ultrasonic noise broadcasting to create avoidance behaviour, or the use of radar to induce turbine shutdowns, with such technologies expected to develop greatly over the life of the project. Further effective mitigation strategies include pest animal control to reduce the occurrence of foxes, cats and dogs, likely to scavenge microbat carcasses, potentially skewing the results or searches, establishment of lighting systems that reduce insect (prey) attraction, and annual reporting requiring accounting for all events over the preceding 12 months and reinvestigation the effectiveness of the current mitigation strategy. In the event of trigger level investigations being required the Proponent has committed to increased carcass searches to determine the actual severity of the event, potential temporary turbine shutdowns (while the investigation is underway), re-assessment of existing low-wind speed curtailment strategy, and ultimately greater curtailment of turbines if unacceptable events are found to be re-occurring.

The proposed proactive low wind speed curtailment strategy (to be developed in detail during the preparation of the BBAMP), combined with the ongoing monitoring schedule and responsive management actions committed to by the Proponent, is considered to provide industry best practise and the best possible opportunity for minimising the potential for the project to result in operational impacts to local microbat populations. Low wind speed curtailment is known to be an effective means of reducing the risk of blade strike for microbats, and there is a growing body of literature of the topic from Australia and around the world that will continue to be reviewed during regular re-evaluation of the project's current strategy (refer Section 7.2.3). The Proponent is prepared to work with authorities to share data and continue to contribute to the growing body of literature. When smart curtailments are developed with the implementation of well-considered environmental parameters, it can maximize both the protection level for microbats and the energy generation at the wind farm (Bennet 2002). A smart curtailment strategy will be developed and employed by the project, based on the collection of additional baseline data and in development of the BBAMP. Following the implementation of the project's low wind speed curtailment strategy, operational monitoring and adaptive management will ensure that any unacceptable events that may occur are captured and mitigated, thus providing an ongoing feedback loop to further reduce the potential for the project to result in substantial operational impacts to microbat species and populations.

As outlined in Table 94 in Section 8.11, the post mitigation collision risk for all remaining turbines, once the above impact avoidance and minimisation strategies have been implemented, has been assessed as low.

Residual prescribed impacts and compensatory measures

Following implementation of required mitigation, additional offset requirements for prescribed impacts may be required to offset residual impacts in accordance with the BAM. This may be achieved via the retiring of credits or payment to the BCT. The amount of credits required to be offset would be calculated by the number of actual and modelled impacts, accounting for scavenger impacts, to individual species in a given year, multiplied by the biodiversity risk weighting (BRW) for the relevant species. This method is commensurate with the Equation 3 (Section 10.1.3) of the BAM for calculating species credit requirements for flora species assessed by a count of the number of individuals, which is aligned with the calculation of offsets required for impacts to individual bird and bat strikes. This method also captures the relevance of a current threatened listing for a species, and is in accordance with the expectations of BAM implementation for prescribed impacts (Section 8.6 of the BAM).

Where an unacceptable impact to a non-threatened 'at risk' species be encountered or estimated, following mitigation, then a like for like risk weighting may be applied from a similar threatened species i.e. – Wedge-tailed Eagle to Little Eagle, following consultation with BCS. Any credit generation required to offset residual prescribed impacts would be calculated during the annual reporting, which will also demonstrate that credits required for the preceding 12 months have been retired under the BOS.

Compliance management and summary

Table 92 demonstrates the key objectives and criteria for effective management of the Bird and Bat operational risks at the Hills of Gold Wind Farm, and will be the crucial in the detailed development of the BBAMP.

Table 92 Overview of commitments in relation to operational prescribed impact on Bird and Bats

Task	When	Responsibility	Criteria and commitment
Baseline surveys	Prior to turbine commissioning	Proponent Ecology contractor	At a minimum 2 spring surveys, 2 summer/autumn survey and 1 winter survey within a 24 month period prior to turbine commissioning for birds and bats.
Low wind speed curtailment strategy	Following completion of baseline surveys and prior to turbine commissioning	Proponent Ecology contractor	Development of a low wind speed curtailment strategy to the satisfaction of DPE to be prescribed in the final BBAMP. Implement the strategy as prescribed by the BBAMP.
Operational surveys	Minimum of 3 years post commissioning of all turbines	Proponent Ecology contractor	At a minimum, undertaken in spring and summer/autumn when activity of both birds and bats are likely to be at their highest.
Triggers	Operational phase, as required	Proponent Ecology contractor	Investigation and review of alerts, triggers and unacceptable impacts. Instigate appropriate mitigation measures in consultation with subject matter experts

Task	When	Responsibility	Criteria and commitment
			and DPE as a result of tier 2 or tier 3 impacts.
Scavenger searches	Up to 5 years post commissioning of all low risk turbine and a minimum of 5 years post commissioning for moderate risk	Proponent Ecology contractor	Two persistence trials undertaken in spring and summer autumn (10 in total).
Prescribed impact mitigation	Operational phase, as required	Proponent	Adaptive mitigation for tier 1 alerts. Adaptive mitigation for tier 2 and 3 triggers. Turbine curtailment or shutdown procedure based on tier 2 and 3 triggers.
Offsetting – Prescribed Impacts	Operational phase, as required	Proponent	Following appropriate mitigation, offset residual prescribed impacts. Report and retire credits annually if required.
Reporting	Operational phase, annually	Proponent	All monitoring data will be shared with DPE, EES and DCCEEW annually and made publicly available on the project's website. Annual reports to identify if any triggers for action have been met. Reports will also incorporate monitoring results and establish if any adaptive actions should be made for management in the following year/s.

DPE, EES and DCCEEW will be promptly notified following determination by the Proponent or the contracted qualified ecologist that an unacceptable trigger level for any species of concern is detected. All monitoring data will be shared with DPE and EES annually.

Monitoring and adaptive management triggers for barrier effect impacts

Whilst the focus of the above section is on mitigation of the impacts associated with collision risk, it is acknowledged that there remains some potential for impacts associated with barrier effects for threatened and/or at-risk species. Following completion of baseline monitoring, and during operational monitoring, if there is a noted discernible statistical reduction or anomaly in abundance of an at-risk or threatened species, additional investigations into possible causes would occur. If it is determined that the operational wind farm was a key factor, additional assessments against key relevant Test of Significance criteria or Significant Impact Criteria would be used to quantify or measure the level of impact. If these assessments determined that an event resulting from barrier effects warranted additional mitigation, compensatory measures or species specific offsetting, these would be employed. This detail and decision framework will be provided within the BBAMP.

8.11 Operational impacts post-mitigation

Following the implementation of stringent safeguards, including mitigation measures, triggers, curtailment strategies and monitoring periods presented in Section 7.2.3 and Section 8.10.2 above, and further development in the BBAMP, it is anticipated that the overall turbine risk for collision and barrier effect impacts will be low. This demonstrated in Table 94 below.

As outlined below in Table 93, the following considerations are applicable when determining risk, in line with multiple parameters stated above, which then determines the level of safeguards required.

Table 93 Qualitative risk consideration for turbines

Risk	Collision Risk	Barrier Effect Risk
Low	Potential unacceptable triggers considered unlikely. Adaptive management and monitoring of impact triggers required within the BBAMP	Negligible impacts on connectivity or for the turbine to influence altered flight behaviour or sterilise habitat for a species
Minimal		Minor impacts on connectivity and potential for turbines to influence altered flight behaviour or sterilise habitat for a species
Moderate	Potential unacceptable triggers considered possible. Stringent mitigation required pending adaptive management to be identified within the BBAMP	Considerable impacts on connectivity and likely for turbines to influence altered flight behaviour or sterilise habitat for a species
High	Potential unacceptable triggers considered probable. Stringent mitigation measures required prior to construction and detailed within BBAMP. Consider relocation or removal of turbines.	Significant impacts on connectivity and likely for turbines to influence altered flight behaviour or sterilise habitat for a species

Table 94 Overall Risk assessment following implmentation of safeguards detailed in Section 7.2.3 and Section 8.10.2

Turbine No.	Original Collison Risk	Original barrier effect risk	Revised Collison Risk	Revised barrier effect risk	Post mitigation Collison Risk	Post mitigation barrier effect risk	Justification
WP1	Moderate	Low	**N/A**	**N/A**	Moderate	Low	**Removed from project layout due to moderate risk remaining**
WP2	Low	Low	Low	Low	Low	Low	Relocated within project layout. General, Tier 1 triggers and monitoring applies
WP3	Low	Low	Low	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP4	Moderate	Low	Low	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP5	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP6	Moderate	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP7	Low	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP8	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP9	Moderate	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP10	Moderate	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP11	Moderate	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP12	Low	Minimal	Low	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP13	Low	Minimal	Low	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP14	Low	Minimal	Low	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP15	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP16	Moderate	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP17	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP18	Moderate	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements

Turbine No.	Original Collison Risk	Original barrier effect risk	Revised Collison Risk	Revised barrier effect risk	Post mitigation Collison Risk	Post mitigation barrier effect risk	Justification
WP19	Low	Low	**N/A**	**N/A**	Low	Low	**Removed from project layout primarily for non-biodiversity related considerations**
WP20	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP21	Moderate	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP22	Moderate	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP23	High	Low	**N/A**	**N/A**	Moderate	Low	**Removed from project layout due to moderate risk remaining**
WP24	Moderate	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP25	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP26	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP27	High	Low	**N/A**	**N/A**	Moderate	Low	**Removed from project layout due to moderate risk remaining proximity to potential bat roost and minimising overall collision risk**
WP28	Moderate	Minimal	Moderate	Minimal	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP29	Low	Minimal	Low	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP30	Low	Minimal	Low	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP31	High	Minimal	**N/A**	**N/A**	Moderate	Low	**Removed from project layout due to moderate risk remaining and minimising overall collision risk**
WP32	Moderate	Minimal	Moderate	Minimal	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP33	Moderate	Minimal	Moderate	Minimal	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP34	Low	Minimal	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies

Turbine No.	Original Collison Risk	Original barrier effect risk	Revised Collison Risk	Revised barrier effect risk	Post mitigation Collison Risk	Post mitigation barrier effect risk	Justification
WP35	Low	Minimal	Low	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP36	Moderate	Minimal	Low	Minimal	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP37	Moderate	Minimal	Low	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP38	Moderate	Minimal	Low	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP39	Moderate	Minimal	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP40	Moderate	Minimal	Moderate	Minimal	Low	Low	General, Tier 1 triggers and monitoring applies
WP41	Moderate	Minimal	**N/A**	**N/A**	Low	Low	**Removed from project layout due to moderate risk remaining and to maintain a 1.2 km gap between WP40 and 42**
WP42	Moderate	Minimal	Moderate	Minimal	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP43	Moderate	Minimal	Moderate	Minimal	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP44	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP45	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP46	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP47	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP48	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP49	Moderate	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP50	High	Low	Moderate	Low	Low	Low	Relocated within project layout away from potential microbat roost sites. To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP51	Moderate	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements

Turbine No.	Original Collison Risk	Original barrier effect risk	Revised Collison Risk	Revised barrier effect risk	Post mitigation Collison Risk	Post mitigation barrier effect risk	Justification
WP52	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP53	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP54	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP55	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP56	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP57	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP58	Moderate	Low	Moderate	Minimal	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP59	Moderate	Low	Moderate	Minimal	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP60	Low	Low	Low	Low	Low	Low	
WP61	Moderate	Low	Moderate	Low	Low	Low	To ensure reduced risk, smart curtailment strategies apply as well as general mitigation, Tier 1, Tier2 and Tier 3 triggers with increased monitoring requirements
WP62	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP63	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP64	Moderate	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP65	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP66	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP67	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP68	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP69	Low	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies
WP70	Moderate	Low	Low	Low	Low	Low	General, Tier 1 triggers and monitoring applies

9 Impact summary and biodiversity credit report

For residual impacts that cannot be avoided or fully mitigated, offsets will be required by the BOS to ensure no net loss to biodiversity. In accordance with Section 6.3 of the BC Act, the following values are subject to assessment and offset under the BOS:

- Impacts of the clearing of native vegetation and the loss of habitat.
- Impacts that are prescribed by the regulations.

A summary of relevant impacts associated with the proposal which trigger an offsets requirement is presented in Table 95.

Table 95 Summary of proposal impacts subject to assessment and offset under the BOS

Relevant matter	Details	Direct impacts (area)
Native vegetation communities and ecosystem credit species habitats.	Direct loss of native vegetation communities associated with site clearing	190.54 ha
Threatened ecological communities	Direct loss of Ribbon Gum—Mountain Gum—Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	27.24 ha
	Direct loss of White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	8.15 ha
Habitat for threatened fauna species – species credit species	Large-eared Pied Bat	19.75 ha
	Eastern Cave Bat	19.75 ha
	Southern Myotis	3.93 ha
	Eastern Pygmy-possum	22.36 ha
	Koala	46.28 ha
	Squirrel Glider	17.50 ha
	Booroolong Frog	0.95 ha
	Border Thick-tailed Gecko	0.67 ha
	Powerful Owl	17.26 ha
	Sooty Owl	1.99 ha
	Barking Owl	84.57 ha
	Masked Owl	16.29 ha
Habitat for threatened fauna species – ecosystem credit species	State and Commonwealth listed threatened fauna species known or predicted to occur	190.54 ha

The BAM Calculator offset credit summary reports are included in Appendix G and summarised below in Table 96.

These offset credits have been calculated using the amended design footprint developed following the original BDAR. The assessment presented in this updated BDAR is appropriately conservative and precautionary and is based on worst-case footprint that will be refined and reduced during future detailed design phases. The calculation of credits has also assumed benchmark vegetation integrity scores when the required number of field-verified BAM plots were not achieved. This method, while being highly conservative, has likely over-estimated several of the credit calculations which are influenced by vegetation integrity score data.

During the detailed design phase of the Project, further refinements to the development footprint will be undertaken that will determine the Project's final impacts. Once the development footprint has been finalised, the BAM-Calculator will be updated at assess this final impact footprint, as well as to include any additional BAM plots collected to more accurately determine the range of vegetation integrity scores within the subject land, and the Project's offset liability will be re-calculated. Undertaking this final update and re-assessing the Project's offset liability will ensure there is a strong incentive for continued impact avoidance and minimisation post project approval.

A Biodiversity Offset Strategy has been prepared and includes commencement of investigations on a number of properties adjacent to the project area where Biodiversity Stewardship Sites can be established. These properties are on similar elevated ridgelines, with similar PCTs and fauna habitats, also being subject to historical impacts associated with farming. More information is provided in Section 9.1 below.

Table 96 Biodiversity offsets required to address residual impacts

Relevant matter	Associated TEC	IBRA Region/Sub region	Direct impacts (ha)	Credits required
Ecosystem credits				
84 - River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion	-	Nandewar-Peel	0.07	3
PCT 433: White Box grassy woodland to open woodland on basalt flats and rises in the Liverpool Plains sub-region, BBS Bioregion	White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	Nandewar-Peel	0.02	2
434 - White Box grass shrub hill woodland on clay to loam soils on volcanic and sedimentary hills in the southern Brigalow Belt South Bioregion	-	Nandewar-Peel	0.01	1
PCT 486 - River Oak moist riparian tall open forest of the upper Hunter Valley, including Liverpool Range	-	Nandewar-Peel	2.54	94
		NSW NC-Tomalla	1.98	74

Relevant matter	Associated TEC	IBRA Region/Sub region	Direct impacts (ha)	Credits required
PCT 490- Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion	-	Nandewar-Peel	1.88	69
PCT 492: Silvertop Stringybark - Yellow Box - Apple Box - Rough-barked Apple shrub grass open forest mainly on southern slopes of the Liverpool Range, Brigalow Belt South Bioregion	White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	Nandewar-Peel	1.76	68
PCT 492: Silvertop Stringybark - Yellow Box - Apple Box - Rough-barked Apple shrub grass open forest mainly on southern slopes of the Liverpool Range, Brigalow Belt South Bioregion	White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	NSW NC-Tomalla	1.40	47
PCT 507: Black Sallee - Snow Gum grassy woodland of the New England Tableland Bioregion	-	NSW NC-Tomalla	0.09	3
PCT 526 - Mountain Ribbon Gum - Messmate - Broad-leaved Stringybark open forest on granitic soils of the New England Tableland Bioregion	-	NET- Walcha	0.75	33
538 - Rough-barked Apple - Blakely's Red Gum open forest of the Nandewar Bioregion and western New England Tableland Bioregion	-	Nandewar-Peel	0.06	4
PCT 540 - Silvertop Stringybark - Ribbon Gum - Rough-barked Apple open forest on basalt hills of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion	-	Nandewar-Peel	29.55	993
PCT 540 - Silvertop Stringybark - Ribbon Gum - Rough-barked Apple open forest on basalt hills of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion	Ribbon Gum—Mountain Gum—Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	NET- Walcha	1.41	56
PCT 540 - Silvertop Stringybark - Ribbon Gum - Rough-barked Apple open forest on basalt hills of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion	-	NSW NC-Tomalla	36.50	1171
PCT 541 - Silvertop Stringybark - Rough-barked Apple grassy open forest of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion	-	Nandewar-Peel	17.81	630
PCT 541 - Silvertop Stringybark - Rough-barked Apple grassy open forest of southern Nandewar Bioregion, southern New England Tableland Bioregion and NSW North Coast Bioregion	-	NSW NC-Tomalla	13.03	441
PCT 586 - Snow Grass - Swamp Foxtail tussock grassland sedgeland of cold air drainage	-	NET- Walcha	2.56	53

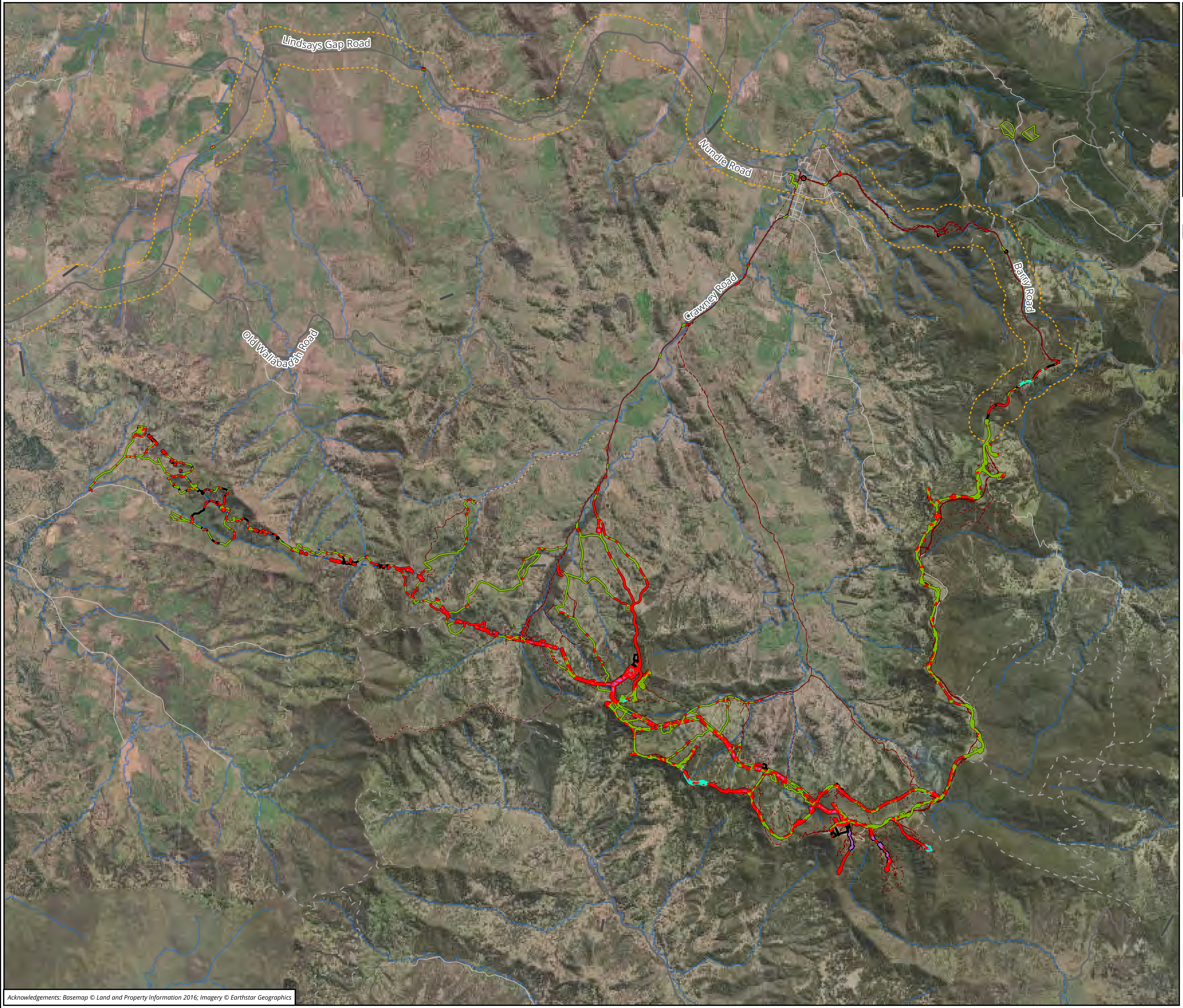
Relevant matter	Associated TEC	IBRA Region/Sub region	Direct impacts (ha)	Credits required
valleys of the New England Tableland Bioregion				
PCT 599 - Blakely's Red Gum - Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	White Box Yellow Box Blakely's Red Gum Woodland and derived native grassland	Nandewar-Peel	4.96	311
PCT 931 - Messmate - Mountain Gum tall moist forest of the far southern New England Tableland Bioregion	-	NET- Walcha	2.25	60
		NSW NC-Tomalla	1.98	45
PCT 934 - Messmate open forest of the tableland edge of the NSW North Coast Bioregion and New England Tableland Bioregion	-	NET- Walcha	19.11	297
		NSW NC-Tomalla	5.49	240
PCT 954 - Mountain Ribbon Gum - Messmate open forest of escarpment ranges of the NSW North Coast Bioregion and New England Tableland Bioregion	-	NSW NC-Tomalla	1.23	54
PCT 1194 - Snow Gum - Mountain Gum - Mountain Ribbon Gum open forest on ranges of the NSW North Coast Bioregion and eastern New England Tableland Bioregion	Ribbon Gum—Mountain Gum—Snow Gum Grassy Forest/Woodland of the New England Tableland Bioregion	NET- Walcha	17.58	465
	-	NSW NC-Tomalla	26.20	691
PCT 1604 - Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter	-	Sydney - Hunter	0.02	1
PCT 1691 - Narrow-leaved Ironbark - Grey Box grassy woodland of the central and upper Hunter	-	Sydney - Hunter	0.04	2
Total				**5,908**
Species credits				
Large-eared Pied Bat	-	Nandewar-Peel NET- Walcha	19.75	631

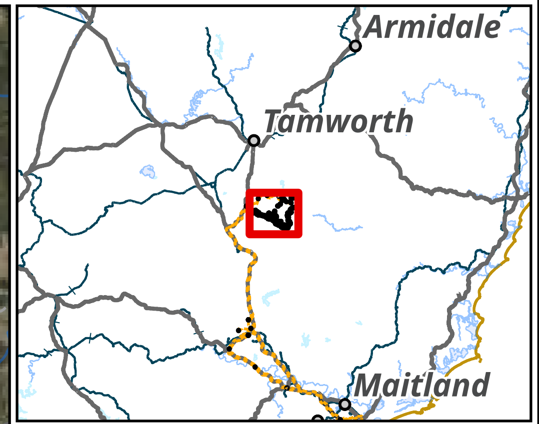
Relevant matter	Associated TEC	IBRA Region/Sub region	Direct impacts (ha)	Credits required
Eastern Cave Bat	-	Nandewar-Peel NET- Walcha	19.75	631
Southern Myotis	-	NET- Walcha NSW NC-Tomalla	3.93	89
Koala	-	Nandewar-Peel NET- Walcha NSW NC-Tomalla	46.28	1581
Eastern Pygmy-possum	-	Nandewar-Peel NET- Walcha NSW NC-Tomalla	22.36	804
Squirrel Glider	-	Nandewar-Peel NET- Walcha NSW NC-Tomalla	17.50	593
Booroolong Frog	-	Nandewar-Peel	0.95	47
Border Thick-tailed Gecko	-	Nandewar-Peel	0.67	33
Powerful Owl	-	NSW NC-Tomalla	17.26	522
Sooty Owl	-	NSW NC-Tomalla	1.99	114
Barking Owl	-	NSW NC-Tomalla	84.57	3225
Masked Owl	-	NSW NC-Tomalla	16.31	596
Total				**8866**

BAM-C notes

- BAM-C was originally established under a single case in the Nandewar IBRA Bioregion and Peel IBRA subregion. This has subsequently been split into three cases, one for each IBRA bioregion / sub-region combination.

- A Separate BOAMs parent case (00031734) had to be opened for the NSW North Coast / Tomalla and New England Tablelands / Walcha Plateau BAM-C assessments, as the original parent case (00020779) would not allow the entry of PCTs from out of the IBRA sub-region specifically PCT 492 in NSW North Coast / Tomalla and PCT 526 in New England Tablelands / Walcha Plateau.
- Relevant Mitchell (NSW) Landscapes were entered for each BAM-C case.
- Percentage native vegetation within the assessment area has not been split by IBRA, and has been entered as 56% for all cases.
- PCT 1194 and PCT 540 Mountain Gum Ribbon Gum TEC vegetation zone area are larger in BAM-C submitted with the Amended BDAR as the entire 'patch' area was entered where that patch was contiguous with the NSW New England Tablelands IBRA bioregion. As the BAM-C cases are now split by IBRA, the entries are split by the IBRA region line, and entered into the BAM-C as such. However the BDAR still assess the TEC as previous (i.e. based on the contiguous patches).
- Where a candidate threatened species habitat polygon did not occur within an IBRA region/sub-region, that species was maintained as a Candidate in each BAM-C but noted as 'No (Surveyed)' in the Habitat Survey tab (Tab 6).
- BAM plot data was entered consistently across the three BAM-C cases. BAM pots entered were not split based on where each plot was collected on-ground. For example if a vegetation zone occurred across two IBRA regions/sub-regions, and three plots were collected in Peel and two collected in Tomalla, all five plots were entered into each BAM-C case.
  - This method is considered to most accurately represent the condition of the vegetation within the development footprint.
- Where benchmark data was used to substitute plots, the benchmark data was correct for each IBRA region.
  - One exception to this was PCT 490 Low, where no benchmarks exist for Nandewar, and benchmarks for the Brigalow Belt South were used.





Legend

- Infrastructure footprint
- Transport haul routes
- Transmission line

Impacts requiring offset

- Threatened species habitat
- Native vegetation

Impacts not requiring offset

- Exotic vegetation
- PCT 1194 DNG - VI score <15

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 1

0 1,000 2,000 3,000 4,000

Meters

Scale: 1:100,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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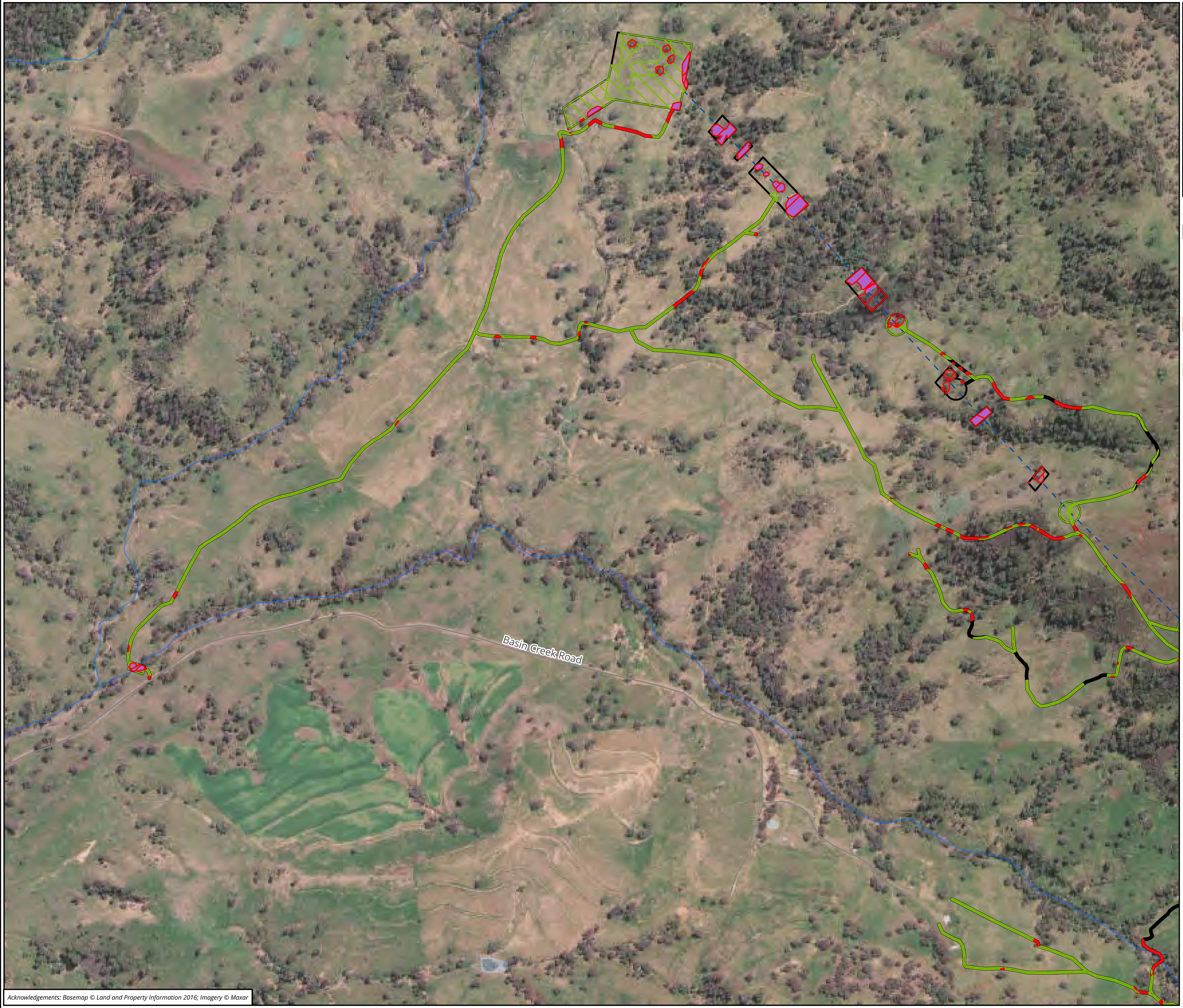

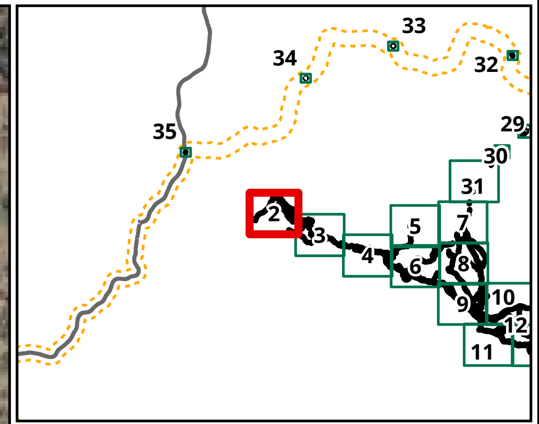

Legend

Infrastructure footprint

Transmission line

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 2

0 125 250 375 500

Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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Date: 25 October 2022 ,
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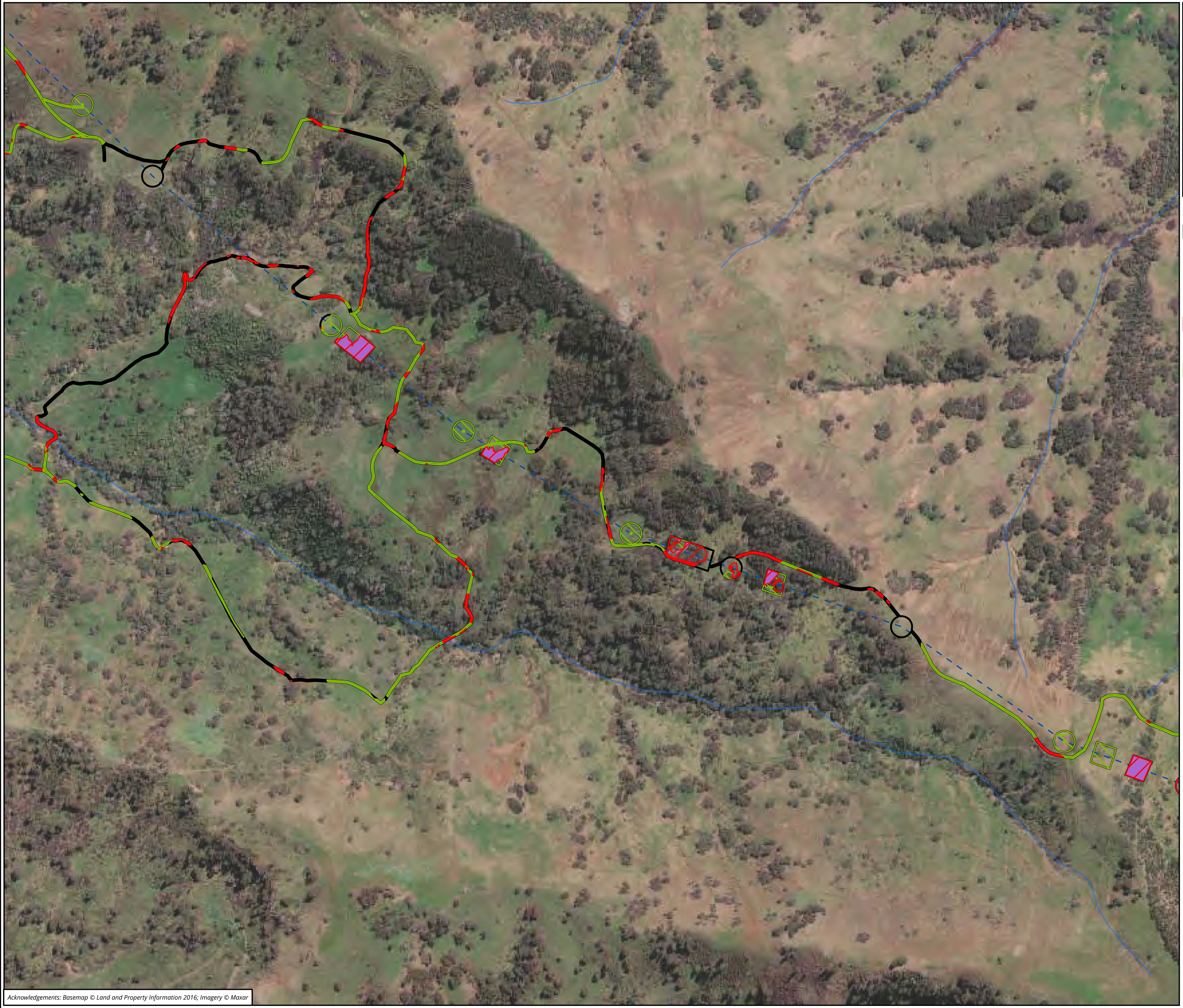

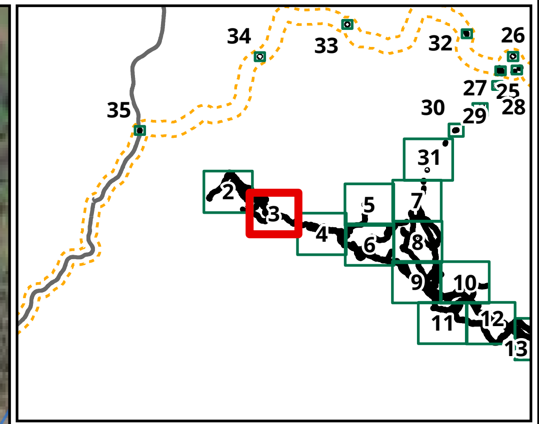

Legend

Infrastructure footprint

Transmission line

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 3

0 125 250 375 500

Meters

N

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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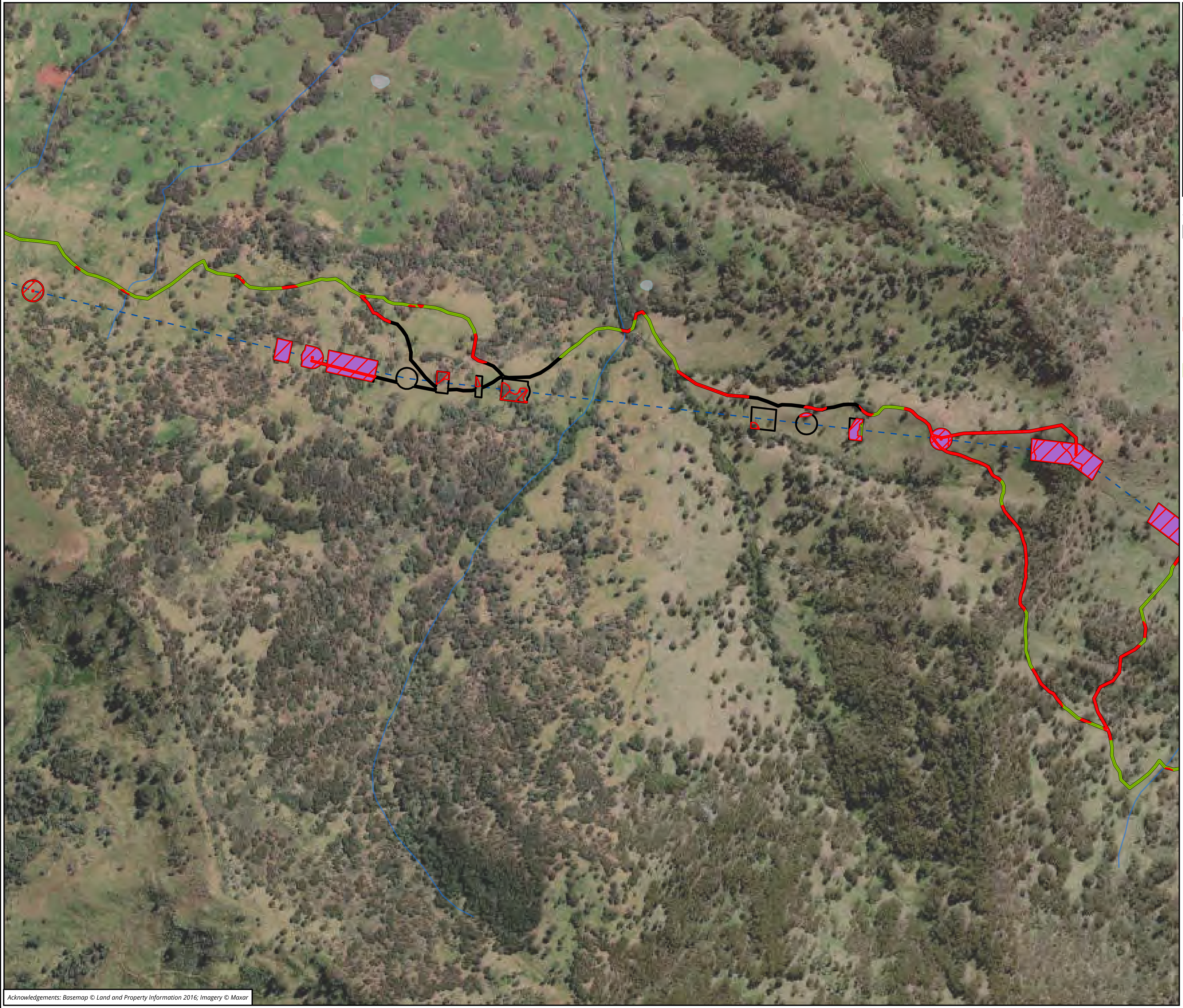

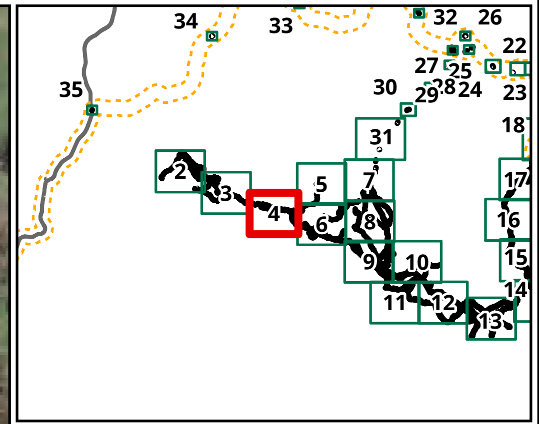

Legend

Infrastructure footprint

Transmission line

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 4

0 125 250 375 500

Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 25 October 2022 ,
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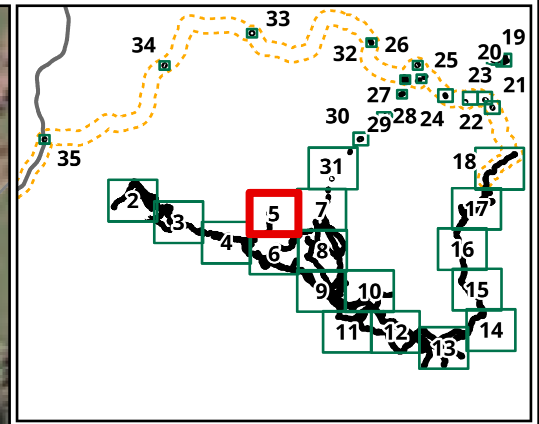

Legend

Infrastructure footprint

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 5

0 125 250 375 500

Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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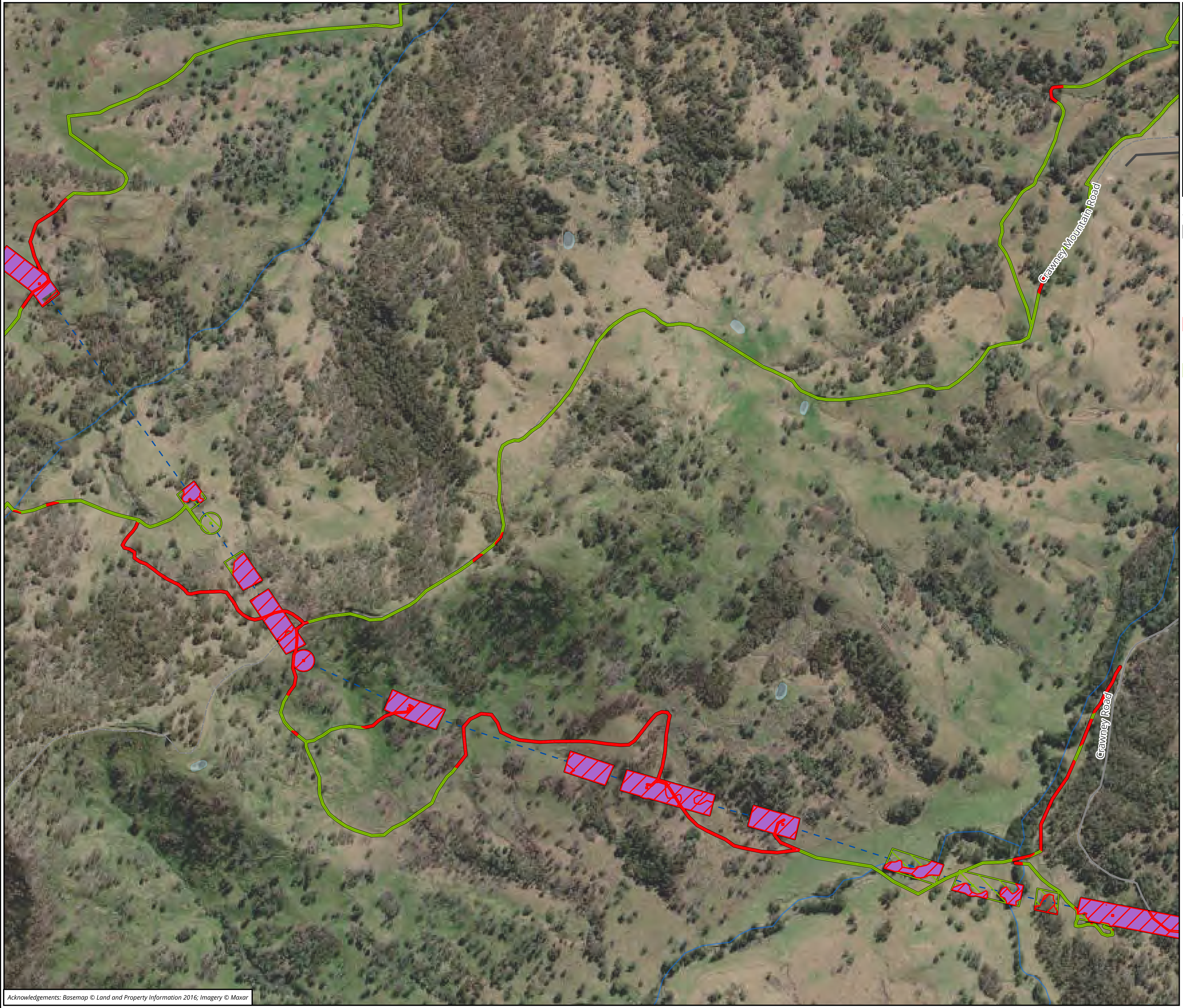

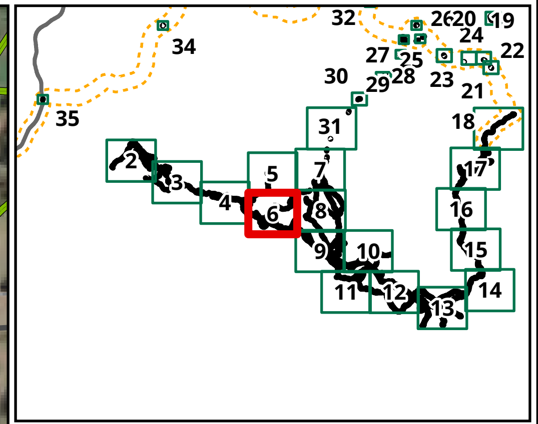

Legend

- Infrastructure footprint
- Transmission line

Impacts requiring offset

- Threatened species habitat
- Native vegetation

Impacts not requiring offset

- Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 6

0 125 250 375 500

Meters

N

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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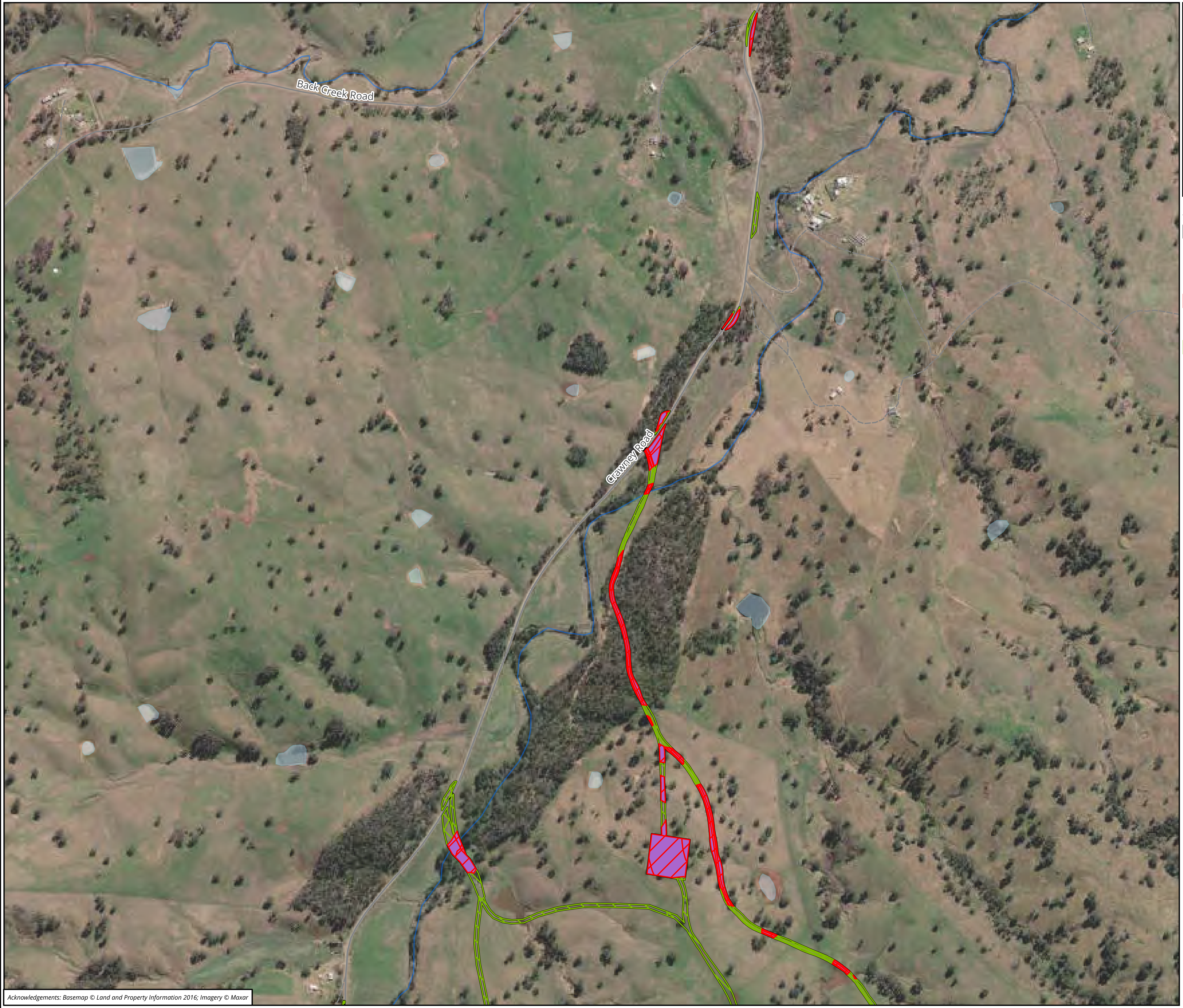

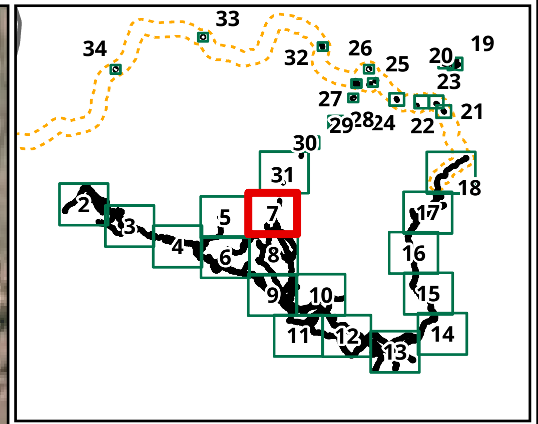

Legend

Infrastructure footprint

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 7

0 125 250 375 500

Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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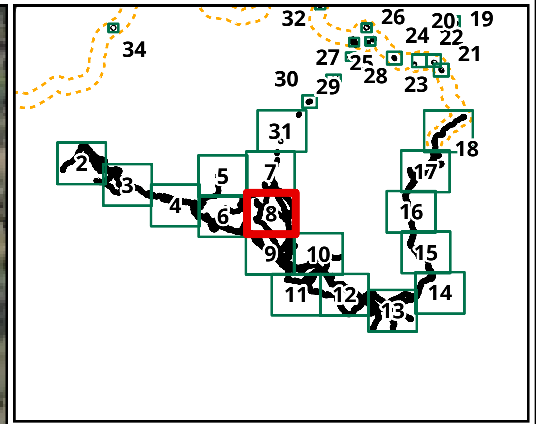

Legend

- Infrastructure footprint
- Transmission line

Impacts requiring offset

- Threatened species habitat
- Native vegetation

Impacts not requiring offset

- Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 8

0 125 250 375 500
Meters
N
Scale: 1:10,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

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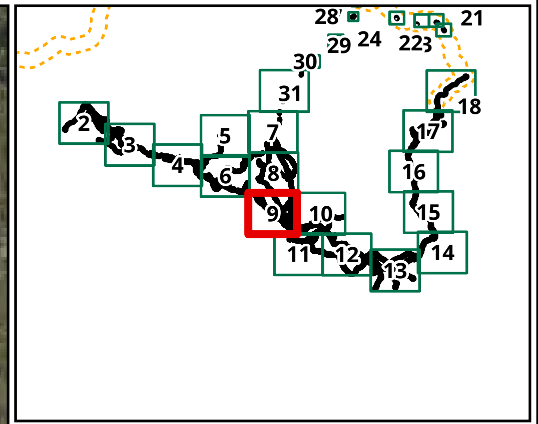

Legend

Infrastructure footprint

Transmission line

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

PCT 1194 DNG - VI score <15

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 9

0 125 250 375 500

Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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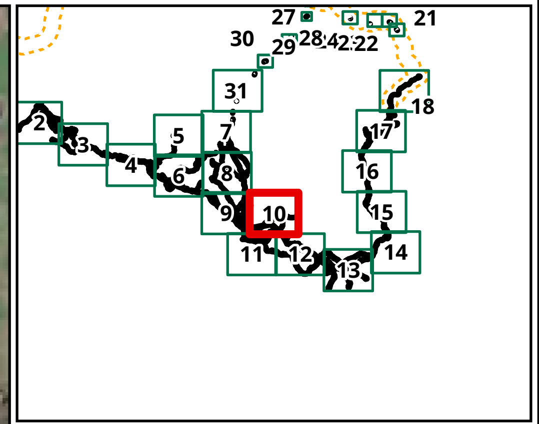

Legend

Infrastructure footprint

Transmission line

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 10

0 125 250 375 500

Meters

Scale: 1:10,000 @ A3

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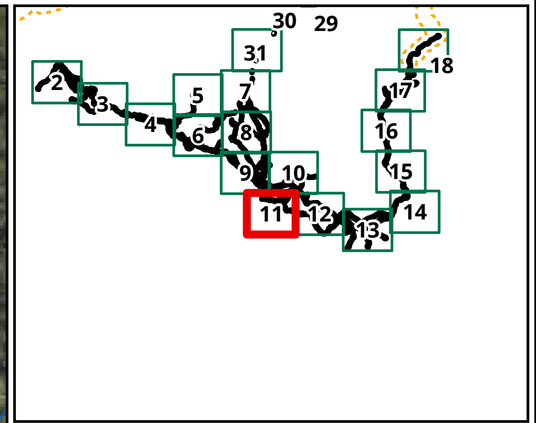


Legend

Infrastructure footprint

Impacts requiring offset

Threatened species habitat

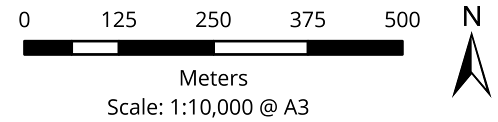
Native vegetation

Impacts not requiring offset

Exotic vegetation

PCT 1194 DNG - VI score <15

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 11



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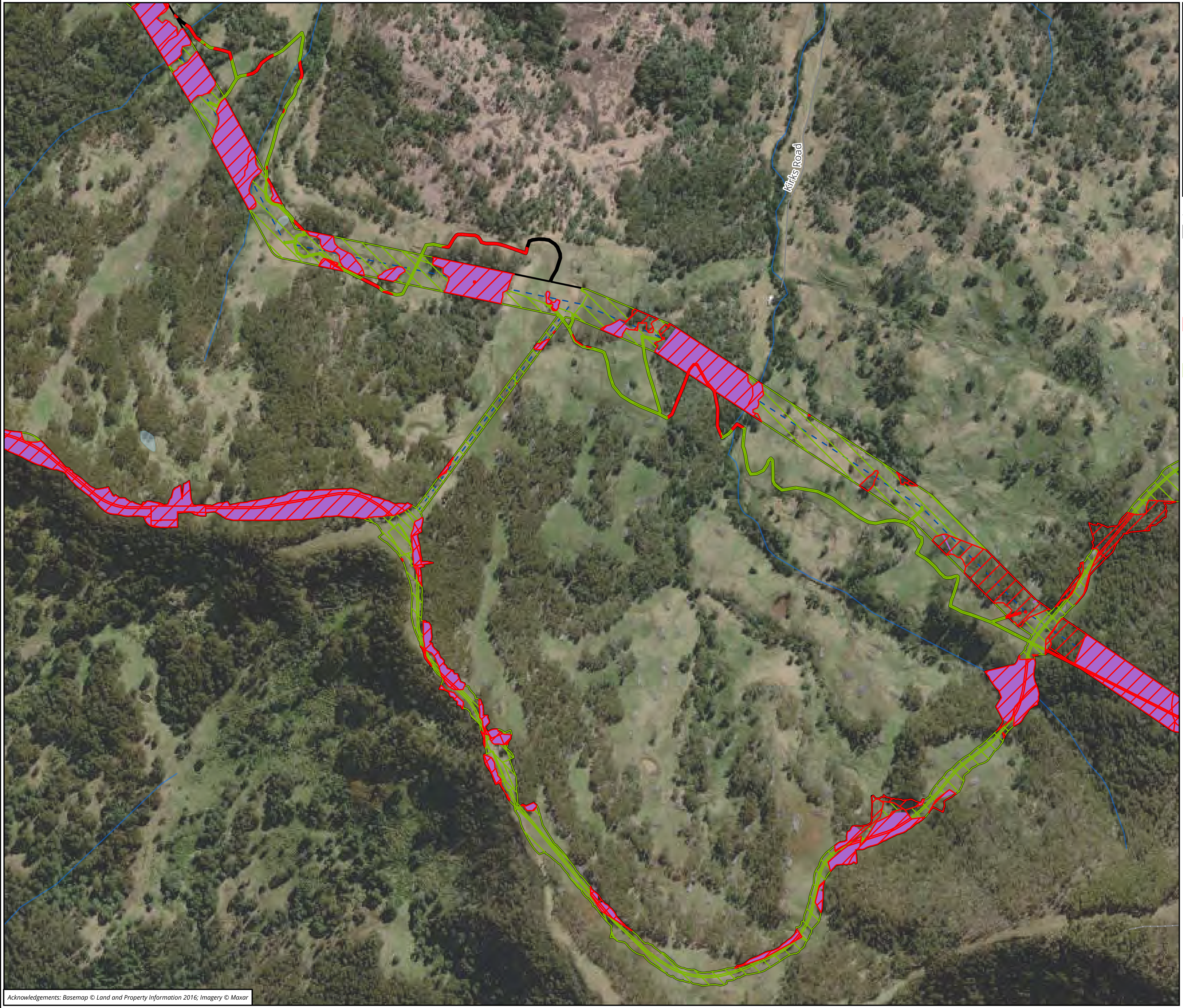

Legend

Infrastructure footprint

Transmission line

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 12

0 125 250 375 500

Meters

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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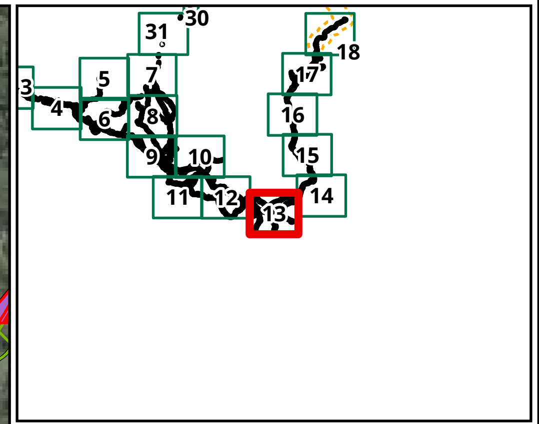

Legend

Infrastructure footprint

Transmission line

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

PCT 1194 DNG - VI score <15

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 13

0 125 250 375 500

Meters

N

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis.

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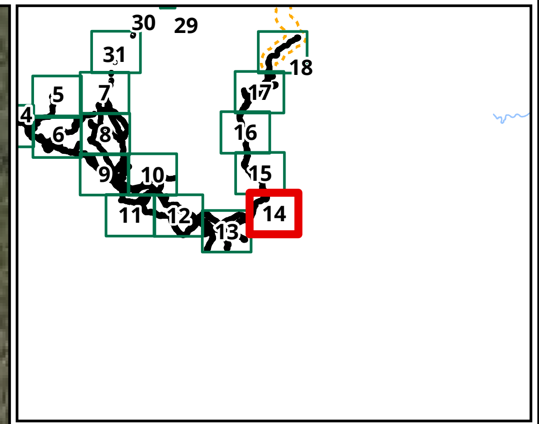

Legend

Infrastructure footprint

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 14

0 125 250 375 500

Meters

N

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

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Date: 25 October 2022 ,
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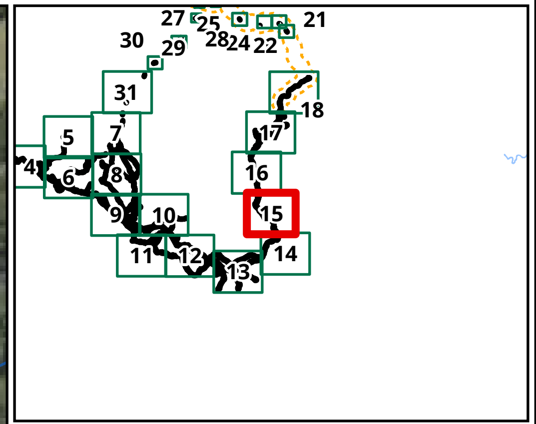

Legend

Infrastructure footprint

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 15

0 125 250 375 500

Meters

N

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis.

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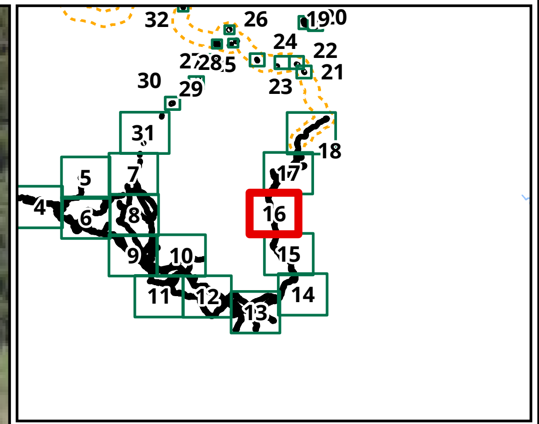

Legend

Infrastructure footprint

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 16

0 125 250 375 500

Meters

N

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

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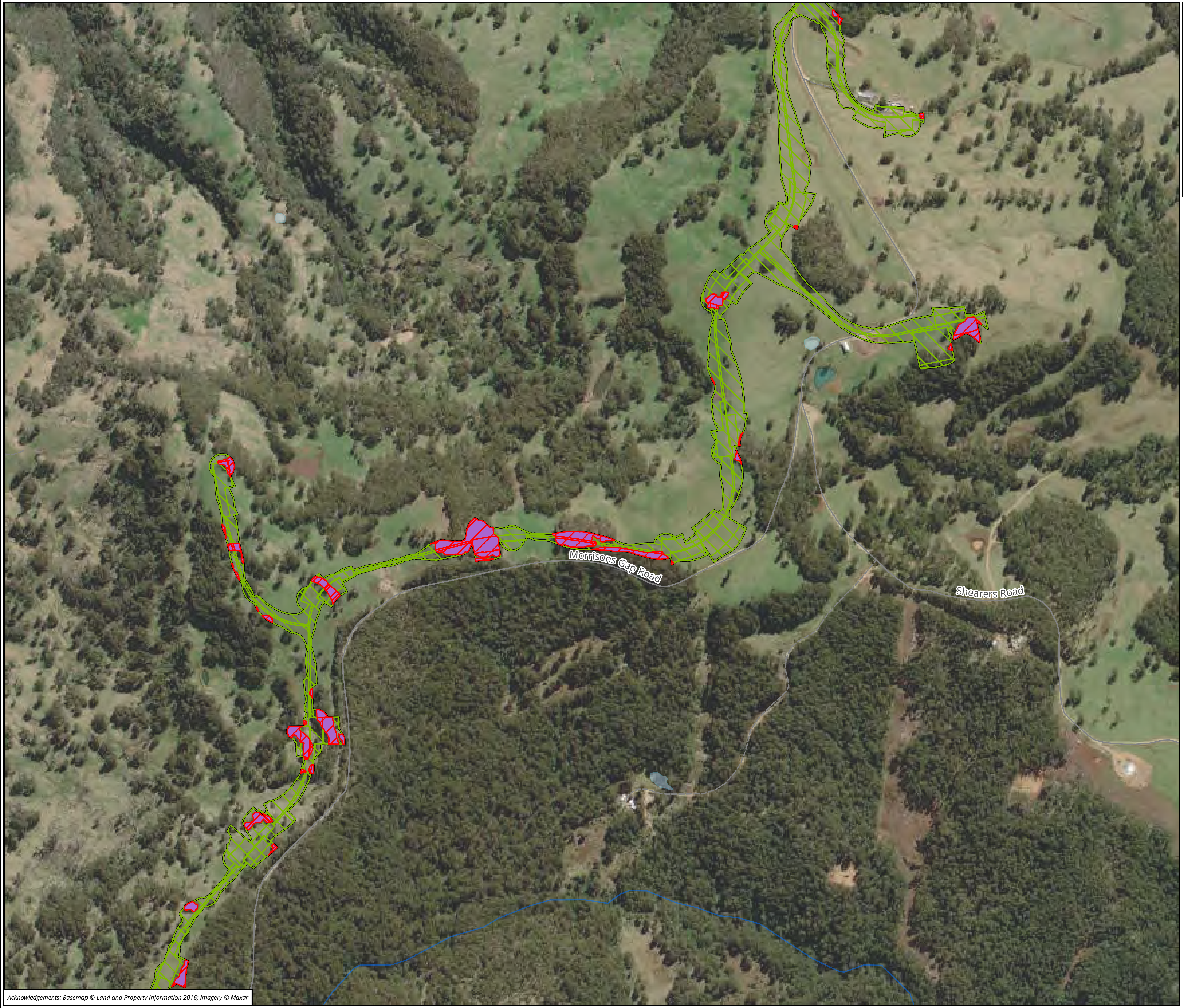
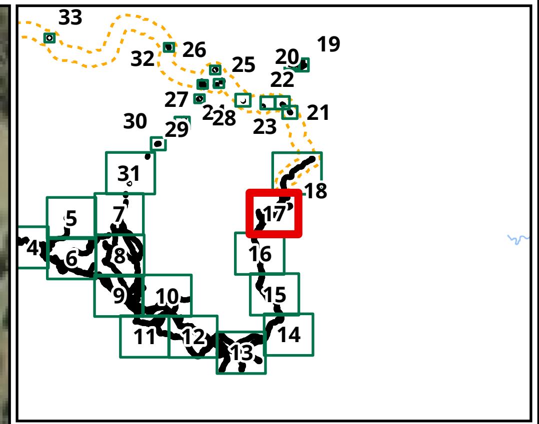




Legend

Infrastructure footprint

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 17

0 125 250 375 500

Meters

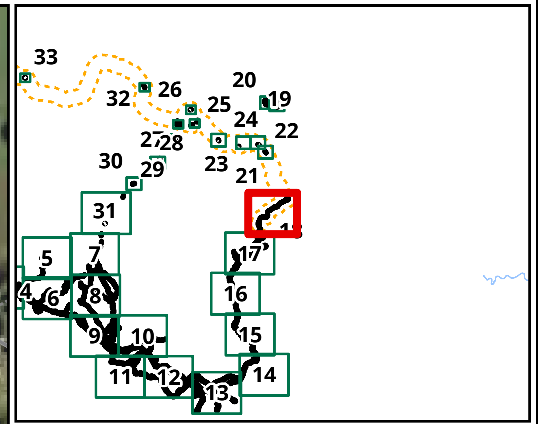
N

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F30_Impacts
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

Infrastructure footprint

Transport haul routes

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

PCT 1194 DNG - VI score <15

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 18

0 125 250 375 500

Meters

N

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
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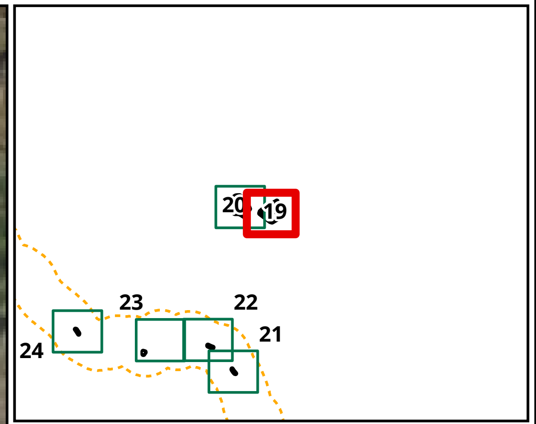

Legend

Infrastructure footprint

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 19

0 30 60 90 120

Meters

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F30_Impacts
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

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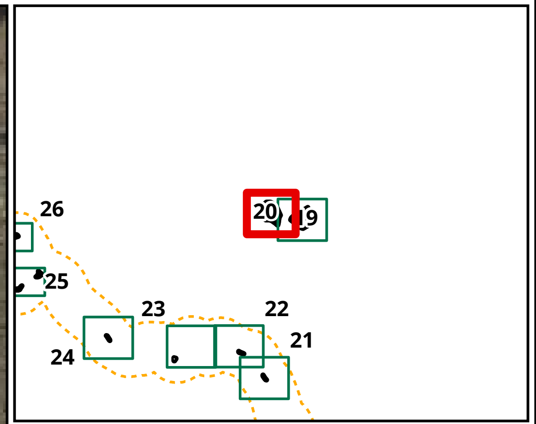

Legend

Infrastructure footprint

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 20

0 30 60 90 120
Meters
Scale: 1:3,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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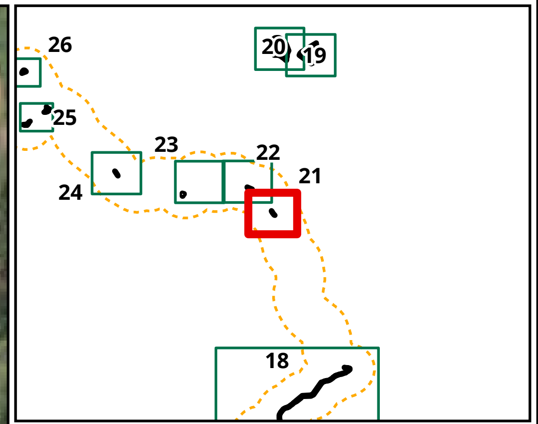

Legend

Infrastructure footprint

Transport haul routes

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 21

0 30 60 90 120

Meters

N

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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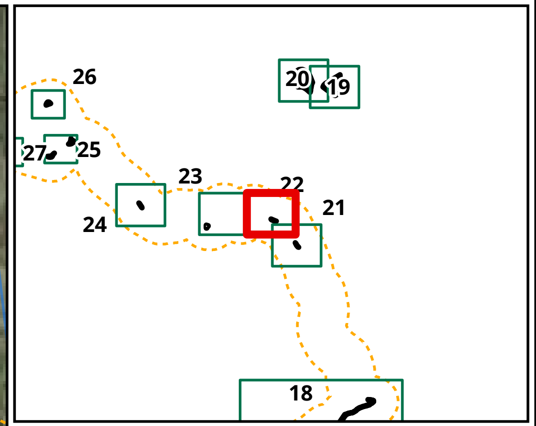


Legend

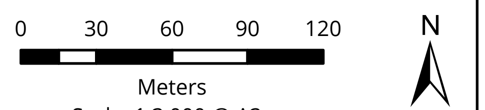
Infrastructure footprint

Transport haul routes

Impacts requiring offset

Native vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 22



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Coordinate System: GDA 1994 MGA Zone 56

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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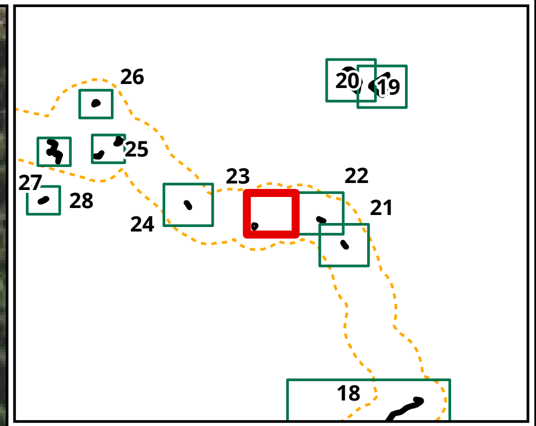

Legend

- Infrastructure footprint
- Transport haul routes

Impacts requiring offset

- Threatened species habitat
- Native vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 23

0 30 60 90 120

Meters

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 25 October 2022 ,
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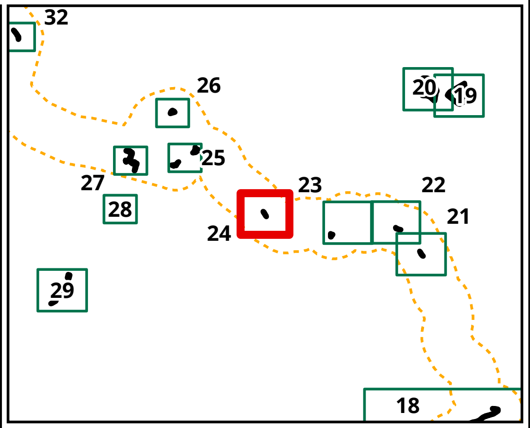

Legend

Infrastructure footprint

Transport haul routes

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 24

0 30 60 90 120

Meters

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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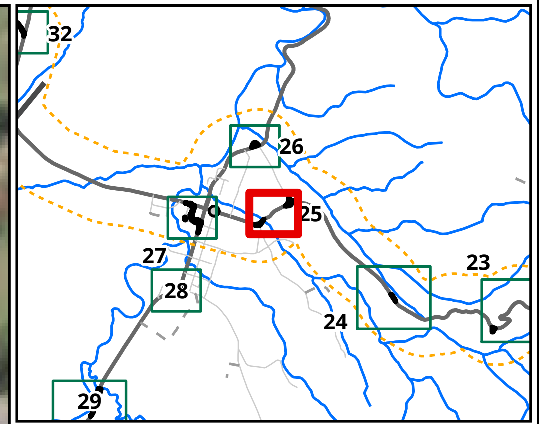


Legend

Infrastructure footprint

Transport haul routes

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 25

0 25 50 75 100

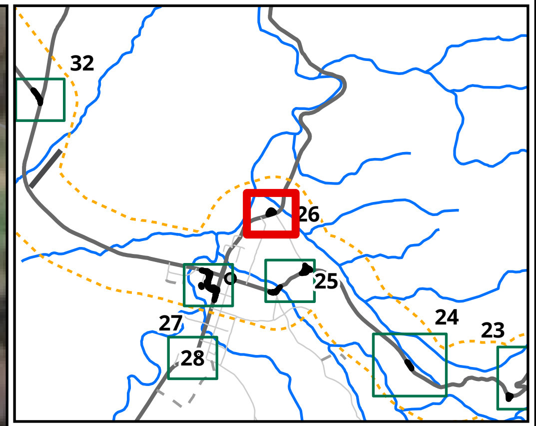
Meters

N

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F30_Impacts
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx



Legend

Infrastructure footprint

Transport haul routes

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 26

0 25 50 75 100

Meters

N

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F30_Impacts
Project: P:\34900s\34963\Mapping\34963_ArcGISPro\34963_BDAR\34963_HoG_BDAR_LH.aprx

Legend

Infrastructure footprint

Transport haul routes

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 27

0 25 50 75 100

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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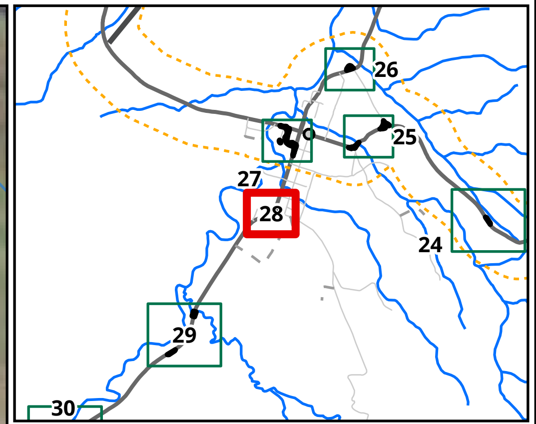

Legend

Infrastructure footprint

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 28

0 25 50 75 100

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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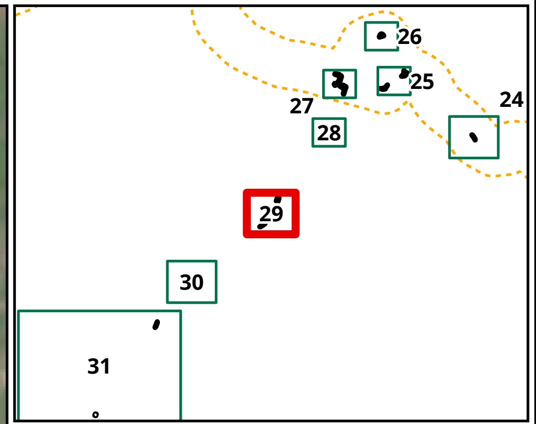

Legend

Infrastructure footprint

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 29

0 30 60 90 120

Meters

N

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
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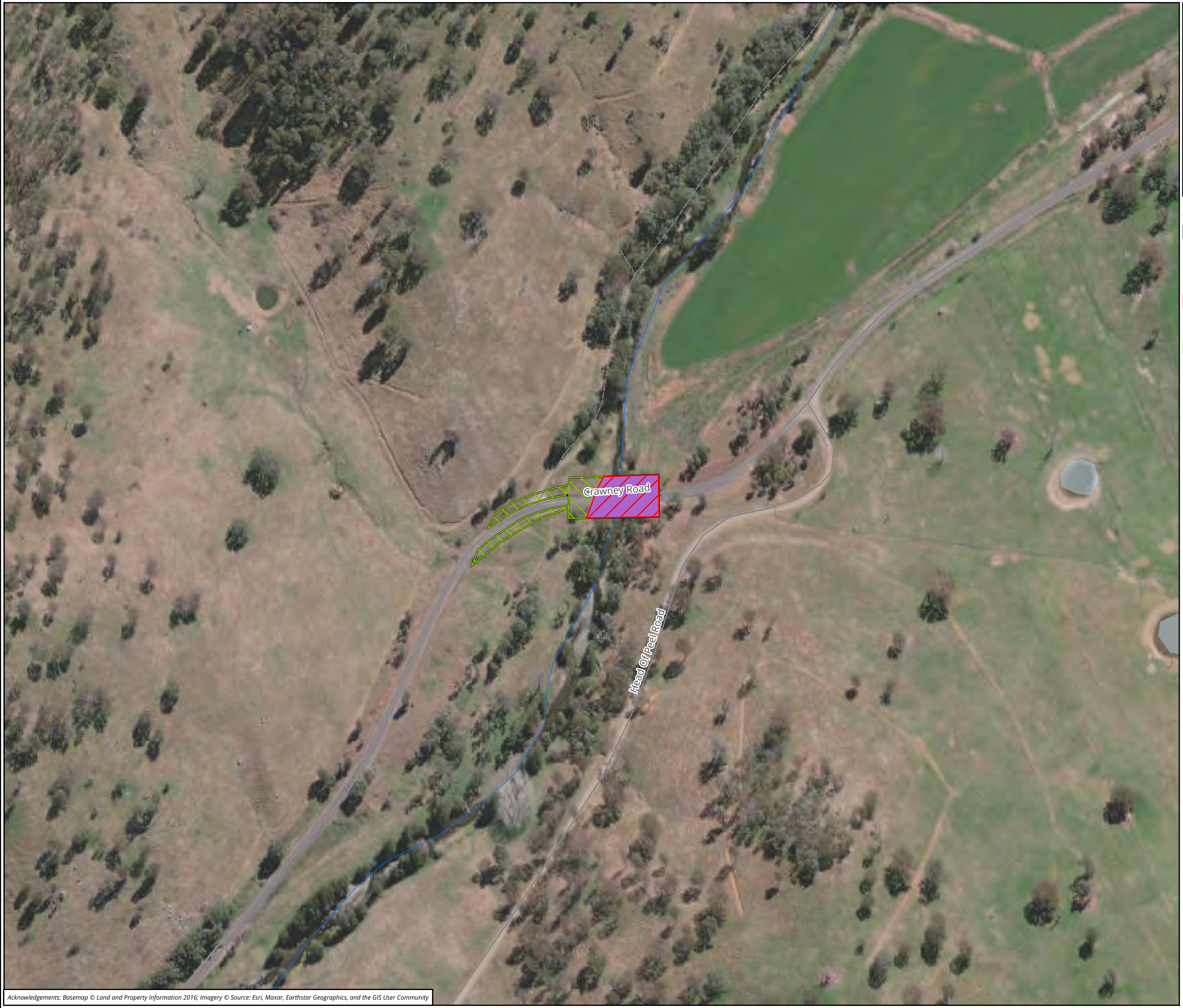

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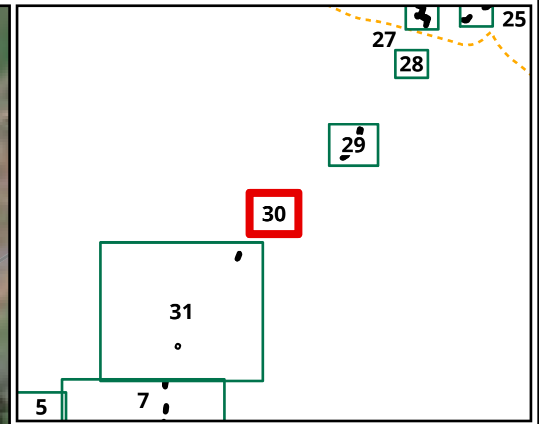

Legend

Infrastructure footprint

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 30

0 30 60 90 120

Meters

Scale: 1:3,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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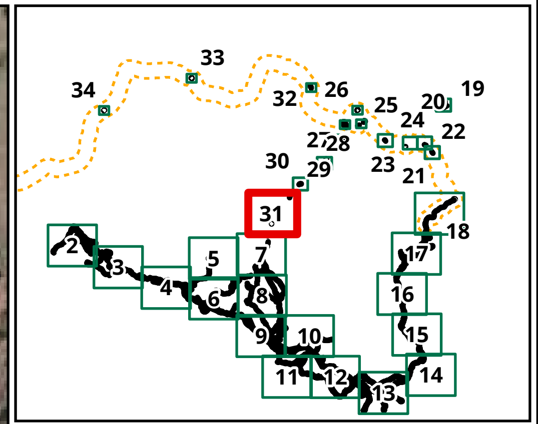

Legend

Infrastructure footprint

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 31

0 125 250 375 500

Meters

N

Scale: 1:10,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Layout: 34963_F30_Impacts
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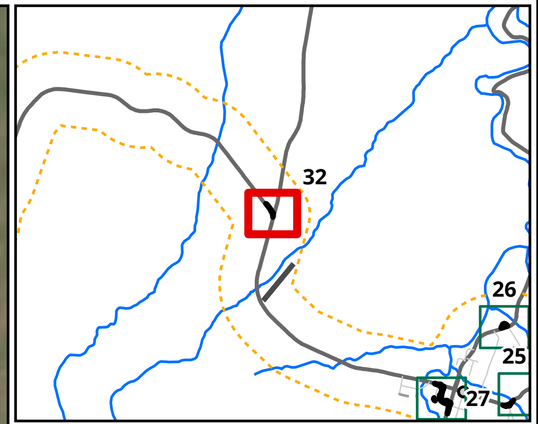

Legend

Infrastructure footprint

Transport haul routes

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 32

0 25 50 75 100

Meters

N

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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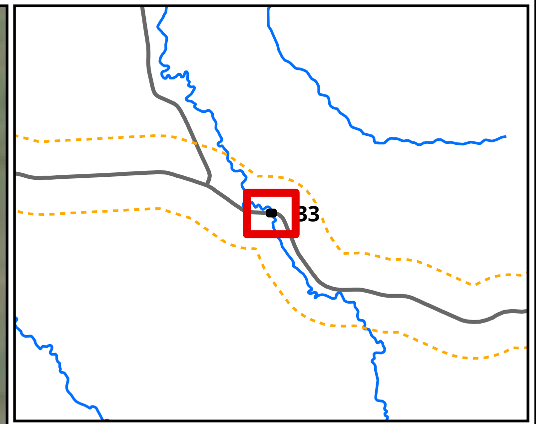

Legend

Infrastructure footprint

Transport haul routes

Impacts requiring offset

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 33

0 25 50 75 100

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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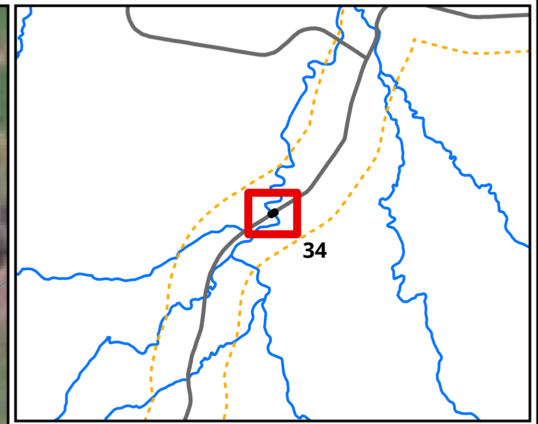

Legend

Infrastructure footprint

Transport haul routes

Impacts requiring offset

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 34

0 25 50 75 100
Meters
N

Scale: 1:2,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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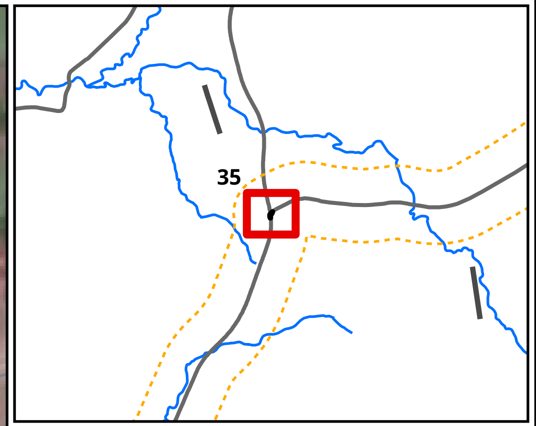

Legend

Infrastructure footprint

Transport haul routes

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 35

0 25 50 75 100

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

N

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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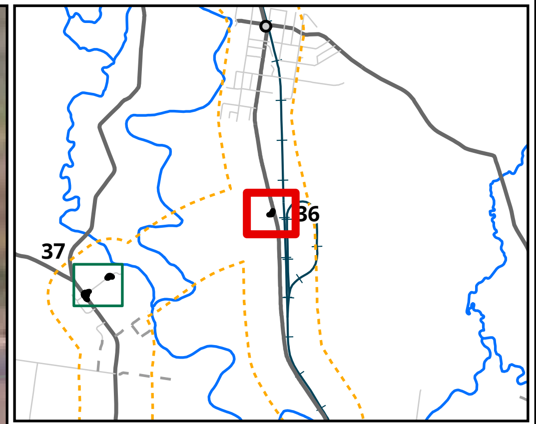

Legend

Infrastructure footprint

Transport haul routes

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 36

0 25 50 75 100

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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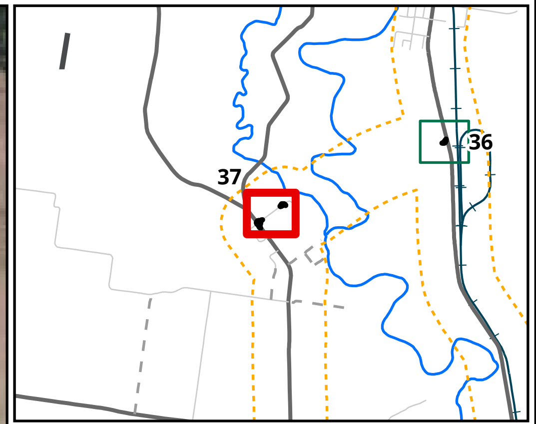

Legend

- Infrastructure footprint
- Transport haul routes

Impacts not requiring offset

- Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 37

0 25 50 75 100
Meters
Scale: 1:2,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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Legend

Infrastructure footprint

Transport haul routes

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 38

0 25 50 75 100

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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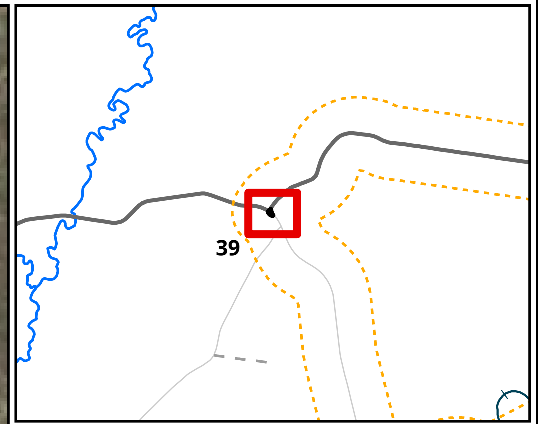

Legend

Infrastructure footprint

Transport haul routes

Impacts requiring offset

Threatened species habitat

Native vegetation

Impacts not requiring offset

Exotic vegetation

Figure 30 Impacts requiring offsets, not requiring offset, not requiring assessment, Page 39

0 25 50 75 100

Meters

Scale: 1:2,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

Matter: 34963,
Date: 25 October 2022 ,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
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