



D:\UMWELT (AUSTRALIA) PTY LTD\859 - 03\S&M\FIGURES_R03\APPENDICES\APPENDIX_G1\859_038_DD_POTENTIALAERIALIMPACTZONE.MXD 10/08/2023 7:32:53 PM
 Scale: 1:20000 at A3

- Legend**
- ▬ RTS Project Site
 - ▬ RTS Development Corridor – Wind Farm
 - ▬ RTS Indicative Development Footprint – Wind Farm
 - ▬ RTS Indicative Development Footprint – Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - ▬ Drainage Line
 - ▬ Water Body
 - ▬ Roads
 - ▬ National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - B5
**Liverpool Range Wind Farm
 Potential Aerial Impact Zone
 (170 metre turbine buffers)**



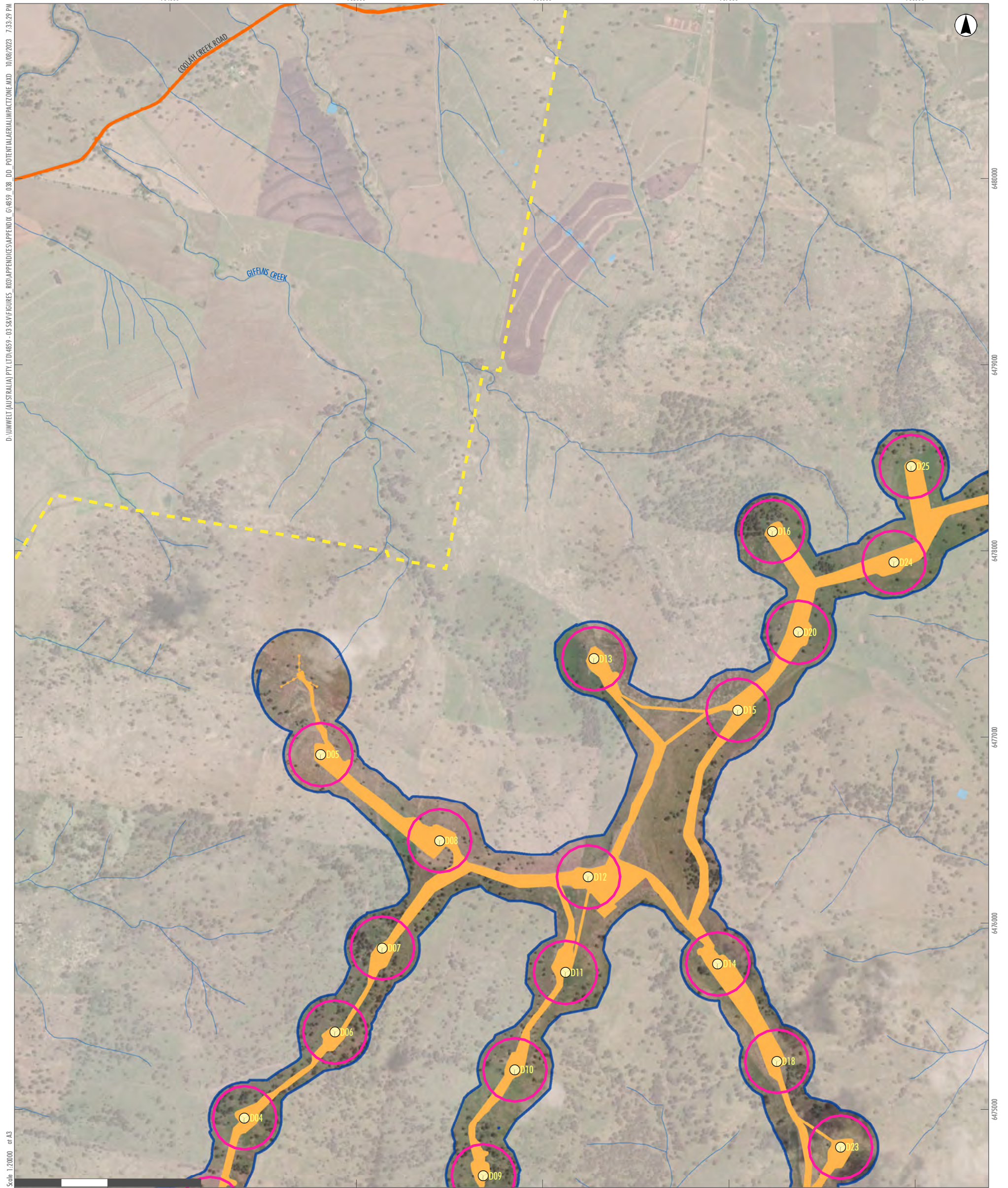
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- Legend**
- RTS Project Site
 - RTS Indicative Development Footprint - Public Road Upgrades
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - C1

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**

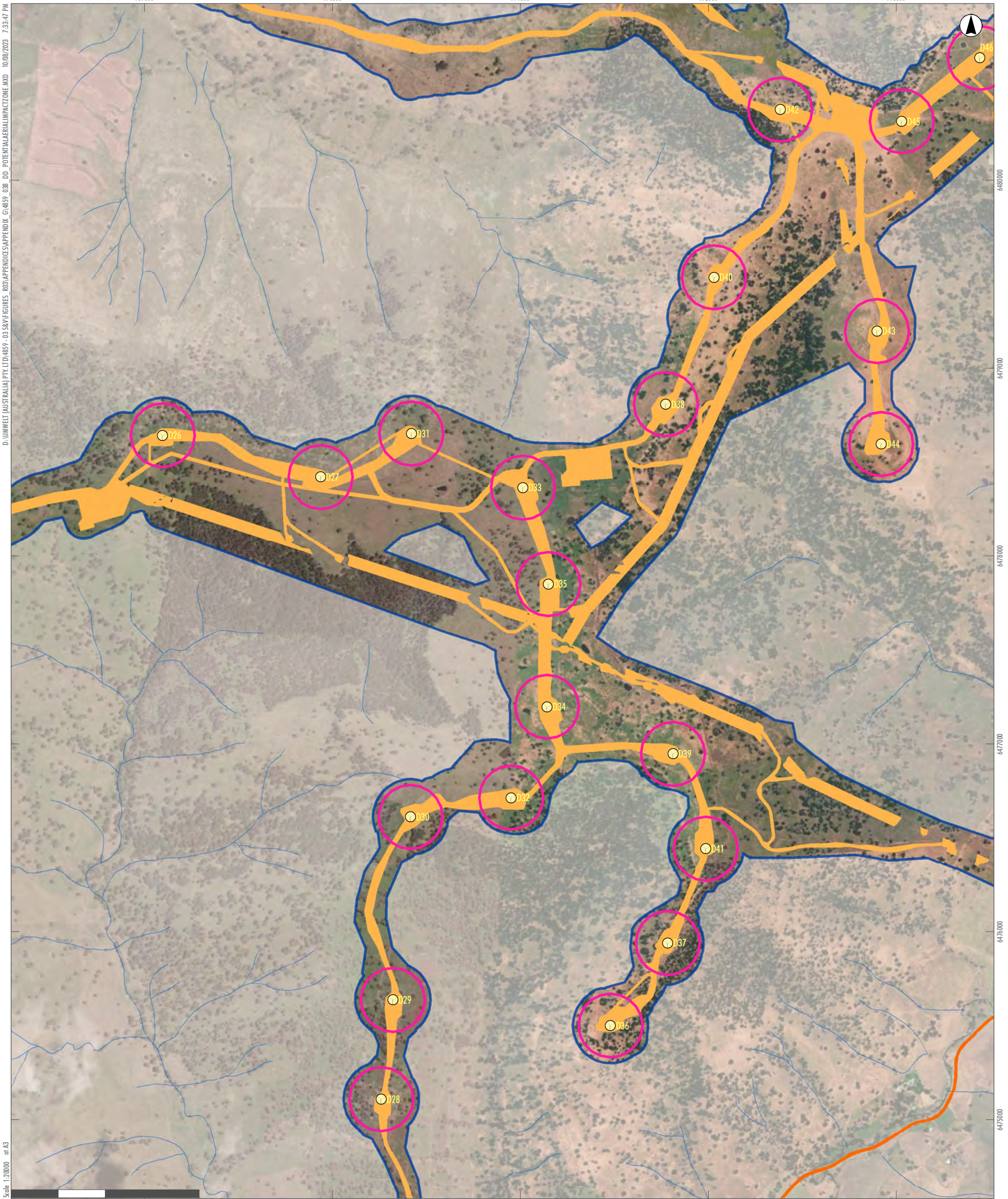


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 Scale: 1:20000 at A3

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - C2
 Liverpool Range Wind Farm
 Potential Aerial Impact Zone
 (170 metre turbine buffers)



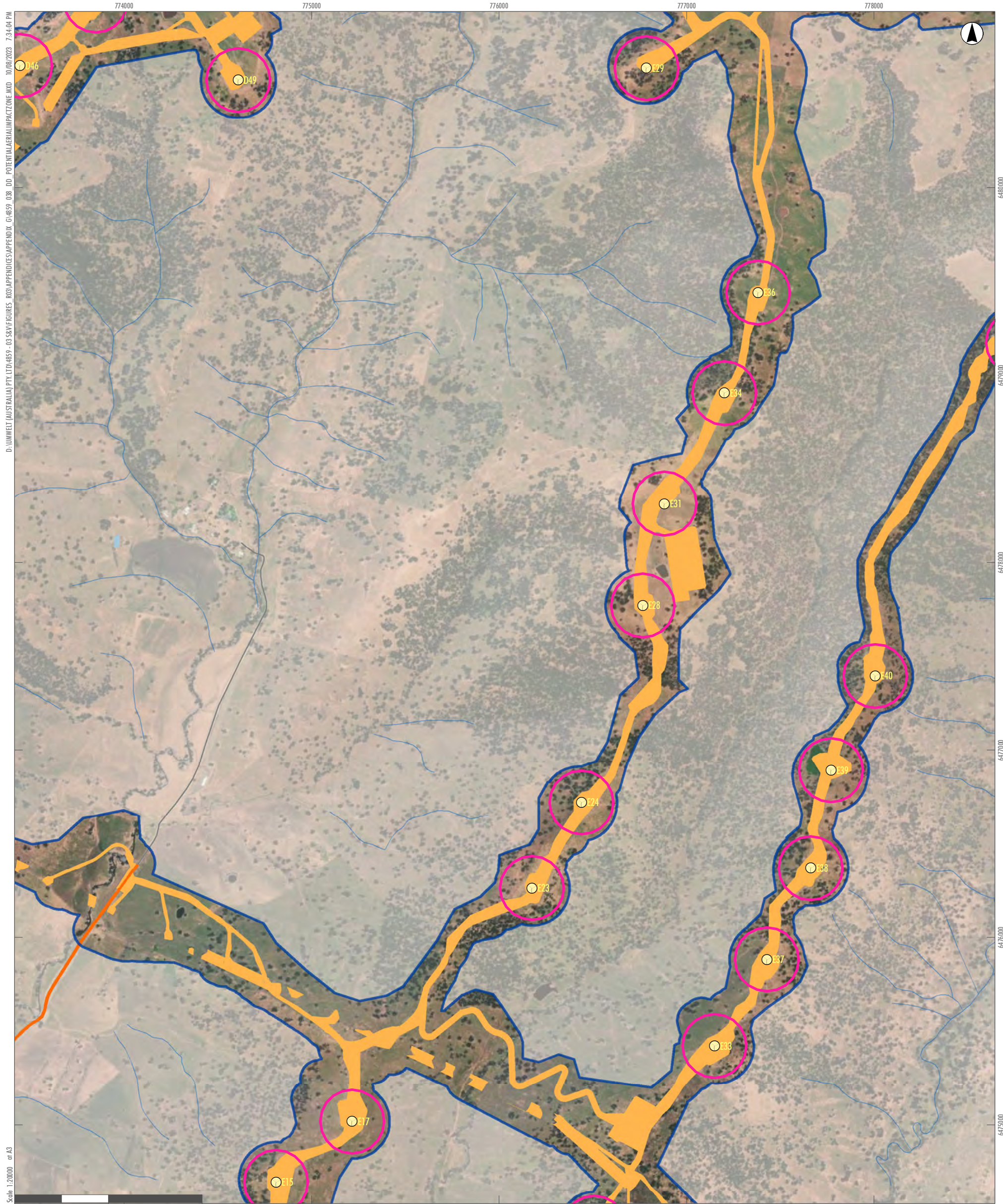
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 Scale: 1:20000 at A3

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - C3

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



D:\UMWELT (AUSTRALIA) PTY LTD\4859 - 03 58\FIGURES_R03\APPENDICES\APPENDIX_G14859_038_DD_POTENTIALAERIALIMPACTZONE.MXD, 10/08/2023 7:34:04 PM

Scale: 1:20000 at A3

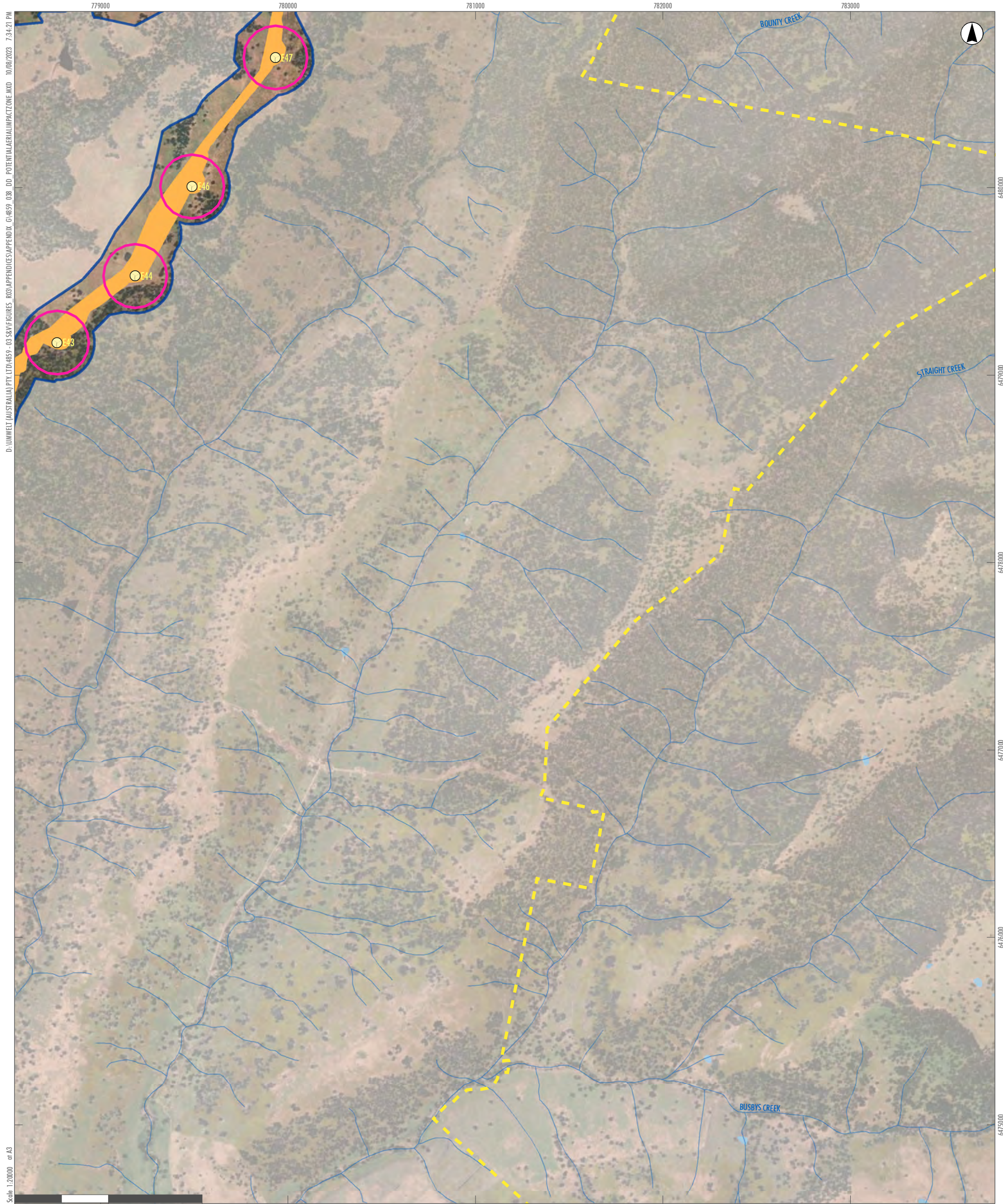
GDA2020 MGA Zone 55

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - C4

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



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Scale: 1:20000 at A3

GDA2020 MGA Zone 55

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - C5

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



Scale: 1:20000 at A3

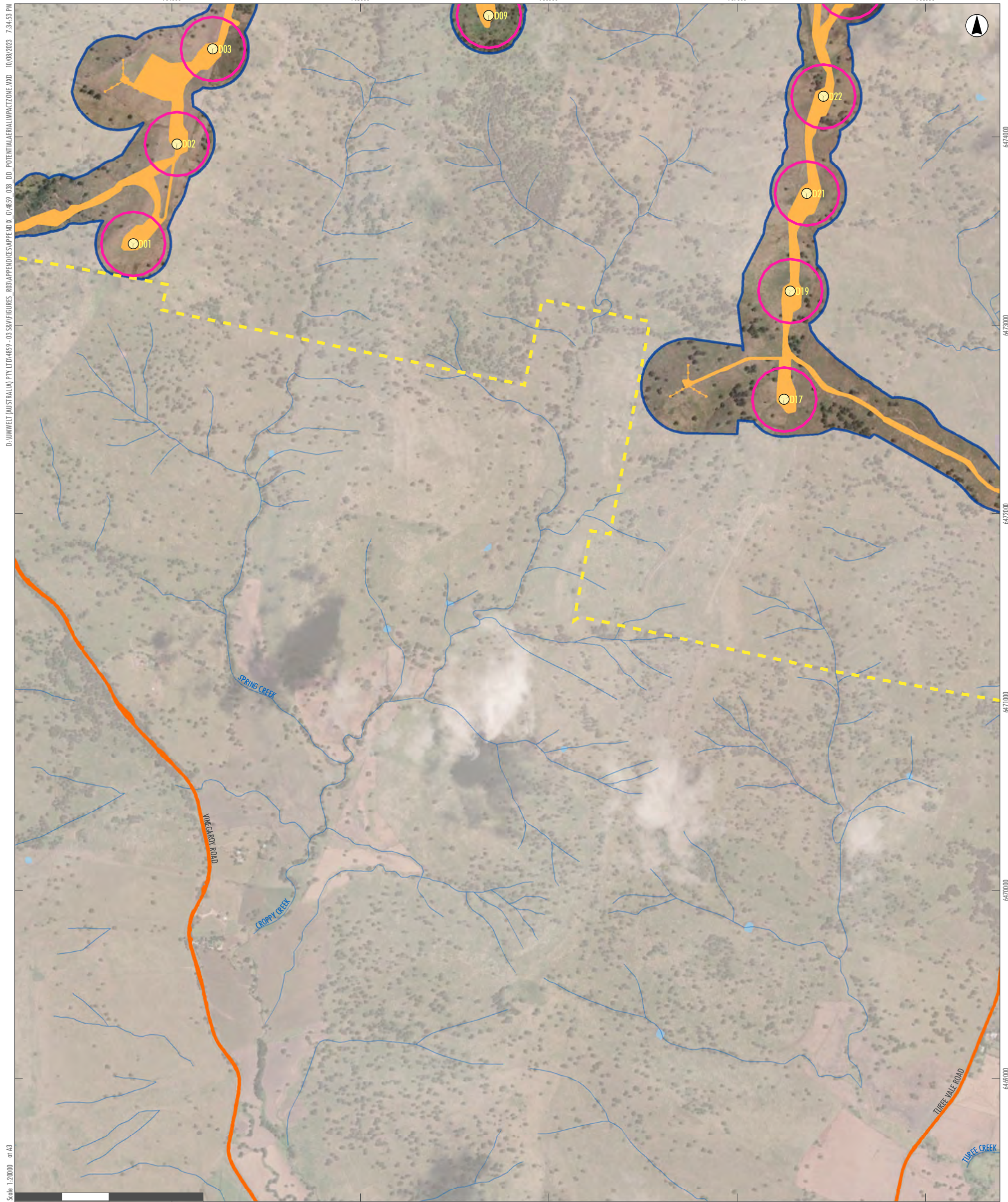
0 500 1,000 Metres

GDA2020 MGA Zone 55

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – Public Road Upgrades
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - D1
Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)



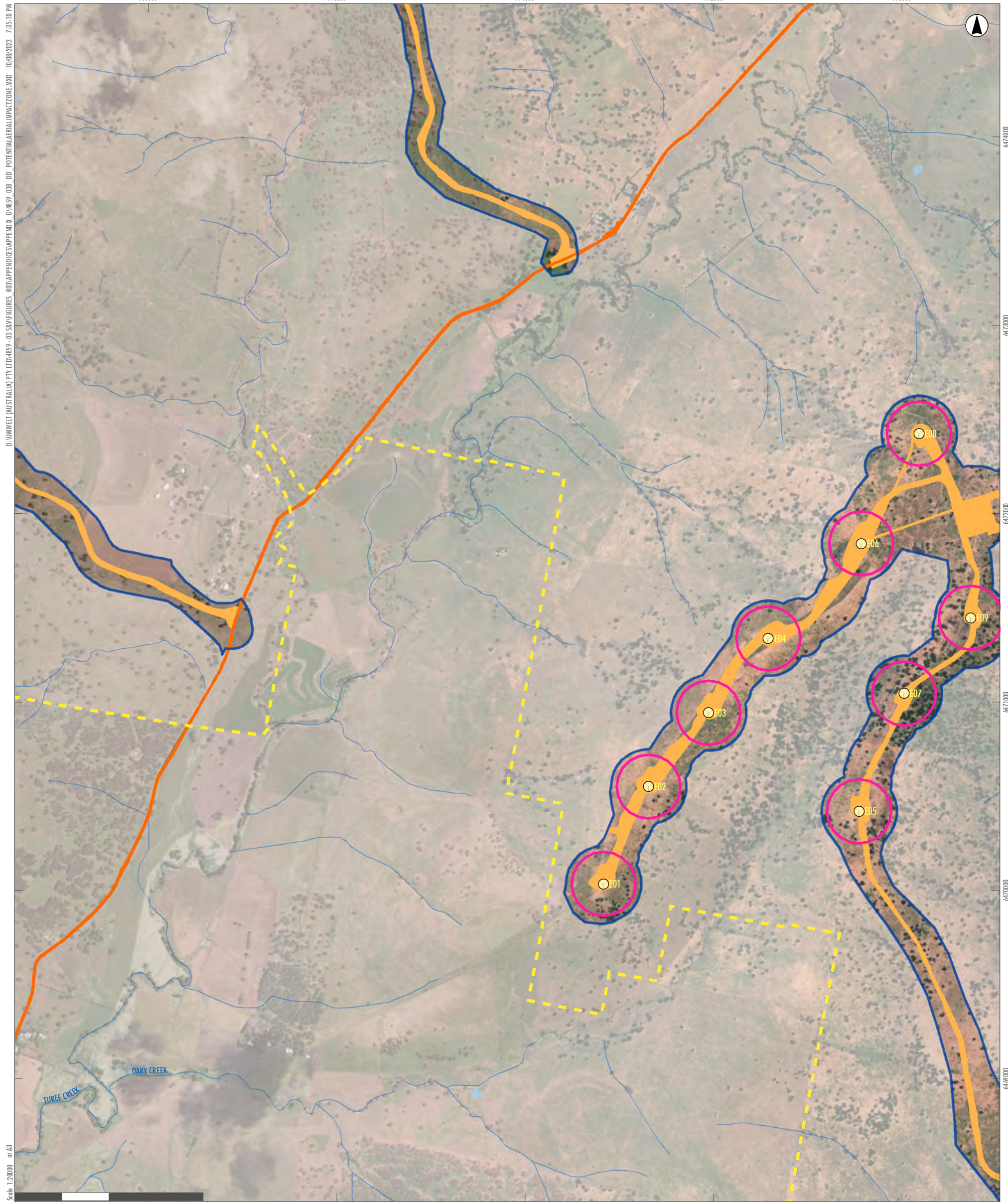
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 Scale: 1:20000 at A3

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - D2

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**

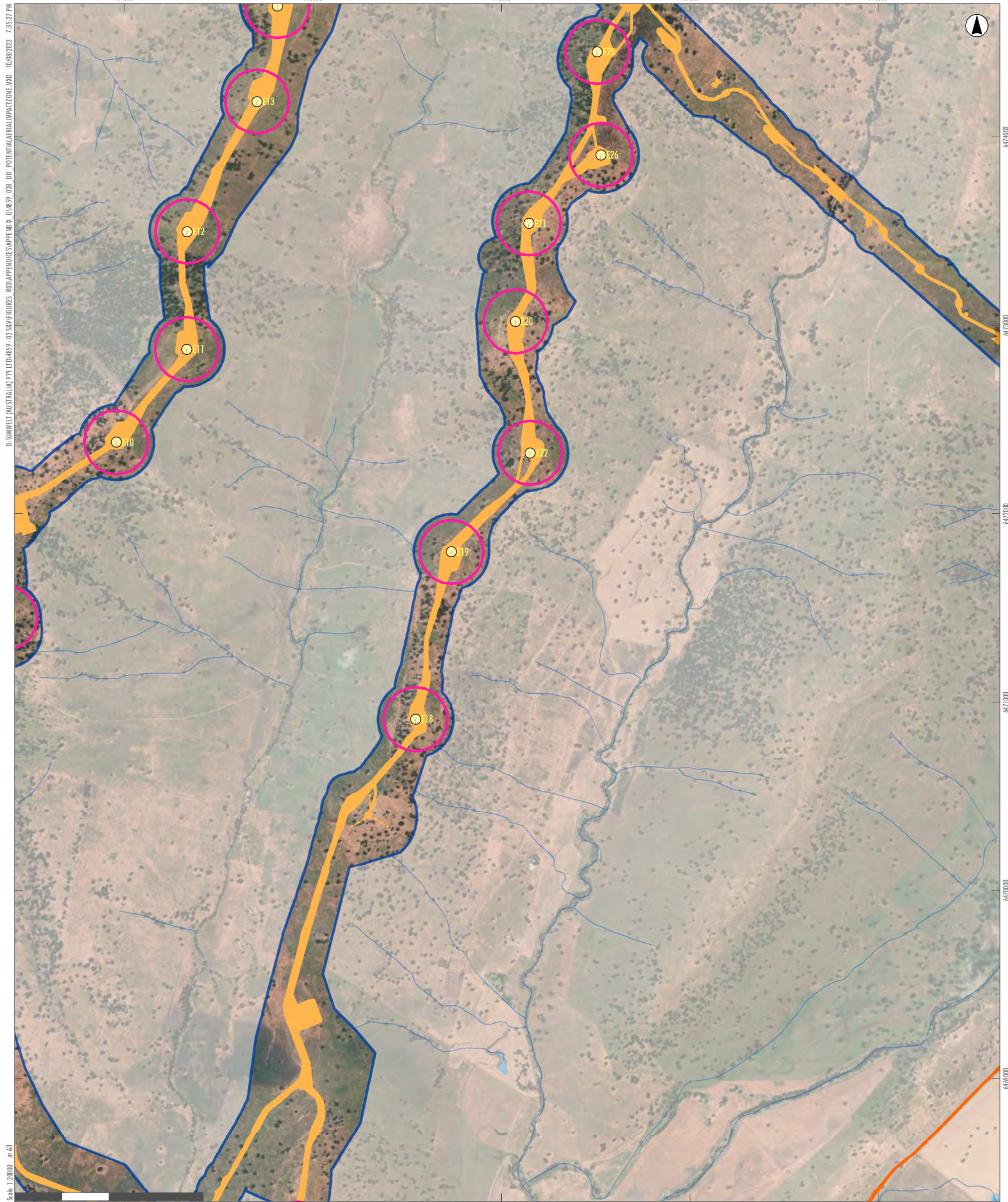


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- Legend**
- RTS Project Site
 - RTS Development Corridor - Wind Farm
 - RTS Indicative Development Footprint - Wind Farm
 - RTS Indicative Development Footprint - Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - D3
Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)



- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - D4
**Liverpool Range Wind Farm
 Potential Aerial Impact Zone
 (170 metre turbine buffers)**



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Scale: 1:20000 at A3

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - D5
Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)



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- Legend**
- RTS Project Site
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - D6

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



D:\UMWELT (AUSTRALIA) PTY LTD\859 - 03 58\FIGURES_R03\APPENDICES\APPENDIX_G1\859_038_DD_POTENTIALAERIALIMPACTZONE.MXD 10/08/2023 7:36:13 PM

Scale: 1:20000 at A3

GDA2020 MGA Zone 55

- Legend**
- RTS Indicative Development Footprint – Public Road Upgrades
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - E2

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



Legend

- - - RTS Project Site
- ▭ RTS Development Corridor – Wind Farm
- ▭ RTS Indicative Development Footprint – Wind Farm
- ▭ RTS Indicative Development Footprint – Public Road Upgrades
- Drainage Line
- ▭ Water Body
- Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - E3

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



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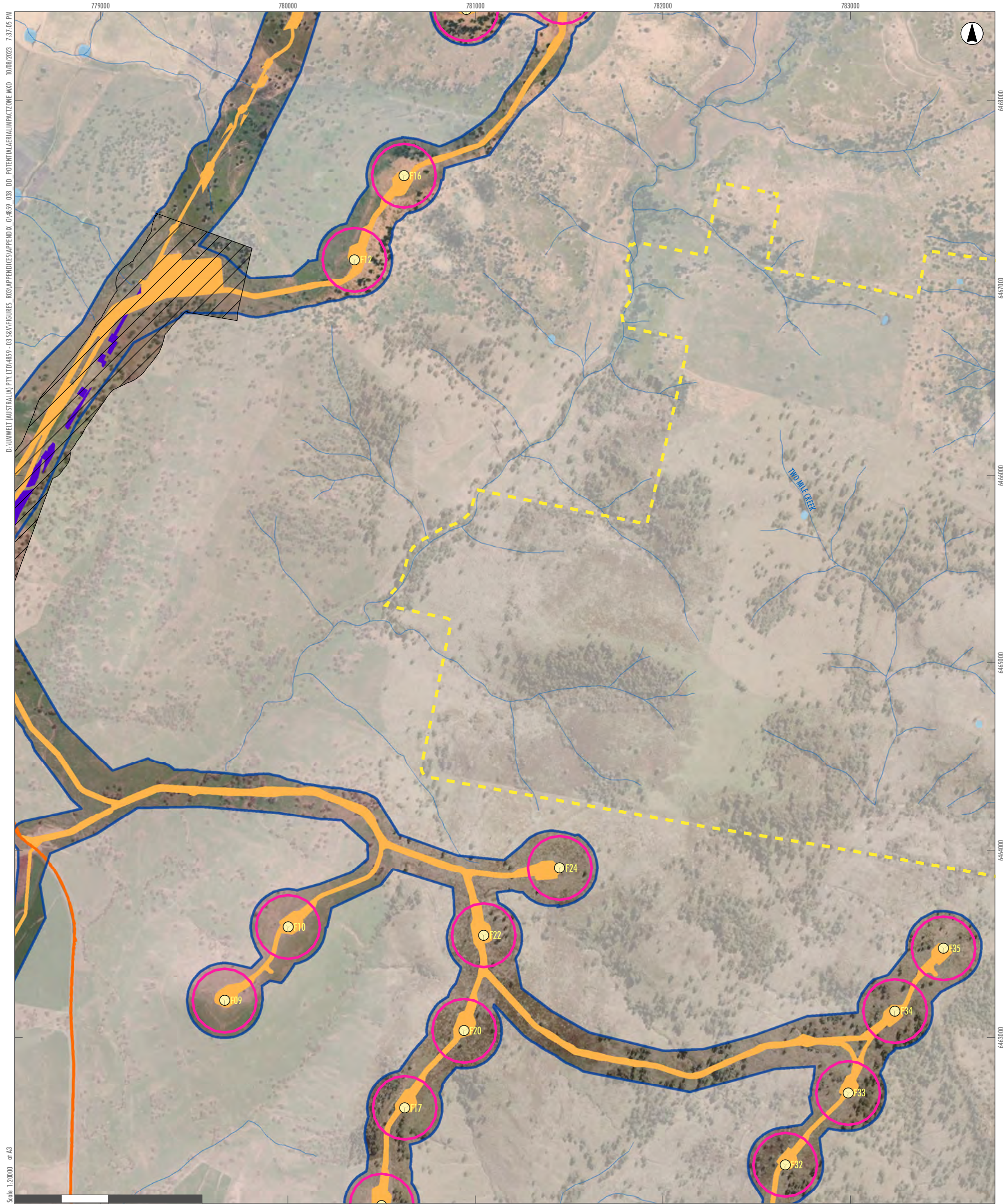
GDA2020 MGA Zone 55

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Development Corridor – External Transmission Line
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – External Transmission Line
 - RTS Indicative Development Footprint – Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - E4

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



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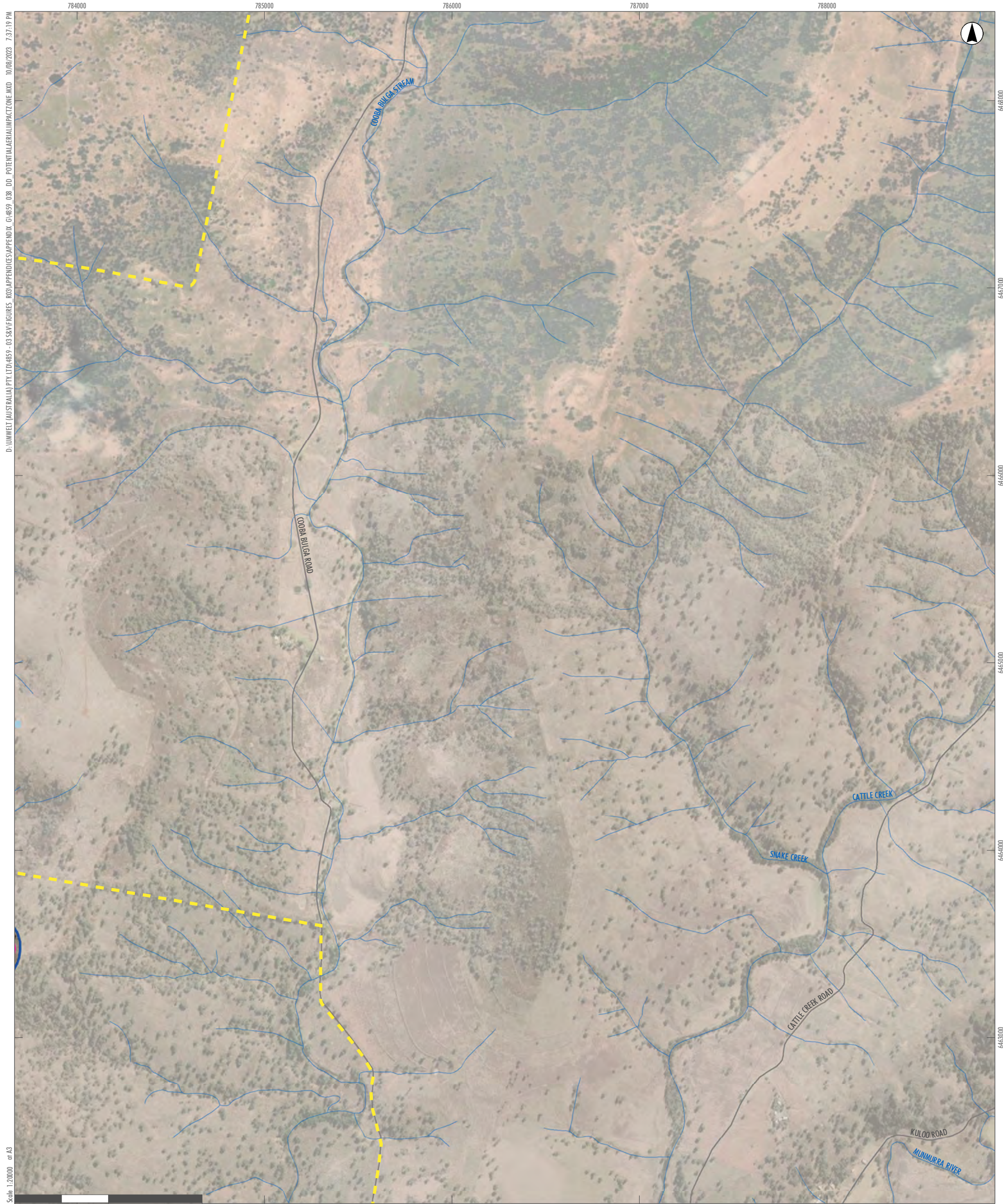
Scale: 1:20000 at A3

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Development Corridor – External Transmission Line
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – External Transmission Line
 - RTS Indicative Development Footprint – Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - E5

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



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 Scale: 1:20000 at A3

GDA2020 MGA Zone 55

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	F6
	F3	F4	F5	F6	
	G3	G4	G5		
	H2	H3	H4		
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - E6

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



D:\UMWELT (AUSTRALIA) PTY LTD\4859 - 03 58\FIGURES_R03\APPENDICES\APPENDIX_G14859_03B_DD_POTENTIALAERIALIMPACTZONE.MXD 10/08/2023 7:37:35 PM

Scale: 1:20,000 at A3

0 500 1,000 Metres

GDA2020 MGA Zone 55

- Legend**
- RTS Indicative Development Footprint – Public Road Upgrades
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - F3

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



D:\UMWELT (AUSTRALIA) PTY LTD\4859 - 03 58\FIGURES_R03\APPENDICES\APPENDIX_G14859_03B_DD_POTENTIALAERIALIMPACTZONE.MXD 10/08/2023 7:37:51 PM

Scale: 1:20000 at A3

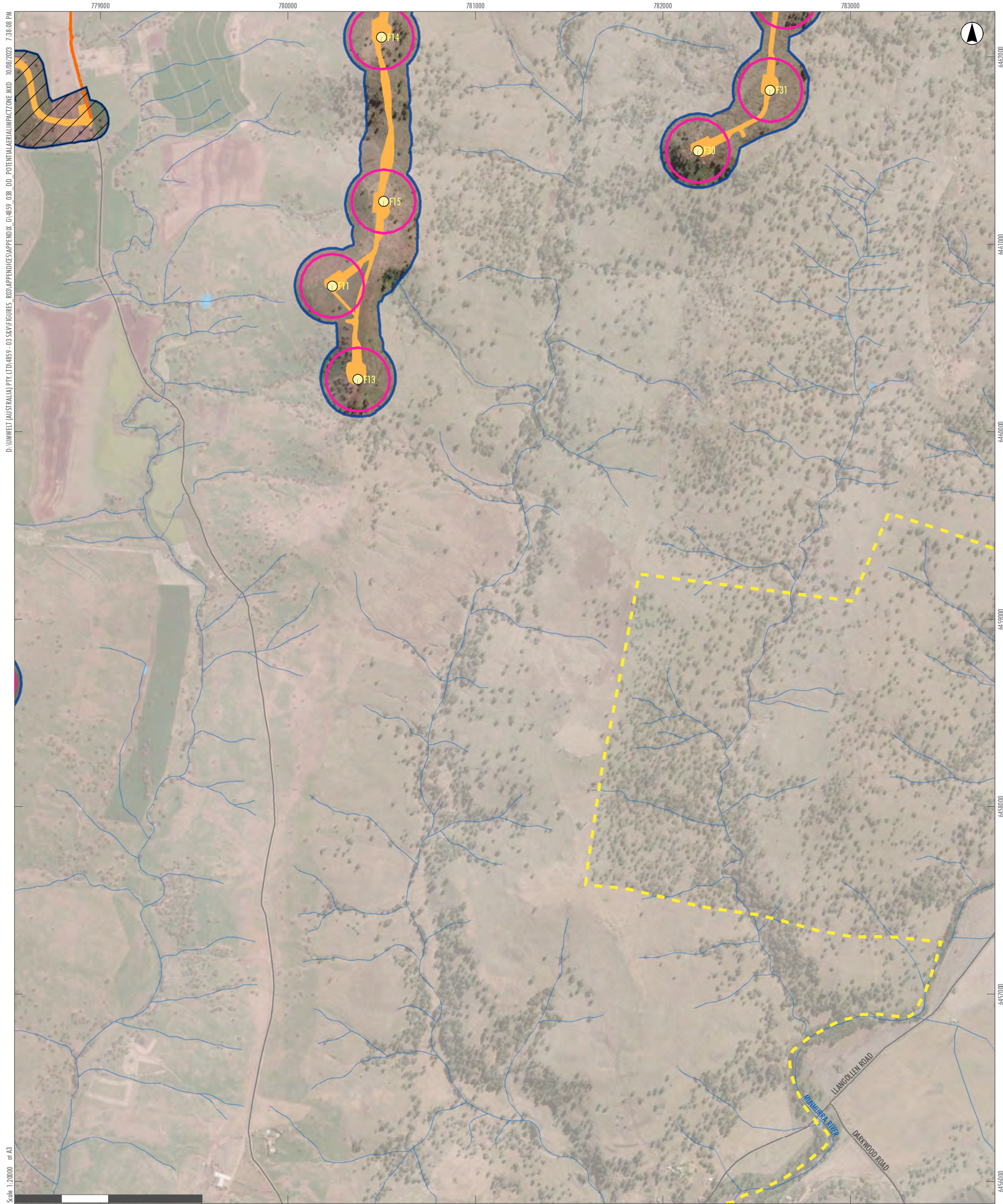
GDA2020 MGA Zone 55

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Development Corridor – External Transmission Line
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – External Transmission Line
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - F4

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



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Scale: 1:20000 at A3

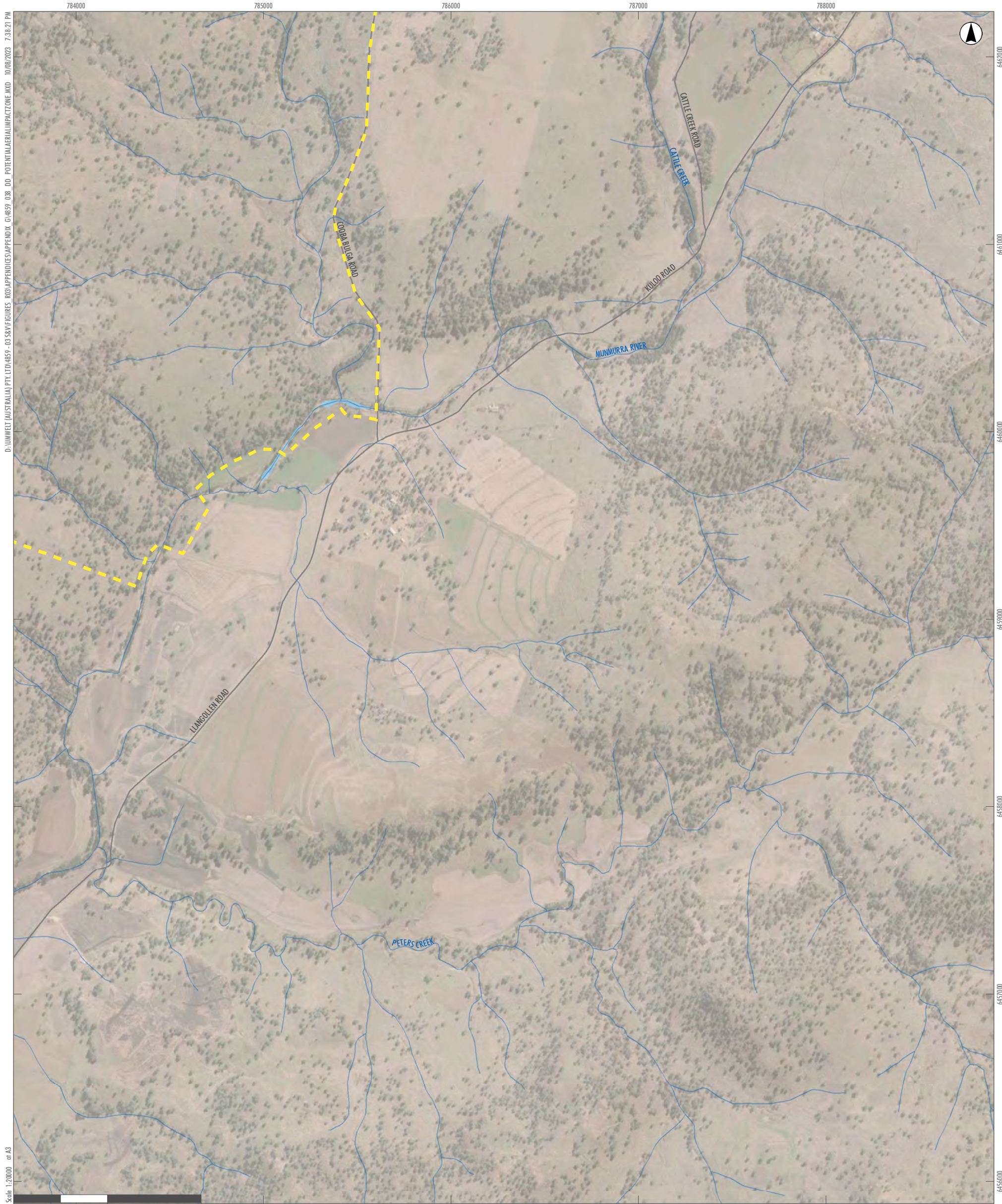
GDA2020 MGA Zone 55

- Legend**
- RTS Project Site
 - RTS Development Corridor – Wind Farm
 - RTS Development Corridor – External Transmission Line
 - RTS Indicative Development Footprint – Wind Farm
 - RTS Indicative Development Footprint – Public Road Upgrades
 - RTS Wind Turbines
 - Potential Aerial Impact Zone (170m radius)
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - F5

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



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Scale: 1:20000 at A3

- Legend**
- ▬ RTS Project Site
 - ▬ Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - F6

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



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Scale: 1:20000 at A3

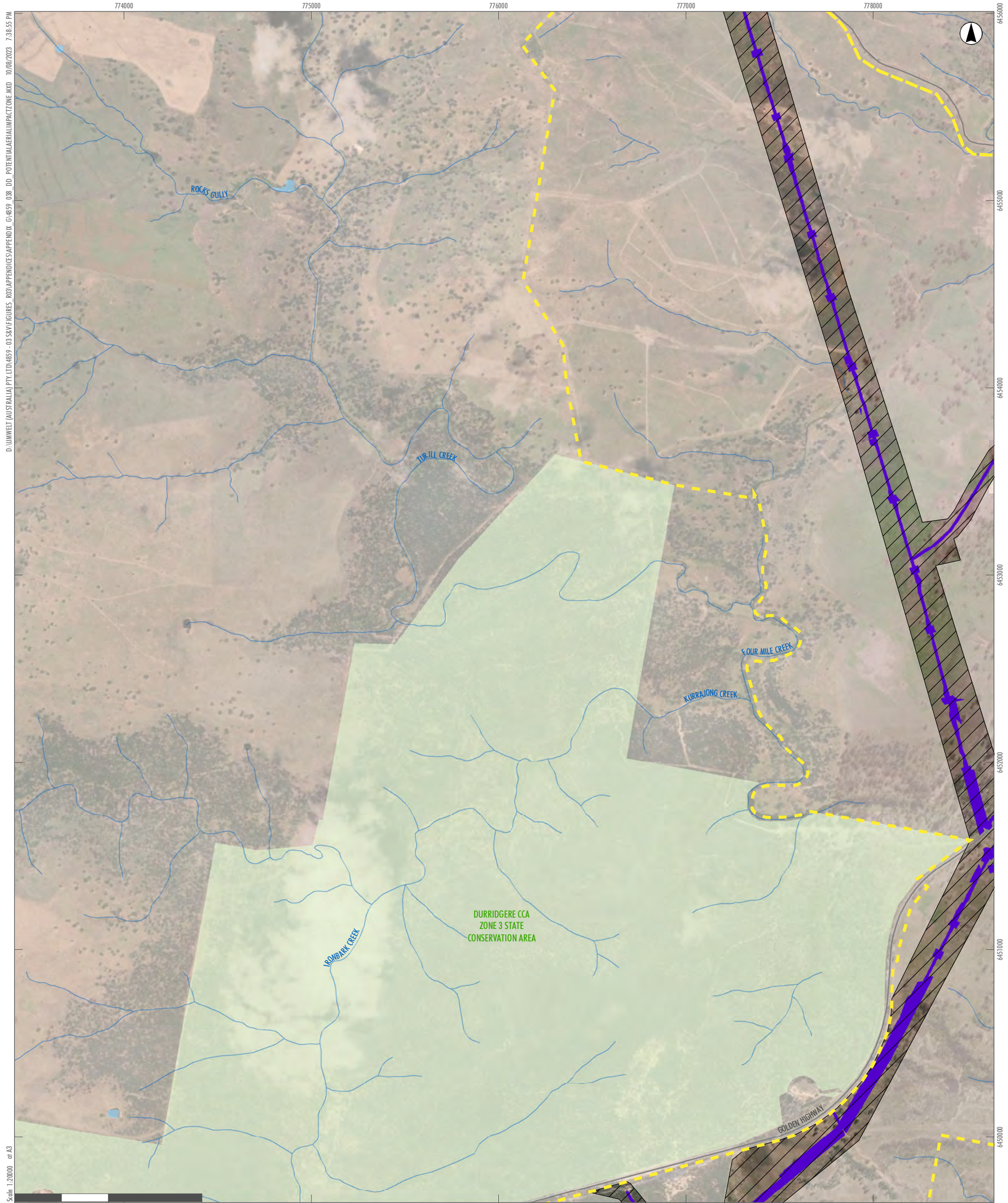
GDA2020 MGA Zone 55

- Legend**
- RTS Indicative Development Footprint – Public Road Upgrades
 - Drainage Line
 - Water Body
 - Roads
 - National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - G3

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



D:\UMWELT (AUSTRALIA) PTY LTD\4859 - 03 58\FIGURES_R03\APPENDICES\APPENDIX_G4\859_038_DD_POTENTIALAERIALIMPACTZONE.MXD, 10/08/2023 7:39:55 PM
 Scale: 1:20000 at A3

- Legend**
- RTS Project Site
 - RTS Development Corridor – External Transmission Line
 - RTS Indicative Development Footprint – External Transmission Line
 - Drainage Line
 - Water Body
 - Roads
 - National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - G4
Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)



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Scale: 1:20000 at A3

GDA2020 MGA Zone 55

Legend

- RTS Project Site
- RTS Development Corridor – External Transmission Line
- RTS Indicative Development Footprint – External Transmission Line
- Drainage Line
- Water Body
- Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - G5

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**

D:\UMWELT (AUSTRALIA) PTY LTD\4859 - 03 58\FIGURES_R03\APPENDICES\APPENDIX_G14859_038_DD_POTENTIALAERIALIMPACTZONE.MXD 10/08/2023 7:39:27 PM

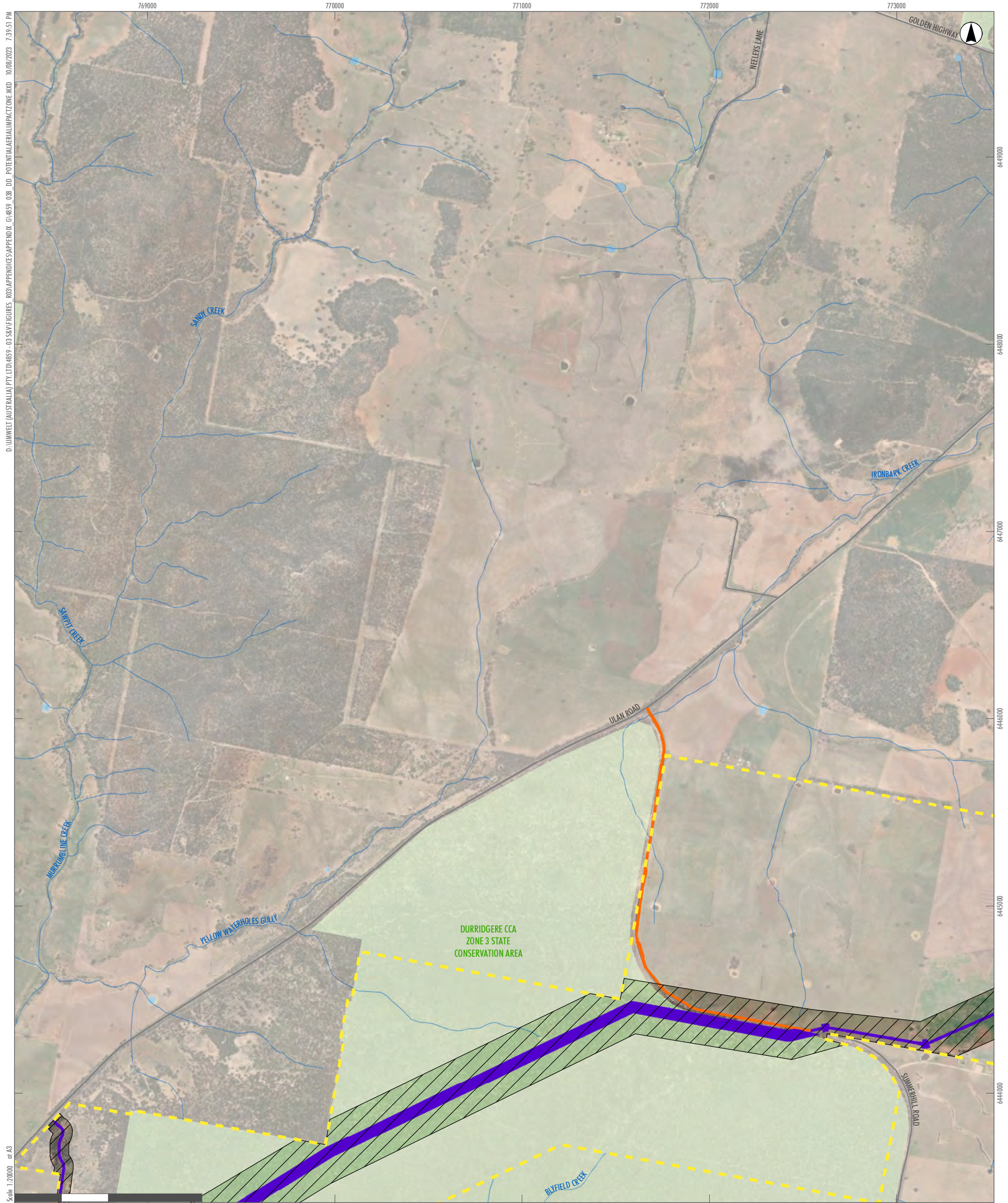


- Legend**
- RTS Project Site
 - Drainage Line
 - Water Body
 - Roads
 - National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - H2

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



D:\UMWELT (AUSTRALIA) PTY LTD\859-03\S&M\FIGURES_R03\APPENDICES\APPENDIX_G1\859_03B_DD_POTENTIALAERIALIMPACTZONE.MXD 10/08/2023 7:39:51 PM

Scale: 1:20000 at A3

GDA2020 MGA Zone 55

- Legend**
- RTS Project Site
 - RTS Development Corridor – External Transmission Line
 - RTS Indicative Development Footprint – External Transmission Line
 - RTS Indicative Development Footprint – Public Road Upgrades
 - Drainage Line
 - Water Body
 - Roads
 - National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - H3

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



D:\UMWELT (AUSTRALIA) PTY LTD\859 - 03 58\FIGURES_R03\APPENDICES\APPENDIX_G1\859_038_DD_POTENTIALAERIALIMPACTZONE.MXD 10/08/2023 7:40:37 PM
 Scale: 1:20000 at A3

- Legend**
- RTS Project Site
 - RTS Development Corridor - External Transmission Line
 - RTS Indicative Development Footprint - External Transmission Line
 - Drainage Line
 - Water Body
 - Roads
 - National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - H4
**Liverpool Range Wind Farm
 Potential Aerial Impact Zone
 (170 metre turbine buffers)**



D:\UMWELT (AUSTRALIA) PTY LTD\4859-03\S&M\FIGURES_R03\APPENDICES\APPENDIX_G1\4859_03B_DD_POTENTIALAERIALIMPACTZONE.MXD 10/08/2023 7:40:52 PM

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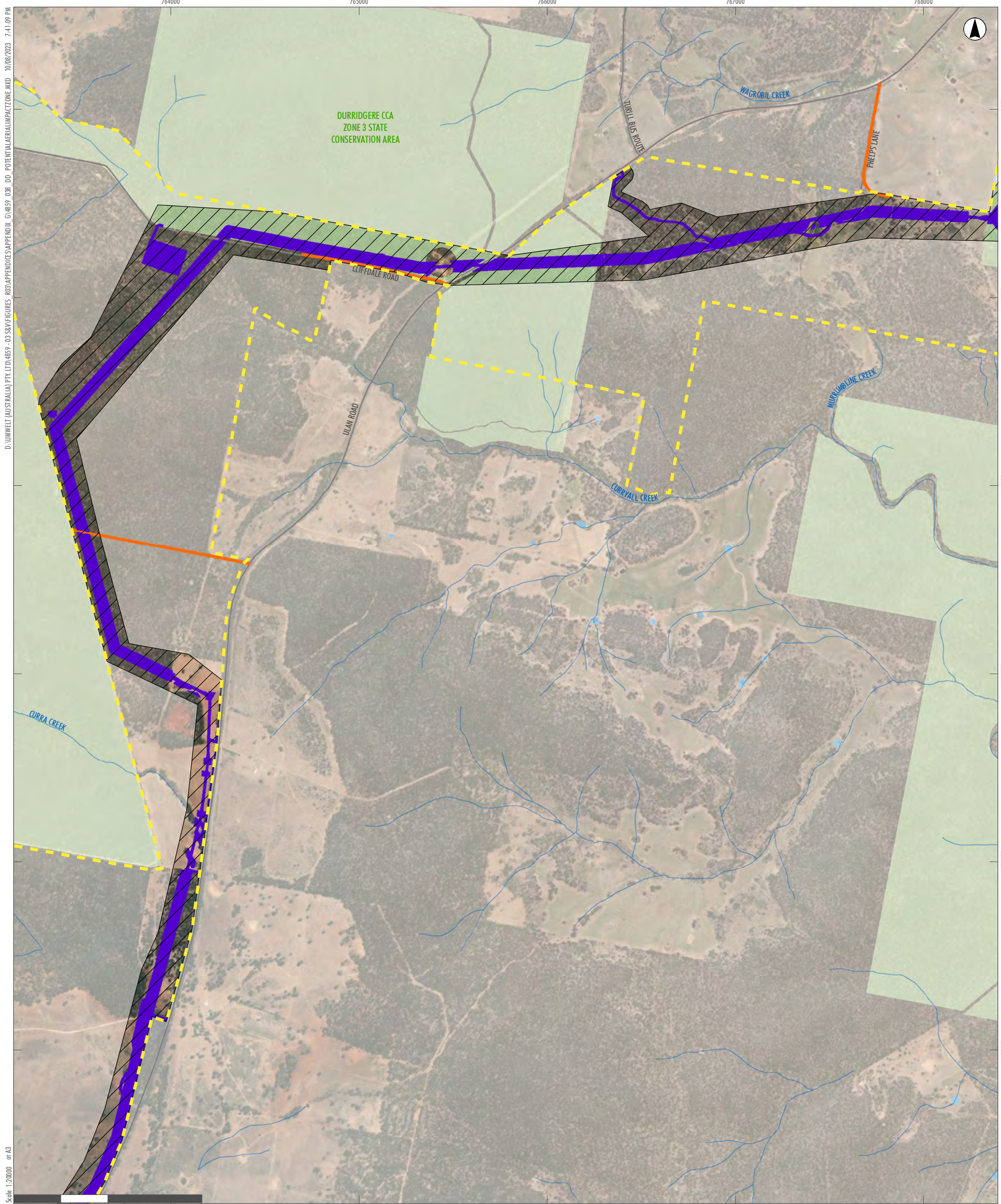
GDA2020 MGA Zone 55

- Legend**
- RTS Project Site
 - Drainage Line
 - Water Body
 - Roads
 - National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - I1

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



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 Scale: 1:20000 at A3

- Legend**
- RTS Project Site
 - RTS Development Corridor – External Transmission Line
 - RTS Indicative Development Footprint – External Transmission Line
 - RTS Indicative Development Footprint – Public Road Upgrades
 - Drainage Line
 - Water Body
 - Roads
 - National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - I2

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



D:\UMWELT (AUSTRALIA) PTY LTD\859 - 03 58\FIGURES_R03\APPENDICES\APPENDIX_G1\859_038_DD_POTENTIALAERIALIMPACTZONE.MXD 10/08/2023 7:41:25 PM

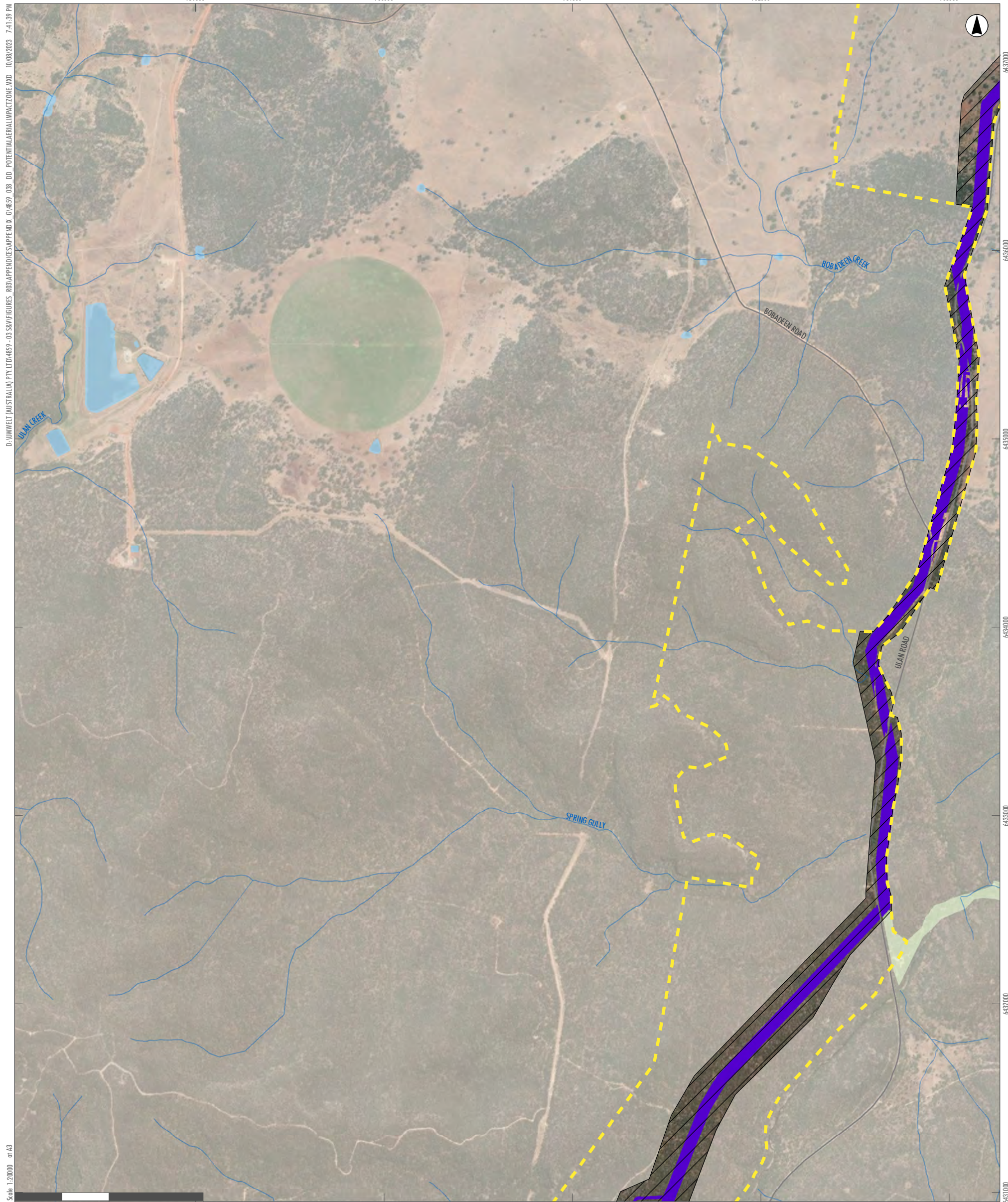
Scale: 1:20000 at A3

- Legend**
- RTS Project Site
 - RTS Development Corridor - External Transmission Line
 - RTS Indicative Development Footprint - External Transmission Line
 - Drainage Line
 - Water Body
 - Roads
 - National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - I3

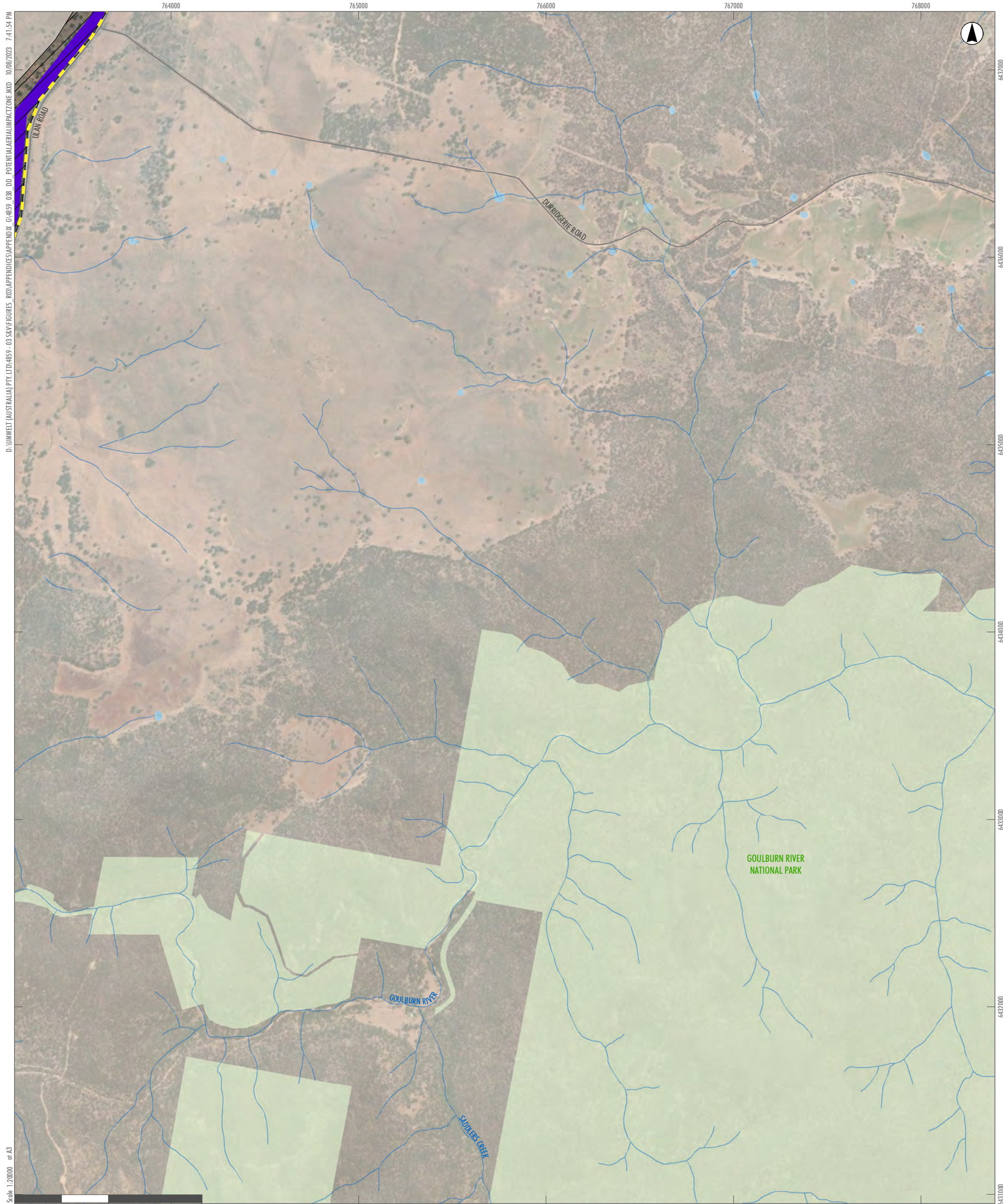
**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



- Legend**
- RTS Project Site
 - RTS Development Corridor – External Transmission Line
 - RTS Indicative Development Footprint – External Transmission Line
 - Drainage Line
 - Water Body
 - Roads
 - National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - J1
**Liverpool Range Wind Farm
 Potential Aerial Impact Zone
 (170 metre turbine buffers)**



D:\UMWELT (AUSTRALIA) PTY LTD\4859 - 03 58\FIGURES_R03\APPENDICES\APPENDIX_G14859_038_DD_POTENTIAL_AERIAL_IMPACT_ZONE_MXD_10/08/2023_7:41:54 PM

Scale: 1:20000 at A3

- Legend**
- RTS Project Site
 - RTS Development Corridor – External Transmission Line
 - RTS Indicative Development Footprint – External Transmission Line
 - Drainage Line
 - Water Body
 - Roads
 - National Parks (NPWS Estate)

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - J2

**Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)**



- Legend**
- RTS Project Site
 - RTS Development Corridor – External Transmission Line
 - RTS Indicative Development Footprint – External Transmission Line
 - Drainage Line
 - Water Body
 - Roads

A2	A3	A4	A5		
B2	B3	B4	B5		
C1	C2	C3	C4	C5	
D1	D2	D3	D4	D5	D6
E2	E3	E4	E5	E6	
F3	F4	F5	F6		
G3	G4	G5			
H2	H3	H4			
I1	I2	I3			
J1	J2				
K1					

APPENDIX 11.1 - K1

Liverpool Range Wind Farm
Potential Aerial Impact Zone
(170 metre turbine buffers)



APPENDIX 2

Bat Call Identification – Coolah, NSW (EchoEcology and Surveying)



ECHO
ECOLOGY AND
SURVEYING

Bat Call Identification

Coolah, NSW

Prepared for
Umwelt (Australia) Pty Ltd
75 York Street
Teralba, NSW 2284

Job Reference BC_UMW87 – February 2021

This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by



Dr Anna McConville

PhD, B.Env.Sc.

Contents

1.0	Introduction	1
2.0	Methods	1
2.1	Call Identification.....	1
2.2	Log file review	2
2.3	Limitations.....	2
3.0	Results.....	3
3.1	Log file review	4
4.0	Sample Calls	7
5.0	References	9

Appendix A Species Identification Confidence and Characteristics – Western Plains

Appendix B Log File Review

List of Tables

Table 3-1: Results of bat call analysis (number of passes per site per night) 5

List of Figures

Figure 4-1: *Austronomus australis* definite call..... 7

Figure 4-2: *Chalinolobus gouldii* definite call

Figure 4-3: *Chalinolobus morio* definite call..... 7

Figure 4-4: *Chalinolobus picatus* probable call..... 8

Figure 4-5: <i>Ozimops planiceps</i> definite call	8
Figure 4-6: <i>Saccolaimus flaviventris</i> probable call.....	8
Figure 4-7: <i>Vespadelus vulturnus</i> definite call	9

1.0 INTRODUCTION

This report has been commissioned by Umwelt (Australia) Pty Ltd to analyse bat echolocation call data collected from Coolah, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

2.1 Call Identification

The identification of bat echolocation calls recorded during surveys was undertaken using Anabat Insight (Titley Electronics, Version 1.9.7) software. Files from Anabat Express units (.zca) were first converted to .zc and a noise filter was applied (EE_Allbats.als). The identification of calls was undertaken with reference to Pennay et al. (2004) and through the comparison of recorded reference calls from the western plains. Reference calls were obtained from the NSW database and from the authors personal collection.

A list of potentially occurring echolocating bat species for the region (approximately 50 – 100 km radius) was obtained from the NSW Office of Environment and Heritage's Bionet Atlas, which holds data from a number of custodians (<http://www.bionet.nsw.gov.au>) and was used to constrain the identification of bat calls.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality

- Unknown - Either background 'noise' files or passes by bats which are too short and/or of poor quality to confidently identify.

Call sequences that were less than three pulses in length were not analysed and were assigned to 'Unknown' and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

Nomenclature follows the Australian Faunal Directory (<https://biodiversity.org.au/afd>; downloaded 15 June 2020).

The echolocation call characteristics used to differentiate species for the region and the identification potential for each species are described in Appendix A.

2.2 Log file review

We reviewed the log files for each night of recording and have summarised the detector settings, recording duration and any errors. This may be used to confirm survey effort, the use of correct detector settings and may help diagnose missing data.

2.3 Limitations

The identification of bat species from echolocation calls in many Australian regions is not straightforward. Our reference call libraries tend to be relatively small, some species vary their call frequency with region and bat behaviour may also influence call shapes and frequencies. Additional factors may add to the level of uncertainty of species identification from echolocation calls such as short call sequences, high levels of noise and missing echolocation pulses. Some species share overlapping echolocation call characteristics and some overlap so much that we are unable to differentiate between species with our current knowledge.

To assist with the interpretation of our results within this context of uncertainty, we provide a qualitative indication of the confidence of bat call identification by assigning confidence levels (Definite, Probable, Possible and Species Groups). We have also provided a list of the general identification potential for each species potentially occurring within your sample region (Appendix A). For a more complete species inventory, bat call recording should be combined with other survey methods such as trapping.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Activity levels should not be compared among species as different species have different detectability due to factors such as call loudness, foraging strategy and call identifying features. Activity comparisons among sites are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

The bat call identification results presented in this report should be interpreted with these limitations in mind and in many cases trapping and habitat assessment should also be undertaken in conjunction with bat call recording.

3.0 RESULTS

Calls were recorded in zero crossings format using Anabat Express bat detectors (Titley Scientific).

A total of 773 call sequences were recorded, of which 190 call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, 126 call sequences (66 %) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 3-1). Species recorded confidently within the site include:

- *Austronomus australis* (White-striped Free-tailed Bat)
- *Chalinolobus gouldii* (Gould's Wattled Bat)
- *Chalinolobus morio* (Chocolate Wattled Bat)
- *Chalinolobus picatus* (Little Pied Bat)
- *Ozimops planiceps* (Southern Free-tailed Bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat)
- *Vespadelus vulturnus* (Little Forest Bat)

Additionally, the following bat species potentially occurred within the site, but could not be confidently identified (those calls classified as possible or as a species group):

- *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat)
- *Myotis macropus* (Large-footed Myotis)
- *Nyctophilus corbeni* (Corben's long-eared bat)
- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Scotorepens balstoni* (Inland Broad-nosed Bat)
- *Vespadelus darlingtoni* (Large Forest Bat)
- *Vespadelus troughtoni* (Eastern cave bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors (or are difficult to identify by bat call) and habitat assessment should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

Table 3-1 below summarises the results of the bat call analysis.

3.1 Log file review

The log file review indicated that detectors were set for entire nights and functioning correctly. Full details are provided in Appendix B.

Table 3-1: Results of bat call analysis (number of passes per site per night)

CONFIDENCE	IDENTIFICATION	ANA1 6/05/2020	ANA1 7/05/2020	ANA2 4/05/2020	ANA2 5/05/2020	ANA7 4/05/2020	ANA7 5/05/2020	ANA8 5/05/2020	BAT5 4/05/2020	BAT6 5/05/2020	BAT6 6/05/2020
DEFINITE	<i>Austronomus australis</i>	12	7	1	-	12	10	1	51	1	-
	<i>Chalinolobus gouldii</i>	-	-	-	-	1	1	-	-	-	-
	<i>Chalinolobus morio</i>	-	-	-	-	1	3	-	3	-	-
	<i>Ozimops planiceps</i>	-	-	-	-	-	1	-	-	-	-
	<i>Vespadelus vulturnus</i>	-	-	-	-	-	2	-	-	-	-
PROBABLE	<i>Austronomus australis</i>	-	1	-	-	2	-	2	3	1	-
	<i>Chalinolobus gouldii</i>	-	-	-	-	-	1	-	2	-	-
	<i>Chalinolobus picatus</i>	-	-	-	-	-	-	-	1	-	-
	<i>Ozimops planiceps</i>	-	-	-	-	-	3	-	-	-	-
	<i>Saccolaimus flaviventris</i>	-	-	-	-	-	-	-	-	1	-
	<i>Vespadelus vulturnus</i>	-	-	-	-	-	2	-	-	-	-
POSSIBLE	<i>Chalinolobus morio</i>	-	-	-	-	-	-	-	1	-	-
SPECIES GROUPS	<i>Chalinolobus gouldii</i> / <i>Ozimops planiceps</i>	3	3	-	-	2	6	-	1	1	-

CONFIDENCE	IDENTIFICATION	ANA1 6/05/2020	ANA1 7/05/2020	ANA2 4/05/2020	ANA2 5/05/2020	ANA7 4/05/2020	ANA7 5/05/2020	ANA8 5/05/2020	BAT5 4/05/2020	BAT6 5/05/2020	BAT6 6/05/2020
	<i>Chalinolobus gouldii</i> / <i>Ozimops planiceps</i> / <i>Scotorepens balstoni</i>	-	1	-	-	3	2	3	1	1	-
	<i>Chalinolobus gouldii</i> / <i>Scotorepens balstoni</i>	-	2	1	-	5	4	-	5	-	-
	<i>Chalinolobus morio</i> / <i>Vespadelus trougtoni</i>	-	-	-	-	-	-	-	3	-	-
	<i>Chalinolobus picatus</i> / <i>Miniopterus orianae oceanensis</i> / <i>Vespadelus darlingtoni</i> / <i>Vespadelus vulturnus</i>	-	-	-	-	-	-	-	-	1	-
	<i>Chalinolobus picatus</i> / <i>Vespadelus darlingtoni</i>	-	-	-	-	-	1	-	-	-	-
	<i>Chalinolobus picatus</i> / <i>Vespadelus darlingtoni</i> / <i>Vespadelus vulturnus</i>	-	-	-	-	-	1	-	-	-	-
	<i>Miniopterus orianae oceanensis</i> / <i>Vespadelus vulturnus</i>	-	1	-	-	4	4	-	3	-	-
	<i>Myotis macropus</i> / <i>Nyctophilus corbeni</i> / <i>Nyctophilus geoffroyi</i> / <i>Nyctophilus gouldi</i>	-	-	-	-	1	-	-	-	-	-
UNKNOWN	Unknown	10	4	-	2	4	6	4	20	2	-
	'Noise' files	9	11	19	119	24	15	1	9	323	1
TOTAL		34	30	21	121	59	62	11	103	331	1

4.0 SAMPLE CALLS

A sample of the calls actually identified from the site for each species is given below.

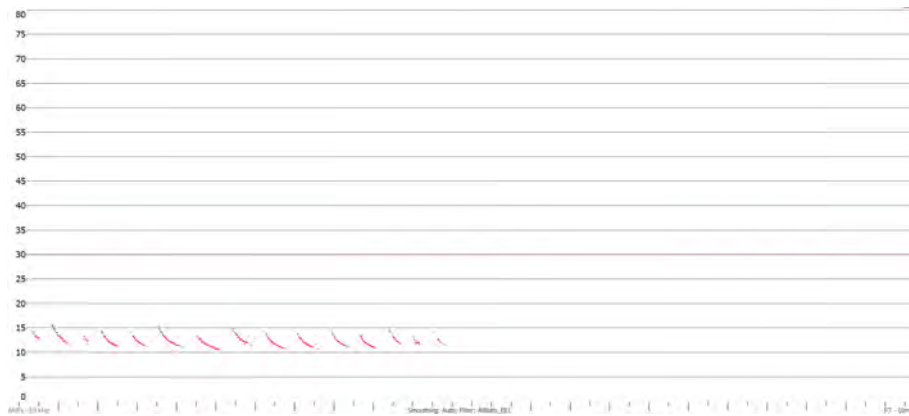


Figure 4-1: *Austronomus australis* definite call

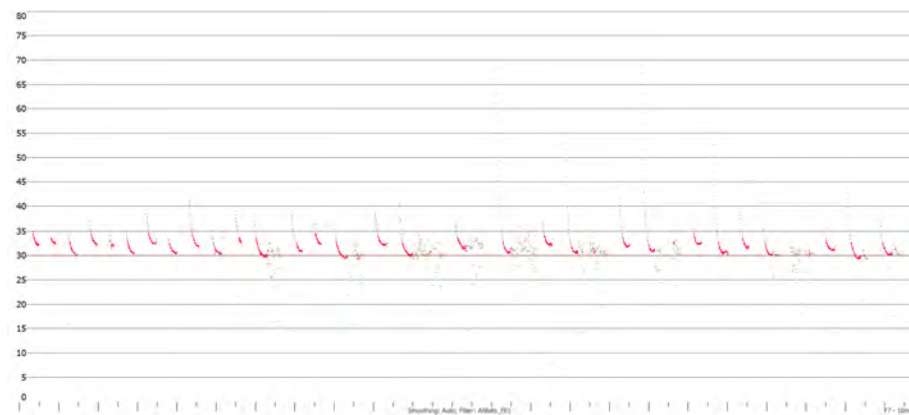


Figure 4-2: *Chalinolobus gouldii* definite call

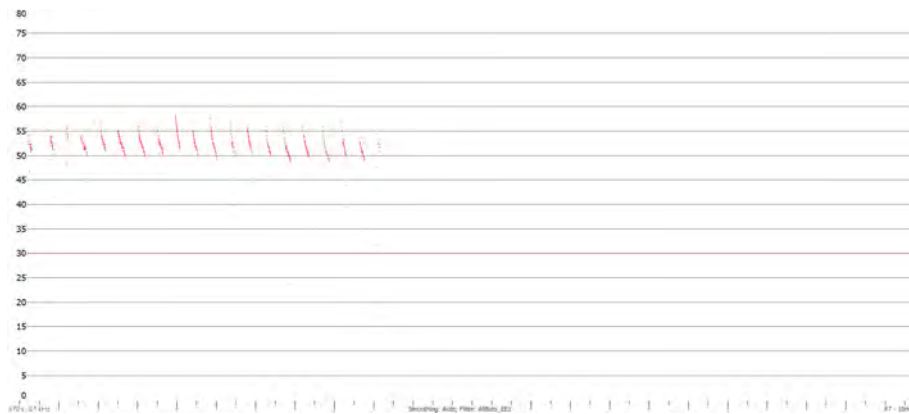


Figure 4-3: *Chalinolobus morio* definite call

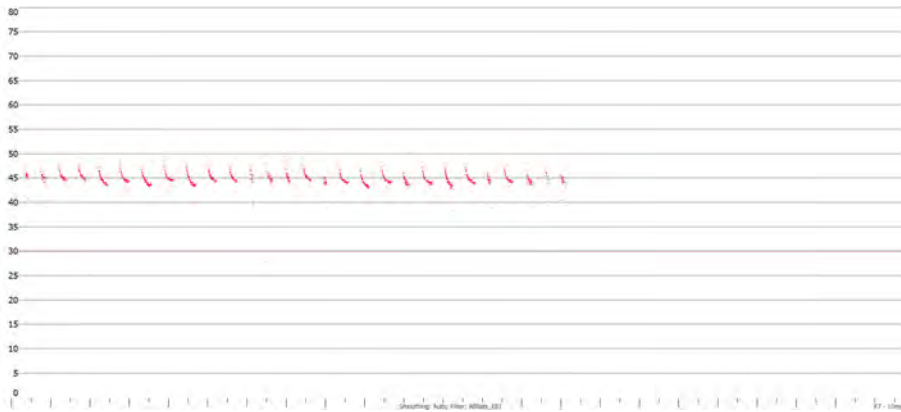


Figure 4-4: *Chalinolobus picatus* probable call

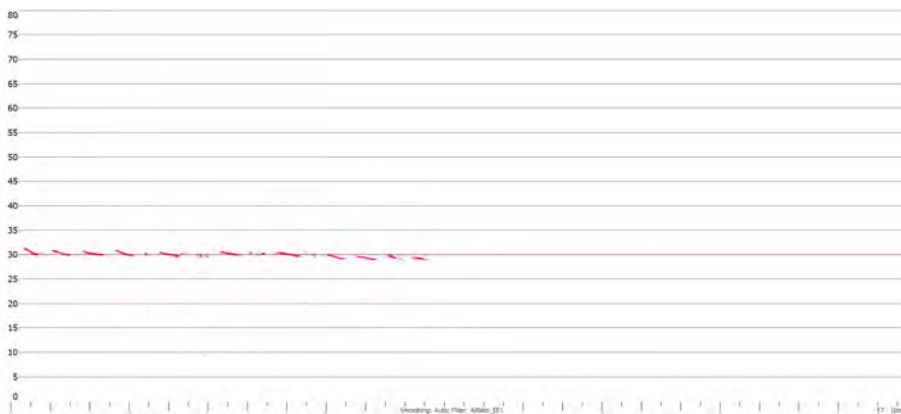


Figure 4-5: *Ozimops planiceps* definite call

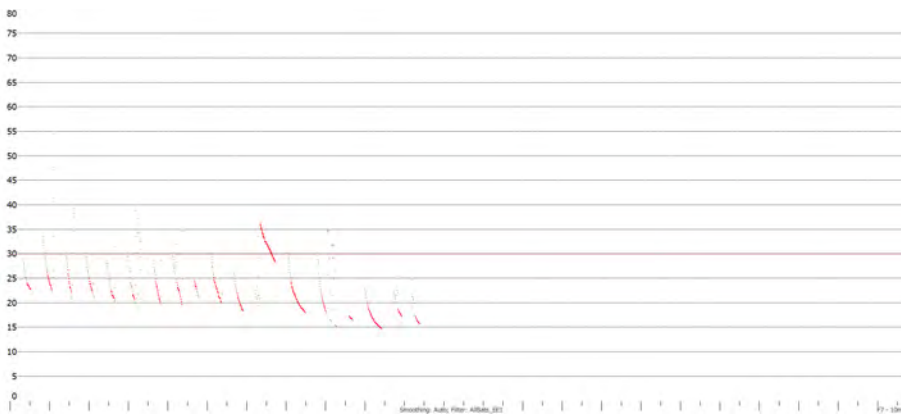


Figure 4-6: *Saccolaimus flaviventris* probable call

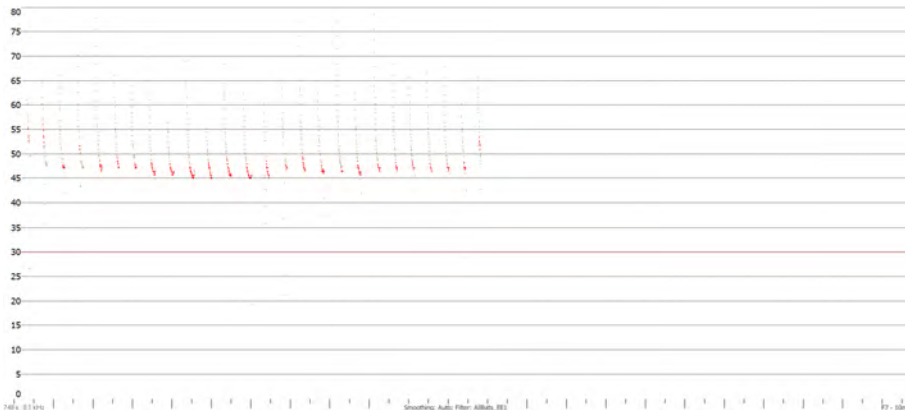


Figure 4-7: *Vespadelus vulturnus* definite call

5.0 REFERENCES

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APPENDIX A SPECIES IDENTIFICATION CONFIDENCE AND CHARACTERISTICS – WESTERN PLAINS

Table A1: Identification confidence and characteristics of bat echolocation calls from the western plains region (Coolah area)

Scientific Name	Common Name	Identification Potential	Identification characteristics
<i>Austronomus australis</i>	White-striped Free-tailed Bat	High	Good quality calls unlikely to be confused. However, partial calls may be confused with social calls of other bat species and insects.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	High	Calls may overlap with <i>Saccolaimus flaviventris</i> . However, good quality call sequences are unlikely to be confused due to small pulse shape and alternating pulses in <i>Chalinolobus dwyeri</i> .
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat	Mod - High	Overlaps with <i>Ozimops petersi</i> , <i>Ozimops planiceps</i> and <i>Scotorepens balstoni</i> . In good quality recordings, differentiated from <i>Ozimops</i> spp. by curved pulses and from <i>Scotorepens balstoni</i> by alternating pulse frequencies.
<i>Chalinolobus morio</i>	Chocolate Wattled Bat	Mod - High	Overlaps with <i>Vespadelus troughtoni</i> . Differentiated from <i>Vespadelus troughtoni</i> by the presence of down-sweeping tails on pulses and generally little doppler effect that is typically displayed by <i>Vespadelus</i> spp.
<i>Chalinolobus picatus</i>	Little Pied Bat	Mod	Overlaps with <i>Scotorepens greyii</i> at lower characteristic frequencies and with <i>Vespadelus vulturnus</i> at higher characteristic frequencies. Differentiated only where alternating pulse frequencies occur in good quality call sequences.

Scientific Name	Common Name	Identification Potential	Identification characteristics
<i>Myotis macropus</i>	Large-footed Myotis	Low - Mod	Overlaps in call features with <i>Nyctophilus</i> spp. Differentiated from <i>Nyctophilus</i> spp. in good quality call sequences with pulse intervals < 75 ms, initial slope > 400 OPS and often with a central kink and varying slopes among pulses.
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	Low	Overlaps in call features with <i>Nyctophilus geoffroyi</i> , <i>Nyctophilus gouldi</i> and <i>Myotis macropus</i> . Differentiated from <i>Myotis macropus</i> by pulse intervals > 95 ms and an initial slope of < 300 OPS. However, <i>Nyctophilus corbeni</i> , <i>Nyctophilus geoffroyi</i> and <i>Nyctophilus gouldi</i> are unable to be differentiated from each other.
<i>Nyctophilus geoffroyi</i>	Lesser long-eared bat	Low	Overlaps in call features with <i>Nyctophilus corbeni</i> , <i>Nyctophilus gouldi</i> and <i>Myotis macropus</i> . Differentiated from <i>Myotis macropus</i> by pulse intervals > 95 ms and an initial slope of < 300 OPS. However, <i>Nyctophilus corbeni</i> , <i>Nyctophilus geoffroyi</i> and <i>Nyctophilus gouldi</i> are unable to be differentiated from each other.
<i>Nyctophilus gouldi</i>	Gould's long-eared bat	Low	Overlaps in call features with <i>Nyctophilus geoffroyi</i> , <i>Nyctophilus corbeni</i> and <i>Myotis macropus</i> . Differentiated from <i>Myotis macropus</i> by pulse intervals > 95 ms and an initial slope of < 300 OPS. However, <i>Nyctophilus corbeni</i> , <i>Nyctophilus geoffroyi</i> and <i>Nyctophilus gouldi</i> are unable to be differentiated from each other.
<i>Ozimops petersi</i>	Inland Free-tailed Bat	Mod	Overlaps with in characteristic frequency with <i>Chalinolobus gouldii</i> and <i>Scotorepens balstoni</i> . Differentiated from <i>Chalinolobus gouldii</i> and <i>Scotorepens balstoni</i> in long call sequences with mostly flat pulse shapes.
<i>Ozimops planiceps</i>	Southern Free-tailed Bat	Mod	Overlaps in characteristic frequency with <i>Chalinolobus gouldii</i> and <i>Scotorepens balstoni</i> . Differentiated from <i>Chalinolobus gouldii</i> and <i>Scotorepens balstoni</i> in long call sequences with mostly flat pulse shapes.
<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat	High	Long duration, flat calls at characteristic frequency of 66 – 70kHz, unlikely to be confused with any other species.

Scientific Name	Common Name	Identification Potential	Identification characteristics
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat	Mod - High	Calls may overlap with <i>Chalinolobus dwyeri</i> . However, good quality call sequences are unlikely to be confused due to <i>Chalinolobus dwyeri</i> having small pulse shape and alternating pulses. The harmonics of <i>Saccolaimus flaviventris</i> assist identification in full spectrum (.WAV) recordings. The characteristic frequency of the fundamental (first harmonic) is 10-12 kHz, the second (loudest harmonic) is 20-25kHz and the third harmonic 30-35kHz.
<i>Scotorepens balstoni</i>	Inland Broad-nosed Bat	Low - Mod	Overlaps in characteristic frequency with <i>Ozimops petersi</i> , <i>Ozimops planiceps</i> and <i>Chalinolobus gouldii</i> . Differentiated from <i>Ozimops</i> spp. in long call sequences by the presence of mostly curved pulse shapes. Differentiated from <i>Chalinolobus gouldii</i> only in long call sequences with no alternating pulse frequencies.
<i>Scotorepens greyii</i>	Little Broad-nosed Bat	Mod - High	Overlaps in characteristic frequency with <i>Chalinolobus picatus</i> at higher frequencies. Differentiated from <i>Chalinolobus picatus</i> in long call sequences with no pulse alternation.
<i>Vespadelus trouhntoni</i>	Eastern cave bat	Mod - High	Overlaps in characteristic frequency with <i>Chalinolobus morio</i> . Differentiated from <i>Chalinolobus morio</i> at higher characteristic frequencies or in long call sequences with few down-sweeping tails on pulses and displaying the doppler effect that is typically displayed by <i>Vespadelus</i> spp.
<i>Vespadelus vulturnus</i>	Little Forest Bat	Mod	Overlaps in characteristic frequency with <i>Chalinolobus picatus</i> . Differentiated from <i>Chalinolobus picatus</i> by a lack of alternating pulse frequency and the doppler effect that is typically displayed by <i>Vespadelus</i> spp..

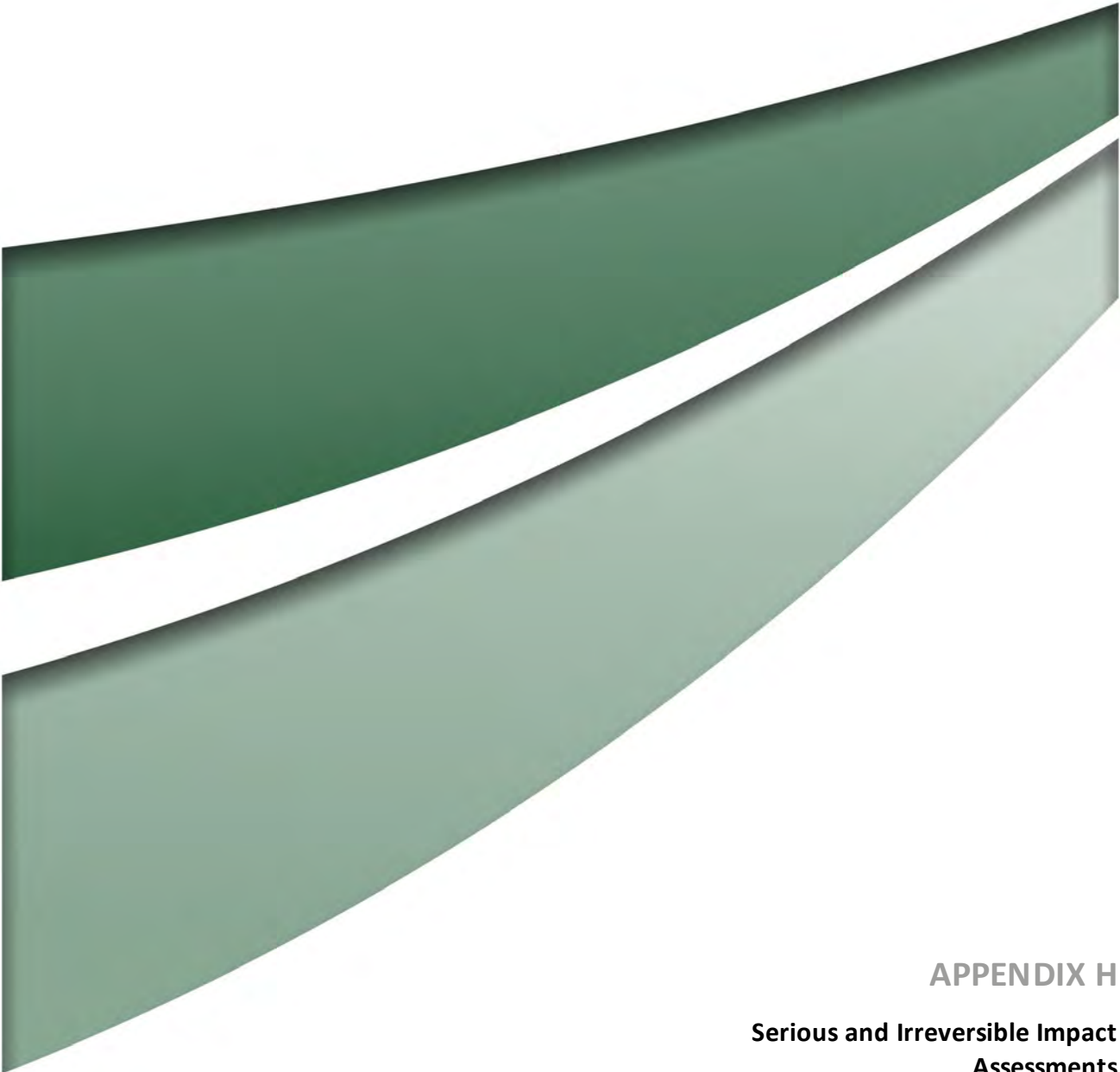
APPENDIX B LOG FILE REVIEW

Table B1: Log file review results

Folder	Log file name	Unit Type	Set to Record ?	Setting Mode	Data Division	Sensi tivity	Firmware	GPS	Entire Night?	Errors?	Comments
ANA1\	SN445946 2020-05-06 log.csv	Anabat Express	Yes	Night	8	115	V5507J	-31.78112 149.88104	Yes	Clock battery flat	
ANA1\	SN445946 2020-05-07 log.csv	Anabat Express	Yes	Night	8	115	V5507J	-31.78082 149.88135	Yes	Clock battery flat	
ANA2\	SN445929 2020-05-04 log.csv	Anabat Express	Yes	Night	8	115	V5507J	-31.81793 149.81444	Yes	None	
ANA2\	SN445929 2020-05-05 log.csv	Anabat Express	Yes	Night	8	115	V5507J	-31.81796 149.81447	Yes	None	
ANA7\	SN409385 2020-05-04 log.csv	Anabat Express	Yes	Night	8	115	V5507J	-31.72528 149.803	Yes	None	
ANA7\	SN409385 2020-05-05 log.csv	Anabat Express	Yes	Night	8	115	V5507J	-31.72533 149.80291	Yes	None	

Folder	Log file name	Unit Type	Set to Record ?	Setting Mode	Data Division	Sensitivity	Firmware	GPS	Entire Night?	Errors?	Comments
ANA8\	SN409430 2020-05-05 log.csv	Anabat Express	Yes	Night	8	115	V5507J	-31.70294 149.90047	Yes	None	
ANA8\	SN409430 2020-05-06 log.csv	Anabat Express	Yes	Night	8	115	V5507J	-31.70292 149.90046	Yes	None	





APPENDIX H

**Serious and Irreversible Impact
Assessments**

Appendix H Serious and Irreversible Impact Assessments

1.0 Threatened Entities at Risk of a Serious and Irreversible Impact

Assessments have been conducted for three serious and irreversible impact (SAII) entities recorded for the RTS Project, being:

- NSW Box Gum Woodland CEEC (BC Act) (refer to **Section 2.0**)
- Large-eared Pied Bat (*Chalinolobus dwyeri*) (refer to **Section 3.0**)
- Eastern Cave Bat (*Vespadelus troughtoni*) (refer to **Section 4.0**).

These assessments have been conducted in accordance with the additional impact assessment criteria provided in Subsection 9.1.1 (for ecological communities) and 9.1.2 (for threatened species or populations) of the BAM (DPIE 2020a), the principles set out in Clause 6.7 of the Biodiversity Conservation Regulations 2017 and the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE, 2019b).

Section 2.0 provides an assessment of the impacts of the RTS Project on the woodlands (ModerateGood Condition and Low Condition) and Derived Native Grassland components of NSW Box Gum Woodland CEEC. A separate assessment has been prepared for the Low Condition Woodlands and Derived Native Grasslands that also conforms to NSW Box Gum Woodland CEEC, as these communities are considered to be of substantially lower conservation value than the woodlands (ModerateGood Condition). We do however ensure that the total proposed impacts of the RTS Project on NSW Box Gum Woodland is clearly identified and assessed for consideration of SAII by the determining authority.

Where occurring as a Derived Native Grassland, the NSW Box Gum Woodland CEEC is co-dominated by native grasses and herbs amongst multiple non-native flora species providing an indication of the level of historical and ongoing agricultural practises. The Low Condition Woodlands support a similar understorey however support an open cover of remnant canopy species. These vegetation zones meet the scientific committee determination due to the presence or former presence of characteristic canopy species and hardy native perennials within a matrix of annual and perennial weed species. While likely to have historically comprised remnant Box Gum Woodland, historic and ongoing agricultural practices have reduced the conservation value of the community such that it is of very low conservation value. So much so, that in its condition these vegetation zones do not meet the condition thresholds of the Commonwealth Box Gum Woodland CEEC.

The assessment of the impact of the RTS Project on high conservation value NSW Box Gum Woodland CEEC (ModerateGood) is provided in **Section 2.2** and a separate assessment of the impact of the RTS Project on low conservation value Low Condition Woodlands and Derived Native Grasslands that conform to the NSW Box Gum Woodland CEEC is provided in **Section 2.3**.

2.0 NSW Box Gum Woodland CEEC

2.1 Section 9.1.1 of BAM 2020 Additional Impact Assessment Provisions– Current TEC Status

BAM 2020 SAII Impact Assessment Criterion	Current TEC Status in NSW	Impact of the Liverpool Range WF Modification
<p>1. The action and measures taken to avoid the direct and indirect impacts on the potential entity for an SAII</p>	<p>Not applicable.</p>	<p>The measures taken to avoid direct and indirect impacts are detailed in Section 4.0 of the BDAR.</p>
<p>2. Current status of the TEC at risk of an SAII (excluding impacts of the proposal)</p>		
<p>2a. Evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal).</p>	<p>Paragraph 2.1. of the Final Determination by the NSW Threatened Species Scientific Committee (NSW Determination) identifies that within NSW, this NSW Box Gum Woodland CEEC occurs in the Brigalow Belt South, Nandewar, New England Tableland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes and Riverina Bioregions. The assemblage of species is also known to occur in the South Eastern Queensland Bioregion in Queensland and the Victorian Midlands Bioregion in Victoria.</p> <p>An assessment completed by TSSC (2006) and reproduced by Tozer and Simpson (2020) estimate that the pre-1750 area of the NSW Box Gum Woodland CEEC was 3,717,366 ha, which has been reduced to a current extent in 2020 of just 250,729 ha. This represents a 93% reduction since 1750.</p> <p>Umwelt has utilised the current available State Vegetation Type Mapping (SVTM) which identifies an estimate of the per 1750 and current extent of NSW Box Gum Woodland CEEC using the best currently available mapping. The SVTM pre-1750 area of NSW Box Gum Woodland CEEC is between 1,895,058 ha and 2,403,693 ha and the current SVTM extent of NSW Box Gum Woodland CEEC is between 1,267,603 ha and 1,639,571 ha, as mapped in Figure 5.2 of the BDAR. The variance in the SVTM upper estimate is due to some mapped PCTs being identified as only partly being associated with the NSW Box Gum Woodland CEEC. Based on the STVM there has been a 33.1–31.75% reduction in NSW Box Gum Woodland CEEC since 1750.</p>	<p>Not applicable</p>

BAM 2020 SAII Impact Assessment Criterion	Current TEC Status in NSW	Impact of the Liverpool Range WF Modification
	<p>Paragraph 3.1.2 and 3.2 of the NSW Determination recognises that the community is eligible for listing as a CEEC as it has suffered a very large reduction in its previous geographic distribution (TSSC 2020). There is evidence that clearing is ongoing and has increased in recent years; with less than 10% of the pre-1750 area remaining (TSSC 2020).</p> <p>Tozer and Simpson (2020) have identified that the loss of the woodland component of NSW Box Gum Woodland CEEC between 2009 and 2019 was 6,653 ha or 665.3 ha per annum distributed disproportionately between years.</p> <p>Using an annual loss rate of 665.3 ha, an estimate of the loss over the 1970 to 2020 period of 33,265 ha of the woodland component of the CEEC has been obtained. However, it is considered the rate of loss prior to 2009 is likely to have been much greater than 665.3 ha per annum due to a non-linear rate of clearing attributed to less legislative restrictions protecting NSW Box Gum Woodland CEEC prior to its listing.</p>	
<p>2b. Extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by:</p> <p>i. change in community structure ii. change in species composition iii. disruption of ecological processes iv. invasion and establishment of exotic species v. degradation of habitat, and vi. fragmentation of habitat.</p>	<p>Paragraph 3.1.4 of the NSW Determination identifies that the ecological community is subject to a number of threatening processes that have caused severe declines in biotic processes and interactions throughout its range and are likely to cause continuing decline in the future from:</p> <ul style="list-style-type: none"> • grazing pressures reducing understorey diversity and richness • changes in fire frequency • pasture improvement increasing cover and abundance of exotic species • clearing of woody vegetatio • grazing by feral European rabbit. <p>Compositional change is evident even in those remnants that have avoided long-term impacts of pastoralism (Tozer and Simpson 2020).</p> <p>Tozer and Simpson (2020) found that <i>“cumulatively, the disruption of biotic processes and interactions caused by the implementation of management for agricultural production is very severe and the impacts are estimated to apply over more than 90% of the pre-1750 distribution of the CEEC”</i>.</p>	<p>Not applicable</p>

BAM 2020 SAII Impact Assessment Criterion	Current TEC Status in NSW	Impact of the Liverpool Range WF Modification
	<p>Paragraph 3.2 of the NSW Determination recognises that the community has been listed as CEEC as it has undergone or is likely to undergo a very large disruption to biotic processes or interactions.</p> <p>There are a number of threatening processes that are likely to cause continuing decline in environmental quality including dryland salinity however paragraph 3.2 of the NSW Determination recognises that the data is deficient to list the community for evidence of environmental degradation (TSSC 2020).</p>	
<p>2c. Evidence of restricted geographic distribution (Principle 3, clause 6.7(2)(c) BC Regulation), based on the TEC's geographic range in NSW according to the:</p> <p>i. Extent of occurrence</p>	<p>Paragraph 3.1.3 of the NSW Determination identifies that the best estimate extent of occurrence of the NSW Box Gum Woodland CEEC in NSW is 702,800km² based on a minimum convex polygon enclosing likely occurrences of the community (TSSC 2020). This is above the threshold required for the category of vulnerable under Criterion B1 (Tozer and Simpson 2020).</p>	<p>Not applicable</p>
<p>ii. Area of occupancy</p>	<p>The current geographic extent of this CEEC across its range is estimated by Tozer and Simpson (2020) (reproduced from TSSC 2006) as 576,654 ha, which includes an area of occupancy of 250,729 ha within NSW. This estimate does not include the Derived Native Grassland component of the ecological community.</p> <p>It is also considered that the current extent of NSW Box Gum Woodland CEEC provided by Tozer and Simpson (2020) is an underestimate based on the current SVTM mapping which maps between 1,267,603 ha and 1,639,571 ha within NSW, as mapped in Figure 5.2 of the BDAR. The variance in the SVTM estimate is due to the upper limit including some PCTs which are described as only partly being associated with the NSW Box Gum Woodland CEEC.</p> <p>This is above the threshold required for the category of vulnerable under Criterion B2 (Tozer and Simpson 2020).</p>	<p>Not applicable</p>
<p>iii. Number of threat defined locations</p>	<p>No threat defined locations are specifically identified in the TBDC profile, however the ecological community is listed under the NSW Determination as critically endangered across its range.</p>	<p>Not applicable</p>

BAM 2020 SAII Impact Assessment Criterion	Current TEC Status in NSW	Impact of the Liverpool Range WF Modification
<p>2d. Evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation)</p>	<p>The TBDC profile for the NSW Box Gum Woodland CEEC identified multiple Management Actions that are applicable to the ongoing management of the NSW Box Gum Woodland CEEC including the following habitat management controls: feral animal control; management of stock grazing in high quality remnants; no firewood harvest; leave fallen timber; fencing/signage of high-quality remnants; weed control; and habitat rehabilitation/ restoration/ regeneration to connect remnants. These are described in Section 4.3 of the BDAR, but generally include, demarcation, pre-clearance and tree-felling protocols, salvaging of key fauna habitat, natural regeneration and recruitment of flora species, weed species management, and erosion control. Disturbance to the local occurrence of NSW Box Gum Woodland CEEC will be minimised as part of the detailed design once contractor(s) are engaged.</p> <p>Management practices essential to the maintenance and/or improvement of the NSW Box Gum Woodland CEEC are listed in the national recovery plan include: maintain or improve soil and drainage conditions/hydrological regime; control exotic plants and feral animals; avoid inappropriate native tree planting; maintain or improve connectivity; maintain or improve structural diversity; ensure adequate buffers; minimise chemical use; implement strategic grazing; implement appropriate burning regimes; avoid inappropriate mowing/slashing.</p> <p>Additional mitigation and management measures have been prepared with consideration of the Saving Our Species program (DPIE, 2021) for the NSW Box Gum Woodland CEEC. These additional mitigation and management measures are presented in Section 4.3.1 of the BDAR.</p> <p>During construction, the RTS Project will implement a range of mitigation measures targeted at further minimising impacts on the NSW Box Gum Woodland CEEC.</p> <p>The identification of such management actions is a clear suggestion the NSW Box Gum Woodland CEEC is likely to respond to management so long as it is funded and managed appropriately.</p>	<p>General management actions proposed for the Project are described in Section 4.3 of the BDAR, with specific additional mitigation measures relating to managing impacts on NSW Box Gum Woodland CEEC is provided in Section 4.3.1 of the BDAR.</p>

BAM 2020 SAII Impact Assessment Criterion	Current TEC Status in NSW	Impact of the Liverpool Range WF Modification
3. Where the TBDC indicates data is ‘unknown’ or ‘data deficient’ for a TEC for a criterion listed in Subsection 9.1.1(2), the assessor must record this in the BDAR or BCAR	The NSW Box Gum Woodland CEEC is not identified as ‘unknown’ or ‘data deficient’ in the TBDC profile (DPIE 2021b).	Not applicable

2.2 Section 9.1.1 of BAM 2020 –Assessment of the Impact of the RTS Project on high conservation value NSW Box Gum Woodland CEEC

The RTS Project proposes a total impact of 428.3 ha on NSW Box Gum Woodland CEEC, of which 31.6 ha comprises ModerateGood vegetation considered to be high conservation value. The remaining 396.7 ha of impact to NSW Box Gum Woodland CEEC proposed by the RTS Project comprises Low Condition Woodland CEEC and Derived Native Grassland CEEC and is considered to be low conservation value.

The following assessment has been prepared to determine the impact of the RTS Project on high conservation value NSW Box Gum Woodland CEEC. High conservation value components of the NSW Box Gum Woodland CEEC have been determined to comprise woodland vegetation zones that are in ModerateGood Condition, totalling 31.6 ha. These vegetation zones include the following:

- Vegetation Zone 2 (13.4 ha), of which 8.4 ha will be partially directly impacted and the remaining 5 ha will be fully impacted.
- Vegetation Zone 6 (16.2 ha), of which 8.9 ha will be partially directly impacted and the remaining 7.3 ha will be fully impacted.
- Vegetation Zone 9 (2.0 ha), which will be directly impacted.

It is noted that in the event that the CWO REZ transmission line currently proposed by EnergyCo becomes a viable connection option and is adopted by the Liverpool Range Wind Farm RTS Project (see Section 1.2 of the BDAR), the External Transmission Line component of the RTS Project would no longer be required and all impacts on biodiversity values associated with the RTS External Transmission Line would no longer apply. Removal of the RTS External Transmission Line component would result in the reduction in the area of impact to 95.7 ha of NSW Box Gum Woodland CEEC, of which 17.7 ha (18.5%) is in ModerateGood condition. The remaining 78.0 ha (81.5%) that would be removed from the RTS Project are Low Condition Woodlands or Derived Native Grasslands. Of the total 95.7 ha of proposed impact to NSW Box Gum Woodland CEEC within the RTS External Transmission Line, 48.9 ha will be partially impacted as described in Section 5.1.2 of the BDAR. The remaining 46.8 ha will be fully impacted.

4. In relation to the impacts from the proposal on the TEC at risk of an SAIL, the assessor must include data and information on:

a. The impact on the geographic extent of the TEC (Principles 1 and 3) by estimating:

i. Total area of the TEC to be impacted by the proposal (hectares)

The RTS Project Indicative Development Footprints impact a total of 428.3 ha of NSW Box Gum Woodland CEEC, inclusive of ModerateGood, Low Condition and Derived Native Grassland vegetation.

Of the six vegetation zones identified as the NSW Box Gum Woodland CEEC in the RTS Project Indicative Development Footprints, the following comprise high conservation value woodland vegetation zones, vegetation Zone 2, 6 and 9 (partially) are considered to be in ModerateGood condition (combined total of 31.61 ha or 7.3%).

- Vegetation Zone 2 (13.4 ha) of which 8.4 ha will be subject to partial direct impacts.
- Vegetation Zone 6 (16.2 ha), of which 8.9 ha will be subject to partial direct impacts.
- Vegetation Zone 9 (2.0 ha), which will be directly impacted. This represents a portion of the total 59.6 ha of this vegetation (remainder of which does not conform with NSW Box Gum Woodland CEEC).

The existing Development Consent SSD 6696 allows for impacts up to 200.85 ha to the NSW Box Gum Woodland TEC. At the time of the original assessment and the grant of development Consent SSD 6696, the NSW Box Gum Woodland TEC was listed as an Endangered Ecological Community (EEC). On 17 July 2020, the NSW Threatened Species Scientific Committee made a final determination to list the TEC as a CEEC.

The RTS Project proposes to impact a total 428.3 ha of the NSW Box Gum Woodland CEEC within the RTS Indicative Development Footprints, of which 31.6 ha is in ModerateGood condition. Accordingly, the RTS Project proposes to impact an additional 227.45 ha of the NSW Box Gum Woodland CEEC over that already authorised by Development Consent SSD 6696.

However, Umwelt has undertaken a careful analysis of the true delta (change) in proposed impacts to the NSW Box Gum Woodland CEEC of the RTS Project to the Approved Project (SSD 6696). This analysis is described in Section 5.2.1.1 of the BDAR. It found the true delta (change) of proposed impacts to NSW Box Gum Woodland CEEC between the RTS Project (428.3 ha) and the Approved Project (SSD 6696) (236.8 ha [using the proposed areas of impact]) is 191.5 ha.

The RTS Project proposes an Indicative Development Footprint totalling 1,794.1 ha. The proposed impact to 428.3 ha of NSW Box Gum Woodland CEEC represents approximately 24% of the RTS Indicative Development Footprint. In summary, despite the RTS Project proposing an Indicative Development Footprint that is 1,043.84 ha (+139%) greater than the disturbance area of the Approved Project (SSD 6696), the proportional impacts to NSW Box Gum Woodland CEEC have decreased by 1%, with the proportional reduction based on considered and extensive avoidance of high-quality NSW Box Gum Woodland CEEC patches.

4. In relation to the impacts from the proposal on the TEC at risk of an SAIL, the assessor must include data and information on:

	<p>Tozer and Simpson (2020) have identified that not all the areas occupied by NSW Box Gum Woodland CEEC are covered by maps of appropriate scale and accuracy. Therefore, the values for extent of occurrence and area of occupancy quoted may underestimate the true values.</p> <p>Umwelt notes that 2,644.7 ha of NSW Box Gum Woodland CEEC confirmed to be located within the wider RTS Development Corridor, of which 173.9 ha is in ModerateGood condition. Therefore, 142.3 ha of ModerateGood condition vegetation within the RTS Development Corridor will not be impacted by the RTS Project.</p>
<p>ii. Area of the TEC to be impacted as a percentage of the current geographic extent of the TEC in NSW (%).</p> <p>Data and information should include direct impacts (i.e. from clearing) and indirect impacts where partial loss of the TEC is likely as a result of the proposal. The assessor should consider for example, changes to fire regime (frequency, severity), hydrology, pollutants, species interactions (increased competition, changes to pollinators or dispersal), fragmentation, increased edge effects and disease, pathogens and parasites, which are likely to contribute to the loss of flora and/or fauna species characteristic of the TEC</p>	<p>As outlined above, the NSW Box Gum Woodland CEEC occupies a very large area of land within NSW and also exists outside of NSW and does not meet the assessment criterion for geographic range (that is extent of occurrence or area of occupancy). However, it has undergone a very large reduction in geographic distribution and meets listing as a CEEC for this criterion.</p> <p>Tozer and Simpson (2020) have identified that not all the areas occupied by NSW Box Gum Woodland CEEC are covered by maps of appropriate scale and accuracy. Therefore, the values for extent of occurrence and area of occupancy quoted may underestimate the true values.</p> <p>The best available information on the current geographic extent of this NSW Box Gum Woodland CEEC across its range is estimated from the SVTM as between 1,267,603 ha and 1,639,571 ha within NSW, as mapped in Figure 5.2 of the BDAR. It is considered that this is likely to be an underestimate given there are many areas of Derived Native Grasslands corresponding to this NSW Box Gum Woodland CEEC which are not mapped as part of the SVTM.</p> <p>Based on the best available estimates, of the total NSW Box Gum Woodland CEEC (428.3 ha) proposed to be impacted by the RTS Project:</p> <ul style="list-style-type: none"> • This represents between 0.03% and 0.02% of the geographic extent of this CEEC mapped in the SVTM. However, it is considered that the actual proportional impact is likely to be much lower due to the presence of large areas of highly degraded derived native vegetation which are not captured in the SVTM. <p>Only 31.6 ha (7.3%) is in ModerateGood condition woodland, with the remaining 396.8 ha (92.6%) being Derived Native Grasslands and low condition woodlands. The impacts to ModerateGood condition woodland represents <0.01% of the geographic extent of this CEEC mapped in the SVTM.</p> <p>The impacts of the RTS Project on high conservation value NSW Box Gum Woodland CEEC represent 31.6 ha which is between 0.002% and 0.001% of the geographic extent of the NSW Box Gum Woodland CEEC mapped in the SVTM. It is considered that the actual proportional impact is likely to be much lower due to the presence of large areas of highly degraded derived native vegetation which are not captured in the SVTM.</p>

4. In relation to the impacts from the proposal on the TEC at risk of an SAI, the assessor must include data and information on:

As described in Section 5.1.2 of the BDAR, partial direct impacts have been assessed for Vegetation Zones 2 and 6 within the transmission line balance of easement easements of the RTS Project. As presented in Section 3.3.3.1 of the BDAR, Vegetation Zones 2 and 6 were identified as conforming with the NSW Box Gum Woodland CEEC. These two vegetation zones comprise 17.3 ha of partial impacts, representing approximately 4% of the total NSW Box Gum Woodland CEEC to be impacted by the RTS Project. Given the ecological sensitivity of these two Vegetation Zones, strict construction and post-construction monitoring protocols will be implemented where partial direct impacts have been assessed to ensure the respective NSW Box Gum Woodland CEEC persist. This will include management actions as well as monitoring activities. The detail of such protocols is summarised in Section 4.3 of the BDAR but will be detailed through the preparation of the BMP. Section 4.3.1 presents additional mitigation measures that have been prepared specifically for the management of NSW Box Gum Woodland CEEC SAI by the RTS Project.

The process of constructing a transmission line easement in this manner (i.e., allowing biodiversity values to remain) is substantially more time consuming, complex to manage, requires ongoing monitoring and management and is ultimately more costly to construct. This demonstrates the level to which the proponent is committed to minimising the impact of the RTS Project on biodiversity values, particularly in relation to NSW Box Gum Woodland CEEC and large intact patches of remnant vegetation which occur along the majority of the External Transmission Line.

The RTS Project is not considered to modify the fire regime (frequency, severity) of the NSW Box Gum Woodland recorded. As most of the vegetation recorded is on private property, its fire regime is already restricted; while those stands that occur on public land occur in proximity to major road infrastructure and thus fire regime would already be restricted. Hydrology, pollutants, pathogens, and parasites are unlikely to be affected in NSW Box Gum Woodland CEEC of the RTS Project.

Keith (1998) described plant populations as "geographically or otherwise distinct groups between which there is little genetic exchange through seed dispersal. Propagules are generally dispersed in the order of metres, with distances greater than 1 kilometre being very rare. In this context, populations are considered distinct if they are separated by discontinuities of >1 kilometre." The RTS Project is generally linear in nature and only involves relatively small areas of disturbance within a very large project area; therefore, it is unlikely to limit species interactions. It does not involve any components that are 1 kilometre or greater in width.

The biggest risk posed by the proposed partial direct impacts proposed by the RTS Project within NSW Box Gum Woodland CEEC occurs in the southern extent along the external transmission line. Edge effects will be enhanced as the RTS Project traverses intact vegetation; while construction activities also increase likelihood of weed species being introduced. However, this risk is likely to be negligible as a BMP will be prepared and implemented.

4. In relation to the impacts from the proposal on the TEC at risk of an SAI, the assessor must include data and information on:

b. The extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by:

i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals

A total of 2,644.7 ha of the NSW Box Gum Woodland CEEC was identified within the RTS Development Corridor. Within the RTS Development Corridor alone, 2,613.1 ha of the NSW Box Gum Woodland CEEC will persist following the removal of the 31.6 ha of high conservation value remnants. The proposed removal represents approximately 1.2% of the total NSW Box Gum Woodland CEEC within the RTS Development Corridor, while it represents approximately 18% of the ModerateGood condition vegetation (173.9 ha in total) within the RTS Development Corridor.

The proposed impacts to the NSW Box Gum Woodland CEEC by the RTS Project do not occur to large intact patches of vegetation. The majority of occurrences of the NSW Box Gum Woodland CEEC that occur within the RTS Development Corridor are already fragmented and/or isolated as a result of historical land use. The exception to this is where the NSW Box Gum Woodland CEEC occurs within the External Transmission Line. Given the highly fragmented and isolated nature of the NSW Box Gum Woodland CEEC across the RTS Development Corridor, north of external transmission line, the proposed impacts to 31.6 ha is not likely to substantially alter the ratio of fragmentation and isolation.

An analysis of the average patch size for RTS Development Corridor and Indicative Development Footprints was undertaken. The current average patch size of NSW Box Gum Woodland CEEC within RTS Development Corridor and RTS Indicative Development Footprints (i.e., prior to impacts of the RTS Project) is 9.0 ha. This is compared with 8.2 ha following the proposed removal of the NSW Box Gum Woodland CEEC within RTS Indicative Development Footprints for the RTS Project. Therefore, following the proposed direct impacts of the RTS Project on NSW Box Gum Woodland CEEC, it reduces the average patch size of remaining stands of the community by 0.8 ha (8.9%).

Keith (1998) described plant populations as “geographically or otherwise distinct groups between which there is little genetic exchange through seed dispersal. Propagules are generally dispersed in the order of metres, with distances greater than 1 kilometre being very rare. In this context, populations are considered distinct if they are separated by discontinuities of >1 kilometre.” The RTS Project is generally linear in nature and only involves relatively small areas of disturbance within a very large project area. It does not involve any components that are 1 kilometre or greater in width, therefore remaining NSW Box Gum Woodland CEEC will not be distinctly isolated.

The existing Development Consent (SSD 6696) for the Project already authorises impacts to 200.85 ha of NSW Box Gum Woodland CEEC.

4. In relation to the impacts from the proposal on the TEC at risk of an SAIL, the assessor must include data and information on:

	<p>The identification of 2,644.7 ha of the NSW Box Gum Woodland CEEC (including ModerateGood, Derived Native Grassland and low condition) within the RTS Development Corridor indicates a substantial extent of the NSW Box Gum Woodland CEEC is present across the RTS Project Site as a whole. While the community is identified as a CEEC under the BC Act, it is common across the locality.</p> <p>Accordingly, while the Proponent has made all reasonable attempts to minimise impacts to the NSW Box Gum Woodland CEEC (refer to Table 4.1 and Table 4.2 of the BDAR), it is not possible to design the RTS Project to avoid the NSW Box Gum Woodland CEEC. Further attempts will be made to avoid and minimise impacts to the NSW Box Gum Woodland CEEC through the detailed design phase and finalisation of the development footprints.</p>
<p>ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:</p> <ul style="list-style-type: none"> • distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and • estimated maximum dispersal distance for native flora species characteristic of the TEC, and • other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development 	<p>Less than 10% of the original distribution of the NSW Box Gum Woodland CEEC is likely to have avoided structural changes (TSSC 2020). As such, the NSW Box Gum Woodland CEEC now occurs in a heavily fragmented and isolated form.</p> <p>The impacts to the NSW Box Gum Woodland CEEC associated with the RTS Project are not likely to remove full patches of the NSW Box Gum Woodland CEEC, but rather parts of already isolated remaining vegetation. This will lead to increased fragmentation of remaining vegetation and could increase the distances between patches of woodland and open woodland and remnant trees in Derived Native Grassland in some cases.</p> <p>However, it should be noted that the risk of this is substantially reduced considering the linear nature of infrastructure projects such as the RTS Project. While the RTS Project will impact stands of NSW Box Gum Woodland CEEC, the width of proposed impacts are generally no wider than 6000 metres. Despite the RTS Project including temporary disturbance either side of access tracks and hardstands, full impacts have been assessed in these areas. However, the implementation of the BMP will ensure these areas rehabilitate over time. Furthermore, the proposed partial direct impacts (see Section 5.1.2 of the BDAR) managed for the RTS Project will ensure biodiversity values persist in discrete locations along the internal and external transmission line balance of easements.</p> <p>Analysis of the average distances between patches of NSW Box Gum Woodland CEEC was undertaken for mapping within the RTS Development Corridor and RTS Indicative Development Footprints (noting that the RTS Indicative Development Footprint – Public Road Upgrades extend beyond the RTS Development Corridor). This found that the current extent of NSW Box Gum Woodland CEEC within RTS Development Corridor and RTS Indicative Development Footprints (i.e., prior to impacts of the RTS Project) are separated by an average of approximately 65 m.</p>

4. In relation to the impacts from the proposal on the TEC at risk of an SAI, the assessor must include data and information on:

	<p>This is compared with approximately 44 m following the proposed removal of the NSW Box Gum Woodland CEEC within RTS Indicative Development Footprints for the RTS Project. This presents a 21 m reduction in average distance between patches of the NSW Box Gum Woodland CEEC due to the RTS Project. While this result seems counter intuitive, it relates to the linear nature of the RTS Project. This allows for two patches that were once separated by 70 m (for example), may become separated by 30 m (for example) following the RTS Project breaking up a single patch into two as a result of an access track (for example).</p> <p>Following the result above, whereby the RTS Project does not negatively affect the average distances between patches of NSW Box Gum Woodland CEEC, the average patch size within the RTS Development Corridor and RTS Indicative Development Footprints were analysed. The current average patch size of NSW Box Gum Woodland CEEC within the RTS Development Corridor (i.e., prior to impacts of the RTS Project) is 9.0 ha. This is compared with 8.2 ha following the proposed removal of the NSW Box Gum Woodland CEEC within RTS Indicative Development Footprints for the RTS Project. Therefore, following the proposed direct impacts of the RTS Project on NSW Box Gum Woodland CEEC, it reduces the average patch size of remaining stands of the community by 0.8 ha (8.9%).</p> <p>Keith (1998) described plant populations as “geographically or otherwise distinct groups between which there is little genetic exchange through seed dispersal. Propagules are generally dispersed in the order of metres, with distances greater than 1 kilometre being very rare. In this context, populations are considered distinct if they are separated by discontinuities of >1 kilometre.” The RTS Project is generally linear in nature and only involves relatively small areas of disturbance within a very large project area. It does not involve any components that are 1 kilometre or greater in width. Accordingly, all species characteristic of the NSW Box Gum Woodland CEEC recorded within the in the RTS Development Corridor will still be able to naturally disperse. Furthermore, the remaining patches of NSW Box Gum Woodland CEEC will not be considered as distinct.</p>
<p>iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Section 4.3). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.</p>	<p>The following vegetation integrity scores are provided for each of the moderate good vegetation zones impacted by the RTS Project and broken down into IBRA Sub-region:</p> <ul style="list-style-type: none"> • Brigalow Belt South (BBS) – Liverpool Range (refer to Table 3.13 of the BDAR) • Brigalow Belt South (BBS) – Pilliga (refer to Table 3.14 of the BDAR), • Sydney Basin – Kerrabee (refer to Table 3.15 of the BDAR). <p>Descriptions for each applicable Vegetation Zone is provided in Section 3.3.1 of the BDAR.</p>

4. In relation to the impacts from the proposal on the TEC at risk of an SAI, the assessor must include data and information on:

	Vegetation Integrity Analysis	Vegetation Zone 2 (Moderate/Good)		
		BBS - Liverpool Range	BBS-Pilliga	SB-Kerrabee
	Composition	63.4	74.4	80.6
	Structure	48.8	71.0	81.7
	Function	43.7	81.3	96.4
	Vegetation Integrity Score	51.3	75.4	85.9
	Vegetation Integrity Analysis	Vegetation Zone 6 (Moderate/Good)		
		BBS - Liverpool Range	BBS-Pilliga	SB-Kerrabee
	Composition	65.0	80.9	91.5
	Structure	98.4	94.0	90.6
	Function	68.9	86.5	66.4
	Vegetation Integrity Score	76.1	87.0	81.9
	Vegetation Integrity Analysis	Vegetation Zone 9 (Moderate/Good)		
		BBS – Liverpool Range	BBS – Pilliga	SB - Kerrabee
	Composition	77.5	67.0	-
	Structure	94.4	53.5	-
	Function	97.2	46.3	-
	Vegetation Integrity Analysis	89.3	54.9	-

2.3 Section 9.1.1 of BAM 2020 –Assessment of the Impact of the RTS Project on low conservation value NSW Box Gum Woodland CEEC

The RTS Project proposes a total impact of 428.3 ha on NSW Box Gum Woodland CEEC, of which 396.7 ha comprises Low Condition Woodland CEEC and Derived Native Grassland CEEC and is considered to be low conservation value. The remaining 31.6 ha of impact to NSW Box Gum Woodland CEEC proposed by the RTS Project comprises ModerateGood vegetation and is considered to be high conservation value.

The 396.8 ha or 92.6 % of the NSW Box Gum Woodland CEEC to be impacted within the RTS Indicative Development Footprints is considered to be in either Derived Native Grassland (primarily consisting of exotic pasture) or in Low Condition Woodland, and as a result is considered to be of low conservation value.

These vegetation zones include the following:

- Vegetation Zone 7 (266.9 ha), of which 76.2 ha will be partially directly impacted and the remaining 190.7 ha will be fully impacted.
- A 2.1 ha portion of Vegetation Zone 11 (totalling 205.3 ha). The entire 2.1 ha of the NSW Box Gum Woodland CEEC will be fully impacted.
- Vegetation Zone 17 (127.8 ha) conforms, which will be fully impacted.

It is noted that in considering the assessment on low conservation value NSW Box Gum Woodland, 78.0 ha occurs within the RTS External Transmission Line and will be removed from the RTS Project in the event that EnergyCo’s currently proposed CWO REZ transmission line becomes a viable connection option and is adopted by the Liverpool Range Wind Farm RTS Project.

4. In relation to the impacts from the proposal on the TEC at risk of an SAIL, the assessor must include data and information on:

a. The impact on the geographic extent of the TEC (Principles 1 and 3) by estimating:

i. Total area of the TEC to be impacted by the proposal (hectares)

The RTS Project Indicative Development Footprints impact a total of 428.3 ha of NSW Box Gum Woodland CEEC, of which 396.8 ha is considered low conservation value, either Low Condition Woodlands or Derived Native Grasslands. Of the six vegetation zones (2, 6, 7, 9 [partially], 11 [partially] and 17) identified as the NSW Box Gum Woodland CEEC in the RTS Indicative Development Footprints the following three vegetation zones comprised low conservation value:

- Vegetation Zone 7 (266.9 ha), of which 76.2 ha will be partially directly impacted and the remaining 190.7 ha will be fully impacted.

4. In relation to the impacts from the proposal on the TEC at risk of an SAIL, the assessor must include data and information on:

- A 2.1 ha portion of Vegetation Zone 11 (totalling 205.3 ha). The entire 2.1 ha of the NSW Box Gum Woodland CEEC will be fully impacted.
- Vegetation Zone 17 (127.8 ha) conforms, which will be fully impacted.

Vegetation zones (7, 11 and 17) are highly disturbed and do not support remnant woodland. Vegetation Zone 17 (127.8 ha conforming with the NSW Box Gum Woodland CEEC, representing 29.8% of the NSW Box Gum Woodland CEEC) is a Derived Native Grassland; Vegetation Zones 7 (266.9 ha, representing 62.3% of the NSW Box Gum Woodland CEEC) and Vegetation Zone 11 (2.1 ha, representing 0.5% of the NSW Box Gum Woodland CEEC) are considered to be Low Condition Woodlands. Despite hardy native flora species persisting in the understorey, these vegetation zones are characterised by a mostly exotic pasture, with some scattered canopy trees occurring throughout which result in it still be classified as NSW Box Gum Woodland CEEC.

In summary, 396.8 ha or 92.6% of the NSW Box Gum Woodland CEEC to be impacted within the RTS Indicative Development Footprints is considered to be in either Derived Native Grassland (primarily consisting of exotic pasture) or in Low Condition Woodland.

The existing Development Consent SSD 6696 allows for impacts up to 200.85 ha to the NSW Box Gum Woodland TEC. At the time of the original assessment and the grant of development Consent SSD 6696, the Box Gum Woodland TEC was listed as an Endangered Ecological Community (EEC). On 17 July 2020, the NSW Threatened Species Scientific Committee made a final determination to list the TEC as a CEEC. The RTS Project proposes to impact 428.3 ha of the NSW Box Gum Woodland CEEC that includes 396.8 ha of low conservation value woodlands and Derived Native Grasslands within the RTS Indicative Development Footprints. Accordingly, the RTS Project proposes to impact an additional 227.45 ha of the NSW Box Gum Woodland CEEC over that already authorised by Development Consent SSD 6696.

Umwelt has undertaken a careful analysis of the true delta (change) in proposed impacts to the NSW Box Gum Woodland CEEC of the RTS Project to the Approved Project (SSD 6696). This analysis is described in Section 5.2.1.1 of the BDAR. It found the true delta (change) of proposed impacts to NSW Box Gum Woodland CEEC between the RTS Project (428.3 ha) and the Approved Project (SSD 6696) (236.8 ha [using the proposed areas of impact]) is 191.5 ha. The RTS Project proposes an Indicative Development Footprint totalling 1,794.1 ha, the proposed total impacts to 428.3 ha of NSW Box Gum Woodland CEEC represents approximately 24% of the Indicative Development Footprint. In summary, despite the RTS Project proposing an Indicative Development Footprint that is 1,043.84 ha (+139%) greater than the disturbance area of the Approved Project (SSD 6696), the proportional impacts to NSW Box Gum Woodland CEEC have decreased by 1%, with the proportional reduction based on considered and extensive avoidance of high-quality NSW Box Gum Woodland CEEC patches.

4. In relation to the impacts from the proposal on the TEC at risk of an SAI, the assessor must include data and information on:

	<p>Tozer and Simpson (2020) have identified that not all the areas occupied by NSW Box Gum Woodland CEEC are covered by maps of appropriate scale and accuracy. Therefore, the values for extent of occurrence and area of occupancy quoted may underestimate the true values.</p> <p>Umwelt notes that 2,644.7 ha of NSW Box Gum Woodland CEEC confirmed to be located within the wider RTS Development Corridor, of which 2,470.8 ha is either Low Condition Woodland or Derived Native Grasslands. Therefore, 2,074 ha of Low Condition Woodland or Derived Native Grasslands within the RTS Development Corridor will not be impacted by the RTS Project.</p>
<p>ii. Area of the TEC to be impacted as a percentage of the current geographic extent of the TEC in NSW (%).</p> <p>Data and information should include direct impacts (i.e. from clearing) and indirect impacts where partial loss of the TEC is likely as a result of the proposal. The assessor should consider for example, changes to fire regime (frequency, severity), hydrology, pollutants, species interactions (increased competition, changes to pollinators or dispersal), fragmentation, increased edge effects and disease, pathogens and parasites, which are likely to contribute to the loss of flora and/or fauna species characteristic of the TEC</p>	<p>As outlined above, the NSW Box Gum Woodland CEEC occupies a very large area of land within NSW and also exists outside of NSW and does not meet the assessment criterion for geographic range (that is extent of occurrence or area of occupancy). However, it has undergone a very large reduction in geographic distribution and meets listing as a CEEC for this criterion.</p> <p>Tozer and Simpson (2020) have identified that not all the areas occupied by NSW Box Gum Woodland CEEC are covered by maps of appropriate scale and accuracy. Therefore, the values for extent of occurrence and area of occupancy quoted may underestimate the true values.</p> <p>The best available information on the current geographic extent of this NSW Box Gum Woodland CEEC across its range is estimated from the SVTM as between 1,267,603 ha and 1,639,571 ha within NSW, as mapped in Figure 5.2 of the BDAR. It is considered that this is likely to be an underestimate given there are many areas of Derived Native Grasslands corresponding to this NSW Box Gum Woodland CEEC which are not mapped as part of the SVTM.</p> <p>Based on the best available estimates, of the total NSW Box Gum Woodland CEEC (428.3 ha) proposed to be impacted by the RTS Project:</p> <ul style="list-style-type: none"> • This represents between 0.03% and 0.02% of the geographic extent of this CEEC mapped in the SVTM. However, it is considered that the actual proportional impact is likely to be much lower due to the presence of large areas of highly degraded derived native vegetation which are not captured in the SVTM. <p>The RTS Project proposes to impact 396.8 ha of Derived Native Grasslands and Low Condition Woodlands. These impacts represent 0.03% and 0.02% of the geographic extent of this CEEC mapped in the SVTM.</p> <p>It is important to note that the current geographic extent of this CEEC across its range is estimated by Tozer and Simpson (2020) (reproduced from TSSC 2006) as 576,654 ha, which includes an area of occupancy of 250,729 ha within NSW. This estimate does not include the Derived Native Grassland component of the ecological community.</p>

4. In relation to the impacts from the proposal on the TEC at risk of an SAIL, the assessor must include data and information on:

The impacts of the RTS Project would impact directly on 396.8 ha of low conservation value woodlands and Derived Native Grasslands which is between 0.03% and 0.02% of the geographic extent of the NSW Box Gum Woodland CEEC mapped in the SVTM. It is considered that the actual proportional impact is likely to be much lower due to the presence of large areas of highly degraded derived native vegetation which are not captured in the SVTM.

Given the ecological sensitivity of the NSW Box Gum Woodland CEEC, strict construction and post-construction monitoring protocols will be implemented where partial direct impacts have been assessed to ensure the respective NSW Box Gum Woodland CEEC persist. This will include management actions as well as monitoring activities. The detail of such protocols is summarised in Section 4.3 of the BDAR but will be detailed through the preparation of the BMP. Section 4.3.1 presents additional mitigation measures that have been prepared specifically for the management of NSW Box Gum Woodland CEEC SAIL by the RTS Project.

The process of constructing a transmission line easement in this manner (i.e., allowing biodiversity values to remain) is substantially more time consuming, complex to manage, requires ongoing monitoring and management and is ultimately more costly to construct. This demonstrates the level to which the proponent is committed to minimising the impact of the RTS Project on biodiversity values, particularly in relation to NSW Box Gum Woodland CEEC and large intact patches of remnant vegetation which occur along the majority of the External Transmission Line.

The RTS Project is not considered to modify the fire regime (frequency, severity) of the NSW Box Gum Woodland recorded. As most of the vegetation recorded is on private property, its fire regime is already restricted; while those stands that occur on public land occur in proximity to major road infrastructure and thus fire regime would already be restricted. Hydrology, pollutants, pathogens, and parasites are unlikely to be affected in NSW Box Gum Woodland CEEC of the RTS Project.

Keith (1998) described plant populations as "geographically or otherwise distinct groups between which there is little genetic exchange through seed dispersal. Propagules are generally dispersed in the order of metres, with distances greater than 1 kilometre being very rare. In this context, populations are considered distinct if they are separated by discontinuities of >1 kilometre." The RTS Project is generally linear in nature and only involves relatively small areas of disturbance within a very large project area; therefore, it is unlikely to limit species interactions. It does not involve any components that are 1 kilometre or greater in width.

The biggest risk posed by the proposed partial direct impacts proposed within NSW Box Gum Woodland CEEC within the RTS Project occurs in the southern extent along the external transmission line. Edge effects will be enhanced as the RTS Project traverses intact vegetation; while construction activities also increase likelihood of weed species being introduced. However, this risk is likely to be negligible as a BMP will be prepared and implemented.

4. In relation to the impacts from the proposal on the TEC at risk of an SAI, the assessor must include data and information on:

b. The extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by:

i. estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the development footprint or equivalent area for other types of proposals

A total of 2,644.7 ha of the NSW Box Gum Woodland CEEC was identified within the RTS Development Corridor. Within the RTS Development Corridor alone, 2,247.9 ha of the NSW Box Gum Woodland CEEC will persist following the removal of 396.8 ha of Low Condition Woodlands and Derived Native Grasslands. The proposed removal represents approximately 15% of the NSW Box Gum Woodland CEEC within the RTS Development Corridor.

The proposed impacts to the NSW Box Gum Woodland CEEC by the RTS Project do not occur to large intact patches of vegetation. The majority of occurrences of the NSW Box Gum Woodland CEEC that occur within the RTS Development Corridor are already fragmented and/or isolated as a result of historical land use. The exception to this is where the NSW Box Gum Woodland CEEC occurs within the External Transmission Line. Given the highly fragmented and isolated nature of the NSW Box Gum Woodland CEEC across the RTS Development Corridor, north of external transmission line, the proposed impacts to 396.8 ha is not likely to substantially alter the ratio of fragmentation and isolation.

An analysis of the average patch size for RTS Development Corridor and Indicative Development Footprints was undertaken. The current average patch size of NSW Box Gum Woodland CEEC within RTS Development Corridor (i.e., prior to impacts of the RTS Project) is 9.0 ha. This is compared with 8.2 ha following the proposed removal of the NSW Box Gum Woodland CEEC within Indicative Development Footprints for the RTS Project. Therefore, following the proposed direct impacts of the RTS Project on NSW Box Gum Woodland CEEC, it reduces the average patch size of remaining stands of the community by 0.8 ha (8.9%).

Keith (1998) described plant populations as “geographically or otherwise distinct groups between which there is little genetic exchange through seed dispersal. Propagules are generally dispersed in the order of metres, with distances greater than 1 kilometre being very rare. In this context, populations are considered distinct if they are separated by discontinuities of >1 kilometre.” The RTS Project is generally linear in nature and only involves relatively small areas of disturbance within a very large project area. It does not involve any components that are 1 kilometre or greater in width, therefore remaining NSW Box Gum Woodland CEEC will not be distinctly isolated.

The existing Development Consent (SSD 6696) for the Project already authorises impacts to 200.85 ha of NSW Box Gum Woodland CEEC.

The identification of 2,644.7 ha of the NSW Box Gum Woodland CEEC (including ModerateGood, Derived Native Grassland and Low Condition Woodland) within the RTS Development Corridor indicates a substantial extent of the NSW Box Gum Woodland CEEC is present across the RTS Project Site as a whole. While the community is identified as a CEEC under the BC Act, it is common across the locality.

4. In relation to the impacts from the proposal on the TEC at risk of an SAI, the assessor must include data and information on:

	<p>Accordingly, while the Proponent has made all reasonable attempts to minimise impacts to the NSW Box Gum Woodland CEEC (refer to Table 4.2 of the BDAR), it is not possible to design the RTS Project to avoid the NSW Box Gum Woodland CEEC. Further attempts will be made to avoid and minimise impacts to the NSW Box Gum Woodland CEEC through the detailed design phase and finalisation of the development footprints.</p>
<p>ii. describing the impacts on connectivity and fragmentation of the remaining areas of TEC measured by:</p> <ul style="list-style-type: none"> • distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and • estimated maximum dispersal distance for native flora species characteristic of the TEC, and • other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development 	<p>Less than 10% of the original distribution of the NSW Box Gum Woodland CEEC is likely to have avoided structural changes (TSSC 2020). As such, the NSW Box Gum Woodland CEEC now occurs in a heavily fragmented and isolated form.</p> <p>The impacts to the NSW Box Gum Woodland CEEC associated with the RTS Project are not likely to remove full patches of the NSW Box Gum Woodland CEEC, but rather parts of already isolated remaining vegetation (most of which is in either Derived Native Grassland (primarily consisting of exotic pasture) or in low condition. This will lead to increased fragmentation of remaining vegetation and could increase the distances between patches of woodland and open woodland and remnant trees in Derived Native Grassland in some cases.</p> <p>However, it should be noted that the risk of this is substantially reduced with consideration of linear infrastructure projects such as the RTS Project. While the RTS Project will impact on stands of the NSW Box Gum Woodland CEEC, the width of proposed impacts are generally no wider than 60 metres. Despite the RTS Project including temporary disturbance either side of access tracks and hardstands, full impacts have been assessed in these areas. However, the implementation of the BMP will ensure these areas rehabilitate over time. Furthermore, the proposed partial direct impacts (see Section 5.1.2 of the BDAR) managed for the RTS Project will ensure biodiversity values persist in discrete locations along the internal and external transmission line balance of easements.</p> <p>Analysis of the average distances between patches of NSW Box Gum Woodland CEEC was undertaken for mapping within the RTS Development Corridor and Indicative Development Footprints (noting that the Indicative Development Footprint – Public Road Upgrades extend beyond the RTS Development Corridor). This found that the current extent of NSW Box Gum Woodland CEEC within RTS Development Corridor and Indicative Development Footprints (i.e., prior to impacts of the RTS Project) are separated by an average of approximately 65 m. This is compared with approximately 44 m following the proposed removal of the NSW Box Gum Woodland CEEC within Indicative Development Footprints for the RTS Project. This presents a 21 m reduction in average distance between patches of the NSW Box Gum Woodland CEEC due to the RTS Project. While this result seems counter intuitive, it relates to the linear nature of the RTS Project. This allows for two patches that were once separated by 70 m (for example), may become separated by 30 m (for example) following the RTS Project breaking up a single patch into two as a result of an access track (for example).</p>

4. In relation to the impacts from the proposal on the TEC at risk of an SAII, the assessor must include data and information on:

Following the result above, whereby the RTS Project does not negatively affect the average distances between patches of NSW Box Gum Woodland CEEC, we analysed the average patch size for RTS Development Corridor and Indicative Development Footprints. The current average patch size of NSW Box Gum Woodland CEEC within RTS Development Corridor (i.e., prior to impacts of the RTS Project) is 9.0 ha. This is compared with 8.2 ha following the proposed removal of the NSW Box Gum Woodland CEEC within Indicative Development Footprints for the RTS Project. Therefore, following the proposed direct impacts of the RTS Project on NSW Box Gum Woodland CEEC, it reduces the average patch size of remaining stands of the community by 0.8 ha (8.9%).

Keith (1998) described plant populations as “geographically or otherwise distinct groups between which there is little genetic exchange through seed dispersal. Propagules are generally dispersed in the order of metres, with distances greater than 1 kilometre being very rare. In this context, populations are considered distinct if they are separated by discontinuities of >1 kilometre.” The RTS Project is generally linear in nature and only involves relatively small areas of disturbance within a very large project area. It does not involve any components that are 1 kilometre or greater in width. Accordingly, all species characteristic of the NSW Box Gum Woodland CEEC recorded within the in the RTS Development Corridor will still be able to naturally disperse. Furthermore, the remaining patches of NSW Box Gum Woodland CEEC will not be considered as distinct.

iii. describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone(s) (Section 4.3). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.

The following vegetation integrity scores are provided for each vegetation zone and IBRA Sub-region:

- Brigalow Belt South (BBS) – Liverpool Range (refer to Table 3.13 of the BDAR)
- Brigalow Belt South (BBS) – Pilliga (refer to Table 3.14 of the BDAR),
- Sydney Basin – Kerrabee (refer to Table 3.15 of the BDAR).

Descriptions for each applicable Vegetation Zone is provided in Section 3.3.1 of the BDAR.

Vegetation Integrity Analysis	Vegetation Zone 7 (Low Condition)		
	BBS - Liverpool Range	BBS-Pilliga	SB-Kerrabee
Composition	36.7	41.3	78.1
Structure	75.3	89.7	92.8
Function	41.7	54.3	90.2
Vegetation Integrity Score	48.7	58.6	86.8

4. In relation to the impacts from the proposal on the TEC at risk of an SAI, the assessor must include data and information on:

	Vegetation Integrity Analysis	Vegetation Zone 11 (Low Condition)		
		BBS - Liverpool Range	BBS-Pilliga	SB-Kerrabee
Composition	55.6	52.7	57.3	
Structure	80.7	78.4	51.4	
Function	59.5	59.9	48.2	
Vegetation Integrity Score	64.4	62.8	52.2	
	Vegetation Integrity Analysis	Vegetation Zone 17 (DNG)		
		BBS - Liverpool Range	BBS-Pilliga	SB-Kerrabee
Composition	24.9	22.4	44.0	
Structure	61.3	61.4	55.2	
Function	15.0	15.0	0.3	
Vegetation Integrity Score	28.4	27.4	8.5	

2.4 Summary of the SAII Assessment for the TEC against Clause 6.7(2) of the BC Regulation

6.7(2) 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 decline¹ of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or

Paragraph 3.1.2 and 3.2 of the NSW Scientific Committee recognises that the community is eligible for listing as a CEEC as it has suffered a very large reduction in geographic distribution (TSSC 2020). There is evidence that clearing is ongoing and has increased in recent years; with only about 7% of the pre-1750 area remaining (TSSC 2020). The conservation assessment identifies that annual clearing of grassy woodland in NSW over the period 2009-2016 averaged 395 hectares for agricultural related activities and 155 hectares for infrastructure (not including forestry and fire) (Tozer and Simpson 2020)

The Project is located within the South West Slopes bioregion. The NSW conservation assessment identifies that less than four percent of the woodland remains in this bioregion with an estimated 55,798 hectares of woody vegetation in this bioregion reported from TSSC 2006 (Tozer and Simpson 2020).

The extent of occurrence of NSW Box Gum Woodland CEEC throughout its entire range in Australia is identified by Tozer and Simpson (2020) as 702,800 km². The extent of occurrence within NSW is not identified in the TBDC or separately assessed by Tozer and Simpson (2020).

The current geographic extent of this CEEC across its range is estimated by Tozer and Simpson (2020) (reproduced from TSSC 2006) as 576,654 ha, which includes an area of occupancy of 250,729 ha within NSW. This estimate does not include the Derived Native Grassland component of the ecological community.

It is also considered that the current extent of NSW Box Gum Woodland CEEC provided by Tozer and Simpson (2020) is an underestimate based on the current SVTM mapping which maps between 1,267,603 ha and 1,639,571 ha within NSW, as mapped in Figure 5.2 of the BDAR. The variance in the SVTM estimate is due to the upper limit including some PCTs which are described as only partly being associated with the NSW Box Gum Woodland CEEC.

Umwelt has identified 2,644.7 hectares of NSW Box Gum Woodland CEEC within the RTS Development Corridor. The RTS Project Indicative Development Footprints will impact a total of 428.3 hectares of the NSW Box Gum Woodland CEEC in the RTS Development Corridor, representing between 0.003% and 0.002% of the geographic extent of this CEEC mapped in the SVTM. It is considered that the actual proportional impact is likely to be much lower due to the presence of large areas of highly degraded derived native vegetation which are not captured in the STVM.

6.7(2) 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:

The existing Development Consent SSD 6696 allows for impacts up to 200.85 ha to the NSW Box Gum Woodland TEC. At the time of the original assessment and the grant of development Consent SSD 6696, the Box Gum Woodland TEC was listed as an Endangered Ecological Community (EEC). On 17 July 2020, the NSW Threatened Species Scientific Committee made a final determination to list the TEC as a CEEC. The RTS Project proposes to impact 428.3 ha of the NSW Box Gum Woodland CEEC that includes 396.8 ha of low conservation value woodlands and Derived Native Grasslands within the RTS Indicative Development Footprints. Accordingly, the RTS Project proposes to impact an additional 227.45 ha of the NSW Box Gum Woodland CEEC over that already authorised by Development Consent SSD 6696.

Umwelt has undertaken a careful analysis of the true delta (change) in proposed impacts to the NSW Box Gum Woodland CEEC of the RTS Project to the Approved Project (SSD 6696). This analysis is described in Section 5.2.1.1 of the BDAR. It found the true delta (change) of proposed impacts to NSW Box Gum Woodland CEEC between the RTS Project (428.3 ha) and the Approved Project (SSD 6696) (236.8 ha [using the proposed areas of impact]) is 191.5 ha. The RTS Project proposes an Indicative Development Footprint totalling 1,794.1 ha, the proposed total impacts to 428.3 ha of NSW Box Gum Woodland CEEC represents approximately 24% of the Indicative Development Footprint. In summary, despite the RTS Project proposing an Indicative Development Footprint that is 1,043.84 ha (+139%) greater than the disturbance area of the Approved Project (SSD 6696), the proportional impacts to NSW Box Gum Woodland CEEC have decreased by 1%, with the proportional reduction based on considered and extensive avoidance of high-quality NSW Box Gum Woodland CEEC patches.

The 200.85 ha already approved to be cleared under the Development Consent (SSD 6696) represents between 0.02% and 0.01% of the geographic extent of this CEEC mapped in the SVTM.

It is noted that the 428.3 ha of impact to the NSW Box Gum Woodland CEEC associated with the RTS Project is likely to occur over a construction period that is expected to be in excess of 3 years, and therefore the average extent of annual clearing would be less than the average annual clearance of grassy woodland in NSW for agricultural related activities (Tozer and Simpson 2020).

The RTS Project proposes to cause the further decline in area of NSW Box Gum Woodland CEEC that is observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, to the extent of 428.3 ha of NSW Box Gum Woodland CEEC. Comprising 31.6 ha of ModerateGood vegetation, and 396.7 ha of Low Condition Woodlands and Derived Native Grasslands.

6.7(2) 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:

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

Paragraph 3.1.4 of the NSW Scientific Committee identify that the ecological community is subject to a number of threatening processes that have caused severe declines in biotic processes and interactions throughout its range and are likely to cause continuing decline (Tozer and Simpson 2020).

The RTS Project is estimated to impact a total of 428.3 hectares of the NSW Box Gum Woodland CEEC.

Of the six vegetation zones (2, 6, 7, 9 [partially], 11 [partially] and 17) identified as the NSW Box Gum Woodland CEEC, the following are considered to be in ModerateGood condition (totalling 31.6 ha or 7.4% of the total impact area for this RTS Project):

- Vegetation Zone 2 (13.4 ha, representing 3.1% of the NSW Box Gum Woodland CEEC).
- Vegetation Zone 6 (16.2 ha, representing 3.7% of the NSW Box Gum Woodland CEEC).
- Vegetation Zone 9 (2.0 ha [of the total 59.6 ha of the vegetation zone], representing 0.5% of the NSW Box Gum Woodland CEEC).

The remaining three vegetation zones (7, 11 [partially] and 17) are highly disturbed and do not support remnant woodland. These vegetation zones have been disrupted by management for agricultural production including:

- Vegetation Zone 7 (266.9 ha, representing 62.3% of the NSW Box Gum Woodland CEEC) is considered to be in low condition. Despite some hardy native flora species persisting in the understorey, it is characterised by a mostly exotic understorey (exotic pasture), with canopy trees scattered throughout.
- Vegetation Zone 11 (a 2.1 ha portion of the vegetation zone [totalling 205.3 ha], representing 0.5% of the NSW Box Gum Woodland CEEC) is considered to be in low condition. Despite some hardy native flora species persisting in the understorey, it is characterised by a mostly exotic understorey (exotic pasture), with canopy trees scattered throughout.
- Vegetation Zone 17 (127.8 ha conforming with the NSW Box Gum Woodland CEEC, representing 29.8% of the NSW Box Gum Woodland CEEC) is a Derived Native Grassland (however scattered canopy trees do occur).

In summary, 396.8 ha (92.6 %) of the NSW Box Gum Woodland CEEC listed under the BC Act proposed to be impacted within the RTS Indicative Development Footprints is considered to be in either Derived Native Grassland (primarily consisting of exotic pasture) or Low Condition Woodlands. These areas have been impacted by grazing, changes in fire frequency, clearing of woody vegetation, weed species and feral animals.

6.7(2) 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:

	<p>The RTS Project proposes to impact a total of 428.3 ha of the NSW Box Gum Woodland CEEC, comprising 31.6 ha of ModerateGood vegetation, and 396.7 ha of Low Condition Woodlands and Derived Native Grasslands. The best estimate of current geographic extent remaining, using the current SVTM mapping which maps between 1,267,603 ha and 1,639,571 ha of NSW Box Gum Woodland CEEC within NSW. Based on these estimates, the NSW Box Gum Woodland CEEC is NOT currently observed, estimated, inferred or reasonably suspected to have a very small population size.</p>
<p><i>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</i></p>	<p>The RTS Project is estimated to impact a total of 428.3 hectares of the NSW Box Gum Woodland CEEC. However, it is noted that the NSW Scientific Determination for the NSW Box Gum Woodland CEEC identifies that the community does not meet the criteria for critically endangered status as it is not ‘currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution’ as identified for the following parameters:</p> <ul style="list-style-type: none"> • best estimate extent of occurrence of the NSW Box Gum Woodland CEEC in NSW is 702,800 km² and this is above the threshold required for the category of vulnerable under Criterion B1 (Tozer and Simpson 2020) • the best estimate of the area of occupancy of the NSW Box Gum Woodland CEEC in NSW is 151,100 km² and this is above the threshold required for the category of vulnerable under Criterion B2 (Tozer and Simpson 2020). <p>The best estimate of current geographic extent remaining, using the current SVTM mapping which maps between 1,267,603 ha and 1,639,571 ha of NSW Box Gum Woodland CEEC within NSW. Based on these estimates, the NSW Box Gum Woodland CEEC is NOT considered to be observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution.</p>
<p><i>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.</i></p>	<p>The TBDC profile for the NSW Box Gum Woodland CEEC identified multiple Management Actions that are applicable to the ongoing management of the NSW Box Gum Woodland CEEC including the following habitat management controls:</p> <ul style="list-style-type: none"> • feral animal control • management of stock grazing in high quality remnants • no firewood harvest • leave fallen timber • fencing/signage of high-quality remnants • weed control; and • habitat rehabilitation/ restoration/ regeneration to connect remnants.

6.7(2) 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:

Management practices essential to the maintenance and/or improvement of the NSW Box Gum Woodland CEEC are listed in the national recovery plan include:

- maintain or improve soil and drainage conditions/ hydrological regime;
- control exotic plants and feral animals
- avoid inappropriate native tree planting
- maintain or improve connectivity
- maintain or improve structural diversity
- ensure adequate buffers
- minimise chemical use
- implement strategic grazing, and
- implement appropriate burning regimes; avoid inappropriate mowing/slashing.

The identification of such management actions suggests the NSW Box Gum Woodland CEEC is likely to respond to management.

The RTS Project has made all reasonable attempts to avoid higher quality remnants, minimise fragmentation and provide buffers. Less than 8% of the NSW Box Gum Woodland CEEC to be cleared in ModerateGood condition with the majority of the NSW Box Gum Woodland CEEC impacted by the project being either Derived Native Grassland or Low Condition Woodland.

During construction, the RTS Project will implement a range of mitigation measures targeted at further minimising impacts on the NSW Box Gum Woodland CEEC. These are described in Section 4.3 of the BDAR, but generally include, demarcation, pre-clearance and tree-felling protocols, salvaging of key fauna habitat, natural regeneration and recruitment of flora species, weed species management, and erosion control. Thus, disturbance of the NSW Box Gum Woodland CEEC will be minimised.

The NSW Box Gum Woodland CEEC is known to respond positively to management actions to improve its habitat and vegetation integrity, therefore the proposed impacts of the RTS Project are not considered irreplaceable for the NSW Box Gum Woodland CEEC.

¹ Clause 6.7(3) of the BC Regulations defines a decline of a species or ecological community as a continuing or project decline in the index of abundance or the geographic distribution and habitat quality.

3.0 Large-eared Pied Bat (*Chalinolobus dwyeri*)

3.1 Section 9.1.2 of BAM 2020 Additional Impact Assessment Provisions – Current Population Status

There is no determination from the NSW Threatened Species Committee on which to rely upon for this assessment of status of the large-eared pied bat in NSW. The following information relies largely on information within the recent national conservation advice (DAWE 2021) and the NSW Threatened Biodiversity Data Collection (TBDC).

Criteria	Current Status in NSW	Impact of the Liverpool Range WF Modification
1. The action and measures taken to avoid the direct and indirect impacts on the potential entity for an SAI	Not applicable	The measures taken to avoid direct and indirect impacts are detailed in Section 4.0 of the BDAR
2. Current status of the Large-eared Pied Bat at risk of an SAI:		
a. Evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the:	The generation length for the large-eared pied bat is 4 to 5 years (DAWE 2021) therefore three generations are 12 to 15 years. The EPBC Act listing advice for the species states that while there is no definitive data on total population numbers it is presumed to have undergone large declines in numbers due to removal of suitable habitat (TSSC 2010). The National Recovery Plan (DERM 2011) for the large-eared pied bat determined the species has a declining population. The degree to which this has occurred over the last decade, or three generations is not published information. Based on the information above, estimating the population size of this species in NSW is not possible.	Not applicable
i. Decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or		
ii. Decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in	Based on information in the TBDC profile, the species breeds in sandstone caves and overhangs (DPIE 2021). Generally speaking, this habitat is less susceptible to clearing activities. It could therefore be assumed that removal of suitable breeding habitat in NSW is likely to be low. Despite this, it cannot be determined if the NSW population is in decline.	Not applicable

Criteria	Current Status in NSW	Impact of the Liverpool Range WF Modification
<p>geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.</p>	<p>The EPBC Act listing advice for the species identifies that the species is likely to continue to decline in numbers due to ongoing threats of disturbance and interference with primary nursery roosts (TSSC 2010).</p> <p>Habitat disturbance by other animals is a known historical and current threat to the population. The feral goat is increasingly inhabiting and destroying roost sites in sandstone caves (DAWE 2021).</p> <p>Predation by introduced predators has not been investigated (DAWE 2021).</p> <p>It is unknown if there is a disease impacting the species (DAWE 2021).</p>	
<p>b. Evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by:</p> <p>i. An estimate of the species' current population size in NSW, and</p>	<p>The TBDC profile provides no estimation of the population size of the large-eared pied bat in NSW.</p> <p>The 2021 conservation advice for listing under the EPBC Act (DAWE 2021) identifies that the national population size was estimated to be less than 20,000 individuals as at 2014 (DAWE 2021). The population structure and number of locations are poorly known however many of the strongholds for the species are associated with the Sydney sandstone region and Pilliga in NSW (DAWE 2021). Based on this advice it is likely that the majority of the population occurs in NSW.</p> <p>Based on the information above, estimating the population size of this species in NSW is not possible (DERM 2011).</p>	Not applicable
<p>ii. An estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer), and</p>	<p>Based on the information provided above, the extent and rate of decline cannot be determined for the NSW population.</p>	Not applicable
<p>iii. Where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations</p>	<p>The largest known populations of the large-eared pied bat occur in those areas dominated by sandstone escarpments. A number of locations have been estimated to support maternity colonies containing 20 to 40 females, while up to 100 individuals may be present at maternity roosts (DAWE 2021). Further survey is required throughout its known range to determine the size and distribution of existing populations (DERM 2011).</p>	Not applicable

Criteria	Current Status in NSW	Impact of the Liverpool Range WF Modification
	<p>Across the species range it is infrequently recorded and in the area of NSW with its highest recording the species comprised only 6% of all bat observations (DAWE 2021) but this may reflect the habitat specialisation of the species more than rarity (Pennay et al 2011).</p> <p>Within NSW, based on available records, the largest concentration of populations appears to be in the sandstone escarpments of the Sydney basin and northwest slopes of NSW where it is present in areas of volcanic strata (DAWE 2021). Much of this habitat occurs within state reserves and should be the subject of recovery actions. The species has also been recorded from a few locations in the sandstone escarpments of the Morton National Park at the southern end of its range.</p> <p>Pennay et al (2011) mapped high densities of large-eared pied bat in the Pilliga and Sydney sandstone region. The RTS Project Site occurs at the northern end of the sandstone region and south of the Pilliga.</p> <p>Within the immediate locality of the RTS Project, the large-eared pied-bat is known from Coolah Tops National Park, Goulburn River National Park, Munghorn Gap Nature Reserve, Wollemi National Park and crown land near Ulan (DERM 2011). It is likely that these reserves will support roosting and foraging habitat for the species.</p>	
<p>c. Evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by:</p> <p>i. Extent of occurrence</p>	<p>This species is typically found in areas with extensive cliffs and caves (DPIE 2021). The species extent spans from Rockhampton in Queensland, south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW (DPIE 2021). Scattered records also occur between the New England Tablelands and North West Slopes (DPIE 2021).</p> <p>The national population extent of occurrence is estimated to be 280,000km² however the distribution may be considered severely fragmented given that most individuals occur in small and relatively isolated subpopulations (DAWE 2021).</p> <p>The extent of occurrence in NSW is unknown. Pennay et al (2011) estimated the range in NSW as 183,059 km².</p>	<p>Not applicable</p>

Criteria	Current Status in NSW	Impact of the Liverpool Range WF Modification
ii. Area of occupancy	<p>The area of occupancy is defined by the area supporting maternity roost sites. The national population area of occupancy is estimated to be 1,500km² (DAWE 2021).</p> <p>The EPBC Act listing advice states that despite detailed surveys throughout the species' extent of occurrence in NSW, only three nursery roosts are known and only one of these is currently being used. The area of occupancy in NSW during the breeding season is likely to be limited to this one site which is less than 1 km² (TSSC 2010).</p>	<p>Not applicable</p>
iii. Number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and	<p>Not applicable to this species.</p>	<p>Not applicable</p>
iv. Whether the species' population is likely to undergo extreme fluctuations	<p>The population of this species is not likely to undergo extreme fluctuations, as it is not typically a 'boom and bust' species subject to major fluctuations related to the availability of resources.</p>	<p>Not applicable</p>
<p>d. Evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:</p> <p>i. Known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g., species is clonal) on, a biodiversity stewardship site</p>	<p>This species does have reproductive characteristics that severely limit its ability to increase in population size or occupy new habitat, as the species is reliant on specific habitat for breeding allowing for clustering of roosting bats. Females will return to the same maternity sites. While this habitat cannot be created on a Biodiversity Stewardship Site, breeding habitat on the site can be enhanced or even created.</p>	<p>Not applicable</p>
<p>ii. The species is reliant on abiotic habitats which cannot be restored or replaced (e.g., karst systems) on a biodiversity stewardship site, or</p>	<p>This species is reliant on sandstone caves and overhangs for maternity roosts (DPIE 2021). The structure of maternity roosts appears to be very specific (arch caves with dome roofs) with caves high and deep enough to allow juveniles to learn to fly inside with indentations to allow for clustering (DAWE 2021). The species also requires high-fertility forest or woodland near roosting habitat (DAWE 2021).</p>	<p>Not applicable</p>

Criteria	Current Status in NSW	Impact of the Liverpool Range WF Modification
	In keeping with the BAM, breeding habitat is identified as nominated PCTs within 2 km of suitable roosting habitat (i.e. caves and overhangs), and therefore a biodiversity stewardship site within 2 km or comprising this habitat could be suitable.	
iii. Life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g., frogs severely impacted by chytrid fungus).	There is no available literature or information on the life history traits of the species that would provide insight to its ability to control key threatening processes at a stewardship site.	Not applicable
3. Where the TBDC indicates data is 'unknown' or 'data deficient' for a species for a criterion listed in Subsection 9.1.2(2), the assessor must record this in the BDAR or BCAR	The TBDC profile does not provide any information, or is unknown, for SAIL Principles 1–4.	Not applicable

3.2 Section 9.1.2 of BAM 2020 - Assessment of the Impact of the RTS Project

4. In relation to the impacts from the proposal on the species at risk of an SAIL, the assessor must include data and information on:	
a. The impact on the species' population (Principles 1 and 2) presented by:	
i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and	<p>The population size within the RTS Indicative Development Footprints is not and cannot be known. The species was recorded at five locations, primarily within and adjacent to the Durrigere State Conservation Area as well as one location in the wind farm component of the Project (NGH 2013a, 2013b and 2017).</p> <p>An estimate of the number of individuals present in the subpopulation in the RTS Project Site is not known and there is no data on the total NSW population size.</p>
ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or	The population size within the RTS Indicative Development Footprints and in NSW is not known. Therefore, an estimate of the number of individuals impacted by the RTS Indicative Development Footprints as a percentage of the total NSW population cannot be provided.

4. In relation to the impacts from the proposal on the species at risk of an SAI, the assessor must include data and information on:

iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal

The EPBC Act listing advice for the species states that there is no definitive data on total population numbers (TSSC 2010). Furthermore, the population size within the RTS Indicative Development Footprints is not and cannot be known.

The unit of measure for this species under BAM is 'area'. It is not possible to determine the numbers of individuals present or that will be impacted. Foraging habitat only (no breeding habitat) was recorded in the RTS Project.

Habitat has been identified based on presence of suitable PCTs occurring in the RTS Indicative Development Footprints within 2 km of suitable rocky habitat. This analysis identified 106.7 ha of foraging habitat occurs in the RTS Indicative Development Footprints.

A total of 571.9 ha of foraging habitat was mapped in the RTS Development Corridor, in accordance with the BAM methodology as part of the biodiversity assessment. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project. A total of 106.7 ha of foraging habitat will be directly impacted within the RTS Indicative Development Footprints as part of the RTS Project. This represents a reduction of 18.7% of the area of foraging habitat recorded within the RTS Development Corridor.

b. Impact on geographic range (Principles 1 and 3) presented by:

i. the area of the species' geographic range to be impacted by the proposal in ha, and a percentage of the total AOO, or EOO within NSW

Detailed information regarding AOO or EOO within NSW is not available, however the proposed removal of 106.7 ha of foraging habitat is likely to be negligible within NSW.

ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted

A total of 106.7 ha of mapped foraging habitat occurs in the RTS Indicative Development Footprints. This area of habitat represents foraging habitat for the species in proximity to potential roost sites and breeding habitat. Therefore, no individuals of the species will be directly impacted through habitat clearing however, some habitat will be affected. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project.

The RTS Project has potential to impact on the species through turbine strike and/or barotrauma. The number of individuals is not known and cannot be accurately predicted. The RTS Project will prepare and implement a BBAMP which will assess and monitor micro-bats being impacted by turbine strike and/or barotrauma. Trigger levels will be established as to corrective measures that would be required should the species be impacted by turbine strike and/or barotrauma.

4. In relation to the impacts from the proposal on the species at risk of an SAI, the assessor must include data and information on:

iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g., seed dispersal) and pollination distance for the species

The EPBC Act listing advice for the species states that there is no definitive data on total population numbers (TSSC 2010). Therefore, identifying individual populations is not possible.

However, the removal of 106.7 ha of mapped foraging habitat is unlikely to impact upon the viability of any individuals that may occur within the RTS Indicative Development Footprints. Genetic exchange is likely to remain unaffected due to the highly mobile nature of the species. Within the broader RTS Development Corridor, a total of 571.9 ha of foraging habitat was recorded for the species.

The removal of 106.7 ha of foraging habitat within the RTS Indicative Development Footprints represents a reduction of 18.7% of the area of habitat recorded within the RTS Development Corridor. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project.

iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.

The removal of 106.7 ha of foraging habitat is unlikely to change any potential threats for this highly species. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project. The proposal is not likely to change fire regimes, hydrology, pollutants, species interactions, fragmentation, edge effects, likelihood of disturbance, disease, pathogens and parasites to a point at which measurable change will occur.

3.3 Summary of the SAII Assessment for the Large-eared Pied Bat against Clause 6.7(2) of the BC Regulation

6.7(2) 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 decline¹ of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or	<p>The EPBC Act listing advice for the species states that while there is no definitive data on total population numbers it is presumed to have undergone large declines in numbers due to removal of suitable habitat (TSSC 2010). The National Recovery Plan (DERM 2011) for the large-eared pied bat determined the species has a declining population. Therefore, it is not possible to assess if there has been or is currently a rapid decline in the population.</p> <p>The RTS Indicative Development Footprint would clear about 18.7% of the area of foraging habitat recorded within the RTS Development Corridor as defined by the BAM. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project. The species is particularly vulnerable to threats that impact shelter and breeding sites. The RTS Indicative Development Footprint will not impact directly on shelter and breeding sites but will clear vegetation within 2km of potential roosting habitat associated with rocky areas containing caves, or overhangs or crevices.</p> <p>There are no records of blade strike of large-eared pied bat in the available literature from post-construction monitoring conducted and made publicly available (Moloney et al. 2019). Despite there being a substantial lack of information on the flying behaviour of this species, it is possible that the large-eared pied bat will fly at rotor sweep height. The overall risk rating for large-eared pied bat is moderate, based on a moderate likelihood and moderate consequence of collision.</p> <p>The RTS Project is required to prepared and implement a detailed Bird and Bat Adaptive Management Plan (BBAMP) as part of its existing state (SSD 6696) and Federal Approval (EPBC 2014/7136). This document will be a critical post-approval management plan for the RTS Project ensuring it adequately manages and reduces risks of turbine strike and barotrauma in an adaptive manner.</p> <p>The RTS Project has the potential to cause further decline of large-eared pied-bat which is observed, estimated, inferred or reasonably suspected to be in a decline. Whether or not that decline is rapid is not known. The decline could relate to the potential for turbine strike, as well as the removal of 106.7 ha of foraging habitat.</p>
b) it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or	<p>The population size in NSW is not known. Across the species range it is infrequently recorded and in the area with its highest recording the species comprised only 6% of all bat observations (DAWE 2021). The large-eared pied bat appears to exist in several small populations throughout its range dispersing from the maternity roosts around April.</p>

6.7(2) 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:

reasonably suspected to have a very small population size, or

The population within the Indicative Development Footprints is not and cannot be known. The species was recorded at five locations, primarily within and adjacent to the Durrigere State Conservation Area as well as one location in the wind farm component of the Project (NGH 2013a, 2013b and 2017). No high densities of the species have been recorded.

The RTS Project is required to prepared and implement a detailed BBAMP) as part of its existing state (SSD 6696 and Federal Approval (EPBC 2014/7136). This document will be a critical post-approval management plan for the RTS Project ensuring it adequately manages and reduces risks of turbine strike and barotrauma in an adaptive manner.

The RTS Project has the potential to reduce the population size of large-eared pied-bat which is observed, estimated, inferred or reasonably suspected to have a small population. Whether or not it is a very small population is not known. The reduction could relate to the potential for turbine strike, as well as the removal of 106.7 ha of foraging habitat.

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

The species current distribution is poorly known. The geographic distribution of the large-eared pied bat extends from Rockhampton in Queensland, south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution across its range but much of the known distribution is within NSW particularly in the sandstone escarpments of the Sydney Basin and the north-west slopes. Scattered records also occur between the New England Tablelands and North West Slopes (DPIE 2021). The distribution may be considered severely fragmented given that most individuals occur in small and relatively isolated subpopulations (DAWE 2021).

A total of 571.9 ha of foraging habitat was mapped in accordance with the BAM methodology as part of the biodiversity assessment within the RTS Development Corridor, of which, 106.7 ha will be directly impacted in the Indicative Development Footprints as part of the RTS Project. This represents a reduction of 18.7% of the area of foraging habitat recorded within the RTS Development Corridor. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project.

The RTS Project proposes to impact on 106.7 ha of foraging habitat for large-eared pied-bat, which is observed, estimated, inferred or reasonably suspected have a very limited geographic distribution.

6.7(2) 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:

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.

The main threat to this species is loss of roosting habitat. With no roosting habitat recorded within the RTS Development Corridor, the RTS Project does not propose to impact any roosting habitat for the species. The main measures to improve its habitat include protection of roosting sites from development and control of feral goats to reduce disturbance of roosting sites. TBDC profile identifies other management measures focused on improving foraging habitat and include management of too-frequent intervals of fires that expose roosting bats to smoke impacts and change the structure of foraging habitat; and reduce use of pesticides. The RTS Project is not proposing any specific mitigation measures that would specifically address the main threat identified for the species. However, the pre-clearance and tree-felling procedure described in Section 4.3 will potentially directly mitigate impacts on the species through construction should any individuals be temporarily using foraging habitat for roosting purposes.

It is not known whether or not the large-eared pied-bat would respond to measures to improve its habitat, however as the TBDC does identify a number of management measures it is inferred. Therefore the proposed impacts of the RTS Project are not considered to be irreplaceable.

¹ Clause 6.7(3) of the BC Regulations defines a decline of a species or ecological community as a continuing or projected decline in the index of abundance or the geographic distribution and habitat quality.

4.0 Eastern Cave Bat (*Vespadelus troughtoni*)

4.1 Section 9.1.2 of BAM 2020 Additional Impact Assessment Provisions – Current Population Status

There is no determination from the NSW Threatened Species Committee on which to rely upon for this assessment of status of the eastern cave bat in NSW. The following information relies largely on information on the NSW Threatened Biodiversity Data Collection (TBDC) and threatened species profiles.

Criteria	Current Status in NSW	Impact of the Liverpool Range WF Modification
1. The action and measures taken to avoid the direct and indirect impacts on the potential entity for an SAI	Not applicable	The measures taken to avoid direct and indirect impacts are detailed in Section 4.0 of the BDAR
2. Current status of the eastern cave bat at risk of an SAI		
a. Evidence of rapid decline (Principle 1, clause 6.7(2)(a) BC Regulation) presented by an estimate of the: i. Decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or	<p>The TBDC profile for the species states that “very little is known about the biology of this uncommon species” and “little is understood of its feeding or breeding requirements or behaviour” (DPIE 2021).</p> <p>There is no available literature or information on the population of this species, including its entire population or its population in NSW. Therefore, it is not possible to assess the decline in the population in the past 10 years or three generations.</p>	Not applicable
ii. Decline in population of the species in NSW in the past 10 years or three generations (whichever is longer) as indicated by: an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effect of introduced species, hybridisation, pathogens, pollutants, competitors or parasites.	<p>Based on the information above, it is not possible to assess the decline in the population in the past 10 years or three generations.</p> <p>There is no available literature on an index of abundance.</p>	Not applicable
b. Evidence of small population size (Principle 2, clause 6.7(2)(b) BC Regulation) presented by: i. An estimate of the species’ current population size in NSW, and	Based on the information above, the current population of the species is not known.	Not applicable
ii. An estimate of the decline in the species’ population size in NSW in three years or one generation (whichever is longer), and	Based on the information above, it is not possible to assess the status of the population in the past 3 years or one generation.	Not applicable

Criteria	Current Status in NSW	Impact of the Liverpool Range WF Modification
iii. Where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations	<p>There is no available literature or information on the population of this species, nor its potential for fluctuations.</p> <p>The TBDC profile for the species states that the species has been recorded in colonies of up to 500 individuals.</p>	<p>Not applicable</p>
c. Evidence of limited geographic range for the threatened species (Principle 3, clause 6.7(2)(c) BC Regulation) presented by: i. Extent of occurrence	<p>The Eastern Cave Bat has primarily a tropical distribution and is found in a broad band on both sides of the Great Dividing Range from Cape York (QLD) to Kempsey (NSW), with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT (DPIE 2021).</p> <p>The extent of occurrence in NSW is unknown. Pennay et al (2011) estimated the range in NSW as 148,895km².</p>	<p>Not applicable</p>
ii. Area of occupancy	<p>There is no available literature or information on the area of occupancy for this species.</p>	<p>Not applicable</p>
iii. Number of threat-defined locations (geographically or ecologically distinct areas in which a single threatening event may rapidly affect all species occurrences), and	<p>There is no available literature or information on the species that would allow for the identification of threat-defined locations.</p>	<p>Not applicable</p>
iv. Whether the species' population is likely to undergo extreme fluctuations	<p>There is no available literature or information on the population of this species, nor its potential for fluctuations.</p>	<p>Not applicable</p>
d. Evidence that the species is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation) because:	<p>There is no available literature or information on the known reproductive characteristics of the species.</p>	<p>Not applicable</p>

Criteria	Current Status in NSW	Impact of the Liverpool Range WF Modification
<p>i. Known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g., species is clonal) on, a biodiversity stewardship site</p>		
<p>ii. The species is reliant on abiotic habitats which cannot be restored or replaced (e.g., karst systems) on a biodiversity stewardship site, or</p>	<p>This species is reliant on caves for maternity roosts and therefore breeding habitat cannot be restored or replaced on a biodiversity stewardship site (DPIE 2021).</p> <p>In keeping with the BAM, breeding habitat is identified as nominated PCTs within 2 km of suitable roosting habitat (i.e., caves and overhangs), and therefore a biodiversity stewardship site within 2 km or comprising this habitat could be suitable.</p>	<p>Not applicable</p>
<p>iii. Life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g., frogs severely impacted by chytrid fungus).</p>	<p>There is no available literature or information on the life history traits of the species that would provide insight to its ability to control key threatening processes at a stewardship site.</p>	<p>Not applicable</p>
<p>3. Where the TBDC indicates data is ‘unknown’ or ‘data deficient’ for a species for a criterion listed in Subsection 9.1.2(2), the assessor must record this in the BDAR or BCAR</p>	<p>The TBDC profile does not provide any information, or is unknown, for SAll Principles 1 – 4.</p>	<p>Not applicable</p>

4.2 Section 9.1.2 of BAM 2020 Assessment of the Impact of the RTS Project

4. In relation to the impacts from the proposal on the species at risk of an SAIL, the assessor must include data and information on:	
a. The impact on the species' population (Principles 1 and 2) presented by:	
i. an estimate of the number of individuals (mature and immature) present in the subpopulation on the subject land (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and	<p>The population size within the Indicative Development Footprint or RTS Development Corridor is not and cannot be known. The species was recorded at 7 locations, across the wind farm component of the RTS Project to Durridgere State Conservation Area as part of the original assessment (NGH 2013a, 2013b and 2017). Umwelt recorded this species to a possible or species group confidence. It was recorded at one location, in the north west corner of the wind farm component of the RTS Project.</p> <p>There is no available literature or information on the population of this species in NSW.</p> <p>Therefore, the population size within the RTS Indicative Development Footprints is not and cannot be known.</p>
ii. an estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or	<p>The population size within the RTS Indicative Development Footprints and in NSW is not known. Therefore, an estimate of the number of individuals impacted by the RTS Indicative Development Footprints as a percentage of the total NSW population cannot be provided.</p>
iii. if the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that will be impacted, along with the area of habitat to be impacted by the proposal	<p>There is no available literature or information on the population of this species. Therefore, the population size within the RTS Indicative Development Footprints or RTS Development Corridor is not and cannot be known.</p> <p>A total of 587.4 ha of foraging habitat was mapped in the RTS Development Corridor, in accordance with the BAM methodology as part of the biodiversity assessment. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project. A total of 108.3 ha of foraging habitat will be directly impacted within the RTS Indicative Development Footprints as part of the RTS Project. This represents a reduction of 18.4% of the area of foraging habitat recorded within the RTS Development Corridor.</p>
b. Impact on geographic range (Principles 1 and 3) presented by:	
i. the area of the species' geographic range to be impacted by the proposal in ha, and a percentage of the total AOO, or EOO within NSW	<p>Detailed information regarding AOO or EOO is not available, however the proposed removal of 108.3 ha of foraging habitat is likely to be negligible within NSW. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project.</p>

4. In relation to the impacts from the proposal on the species at risk of an SAIL, the assessor must include data and information on:

<p>ii. the impact on the subpopulation as either: all individuals will be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species will be directly impacted</p>	<p>A total of 108.3 ha of mapped foraging habitat occurs in the RTS Indicative Development Footprints. This area of habitat represents foraging habitat for the species in proximity to potential roost sites and breeding habitat. Therefore, no individuals of the species will be directly impacted through habitat clearing however, some habitat will be affected. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project.</p> <p>The RTS Project has potential to impact on the species through turbine strike and/or barotrauma. The number of individuals is not known and cannot be accurately predicted. A BBAMP will be prepared and implemented for the RTS Project which will assess and monitor micro-bats being impacted by turbine strike and/or barotrauma. Trigger levels will be established as to corrective measures that would be required should the species be impacts by turbine strike and/or barotrauma.</p>
<p>iii. to determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g., seed dispersal) and pollination distance for the species</p>	<p>There is no available literature or information on the population of this species. Therefore, identifying individual populations is not possible.</p> <p>The broader landscape within which the Project is located is highly fragmented and the RTS Project is not expected to result in additional fragmentation that will adversely affect the viability of this highly mobile species.</p> <p>The removal of 108.3 ha of foraging habitat is unlikely to impact upon the viability of any individuals that may occur within the RTS Indicative Development Footprints. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project. Genetic exchange is likely to remain unaffected due to the highly mobile nature of the species.</p>
<p>iv. to determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.</p>	<p>There is no available literature or information on the population of this species. Therefore, identifying individual populations is not possible.</p> <p>However, the removal of 108.3 mobile species. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project. The proposal is not likely to change fire regimes, hydrology, pollutants, species interactions, fragmentation, edge effects, likelihood of disturbance, disease, pathogens and parasites to a point at which a measurable change to the species will occur.</p>

4.3 Summary of the SAII Assessment for the Large-eared Pied Bat against Clause 6.7(2) of the BC Regulation

6.7(2) 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:	
<i>a) it will cause a further decline¹ of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or</i>	<p>There is no available literature or information on the population of this species, including its entire population or its population in NSW. Therefore, it is not possible to assess if there has been or is currently a rapid decline in the population.</p> <p>The RTS Indicative Development Footprint would clear about 18.5% of the area of foraging habitat recorded within the RTS Development Corridor as defined by the BAM. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project. As this species is a habitat specialist with regard to roosting sites, meaning its roosting habitat is very restrictive, it is assumed that the species is particularly vulnerable to threats that impact shelter and breeding sites. The RTS Indicative Development Footprint will not impact directly on shelter and breeding sites but will clear vegetation within 2 km of potential roosting habitat associated with rocky areas containing caves, or overhangs or crevices.</p> <p>The RTS Project has potential to impact on the species through turbine strike and/or barotrauma. The number of individuals is not known and cannot be accurately predicted. A BBAMP will be prepared and implemented for the RTS Project which will assess and monitor micro-bats being impacted by turbine strike and/or barotrauma. Trigger levels will be established as to corrective measures that would be required should the species be impacted by turbine strike and/or barotrauma.</p> <p>The RTS Project has the potential to cause further decline of eastern cave bat, however it is not known if the species is observed, estimated, inferred or reasonably suspected to be in a rapid state of decline. The decline could relate to the potential for turbine strike, as well as the removal of 106.7 ha of foraging habitat.</p>
<i>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</i>	<p>The population size in NSW is not known.</p> <p>The population within the RTS Indicative Development Footprints is not and cannot be known and it is unknown what subpopulations occur in the region.</p> <p>The potential impacts described above may impact on individuals.</p> <p>The RTS Project has the potential to reduce the population size of eastern cave bat through the potential for turbine strike, as well as the removal of 106.7 ha of foraging habitat. However it is not known if the species is observed, estimated, inferred or reasonably suspected to have a very small population.</p>

6.7(2) 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:

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

The Eastern Cave Bat has primarily a tropical distribution and is found in a broad band on both sides of the Great Dividing Range from Cape York (QLD) to Kempsey (NSW), with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT (DPIE 2021).

A total of 587.4 ha of foraging habitat was mapped in the RTS Development Corridor, in accordance with the BAM methodology as part of the biodiversity assessment. No roosting habitat has been recorded or is proposed to be impacted by the RTS Project. A total of 108.3 ha of foraging habitat will be directly impacted within the RTS Indicative Development Footprints as part of the RTS Project. This represents a reduction of 18.4% of the area of foraging habitat recorded within the RTS Development Corridor.

The RTS Project proposes to impact on 108.3 ha of foraging habitat for eastern cave bat, however the species is not considered to be observed, estimated, inferred or reasonably suspected have a very limited geographic distribution.

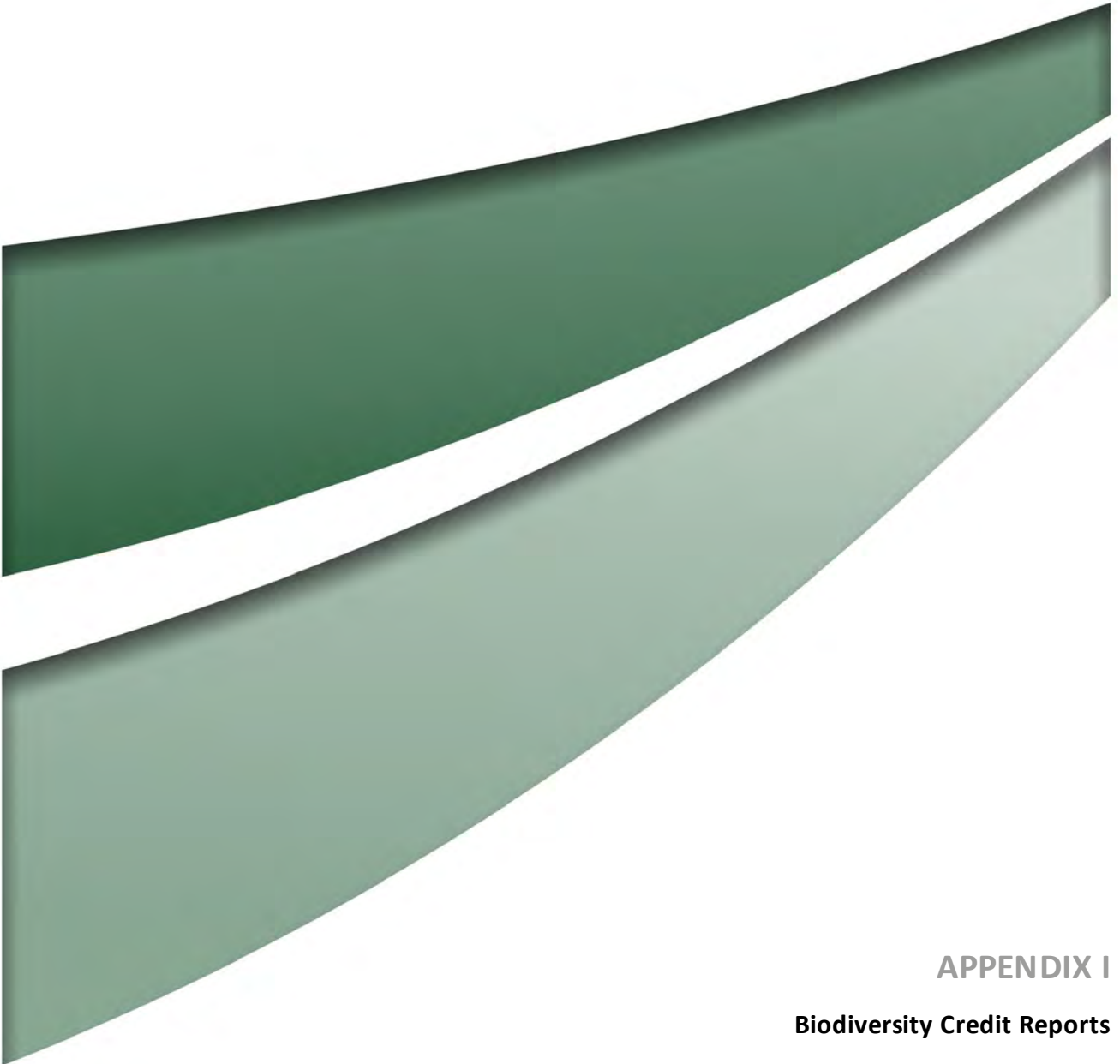
d) the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.

The key threats to the species are loss, fragmentation and degradation of habitat particularly around potential roosting habitat.

No roosting habitat has been recorded or is proposed to be impacted by the RTS Project.

The main measures to improve its habitat include protection of roosting sites from development and avoidance of disturbance of known roosting and maternity sites from recreational caving activities. TBDC profile identifies other management measures focused on improving foraging habitat and include management of too-frequent intervals of fires and reduce use of pesticides.

It is not known whether or not the eastern cave bat would respond to measures to improve its habitat, however as the TBDC does identify a number of management measures it is inferred. Therefore the proposed impacts of the RTS Project are not considered to be irreplaceable.



APPENDIX I

Biodiversity Credit Reports

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018634/BAAS17068/19/00018638	LR Wind Farm - SydneyBasin-Kerrabee 2023 RTS Revised Partial Impacts	22/06/2023
Assessor Name	Report Created	BAM Data version *
	14/08/2023	61
Assessor Number	BAM Case Status	Date Finalised
	Finalised	14/08/2023
Assessment Revision	Assessment Type	
9	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Ecosystem credits
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Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley

4	483_VZ6- ModGood	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	81.9	32.7	0.2	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	4
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5	483_VZ7- Low	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	86.8	57.9	18	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	651
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6	483_VZ8- Low-DNG	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	23.2	23.2	0.3	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	4
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10	483_VZ17-DNG	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	8.5	8.5	0.2	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	0
										Subtotal	659	
Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin												
8	1661_VZ15-ModGood	Not a TEC	63.4	42.3	24	PCT Cleared - 50%	High Sensitivity to Gain			1.75		444
										Subtotal	444	

Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion												
2	479_VZ4- ModGood	Not a TEC	58.3	39.7	2.7	PCT Cleared - 40%	High Sensitivity to Gain			1.50		40
										Subtotal	40	
Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region												
3	481_VZ5- ModGood	Not a TEC	62.6	43.7	2.3	PCT Cleared - 28%	High Sensitivity to Gain			1.50		38
										Subtotal	38	

Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

1	281_VZ2- ModGood	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	85.9	51.0	10.5	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	335
											Subtotal	335

Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin

9	1675_VZ1 6- ModGood	Not a TEC	73.7	46.1	21.8	PCT Cleared - 27%	High Sensitivity to Gain			1.50		377
											Subtotal	377

Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion

7	488_VZ11- Low	Not a TEC	52.2	35.0	3.6	PCT Cleared - 50%	High Sensitivity to Gain		1.75		55
										Subtotal	55
										Total	1948

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAI	Species credits	
<i>Acacia ausfeldii / Ausfeld's Wattle (Flora)</i>										
281_VZ2- ModGood	51.0	51.0	10.5			Vulnerable	Not Listed	False	268	
									Subtotal	268
<i>Calyptorhynchus lathami / Glossy Black-Cockatoo (Fauna)</i>										
488_VZ11-Low	35.0	35.0	1.7			Vulnerable	Vulnerable	False	30	
									Subtotal	30
<i>Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)</i>										
281_VZ2- ModGood	51.0	51.0	10.5			Vulnerable	Vulnerable	True	401	
488_VZ11-Low	35.0	35.0	3			Vulnerable	Vulnerable	True	79	
									Subtotal	480

<i>Lophoictinia isura / Square-tailed Kite (Fauna)</i>									
281_VZ2-ModGood	51.0	51.0	0.4		Vulnerable	Not Listed	False		8
1661_VZ15-ModGood	42.3	42.3	0.4		Vulnerable	Not Listed	False		6
1675_VZ16-ModGood	46.1	46.1	0.7		Vulnerable	Not Listed	False		12
								Subtotal	26
<i>Petaurus norfolcensis / Squirrel Glider (Fauna)</i>									
281_VZ2-ModGood	51.0	51.0	10.5		Vulnerable	Not Listed	False		268
481_VZ5-ModGood	43.7	43.7	2.3		Vulnerable	Not Listed	False		50
483_VZ6-ModGood	32.7	32.7	0.2		Vulnerable	Not Listed	False		3
483_VZ7-Low	57.9	57.9	12.6		Vulnerable	Not Listed	False		365
488_VZ11-Low	35.0	35.0	3.6		Vulnerable	Not Listed	False		63
								Subtotal	749
<i>Vespadelus troughtoni / Eastern Cave Bat (Fauna)</i>									
281_VZ2-ModGood	51.0	51.0	10.5		Vulnerable	Not Listed	True		401
488_VZ11-Low	35.0	35.0	3		Vulnerable	Not Listed	True		79
								Subtotal	480

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018634/BAAS17068/19/00018635	LR Wind Farm - Brigalow-Liverpool Range 2023 RTS Revised Partial Impacts	22/06/2023
Assessor Name	Report Created	BAM Data version *
	14/08/2023	61
Assessor Number	BAM Case Status	Date Finalised
	Finalised	14/08/2023
Assessment Revision	Assessment Type	
9	Major Projects	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Ecosystem credits
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Brittle Gum - Silvertop Stringybark grassy open forest of the Liverpool Range, Brigalow Belt South Bioregion												
13	495_VZ14- ModGood	Not a TEC	52.7	46.6	23.7	PCT Cleared - 17%	High Sensitivity to Gain			1.50		415
										Subtotal	415	
Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley												
3	483_VZ6- ModGood	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	76.1	55.3	15.6	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	539

4	483_VZ7-Low	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	48.7	43.7	187. Population 7 size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	5129
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14	483_VZ17-DNG	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	28.4	28.4	104.	Population 2 size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	1850
											Subtotal	7518
Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley												
5	483_VZ8-Low-DNG	Not a TEC	24.6	24.6	270	PCT Cleared - 90%	High Sensitivity to Gain			2.50		4155
											Subtotal	4155

River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion													
1	84_VZ1- ModGood	Not a TEC	54.4	46.9	6.5	PCT Cleared - 40%	High Sensitivity to Gain				1.50	114	
											Subtotal	114	
Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion													
2	281_VZ2- ModGood	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	51.3	17.2	0.7	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed		2.50	True	8
											Subtotal	8	

Silvertop Stringybark - Forest Ribbon Gum very tall moist open forest on basalt plateau on the Liverpool Range, Brigalow Belt South Bioregion											
12	490_VZ13- ModGood	Not a TEC	78.5	78.5	15.2	PCT Cleared - 28%	High Sensitivity to Gain			1.50	447
										Subtotal	447
Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion											
6	488_VZ9- ModGood	Not a TEC	89.3	79.5	56.9	PCT Cleared - 50%	High Sensitivity to Gain			1.75	1979
8	488_VZ10- ModGood -Shrub	Not a TEC	81.1	48.5	0.5	PCT Cleared - 50%	High Sensitivity to Gain			1.75	11
9	488_VZ11- Low	Not a TEC	64.4	57.7	197.1	PCT Cleared - 50%	High Sensitivity to Gain			1.75	4977
11	488_VZ12- Exotic	Not a TEC	14.1	14.1	366.2	PCT Cleared - 50%	High Sensitivity to Gain			1.75	0
										Subtotal	6967

Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion

7	488_VZ9- ModGood -CEEC	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	89.3	89.3	2	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	112
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10	488_VZ11-Low-CEEC	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	64.4	64.4	2.1	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	85
											Subtotal	197
											Total	19821

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAIL	Species credits
<i>Chalinolobus dwyeri</i> / Large-eared Pied Bat (Fauna)									
488_VZ9-ModGood	79.5	79.5	24.6			Vulnerable	Vulnerable	True	1467
488_VZ11-Low	57.7	57.7	59.1			Vulnerable	Vulnerable	True	2558

495_VZ14-ModGood	46.6	46.6	8.9			Vulnerable	Vulnerable	True	311
								Subtotal	4336
<i>Petauroides volans / Southern Greater Glider (Fauna)</i>									
490_VZ13-ModGood	78.5	78.5	15.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Endangered	Endangered	False	596
495_VZ14-ModGood	46.6	46.6	4.1	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Endangered	Endangered	False	96
								Subtotal	692
<i>Petaurus norfolcensis / Squirrel Glider (Fauna)</i>									
84_VZ1-ModGood	46.9	46.9	0.4			Vulnerable	Not Listed	False	9
281_VZ2-ModGood	17.2	17.2	0.7			Vulnerable	Not Listed	False	6
483_VZ6-ModGood	55.3	55.3	12			Vulnerable	Not Listed	False	332
483_VZ7-Low	43.7	43.7	60.7			Vulnerable	Not Listed	False	1327
								Subtotal	1674
<i>Vespadelus troughtoni / Eastern Cave Bat (Fauna)</i>									
84_VZ1-ModGood	46.9	46.9	1.6			Vulnerable	Not Listed	True	56

BAM Credit Summary Report

488_VZ9-ModGood	79.5	79.5	24.6		Vulnerable	Not Listed	True	1467
488_VZ11-Low	57.7	57.7	59.1		Vulnerable	Not Listed	True	2558
495_VZ14-ModGood	46.6	46.6	8.9		Vulnerable	Not Listed	True	311
							Subtotal	4392

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00018634/BAAS17068/19/00018637	LR Wind Farm - Brigalow-Pilliga Revised Project 2023 RTS Revised Partial Impacts	22/06/2023
Assessor Name	Report Created	BAM Data version *
	14/08/2023	61
Assessor Number	BAM Case Status	Date Finalised
	Finalised	14/08/2023
Assessment Revision	Assessment Type	
9	Major Projects	

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Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Ecosystem credits
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Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley

5	483_VZ6- ModGood	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	87	87.0	0.5	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	27
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6	483_VZ7- Low	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	58.6	48.8	61.1	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	1863
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13	483_VZ17-DNG	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	27.4	27.4	23.4	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	401
										Subtotal	2291	
Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley												
7	483_VZ8-Low-DNG	Not a TEC	24.1	24.1	124.9	PCT Cleared - 90%	High Sensitivity to Gain			2.50		1881
										Subtotal	1881	
Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin												
11	1661_VZ15-ModGood	Not a TEC	71.8	53.2	31.3	PCT Cleared - 50%	High Sensitivity to Gain			1.75		729

14	1661_VZ1 8-DNG	Not a TEC	25.7	25.7	2.5	PCT Cleared - 50%	High Sensitivity to Gain			1.75		28
										Subtotal	757	
Narrow-leaved Ironbark- Black Cypress Pine - stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion												
3	479_VZ4- ModGood	Not a TEC	80.3	55.6	17.1	PCT Cleared - 40%	High Sensitivity to Gain			1.50		357
										Subtotal	357	
River Oak - Rough-barked Apple - red gum - box riparian tall woodland (wetland) of the Brigalow Belt South Bioregion and Nandewar Bioregion												
1	84_VZ1- ModGood	Not a TEC	30.5	28.7	3	PCT Cleared - 40%	High Sensitivity to Gain			1.50		32
										Subtotal	32	
Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region												
4	481_VZ5- ModGood	Not a TEC	71.8	55.8	10.4	PCT Cleared - 28%	High Sensitivity to Gain			1.50		218
										Subtotal	218	

Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

2	281_VZ2- ModGood	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	75.4	61.0	2.2	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	84
											Subtotal	84

Scribbly Gum - Narrow-leaved Ironbark - Bossiaea rhombifolia heathy open forest on sandstone ranges of the Sydney Basin

12	1675_VZ1 6- ModGood	Not a TEC	86.3	55.5	10.1	PCT Cleared - 27%	High Sensitivity to Gain			1.50		210
											Subtotal	210

Silvertop Stringybark - Yellow Box +/- Nortons Box grassy woodland on basalt hills mainly on northern aspects of the Liverpool Range, Brigalow Belt South Bioregion

8	488_VZ9-ModGood	Not a TEC	54.9	54.9	0.6	PCT Cleared - 50%	High Sensitivity to Gain			1.75		14
9	488_VZ11-Low	Not a TEC	62.8	50.5	2.5	PCT Cleared - 50%	High Sensitivity to Gain			1.75		55
10	488_VZ12-Exotic	Not a TEC	18.3	18.3	7.2	PCT Cleared - 50%	High Sensitivity to Gain			1.75		58
										Subtotal		127
										Total		5957

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAIL	Species credits	
<i>Calyptrorhynchus lathami / Glossy Black-Cockatoo (Fauna)</i>										
488_VZ11-Low		50.5	50.5	0.3		Vulnerable	Vulnerable	False	8	
									Subtotal	8
<i>Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)</i>										
488_VZ11-Low		50.5	50.5	0.6		Vulnerable	Vulnerable	True	23	
									Subtotal	23

<i>Petaurus norfolcensis / Squirrel Glider (Fauna)</i>									
84_VZ1-ModGood	28.7	28.7	0.4			Vulnerable	Not Listed	False	6
281_VZ2-ModGood	61.0	61.0	0.1			Vulnerable	Not Listed	False	3
481_VZ5-ModGood	55.8	55.8	8.4			Vulnerable	Not Listed	False	234
483_VZ7-Low	48.8	48.8	3			Vulnerable	Not Listed	False	73
488_VZ11-Low	50.5	50.5	1.3			Vulnerable	Not Listed	False	33
								Subtotal	349
<i>Swainsona sericea / Silky Swainson-pea (Flora)</i>									
481_VZ5-ModGood	55.8	55.8	1.9			Vulnerable	Not Listed	False	53
483_VZ7-Low	48.8	48.8	8.6			Vulnerable	Not Listed	False	210
483_VZ17-DNG	27.4	27.4	7			Vulnerable	Not Listed	False	96
								Subtotal	359
<i>Vespadelus troughtoni / Eastern Cave Bat (Fauna)</i>									
488_VZ11-Low	50.5	50.5	0.6			Vulnerable	Not Listed	True	23
								Subtotal	23

