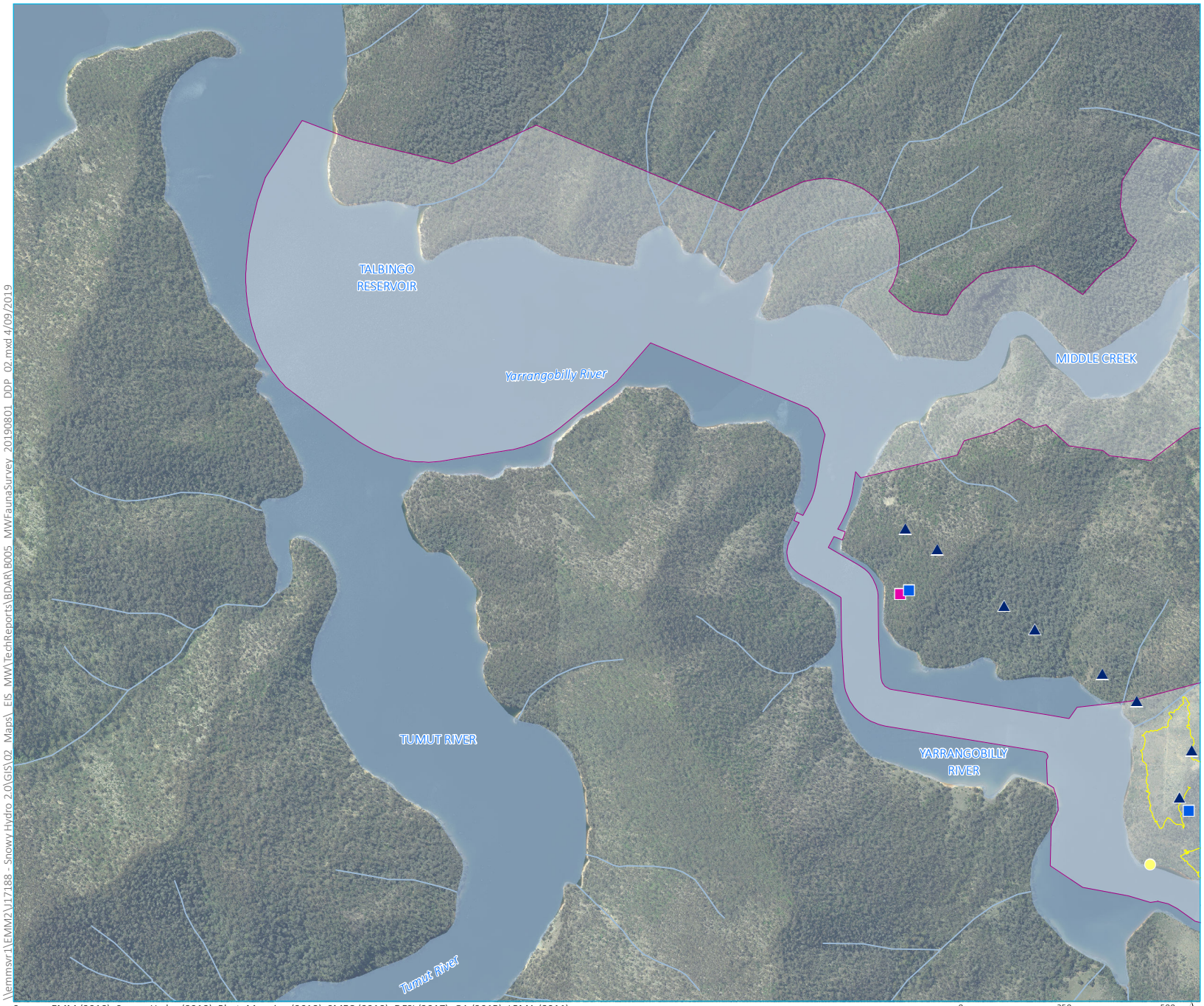
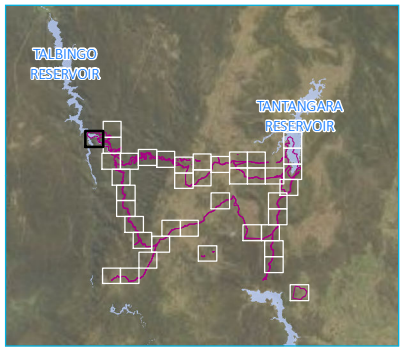




KEY

- Main Works disturbance footprint
- Waterbody
- Watercourse / drainage line
- Bird survey
- Remote camera - small mammal
- Small mammal terrestrial trapping
- Arboreal trapping
- Koala spot assessment technique (SAT)

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

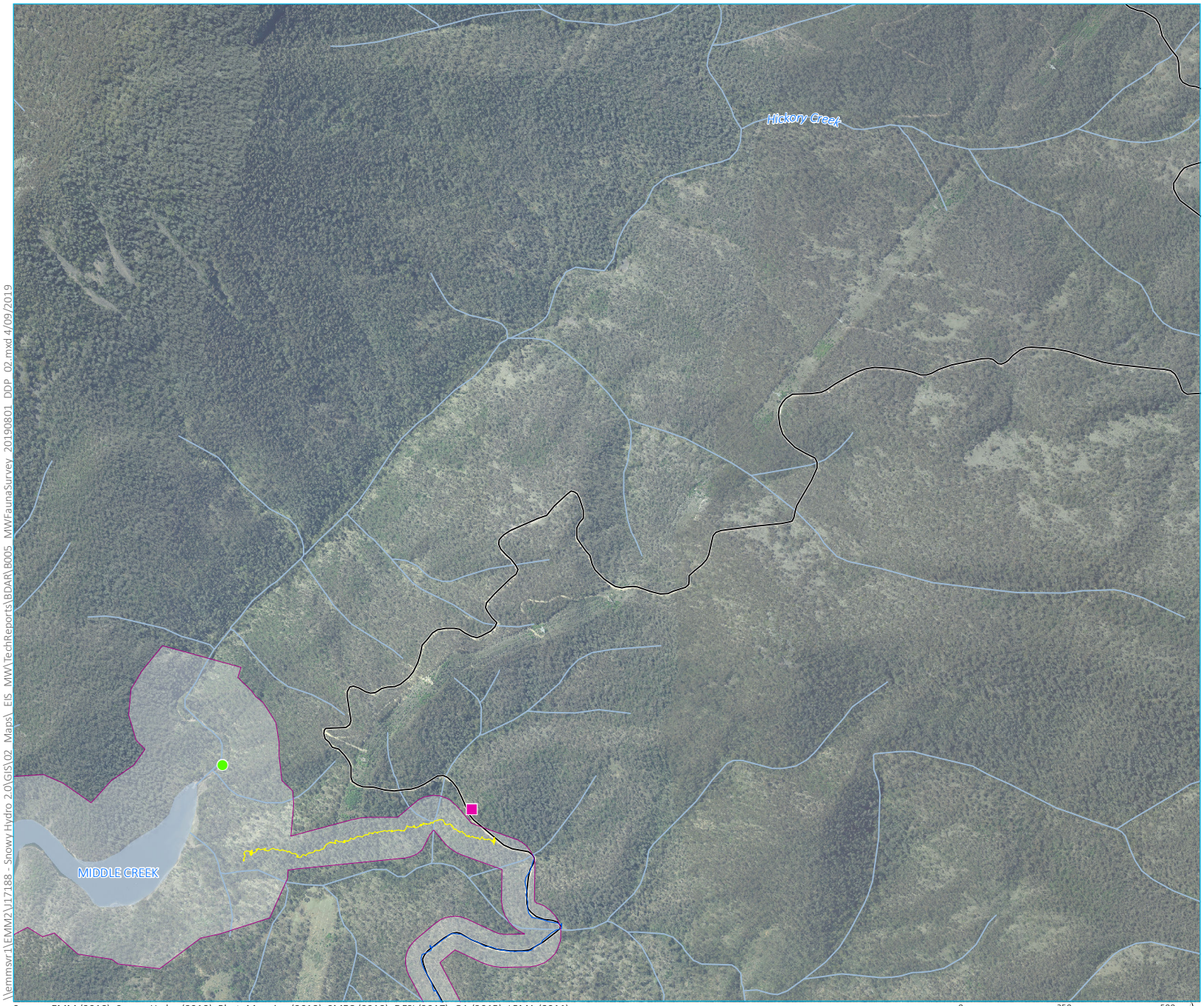
\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MW\TechReports\BDAR\B005_MWFaunaSurvey_20190801_DDP_02.mxd 4/09/2019

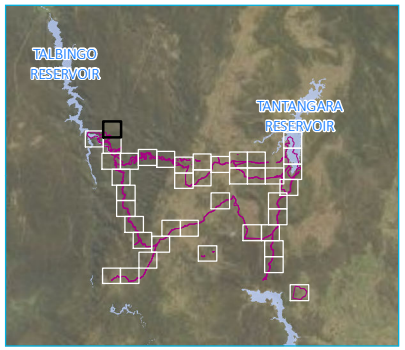
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.1

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Local road
- Watercourse / drainage line
- Bird survey
- Spotlighting
- Small mammal terrestrial trapping
- Anabat acoustic detection

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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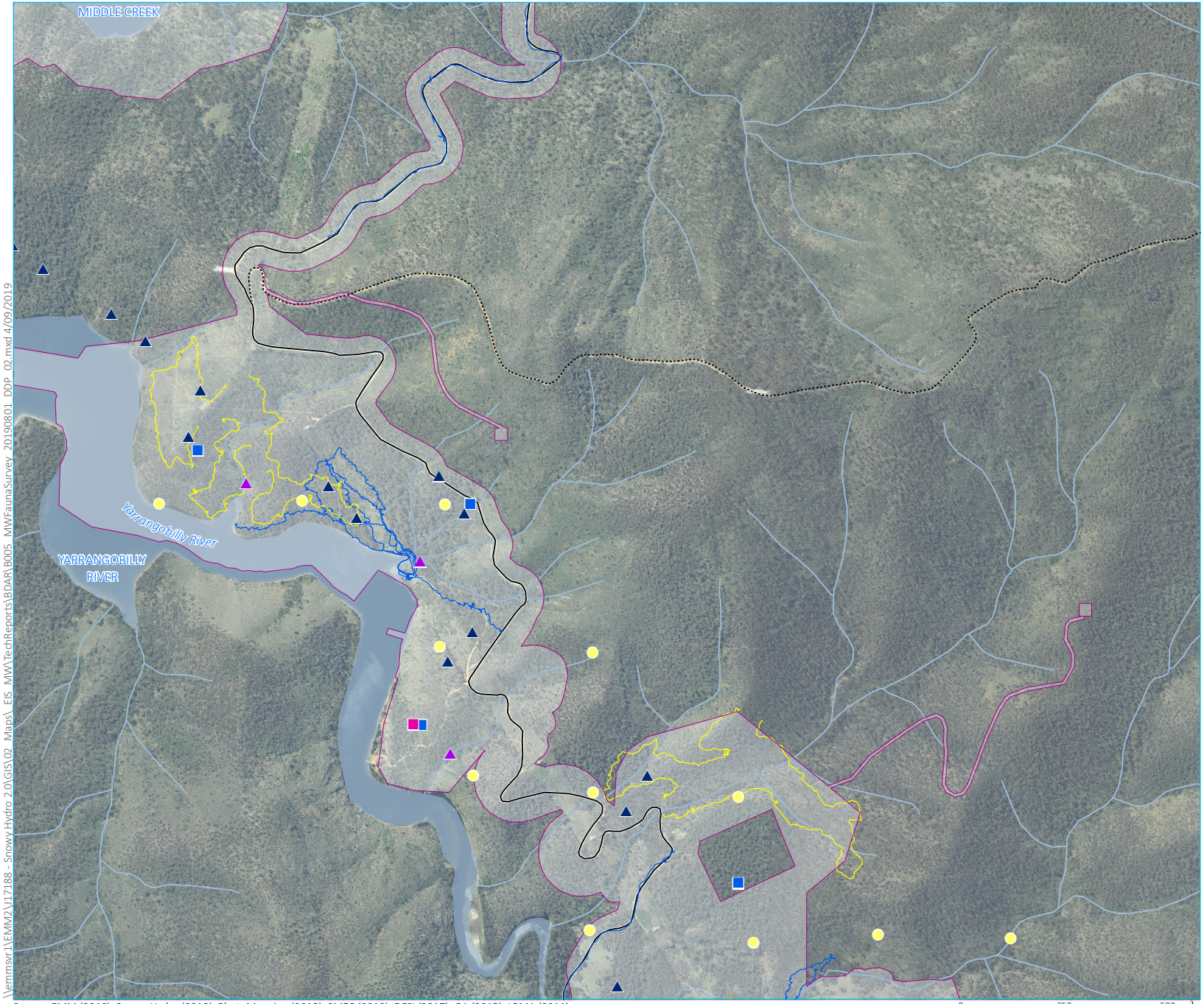
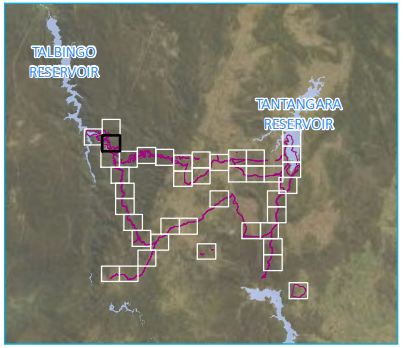
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.2

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Local road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Booroolong Frog survey
- Spotlighting
- Remote camera - small mammal
- Remote camera - large mammal
- Small mammal terrestrial trapping
- Arboreal trapping
- Koala spot assessment technique (SAT)

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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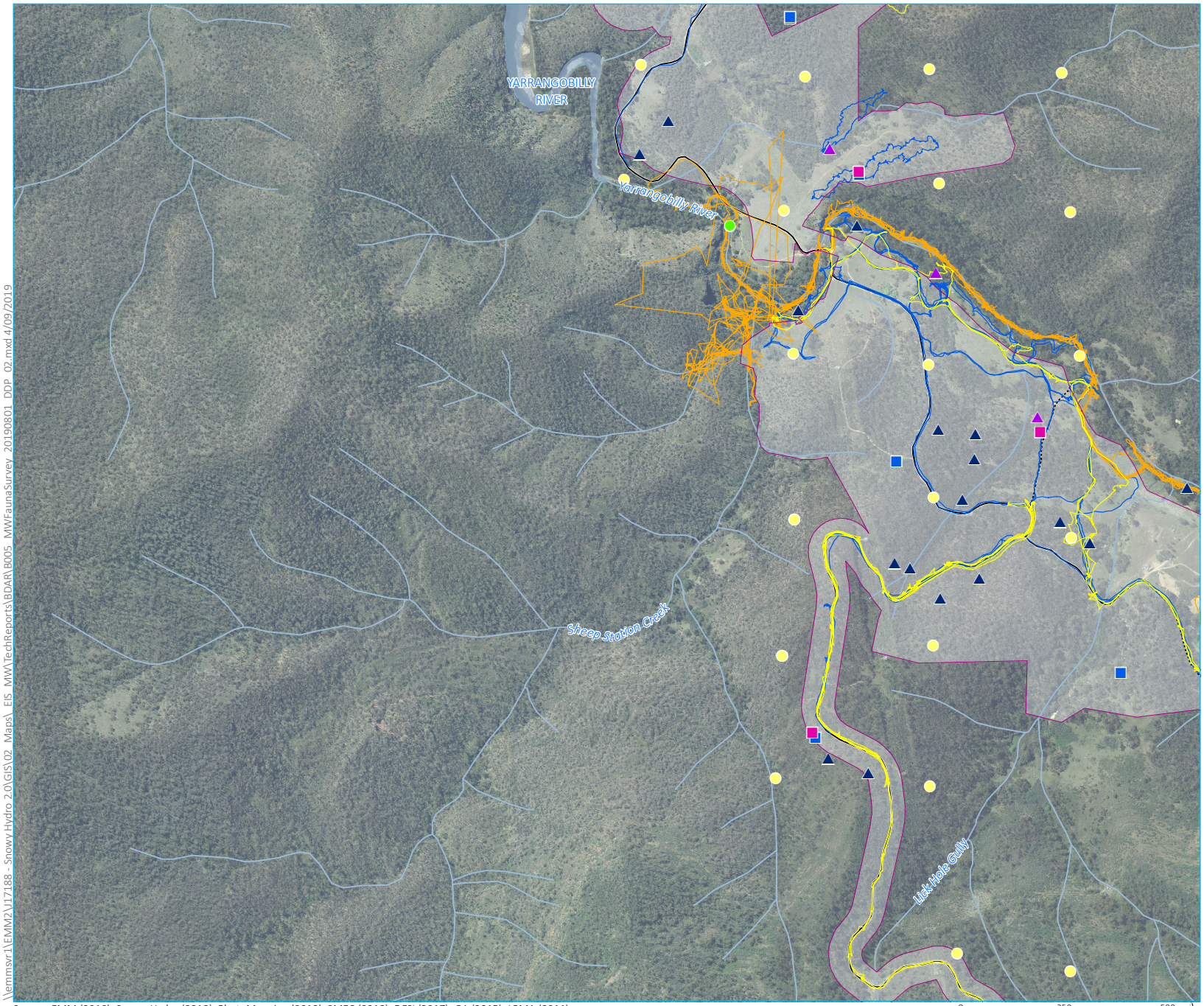
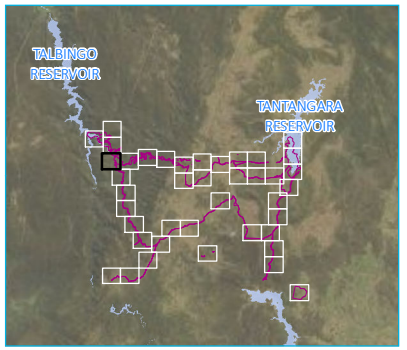
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.3

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Local road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Booroolong Frog survey
- Spotlighting
- Remote camera - small mammal
- Remote camera - large mammal
- Small mammal terrestrial trapping
- Arboreal trapping
- Koala spot assessment technique (SAT)
- Anabat acoustic detection

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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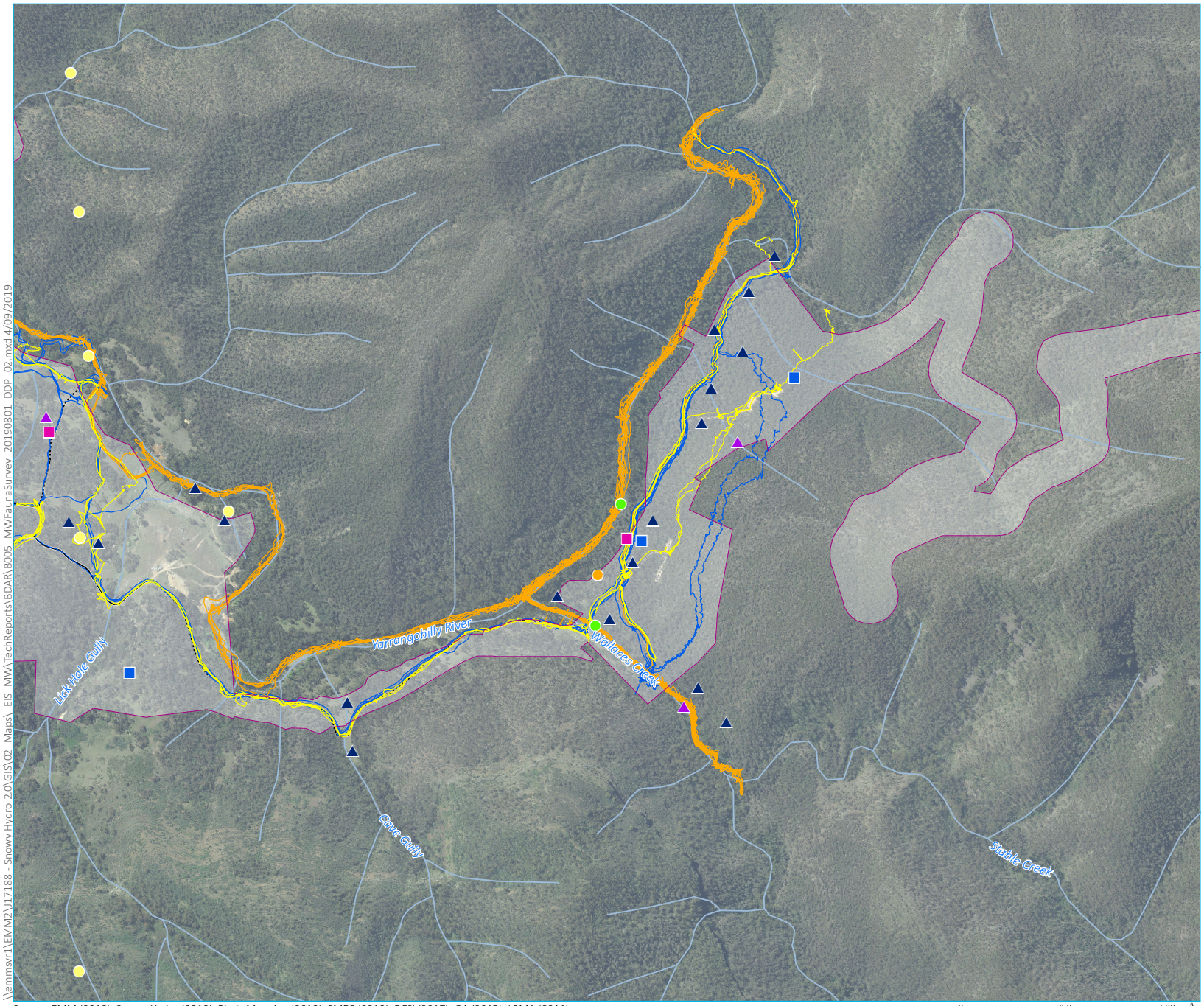
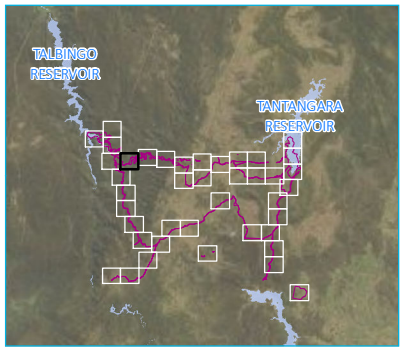
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.4

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Local road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Booroolong Frog survey
- Spotlighting
- Remote camera - small mammal
- Remote camera - large mammal
- Small mammal terrestrial trapping
- Arboreal trapping
- Koala spot assessment technique (SAT)
- Koala song meter
- Anabat acoustic detection

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\BDAR\B005 MWFaunaSurvey 20190801 DDP 02.mxd 4/09/2019

Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.5

snowy 2.0

EMM creating opportunities

KEY

- Main Works disturbance footprint
- Watercourse / drainage line
- Bird survey
- North Corroborree Frog survey
- Spotlighting
- Remote camera - small mammal
- Small mammal terrestrial trapping
- Arboreal trapping
- Koala song meter

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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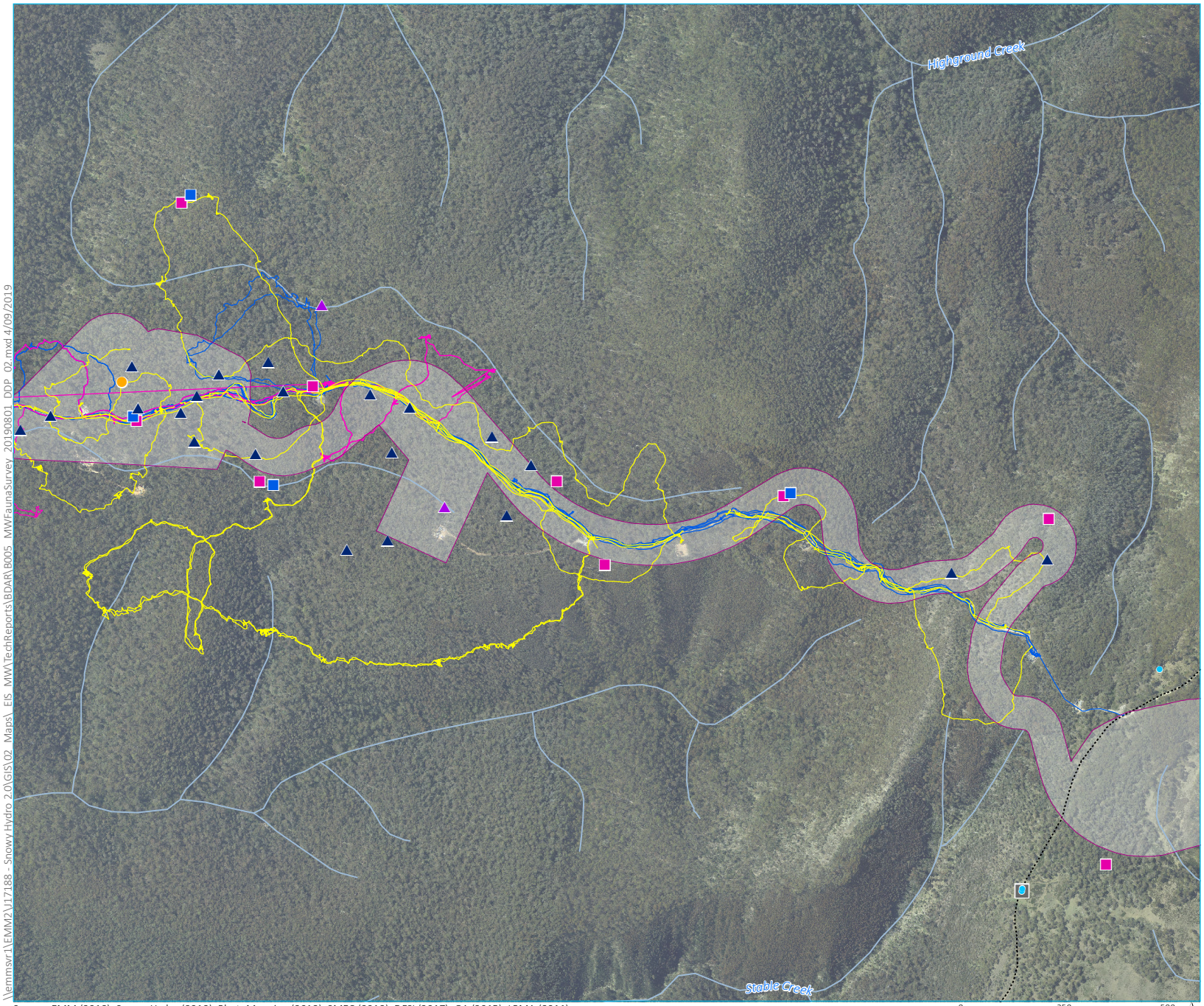
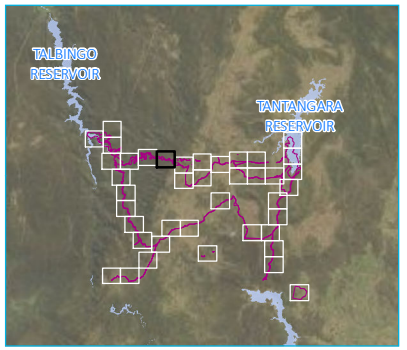
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.6

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Vehicular track
- Watercourse / drainage line
- Bird survey
- North Corroborree Frog survey
- Spotlighting
- Remote camera - small mammal
- Remote camera - large mammal
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Arboreal trapping
- Koala song meter

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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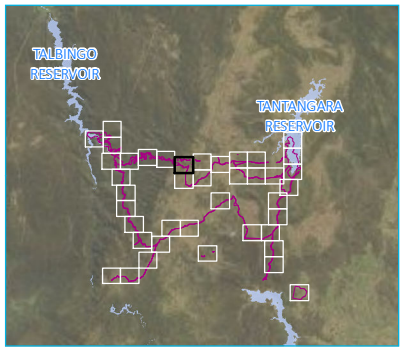
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.7

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Main road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- North Corroborree Frog survey
- Spotlighting
- Remote camera - small mammal
- Tile grid
- Tile transect
- Small mammal terrestrial trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

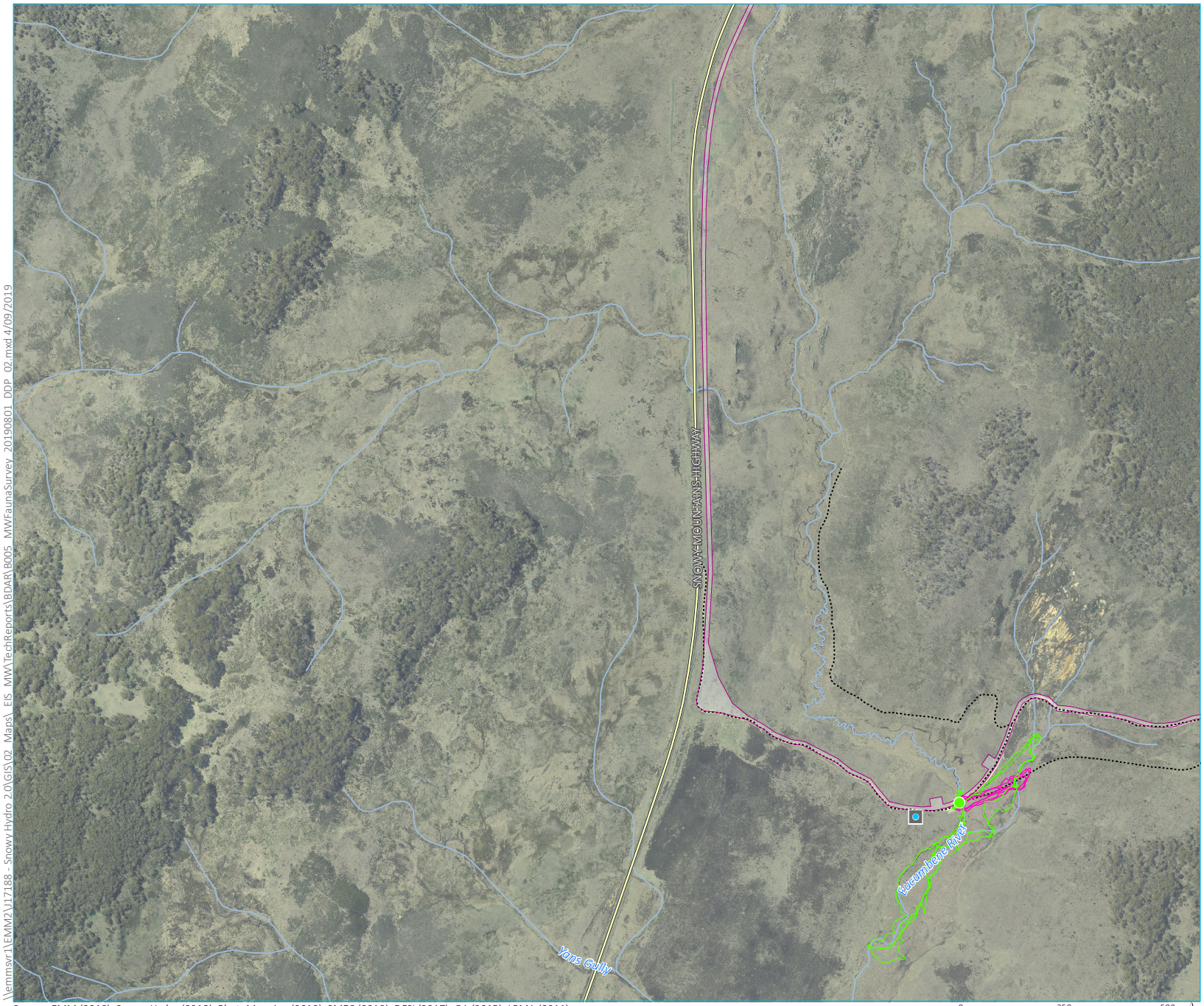
\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\BDAR\B005 MWFaunaSurvey 20190801 DDP 02.mxd 4/09/2019

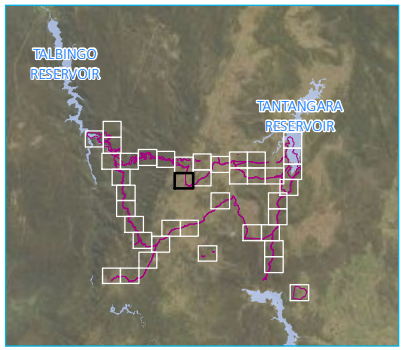
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.8

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Main road
- Vehicular track
- Watercourse / drainage line
- Alpine Tree Frog survey
- North Corroborree Frog survey
- Tile grid
- Tile transect
- Anabat acoustic detection

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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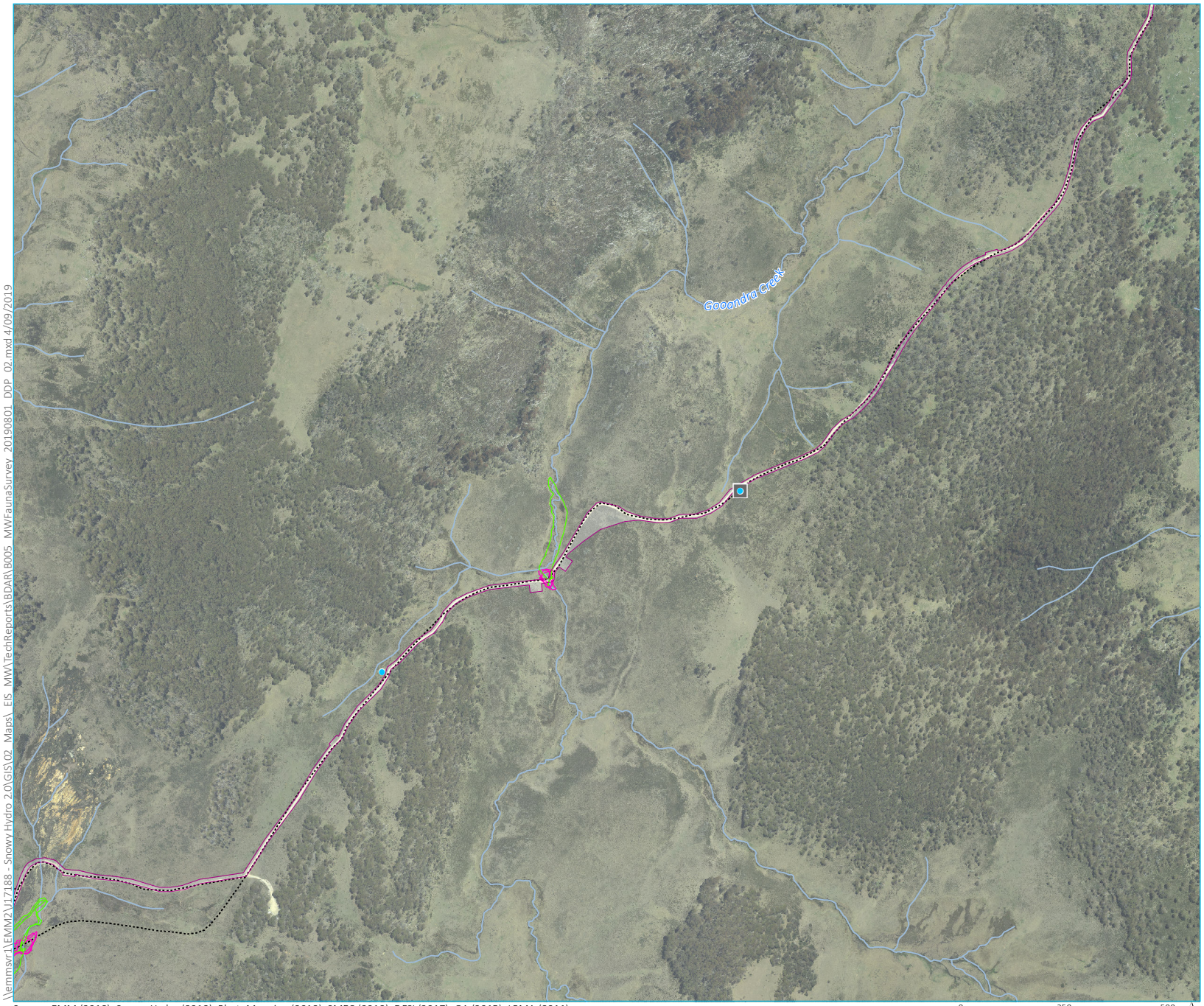
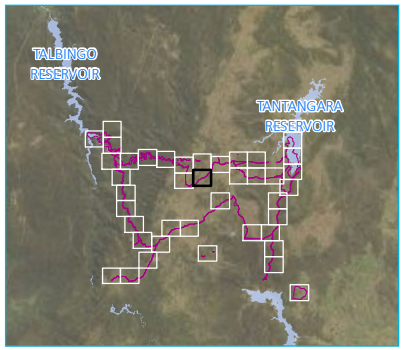
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.9

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- North Corroborree Frog survey
- Tile grid
- Tile transect

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\BDAR\B005 MWFaunaSurvey 20190801 DDP 02.mxd 4/09/2019

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

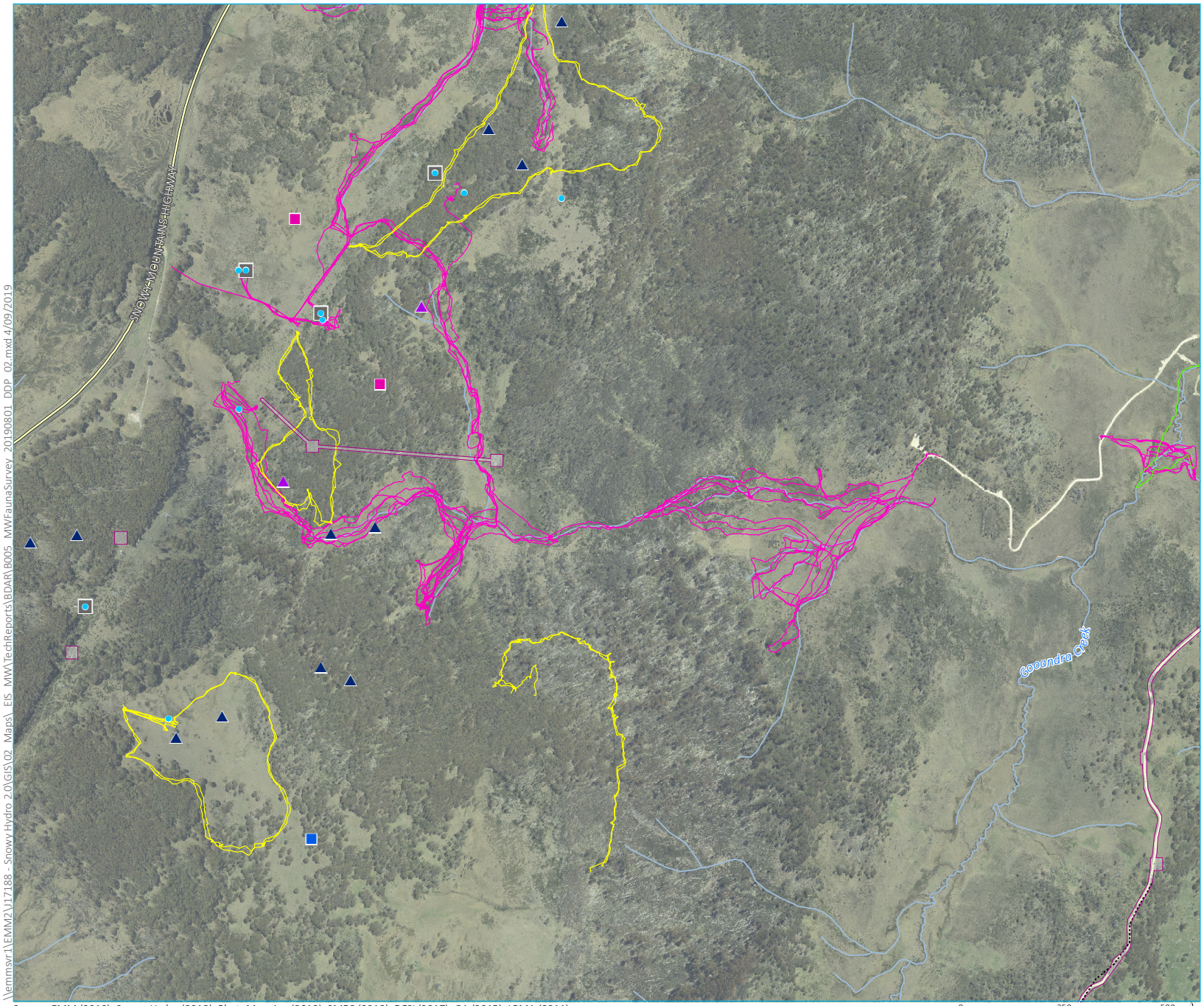
N

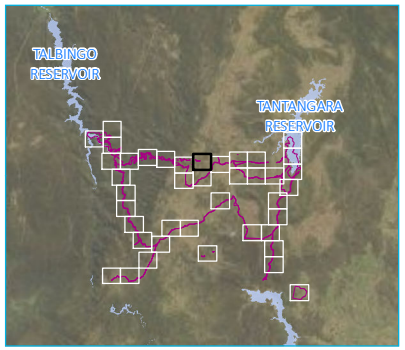
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.10

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Main road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- North Corroborree Frog survey
- Remote camera - small mammal
- Remote camera - large mammal
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Arboreal trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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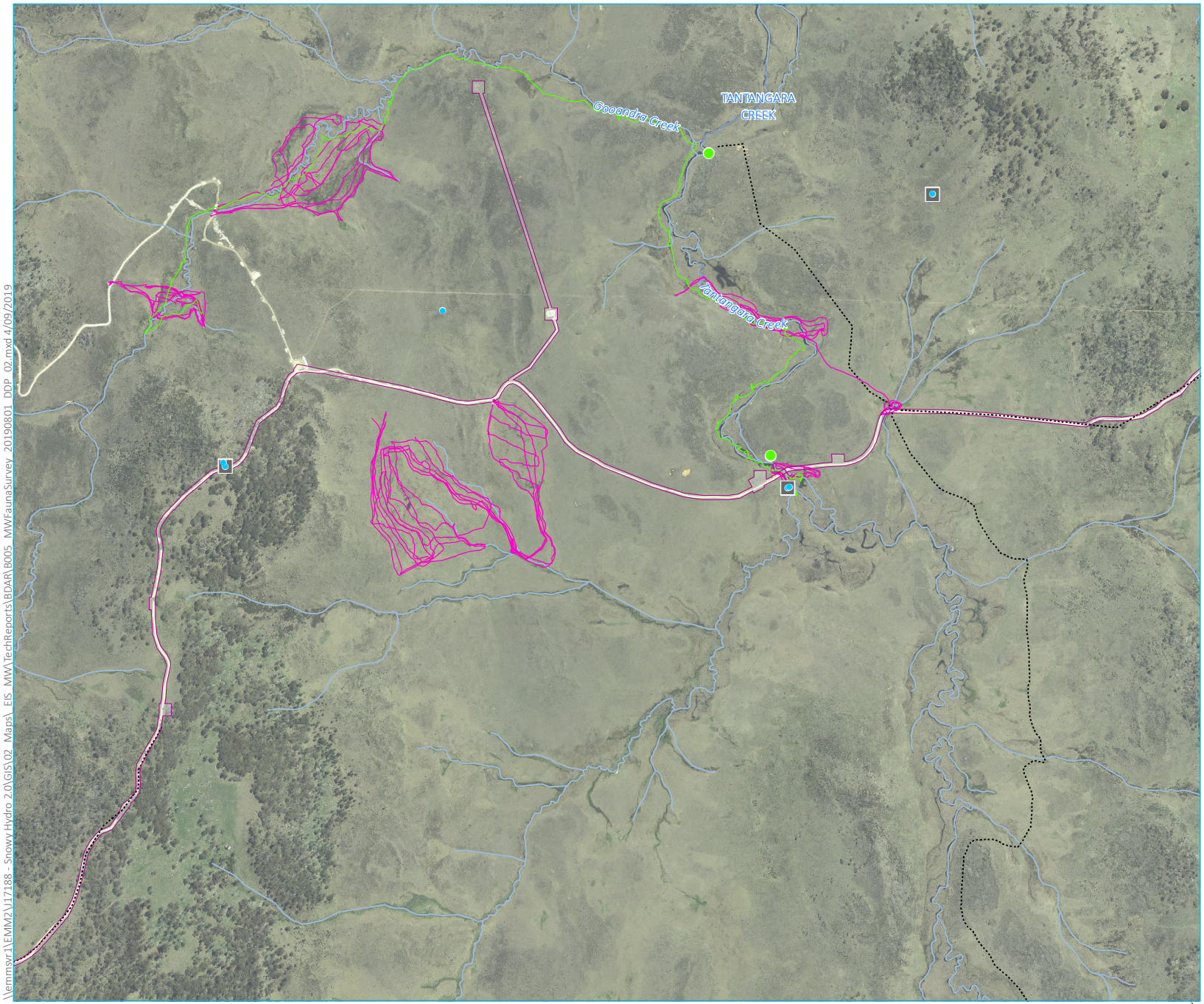
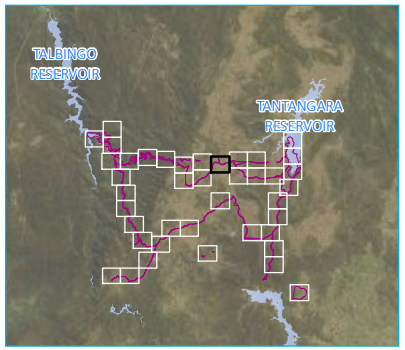
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.11

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Vehicular track
- Watercourse / drainage line
- Alpine Tree Frog survey
- North Corroborree Frog survey
- Tile grid
- Tile transect
- Anabat acoustic detection

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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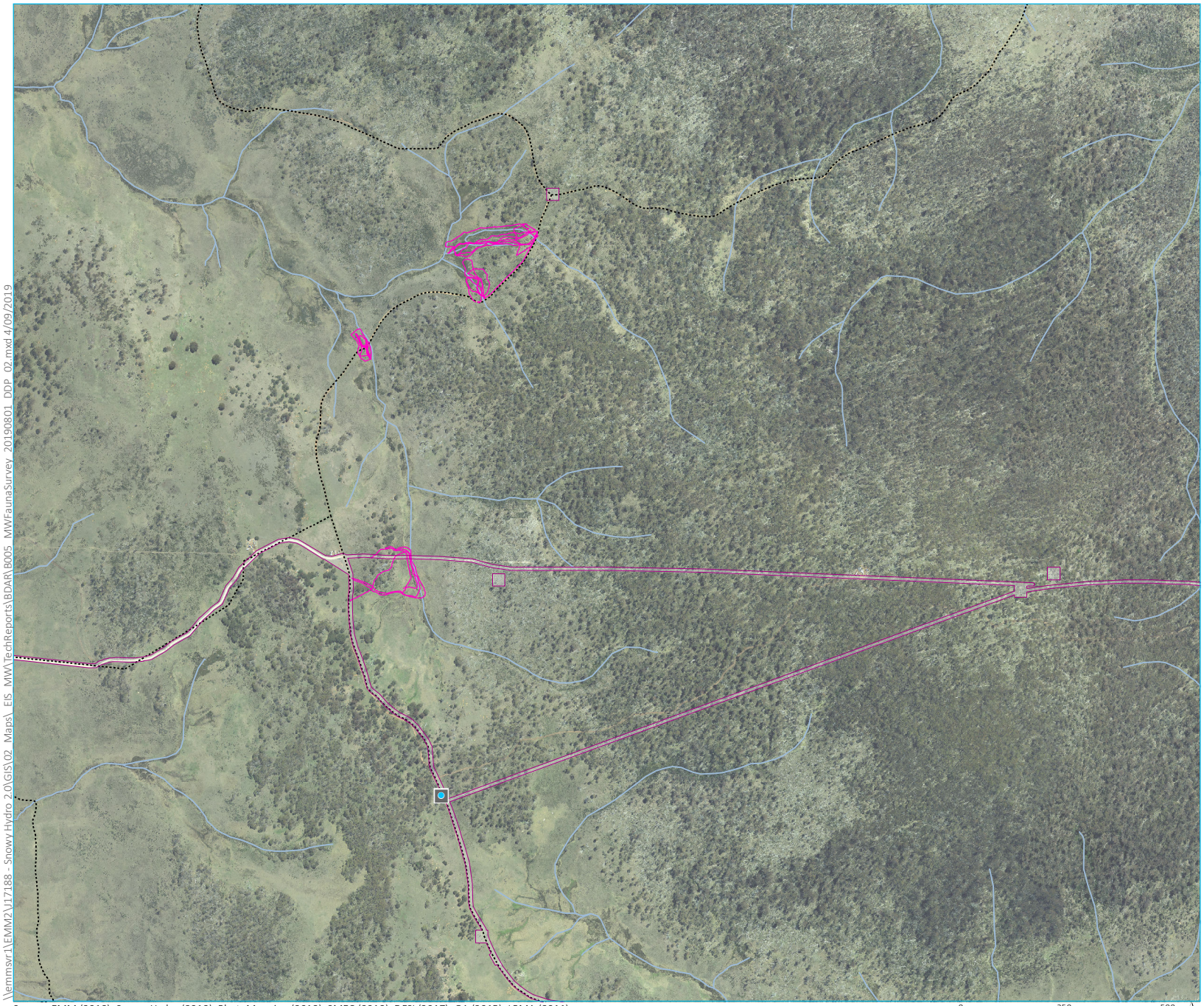
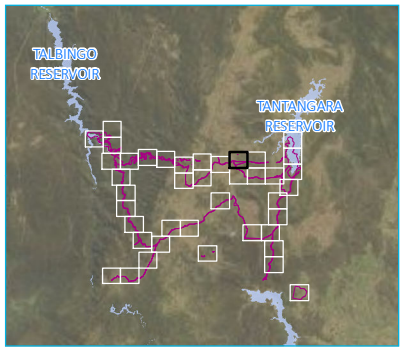
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.12

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Vehicular track
- Watercourse / drainage line
- North Corroboree Frog survey
- Tile grid
- Tile transect

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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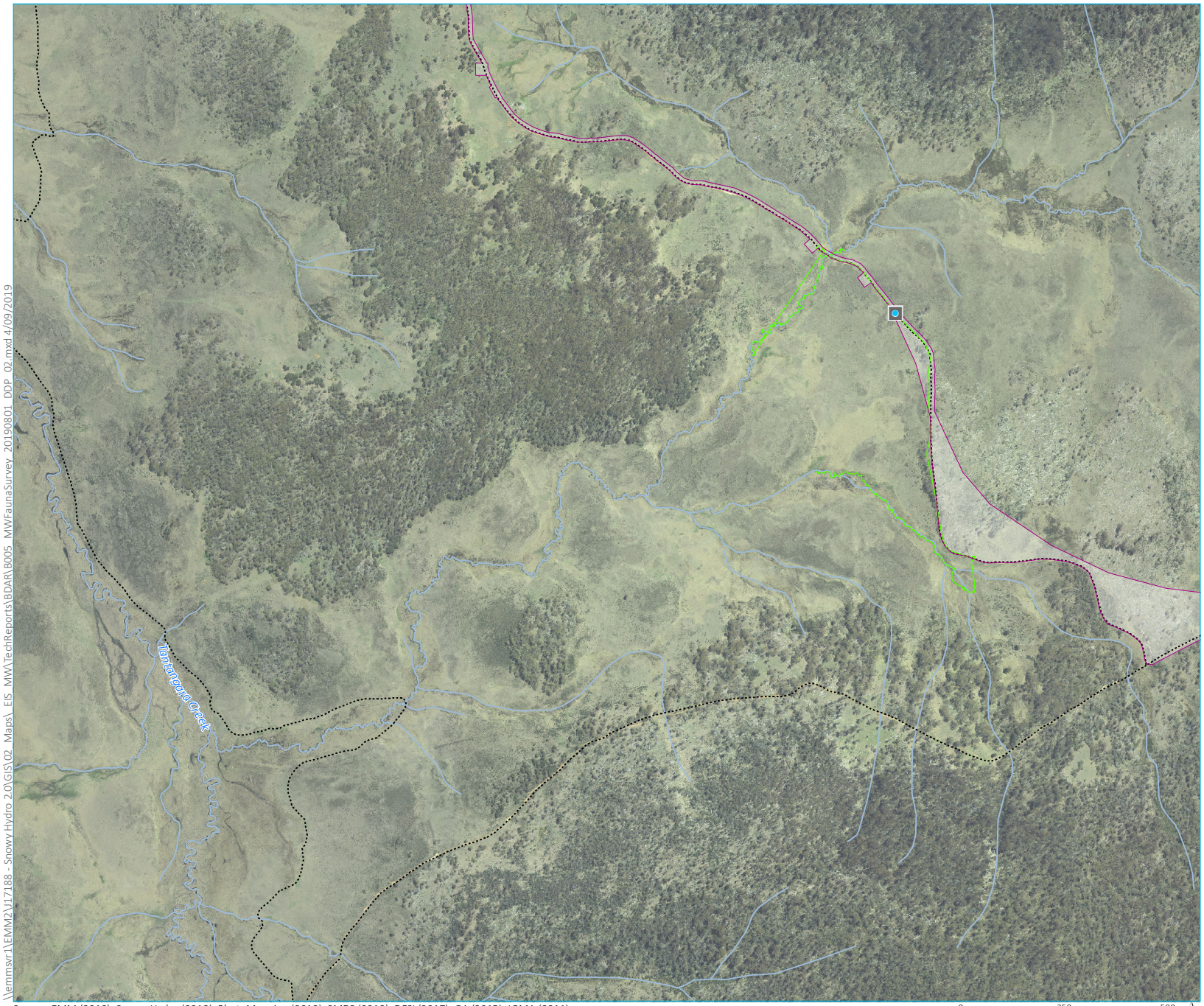
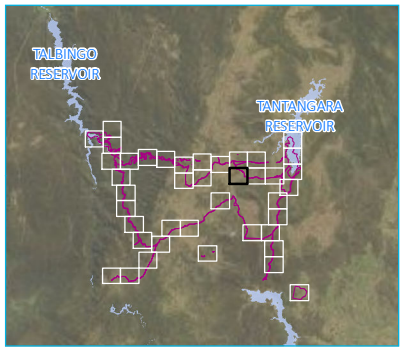
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.13

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Vehicular track
- Watercourse / drainage line
- Alpine Tree Frog survey
- Tile grid
- Tile transect

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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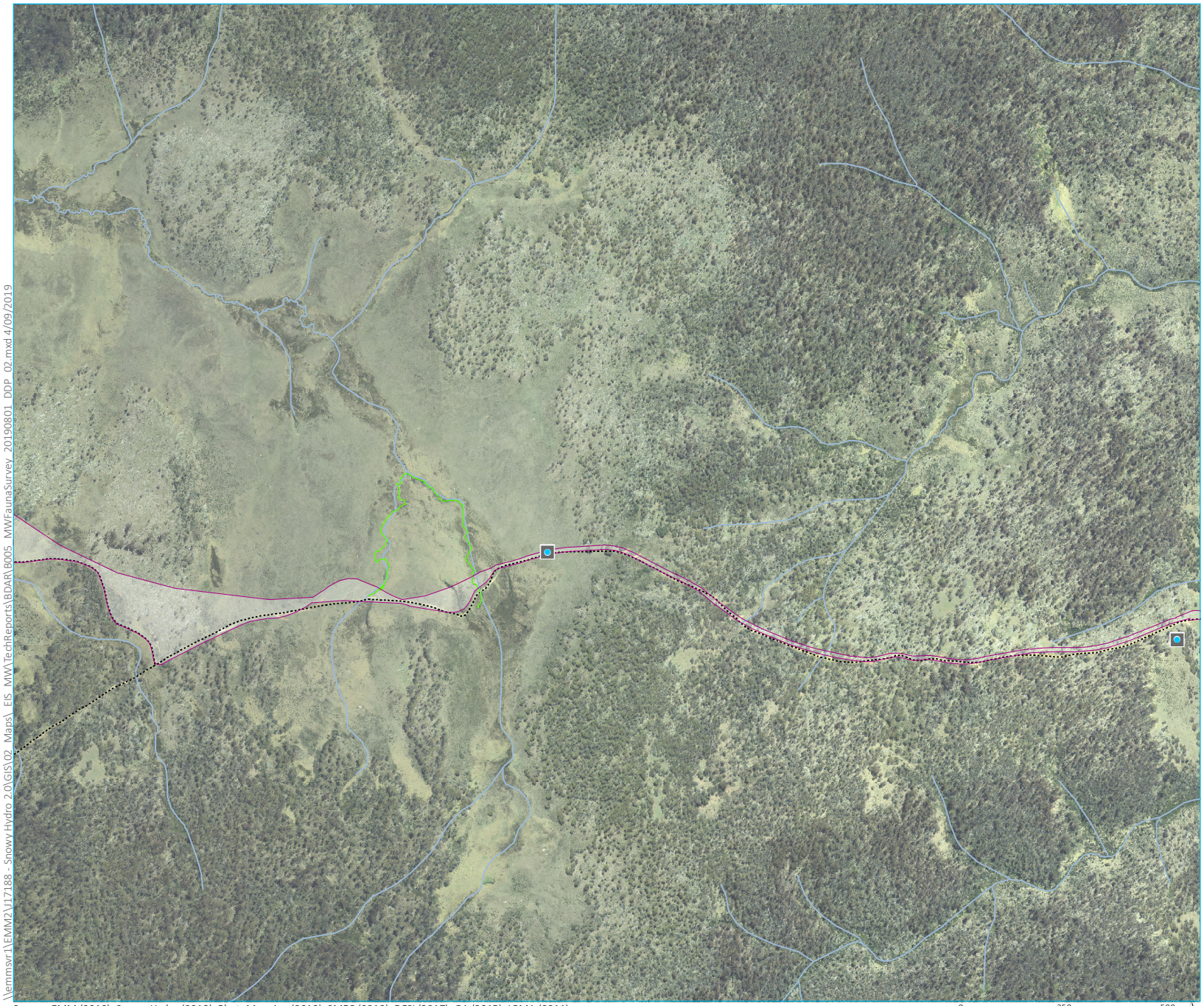
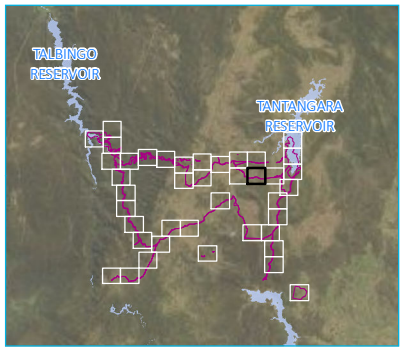
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.14

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Vehicular track
- Watercourse / drainage line
- Alpine Tree Frog survey
- Tile grid
- Tile transect

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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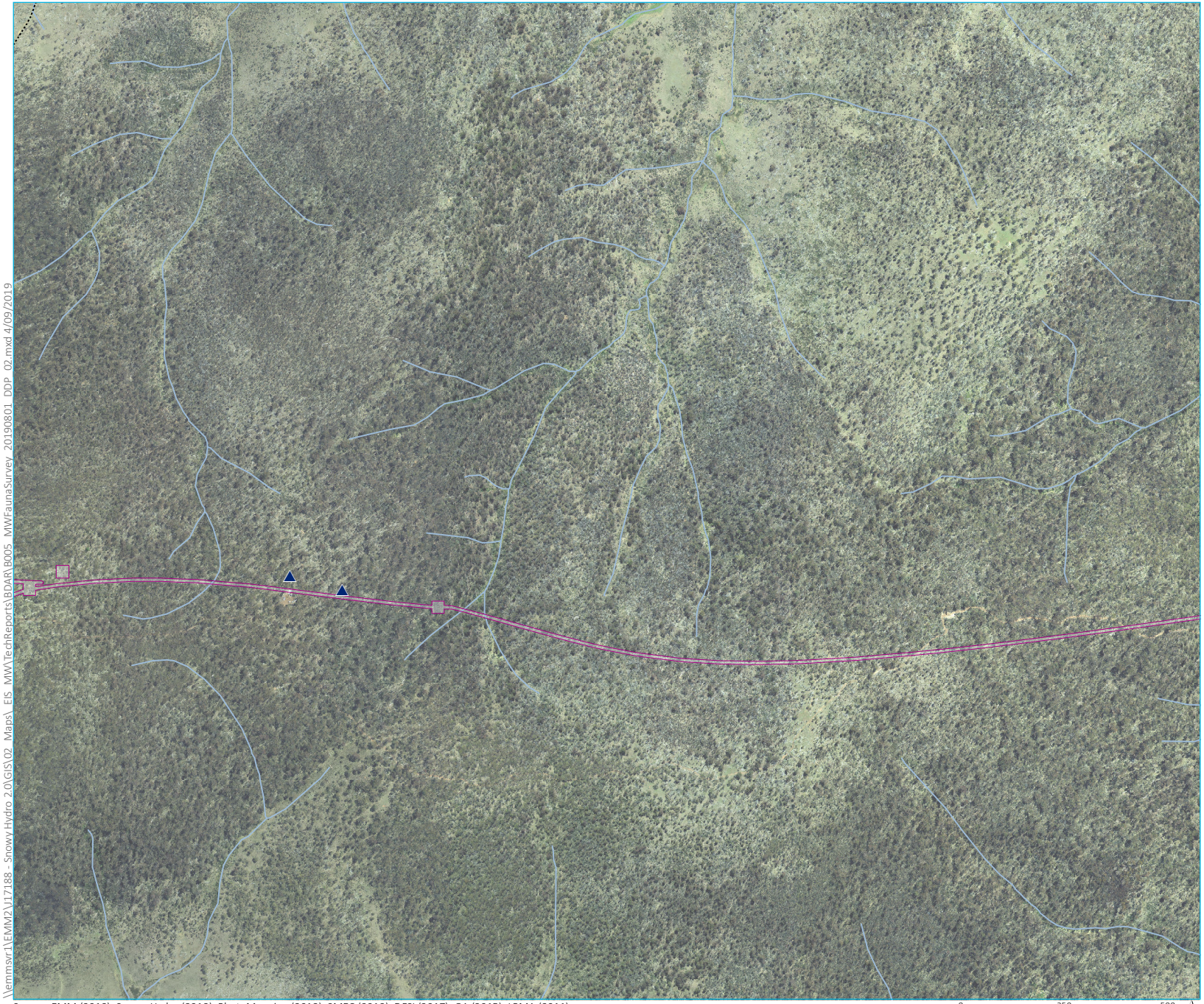
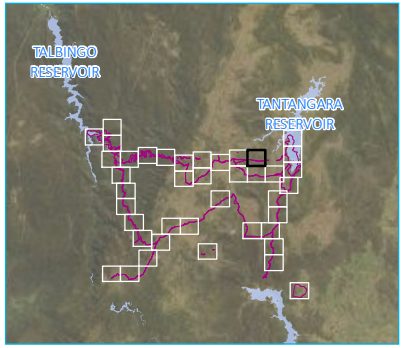
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.15

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Vehicular track
- Watercourse / drainage line
- Remote camera - small mammal

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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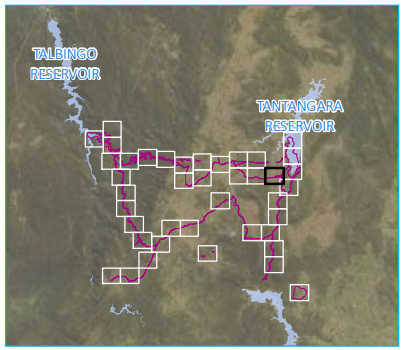
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.16

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- Spotlighting
- Tile grid
- Tile transect
- Anabat acoustic detection

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

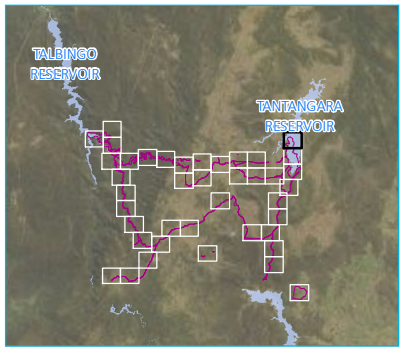
\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MW\TechReports\BDAR\B005_MWFaunaSurvey_20190801_DDP_02.mxd 4/09/2019

Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.17

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Waterbody
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- Spotlighting
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Arboreal trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

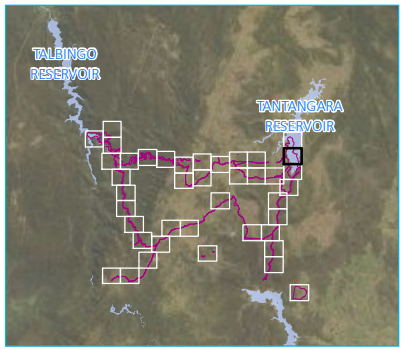
\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MW\TechReports\BDAR\B005_MWFaunaSurvey_20190801_DDP_02.mxd 4/09/2019

Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.18

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Waterbody
- Local road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- Spotlighting
- Remote camera - small mammal
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Arboreal trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

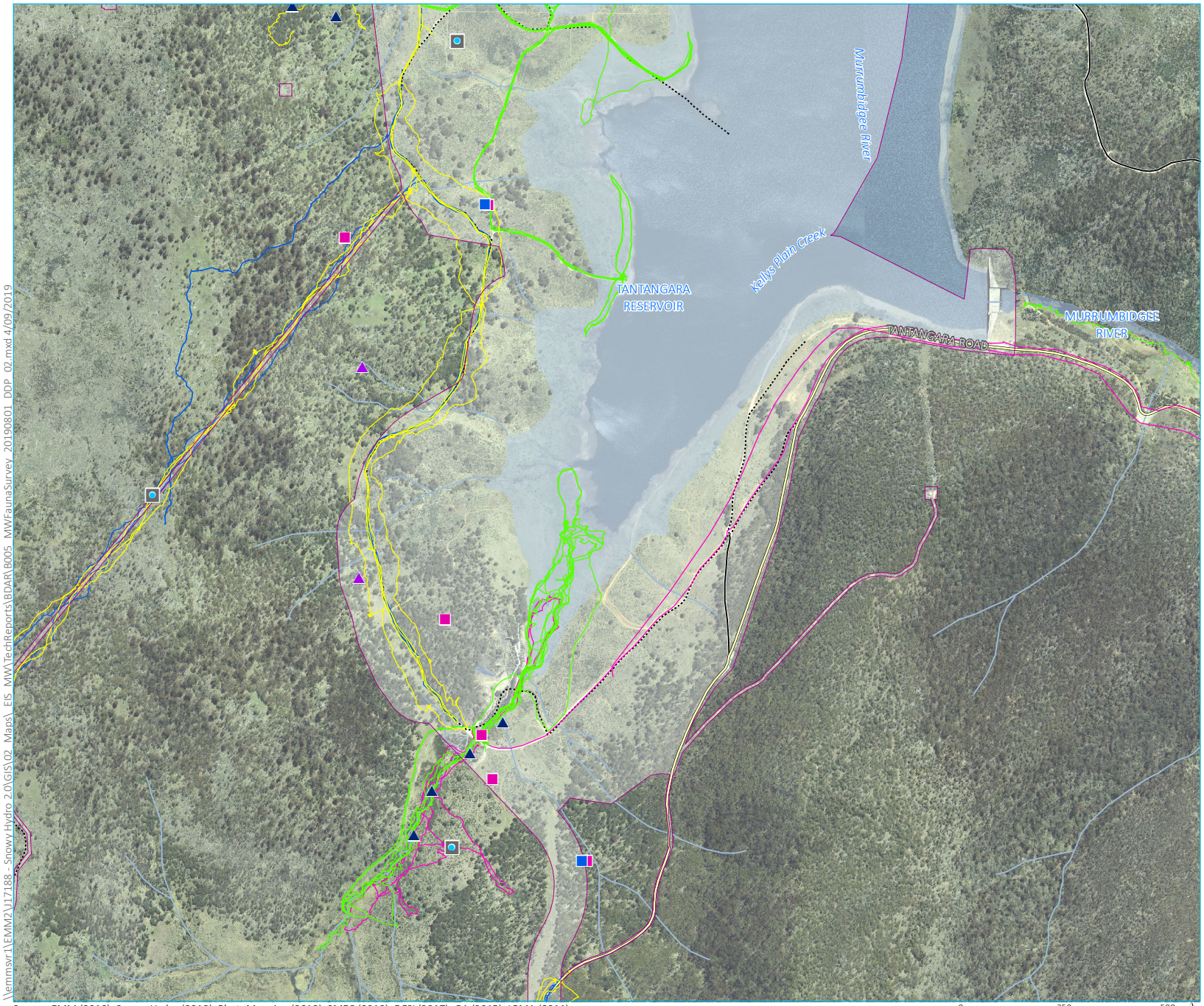
\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\BDAR\B005 MWFaunaSurvey 20190801 DDP 02.mxd 4/09/2019

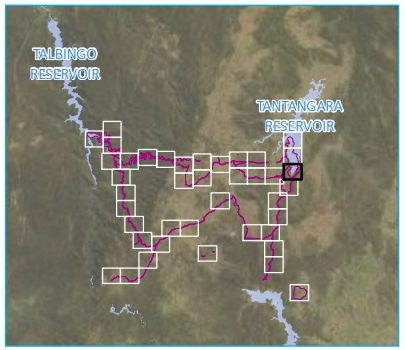
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.19

snowy 2.0

EMM
creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Main road
- Local road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- North Corroborree Frog survey
- Spotlighting
- Remote camera - small mammal
- Remote camera - large mammal
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Arboreal trapping

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Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

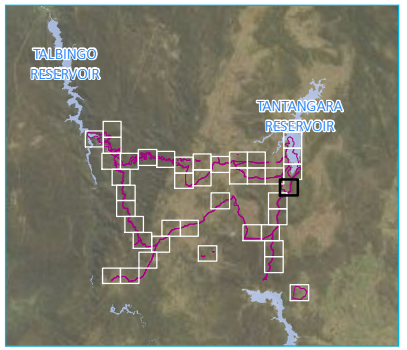
N

Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.20

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Main road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- North Corroborree Frog survey
- Spotlighting
- Tile grid
- Tile transect

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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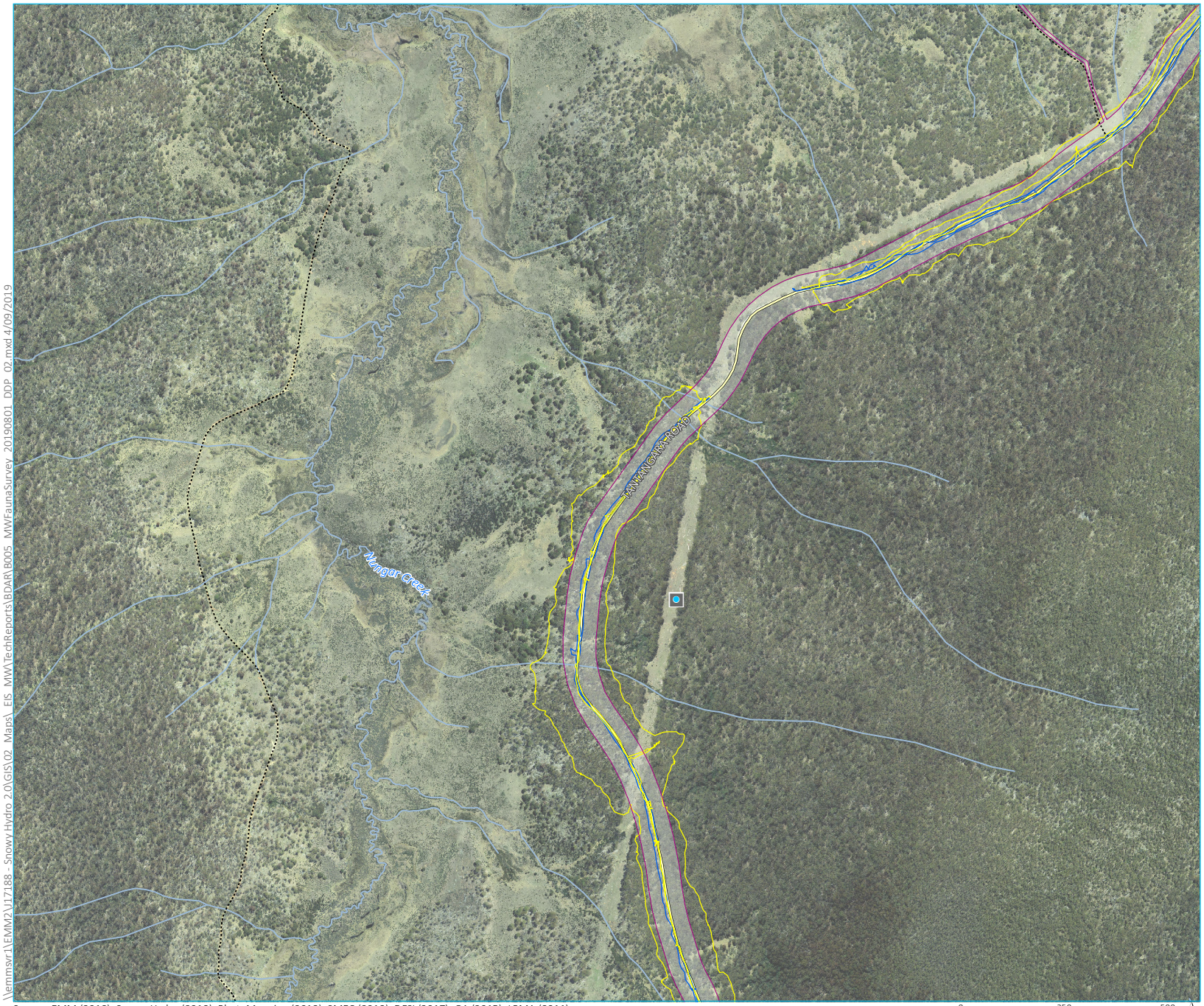
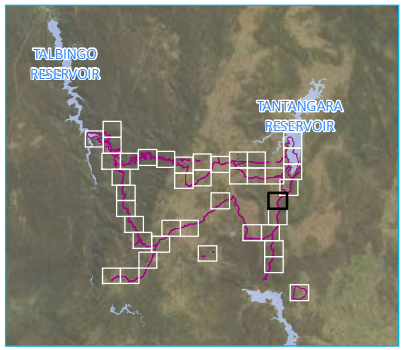
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.21

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Main road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Spotlighting
- Tile grid
- Tile transect

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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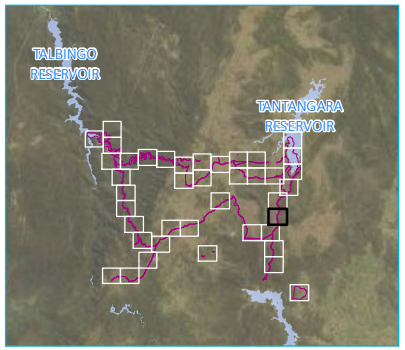
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.22

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Main road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- North Corroboree Frog survey
- Spotlighting
- Remote camera - small mammal
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Arboreal trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

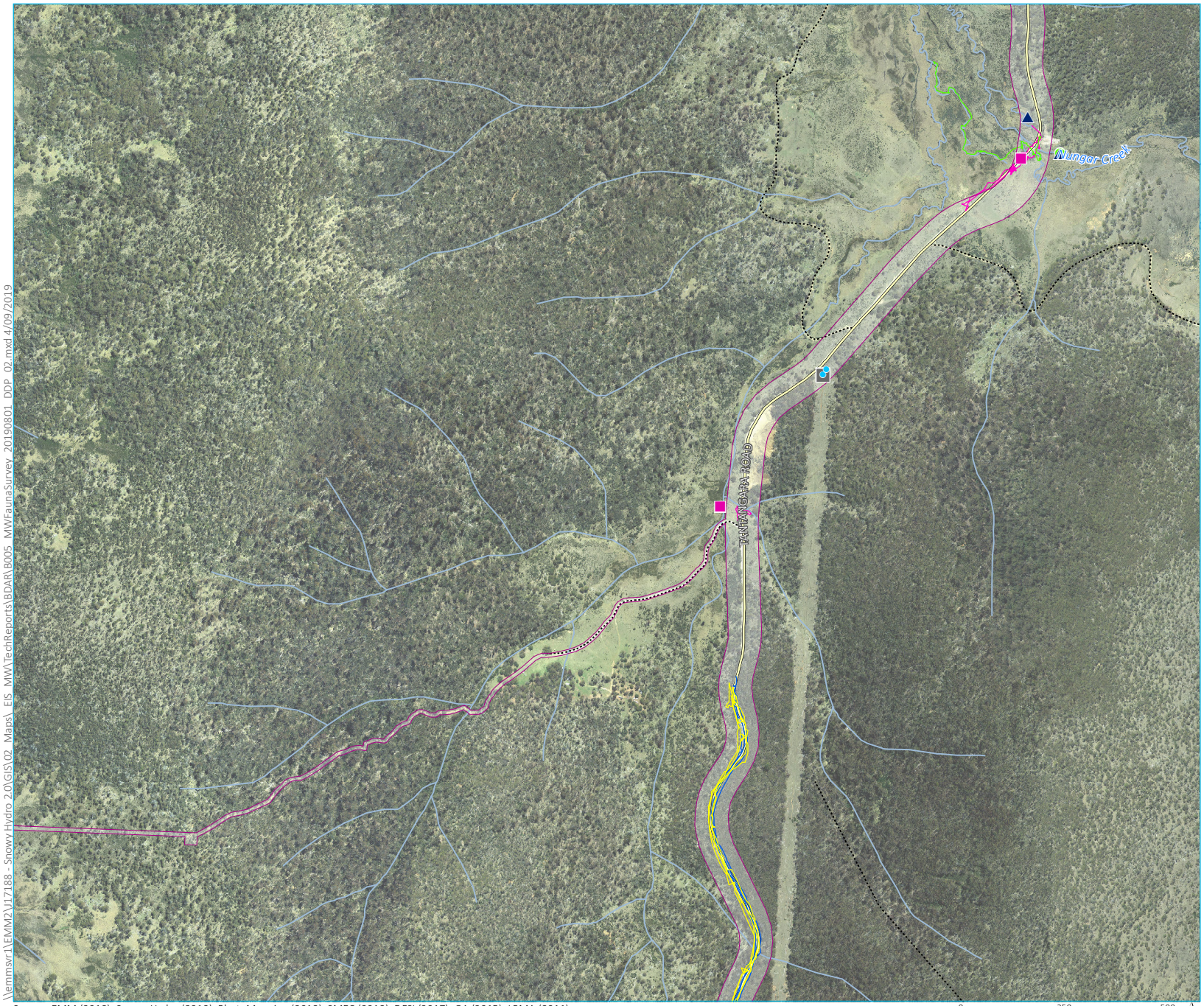
\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\BDAR\B005 MWFaunaSurvey_20190801_DDP 02.mxd 4/09/2019

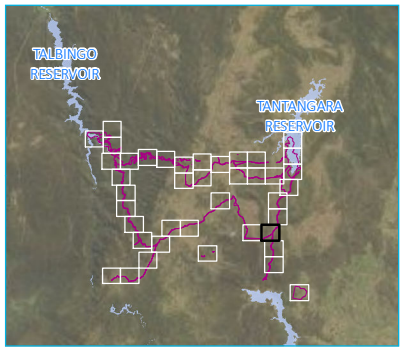
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.23

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Main road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- North Corroborree Frog survey
- Spotlighting
- Remote camera - small mammal
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Anabat acoustic detection

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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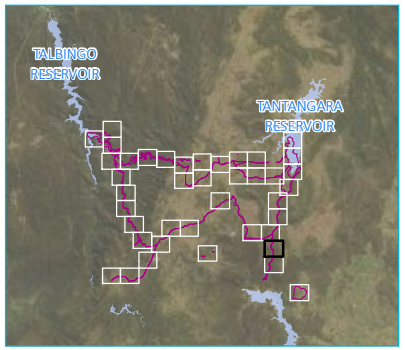
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.24

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Main road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Spotlighting
- Remote camera - small mammal
- Tile grid
- Tile transect

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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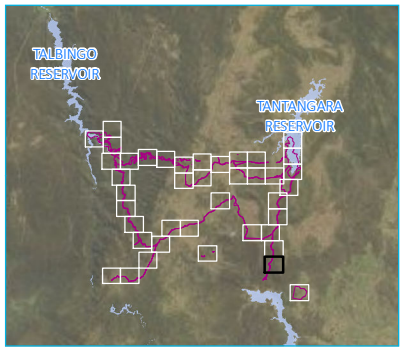
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.25

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Main road
- Watercourse / drainage line
- Bird survey
- Spotlighting
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Arboreal trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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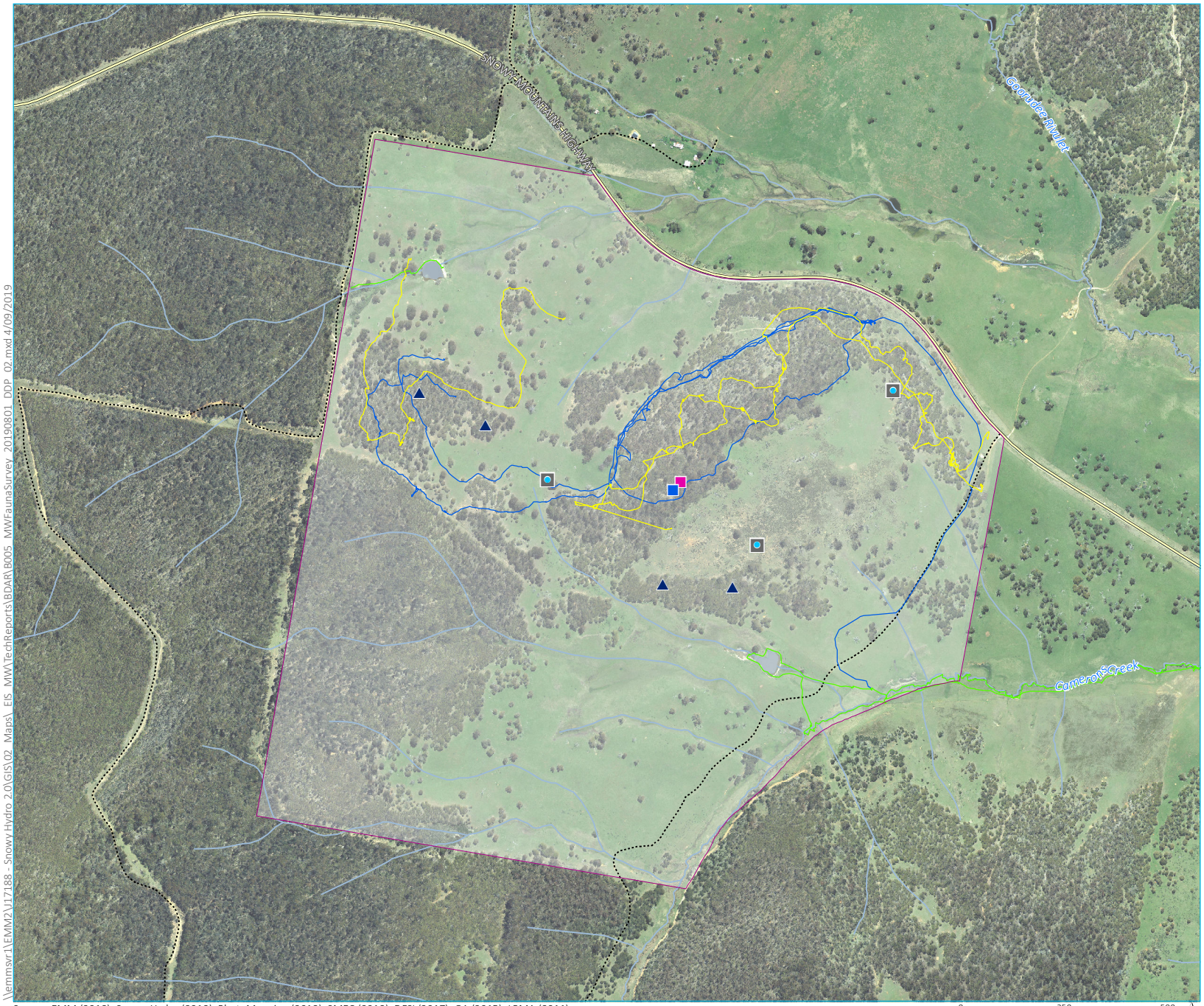
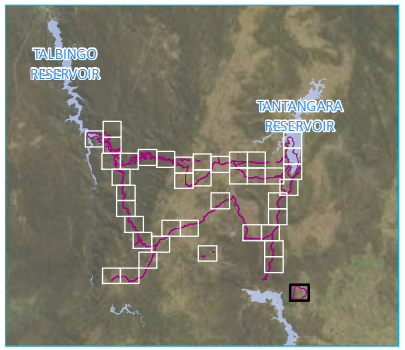
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.26

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Main road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Alpine Tree Frog survey
- Spotlighting
- Remote camera - small mammal
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Arboreal trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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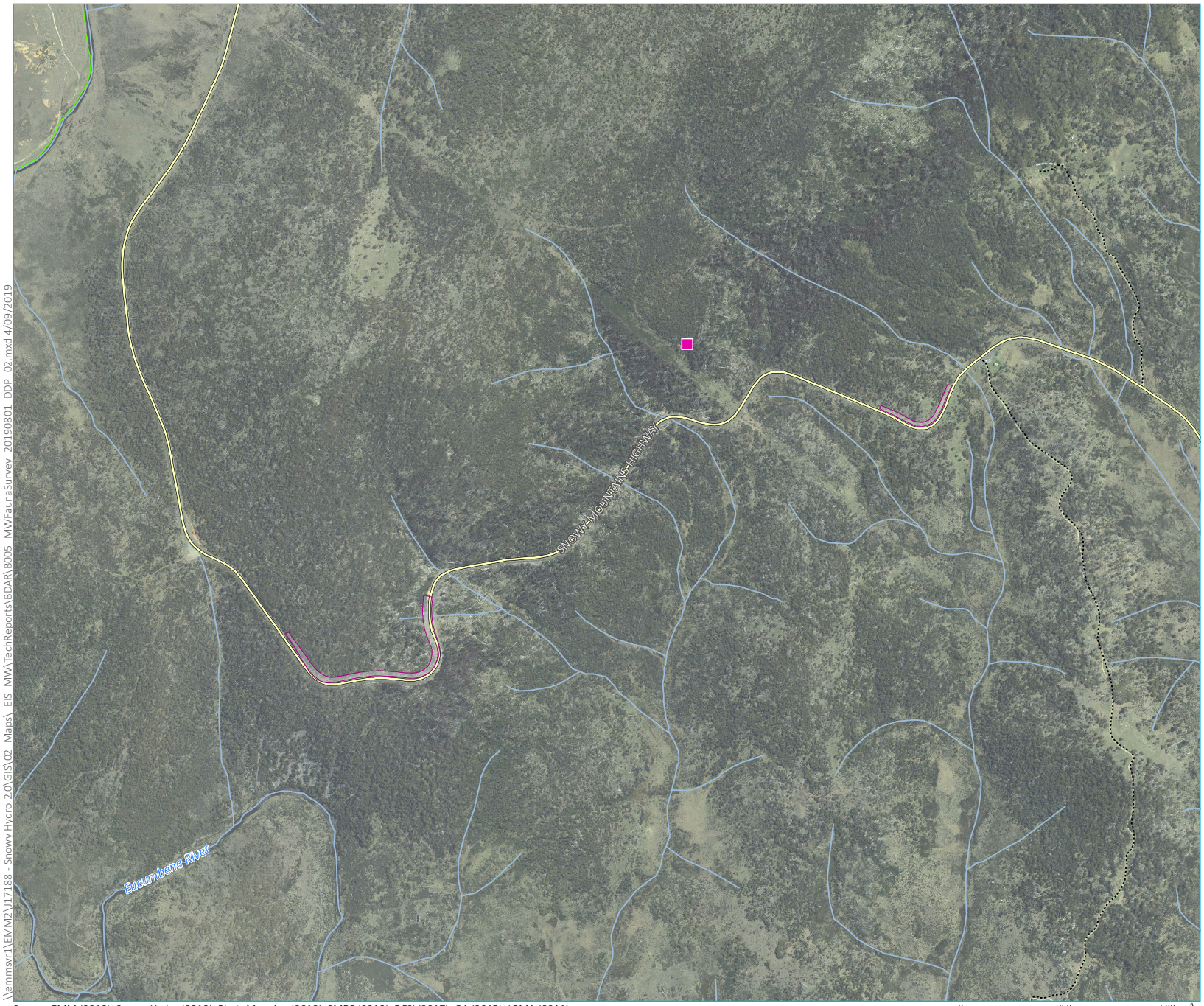
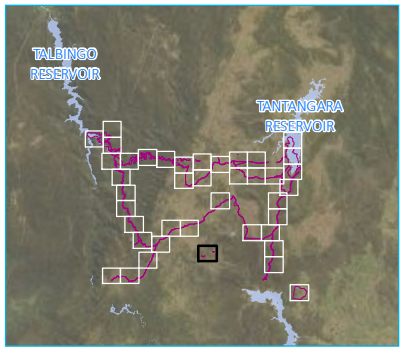
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.27

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Main road
- Vehicular track
- Watercourse / drainage line
- Alpine Tree Frog survey
- Small mammal terrestrial trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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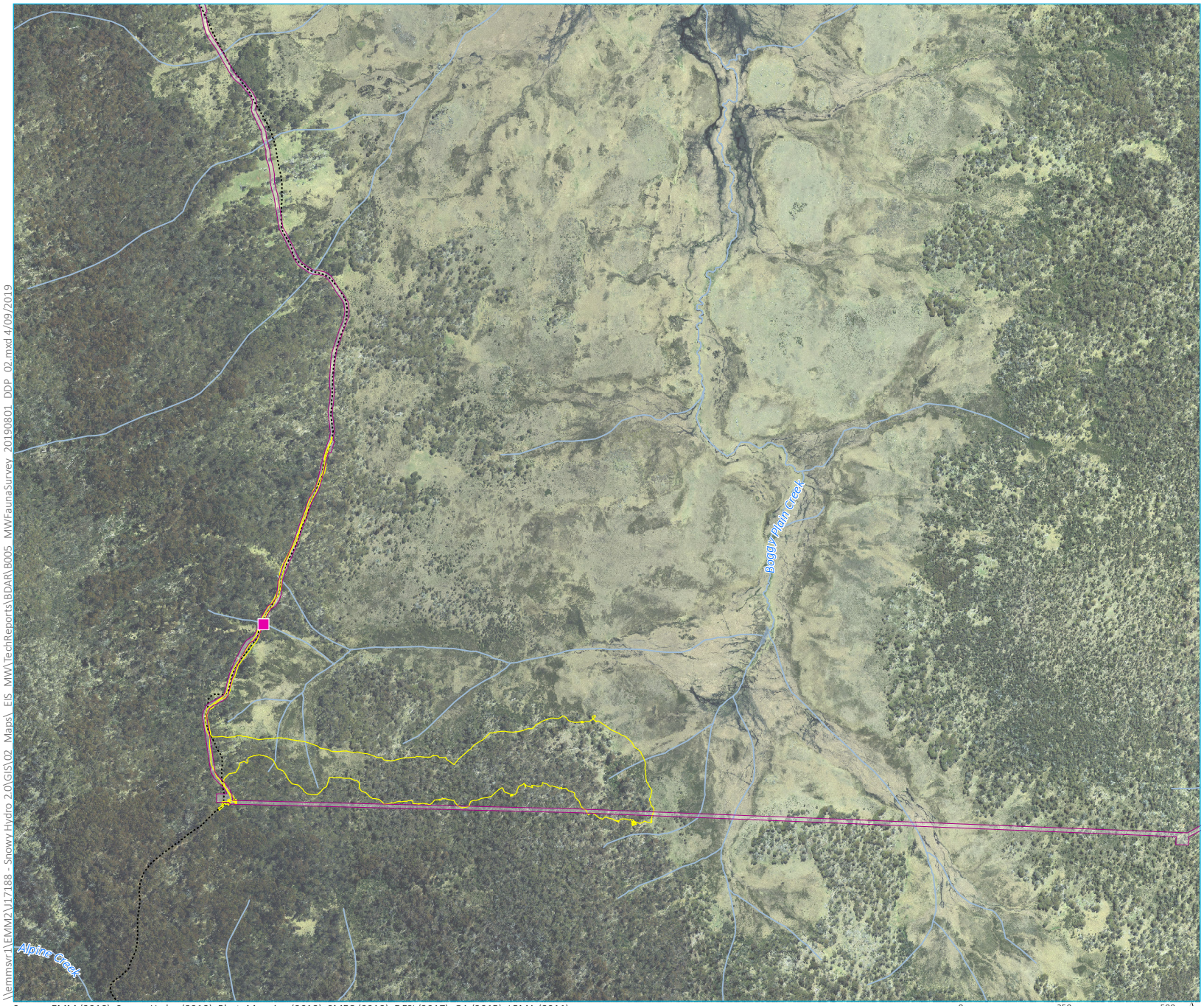
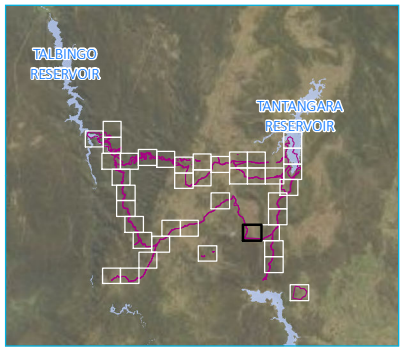
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.28

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Small mammal terrestrial trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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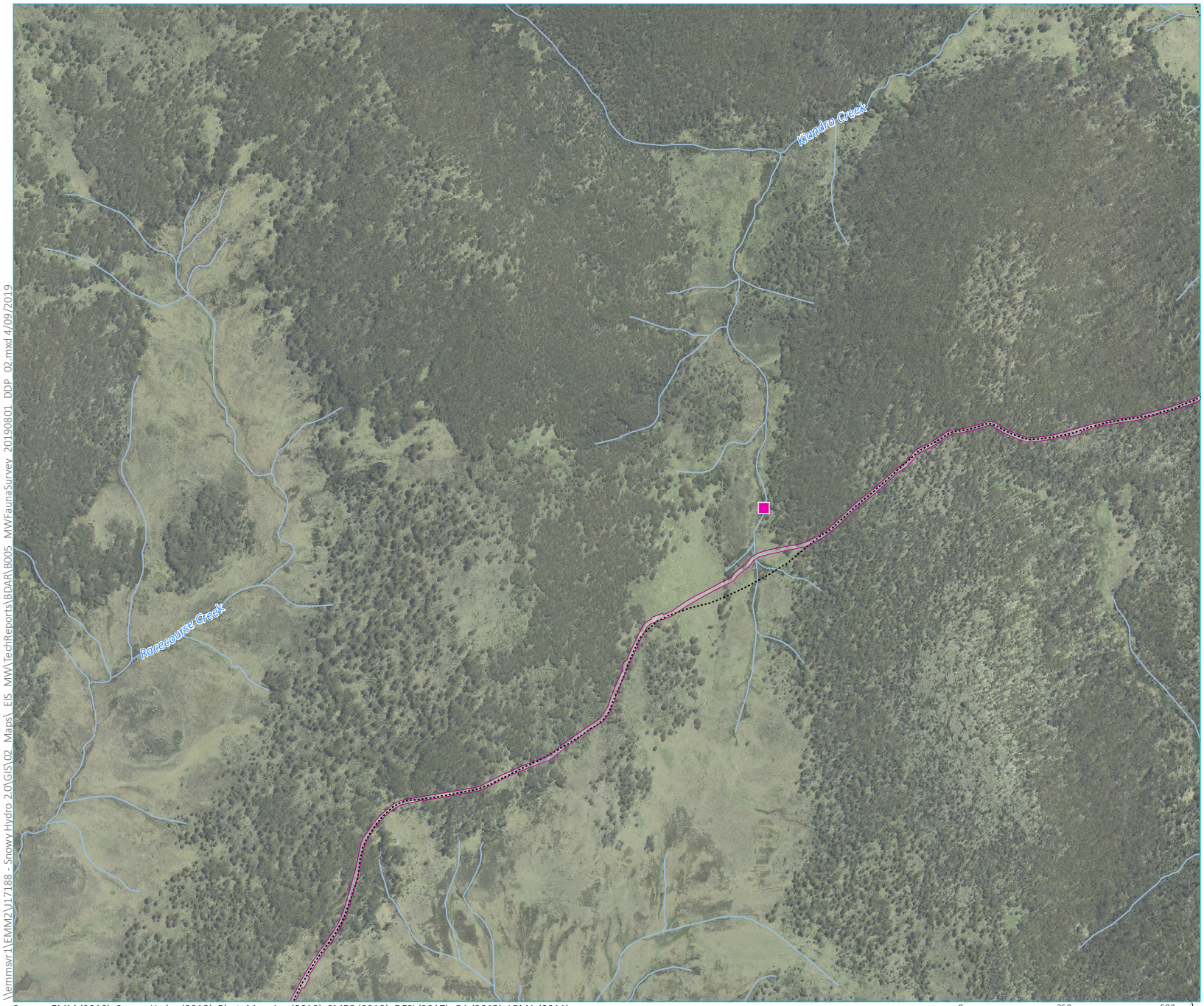
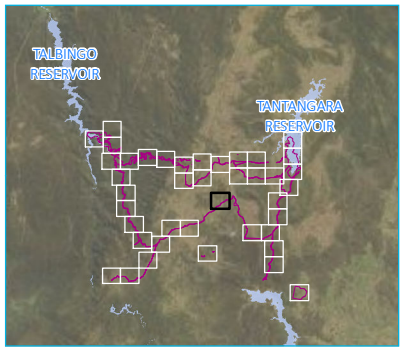
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.29

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Vehicular track
- Watercourse / drainage line
- Small mammal terrestrial trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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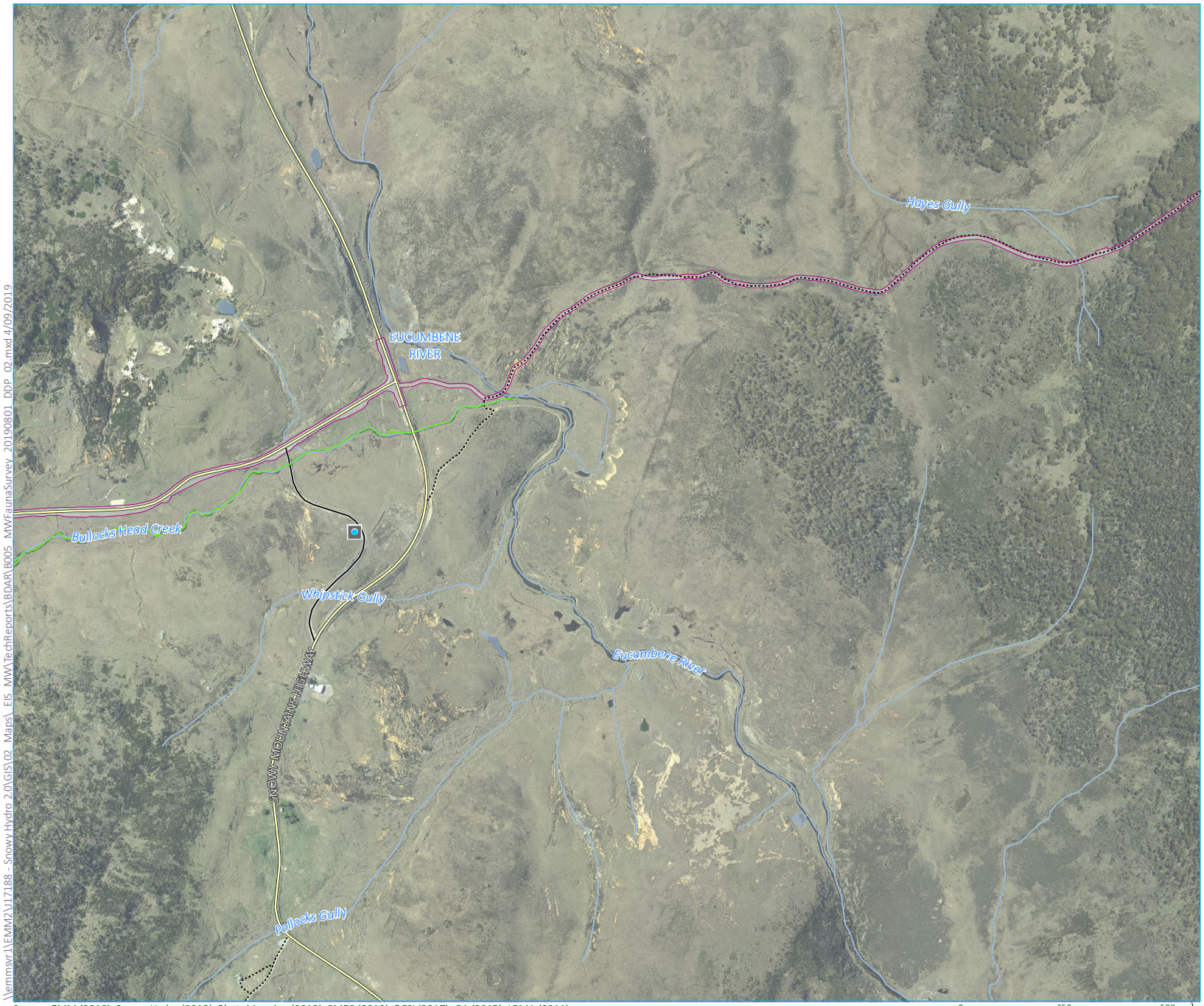
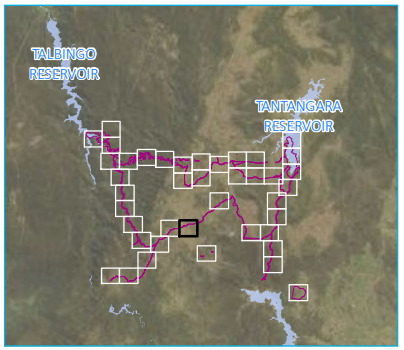
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.30

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Main road
- Local road
- Vehicular track
- Watercourse / drainage line
- Alpine Tree Frog survey
- Tile grid
- Tile transect

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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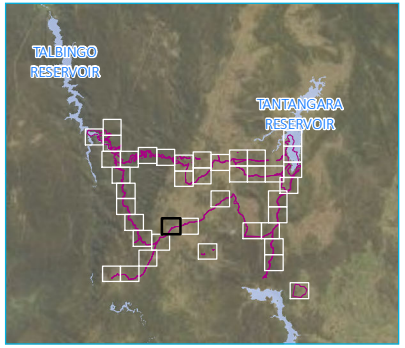
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.31

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Main road
- Watercourse / drainage line
- Alpine Tree Frog survey
- Tile grid
- Tile transect

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02_Maps_EIS_MW\TechReports\BDAR\B005_MWFaunaSurvey_20190801_DDP_02.mxd 4/09/2019

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

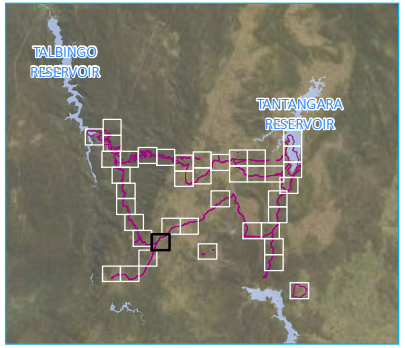
N

Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.32

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Waterbody
- Main road
- Local road
- Vehicular track
- Watercourse / drainage line
- Alpine Tree Frog survey
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Anabat acoustic detection

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

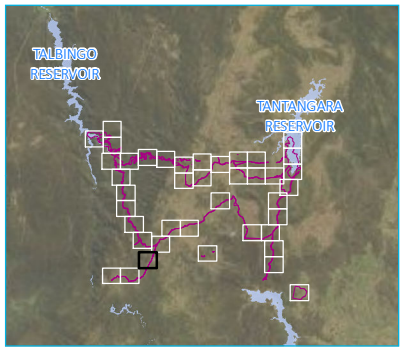
\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\BDAR\B005 MWFaunaSurvey 20190801 DDP 02.mxd 4/09/2019

Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.33

snowy 2.0

EMM
creating opportunities



KEY

- Main Works disturbance footprint
- Waterbody
- Local road
- Vehicular track
- Watercourse / drainage line
- Small mammal terrestrial trapping

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\BDAR\B005 MWFaunaSurvey 20190801 DDP 02.mxd 4/09/2019

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

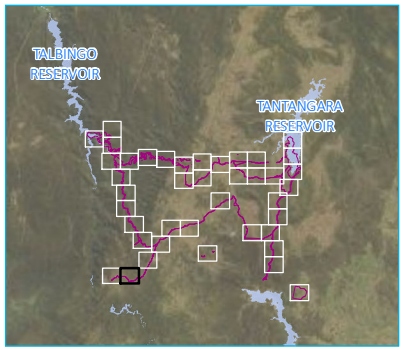
N

Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.34

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Waterbody
- Local road
- Vehicular track
- Watercourse / drainage line
- Tile grid
- Tile transect
- Small mammal terrestrial trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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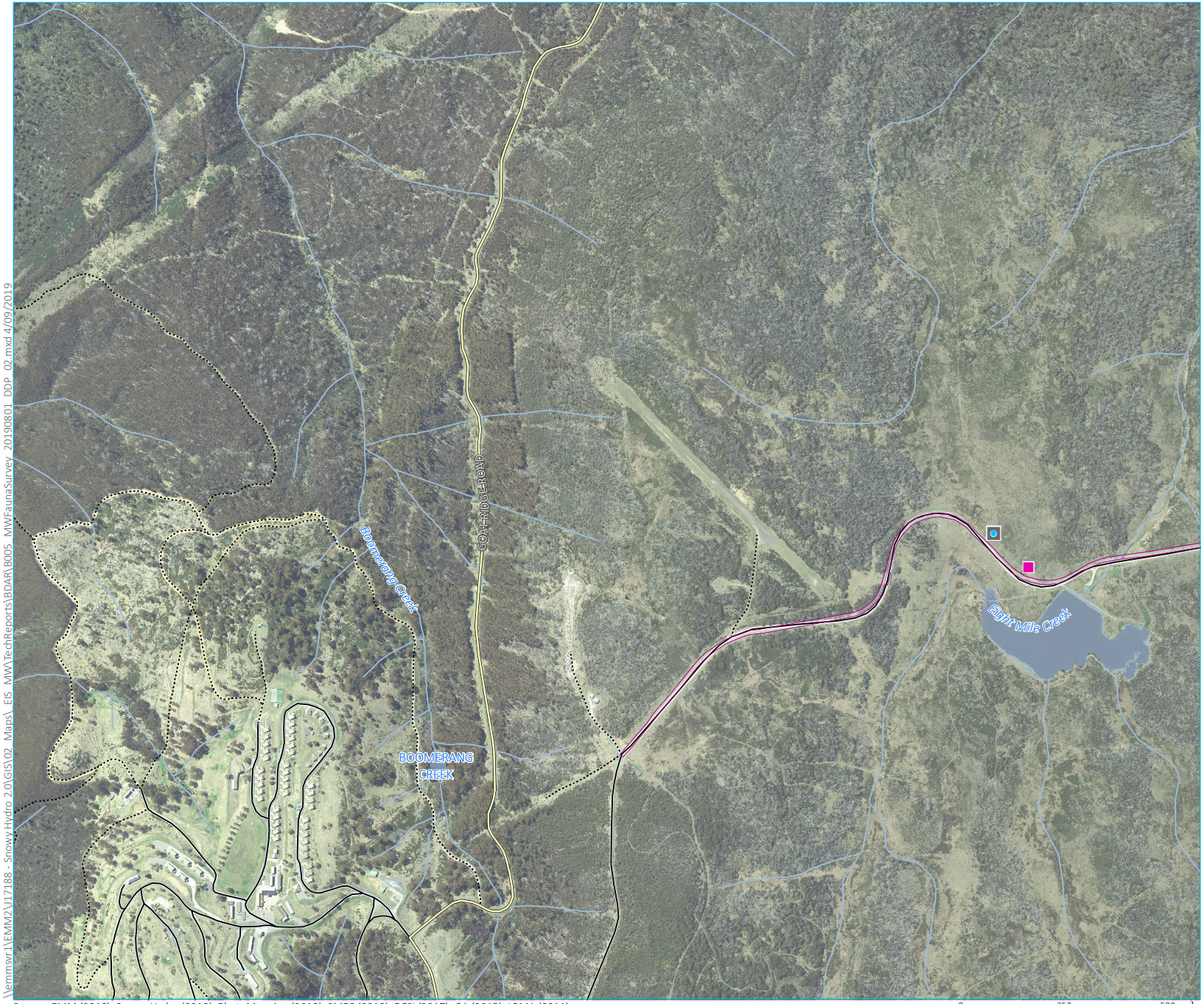
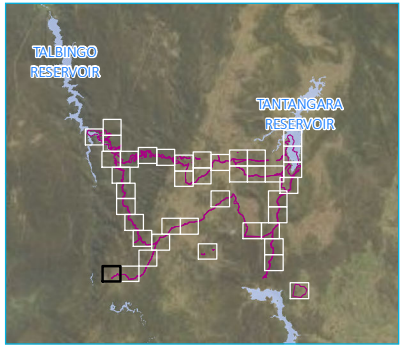
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.35

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Main road
- Local road
- Vehicular track
- Watercourse / drainage line
- Tile grid
- Tile transect
- Small mammal terrestrial trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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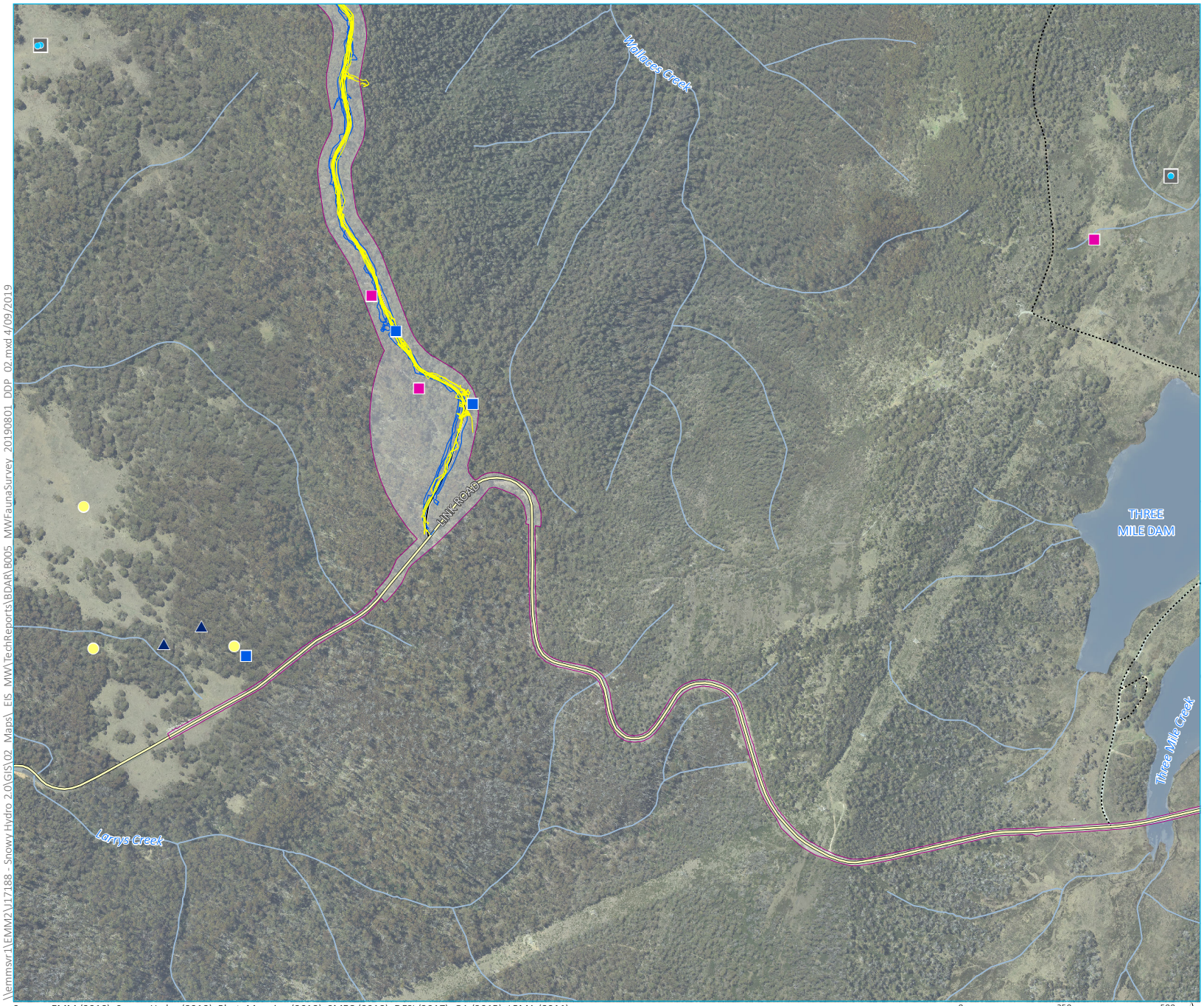
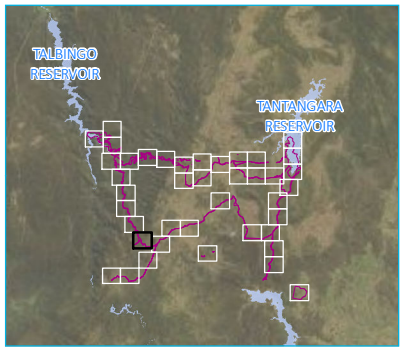
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.36

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Waterbody
- Main road
- Local road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Spotlighting
- Remote camera - small mammal
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Arboreal trapping
- Koala spot assessment technique (SAT)

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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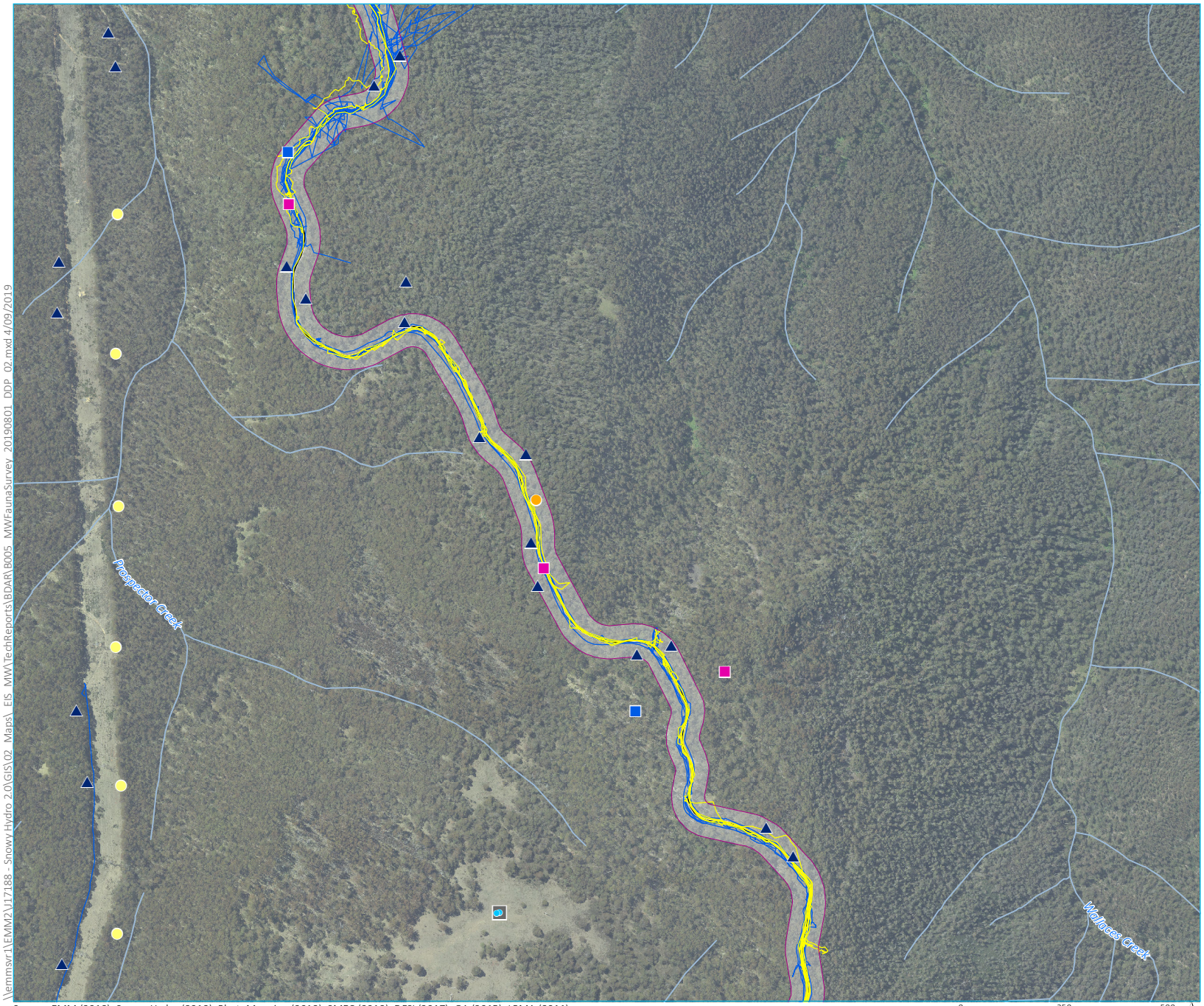
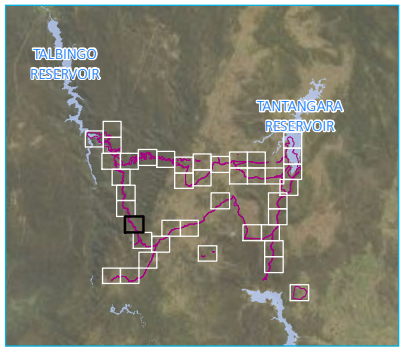
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.37

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Local road
- Watercourse / drainage line
- Bird survey
- Spotlighting
- Remote camera - small mammal
- Tile grid
- Tile transect
- Small mammal terrestrial trapping
- Arboreal trapping
- Koala spot assessment technique (SAT)
- Koala song meter

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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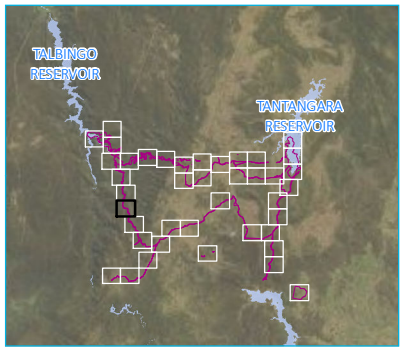
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.38

snowy 2.0

EMM creating opportunities



KEY

- Main Works disturbance footprint
- Local road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Spotlighting
- Remote camera - small mammal
- Small mammal terrestrial trapping
- Arboreal trapping

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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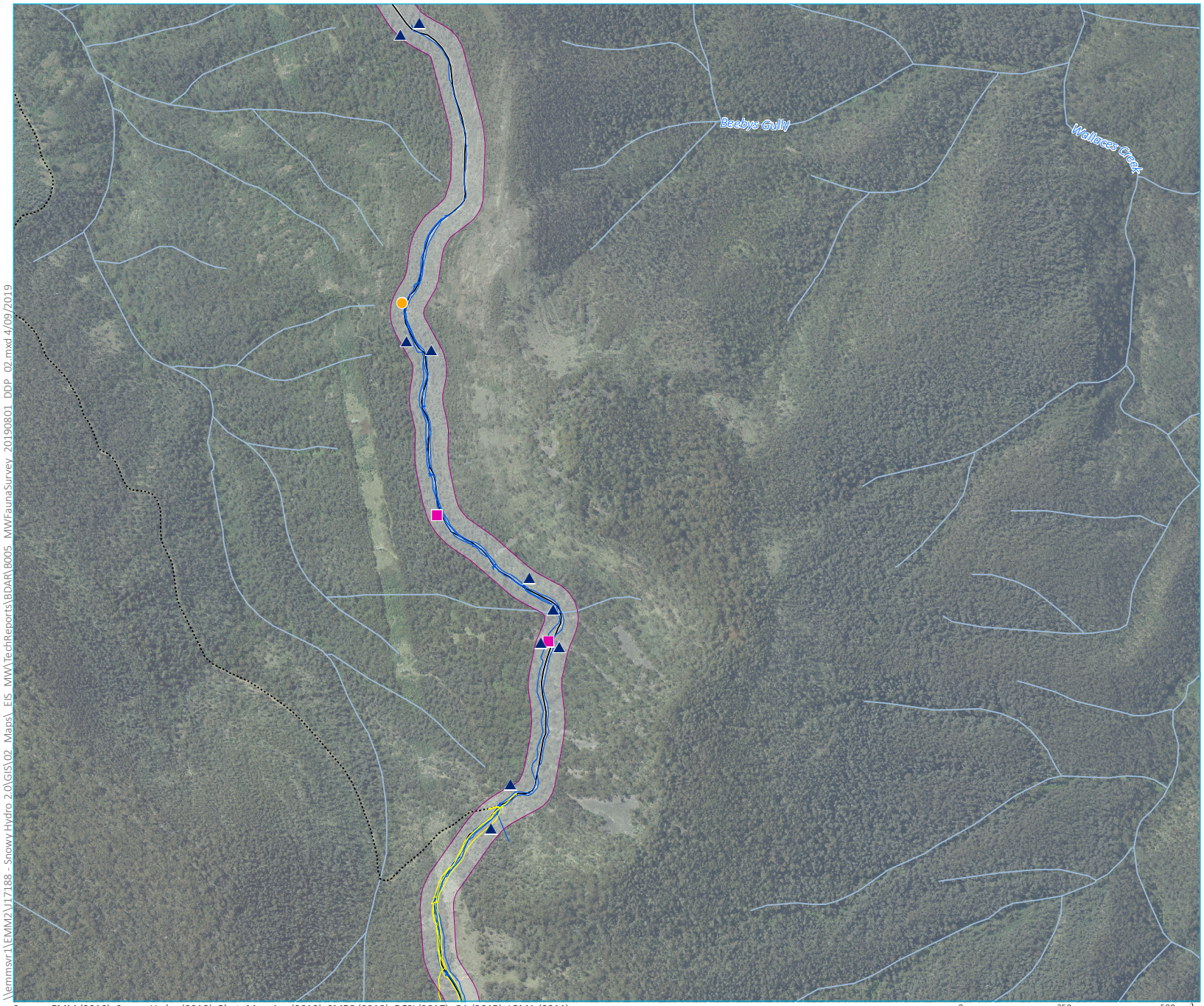
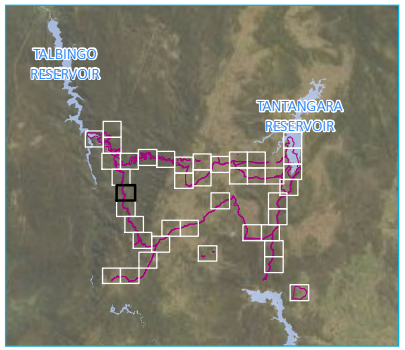
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.39

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Local road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Spotlighting
- Remote camera - small mammal
- Small mammal terrestrial trapping
- Koala song meter

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

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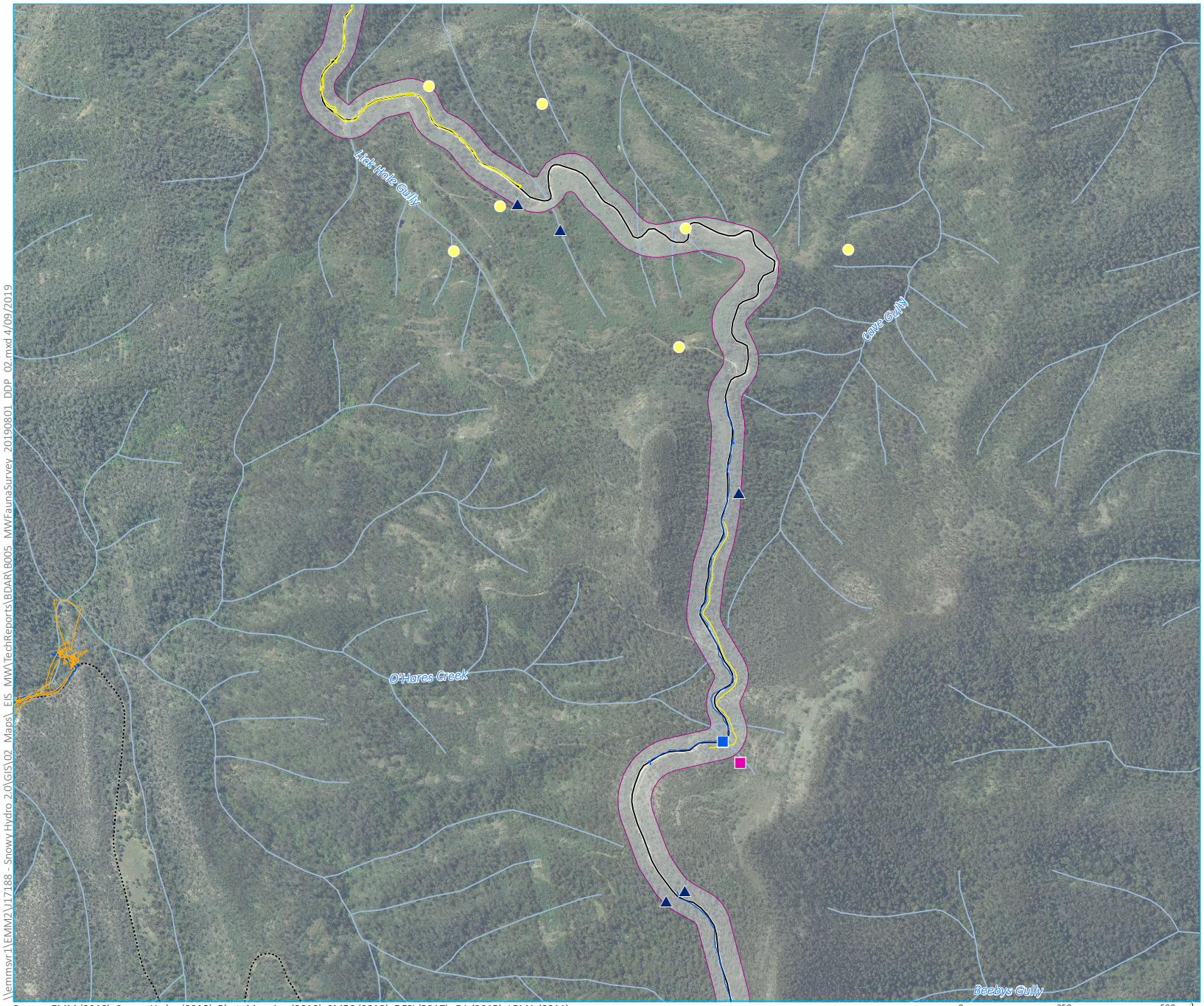
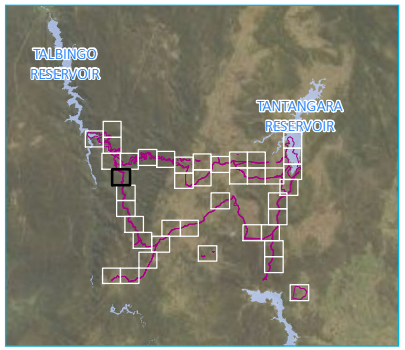
Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.40

snowy 2.0

EMM creating opportunities





KEY

- Main Works disturbance footprint
- Local road
- Vehicular track
- Watercourse / drainage line
- Bird survey
- Booroolong Frog survey
- Spotlighting
- Remote camera - small mammal
- Small mammal terrestrial trapping
- Arboreal trapping
- Koala spot assessment technique (SAT)

Source: EMM (2018); Snowy Hydro (2018); PhotoMapping (2018); SMEC (2018); DFSI (2017); GA (2015); LPMA (2011)

0 250 500 m

GDA 1994 MGA Zone 55

N

\\emmsvr1\EMM2\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS MW\TechReports\BDAR\B005 MWFaunaSurvey 20190801 DDP 02.mxd 4/09/2019

Fauna survey locations

Snowy 2.0
Biodiversity Assessment Report
Main Works
Figure 6.2.41

snowy 2.0

EMM creating opportunities

6.3.4 Targeted survey results

Candidate species credit species have been discussed below; addressing records of threatened flora and fauna, and identification of species polygons. As per the BAM (OEH 2017a), a species polygon must be developed to identify the area, or count and location, of suitable habitat for a species credit species within the development footprint.

Species polygons have been created for species within the development footprint as per the TBDC. For species without relevant guidelines, species polygons have been established based on requirements of similar species or identifying all suitable habitat, as required by the BAM (OEH 2017a).

i Threatened flora species results

Seven threatened flora species have been recorded within the Main Works disturbance footprint (Figure 6.3). These include:

- Clover Glycine
- Kiandra Leek Orchid;
- Leafy Anchor Plant;
- Mauve Burr-daisy;
- Raleigh Sedge; and
- Slender Greenhood; and
- *Thelymitra alpicola*.

Three additional flora species have been recorded adjacent to, but not within, the disturbance area. These include:

- Max Mueller's Burr-daisy (*Calotis pubescens*);
- Prasophyllum innubum; and
- *Pterostylis alpina*.

These species are listed in the calculator as not being present in the disturbance footprint, and therefore not being impacted.

ii Threatened fauna survey results

Twenty-five threatened fauna species listed under the BC Act have been recorded within or adjacent to the Main Works disturbance footprint and two EPBC listed migratory species (Figure 6.2). These include:

- twelve threatened bird species, including two EPBC listed species:
    - Brown Treecreeper (ecosystem credit species);
    - Diamond Firetail (ecosystem credit species);

- Dusky Woodswallow (ecosystem credit species);
- Flame Robin (ecosystem credit species);
- Gang-gang Cockatoo;
- Latham's Snipe (EPBC listed migratory species);
- Little Eagle (ecosystem credit species);
- Masked Owl;
- Olive Whistler (ecosystem credit species);
- Satin Flycatcher (EPBC listed migratory species);
- Scarlet Robin (ecosystem credit species);
- Square-tailed Kite (ecosystem credit species);
- Varied Sittella (ecosystem credit species);
- White-bellied Sea-Eagle (ecosystem credit species);

• four threatened mammal species:
  - Broad-toothed Rat;
  - Eastern Pygmy-possum;
  - Smoky Mouse;
  - Spotted-tailed Quoll (ecosystem credit species);
• two threatened microchiropteran bat species:
  - Eastern Bentwing-bat (ecosystem credit species);
  - Eastern False Pipistrelle (ecosystem credit species);
• two threatened amphibian species:
  - Alpine Tree Frog;
  - Booroolong Frog; and
• Alpine She-oak Skink.

Threatened fauna survey results are outlined for each survey group in the sections below. Ecosystem credit species are not discussed further in this section as they are not candidate threatened species credit species.

a Diurnal birds

One target species, the Gang-gang Cockatoo, was recorded within and adjacent to the disturbance footprint (Figure 6.5). No other diurnal bird candidate species credit species were recorded, and all other species are considered a low likelihood of occurring in the disturbance footprint.

Gang-gang Cockatoo

The Gang-gang Cockatoo (Photograph 6.1) was found to be common throughout the disturbance footprint, with the species observed foraging at numerous locations (Figure 6.5). The species was observed to be most common in sub-alpine woodlands (such as at the top of Lobs Hole Ravine Road and Marica), riparian areas at lower elevations (close to the Yarrangobilly River) and dry sclerophyll forests (within Marica).

The Gang-gang Cockatoo nests in the trunks, limbs or dead spouts of tall living trees, in tall, mature sclerophyll forests, often near water (NSWSC 2005, 2008). Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts (OEH 2018b). Suitable hollows are most common in the areas where the species was observed to be most common; along the upper reaches of Lobs Hole Ravine Road, in PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion, along the Yarrangobilly River, in PCT 300 - Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment, and along Marica, in PCT 953 – Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion.

Targeted nest searches were undertaken across the Main Works survey area. The Gang-gang Cockatoo was not observed nesting but was observed investigating hollows on four occasions, three of which were recorded within 100 m of the disturbance footprint. One occurrence was along the upper sections of Lobs Hole Ravine Road, a second record was of a pair found in a large hollow along the Yarrangobilly River and the third occurrence was recorded within the Marica area. The other occurrence, outside of the disturbance footprint, was north of Link Road with a pair perched in a large hollow.

The threatened biodiversity data collection (TBDC) does not specify how the species polygon for the Gang-gang Cockatoo should be defined. Thus, the species polygon has been established based on the requirements of the Superb Parrot, by providing a circular buffer of 100 m around the three nest trees identified above. The Superb Parrot is the only species in the order Psittaciformes that has a defined method for identifying the species polygon, and this was therefore deemed appropriate.

On this basis areas of the following PCTs were identified as potential breeding habitat for this species within the disturbance footprint:

- PCT 296 - Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion;
- PCT 300 - Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment;
- PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion;
- 953 - Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion; and

- 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion.

This data was used to determine species polygons for the species (Figure 6.5).

Photograph 6.1 Gang-gang Cockatoo

b Nocturnal birds

One target species, the Masked Owl, was recorded within or adjacent to the disturbance footprint (Figure 6.6). The Powerful Owl is considered likely to forage within the disturbance footprint on occasion given the species large home range, provided a nesting pair is present within the locality. A deceased Powerful Owl was recorded within Lobs Hole; however, no evidence of nesting was observed and the species was not recorded during targeted surveys.

The Barking Owl is considered a low likelihood of occurring within the disturbance footprint. The Barking Owl is considered scarce at higher elevations of the tablelands (NPWS 2003) and the species is known to respond strongly to call playback. Given the failure to record this species during targeted surveys it is considered unlikely to occur.

Breeding habitat for the Sooty Owl is considered highly limited within and adjacent to the project area.

Masked Owl

The Masked Owl (Photograph 6.2) was recorded at two locations within and adjacent to the Main Works disturbance footprint during targeted surveys; on the Yarrangobilly River in Lobs Hole and in the upper sections of Lobs Hole Ravine Road, near the intersection with Link Road (Figure 6.6). Both records were from the species being “called in” as a result of call playback.

The Masked Owl nests in large (greater than 90 cm diameter at breast height), old, hollow eucalypts. Nesting hollows are greater than 40 cm wide and 100 cm deep. Unlike other forest owls, there is no relationship with distance to watercourses and the species will breed in a variety of topographic positions (DEC 2006b). Suitable sized trees and hollows are restricted to the two areas where the species was observed; the upper sections or Lobs Hole Ravine Road in areas of PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion and along the Yarrangobilly River in PCT 302 - Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands. However, no nesting birds were identified during surveys.

As per the TBDC, the species polygon should be established by providing a circular buffer of 100m around the nest tree. As no nesting birds were observed a species polygon for the Masked Owl has not been identified, and species credits are not required. Foraging habitat will be offset as an ecosystem credit.

Photograph 6.2 Masked Owl

c Small terrestrial mammals

Three target species, the Broad-toothed Rat, Eastern Pygmy-possum and Smoky Mouse, were recorded within or adjacent to the disturbance footprint (Figure 6.7).

Broad-toothed Rat

The Broad-toothed Rat (Photograph 6.3) was recorded at a number of locations within or adjacent to the disturbance footprint; along Link Road, west of the Snowy Mountain Highway and adjacent to Tantangara Reservoir (Figure 6.7). The species has been recorded in the following PCTs:

- PCT 637 – Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion (with a dense shrubby midstorey); and
- PCT 1225 - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion.

The Broad-toothed Rat favours dense vegetation used for tunnelling through wet grass, sedge or heath. Sheltering nests of grass are built within understorey vegetation or under logs. The Broad-toothed Rat feeds on grass and sedge stems, seeds and moss spore cases (OEH 2017b). The TBDC does not provide guidance on development of the species polygon for this species. All suitable habitat, as identified by the PCTs listed above, was used to develop the species polygon on the basis of suitable understorey habitat (Figure 6.7). PCTs in Low condition were excluded as they do not provide a sufficiently dense native understorey selected by the species.

Photograph 6.3 Broad-toothed Rat (image courtesy of George Madani)

Eastern Pygmy-possum

The Eastern Pygmy-possum (Photograph 6.4) was recorded at numerous locations within and adjacent to the disturbance footprint, within the upper reaches of Lobs Hole Ravine Road to Lobs Hole and spanning across to Marica (Figure 6.7). The species has been recorded in the following PCTs:

- PCT 296 – Brittle Gum – Peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion;
- PCT 300 – Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment;
- PCT 302 - Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion;
- PCT 639 - Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion;
- PCT 953 - Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion;
- PCT 999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion; and
- PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion.

The Eastern Pygmy-possum can be found in a broad range of habitats from rainforest through sclerophyll forest and woodland to heath, but in most areas woodlands and heath appear to be preferred. The species feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes and there is a strong association with Banksias (Tullockh and Dickman 2006) and a dense, flowering understorey (Harris et al. 2014, Law et al. 2017).

The TBDC does not provide guidance on development of the species polygon for this species. All suitable habitat, as identified by the PCTs listed above, plus PCT 311 - Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion and PCT 638 - Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion, were used to develop the species polygon on the basis of suitable understorey habitat were used to develop the species polygon on the basis of suitably dense understorey habitat with flowering Banksias (Figure 6.7). PCTs in Low or Derived grassland condition classes were excluded as they do not provide a sufficiently dense understorey selected by the species.

Photograph 6.4 Eastern Pygmy-possum (image courtesy of Lachlan Hall)

Smoky Mouse

Extensive targeted surveys for the Smoky Mouse (Photograph 6.5) have been undertaken, with the species identified at 71 locations, with 61 locations within and adjacent to the disturbance footprint (seven by terrestrial trapping, 53 by remote camera and one incidental record along Link Road, Figure 6.7).

The species distribution within the survey area is predominantly associated with tall forests dominated by Mountain Gum and Snow Gum, with a moderate to dense shrubby midstorey dominated by shrubs from the plant family Fabaceae (with some Epacridaceae and Mimosaceae), and dense groundcover with abundant sub-shrubs, logs and leaf litter along the upper reaches of Lobs Hole Ravine Road and in the Marica area, above 1,100 m. At around 1,100 m, vegetation transitions to drier communities dominated by Peppermint, Brittle Gum and Candlebark with a moderate to sparse midstorey and sparse grassy groundcover. Soils also become much rockier and may be less suitable for burrowing.

Smoky Mouse was recorded in the following PCTs:

- PCT 300 –Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment (single record);
- PCT 638 –Alpine Ash - Mountain Gum moist shrubby tall open forest of montane areas, southern South Eastern Highlands Bioregion and Australian Alps Bioregion (single record);
- PCT 643 – Alpine shrubland on scree, blockstreams and rocky sites of high altitude areas of Kosciuszko National Park, Australian Alps Bioregion (single record);
- PCT 644 –Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion (five records);
- PCT 729 – Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion (single record);
- PCT 953 - Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion (single record); and
- PCT 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion (17 records).

The TBDC does not provide guidance on development of the species polygon for this species. All suitable habitat, as identified by the PCTs listed above not in Low or Derived Grassland condition classes to around 1,100 m AHD and west of the Snowy Mountain Highway and in proximity of Link Road, was used to develop the species polygon on the basis of suitable dense and complex understorey habitat and proximity to the population recorded as a part of surveys undertaken for Snowy 2.0 (Figure 6.7).

Photograph 6.5 Smoky Mouse

d Large terrestrial mammals

No Spotted-tail Quolls were recorded during targeted surveys; however, an incidental record of a Quoll scat was recorded off Wallace's Creek Firetrail (Figure 6.8).

The Spotted-tail Quoll is known to have home ranges of several hundred to several thousand hectares and occurs at low densities (DELWP 2016, DEWHA 2009a, DSE 2011a). The species is primarily forest-dependent, and occupies a wide range of habitat types, including rainforest, wet and dry sclerophyll forest, coastal heathland, scrub and dunes, woodland, heathy woodland, swamp forest, mangroves, on beaches and sometimes in grassland or pastoral areas adjacent to forested areas. Given this, the species has potential to occupy the Main Works disturbance footprint at low densities, with large areas of suitable habitat present throughout the locality; the species is likely to be wide ranging. All areas of the survey area are deemed to provide suitable habitat, with suitable denning sites focused on boulderfields on Lobs Hole Ravine Road, and areas with a high density of hollow logs in sub-alpine areas at the top of Lobs Hole Ravine Road and along the Yarrangobilly River.

However, as the species is an ecosystem credit species for the purposes of the BAM a species polygon has not been developed.

e Arboreal mammals

No arboreal mammals were recorded during targeted surveys.

Although there is some potential for these species to occur at low densities and/or utilise habitats within the disturbance footprint on occasion, the species are not considered present for the purposes of this assessment.

The Koala is rare in the KNP, with a single record within 10 km of the Main Works survey area and a recent record in November 2016 from near Blowering Dam, east of Tumut (ABC News 2018). There is insufficient evidence to undertake a Koala habitat assessment in accordance with the Koala habitat assessment tool outlined in DoE (2014a). Therefore, RGB SAT surveys, spotlighting and Songmeter surveys were undertaken. The Koala was not observed during these surveys and is considered unlikely to occur for the purposes of this assessment.

f Microchiropteran bats

One target species, the Eastern Bentwing-bat, was recorded at two sites within or adjacent to the disturbance footprint (Figure 6.9); however, no breeding habitat for the species was recorded in or adjacent to the disturbance footprint. The Southern Myotis was not recorded within the disturbance footprint.

As such, no species polygons are required for these target species.

g Amphibians

Two target species, the Booroolong Frog and Alpine Tree Frog, were recorded within or adjacent to the Main Works disturbance footprint.

Booroolong Frog

Extensive targeted surveys were undertaken of all permanent to intermittent watercourses within the survey area. The Booroolong Frog (Photograph 6.6) was recorded within the survey area along the Yarrangobilly River, from the full supply level (FSL) of Talbingo Reservoir to the upper reaches of the Yarrangobilly River, as well as along Wallace's Creek (Figure 6.10). It is likely that this population extends upstream to at least Blue Creek Firetrail (Dave Hunter, DPIE, pers. comm.).

The Yarrangobilly River is a major regional watercourse that flows into Talbingo Reservoir, downstream of Lobs Hole. The river's catchment has an area of 271 km^2 that is wholly with KNP. Baseline water monitoring was undertaken by EMM (2019a) within Yarrangobilly River and Wallace's Creek. Monitoring was undertaken at a monthly frequency within the Yarrangobilly River Catchment. A summary of the water quality results is presented in Annexure E. Key results from water quality sampling are summarised as follows:

- pH ranges between 6.2 to 8.5, with occasional lower and upper bound exceedances;
- Low concentrations of suspended solids and low turbidity;
- Carbonate and salinity vary seasonally, with higher levels occurring in summer/autumn;
- Oxidised nitrogen concentrations exceed WQO values frequently in summer/autumn and occasionally in winter/spring;
- Total and reactive phosphorus concentrations are generally below WQO values; and
- Aluminium concentrations in the Yarrangobilly River exceed WQO values frequently in winter/spring and occasionally in summer/autumn. Copper concentrations in Wallace's Creek exceed WQO values occasionally.

- The water quality during dry weather conditions in minor watercourses in Lobs Hole is generally poorer than larger watercourses, with elevated suspended sediment, nutrients and some metals (aluminium and copper).

- The understanding of water quality during wet weather conditions is informed by data from monitoring undertaken in March and May 2019 following moderate rainfall. Receiving water quality during wet weather conditions is generally poorer relative to baseflow conditions with higher turbidity, lower pH, higher nutrients and potential for non-trivial concentrations of some metals such as aluminium and copper.

The Yarrangobilly River provides optimal breeding habitat for Booroolong Frog, with a series of cobble banks and bedrock structures along stream margins, with slow-flowing water. These areas are connected by larger, slow-flowing pools. Breeding habitat in Wallace's Creek is much more limited, with small sections providing suitable breeding habitat. It is likely this area provides sub-optimal breeding habitat as well as connective and dispersal habitat.

During the breeding season the species shelters under rocks or amongst vegetation near the ground on the stream edge (Anstis 2002, Robinson 1993). In winter, the frogs have been observed under rocks within the riparian zone (Anstis et al. 1998, OEH 2012a). The Booroolong Frog is not known to move very far along the stream from where they are recorded (less than 50 m within a season) with maximum movements recorded being 300 m (Hunter 2001). During targeted surveys, the Booroolong Frog was observed up to 130 m from the Yarrangobilly River during a high rainfall event that saw key breeding habitat flooded. During this period the majority of frogs were observed within the riparian zone (ie within 50 m of the River, see Figure 6.10).

Based on the above information, the Yarrangobilly River and Wallace's Creek have been identified as breeding habitat, while areas within 50 m of this breeding habitat has been identified as potential dispersal and refuge habitat. This criterion was used to develop the species polygon for the Booroolong Frog (Figure 6.10).

Photograph 6.6 Booroolong Frog

Alpine Tree Frog

The Alpine Tree Frog (Photograph 6.7) was recorded in various locations within and adjacent to the disturbance footprint, including near Tantangara Reservoir and along Nungar Creek Fire Trail (Figure 6.10). The species was recorded breeding in Tantangara Reservoir between minimum operating level (MOL) and full supply level (FSL) on several occasions as well as Nungar Creek, Eucumbene River and Tantangara Creek.

Baseline water monitoring was undertaken by EMM (2019a) in the Murrumbidgee and Eucumbene Rivers, Tantangara, Gooandra, Nungar and Kelly's Plain Creeks and associated minor watercourses. Monitoring was undertaken at a monthly frequency, predominantly during baseflow conditions. A summary of the water quality results is presented in Annexure E. Key results from water quality sampling are summarised as follows:

- pH that generally ranges between 6.2 and 8.5, with occasional lower and upper bound exceedances;
- carbonate and salinity vary seasonally, with higher levels occurring in summer/autumn;
- low concentrations of suspended solids and low turbidity;
- oxidised nitrogen concentrations exceed WQO values frequently in summer/autumn and occasionally in winter/spring;

- total and reactive phosphorus concentrations are generally below WQO values;
- aluminium concentrations exceed the WQO value on a frequent basis. Copper, iron and zinc concentrations exceed WQO values on an occasional basis;
- the water quality of minor watercourses in the vicinity of the proposed surface works near Tantangara Reservoir is generally poorer than larger watercourses, with elevated suspended sediment, nutrients and some metals (aluminium and iron); and
- the water quality during wet weather conditions is poorly understood. It is expected that concentrations of suspended sediment and some metals may be higher than dry weather concentrations. Wet weather sampling is proposed prior to commencement of works.

The Alpine Tree Frog occurs in the south-eastern NSW and Victorian high country (alpine and sub-alpine zones) generally above 1,100 m AHD. Most locations are within National Parks and some are close to alpine resorts. This species is found in a wide variety of habitats including woodland, heath, grassland and herb fields. They will utilise natural and artificial wetlands for breeding. Non-breeding habitat and overwintering refuges are poorly known but are likely to include flat rocks, fallen logs, leaf litter and other ground debris.

On the basis of the above information, the species polygon for the Alpine Tree Frog has been defined as breeding areas such as between FSL and MOL in Tantangara Reservoir and suitable watercourses, plus areas within the 50 m of suitable breeding habitat (Figure 6.10).

Photograph 6.7 Alpine Tree Frog recorded breeding in Tantangara Reservoir

Northern Corroboree Frog

The Northern Corroboree Frog was not recorded during targeted surveys within the survey area.

The Northern Corroboree Frog is highly restricted to two populations, one in Bogong Mountains/Fiery Range and the other in the ACT. The species has declined by 40% in the 2000s, having become locally extinct at a number of sites (TSSC 2013). The Northern Corroboree Frog was not observed during targeted surveys and is considered unlikely to occur for the purposes of this assessment.

h Reptiles

The Alpine She-oak Skink (Photograph 6.8) was recorded within the Main Works disturbance footprint and adjacent areas (Figure 6.11). The species is known to occur in temperate montane grasslands, favouring tree-less or very lightly treed areas containing tussock grasses, low heath or a combination of both. Records were found within PCT 1224 – Sub alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion.

On the basis of the above information, PCT 1224 was used to determine species polygons for this species, including all condition classes excluding Low (Figure 6.11).

Photograph 6.8 Alpine She-oak Skink