

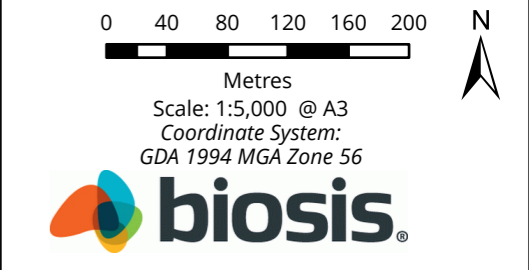
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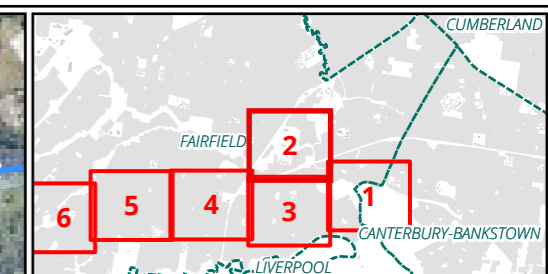
- Impact assessment area
- Impact area
- Underbore
- BAM plot

Vegetation zones


- Urban Native/Exotic
- PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
- PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Intact
- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
- PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley -Thinned


Figure 7.1 Vegetation zones and BAM plots





Legend

 Impact assessment area

 Impact area

Vegetation zones


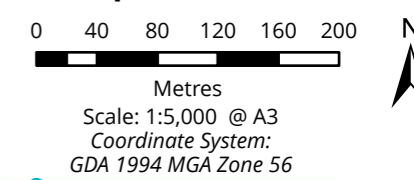
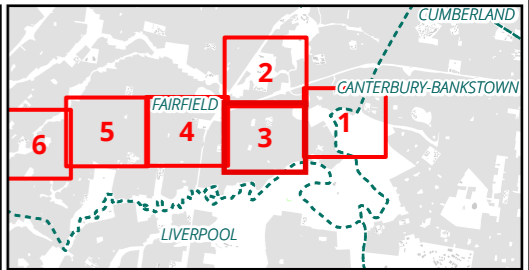
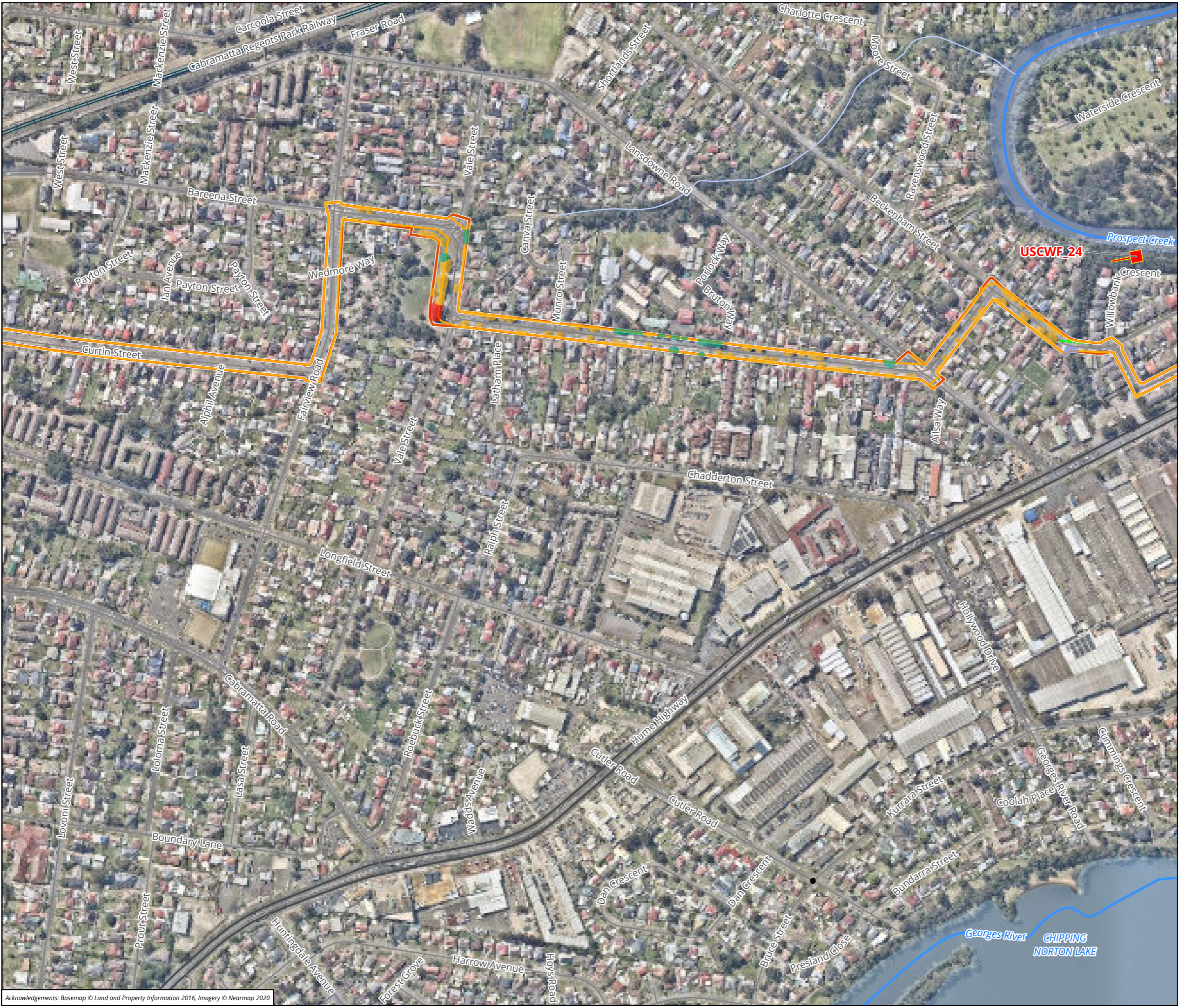
 PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned

Figure 7.2 Vegetation zones and BAM plots





Legend

- Impact assessment area
- Impact area
- Underbore
- BAM plot

Vegetation zones

- Urban Native/Exotic
- PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
- PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley -Thinned

Figure 7.3 Vegetation zones and BAM plots

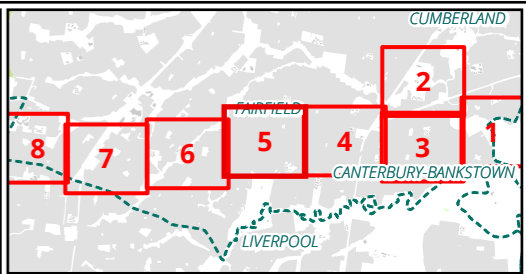
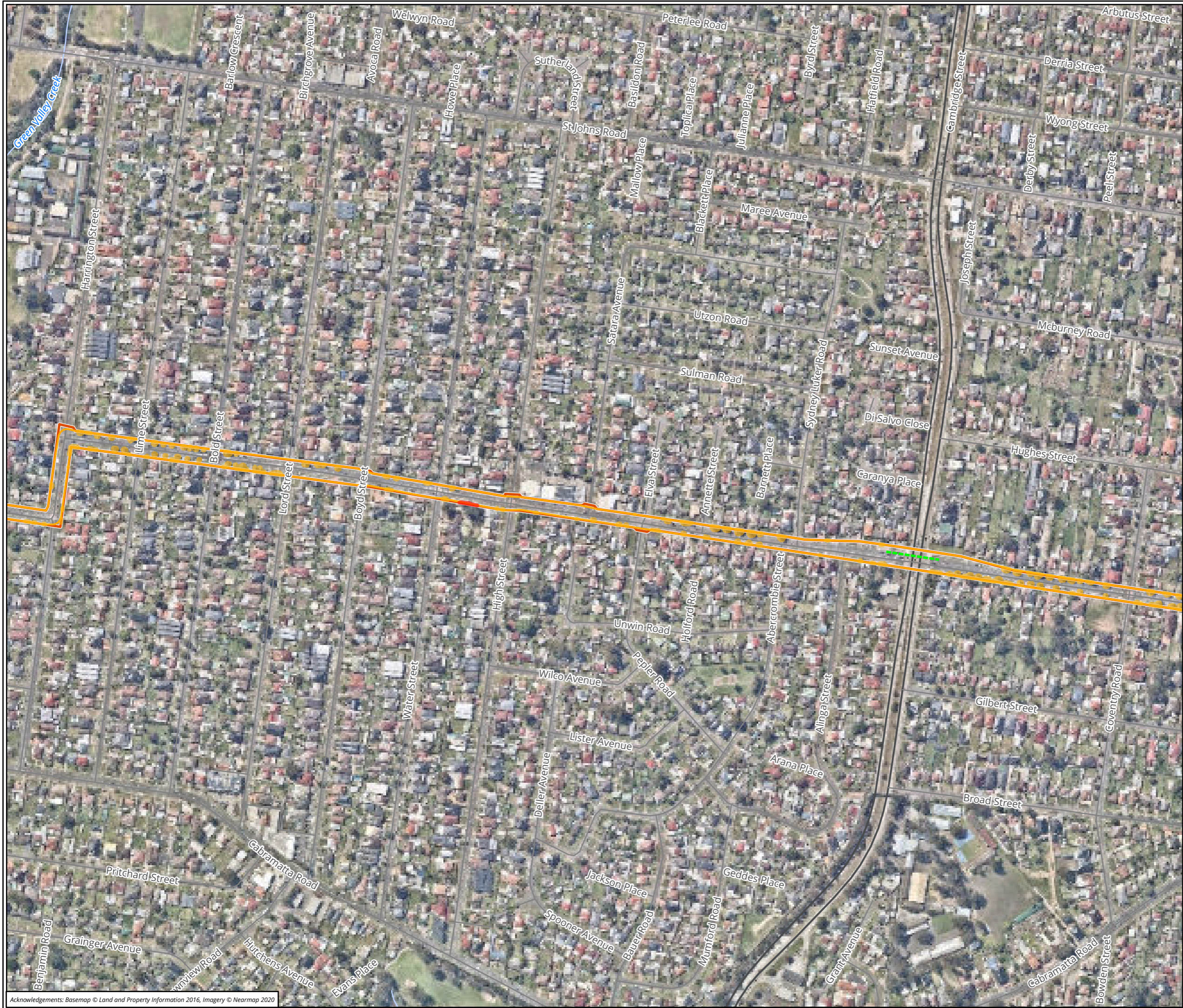
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Scale: 1:5,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 31617,
Date: 24 September 2021,
Prepared for: CW, Prepared by: SSK, Last edited by: amackegard
Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020

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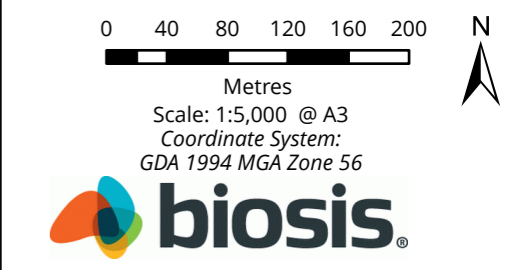
Legend

- Impact assessment area
- Impact area
- Underbore

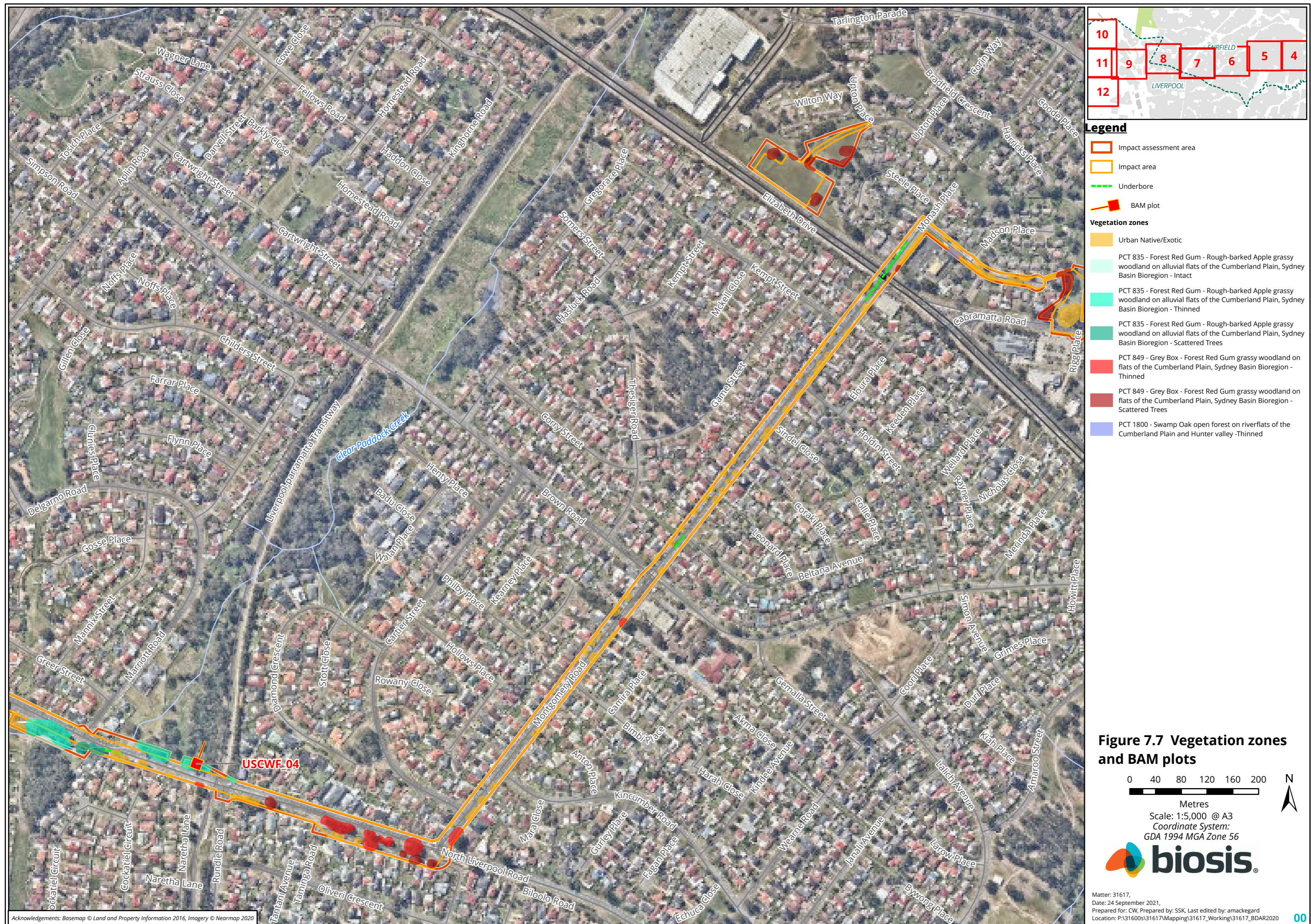
Vegetation zones

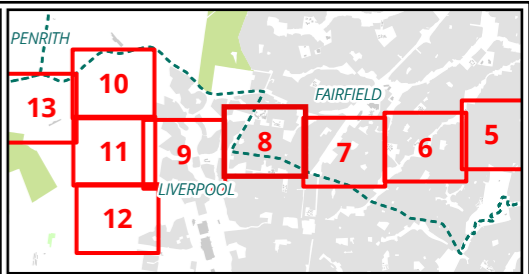
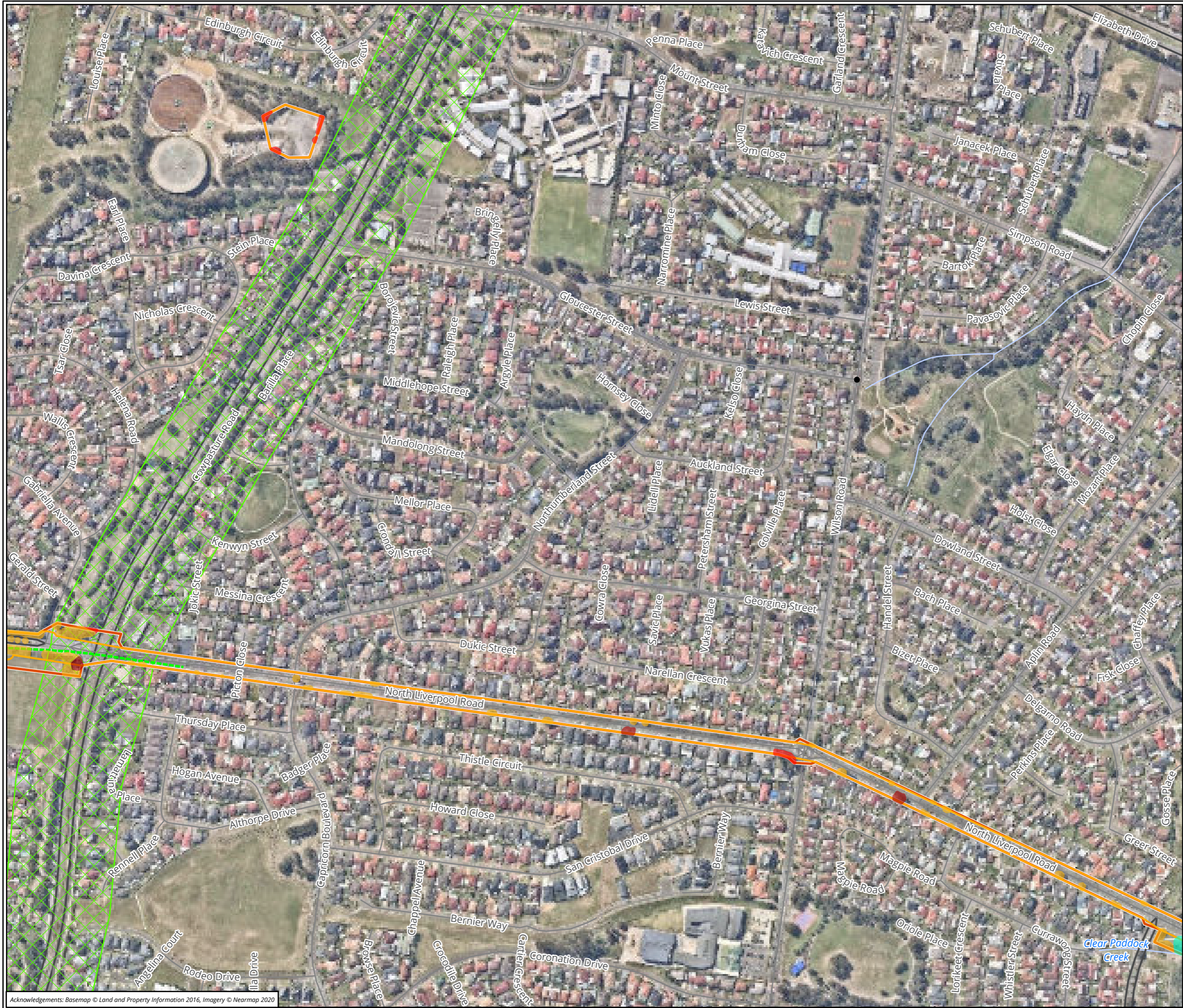
- Urban Native/Exotic
- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned

Figure 7.5 Vegetation zones and BAM plots









- Legend**
- Impact assessment area
 - Impact area
 - Underbore
- Biocertification**
- Existing Certified
- Vegetation zones**
- Urban Native/Exotic
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees

Figure 7.8 Vegetation zones and BAM plots

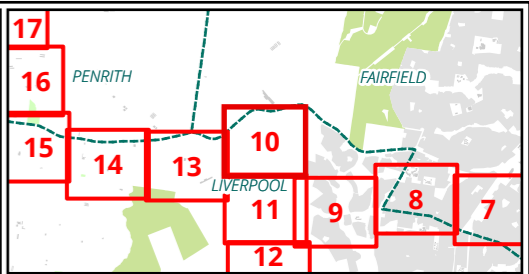
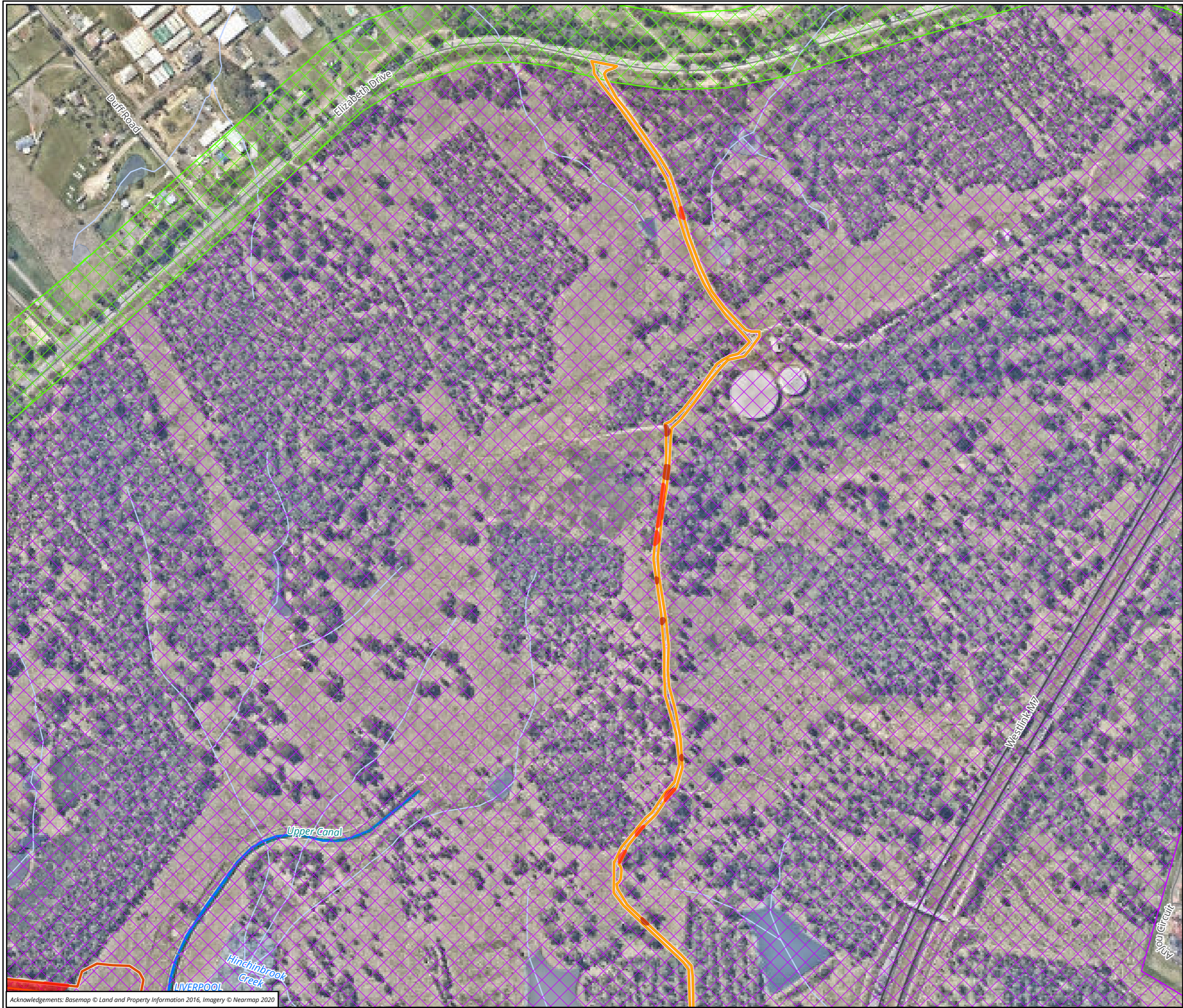
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Metres

Scale: 1:5,000 @ A3
Coordinate System:
GDA 1994 MGA Zone 56

biosis

Matter: 31617,
Date: 24 September 2021,
Prepared for: CW, Prepared by: SSK, Last edited by: amackegard
Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020

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Legend

Impact assessment area
Impact area
Underbore

Biocertification

Existing Certified
Existing Non Certified

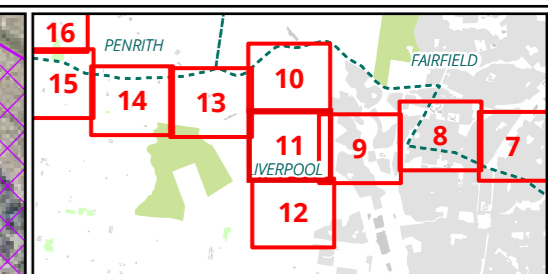
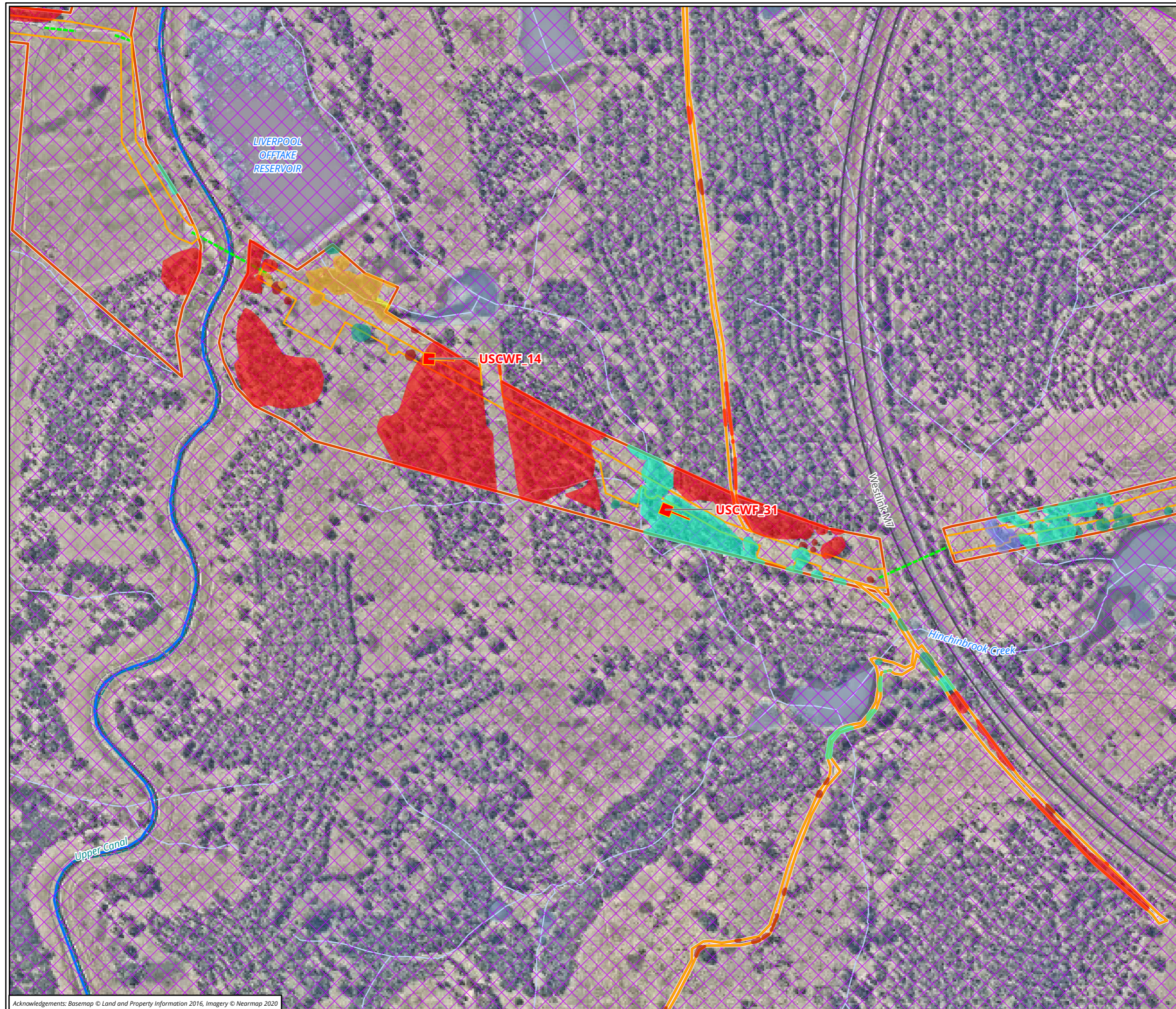
Vegetation zones

PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees

Figure 7.10 Vegetation zones and BAM plots

0 40 80 120 160 200
Metres
Scale: 1:5,000 @ A3
Coordinate System:
GDA 1994 MGA Zone 56

biosis



- Legend**
- Impact assessment area
 - Impact area
 - Underbore
 - BAM plot
 - Biocertification**
 - Existing Non Certified
 - Vegetation zones**
 - Urban Native/Exotic
 - PCT 781 - Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley -Thinned

Figure 7.11 Vegetation zones and BAM plots

0 40 80 120 160 200

Metres

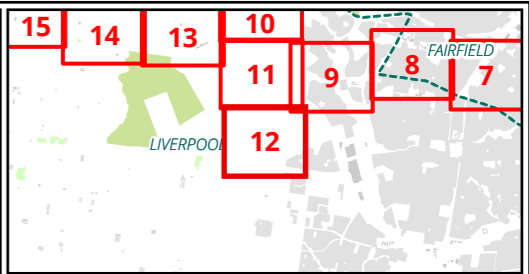
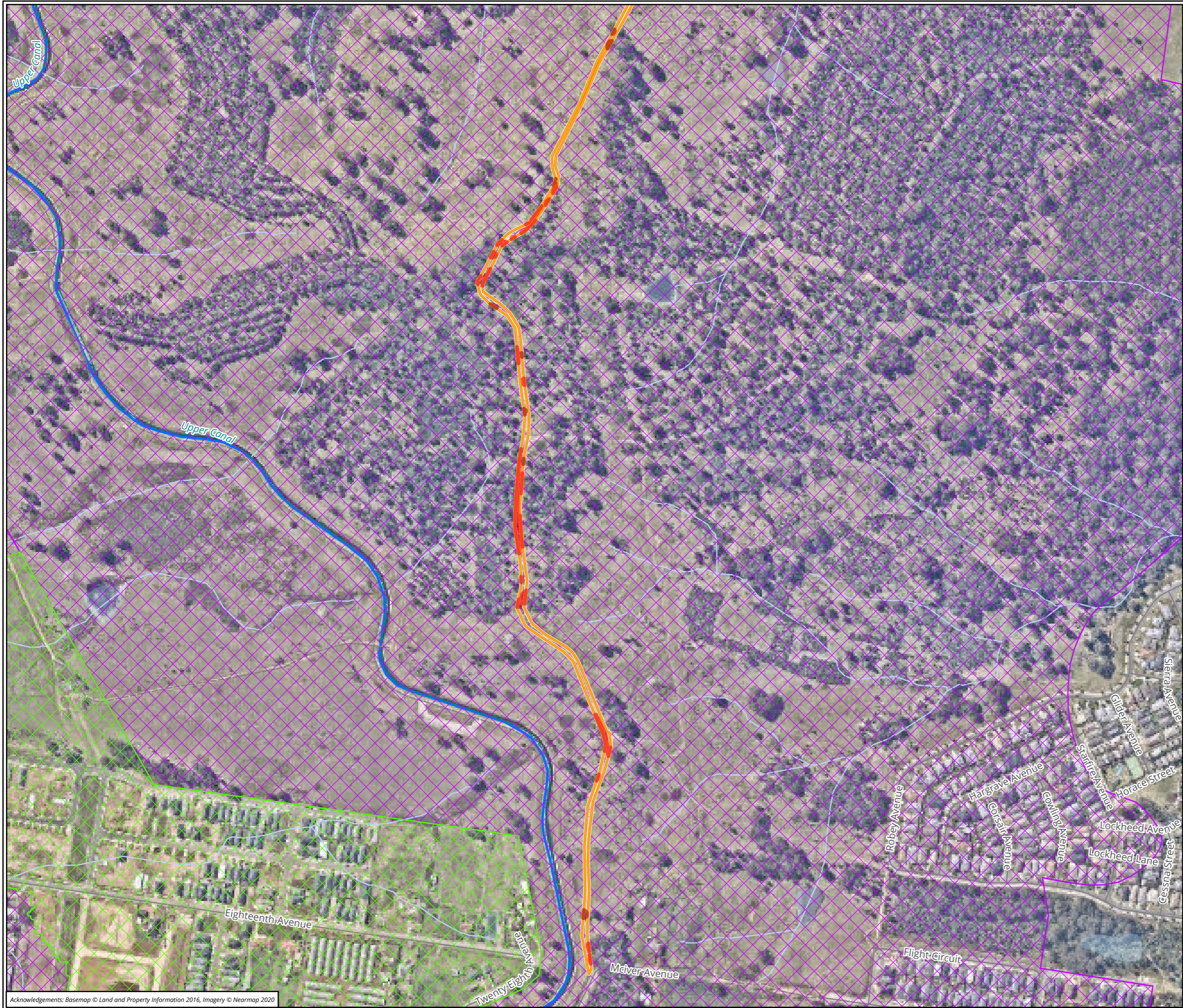
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Coordinate System: GDA 1994 MGA Zone 56

biosis

Matter: 31617,
Date: 24 September 2021,
Prepared for: CW, Prepared by: SSK, Last edited by: amackegard
Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020

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Legend

Impact assessment area

Impact area

Biocertification

Existing Certified

Existing Non Certified

Vegetation zones

PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned

PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees

Figure 7.12 Vegetation zones and BAM plots

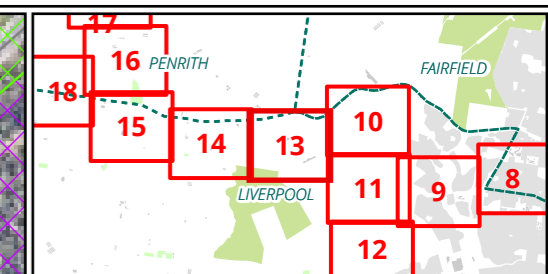
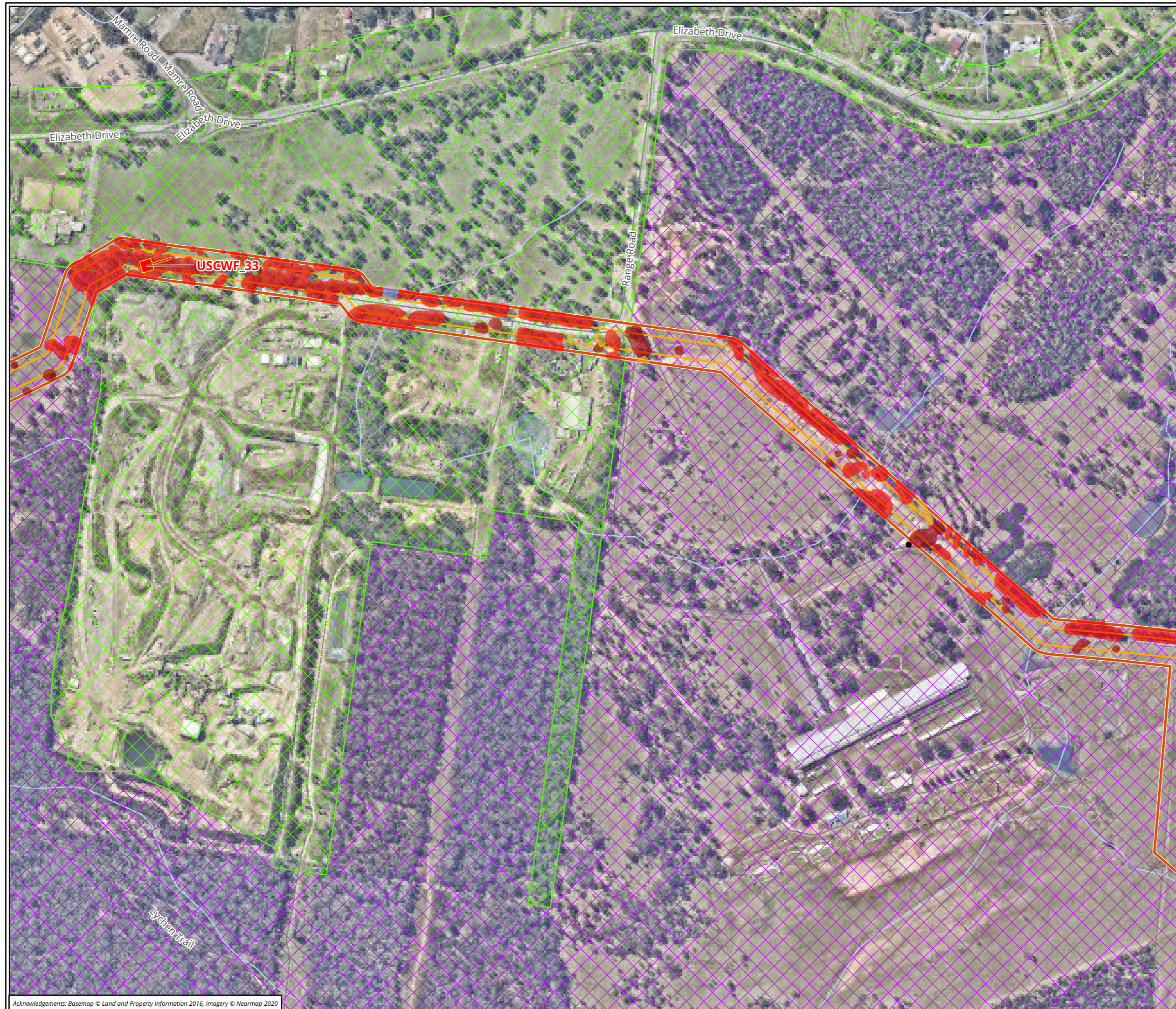
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Metres

Scale: 1:5,000 @ A3

Coordinate System: GDA 1994 MGA Zone 56

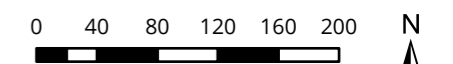
biosis



Legend

- Impact assessment area
- Impact area
- Underbore
- ▶ BAM plot
- Biocertification**
 - Existing Certified
 - Existing Non Certified
- Vegetation zones**
 - Urban Native/Exotic
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley -Thinned

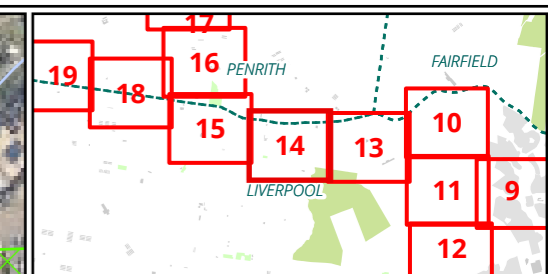
Figure 7.13 Vegetation zones and BAM plots



Scale: 1:5,000 @ A3
Coordinate System:
GDA 1994 MGA Zone 56



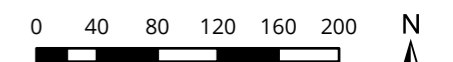
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Date: 24 September 2021,
Prepared for: CW, Prepared by: SSK, Last edited by: amackegard
Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020



Legend

- Impact assessment area
 - Impact area
 - BAM plot
- Biocertification**
- Existing Certified
 - Existing Non Certified
- Vegetation zones**
- Urban Native/Exotic
 - PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 883 - Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley - Scattered Trees

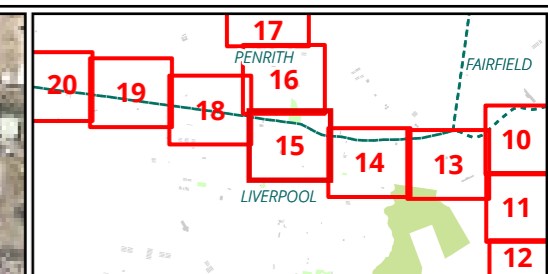
Figure 7.14 Vegetation zones and BAM plots



Scale: 1:5,000 @ A3
Coordinate System:
GDA 1994 MGA Zone 56



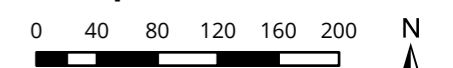
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Prepared for: CW, Prepared by: SSK, Last edited by: amackegard
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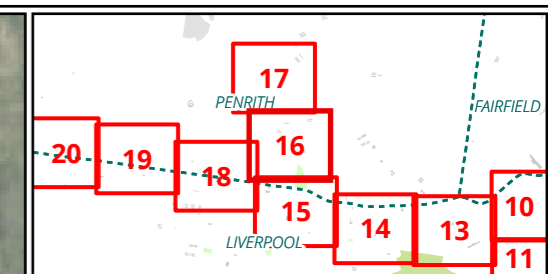
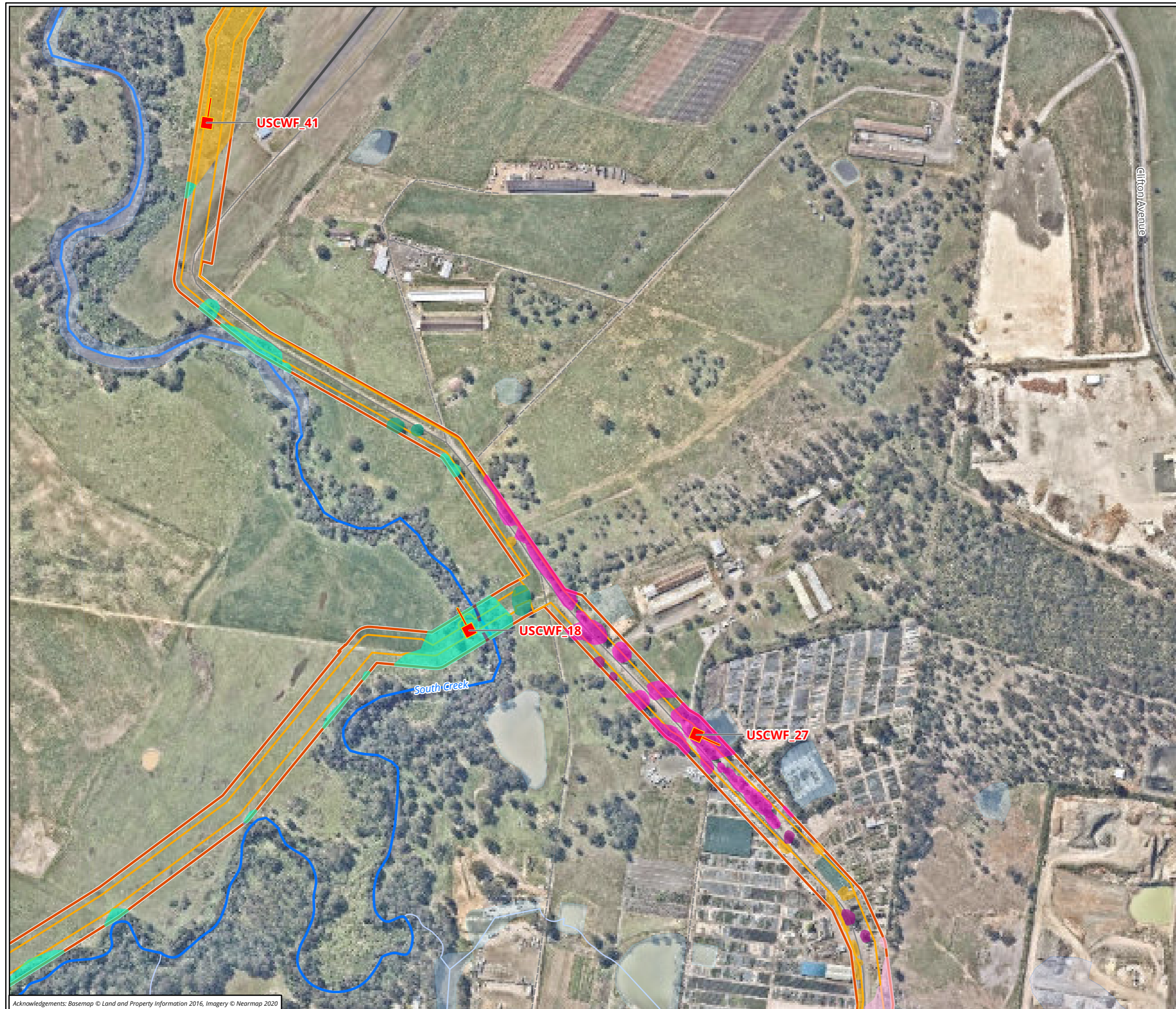
- Impact assessment area
- Impact area
- Underbore
- BAM plot
- Biocertification**
 - Existing Certified
 - Existing Non Certified
- Vegetation zones**
 - Urban Native/Exotic
 - PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 883 - Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 883 - Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 883 - Hard-leaved Scribbly Gum - Parramatta Red Gum heathy woodland of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees

Figure 7.15 Vegetation zones and BAM plots



Scale: 1:5,000 @ A3
Coordinate System:
GDA 1994 MGA Zone 56

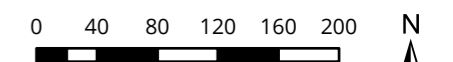




Legend

- Impact assessment area
- Impact area
- BAM plot
- Biocertification**
 - Existing Certified
- Vegetation zones**
 - Urban Native/Exotic
 - PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley - Thinned
 - PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley - Scattered Trees

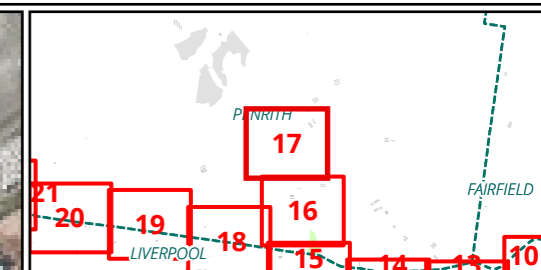
Figure 7.16 Vegetation zones and BAM plots



Scale: 1:5,000 @ A3
Coordinate System:
GDA 1994 MGA Zone 56

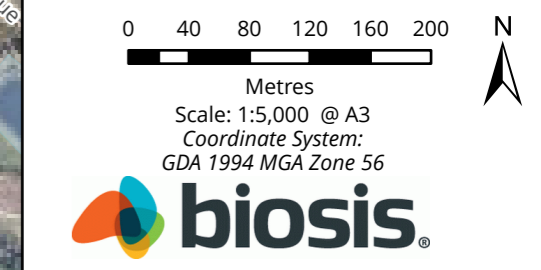


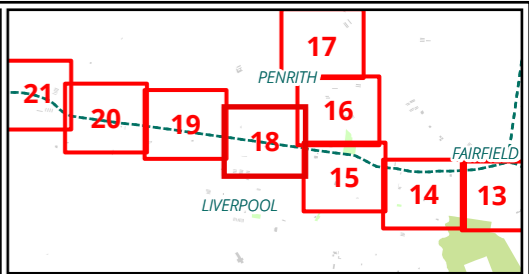
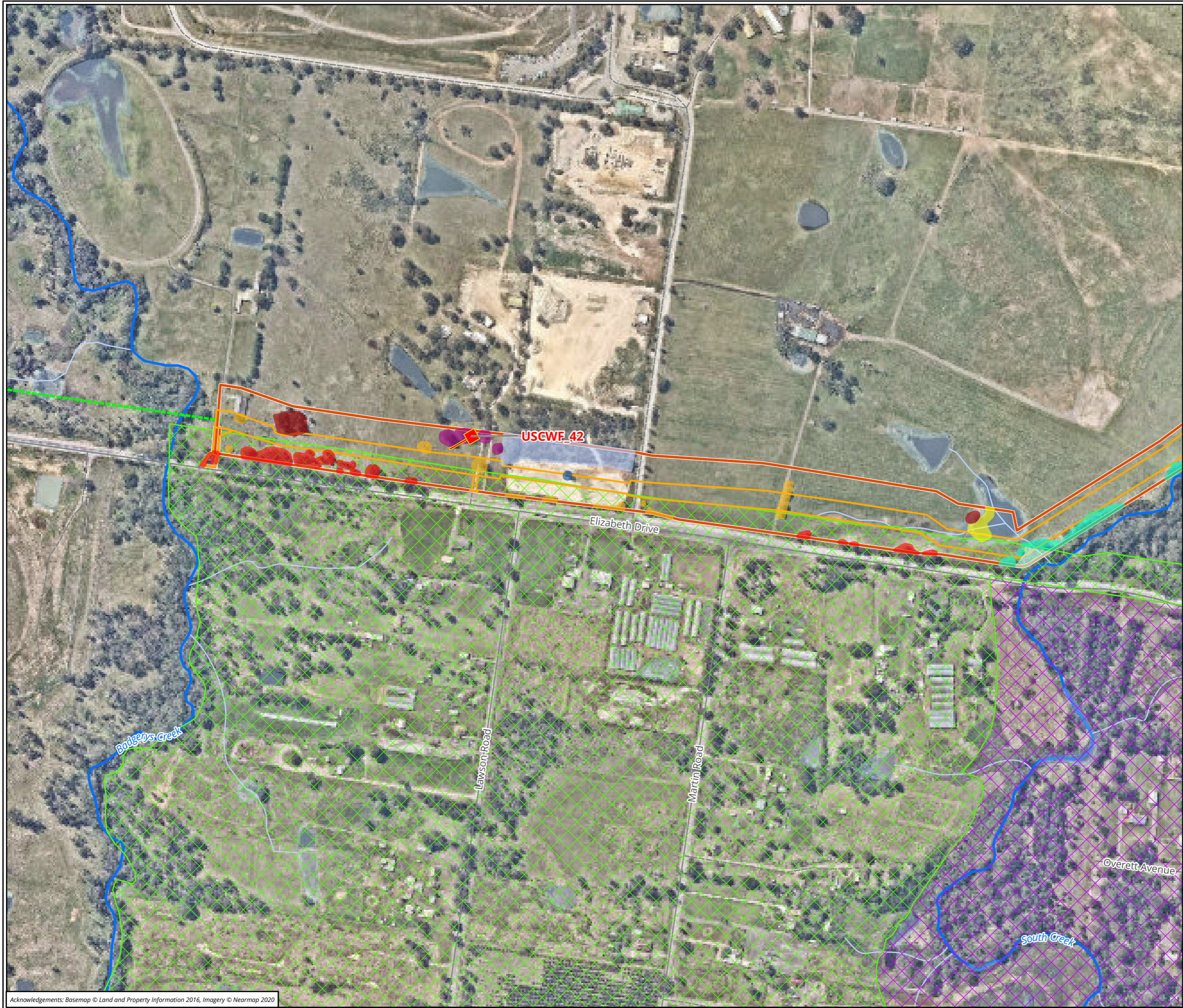
Matter: 31617,
Date: 24 September 2021,
Prepared for: CW, Prepared by: SSK, Last edited by: amackegard
Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020



- Legend**
- Impact assessment area
 - Impact area
 - BAM plot
- Vegetation zones**
- Urban Native/Exotic
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley -Thinned
 - PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley - Scattered Trees

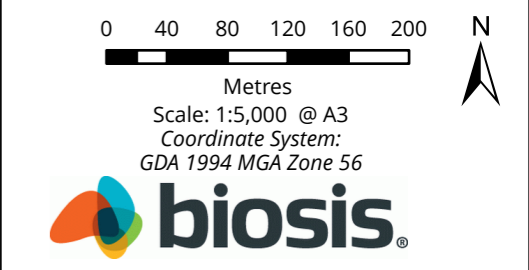
Figure 7.17 Vegetation zones and BAM plots

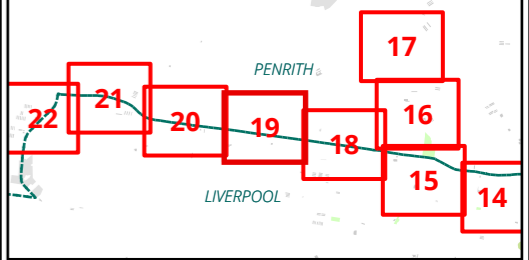




- Legend**
- Impact assessment area
 - Impact area
 - Underbore
 - BAM plot
- Biocertification**
- Existing Certified
 - Existing Non Certified
- Vegetation zones**
- Urban Native/Exotic
 - PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 725 - Broad-leaved Ironbark - Melaleuca decora shrubby open forest on clay soils of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 781 - Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees

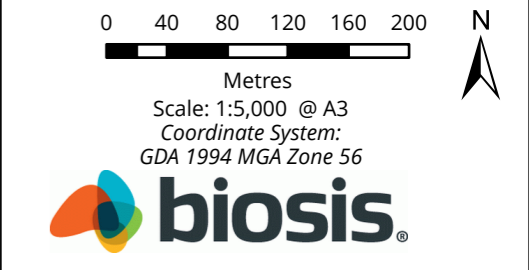
Figure 7.18 Vegetation zones and BAM plots

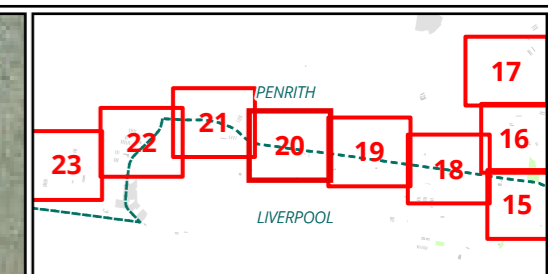
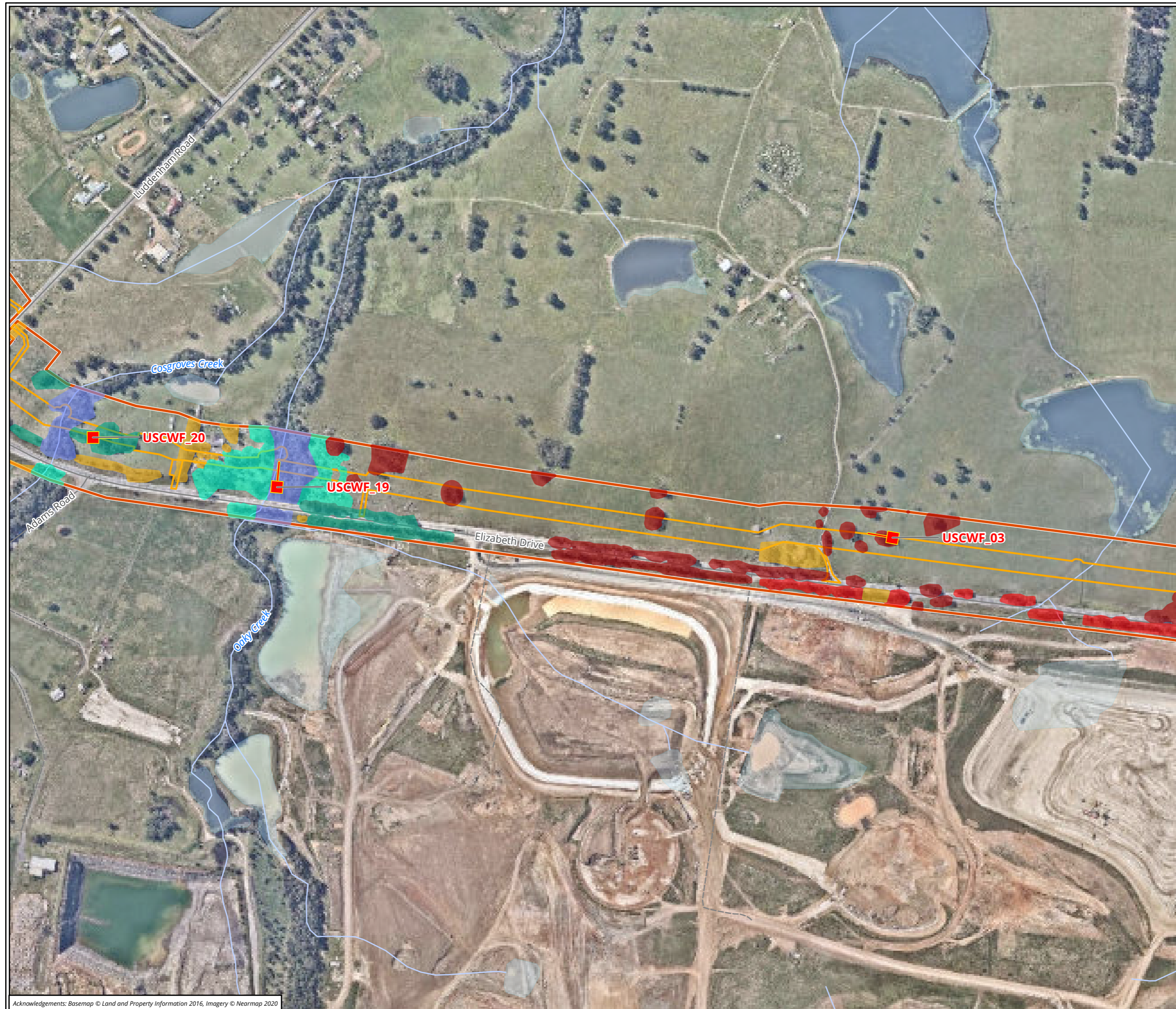




- Legend**
- Impact assessment area
 - Impact area
 - Underbore
- Vegetation zones**
- Urban Native/Exotic
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley -Thinned

Figure 7.19 Vegetation zones and BAM plots

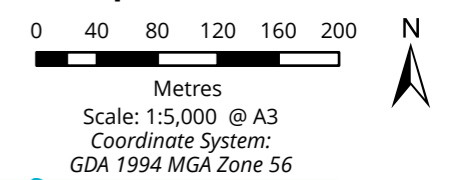




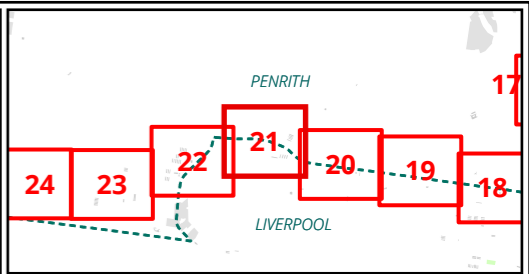
Legend

- Impact assessment area
- Impact area
- BAM plot
- Vegetation zones**
 - Urban Native/Exotic
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley -Thinned

Figure 7.20 Vegetation zones and BAM plots

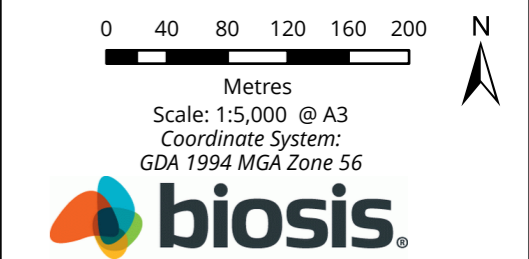


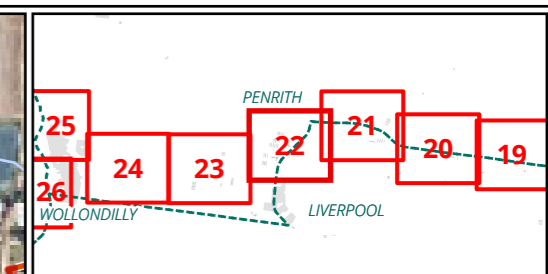
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Date: 24 September 2021,
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Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020



- Legend**
- Impact assessment area
 - Impact area
 - Underbore
 - BAM plot
- Vegetation zones**
- Urban Native/Exotic
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 1800 - Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley -Thinned

Figure 7.21 Vegetation zones and BAM plots

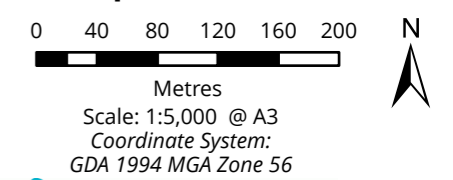


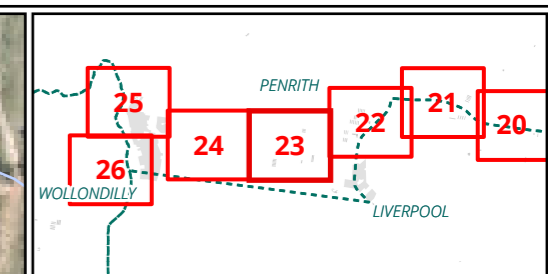
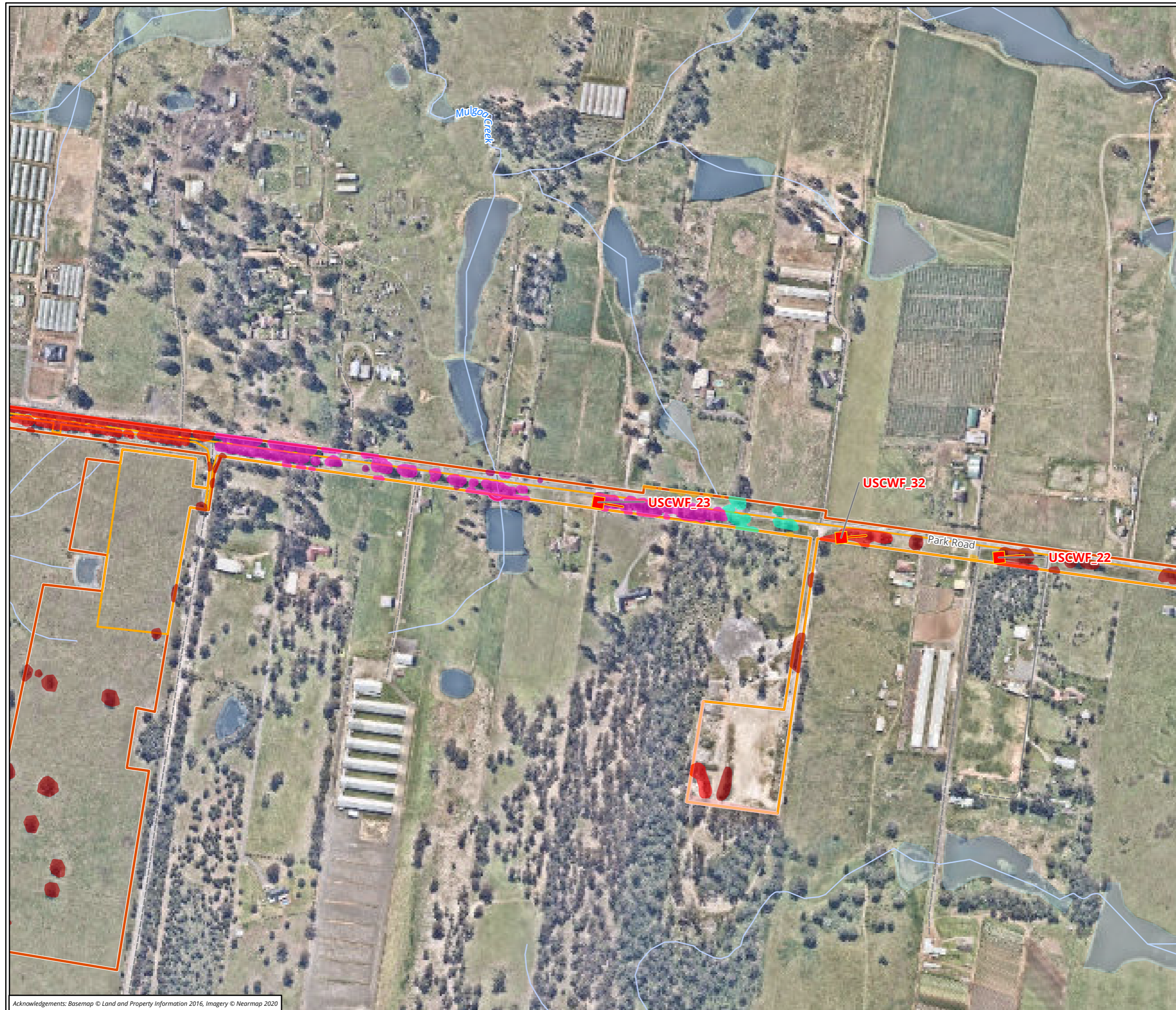


Legend

- Impact assessment area
 - Impact area
 - Underbore
- Vegetation zones**
- Urban Native/Exotic
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees

Figure 7.22 Vegetation zones and BAM plots





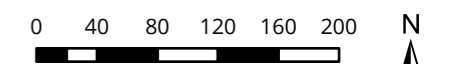
Legend

- Impact assessment area
- Impact area
- BAM plot

Vegetation zones

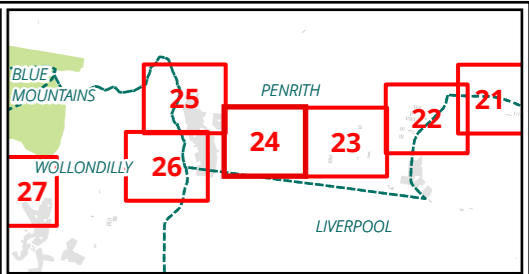
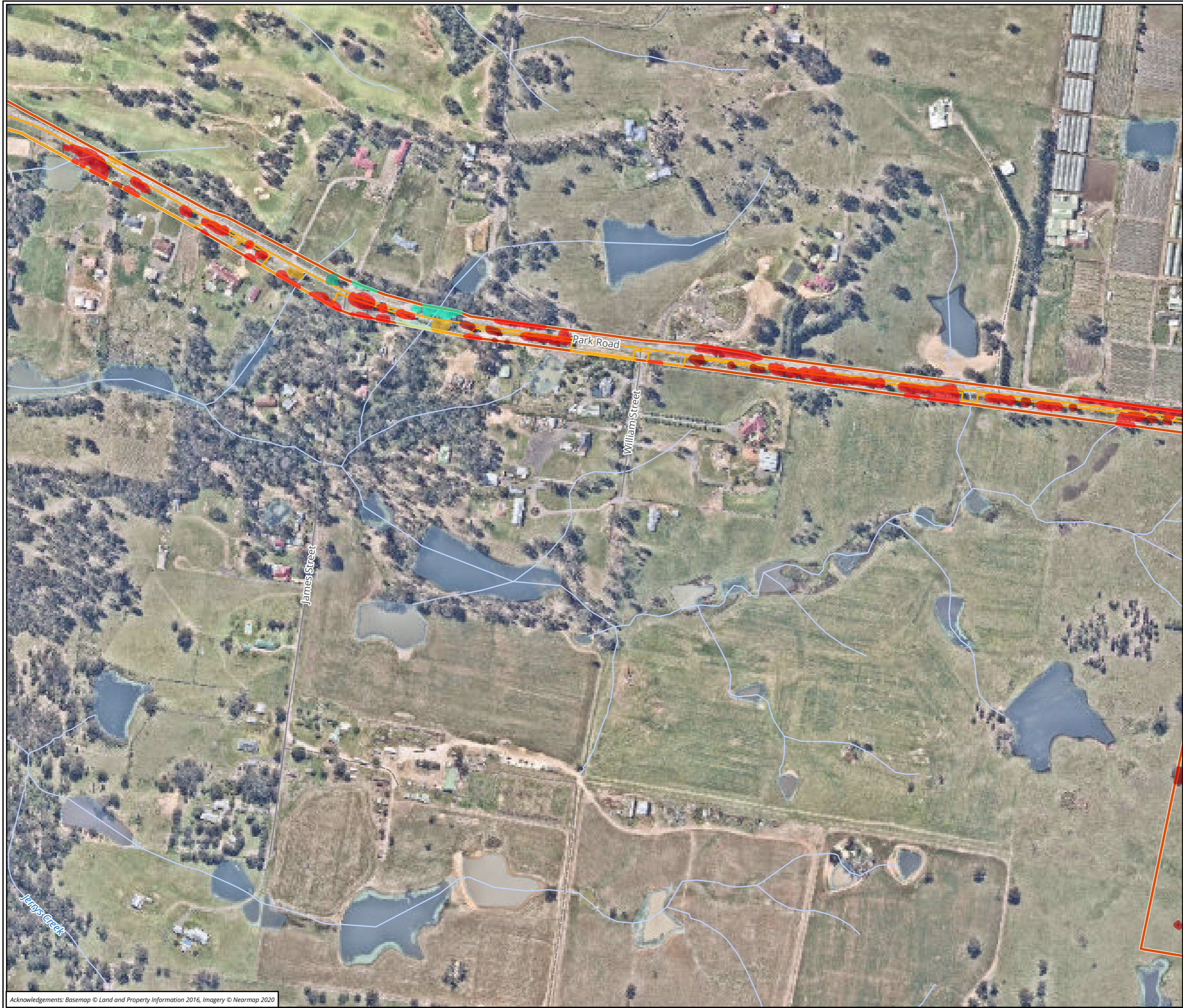
- Urban Native/Exotic
- PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - Thinned
- PCT 724 - Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest on clay/gravel soils of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
- PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Intact
- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
- PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees

Figure 7.23 Vegetation zones and BAM plots



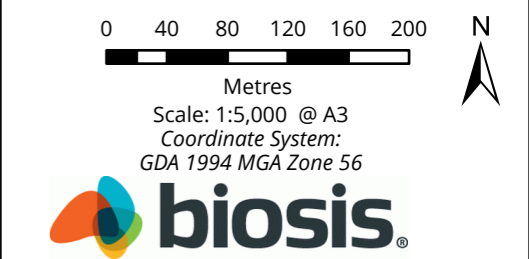
Scale: 1:5,000 @ A3
Coordinate System:
GDA 1994 MGA Zone 56

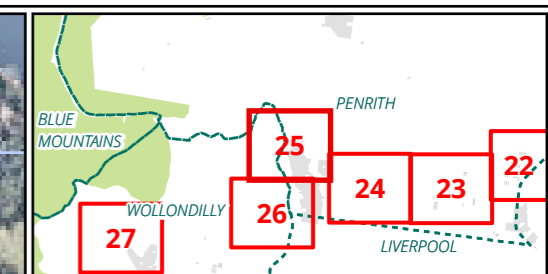
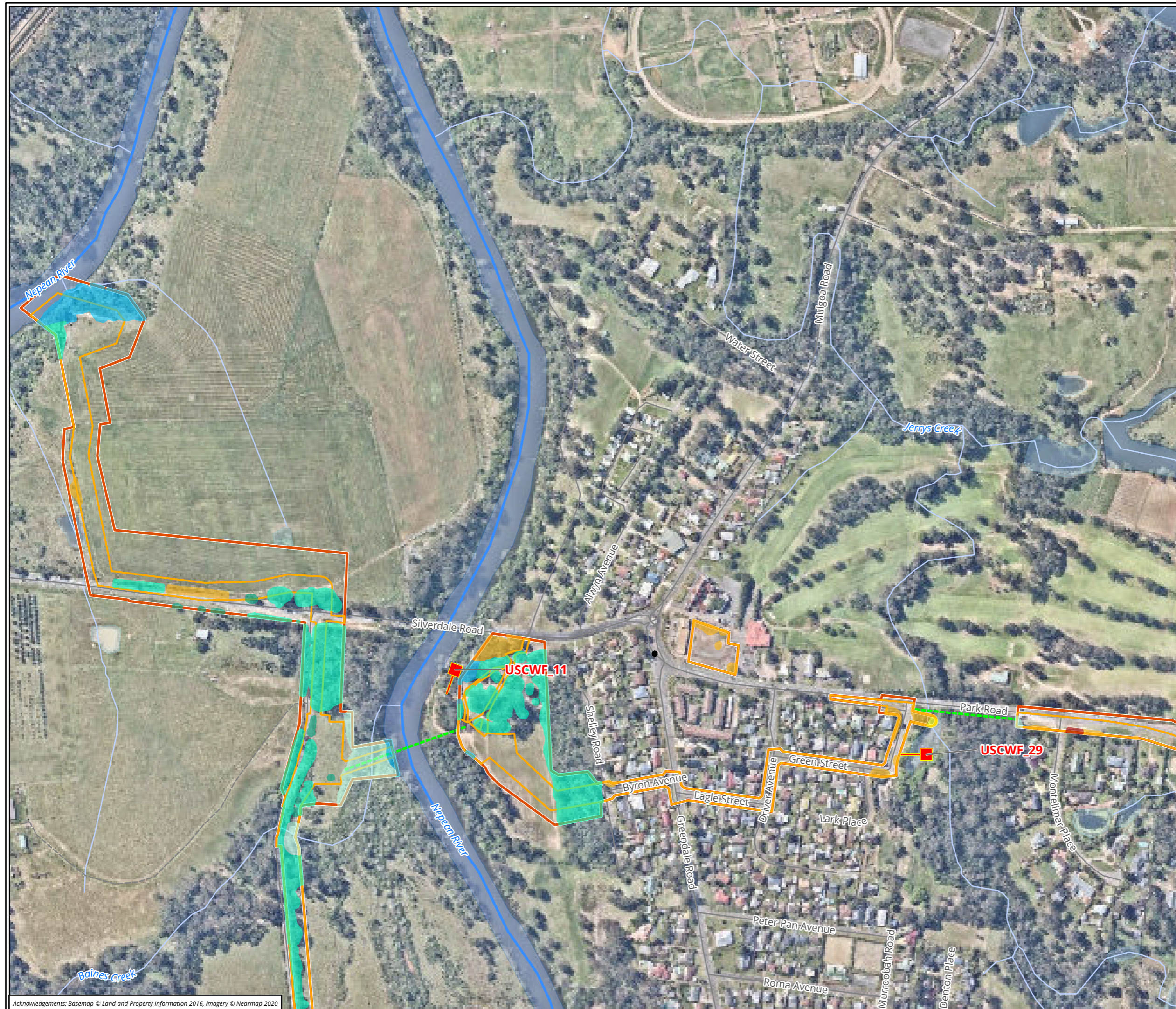




- Legend**
- Impact assessment area
 - Impact area
- Vegetation zones**
- Urban Native/Exotic
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees

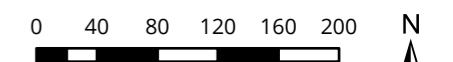
Figure 7.24 Vegetation zones and BAM plots





- Legend**
- Impact assessment area
 - Impact area
 - Underbore
 - BAM plot
- Vegetation zones**
- Urban Native/Exotic
 - PCT 781 - Coastal freshwater lagoons of the Sydney Basin Bioregion and South East Corner Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Intact
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
 - PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 849 - Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
 - PCT 1105 - River Oak open forest of major streams, Sydney Basin Bioregion and South East Corner Bioregion - Thinned

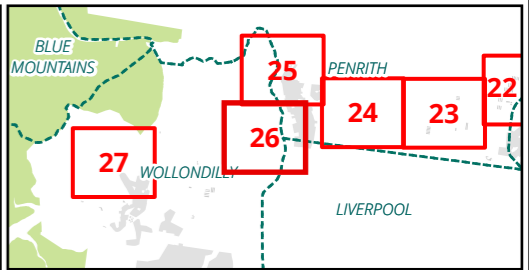
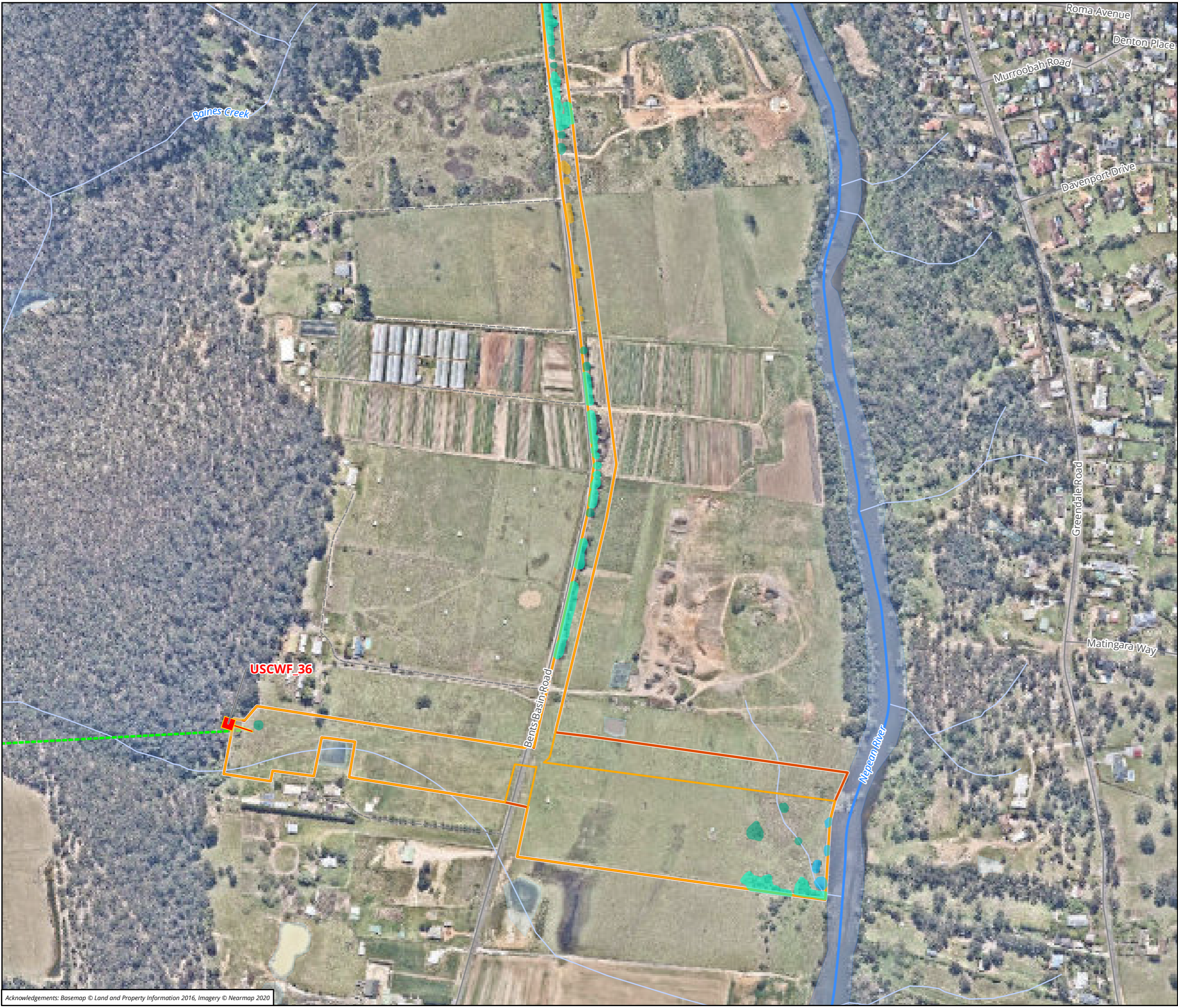
Figure 7.25 Vegetation zones and BAM plots



Scale: 1:5,000 @ A3
Coordinate System:
GDA 1994 MGA Zone 56



Matter: 31617,
Date: 24 September 2021,
Prepared for: CW, Prepared by: SSK, Last edited by: amackegard
Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020



Legend

- Impact assessment area
- Impact area
- Underbore
- BAM plot

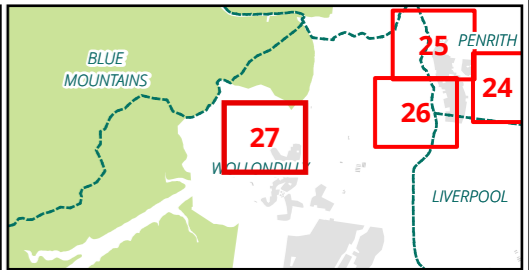
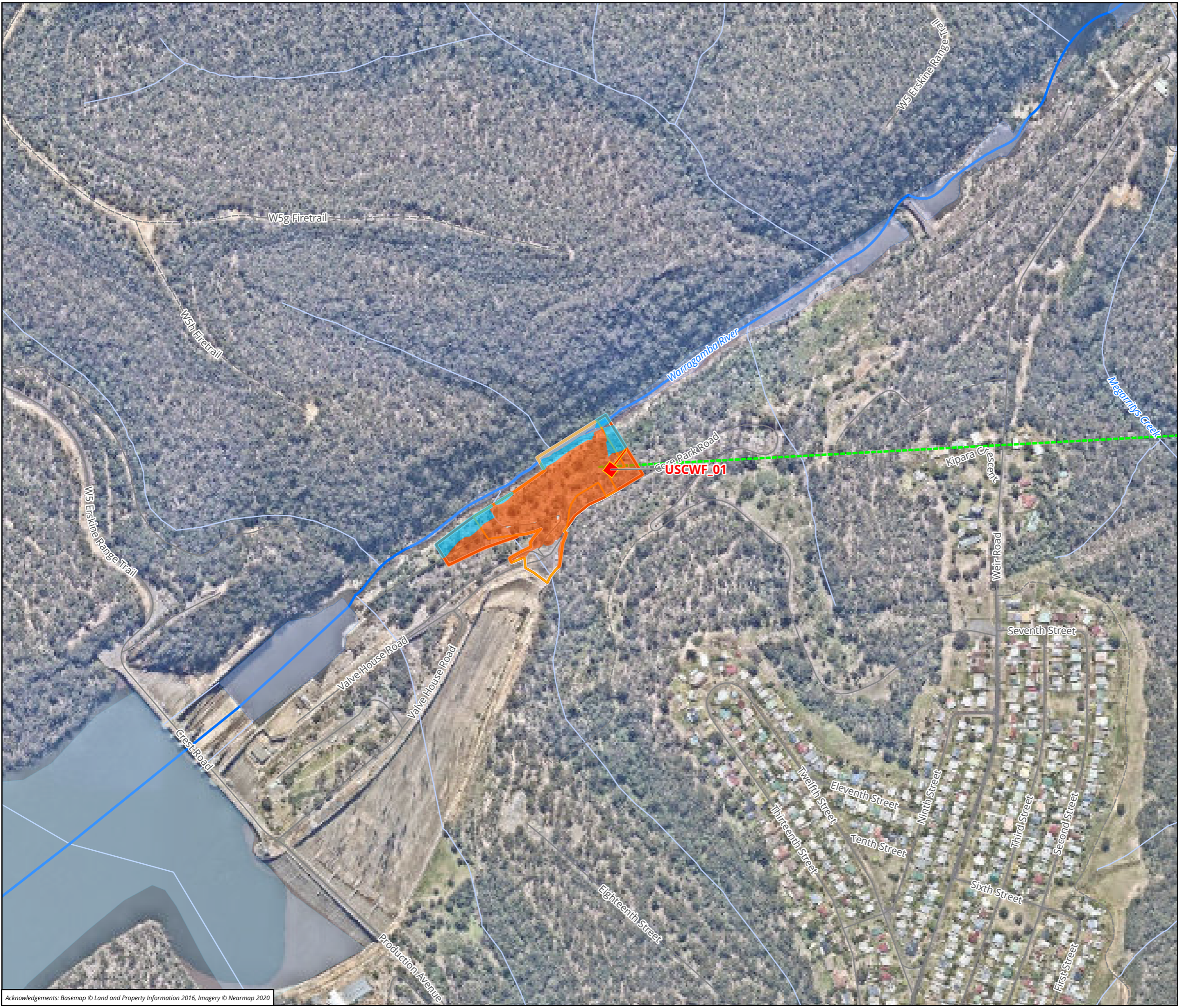
Vegetation zones

- Urban Native/Exotic
- PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Thinned
- PCT 835 - Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion - Scattered Trees
- PCT 1105 - River Oak open forest of major streams, Sydney Basin Bioregion and South East Corner Bioregion - Thinned
- PCT 1181 - Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion - Intact

Figure 7.26 Vegetation zones and BAM plots

0 40 80 120 160 200
Metres
Scale: 1:5,000 @ A3
Coordinate System:
GDA 1994 MGA Zone 56

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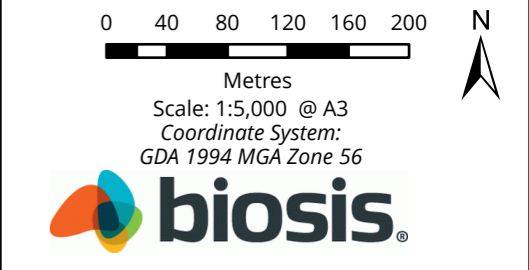
Legend

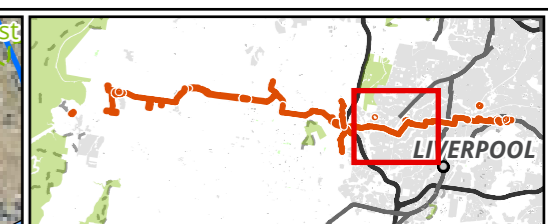
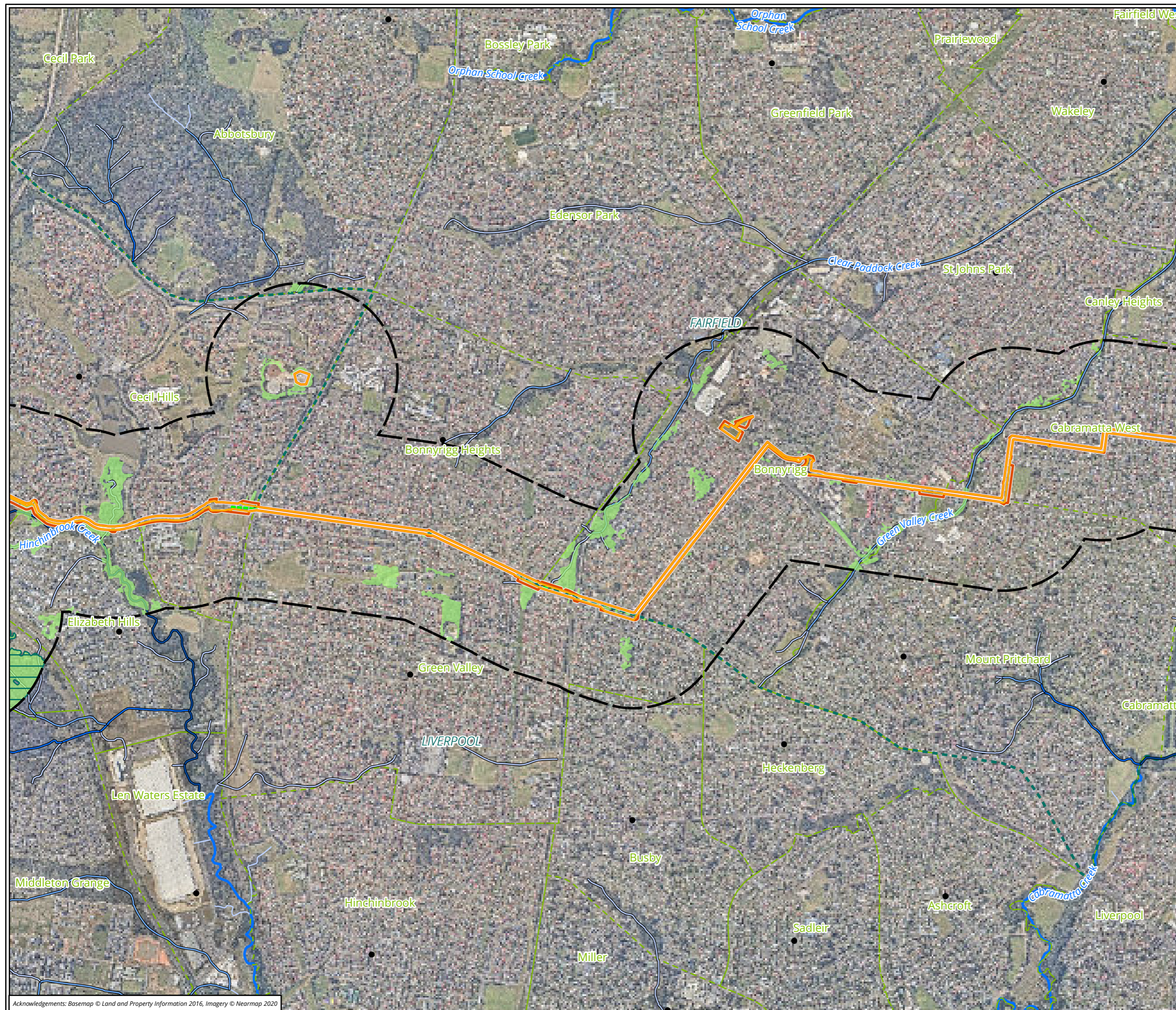
- Impact assessment area
- Impact area
- Underbore
- BAM plot

Vegetation zones

- PCT 1083 - Red Bloodwood - scribbly gum heathy woodland on sandstone plateaux of the Sydney Basin Bioregion - Thinned
- PCT 1105 - River Oak open forest of major streams, Sydney Basin Bioregion and South East Corner Bioregion - Thinned
- PCT 1181 - Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion - Intact

Figure 7.27 Vegetation zones and BAM plots





Legend

- Impact area
- Impact assessment area
- Underbore
- Landscape Assessment area
- Native vegetation

Patch Size locations

≥ 100ha (1800-Scattered Trees, 1800-Thinned, 724-Intact, 724-Scattered Trees, 724-Thinned, 725-Intact, 725-Scattered Trees, 725-Thinned, 781-Thinned, 835-Intact, 835-Scattered Trees, 835-Thinned, 849-Scattered Trees, 849-Thinned, 883-Intact, 883-Scattered Trees, 883-Thinned)

Figure 8.2 Patch Size locations

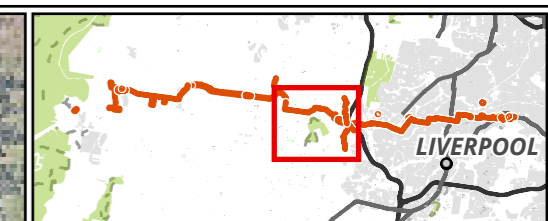
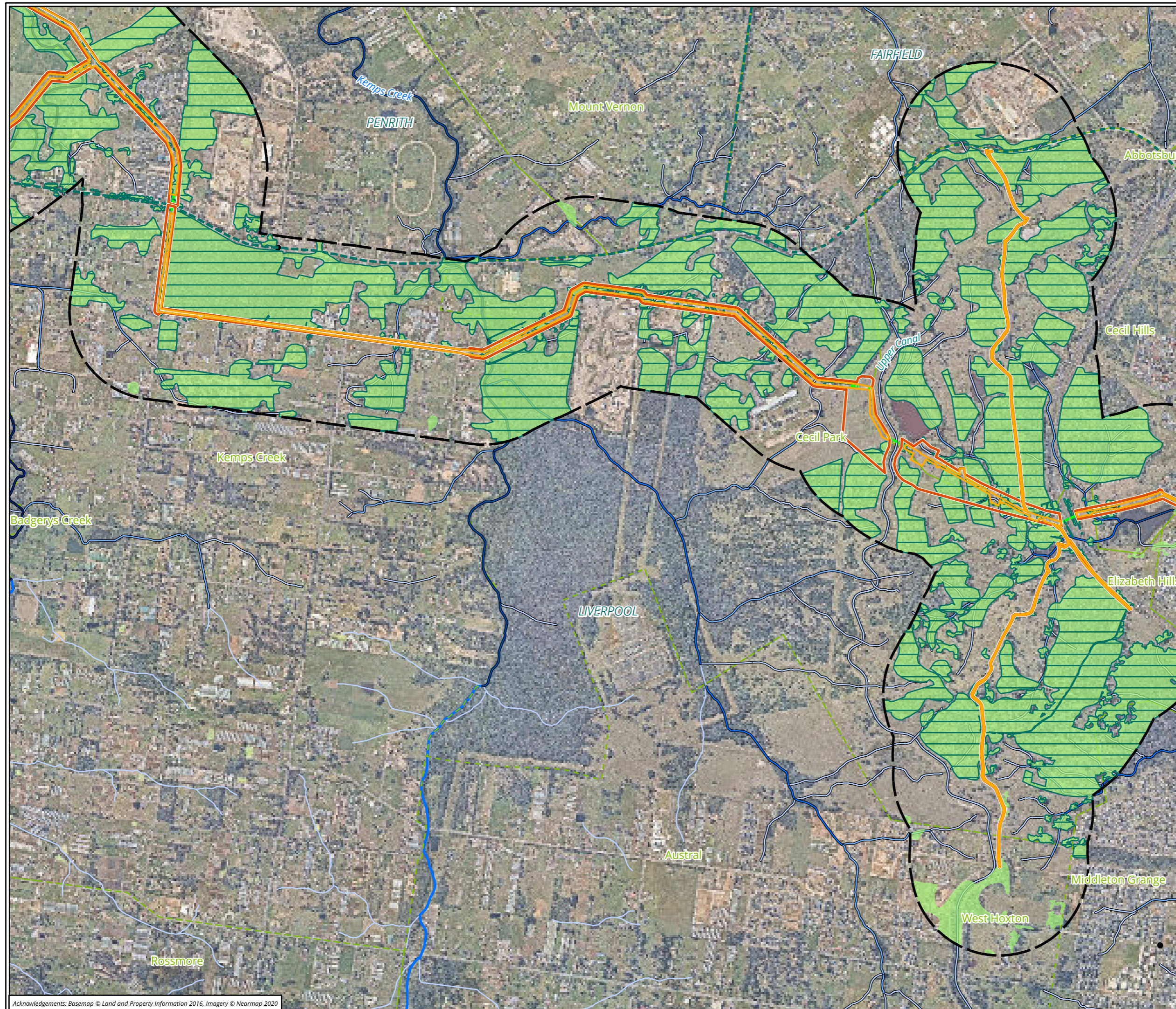
0 160 320 480 640 800
Metres

Scale: 1:20,000 @ A3 Coordinate System:
PCS: GDA 1994 MGA Zone 56

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Matter: 31617,
Date: 24 September 2021,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020.mxd

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- Legend**
- Impact area
 - Impact assessment area
 - Underbore
 - Landscape Assessment area
 - Native vegetation
- Patch Size locations**
- ≥ 100ha (1800-Scattered Trees, 1800-Thinned, 724-Intact, 724-Scattered Trees, 724-Thinned, 725-Intact, 725-Scattered Trees, 725-Thinned, 781-Thinned, 835-Intact, 835-Scattered Trees, 835-Thinned, 849-Scattered Trees, 849-Thinned, 883-Intact, 883-Scattered Trees, 883-Thinned)

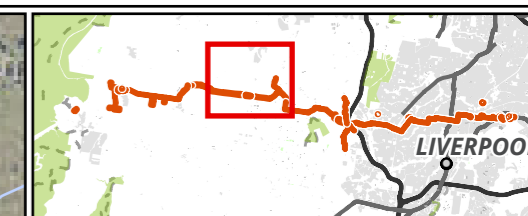
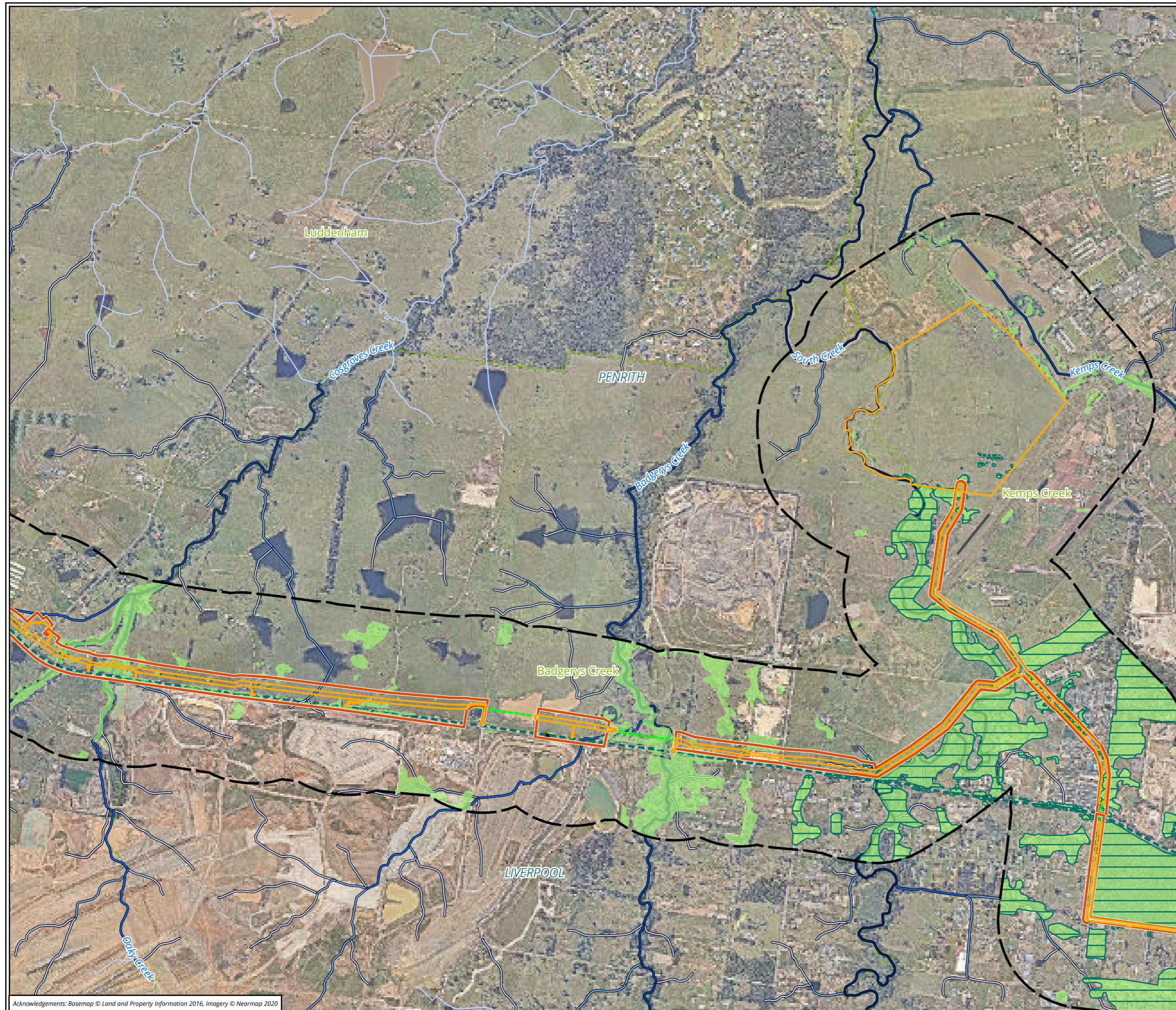
Figure 8.3 Patch Size locations

0 160 320 480 640 800
Metres

Scale: 1:20,000 @ A3 Coordinate System:
PCS: GDA 1994 MGA Zone 56

biosis

Matter: 31617,
Date: 24 September 2021,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020.mxd



- Legend**
- Impact area
 - Impact assessment area
 - Underbore
 - Landscape Assessment area
 - Native vegetation
- Patch Size locations**
- ≥ 100ha (1800-Scattered Trees, 1800-Thinned, 724-Intact, 724-Scattered Trees, 724-Thinned, 725-Intact, 725-Scattered Trees, 725-Thinned, 781-Thinned, 835-Intact, 835-Scattered Trees, 835-Thinned, 849-Scattered Trees, 849-Thinned, 883-Intact, 883-Scattered Trees, 883-Thinned)

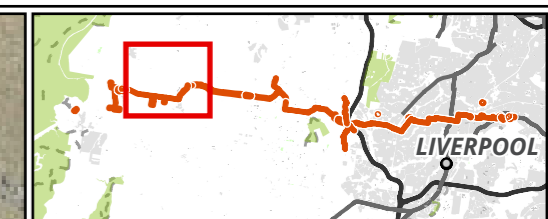
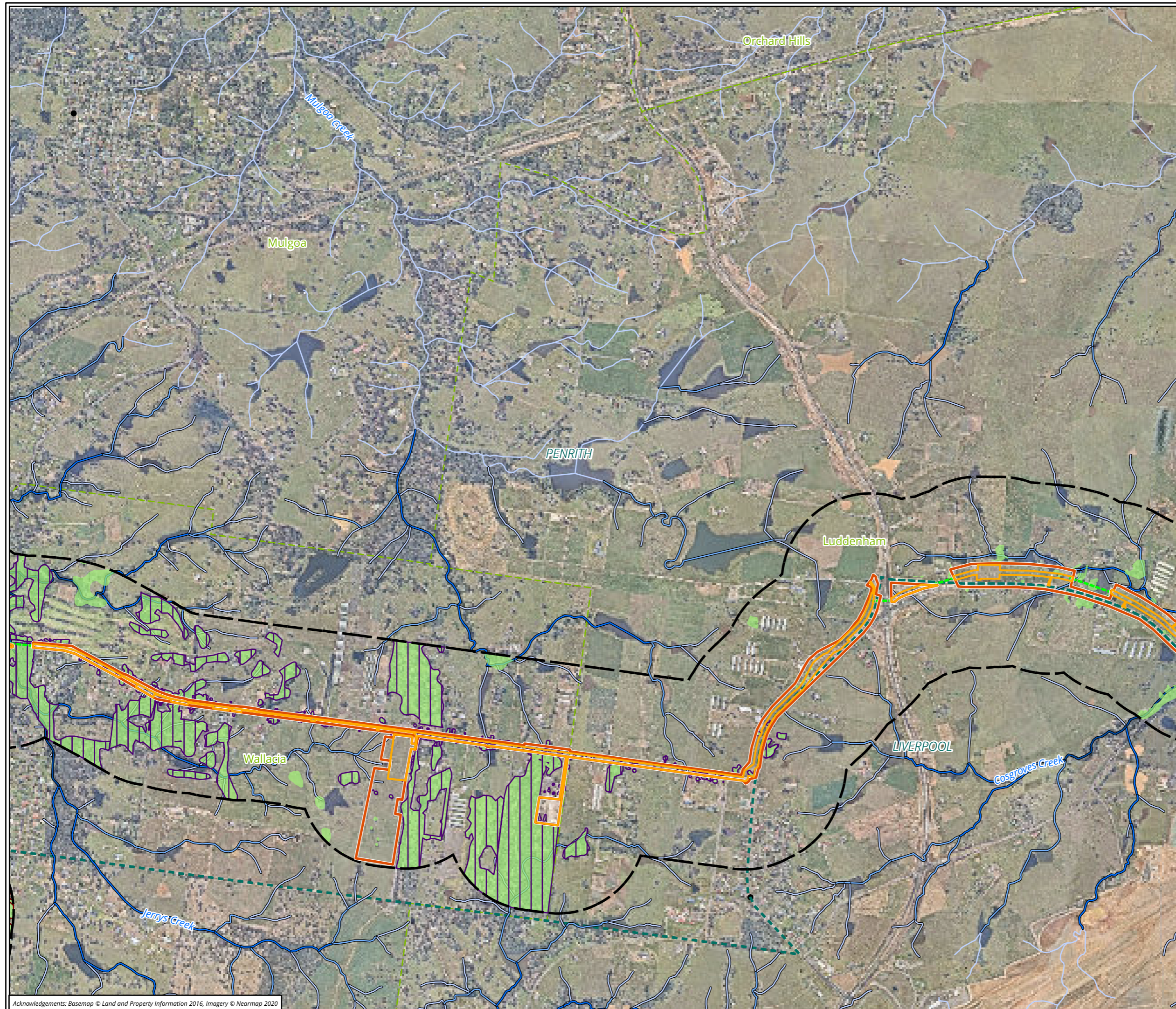
Figure 8.4 Patch Size locations

0 160 320 480 640 800
Metres

Scale: 1:20,000 @ A3 Coordinate System:
PCS: GDA 1994 MGA Zone 56

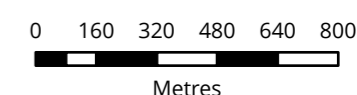
biosis

Matter: 31617,
Date: 24 September 2021,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020.mxd



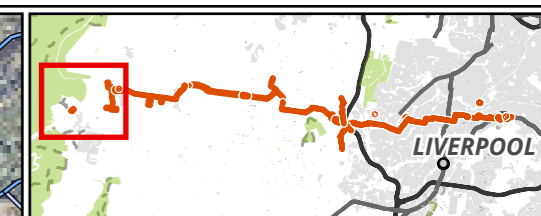
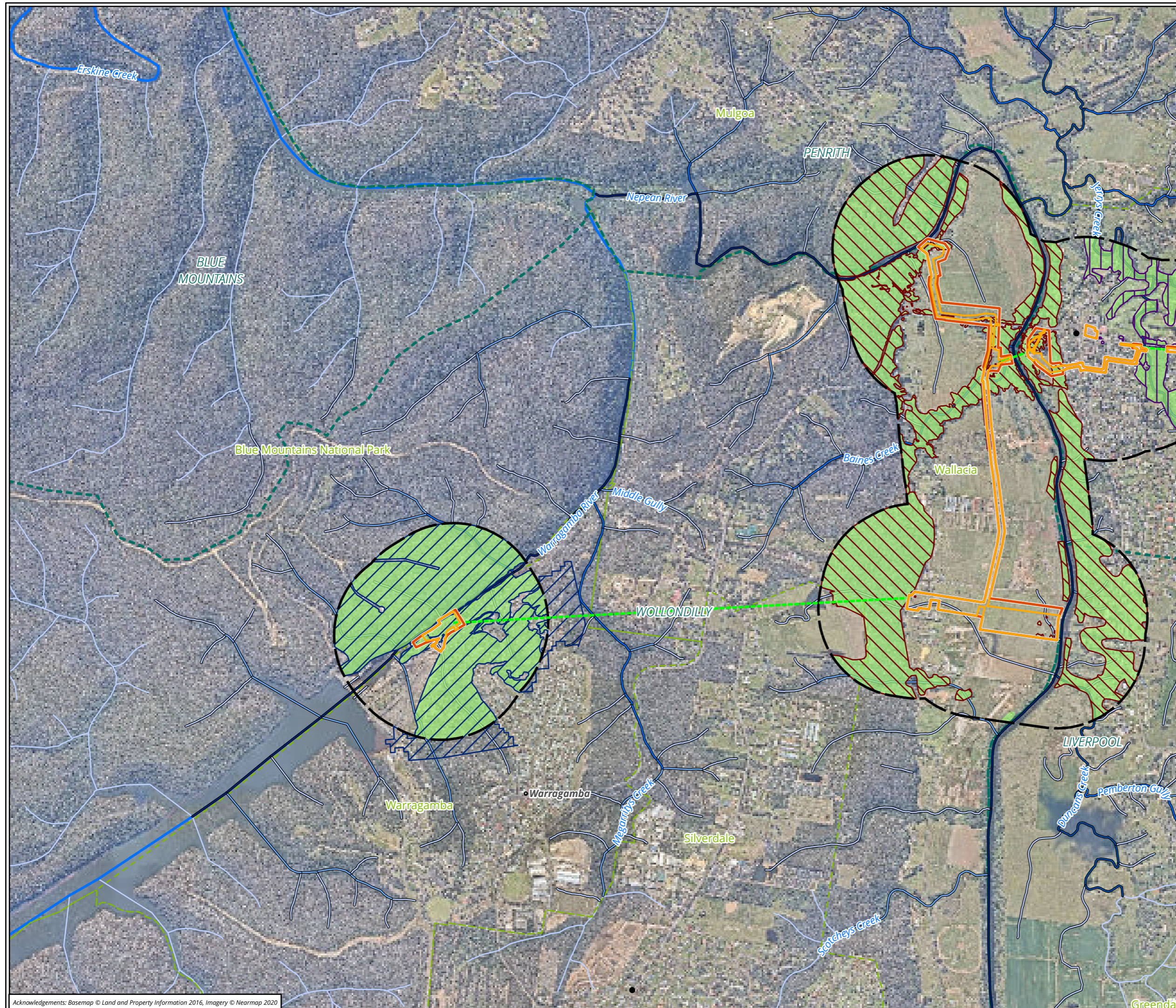
- Legend**
- Impact area
 - Impact assessment area
 - Underbore
 - Landscape Assessment area
 - Native vegetation
- Patch Size locations**
- ≥ 100ha (105-Thinned, 1181-Intact)
 - ≥ 100ha (849-Intact)

Figure 8.5 Patch Size locations



Scale: 1:20,000 @ A3 Coordinate System:
PCS: GDA 1994 MGA Zone 56





Legend

- Impact area
- Impact assessment area
- Underbore
- Landscape Assessment area
- Native vegetation

Patch Size locations

- $\geq 100\text{ha}$ (1083-Thinned)
- $\geq 100\text{ha}$ (105-Thinned, 1181-Intact)
- $\geq 100\text{ha}$ (849-Intact)

Figure 8.6 Patch Size locations

0 160 320 480 640 800
Metres

Scale: 1:20,000 @ A3 Coordinate System:
PCS: GDA 1994 MGA Zone 56

biosis

Matter: 31617,
Date: 24 September 2021,
Prepared for: CW, Prepared by: LH, Last edited by: amackegard
Location: P:\31600s\31617\Mapping\31617_Working\31617_BDAR2020.mxd

8. Threatened species

8.1 Predicted species (ecosystem credit species)

A list of predicted species (ecosystem credit species) expected to occur within the impact area and impact assessment area was generated as per Section 5 of the BAM. Impacts to these species require assessment, however targeted survey is not required as these species are assumed to occur, based on the occurrence of the PCTs, habitat constraints, native vegetation cover in the landscape and calculated patch sizes. Table 25 lists the ecosystem credit species that could not be discounted, based on geographical restrictions or a lack of suitable habitat, from using the impact assessment area or impact area on occasion.

These species were considered when prescribing management and mitigation measures for the project, and a number have been specifically considered as part of the assessment under the Commonwealth EPBC Act.

Table 25 Threatened ecosystem credit species (predicted species) with potential to occur

Species name	Common name	IBRA Subregion
<i>Anthochaera phrygia</i>	Regent Honeyeater	Cumberland, Wollemi
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	Cumberland, Wollemi
<i>Botaurus poiciloptilus</i>	Australasian Bittern	Cumberland, Wollemi
<i>Calidris ferruginea</i>	Curlew Sandpiper	Cumberland
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (foraging)	Cumberland, Wollemi
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (foraging)	Cumberland, Wollemi
<i>Chthonicola sagittata</i>	Speckled Warbler	Cumberland, Wollemi
<i>Circus assimilis</i>	Spotted Harrier	Cumberland, Wollemi
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	Cumberland, Wollemi
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Cumberland, Wollemi
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	Cumberland, Wollemi
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	Cumberland
<i>Epthianura albifrons</i>	White-fronted Chat	Cumberland
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	Cumberland, Wollemi
<i>Glossopsitta pusilla</i>	Little Lorikeet	Cumberland, Wollemi
<i>Grantiella picta</i>	Painted Honeyeater	Cumberland, Wollemi
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Cumberland, Wollemi
<i>Hieraaetus morphnoides</i>	Little Eagle (foraging)	Cumberland, Wollemi
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	Cumberland, Wollemi
<i>Irediparra gallinacea</i>	Comb-crested Jacana	Cumberland
<i>Ixobrychus flavicollis</i>	Black Bittern	Cumberland, Wollemi

Species name	Common name	IBRA Subregion
<i>Lathamus discolor</i>	Swift Parrot	Cumberland, Wollemi
<i>Limicola falcinellus</i>	Broad-billed Sandpiper	Cumberland
<i>Limosa limosa</i>	Black-tailed Godwit	Cumberland
<i>Lophoictinia isura</i>	Square-tailed Kite (foraging)	Cumberland, Wollemi
<i>Melanodryas cucullata cucullata</i>	Hooded Robin (south-eastern form)	Cumberland, Wollemi
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	Cumberland, Wollemi
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	Cumberland, Wollemi
<i>Miniopterus australis</i>	Little Bent-winged Bat	Cumberland, Wollemi
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Cumberland, Wollemi
<i>Neophema pulchella</i>	Turquoise Parrot	Cumberland, Wollemi
<i>Ninox connivens</i>	Barking Owl (foraging)	Cumberland, Wollemi
<i>Ninox strenua</i>	Powerful Owl (foraging)	Cumberland, Wollemi
<i>Nyctophilus corbeni</i>	Corben's Long-eared Bat	Wollemi
<i>Pandion cristatus</i>	Eastern Osprey (foraging)	Cumberland
<i>Petaurus australis</i>	Yellow-bellied Glider	Cumberland, Wollemi
<i>Petroica boodang</i>	Scarlet Robin	Cumberland, Wollemi
<i>Petroica phoenicea</i>	Flame Robin	Cumberland, Wollemi
<i>Phascolarctos cinereus</i>	Koala (foraging)	Cumberland, Wollemi
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	Wollemi
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (foraging)	Cumberland, Wollemi
<i>Rostratula australis</i>	Australian Painted Snipe	Cumberland
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	Cumberland, Wollemi
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	Cumberland, Wollemi
<i>Stagonopleura guttata</i>	Diamond Firetail	Cumberland, Wollemi
<i>Stictonetta naevosa</i>	Freckled Duck	Cumberland
<i>Tyto novaehollandiae</i>	Masked Owl	Cumberland, Wollemi
<i>Tyto tenebricosa</i>	Sooty Owl	Cumberland, Wollemi
<i>Varanus rosenbergi</i>	Rosenberg's Goanna	Cumberland, Wollemi

8.2 Species credit species

Appendix 2 provide the lists of species credit species predicted to occur within the impact and impact assessment area based on the IBRA subregions within which the project occurs, the native vegetation cover

present within the 500 metre buffer area, the PCTs present within the impact area and impact assessment area, and patch sizes listed in Table 21.

The potential for a species to occur within the impact area and impact assessment area was assessed in accordance with Sections 5.1.2 and 5.2 of the BAM and species with geographical restrictions, or habitat constraints not present, were not required to be surveyed. A detailed assessment of potential for occurrence, and potential for impact, for all species credit species predicted to occur within the impact area and impact assessment area is provided in Appendix 2. Species credit species with moderate likelihood of occurrence or higher were considered candidate species credit species and either assumed present, subject to an expert report, or the subject of the target of threatened species surveys within the impact area and impact assessment area. These species and their associated method of assessment are listed in Table 27 (flora species) and Table 29 (fauna species).

8.2.1 Threatened species surveys

Targeted threatened species surveys within the impact area and impact assessment area were undertaken between 20 April 2020 and 20 January 2021 by Biosis ecologists outline in Section 5.3.1. Surveys undertaken and weather observations for each survey date are shown in Table 26. Weather observations sourced from Bankstown Airport weather station (station 066137) (BOM 2020).

Table 26 Weather observations during targeted flora and fauna surveys (Sydney, NSW)

Survey undertaken	Survey date	Temperature (°C)*		Rain (mm)
		Min.	Max.	
<ul style="list-style-type: none"> Targeted flora survey Fauna habitat assessment 	20 April 2020	11.3	20.2	0
<ul style="list-style-type: none"> Targeted flora survey Fauna habitat assessment 	21 April 2020	9.9	26.1	0
<ul style="list-style-type: none"> Targeted flora survey 	22 April 2020	10.2	25.7	0
<ul style="list-style-type: none"> Targeted flora survey Fauna habitat assessment 	27 April 2020	11.6	21.6	0
<ul style="list-style-type: none"> Targeted flora survey Fauna habitat assessment 	7 May 2020	7.1	24.3	0
<ul style="list-style-type: none"> Targeted flora survey Fauna habitat assessment 	8 May 2020	9.9	27.4	0
<ul style="list-style-type: none"> Targeted flora survey 	29 May 2020	9.9	17.6	0
<ul style="list-style-type: none"> Targeted flora survey 	3 June 2020			
<ul style="list-style-type: none"> Targeted fauna survey – Cockatoos and Owls 	27 August 2020	2.8	22	0
<ul style="list-style-type: none"> Targeted fauna survey – Broad-headed Snake 	25 September 2020	6.9	23.5	0
<ul style="list-style-type: none"> Targeted flora survey 	2 October 2020	8.1	28.6	0
<ul style="list-style-type: none"> Targeted flora survey 	6 October 2020	16.3	20.5	0
<ul style="list-style-type: none"> Targeted flora survey 	7 October 2020	16.7	21.5	0

Survey undertaken	Survey date	Temperature (°C)*		Rain (mm)
		Min.	Max.	
<ul style="list-style-type: none"> Targeted fauna survey - Passive microbat acoustic survey 				
<ul style="list-style-type: none"> Targeted flora survey Fauna habitat assessment Targeted fauna survey - Passive microbat acoustic survey Targeted fauna survey – Koala Spot Analysis Technique (SAT) 	8 October 2020	15.1	28.5	0.8
<ul style="list-style-type: none"> Fauna habitat assessment Targeted fauna survey - Passive microbat acoustic survey Targeted fauna survey – Koala SAT 	9 October 2020	9.8	23.4	0
<ul style="list-style-type: none"> Targeted fauna survey - Passive microbat acoustic survey 	10-14 October 2020	9.2	30.6	0
<ul style="list-style-type: none"> Targeted fauna survey – Amphibians and Microbats (stag-watch) Targeted fauna survey - Passive microbat acoustic survey 	15 October 2020	12.4	30.4	0
<ul style="list-style-type: none"> Targeted fauna survey - Passive microbat acoustic survey 	16-21 October 2020	11.5	29.9	5.0
<ul style="list-style-type: none"> Targeted fauna survey – Amphibians and Microbats (stag-watch) 	21 October 2020	11.5	25.7	0
<ul style="list-style-type: none"> Targeted flora survey Fauna habitat assessment 	12 November 2020	15.3	25.4	0
<ul style="list-style-type: none"> Targeted fauna survey – Koala SAT 	23 November 2020	20.7	26.1	1.2
<ul style="list-style-type: none"> Targeted fauna survey - Passive microbat acoustic survey Targeted fauna survey – Remote sensing camera survey for Brush-tailed Rock Wallaby 	14 December 2020 – 20 January 2021	10.5	37.7	122 (total for period)

*Information from the Australia Government Bureau of Meteorology website.

8.2.2 Targeted threatened flora surveys and results

The impact area and impact assessment area support patches of native vegetation ranging from high to low condition, the majority of which contains the potential to support threatened flora species. Specific areas of high resilience native vegetation with a high potential for threatened flora species were identified within the Lansdowne, Cecil Hills to Kemps Creek and Wallacia to Warragamba sections of the impact area and impact assessment area.

Native vegetation within the impact area and impact assessment area has been subject to a varying land use history of; grazing, agricultural, clearing, dumping and recreational impacts contributing to degradation of understorey vegetation, and thus threatened species habitats. The understorey vegetation within the patches of high and moderate condition PCT 849 within Western Sydney Parklands and the Lansdowne BioBank site

have been subject to recent restoration efforts by Western Sydney Parklands Trust and Canterbury Bankstown City Council respectively, aimed towards regenerating the community and habitats toward its benchmark ecological condition.

Targeted threatened flora survey, undertaken on the dates listed in Table 26 above, was done so in accordance with the required BAM survey guideline, *NSW Surveying threatened plants and their habitats* (DPIE 2020e). Targeted threatened flora survey was undertaken throughout the entirety of the impact area utilising a minimum 10 metre separated transects, with the exception of an approximately 650 metres section, between the eastern end of Cross Street and Brandown Quarry at Kemps Creek, where access could not be arranged. Portions of the impact assessment area were not subject to targeted survey for threatened flora.

Survey progress was captured using handheld GPS units, and ArcGIS Tracker enabled on field staff's mobile phones, to geospatially log transects walked throughout the targeted threatened species surveys between April and May 2020, and October and November 2020. Spatial locations of all threatened species recorded were captured by either hand-held GPS units, mobile tablet computers running Collector for ArcGIS (both with accuracy of generally ± 5 metres).

Targeted threatened flora surveys undertaken for the project are detailed in Table 27 below and illustrated on Figure 9, with a detailed assessment of candidate species provided in Appendix 2.

It should be noted that when specific species' habitats were present in areas adjacent to the subregional boundaries, those species were still subject to on-ground searches, despite being potentially noted in the table below as 'N/A' for either adjoining subregion.

Table 27 Threatened flora species credit species (candidate species) requiring assessment

Scientific name	Common name	PCT association	Survey period (DPIE 2020b).	Assessment method	
				Cumberland IBRA subregion	Wollemi IBRA subregion
<i>Acacia bynoeana</i>	Bynoe's Wattle	724, 725, 849, 1083, 1181	Jan-Dec	Surveyed	Surveyed
<i>Acacia pubescens</i>	Downy Wattle	724, 725, 849, 883, 1083, 1181	Jan-Dec	Surveyed	Surveyed
<i>Allocasuarina glareicola</i>	-	724, 725, 883	Jan-Dec	Surveyed	N/A
<i>Ancistrachne maidenii</i>	-	1083, 1181	Dec-Apr	N/A	Surveyed
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	724, 725, 849, 883, 1083, 1181	Sept-Oct	Surveyed	N/A
<i>Callistemon linearifolius</i>	Netted Bottle Brush	724, 725, 835, 1083, 1181	Oct-Jan	Surveyed / Assumed present	N/A
<i>Cynanchum elegans</i>	White-flowered Wax Plant	835, 849	Jan-Dec	Surveyed / Assumed present	N/A
<i>Dillwynia tenuifolia</i>	-	724, 725, 849, 883, 1083	Aug-Oct	Surveyed	Surveyed
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	-	725, 1083, 1181	Sept-Oct	Surveyed	N/A
<i>Eucalyptus benthamii</i>	Camden White Gum	835, 849, 1105	Jan-Dec	Surveyed	Surveyed
<i>Grammitis stenophylla</i>	Narrow-leaf Finger Fern	1181	Jan-Dec	Surveyed	Surveyed
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	724, 725, 849, 883	Jan-Dec	Surveyed	N/A
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	724, 725, 883, 1083	Aug-Nov	Surveyed	Surveyed

Scientific name	Common name	PCT association	Survey period (DPIE 2020b).	Assessment method	
				Cumberland IBRA subregion	Wollemi IBRA subregion
<i>Gyrostemon thesioides</i>	-	724, 725, 1105, 1181, 1800	Jan-Dec	Surveyed	N/A
<i>Haloragis exalata</i> subsp. <i>exalata</i>	Square Raspwort	781, 1105	Jan-Dec	Surveyed	N/A
<i>Hibbertia fumana</i>	-	724, 725, 883	Oct-Dec	Surveyed	N/A
<i>Hibbertia puberula</i>	-	883, 1083, 1181	Oct-Dec	Surveyed	Surveyed
<i>Hibbertia</i> sp. Bankstown	-	725, 835	Sept-Dec	Surveyed	N/A
<i>Leucopogon exolasius</i>	Woronora Beard-heath	883, 1083, 1181	Aug-Sept	Surveyed	Surveyed
<i>Leucopogon fletcheri</i> subsp. <i>fletcheri</i>	-	1083, 1181	Aug-Sept	Surveyed	Surveyed
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	Native Pear	724, 725, 835, 849, 1800	Nov-Feb	Surveyed	Surveyed
<i>Melaleuca deanei</i>	Deane's Paperbark	1083, 1181	Jan-Dec	Surveyed	Surveyed
<i>Micromyrtus minutiflora</i>	-	724, 725, 883	Jan-Dec	Surveyed	N/A
<i>Persoonia acerosa</i>	Needle Geebung	1083, 1181	Jan-Dec	N/A	Surveyed
<i>Persoonia hirsuta</i>	Hairy Geebung	835, 1083, 1181	Jan-Dec	Surveyed	Surveyed
<i>Persoonia nutans</i>	Nodding Geebung	724, 725, 883	Jan-Dec	Surveyed	N/A
<i>Pimelea curviflora</i> var. <i>curviflora</i>	-	724, 849, 883, 1083, 1181	Oct-Mar	Surveyed	Surveyed
<i>Pimelea spicata</i>	Spiked Rice-flower	849	Jan-Dec	Surveyed and Expert report	N/A

Scientific name	Common name	PCT association	Survey period (DPIE 2020b).	Assessment method	
				Cumberland IBRA subregion	Wollemi IBRA subregion
<i>Pomaderris brunnea</i>	Brown Pomaderris	835, 1105, 1181, 1800,	Aug-Oct	Surveyed	Surveyed
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	849, 1083, 1181	Oct	Surveyed	N/A
<i>Pultenaea parviflora</i>	-	724, 725, 883, 1083	Sept-Nov	Surveyed	N/A
<i>Pultenaea pedunculata</i>	Matted Bush-pea	724, 725, 849	Sept-Nov	Surveyed	N/A
<i>Tetradlea glandulosa</i>	-	1083, 1181	Aug-Nov	N/A	Surveyed
<i>Wahlenbergia multicaulis</i>	-	725, 835, 1181	Jan-Dec	Surveyed	N/A
<i>Zannichellia palustris</i>	-	781	Oct-Jan	Surveyed	N/A
<i>Zieria involucreata</i>	-	1181	Jan-Dec	Surveyed	Surveyed
<i>Zieria murphyi</i>	Velvet Zieria	1083	Sept-Nov	Surveyed	Surveyed

Targeted surveys resulted in the detection of the following threatened flora species populations and their habitat, of which a detailed inventory is provided in Table 28, with locations provided on Figure 9:

- A population of Downy Wattle was recorded as occurring in the impact area and impact assessment area within and adjacent to the BioBank site at Lansdowne.
- A population of Native Pear was recorded as occurring in the impact area adjacent to the BioBank site at Lansdowne and along the roadside interface of Park Road between Londonderry and Wallacia.
- A population of Camden White Gum was recorded as occurring in the impact assessment area in Blaxlands Crossing Reserve at Wallacia; however no individuals occur within the impact area.
- A population of Juniper-leaved Grevillea *Grevillea juniperina* subsp. *Juniperina* was detected at Western Sydney Parklands growing in the interface of a sealed internal track. These plants are not within the project's final impact area or impact assessment area.
- A population of *Dillwynia tenuifolia* was recorded as occurring in the impact area and impact assessment area along the roadside interface of Cross Street and Western Road at Kemps Creek. These plants occur entirely within Existing Certified land.
- A population of *Pultenaea parviflora* var. *parviflora* was recorded as occurring in the impact area and impact assessment area along the roadside interface of Cross and Western Streets at Kemps Creek. These plants occur entirely within Existing Certified land. Another small population was recorded in Non-Biocertified land within the impact assessment area along the Elizabeth Road interface.

As outlined in Section 8.2.1 above, due to site access constraints an approximately 650 metre section of the impact area and impact assessment could not be surveyed at Kemps Creek. This has resulted in the need to assume presence of a number of threatened flora species in this location. Further detail is provided in Table 28 and Appendix 2.

Species that have been assumed present in the unsurveyed section of the impact area and impact assessment area at Kemps Creek include:

- *Dillwynia tenuifolia*
- Juniper-leaved Grevillea
- Native Pear
- Matted Bush-pea *Pultenaea pedunculata*
- Netted Bottle Brush *Callistemon linearifolius*.

Table 28 Threatened flora species recorded (within Non-Biocertified land)

Scientific name	Common name	Individuals in Impact area	Individuals in Impact assessment area	Habitat in the Impact area (ha)	Habitat in the Impact assessment area (ha)
Species recorded in impact area and/or impact assessment area					
<i>Acacia pubescens</i>	Downy Wattle	7	12	0.16	0.23
<i>Eucalyptus benthamii</i>	Camden White Gum	0	5	0.00	0.14

Scientific name	Common name	Individuals in Impact area	Individuals in Impact assessment area	Habitat in the Impact area (ha)	Habitat in the Impact assessment area (ha)
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	Native Pear	0	4	0.03	0.11
<i>Pultenaea parviflora</i>	-	0	4	0.01	0.04
Species assumed present at Kemps Creek					
<i>Callistemon linearifolius</i>	Netted Bottle Brush	n/a	n/a	0.46	0.86
<i>Dillwynia tenuifolia</i>	-	n/a	n/a	0.05	0.05
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	n/a	n/a	0.05	0.05
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	Native Pear	n/a	n/a	0.51	0.91
<i>Pultenaea pedunculata</i>	Matted Bush-pea	n/a	n/a	0.05	0.05

Netted Bottle Brush is a species credit species to which impacts are measured as a count of individuals (or stems) rather than as an area of impact. As impacts to Netted Bottle Brush have been assumed based on a lack of survey due to access restriction, a count of stems impacted cannot be provided. In order to estimate the number of stems that would occur in the 0.46 hectares of assumed habitat impacted, as required by the BAM Calculator to generate a credit requirement for the species, the following process was undertaken:

- All BioNet records of the species within 10 kilometres of the impact area were selected using GIS.
- Those records with highly inaccurate location were discarded. This equated to all historical records, more than 70 years old.
- The remaining records were grouped into populations based on location descriptions, and an area of occupancy / habitat was measured for each population.
- This area of habitat was divided by the number of individuals recorded in each location, and the results averaged to determine an average number of stems per ha.
- This average of 13 stems per ha was then used to estimate the number of stems that may be present within the project area, which was a total of 6 stems.

8.2.3 Targeted threatened fauna surveys and results

Fauna habitat within the impact area and impact assessment area were generally found to be degraded by past land use practices which have resulted in a loss of key habitat features across the landscape such as;

large tree-hollows, large patches of intact, well-structured vegetation not subject to edge effects, and high quality connectivity corridors. More localised areas of higher quality fauna habitats were found to occur in areas such as the BioBank site at Lansdowne, Western Sydney Parklands, areas north of Kemps Creek Nature Reserve, and areas near the Nepean and Warragamba Rivers. However fauna habitats in these locations were still considered sub-optimal and disturbed by a range of urban and peri-urban impacts.

Threatened fauna species survey included habitat assessment to determine suitable microhabitats across the impact area and impact assessment area and, where necessary, targeted species survey to determine presence/absence of species and/or their habitats were completed.

Table 29 provides details of threatened fauna species considered candidate species credit species following assessment undertaken in accordance with Section 5 of the BAM (as detailed in Appendix 2), and the assessment method utilised to determine presence/absence and potential impacts.

Threatened fauna surveys undertaken for the current assessment are further detailed below.

Table 29 Threatened fauna species credit species (candidate species) requiring assessment

Species name	Common name	Assessment method	IBRA subregion	
			Cumberland	Wollemi
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Targeted tree hollow surveys and habitat assessment	Yes	Yes
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	Targeted tree hollow surveys and habitat assessment	Yes	Yes
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Microbat acoustic detection surveys, stag watch	Yes	Yes
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Targeted nest tree (stick nest) surveys and habitat assessment	Yes	Yes
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	Threatened species habitat assessment, active searches, spotlighting, call play-back	Yes	Yes
<i>Hieraaetus morphnoides</i>	Little Eagle	Targeted nest tree (stick nest) surveys and habitat assessment	Yes	Yes
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	Threatened species habitat assessment, active searches, hollow-bearing tree assessment	Yes	Yes
<i>Litoria aurea</i>	Green and Golden Bell Frog	Habitat assessment by species expert	Yes	Yes
<i>Lophoictinia isura</i>	Square-tailed Kite	Targeted nest tree (stick nest) surveys and habitat assessment	Yes	Yes
<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	Active searches, habitat assessment by species expert	Yes	Yes
<i>Miniopterus australis</i>	Little Bent-winged Bat	Threatened species habitat assessment, microbat acoustic detection surveys, stag watch	Yes	Yes

Species name	Common name	Assessment method	IBRA subregion	
			Cumberland	Wollemi
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	Threatened species habitat assessment, microbat acoustic detection surveys, stag watch	Yes	Yes
<i>Myotis macropus</i>	Southern Myotis	Threatened species habitat assessment, microbat acoustic detection surveys, stag watch	Assumed present	Yes
<i>Ninox connivens</i>	Barking Owl	Targeted tree hollow surveys and habitat assessment	Yes	Yes
<i>Ninox strenua</i>	Powerful Owl	Targeted tree hollow surveys and habitat assessment	Yes	Yes
<i>Pandion cristatus</i>	Eastern Osprey	Targeted nest tree (stick nest) surveys and habitat assessment	Yes	Yes
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	Threatened species habitat assessment, baited remote camera survey	N/A	Yes
<i>Phascolarctos cinereus</i>	Koala	SAT survey	Yes	Yes
<i>Pommerhelix duralensis</i>	Dural Land Snail	Active searches, habitat assessment by species expert	Yes	Yes
<i>Pseudophryne australis</i>	Red-crowned Toadlet	Threatened species habitat assessment, active searches, spotlighting, call play-back	Yes	Yes
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Threatened species habitat assessment	Yes	Yes
<i>Tyto novaehollandiae</i>	Masked Owl	Targeted tree hollow surveys and habitat assessment	Yes	Yes
<i>Tyto tenebricosa</i>	Sooty Owl	Targeted tree hollow surveys and habitat assessment	Yes	Yes
<i>Vespadelus troungtoni</i>	Eastern Cave Bat	Threatened species habitat assessment, microbat acoustic detection surveys, stag watch	N/A	Yes

Fauna habitat assessment

Fauna habitat assessment was undertaken to determine the presence microhabitats and other critical habitat components suitable for all species outlined in Table 29 and Appendix 2. Habitat assessments focussed on the presence of the following features within the study area:

- Habitat trees including large and/or hollow-bearing trees, stick nests, availability of flowering shrubs and canopy/understorey feed tree species.
- Soil type and presence of cliffs, overhangs and other rocky areas.

- Condition and type of native vegetation and the presence of exotic species.
- Presence and condition of pools and waterways.
- Quantity of ground litter and woody debris.
- Searches for indirect evidence of fauna (i.e. feathers, tracks and scats).
- General degradation of the site as a result of past and current disturbances such as vegetation clearing and industrial land management practices.
- Topography and landscape morphology.
- Presence of Flying-fox camps.

Several habitat features with potential to support threatened species credit species were identified during these habitat assessments. These features have been summarised in Table 30.

Table 30 Habitat features with potential to support threatened species credit species

Habitat feature	Presence within the impact area
Hollow-bearing trees	Habitat trees supporting hollows of a variety of size classes from small (<50 mm diameter) through to extra-large (> 400 mm diameter) were present across the impact area and impact assessment area. These trees have the potential to provide breeding resources for a range of native fauna species including threatened cockatoos (Glossy Black-Cockatoo and Gang-gang Cockatoo), owls (Barking Owl, Masked Owl, Sooty Owl and Powerful Owl), and microbats.
Feed tree species	A variety of tree species identified as Koala use trees within the Central Coast Koala management area, which includes the impact area and impact assessment area, were detected during the assessment. These trees were identified in areas where there are known Koala records, including Wallacia and the Western Sydney Parklands. Trees and shrubs providing food resources for smaller mammals such as Eastern Pygmy-possum and Squirrel Glider were also recorded, but in low abundance throughout the impact area and impact assessment area.
Caves and rocky overhangs	Caves and rocky overhangs were identified at the western end of the project alignment on both sides of the Warragamba River. These environments provide potential breeding habitat for threatened microbats including Large-eared Pied Bat, Little Bent-winged Bat, Large Bent-winged Bat, and Southern Myotis, as well as Sooty Owls and potentially Masked Owls.
Rocky outcrops and sandstone crevices	The surface geology surrounding both Warragamba River and Nepean River at the western extent of the project alignment consists of Hawkesbury Sandstone with the natural areas within the vicinity of both of these water courses supporting rocky outcrops, sandstone crevices, and caves. These features provide potential habitat for native frogs and reptiles including the threatened Giant Burrowing Frog, Red-crowned Toadlet and Broad-headed Snake.
Major and minor watercourses and waterbodies (i.e. dams)	Major watercourses in the western section of the impact area include the Nepean River and the Warragamba River. The sandy banks of these rivers and the supporting vegetation along these systems provide potential habitat for amphibians including Red-crowned Toadlet and Giant Burrowing Frog. Artificial waterbodies (i.e. farm dams) at the western end of the impact area and impact assessment area were also identified as potential habitat for threatened

Habitat feature	Presence within the impact area
	<p>amphibians.</p> <p>Riparian areas also have the potential to support threatened fauna species in a fragmented landscape such as the one relevant to the current project. Large old trees, more likely to support tree hollows, are more common in riparian corridors. The Nepean River riparian vegetation at Wallacia was found to support a Grey-headed Flying-fox colony. This colony is outside the impact area and impact assessment area, and was found to harbour approximately 2000 male bats, with no females or juvenile recorded.</p>
Woody debris and leaf litter	<p>Woody debris and leaf litter was prevalent in the remnant vegetation patches across impact areas and impact assessment area providing potential habitat for the threatened Cumberland Plain Land Snail and Dural Land Snail.</p>

Field capture of detailed fauna habitat information allowed for confirmation of presence/absence of habitat features and microhabitats for a range of candidate threatened species across surveyed portions of the impact area and impact assessment area. Fauna habitat assessments were captured using ArcGIS polygons attributed with specific habitat criteria that allowed for planning of further targeted survey for select species, or the exclusion of the potential for occurrence of various candidate species in various locations across the impact area and impact assessment area.

These field captured polygons have also been used to refine species polygons developed for those species either recorded by targeted survey or assumed present. Further detail is provided in Section 8.4.

Amphibian targeted species surveys

Targeted amphibian surveys were undertaken for Giant Burrowing Frog and Red-crowned Toadlet due to their consideration as candidate species credit species and presence of potential habitat within the impact area and impact assessment area. The survey guidelines and requirements for these targeted surveys are detailed in Table 31. Fieldwork completed for the project was undertaken in accordance with BAM 2017, with this BDAR being updated due to the expiry of the 12 month transitional period post the update of the BAM to BAM 2020 (refer to Section 1.2 above), the relevant survey guidelines (as referred to in BAM 2017 section 6.5.1.3) are the *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (DECC 2009).

Detailed habitat assessments were undertaken for waterways considered to potentially provide habitat to the candidate frog species. These assessments concluded that the only waterway supporting potential habitat was the Warragamba River due to factors such as unsuitable clay-based soils and high levels of disturbances at other watercourses.

Table 31 Survey guidelines and requirements for amphibian targeted surveys

Survey guidelines	Survey requirements
<i>Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians</i> (DECC 2009)	<p>Giant Burrowing Frog and Red-crowned Toadlet</p> <ul style="list-style-type: none"> • Combination of call surveys and nocturnal searches in suitable habitat after rain. • Minimum of one 200-metre transect per water body, repeated on a minimum of two separate nights. • Surveys to be undertaken from September through to May for Giant Burrowing Frog and July through to March for Red-crowned Toadlet.

Targeted survey for both of these species was undertaken in potential habitat along the Warragamba River, adjacent to the Warragamba Dam. These surveys were undertaken in October satisfying the timing requirements for both species.

A total of two nights of survey were undertaken, six days apart, along a 500 metre long transect by two experienced zoologists. The following methodology was implemented during each survey:

- An initial five minute period of passive listening at the start of the transect to detect and identify calling frogs present at the site.
- At each 50 metre interval along the transect a five minute passive listening period was completed followed by two minutes of call broadcast and an additional two minutes of listening for each of the species.
- Each interval was followed by a slow walking visual inspection for five minutes where suitable habitat was searched with torches.

All frog species heard or observed during the surveys were recorded. Neither Giant Burrowing Frog nor Red-Crowned Toadlet were recorded, and final assessment of the habitat following this detailed survey works found it to be degraded and of low quality for either species. Furthermore the area lacked the required breeding microhabitat types for Giant Burrowing Frog, generally being soaks or pools within first or second order streams (EES 2021a), and for Red-crowned Toadlet, being the first or second order ephemeral drainage lines which drain the ridges, benches, cliffs and talus slopes (NPWS 2001).

Bird (cockatoos, owls and raptors) habitat surveys

Targeted bird surveys were undertaken for Glossy Black-Cockatoo, Barking Owl, Eastern Osprey, Little Eagle, Square-tailed Kite and White-bellied Sea-Eagle within the required survey season (as outlined in BioNet), due to their consideration as candidate species credit species (for breeding habitat only) and the potential availability of habitat within the impact area and impact assessment area. The survey guidelines and requirements for these targeted surveys are detailed in Table 32.

Whilst undertaking these surveys, searches for the presence of suitably sized tree hollows providing potential breeding habitat for Gang-gang Cockatoo, Powerful Owl, Masked Owl and Sooty Owl were also completed. These additional surveys allowed for the presence of these breeding birds (and therefore their 'species credit habitat components') to be determined. Where the specific (and static) tree hollow habitat features were not recorded within the impact area or impact assessment area, the conclusion of the absence of these birds' breeding habitat could be confirmed, despite being out of survey season.

Table 32 Survey guidelines and requirements for bird (cockatoos, owls and raptors) surveys

Survey guidelines	Survey requirements
BioNet Atlas of NSW (EES 2021)	Cockatoo habitat survey requirements <ul style="list-style-type: none"> • Glossy Black-Cockatoo - Potential nest trees contain hollows that are; (i) at least 8 m above the ground; and (ii) in stems with a diameter of at least 30 cm; and (iii) hollow diameter is at least 15 cm; and (iv) stem angle is at least 45 degrees, and may be near-vertical or vertical. • Gang-gang Cockatoo – survey for the presence of eucalypts containing hollows that are at least 9 m above the ground, and with hollow diameter of 10 cm or larger. • Assessors should look for signs of breeding on site as follows; (a) begging birds of any age or sex; or (b) lone adult males identified during the breeding season (April to August); or (c) an occupied nest.

Survey guidelines	Survey requirements
	<ul style="list-style-type: none"> If nest trees and signs of breeding are found to be present, targeted surveys are required to confirm presence/absence. <p>Owl habitat survey requirements</p> <ul style="list-style-type: none"> Powerful Owl, Masked Owl and Sooty Owl – survey for the presence of living or dead trees with hollows greater than 20 cm diameter. Look for signs of breeding on site as follows; suitable habitat and (a) presence of male and female or (b) calling to each other (duetting) or (c) find nest. If nest trees and signs of breeding are found to be present, targeted surveys are required to confirm presence/absence. <p>Raptor surveys (Eastern Osprey, Little Eagle, Square-tailed Kite and White-bellied Sea-Eagle)</p> <ul style="list-style-type: none"> Survey for the presence of nest trees supporting large stick nests. If nests are recorded, confirmation of species using the nests is required due to similarities between nests of threatened and non-threatened species.

Targeted survey for Glossy-Black Cockatoo, Barking Owl, Powerful Owl, Masked Owl, Sooty Owl, Eastern Osprey, Little Eagle, Square-tailed Kite and White-bellied Sea-Eagle were undertaken in potential habitat along the Nepean River in Wallacia. These areas were considered to support the highest potential habitat for the target bird species within the impact area and impact assessment area, and were undertaken in August and September, satisfying the survey period for these species.

Two large hollow-bearing trees supporting five large (150 – 400 millimetre diameter) and two extra-large (> 400 millimetre) hollows were mapped in vegetation surrounding Fowler Reserve in Wallacia. An additional hollow-bearing tree supporting one large hollow was also mapped in Crossman Reserve. These hollows represent potential breeding habitat for threatened cockatoos and owls due to their size, however their location within small patches of edge-effected and fragmented vegetation within a public park adjacent to urban dwellings, precludes the majority of these species from utilising them for breeding. This was assessed as the case for Gang-gang Cockatoos, and as such follow-up surveys for the presence of breeding bird was not undertaken in October to January.

Additional habitat assessments, hollow-bearing trees surveys and stick nest surveys were completed throughout the remainder of the impact area and impact assessment area between April and November 2020, as outlined in Table 26.

The following methodology was implemented during the targeted bird surveys:

- Searches for suitably sized hollows within native vegetation was undertaken where potential habitat had been identified due to the presence of indicator PCTs.
- Hollow-bearing trees were mapped and any signs of breeding behaviour being exhibited by target species was recorded. Signs of recent use by any Owl species was also recorded.

No breeding habitat was identified for any of the target raptor species (no stick nests were detected within the impact area). It should be noted that Square-tailed Kite and White-bellied Sea Eagle were recorded foraging over the project alignment during incidental surveys undertaken as part of the field campaign for the project, however neither species was recorded as displaying any evidence of breeding.

A number of medium (10-15 centimetre diameter), large (15-40 centimetre diameter) and extra large (>40 centimetre diameter) potentially suitable to support breeding activity for candidate owl and cockatoo species were recorded at various locations within and adjacent to the impact area and impact assessment area.

However all such trees were assessed as highly unlikely to support breeding due to a range of factors including:

- No signs of breeding observed within or immediately prior/post breeding season.
- Small patch sizes, or edge-effected linear strips of vegetation supporting tree hollows being unsuitable to disturbance sensitive species / breeding activities.
- Incorrect landscape position or topography of hills / ridges rather than well vegetated gullies.
- On-going disturbances from public access, urban noise and activities, and historical clearing.
- No known evidence of species breeding in the area.

Broad-headed Snake targeted survey

Targeted survey for Broad-headed Snake was undertaken due to its consideration as candidate species credit species and availability of potential habitat within the study area. The survey guidelines and requirements for these targeted surveys are detailed in Table 33.

Table 33 Survey guidelines and requirements for Broad-headed Snake targeted surveys

Survey guidelines	Survey requirements
BioNet Atlas of NSW (EES 2021) <i>Survey guidelines for Australia's threatened reptiles (DEWHA 2011)</i>	<ul style="list-style-type: none"> • Species shelters under rocks and crevices during the late summer to early spring, as conditions warms it shifts to using hollows in trees – often in sandstone gully forest just downslope from rocky outcrops. • Survey in dry weather in August and September only. • Surveys to include searches of suitable sheltering sites (under rocks or in crevices) on westerly-facing sandstone cliffs by day.

Targeted survey for Broad-headed Snake was undertaken in areas of potential habitat around Warragamba Dam. These locations are considered the only areas of suitable habitat to support the species within the impact area or impact assessment area. Surveys were undertaken on 25 September 2020, satisfying the survey period for the species.

The following methodology was implemented during the survey:

- Identification of suitable sheltering sites (under rocks or in crevices) in areas of sandstone cliffs.
- Comprehensive searches of crevices, overhangs, cave entrances to detect any individuals. Suitably sized rocks and boulder were also overturned and inspected.

The targeted survey did not record Broad-headed Snake within the impact area or impact assessment area.

Koala Spot Assessment Technique (SAT) surveys

Targeted survey for Koala was undertaken due to its consideration as candidate species credit species and availability of suitable habitat in the study area. Surveys were undertaken in areas of suitable habitat where Koala had been recorded, proximal to the project alignment with some level of habitat connectivity, in the last 20 years. The survey guidelines and requirements for Koala targeted surveys are detailed in Table 34.

Table 34 Survey guidelines for Koala SAT searches

Survey guidelines	Survey requirements
<i>EPBC Act referral guidelines for the vulnerable Koala (DoE 2014)</i>	<ul style="list-style-type: none"> Indirect survey method for determining presence/absence utilising the Spot Assessment Technique (SAT) (Phillips & Callaghan 2011).

Diurnal Koala SAT searches were undertaken at nine locations in suitable vegetation within the impact area and impact assessment area (Figure 9). Four of these surveys were undertaken at the western end of the impact area and impact assessment area, around Wallacia, whilst the other five were undertaken within the Western Sydney Parklands. Surveys were undertaken in October and November.

The following methodology was implemented during the survey:

- Searches were undertaken for Koala scats beneath 30 trees at each site in accordance with the method described in Phillips & Callaghan (2011). This involves searching the ground surface for scats within a distance of 100 cm of the base of each tree for two minutes per tree.
- Each tree was also inspected for scratch marks.

No scats or scratches that could be confirmed as Koala were detected during any of the SAT surveys.

Microbat survey

Survey for threatened microbats included dusk 'stag-watching' surveys at two structures identified as potential habitat, as well as through passive acoustic survey at Warragamba (Figure 9). Species targeted included Large-eared Pied Bat, Little Bent-winged Bat, Large Bent-winged Bat, Eastern Cave Bat and Southern Myotis due to their consideration as candidate species credit species, and the availability of potential habitat within the impact area and impact assessment area. Surveys were centred around a vertical man-made shaft (Photo 1) and blocked (bricked-up) large horizontal tunnel (Photo 2) representing potential habitat at the western end of the project alignment near Warragamba Dam. The opening to the vertical (vent) shaft exceeded 2 metres by 2 metres, with the bore hole extending deep into the rock face. Both of these potential habitat features are associated with access to, or ventilation for, the tunnel construction for one of the Warragamba Dam water supply pipelines.

The aim of these surveys was to ascertain the presence of the target species in the area to provide insight into the potential likelihood of the habitat features providing breeding habitat for the microbat species. Survey guidelines and requirements for these species are detailed in Table 35.

Table 35 Survey guidelines and requirements for Microbat targeted surveys

Survey guidelines	Survey requirements
<i>'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method (OEH 2018)</i>	<p>Southern Myotis</p> <ul style="list-style-type: none"> Acoustic detection survey from October to March over a minimum of four nights. A total effort of 16 trap nights. Harp trap or mist net from October to March over a minimum of four nights. A total effort of 16 trap nights. Roost searches from October to March or 30 minutes per feature. <p>Large-eared Pied Bat</p> <ul style="list-style-type: none"> Acoustic detection survey from mid-November to end of January over a minimum of four nights. A total effort of 16 trap nights. Harp trap or mist net from mid-November to end of January over a minimum of four nights. A total effort of 16 trap nights.

Survey guidelines	Survey requirements
	Little Bent-winged Bat and Large Bent-winged Bat <ul style="list-style-type: none"> Harp trap from December to January over a minimum of four nights. A total effort of 8 trap nights.

One acoustic recording device was installed at the entrance to the vertical (vent) shaft between 8 October and collected on 21 October 2020, with another detector deployed along the Warragamba River for the same period. A second round of acoustic surveys were undertaken between 14 December 2020 and 19 January 2021, with detectors placed near the vertical (vent) shaft and the blocked-off tunnel. Locations of the acoustic detectors are provided on Figure 9.

Stag-watching was also undertaken on 15 and 21 October 2020 at the two man-made habitat structures (Photo 1 and Photo 2), and no microbats were observed exiting the habitat features on either night.

The acoustic surveys found Large-eared Pied Bat, Little Bent-winged Bat, Large Bent-winged Bat to be present, with Eastern Cave Bat and Southern Myotis confirmed as absent by the surveys.

The vertical (vent) shaft, and surrounding rocky habitat present within the impact area have been assessed for potential roosting and/or breeding habitat, in accordance with the BAM, for the species confirmed as present by acoustic surveys. The bricked-up tunnel is not considered potential roosting or breeding habitat as there is little to no opportunity for bats to enter/exit the potential habitat feature.



Photo 1 – Vertical man-made shaft at treated water environmental flows outlet



Photo 2 – Bricked-up tunnel adjacent to the treated water environmental flows outlet



Photo 3 – Rocky cliffs and cervaces near bricked-up tunnel (to the right of the vehicle) surrounding impact area and impact assessment area at Warragamba Dam

Whilst it is acknowledged that the BAM microbat survey guidelines require harp trapping be undertaken to confirm the presence of breeding bats within areas of potential habitat, analysis of call data has shown this is clearly not the case for Large-eared Pied Bat and Little Bent-winged Bat, with breeding also considered highly unlikely for Large Bent-winged Bat. All of these species of bats are known to be communal roosting and breeding species, with large proportions of the known populations of the two Bent-winged Bat species known to utilise a very small number of breeding sites across NSW. If breeding (or roosting) was occurring within the project's impact area or impact assessment area bats would be frequently recorded entering / exiting from the roost location over a period of weeks whilst pups are being raised, prior to the female bats leaving the

maternity roost and migrating back to non-breeding locations. The presence of all species in the area within breeding season can be explained by the calls belonging to foraging males or non-breeding females. Furthermore the habitat provided by the vertical (vent) shaft is considered sub-optimal for breeding as it is known that when using disused mines, bats prefer the horizontal adits, and do not typically use vertical shafts (Australian Bat Society undated).

Call data collected over 30 nights across the two detectors deployed from December 2020 to January 2021 (totalling 54 trap nights) was analysed and the following conclusions were drawn:

- Large-eared Pied Bat was recorded on just six nights out of a possible 30, illustrating the species is not commonly utilising the area and is highly unlikely to be using habitats within, or immediately surrounding the impact area, for roosting or breeding.
- Large-eared Pied Bat calls were first recorded no earlier than 10:03pm (on one occasion), more than one and a half hours after the end of civil twilight (c.8:40pm), with the remaining calls recorded between 11:52pm and 3:20am. Bats arriving in the area long after dark strongly suggests that the site is being utilised for foraging, and that there is no evidence to support the presence of a local roost where bats would be emerging closer to dusk (sunset being at c.8:10pm).
- Little Bent-winged Bat was recorded on just four nights out of a possible 30, illustrating the species is not commonly utilising the area and is highly unlikely to be using habitats within, or immediately surrounding the impact area, for roosting or breeding.
- Little Bent-winged Bat calls were first recorded between 9:07pm and 9:21pm (on three occasions), with the first call recorded on the fourth night, at 1:02am. Three of the four calls are within 30 to 40 minutes of the end of civil twilight (c.8:40pm), suggesting a roost may not be far from the project area, however the low frequency (number of nights) with which the species was recorded strongly suggests that the large number of bats which would be expected to be emerging from a maternity roost are not present within the area.
- Large Bent-winged Bat was commonly recorded during the December to January surveys with the species detected on 29 of the total 30 nights analysed. This demonstrates the species is commonly present in the area during the known breeding season.
- Large Bent-winged Bat calls were first recorded between 8:44pm and 9:40pm, within an hour of the end of civil twilight (c.8:40pm), on just seven of the possible 30 nights, with one call being recorded at 5:04am (sunrise being c.5:38am). The species was first recorded on the remaining 22 nights (73%) between 9:57pm and 3:47am. These trends again strongly suggest that Large Bent-winged Bat is arriving in the area to forage after emerging from a roost closer to dusk from another location.

Based on the above the following conclusions have been drawn:

- Large-eared Pied Bat and Little Bent-winged Bat are not utilising the habitats present within the impact area or impact assessment area for roosting or breeding, their presence indicates foraging only.
- Large Bent-winged Bat is considered highly unlikely to be utilising the habitats present within the impact area or impact assessment area for roosting or breeding, the species is present during foraging activities.

As harp trapping has not been conducted to definitively rule out the presence of breeding, Serious and Irreversible Impact (SAIL) assessments have conservatively been prepared for each species to determine the significance of the project's impacts to each species if breeding was to occur.

Furthermore, due to the common presence of Large Bent-winged Bat within the impact area, 'species credit' impacts have, again conservatively, been assumed and biodiversity offsets will be secured and retired for the species.

Brush-tailed Rock Wallaby surveys

Targeted survey for Brush-tailed Rock Wallaby was undertaken due the presence of potential habitat in the vicinity of the Warragamba Dam, with rocky cliffs and boulders present within the impact area and impact assessment area. The survey guidelines and requirements for Brush-tailed Rock Wallaby targeted surveys are detailed in Table 34.

Table 36 Survey guidelines for Brush-tailed Rock Wallaby

Survey guidelines	Survey requirements
<p><i>Survey guidelines for Australia's threatened mammals</i></p> <p><i>Guidelines for detecting mammals listed as threatened under the EPBC Act (Commonwealth of Australia 2011)</i></p>	<p>The following survey techniques are recommended to detect the presence of the Brush-tailed Rock Wallaby in areas up to 5 hectares in size:</p> <ul style="list-style-type: none"> • Daytime searches for potentially suitable habitat resources, such as shelters sites (caves, rock boulders and rock ledges) in suitable boulder pile, escarpment and cliff-line habitats. • Daytime searches for signs of activity, including tracks, scats and rock shelters worn smooth from resting. • Baited camera traps may be of use in confirming the presence and identity of rock wallabies.

Diurnal searches of suitable habitat and for signs of activity were undertaken within the impact area and impact assessment area surrounding the environmental flows outlet site at Warragamba in September and December 2020, as well as in January 2021.

Two white flash motion sensing cameras baited by Lucerne in a net bag, fixed to a tree approximately 50 centimetres off the ground, were also installed with the impact area (Figure 10). This method found to be successful in monitoring of the species in Victoria (Bluff et al 2011).

The cameras were deployed between 14 December 2020 and 20 January 2021, and achieved a minimum of 27 traps nights, based on the last photos on each device being captured on 20 December 2020 and 2 January 2021. Batteries had run flat on both cameras at the time of collection so it cannot be accurately determined the total number of nights surveyed, however it is considered likely that more than 27 nights were assessed for the presence of the species.

No signs of Brush-tailed Rock Wallaby were recorded within the impact area or impact assessment area during diurnal active searches of potential habitat, or during deployment of motion sensing cameras.



Photo 4 – Motions sensing camera and bait deployed in the impact area near Warragamba Dam

Incidental fauna surveys

Fauna surveys undertaken on an ongoing basis throughout the field campaign included incidental diurnal bird surveys, active searches of woody debris and leaf litter, incidental aural observations of frog species and incidental observations of various mammal species. The following threatened species were recorded during incidental fauna surveys:

- Cumberland Plain Land Snail were recorded along the road verge of Cross Street, Kemps Creek in Existing Certified land.
- Grey-headed Flying-fox were observed during nocturnal frog survey between Wallacia and Warragamba, and a small non-breeding camp occurs near the project alignment along the Nepean River at Wallacia.
- Square-tailed Kite and White-bellied Sea-Eagle were observed foraging over the project alignment.

Locations where these species were recorded are shown on Figure 10.