

**Addendum 4-Eyre Peninsula Blue Gum
(*Eucalyptus petiolaris*) Woodland and Roadside
Vegetation Assessments.**

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1 SUMMARY

This summary should be considered with the initial Kookaburra report and 3 other addendums that have been completed for the client.

A flora survey was undertaken on the 17th, 19th and 20th November 2015 from Bratten Way down Pillaworta Road to the Tod Reservoir, as part of the proposed Kookaburra Gully Graphite Project. The project involves a proposed pipeline which runs south from the project to the Tod Reservoir. The vegetation associations were broadly mapped, condition ratings were assigned and any nationally and state threatened flora species were recorded. Any threatened fauna species were also opportunistically recorded, if present. Targeted Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) Woodland assessments were undertaken to determine whether patches are classified as the Endangered Threatened Ecological community (TEC).

The nationally listed TEC Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) Grassy Woodland (effective from August 2013) was recorded within the project area. Fifteen Eyre Peninsula Blue Gum sites were assessed along Pillaworta Road, Howard Road and White Flat Road. Six areas along the roadsides were assessed as qualifying for as the nationally listed TEC. One area received the highest category A; two areas received category B, one C2 and one C1. Two alternative routes were assessed for the proposed pipeline routes. One route followed White Flat Road and the other along the Tod River Reservoir channel.

Fourteen vegetation associations were mapped (as per below) with the overall condition rating assigned according to factors such as levels of weed invasion, diversity of native species and other impacts such as grazing (Figure 1). Eight of these associations were found to be additional to the 25 associations mapped during the previous EBS Ecology surveys undertaken for the project (Table 1).

No nationally threatened flora species were recorded. This includes the nationally threatened *Olearia pannosa* subsp. *pannosa* (Silver Daisy-bush) and the State rare and nationally endangered *Pultenaea trichophylla* (Tufted Bush-pea), which were not observed along the roadside during the November 2015 survey. State rare species: *Daviesia pectinata* (Zig-zag Bitter Pea) and *Acacia imbricata* (Feathery Wattle) were recorded, the latter being widespread throughout the areas surveyed (in 2013 to 2015 as recorded in EBS's previous surveys). An additional State rare species, *Acacia dodonaeifolia* (Hop-bush Wattle) was recorded within the site of Tod Reservoir held land by SA Water during the November 2015 survey.

The State rare Western Gerygone (*Gerygone fusca*) and State rare Musk Duck (*Biziura lobata*) was also recorded at the SA Water site (Tod Reservoir) during the November 2015 survey.

2 VEGETATION ASSOCIATIONS

A list of the 33 vegetation associations are presented in Table 1 below that have been recorded since the initial surveys that EBS have conducted for the project since 2013. This report will only have descriptions of the associations found within the mapped vegetation in November 2015. This includes the eight new associations. Vegetation associations and condition rating maps are shown below.

Table 1. Overall summary of vegetation associations.

Vegetation assoc. #	Vegetation association	Condition
1	Exotic dominated	0:1- 2:1
2	<i>Eucalyptus cladocalyx</i> Woodland	4:1 - 9:1
3	<i>Eucalyptus cladocalyx</i> +/- <i>Eucalyptus calycogona</i> ssp. <i>spaffordii</i> Woodland	5:1 – 6:1
4	<i>Eucalyptus cladocalyx</i> +/- <i>Eucalyptus calycogona</i> ssp. <i>spaffordii</i> +/- <i>Eucalyptus peninsularis</i> Woodland	5:1
5	<i>Melaleuca uncinata</i> +/- <i>Allocasuarina verticillata</i> Shrubland	4:1 - 7:1
6	<i>Eucalyptus peninsularis</i> Low Woodland	5:1 - 6:1
7	<i>Xanthorrhoea semiplana</i> ssp. +/- <i>Allocasuarina verticillata</i> Grassland	4:1 - 6:1
8	<i>Allocasuarina verticillata</i> +/- emergent <i>Acacia pycnantha</i> Low Open Forest	4:1 - 9:1
9	<i>Eucalyptus</i> spp. Mixed Mallee	6:1- 8:1
10	<i>Eucalyptus</i> spp. +/- <i>Callistemon rugulosa</i> Mallee	6:1
11	<i>Eucalyptus petiolaris</i> Woodlands +/- <i>Allocasuarina verticillata</i> +/- <i>Acacia pycnantha</i>	4:1 - 5:1
12	<i>Eucalyptus petiolaris</i> Woodland over <i>Acacia pycnantha</i> and <i>Acacia rupicola</i>	5:1
13	<i>Acacia pycnantha</i> / <i>Acacia imbricata</i> Shrubland	8:1
14	<i>Gahnia filum</i> Sedgeland	4:1 – 5:1
15	<i>Gahnia filum</i> / <i>Juncus kraussii</i> Sedgeland	6:1- 7:1
16	<i>Juncus kraussii</i> Sedgeland	7:1
17	<i>Juncus kraussii</i> Sedgeland +/- scattered <i>Eucalyptus petiolaris</i>	4:1 - 5:1
18	<i>Juncus kraussii</i> Sedgeland +/- <i>Ficinia nodosa</i> +/- scattered <i>Melaleuca halmaturorum</i>	3:1
19	<i>Juncus kraussii</i> / <i>Ficinia nodosa</i> / <i>Juncus pallidus</i> Sedgeland +/- scattered <i>Acacia pycnantha</i>	4:1
20	<i>Cypress gymnocaulos</i> / <i>Juncus kraussii</i> Sedgeland	4:1
21	<i>Acacia imbricata</i> / <i>Lissanthe strigosa</i> / <i>Acacia rupicola</i> open shrubland +/- <i>Eucalyptus cladocalyx</i> +/- <i>Eucalyptus calycogona</i> ssp. <i>spaffordii</i>	8:1
22	<i>Acacia pycnantha</i> +/- <i>Allocasuarina verticillata</i> Low Open Forest	3:1 -8:1
23	<i>Eucalyptus petiolaris</i> Woodland	4:1- 8:1
24	<i>Eucalyptus calycogona</i> ssp. <i>calycogona</i> open mallee over <i>Melaleuca uncinata</i>	8:1
25	<i>Acacia imbricata</i> / <i>Lissanthe strigosa</i> / <i>Acacia rupicola</i> open shrubland	8:1
26	Planted Trees	0:1
27	<i>Acacia paradoxa</i> Shrubland	2:1- 4:1
28	<i>Lomandra effusa</i> Tussock Grassland	Not assessed
29	<i>Eucalyptus camaldulensis</i> Woodland	4:1
30	<i>Acacia calamifolia</i> + <i>Melaleuca</i> sp.	5:1
31	<i>Gahnia filum</i> , <i>Juncus kraussii</i> and <i>Melaleuca</i> sp.	4:1- 7:1
32	<i>Typha domingensis</i>	5:1
33	<i>Austrostipa</i> sp. Grasslands	2:1- 3:1

2.1.1 Association 1- Exotic dominated

They are characterised by exotic grasses including *Avena barbata* (Oat Grass) and *Hordeum* sp. and *Vulpia myuros* (Fescue), *Phalaris aquatica* (Phalaris) and *Dactylis glomerata* (Cocksfoot). *Senecio pterophorus* (African daisy) is often widespread throughout the region whilst other woody weed species such as *Olea europaea* (Olive) are scattered. The areas are considered to be in very poor condition (SEB ratio of 0:1-1:1).



Figure 1. Association 1- Exotic dominated

Association 2 - *Eucalyptus cladocalyx* (Sugar Gum) Woodland

This vegetation association dominated the Borthwick property and was mapped along the Bratten Way, scattered in areas along Pillaworta Road and found in the SA water site surrounding Tod Reservoir. The structure of the community varied depending on its fire history and grazing levels. The overstorey stratum is considered to be 'old growth' with many of the mature individuals of advanced age. Understorey diversity was moderate to low with sheep grazing removing palatable shrubs and ground layer herbaceous species. Condition was therefore variable, with some areas supporting mixed native grass patches, and other shrubby strata including *Acacia imbricata* (Feathery Wattle), *Acacia rupicola* (Rock Wattle) and *Daviesia pectinata* (Zig-zag Bitter Pea). Density of understorey species varied considerably with some areas extremely dense whilst others were very open and almost denuded.

Summary of vegetation association 2. *Eucalyptus cladocalyx* Woodland.

Representation	Dominant community in proposed pit area
Conservation value	Very High
Vegetation condition	Poor to Good, dependent on grazing pressure and mechanical clearance of understorey.
Overstorey species	<i>Eucalyptus cladocalyx</i> (Sugar Gum)
Midstorey species	<i>Acacia pycnantha</i> (Golden Wattle), <i>Acacia imbricata</i> (Feathery Wattle), <i>Acacia rupicola</i> (Rock Wattle), <i>Daviesia pectinata</i> (Zig-zag Bitter pea), <i>Lissanthe strigosa</i> (Peach Heath)
Understorey species	<i>Rytidosperma</i> spp. (Wallaby Grass), <i>Austrostipa</i> sp. (Spear Grass), <i>Gonocarpus mezianus</i> (Broad-leaf Raspwort).
Threatened species	<i>Acacia imbricata</i> (Feathery Wattle), <i>Daviesia pectinata</i> (Zig-zag Bitter pea)
Declared weeds	<i>Senecio pterophorus</i> (African Daisy)



Figure 2. *Eucalyptus cladocalyx* (Sugar Gum) Woodland

2.1.2 Association 8 - *Allocasuarina verticillata* +/- emergent *Acacia pycnantha* Low

Open Forest

This community has emerged in response to the Wangary fires. These species are commonly associated with ‘en masse’ germinations following fire events and are known as pioneer species and nitrogen fixers which enable the follow-up colonisation of other species. The cover varied considerably, with some areas having very dense thickets of many small individuals. Condition was generally good with the density of regrowth excluding any other smaller herbaceous weed species.

Summary of vegetation association 8. *Allocasuarina verticillata* + emergent *Acacia pycnantha* Low Open Forest

Representation	Widespread regeneration across project area especially on roadsides.
Conservation value	Moderate
Vegetation condition	Moderate
Overstorey species	<i>Allocasuarina verticillata</i> (Sheoak)
Midstorey species	<i>Acacia imbricata</i> (Feathery Wattle), <i>Acacia rupicola</i> (Rock Wattle)
Understorey species	<i>Dampiera dysantha</i> (Dampiera), <i>Hibbertia paeninsularis</i> , <i>Astroloma sp</i> , <i>Adenanthos terminalis</i> , <i>Dianella revoluta</i> .
Threatened species	<i>Acacia imbricata</i> (Feathery Wattle), <i>Acacia dodonaeifolia</i> (Hop Bush Wattle)-SA water site
Declared weeds	<i>Senecio pterophorus</i> (African Daisy), <i>Avena barbata</i> (Wild Oats)



Figure 3. Pillaworta Road reserve with dominant regrowth of *Allocasuarina* and *Acacia pycnantha*.

2.1.3 Association 9 - *Eucalyptus* spp. Mixed Mallee

This association formed small isolated patches fringing the dominant *Melaleuca uncinata* shrublands and isolated patches along the roadside corridors. There appeared to be a high number of mallee tree species mixed within this association and changing frequently at times. This association is widespread and well represented in the wider region particularly towards the coast on sandy soil profiles. It is likely to provide habitat for a range of fauna species particularly given the variation of flowering times throughout the year.

Summary of vegetation association 9 *Eucalyptus* spp. Mixed Mallee.

Representation	Widespread across region, isolated patches present in the project area
Conservation value	Low,
Vegetation condition	Poor to moderate
Overstorey species	<i>Eucalyptus</i> mallee species with potentially, <i>E. leptophylla</i> , <i>E. phenax</i> , <i>E. diversifolia</i> , <i>E. rugosa</i> , <i>E. peninsularis</i> and <i>E. incrassata</i> .
Midstorey species	<i>Melaleuca uncinata</i> , <i>Acacia pycnantha</i> , <i>Babingtonia behrii</i> .
Understorey species	<i>Dianella revoluta</i> , <i>Adenanthos terminalis</i> , <i>Lasiopetalum behrii</i> , <i>Pimelea</i> sp.
Threatened species	<i>Acacia imbricata</i> (Feathery Wattle)
Declared weeds	<i>Senecio pterophorus</i> (African Daisy)



Figure 4. Association 9- *Eucalyptus* spp Mixed Mallee

2.1.4 Association 14 - *Gahnia filum* Sedgeland

This community was located in association with a small swamp along the southern section of the Pillaworta Creek, prior to flowing into the large woodland remnant. The community is considered a vulnerable ecosystem under the *Provisional List of Threatened Ecosystems* (DEH, 2005), where it has historically suffered severe degradation from factors such as grazing and salinity, and only small areas conserved in the reserve system. A number of emergent species were evident throughout including *Melaleuca brevifolia* (Short-leaf Honey-myrtle), *Acacia pycnantha* (Golden Wattle) and *Allocasuarina verticillata* (Drooping Sheoak). A number of exotics have invaded the swamp including *Senecio pterophorus* (African Daisy), *Rubus* sp. (Blackberry) and *Phalaris aquatica* (Phalaris), but only in low levels. Also found in low lying areas in some sections on Pillaworta Road.

Summary of vegetation association 14 *Gahnia filum* Sedgeland

Representation	Small swamp along the southern section of the Pillaworta Creek
Conservation value	High
Vegetation condition	Moderate
Overstorey species	Emergent <i>Acacia pycnantha</i> (Golden Wattle), <i>Melaleuca brevifolia</i> (Short-leaf Honey-myrtle) and <i>Allocasuarina verticillata</i> (Drooping Sheoak)
Midstorey species	<i>Gahnia filum</i> (Thatching Grass)
Understorey species	<i>Juncus kraussii</i> (Sea Rush), <i>Carex tereticaulis</i> (Rush Sedge)
Threatened species	-
Declared weeds	<i>Senecio pterophorus</i> (African Daisy), <i>Rubus</i> sp. (Blackberry)



Figure 5. *Gahnia filum* Sedgeland

2.1.5 Association 15 – *Gahnia filum* / *Juncus kraussii* Sedgeland

This small community was located in association with the creekline between Cullen and Harris properties (Harris Creek). The community is considered to be in a moderate condition with some level of weed invasion, mainly consisting of *Senecio pterophorus* (African Daisy) and *Hypochaeris radicata* (Rough Cats Ear). The occasional *Eucalyptus petiolaris* (Eyre Peninsula Blue Gum) was found growing in the channel.

Summary of vegetation association 15 *Gahnia filum* / *Juncus kraussii* Sedgeland

Representation	Small section associated with the creekline between Cullen and Harris properties (Harris Creek)
Conservation value	Moderate - High
Vegetation condition	Moderate
Overstorey species	Scattered <i>Eucalyptus petiolaris</i> (Eyre Peninsula Blue Gum)
Midstorey species	<i>Gahnia filum</i> (Thatching Grass)
Understorey species	<i>Juncus kraussii</i> (Sea Rush)
Threatened species	-
Declared weeds	<i>Senecio pterophorus</i> (African Daisy)



Figure 6. *Gahnia filum* / *Juncus kraussii* Sedgeland

2.1.6 Association 22 – *Acacia pycnantha* +/- *Allocasuarina verticillata* Low Open Forest

This association was evident along the road reserves of Pillaworta Road. The *Acacia pycnantha* overstorey is extremely dense with an understorey defined by patch native grasses and exotics throughout its linear length. A number of eucalypts were also scattered along the roadside.

Summary of vegetation association 22, *Acacia pycnantha* +/- *Allocasuarina verticillata* Low Open Forest

Representation	Patch along Pillaworta Road
Conservation value	Moderate
Vegetation condition	Poor
Overstorey species	<i>Acacia pycnantha</i> (Golden Wattle), <i>Allocasuarina verticillata</i> (Drooping Sheoak)
Midstorey species	-
Understorey species	<i>Austrostipa</i> sp. (Spear Grass), <i>Rytidosperma setaceum</i> (Wallaby Grass), <i>Dampiera rosmarinifolia</i> (Rosemary Dampiera)
Threatened species	-
Declared weeds	<i>Asparagus asparagoides</i> (Bridal Creeper), <i>Oxalis pes-caprae</i> (Sour Sob)



Figure 7. Typical view of Association 22.

2.1.7 Association 23 – *Eucalyptus petiolaris* Woodland

Association 23 was associated with the Pillaworta Creek on the western side of Pillaworta Road. The association is similar to Associations 11 and 12, with a different assemblage of understorey species. The understorey was dominated by *Acacia imbricata* (Feathery Wattle), *Melaleuca brevifolia* (Short-leaf Honey-myrtle), *Acacia pycnantha* (Golden Wattle) and native grasses including *Austrostipa* sp. (Spear Grass) and *Rytidosperma setaceum* (Wallaby Grass). The waterholes associated with the Pillaworta Creek are characterised by a similar mix of species, but in different densities.

Eucalyptus petiolaris (Eyre Peninsula Blue gum) is considered an endangered Threatened Ecological Community (TEC) and is found in varying conditions along the roadside within the area. Areas classified as Category A and B within the TEC occur along the Pillaworta Road.

Summary of vegetation association 23, *Eucalyptus petiolaris* Woodland

Representation	Pillaworta Creek
Conservation value	High – Threatened Ecological community
Vegetation condition	Moderate- Poor
Overstorey species	<i>Eucalyptus petiolaris</i> (Eyre Peninsula Blue Gum)
Midstorey species	<i>Acacia pycnantha</i> (Golden Wattle), <i>Acacia imbricata</i> (Feathery Wattle) / <i>Lissanthe strigosa</i> (Peach Heath)/ <i>Acacia rupicola</i> (Rock Wattle), <i>Daviesia pectinata</i> (Zig-zag Bitter Pea)
Understorey species	<i>Austrostipa</i> sp. (Spear Grass), <i>Rytidosperma setaceum</i> (Wallaby Grass)
Threatened species	<i>Acacia imbricata</i> (Feathery Wattle), <i>Eucalyptus calycogona</i> ssp. <i>spaffordii</i> (Yeelanna Mallee), <i>Daviesia pectinata</i> (Zig-zag Bitter pea)
Declared weeds	<i>Senecio pterophorus</i> (African Daisy), <i>Asparagus asparagoides</i> (Bridal Creeper)



Figure 8. Association 23- Example of *Eucalyptus petiolaris* Woodland

2.1.8 Association 26 – Planted Trees

Sections of the roadside have been planted out with none native species. These areas are generally around housing areas.

Summary of Association 26-Planted Trees

Representation	All roadsides, mainly in front of housing.
Conservation value	Low
Vegetation condition	Poor
Overstorey species	<i>Eucalyptus globulus</i> (Tasmanian Blue Gum), <i>Eucalyptus</i> sp. (WA species), <i>Pinus</i> Sp.
Midstorey species	<i>Acacia brachybotrya</i> (Grey Mulga)
Understorey species	<i>Austrostipa</i> sp. (Spear Grass), <i>Rytidosperma setaceum</i> (Wallaby Grass)
Threatened species	N/A
Declared weeds	<i>Senecio pterophorus</i> (African Daisy), <i>Avena barbata</i> (Wild Oats)

2.1.9 Association 27- *Acacia paradoxa* Shrubland

Small area on Bailla Hill Road. Midstorey is densely covered in *Acacia paradoxa* (Kangaroo Thorn).

Summary of Association 27- *Acacia paradoxa* Shrubland

Representation	Bailla Hill Road
Conservation value	Moderate
Vegetation condition	Moderate- Poor
Overstorey species	N/A
Midstorey species	<i>Acacia paradoxa</i> (Kangaroo Thorn)
Understorey species	<i>Austrostipa</i> sp. (Spear Grass), <i>Rytidosperma setaceum</i> (Wallaby Grass)
Threatened species	
Declared weeds	<i>Senecio pterophorus</i> (African Daisy), <i>Avena barbata</i> (Wild Oats)

2.1.10 Association 28- *Lomandra effusa* Tussock Grassland

This association has a small representation within the area, only found in one location near the SA water site, Tod Reservoir. This plant community is highly degraded and fragmented in the region; areas are impacted from stock grazing and cropping. This area is not within any infrastructure plans, therefore will not be impacted on by the project.

Summary of Association 28- *Lomandra effusa* Tussock Grassland

Representation	Small area on the hillside exists near SA Water, Tod Reservoir
Conservation value	Moderate
Vegetation condition	Not assessed
Overstorey species	Scattered <i>Allocasuarina verticillata</i> (Drooping Sheoak)
Midstorey species	N/A
Understorey species	<i>Lomandra effusa</i> (<i>Austrostipa</i> sp. (Spear Grass), <i>Rytidosperma setaceum</i> (Wallaby Grass)
Threatened species	-
Declared weeds	<i>Senecio pterophorus</i> (African Daisy), <i>Avena barbata</i> (Wild Oats)

2.1.11 Association 29- *Eucalyptus camaldulensis* Woodland

This association is generally associated with floodplain areas, creek lines or lower lying swampy areas within the region. In this region it is often associated with other tree species such as *Eucalyptus petiolaris* (Eyre Peninsula Blue Gum), *Allocasuarina verticillata* (Drooping Sheoak). Condition in all small patches recorded often had little to no native understorey.

Representation	Bailla Hill Road, White Flat Road
Conservation value	Moderate
Vegetation condition	Poor
Overstorey species	<i>Eucalyptus camaldulensis</i> (River Red Gum),
Midstorey species	<i>Acacia pycnantha</i> (Golden Wattle), <i>Callistemon rugulosus</i> (Scarlet Bottlebrush)
Understorey species	<i>Austrostipa</i> sp. (Spear Grass), <i>Rytidosperma setaceum</i> (Wallaby Grass)
Threatened species	N/A
Declared weeds	<i>Senecio pterophorus</i> (African Daisy), <i>Avena barbata</i> (Wild Oats)

2.1.12 Association 30- *Acacia calamifolia* + *Melaleuca* sp. Shrubland

Only found on a small section on Howards Road. This association joins up with the low lying association 31.

Summary of Association 30- *Acacia calamifolia* + *Melaleuca* sp. Shrubland

Representation	Small area along roadside corridor
Conservation value	Moderate
Vegetation condition	Moderate- Poor
Overstorey species	
Midstorey species	<i>Acacia calamifolia</i> (<i>Wallowa</i>), <i>Acacia pycnantha</i> (Golden Wattle), <i>Melaleuca</i> sp
Understorey species	<i>Austrostipa</i> sp. (Spear Grass), <i>Rytidosperma setaceum</i> (Wallaby Grass)
Threatened species	N/A
Declared weeds	<i>Avena barbata</i> (Wild Oats)

2.1.13 Association 31- *Gahnia filum*, *Juncus kraussii* and *Melaleuca* sp.

Main association along the Tod River that joins into SA Water site. The Tod River joins with the Pillaworta Creek where Pillaworta Road and Bailla Hill Road meet.

Summary of Association 31- *Gahnia filum*, *Juncus kraussii* and *Melaleuca* sp.

Representation	River Tod
Conservation value	Moderate
Vegetation condition	Moderate- Poor
Overstorey species	Scattered
Midstorey species	<i>Melaleuca</i> sp.
Understorey species	<i>Gahnia filum</i> (Chaffy Saw-sedge) <i>Juncus kraussii</i> (Marsh rush), <i>Melaleuca</i> sp. <i>Austrostipa</i> sp. (Spear Grass), <i>Rytidosperma setaceum</i> (Wallaby Grass)
Threatened species	
Declared weeds	<i>Senecio pterophorus</i> (African Daisy), <i>Juncus acutus</i>



Figure 9. Association *Gahnia filum*, *Juncus kraussii* and *Melaleuca* sp.

2.1.14 Association 32- *Typha domingensis*

This association is dominant along the edge of the catchment of the Tod River alongside the Tod Reservoir.

Summary of Association 32- *Typha domingensis*

Representation	Tod River
Conservation value	Moderate
Vegetation condition	Moderate- Poor
Overstorey species	N/A
Midstorey species	<i>Typha domingensis</i> (Bullrush), <i>Juncus</i> sp.
Understorey species	
Threatened species	N/A
Declared weeds	<i>Juncus acutus</i> (Sharp Rush), <i>Phalaris aquatic</i> (Canary Grass)



Figure 10. Example of *Typha domingensis*

**2.1.15 Association 33- *Austrostipa* sp +/- *Austrodanthonia* sp. +/- *Themeda triandra*
Tussock Grassland**

Sections scattered along the roadside edges, mainly Rock Valley Road. Most patches heavily infested with weeds, such as *Avena Barabarta* (Wild Oats), *Senecio pterophorus* (African Daisy).

Summary of Association 33- *Austrostipa* sp +/- *Austrodanthonia* sp. +/- *Themeda triandra* Tussock Grassland

Representation	Rock valley Road
Conservation value	Moderate
Vegetation condition	Moderate- Poor
Overstorey species	Scattered <i>Acacia pycnantha</i> (Golden Wattle), <i>Allocasuarina verticillata</i> (Drooping Sheoak).
Midstorey species	N/A
Understorey species	<i>Austrostipa</i> sp. (Spear Grass), <i>Rytidosperma setaceum</i> (Wallaby Grass), <i>Themeda triandra</i> (Kangaroo Grass)
Threatened species	N/A
Declared weeds	<i>Senecio pterophorus</i> (African Daisy), <i>Avena barbarta</i> (Wild Oats)

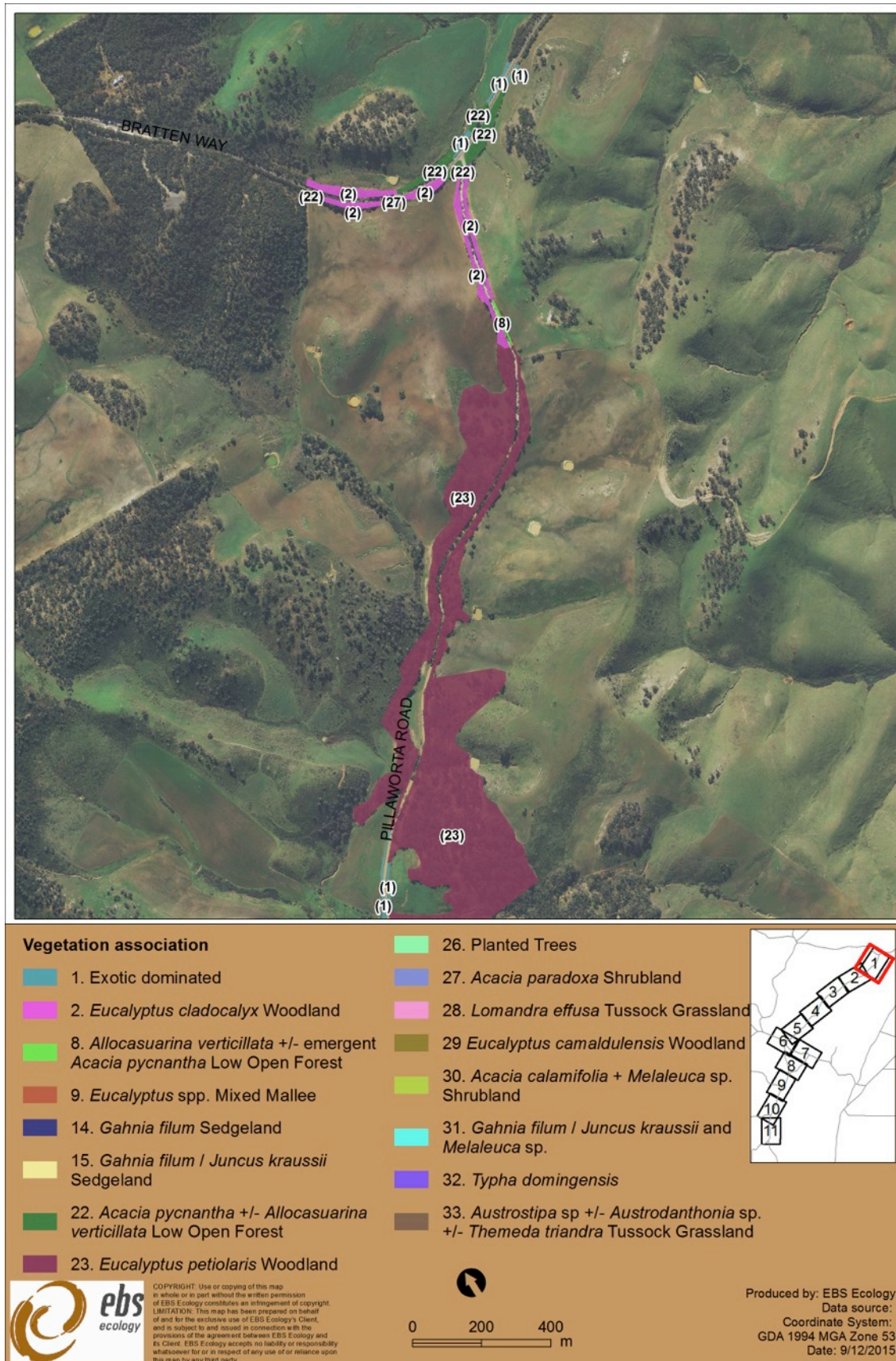


Figure 11. Vegetation Association mapping (Map 1 of 11 Association)

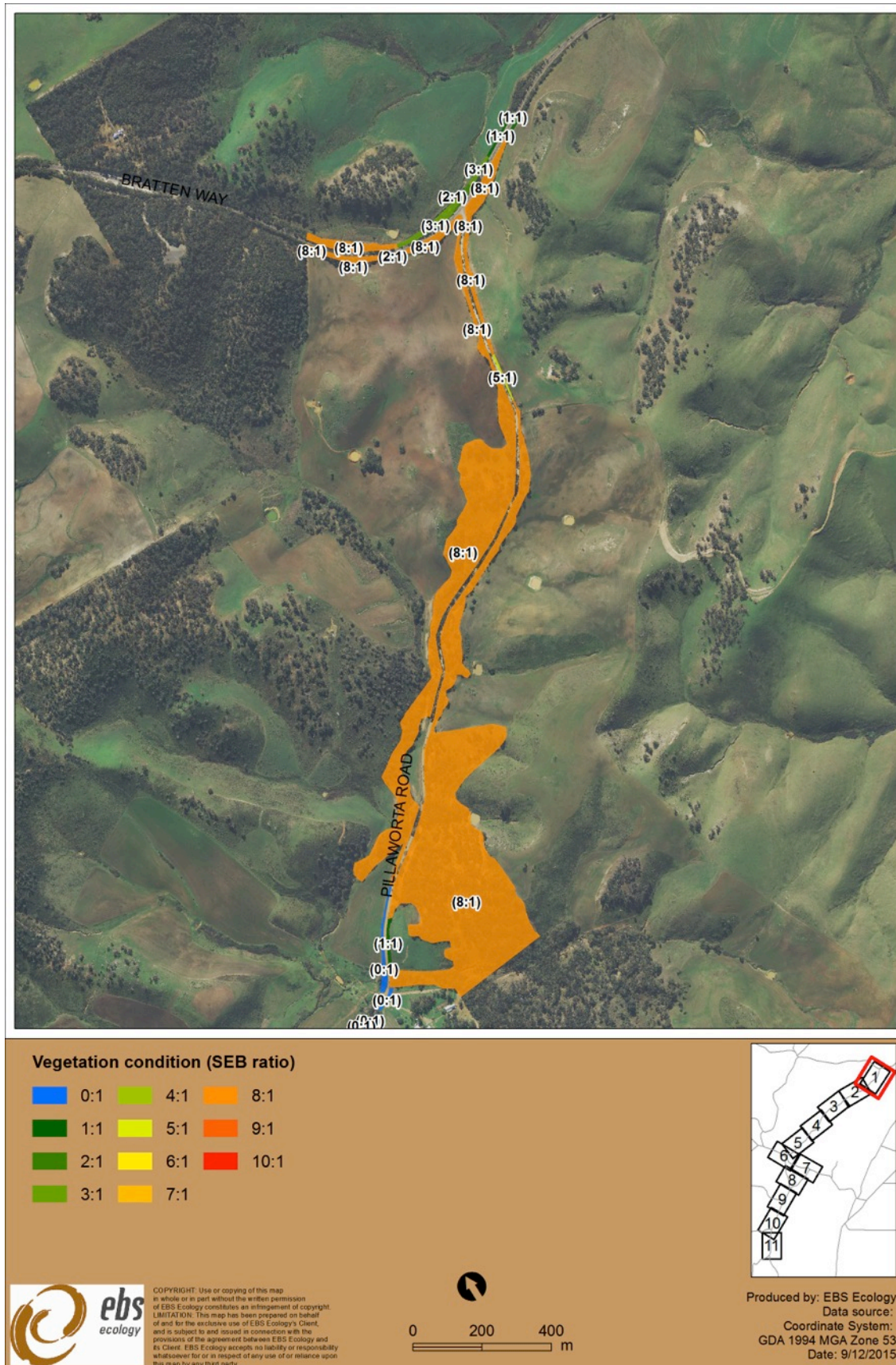


Figure 12. Vegetation condition SEB ratio (Map 1 of 11 SEB)

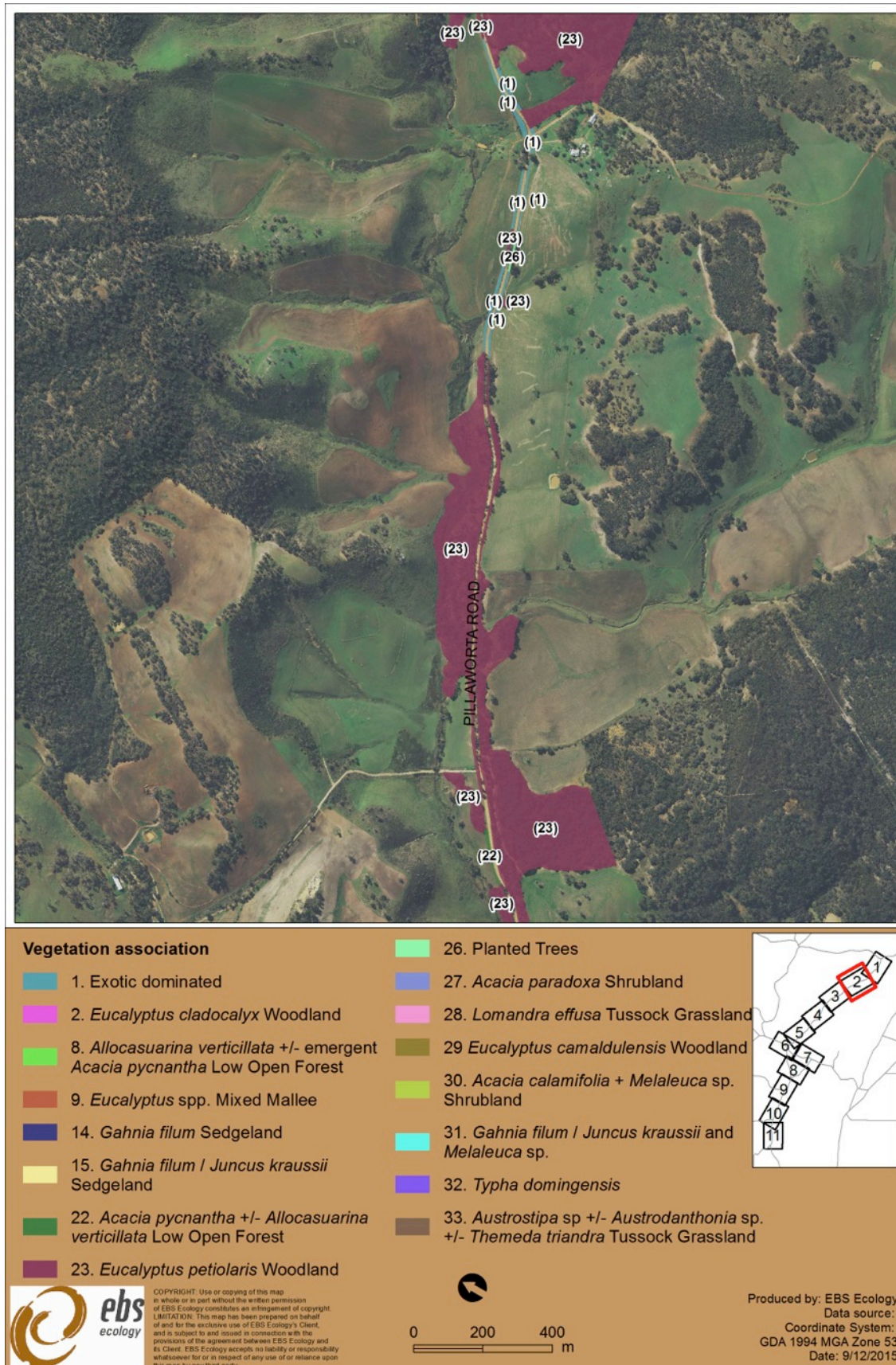


Figure 13. Vegetation Association Mapping (Map 2 of 11 Association)

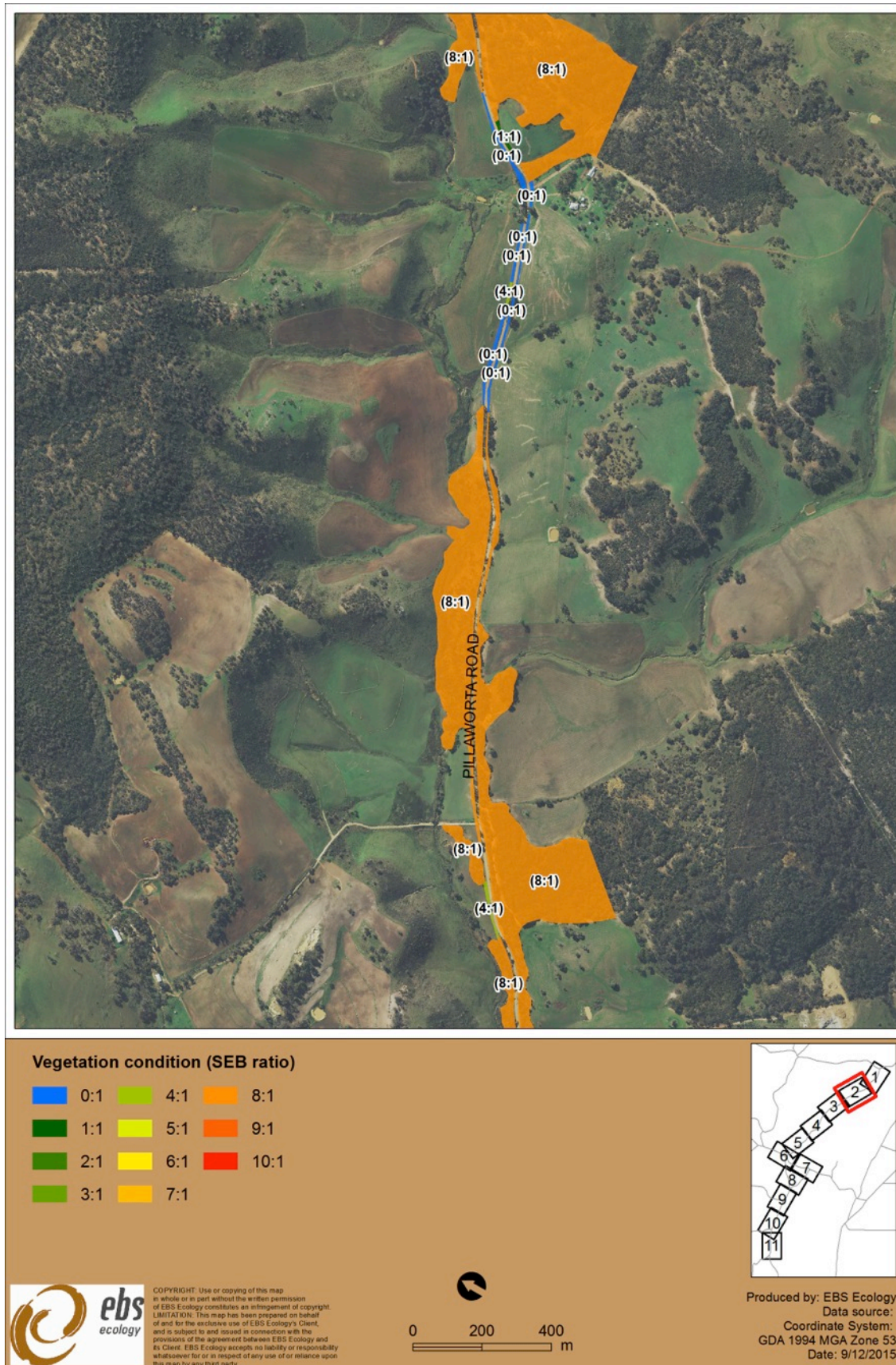


Figure 14. Vegetation condition SEB ratio (Map 2 of 11 SEB)

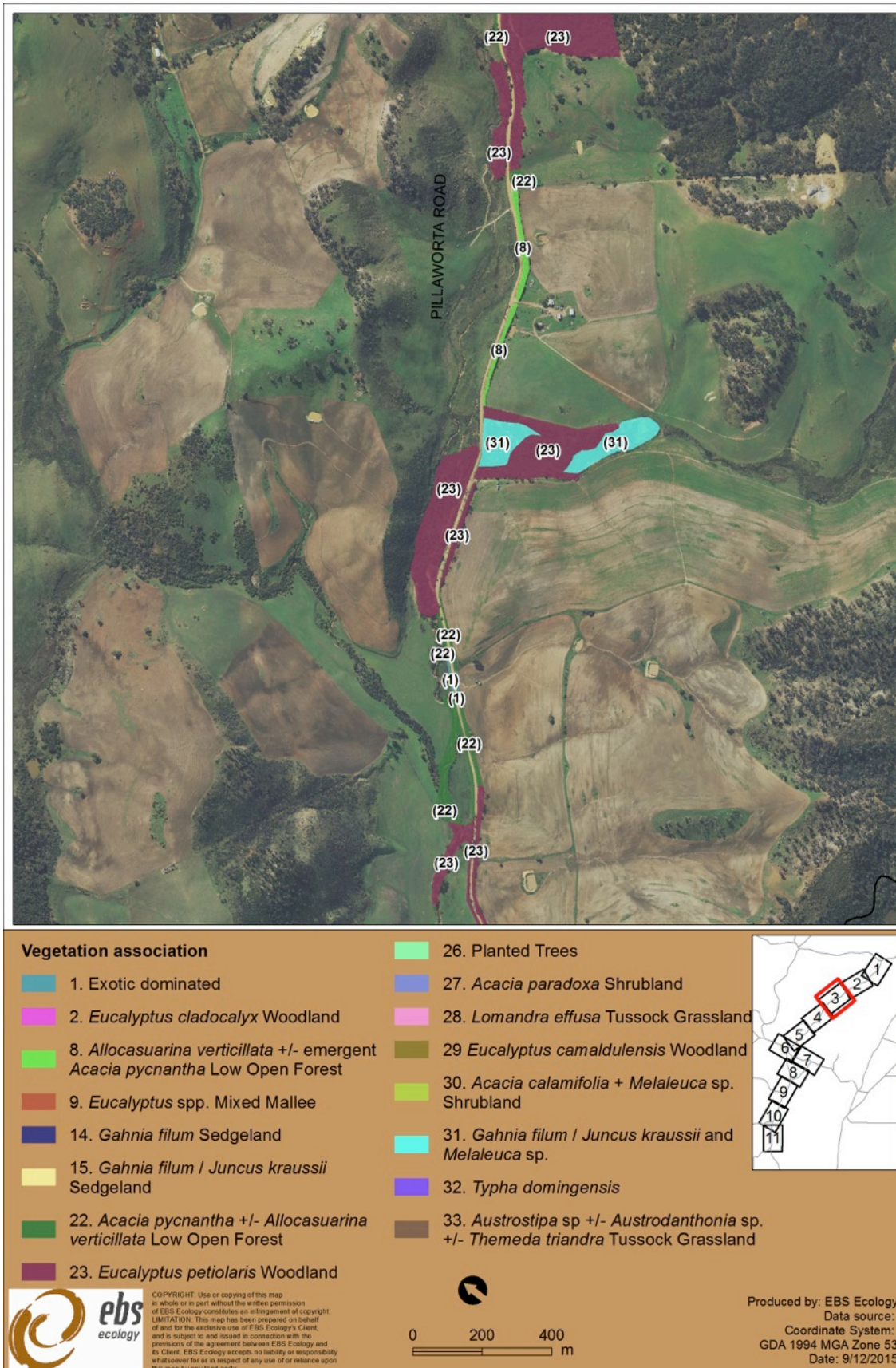


Figure 15. Vegetation Association Mapping (Map 3 of 11 Association)



Figure 16. Vegetation condition SEB ratio (Map 3 of 11 SEB)

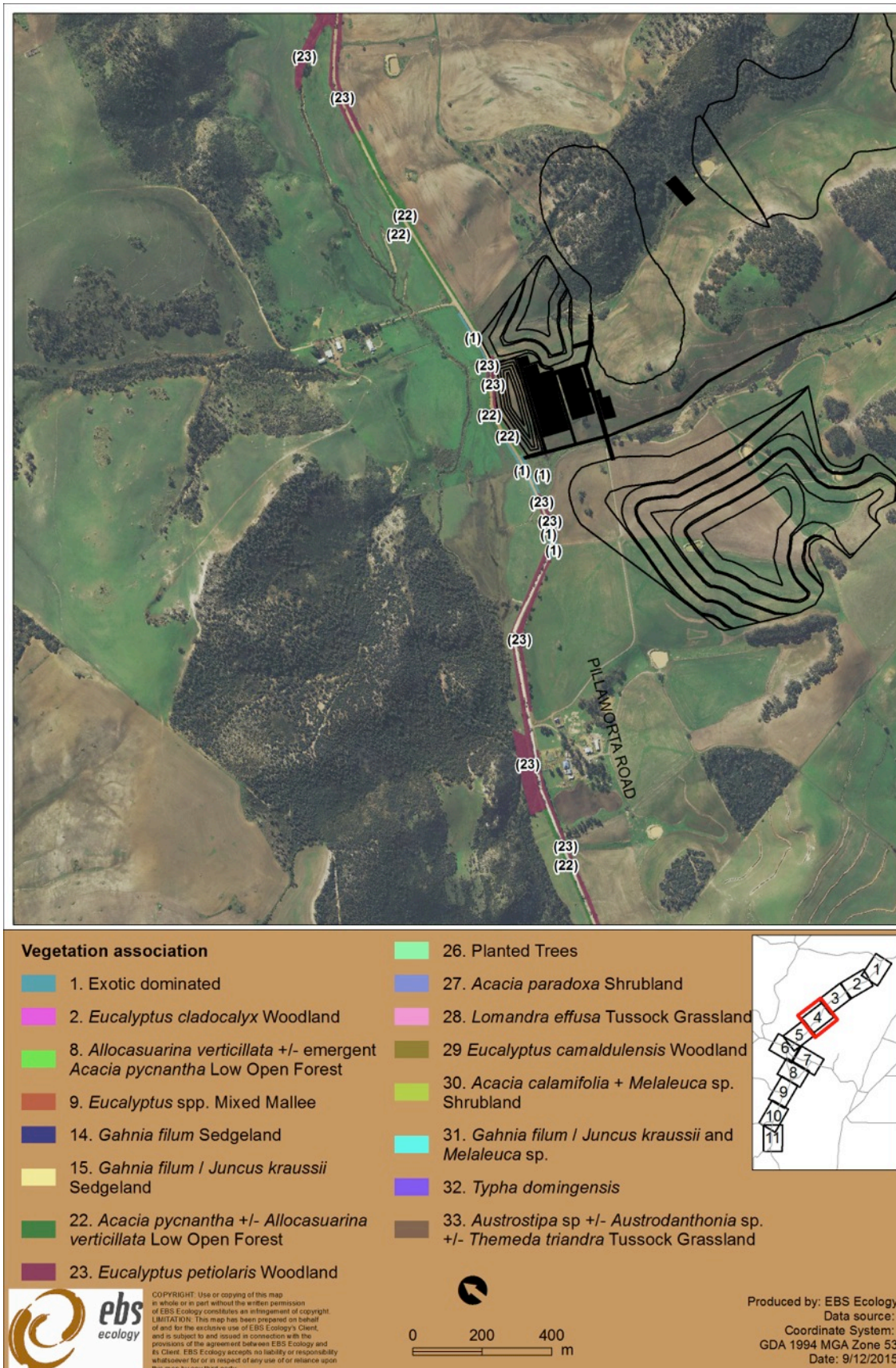


Figure 17. Vegetation Association Mapping (Map 4 of 11 Association)

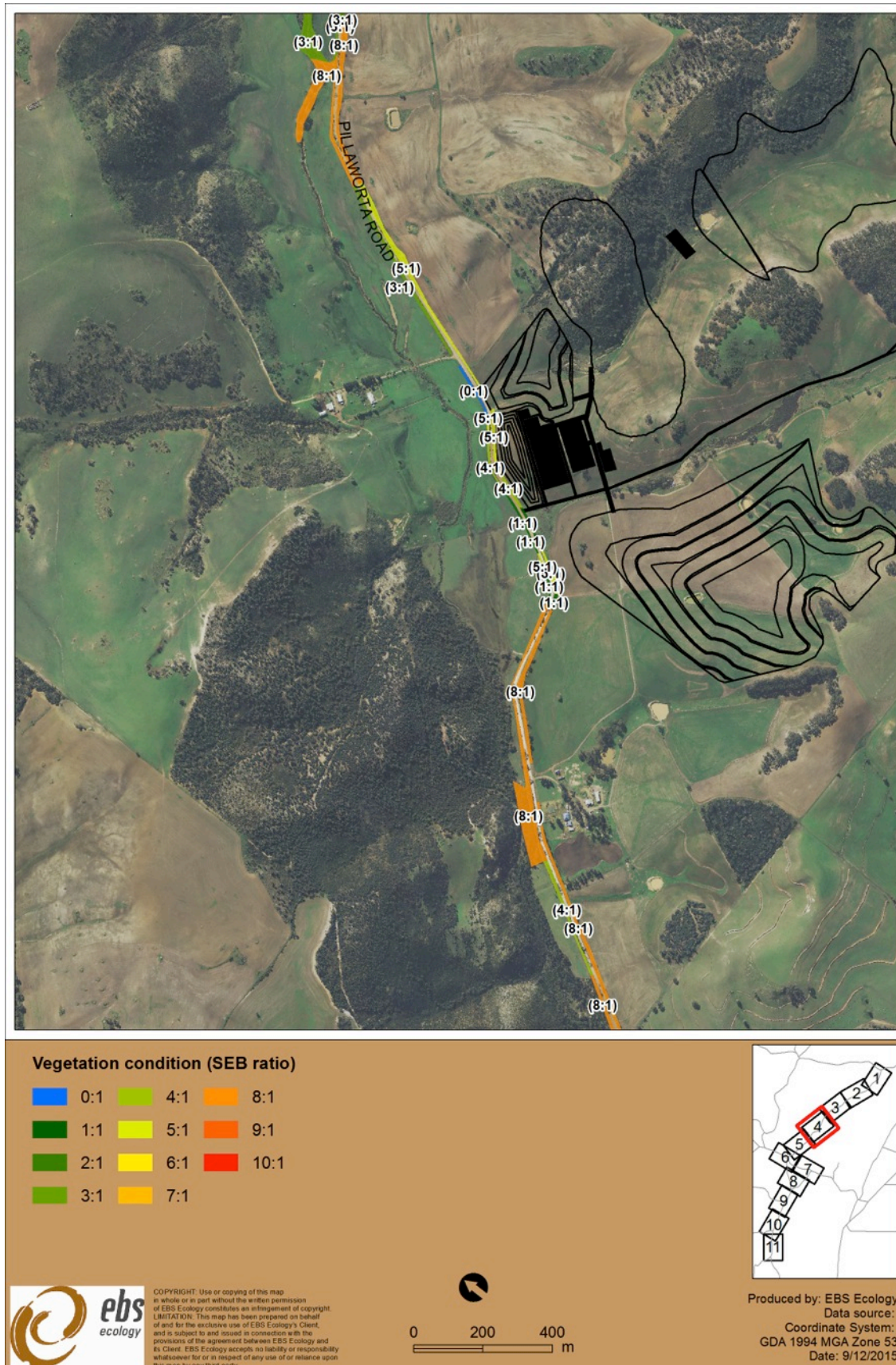


Figure 18. Vegetation condition SEB ratio (Map 4 of 11 SEB)

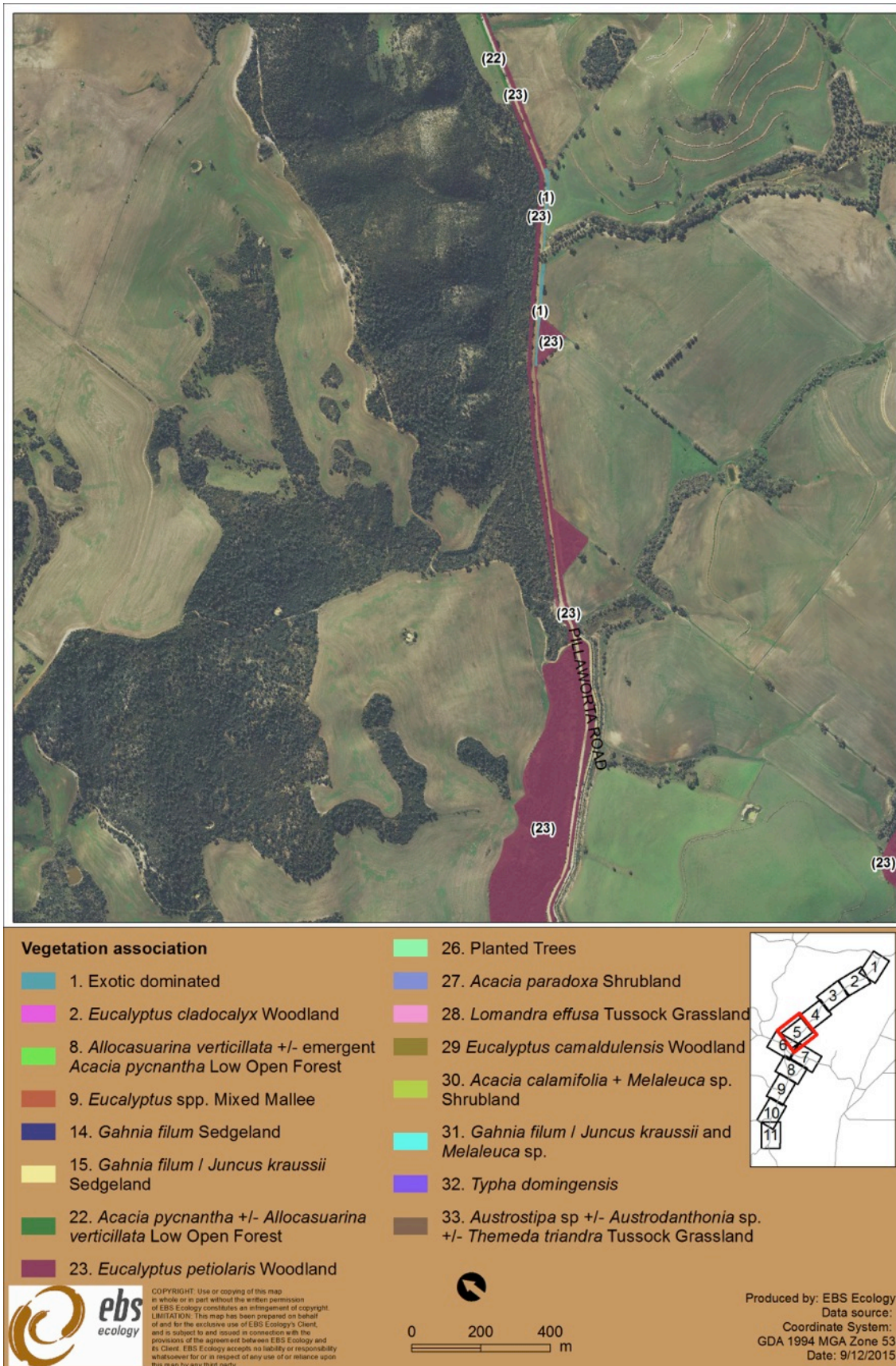


Figure 19. Vegetation Association Mapping (Map 5 of 11 Association)

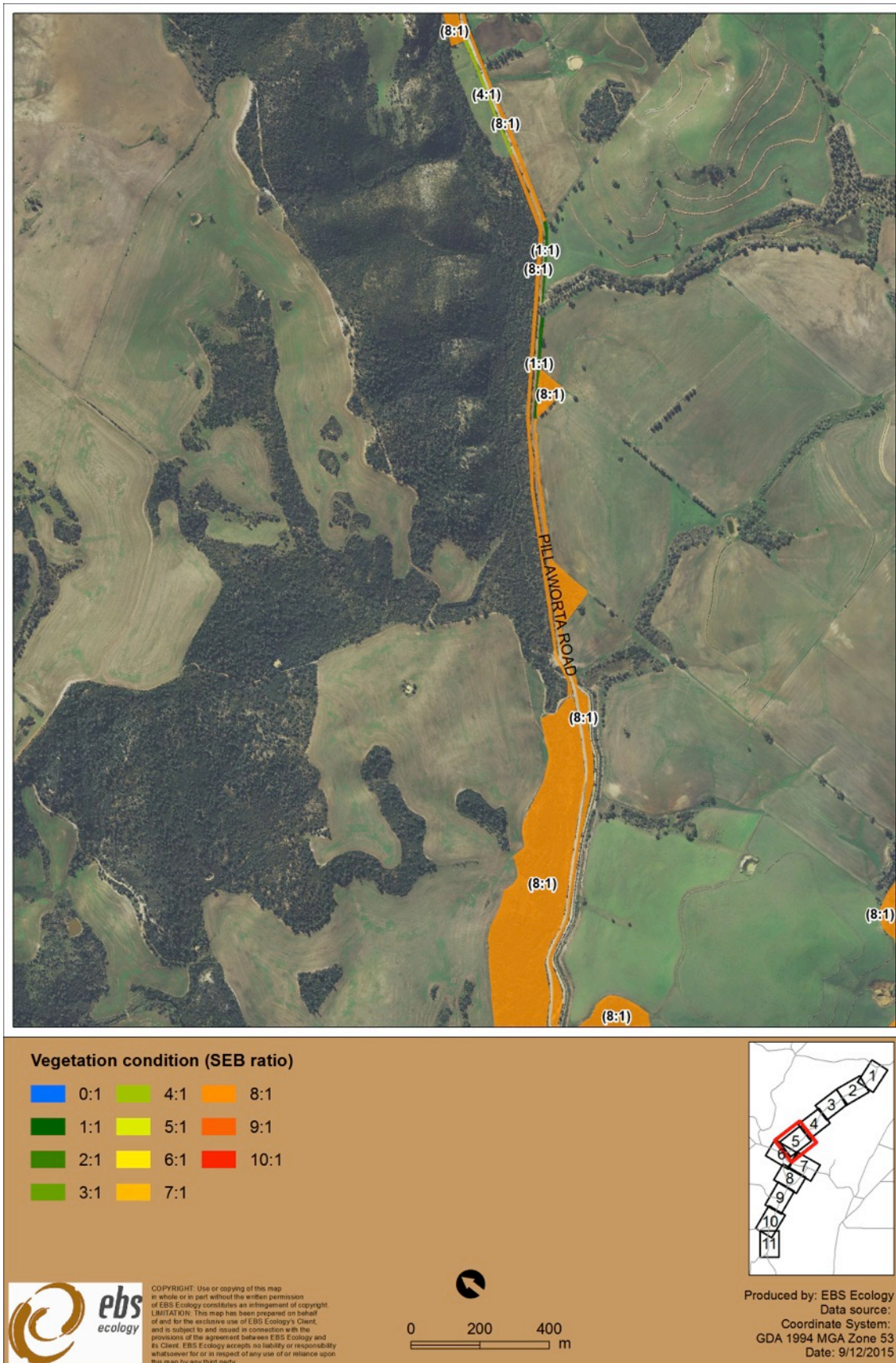


Figure 20. Vegetation condition SEB ratio (Map 5 of 11 SEB)

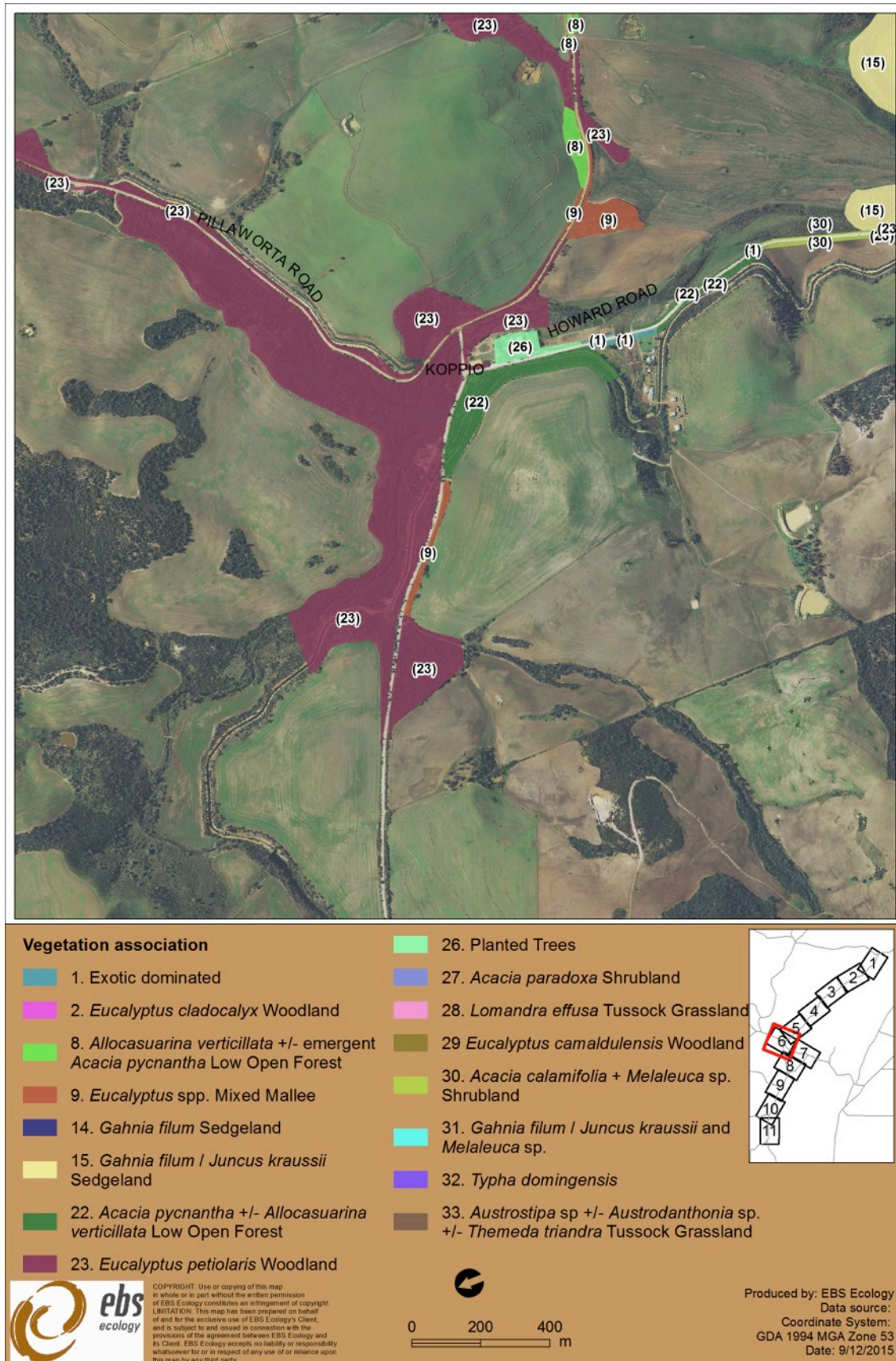


Figure 21. Vegetation Association Mapping (Map 6 of 11 Association)

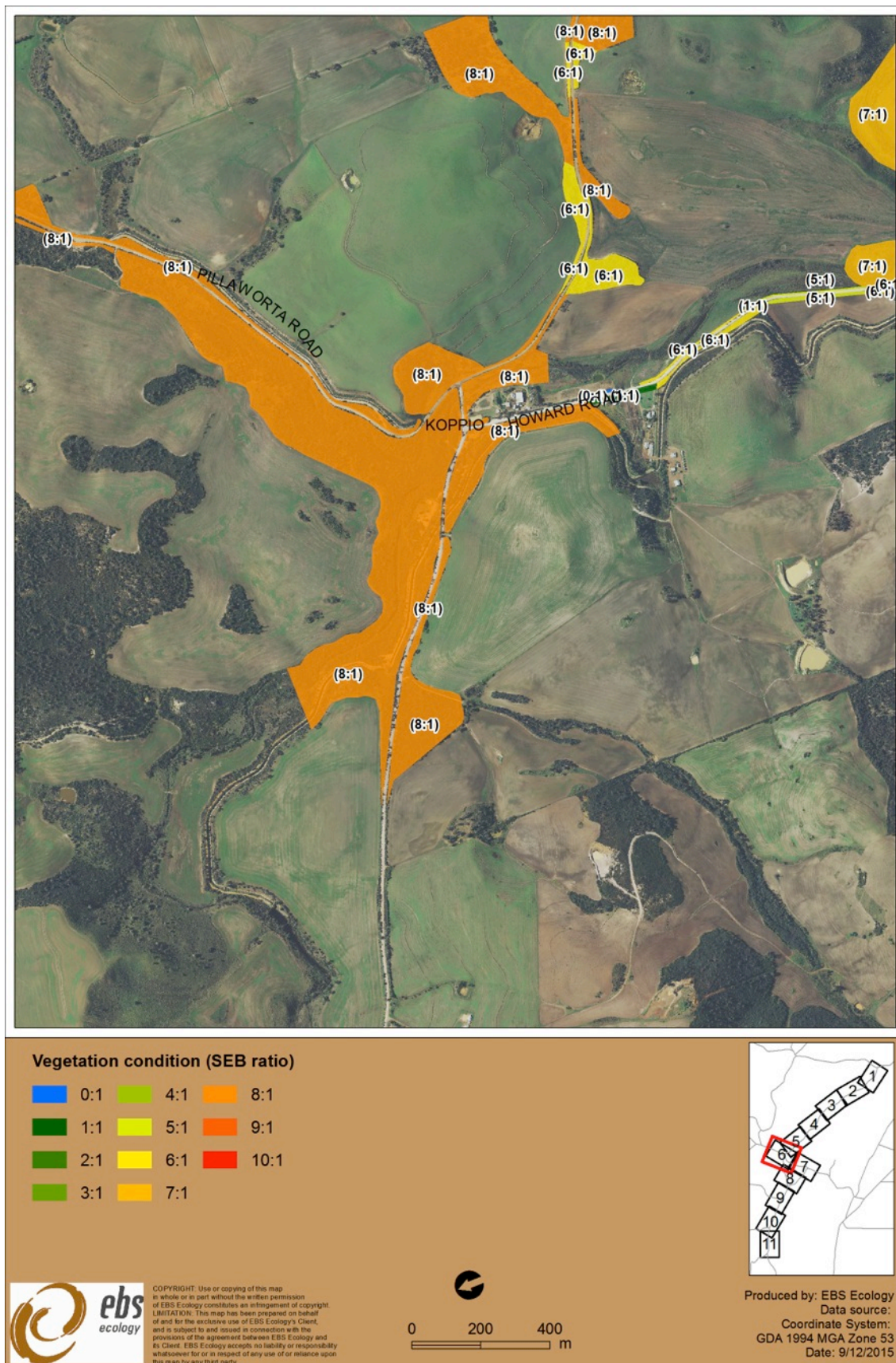


Figure 22. Vegetation condition SEB ratio (Map 6 of 11 SEB)

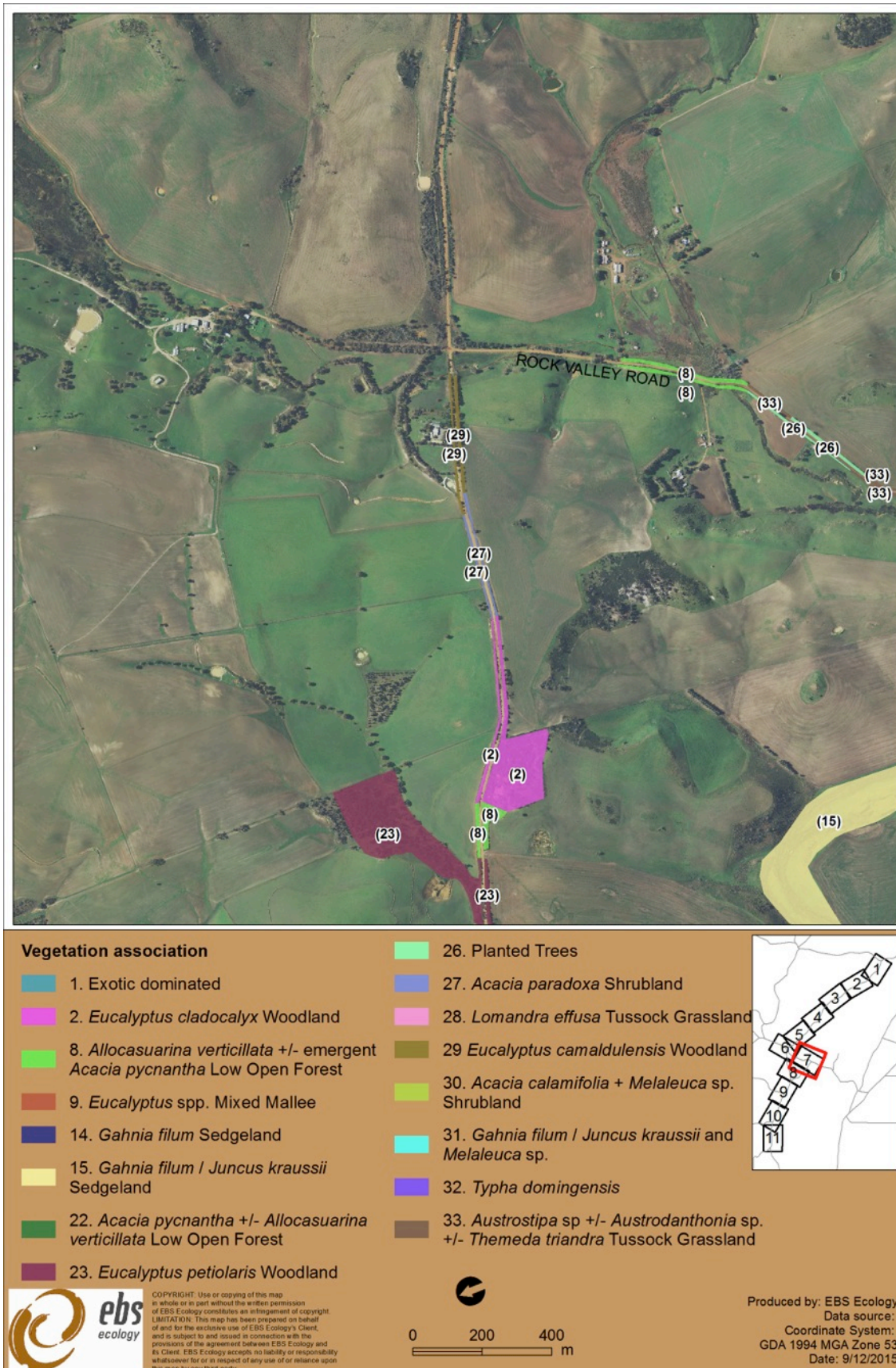


Figure 23. Vegetation Association Mapping (Map 7 of 11 Association)

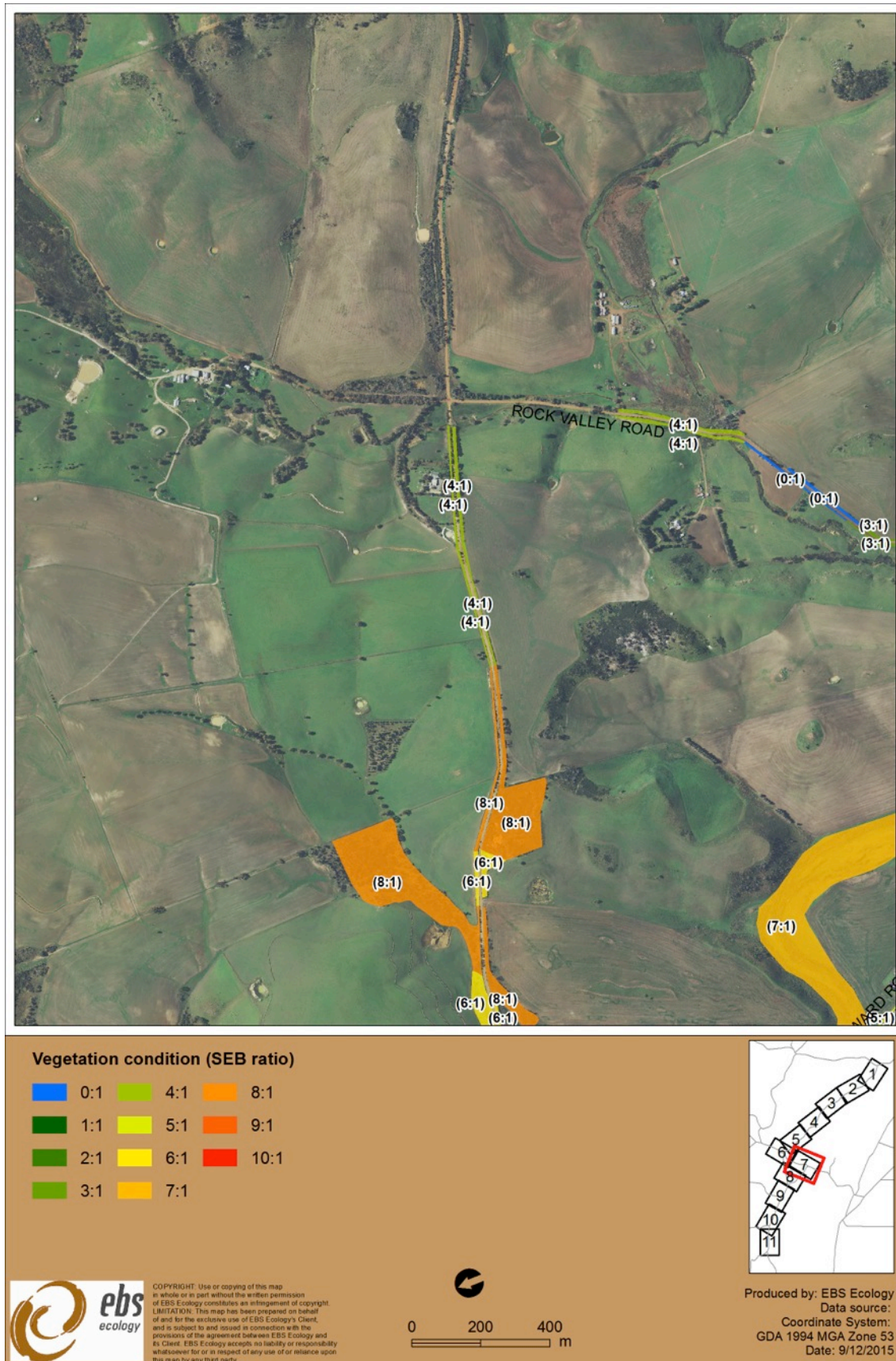


Figure 24. Vegetation condition SEB ratio (Map 7 of 11 SEB)

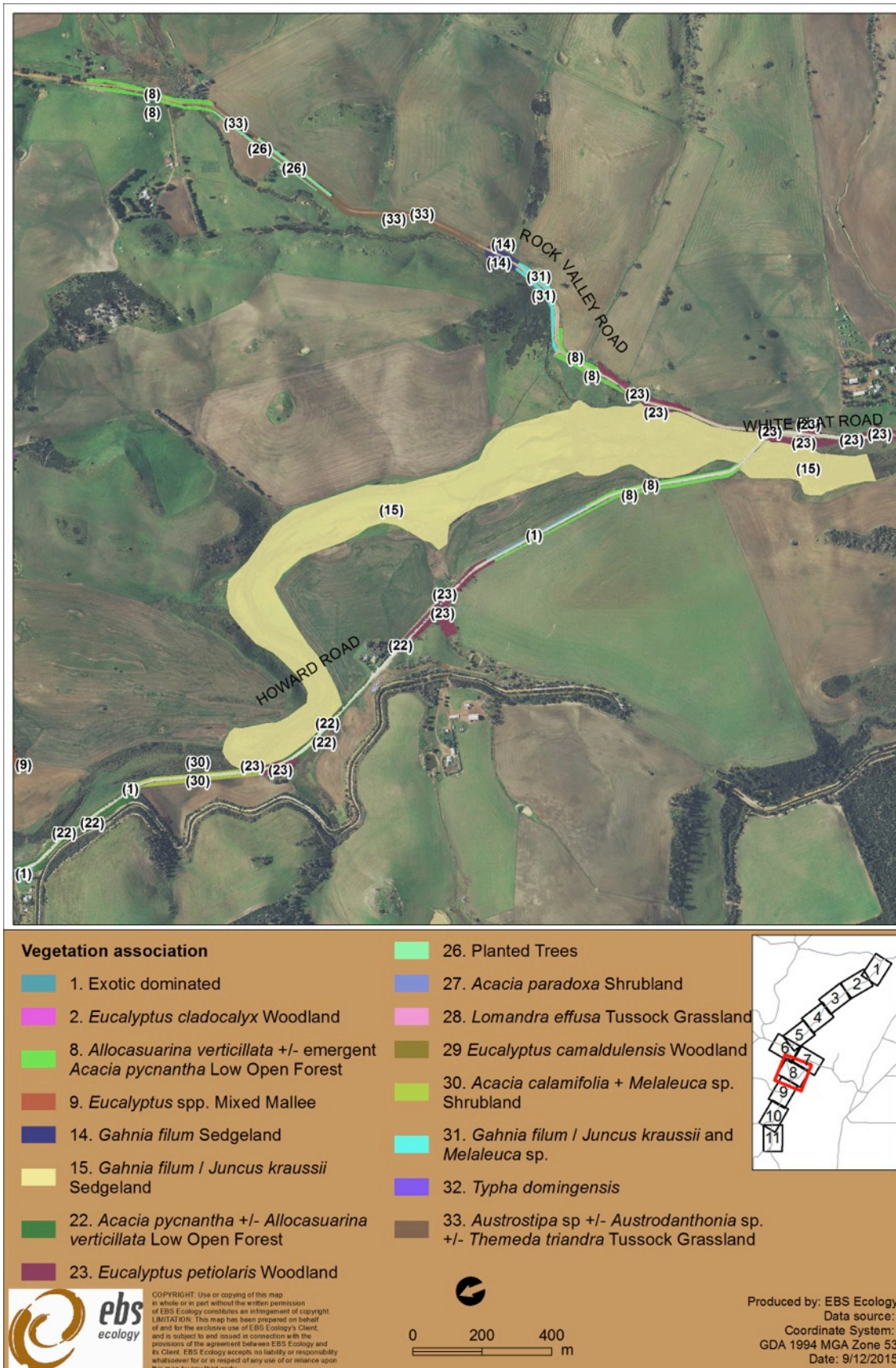


Figure 25. Vegetation Association Mapping (Map 8 of 11 Association)

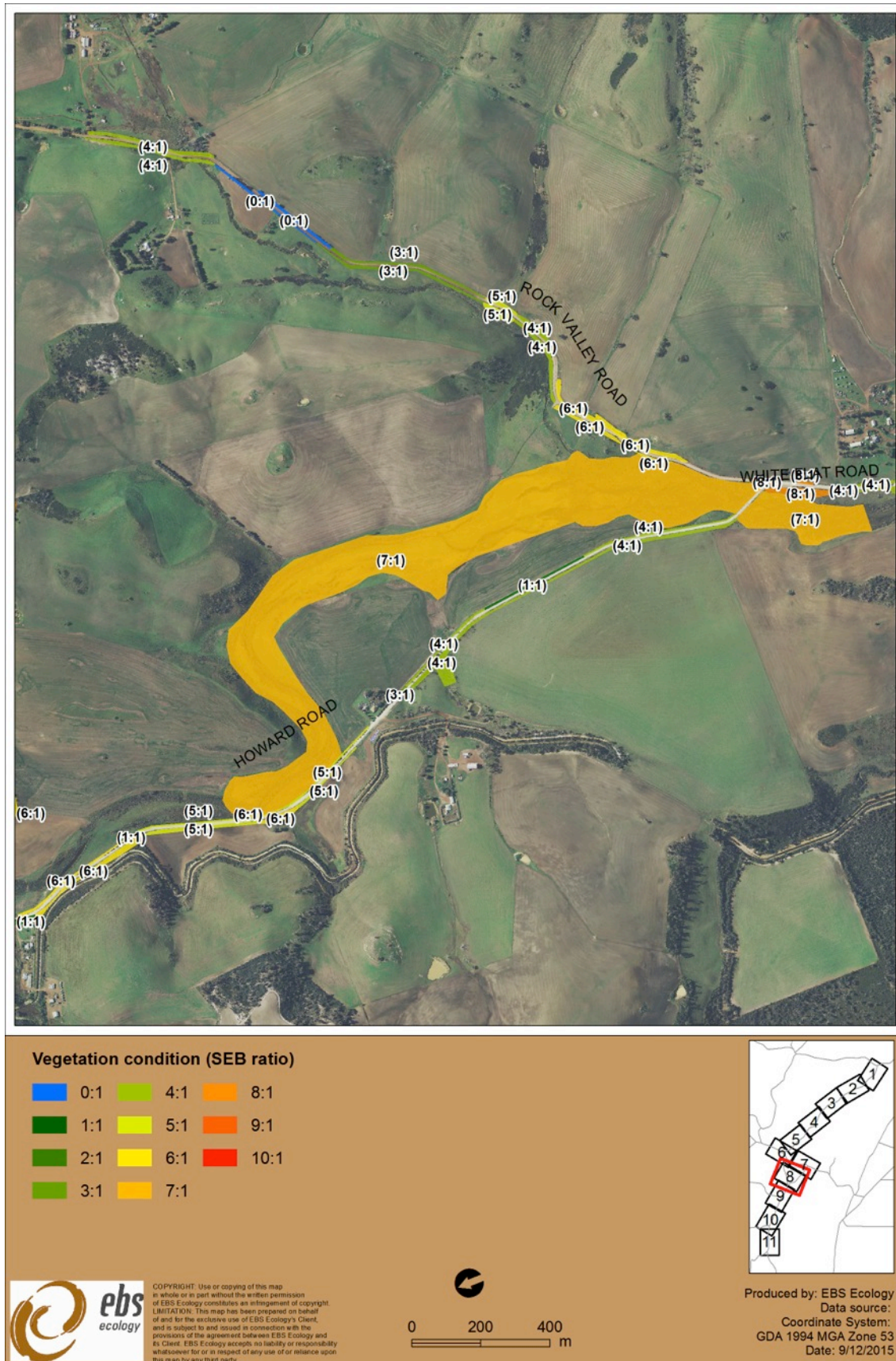


Figure 26. Vegetation condition SEB ratio (Map 8 of 11 SEB)

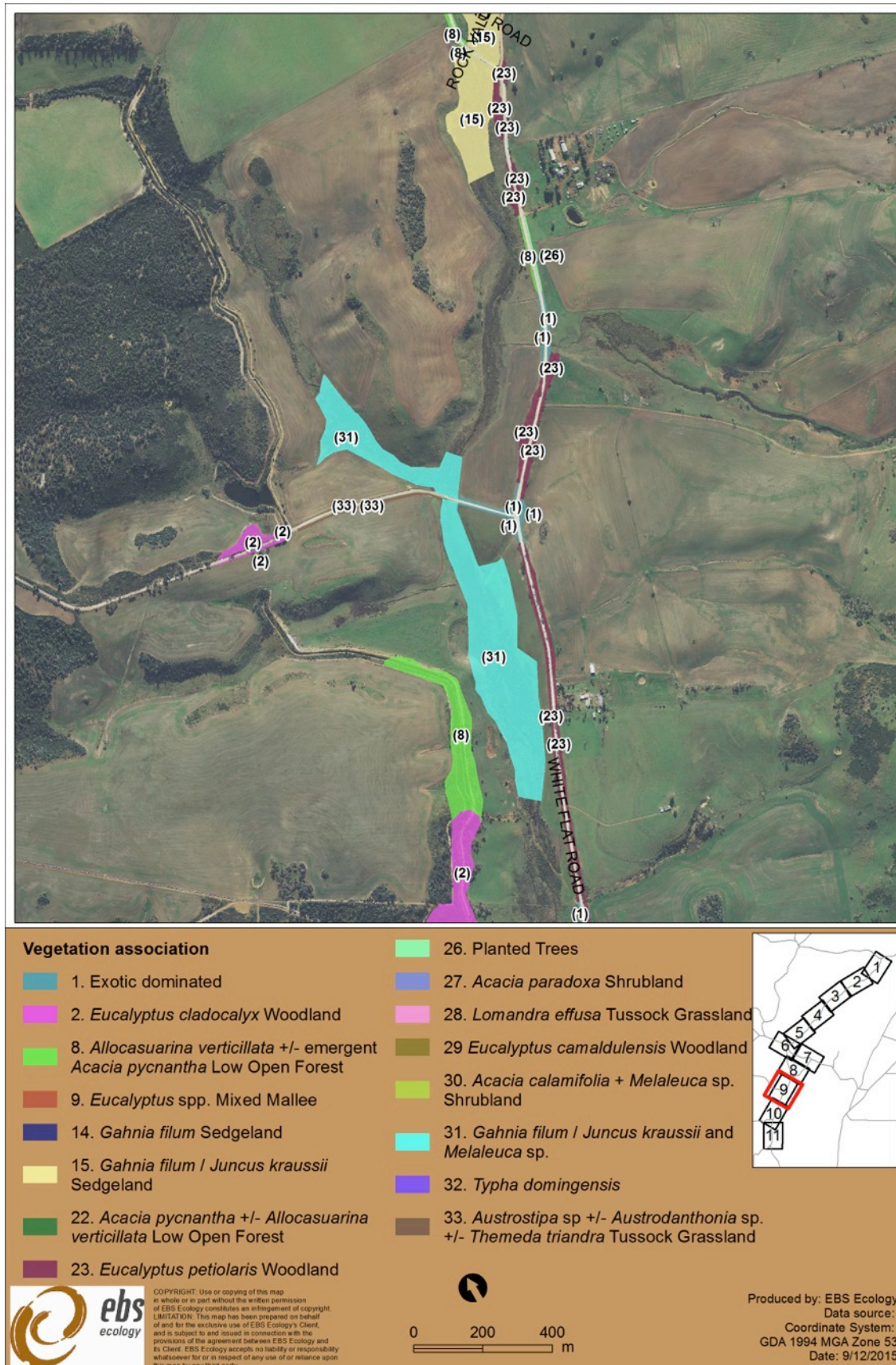


Figure 27. Vegetation Association Mapping (Map 9 of 11 Association)

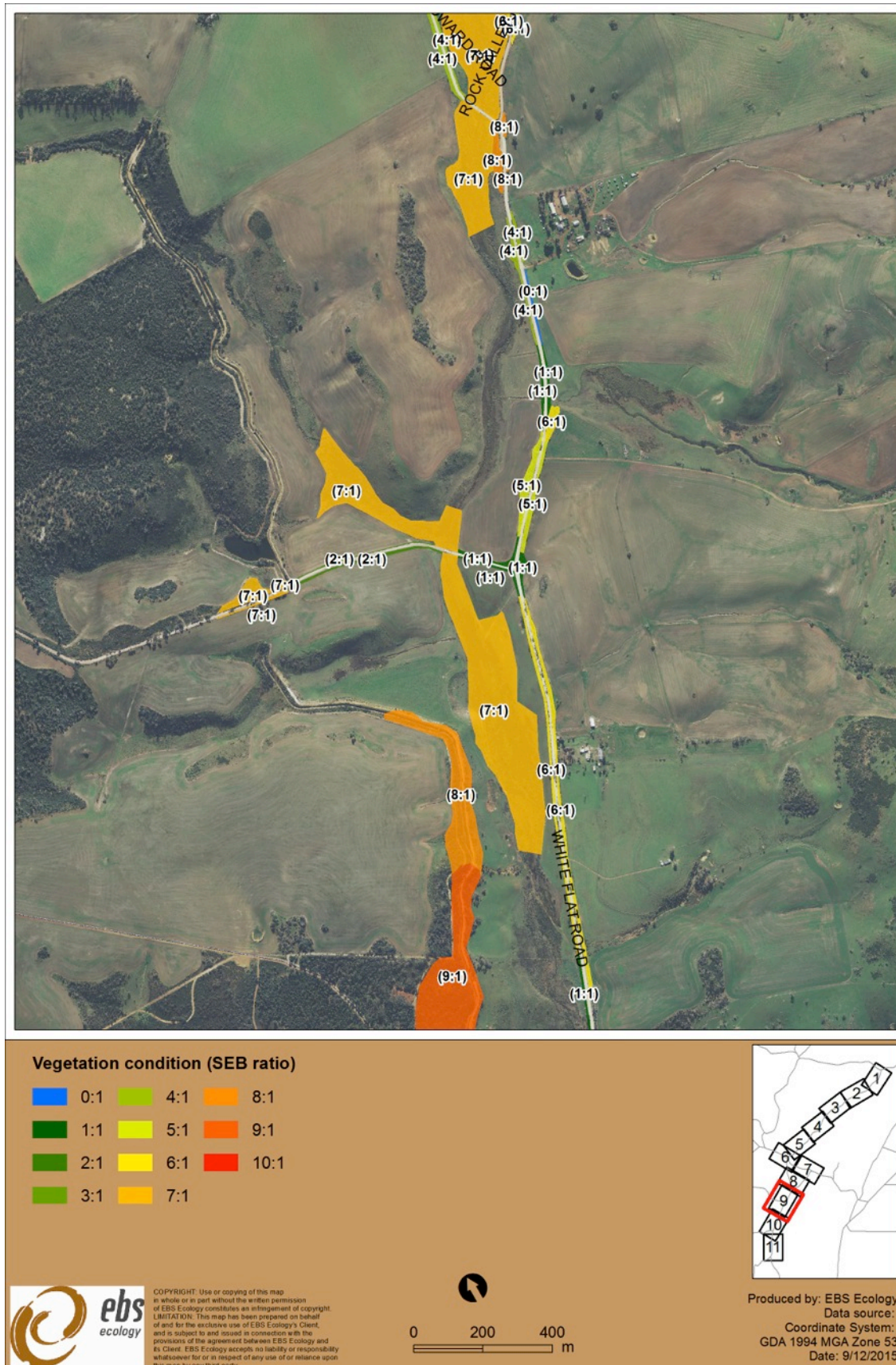


Figure 28. Vegetation condition SEB ratio (Map 9 of 11 SEB)

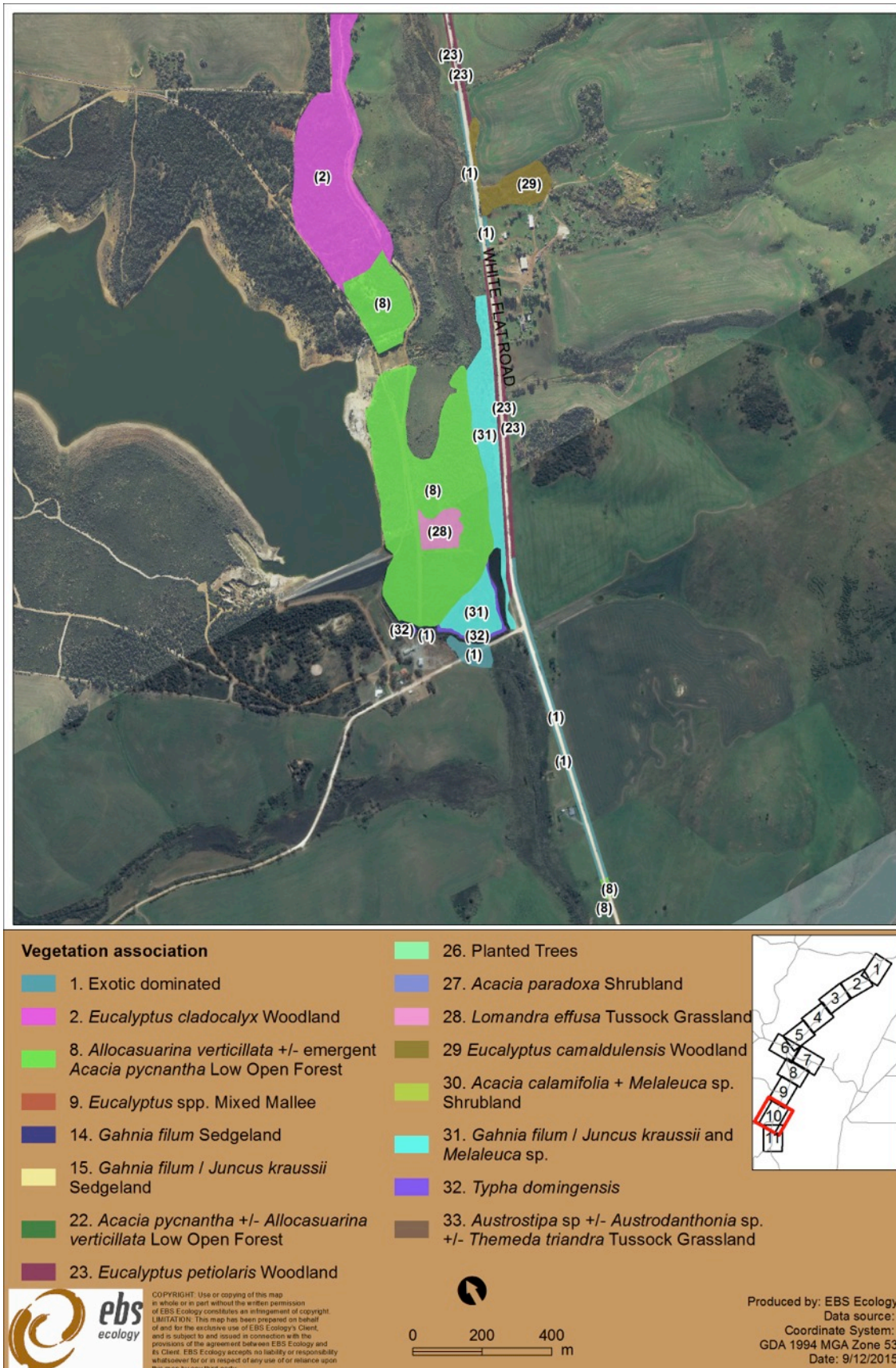


Figure 29. Vegetation Association Mapping (Map 10 of 11 Association)

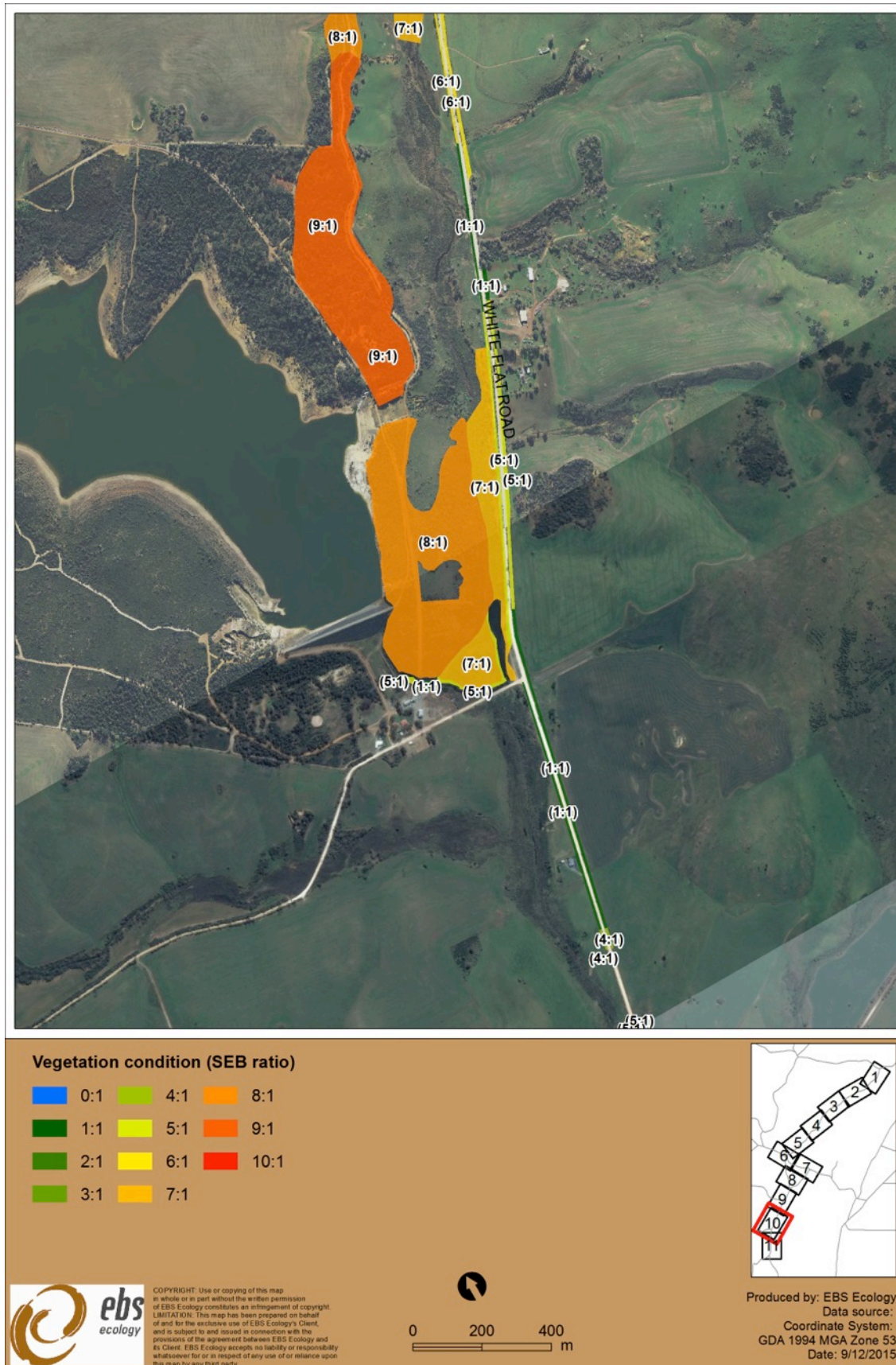


Figure 30. Vegetation condition SEB ratio (Map 10 of 11 SEB)

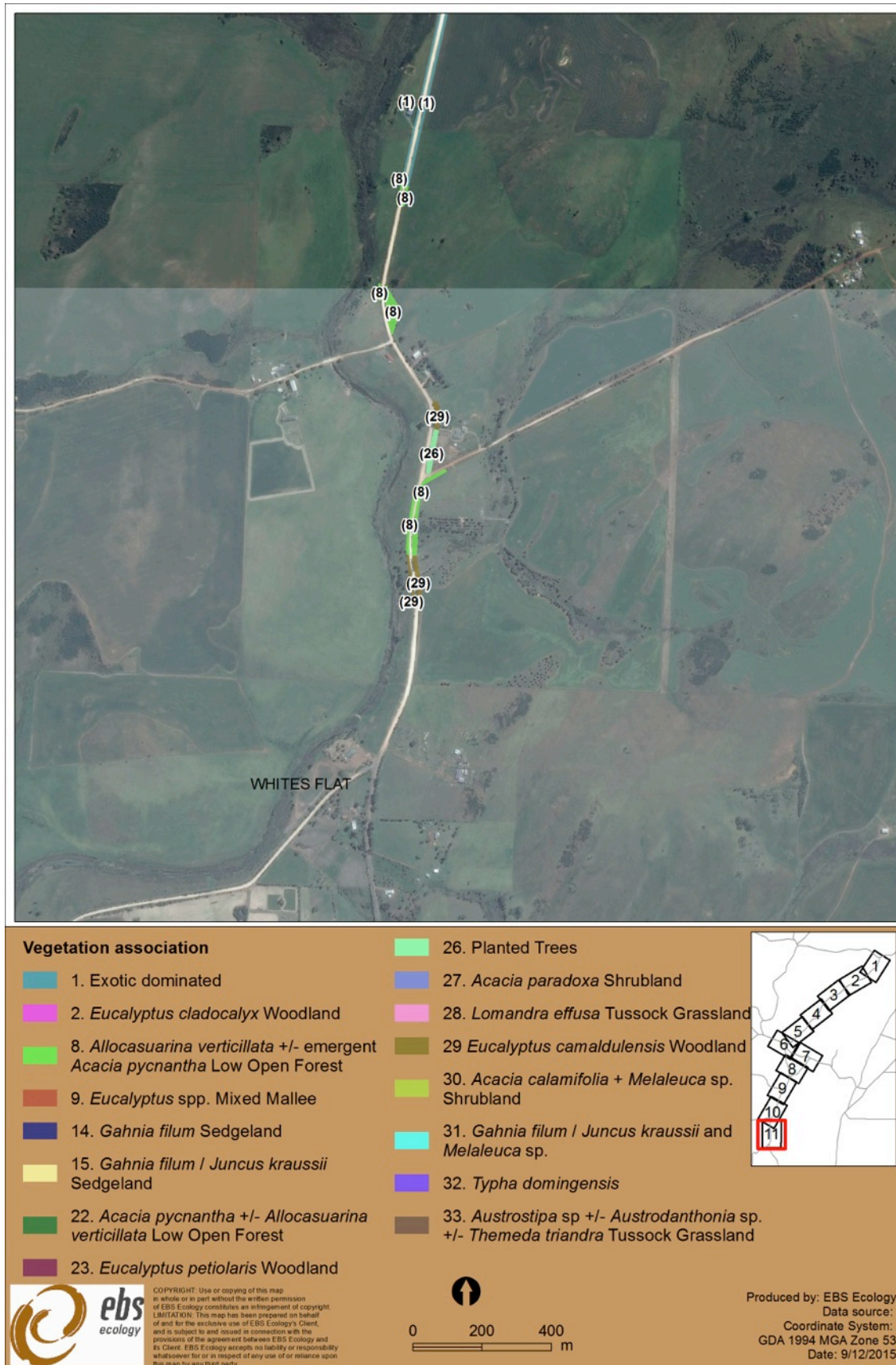


Figure 31. Vegetation Association Mapping (Map 11 of 11 Association)

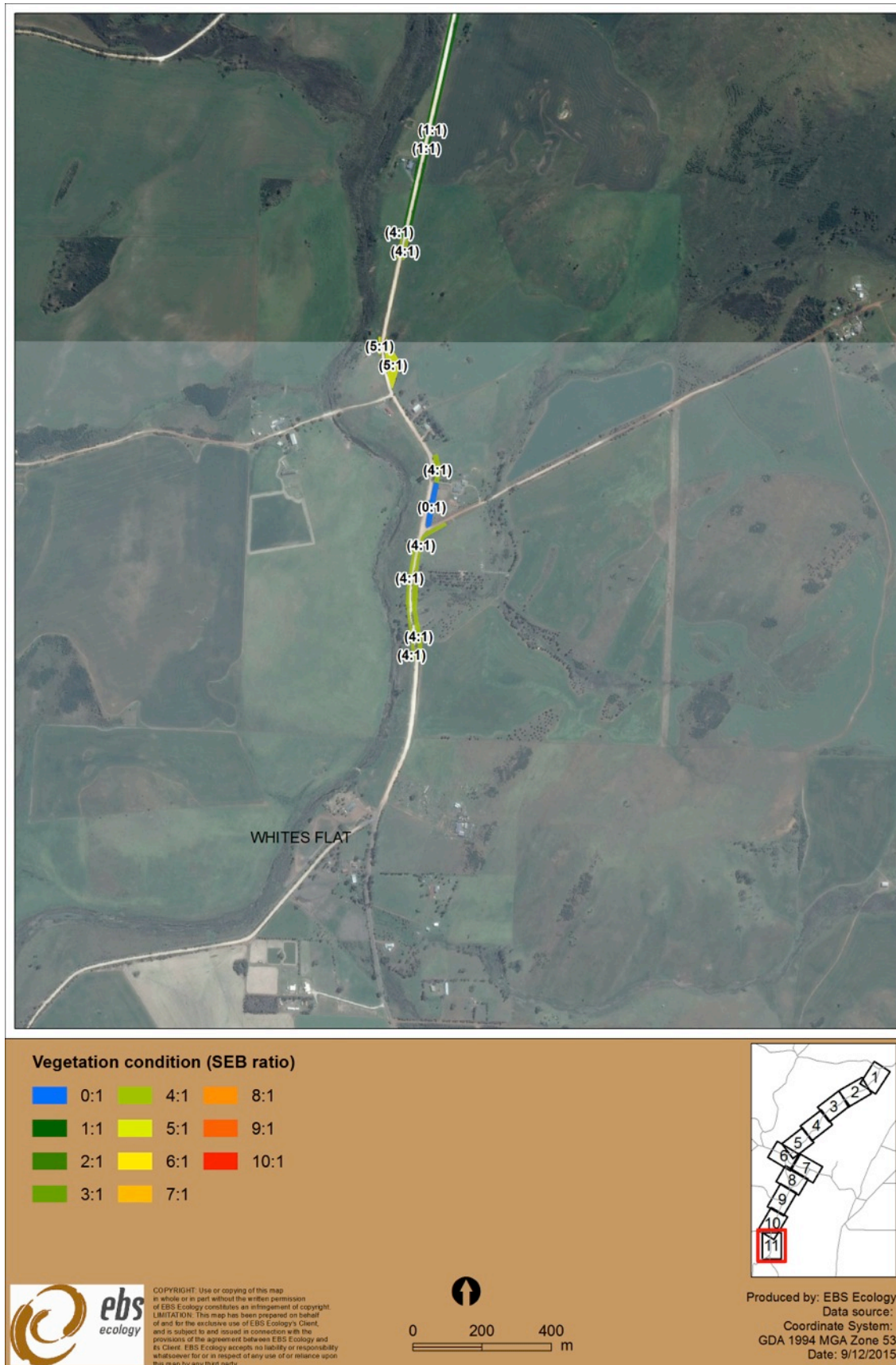


Figure 32. Vegetation condition SEB ratio (Map 11 of 11 SEB)

3 THREATENED ECOLOGICAL COMMUNITIES

Below is the methodology used for assessing the threatened ecological community Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) Grassy Woodland, as taken from the original report EBS 2014.

Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) assessments were conducted within the roadside vegetation corridor taking into account linking patches within private property that was not accessed as impacts into roadside properties would be negligible.

The field survey involved undertaking the following steps to determine the presence of the nationally threatened ecological community, Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) Grassy Woodland:

Step 1

Using the *Key Diagnostic Characteristics*, to determine whether the community qualifies as Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) Grassy Woodland.

The key diagnostic characteristics are:

1. Distribution occurs within the Eyre York Block bioregion – in the Eyre Hills subregion EYB03 with outliers possibly occurring within the Talia subregion EYB04 (IBRA Version 7) of the Eyre Peninsula.
2. Vegetation structure is typically woodland to open forest.
3. The upper layer is dominated or co-dominated by *Eucalyptus petiolaris* (Blue Gum) and the tree canopy cover is 10% or more.
4. The mid layer varies from open to dense in response to soil moisture and disturbance and/or management history and consists of native sclerophyllous shrubs and small trees.
5. The ground layer is variable in development and composition, ranging from sparse to a thick layer of native grasses and other herbs. Ground layer flora typically is dominated by one or more of the graminoid genera: *Austrostipa*, *Carex*, *Chorizandra*, *Gahnia*, *Juncus*, *Lepidosperma*, *Lomandra* and *Rytidosperma*; but also often contains other herbs and small shrubs.
6. The ecological community is mainly restricted to well-drained, moderate to high fertility soils and is typically associated with sheltered valleys, lower hill slopes and watercourses in the higher rainfall districts of the Eyre Peninsula.

Step 2

Using the *Condition Thresholds* to determine whether the patch qualifies as a Nationally Threatened Ecological Community. See for Condition Thresholds from EPBC Listing Advice.

The assessment process involved selection of a sampling site for the patch. According to the EPBC Listing Advice, “The area with the most apparent ‘richness’ of native species in the understorey should be selected to determine estimates of native species richness and cover.” The sampling quadrat should be at least 20m x 20m (400m²).

Table 2. Condition thresholds for the Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) Grassy Woodland

Category and rationale	Thresholds
A. Exceptional quality – larger patches with very high native species vegetation cover and very diverse understorey.	Patch size is ≥ 1 ha; AND $\geq 70\%$ of total vegetative cover ² in the mid and ground layers are comprised of native species ³ ; AND 18 or more native species from Appendix B, Table B1 are present in the mid and ground layers.
B. High quality – good native vegetation cover and good native species diversity in the understorey.	Patch size is ≥ 0.2 ha; AND $\geq 50\%$ of total vegetative cover in the mid and ground layers are comprised of native species; AND 12 or more native species from Appendix B, Table B1 are present in the mid and ground layers.
C1. Medium quality – good native vegetation cover and diverse native species in the understorey.	Patch size is ≥ 0.2 ha; AND $\geq 50\%$ of total vegetative cover in the mid and ground layers are comprised of native species; AND 4 or more native species from Appendix B, Table B1 are present in the mid and ground layers;
OR	
C2. Medium quality – patches with connectivity to other native vegetation remnants in the landscape.	Patch size is ≥ 0.2 ha; AND $\geq 30\%$ of total vegetative cover in the mid and ground layers are comprised of native species; AND 4 or more native species from Appendix B, Table B1 are present in the mid and ground layers; AND The patch is contiguous with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥ 1 ha in area.
OR	
C3. Medium quality – patches that have large mature trees or trees with hollows (habitat)	Patch size is ≥ 0.2 ha; AND $\geq 30\%$ of total vegetative cover in the mid and ground layers are comprised of native species; AND 4 or more native species from Appendix B, Table B1 are present in the mid and ground layers; AND The patch has at least one tree with hollows or at least one large tree (≥ 80 cm dbh ⁴) from the upper layer species list in Table B1. Where patches are ≥ 1 ha, a density of at least one mature tree or tree with hollows per hectare is required.

² Vegetative cover excludes mosses and lichens, patches of bare ground, plant litter.

³ Mid and ground layers exclude juvenile canopy species. This applies to categories A, B, C1, C2 and C3.

⁴ dbh is diameter at breast height.

Fifteen sites were assessed against the criteria for Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) Threatened Ecological Community along Pillaworta Road, Howard Road and White Flat Road. In total six patches of Eyre Peninsula Blue Gum were classified as a Threatened Ecological Community.

Eyre Peninsula Blue Gum sites 1, 2, 3, 4 and 5 are all within a continuous patch; therefore they are classified at the highest level within those 5 sites. Due to sites 4 and 5 receiving a classification of a Category B, the entire patch is classified as a Category B. Sites 6 and 7 are linked therefore receive Category B. Sites 10, 11, 14 and 15 are all found within a Category A class. Whereas site 13 is classed as C2 and site 12 did not meet the criteria to be classified.

Other patches of Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) within the area that were regarded as having less than 30% native cover initially were therefore not assessed for the complete criteria. (See Table 3, Figure 4)

Patch meaning

A patch is defined as a discrete and continuous area of the ecological community. However a patch may include small-scale variations and disturbances, such as tracks or breaks (including exposed soil, leaf litter, cryptogams), watercourses/drainage lines or localised changes in vegetation that do not act as a permanent barrier or significantly alter its overall functionality.



Figure 33. Degraded patch of Eyre Peninsula Blue Gum

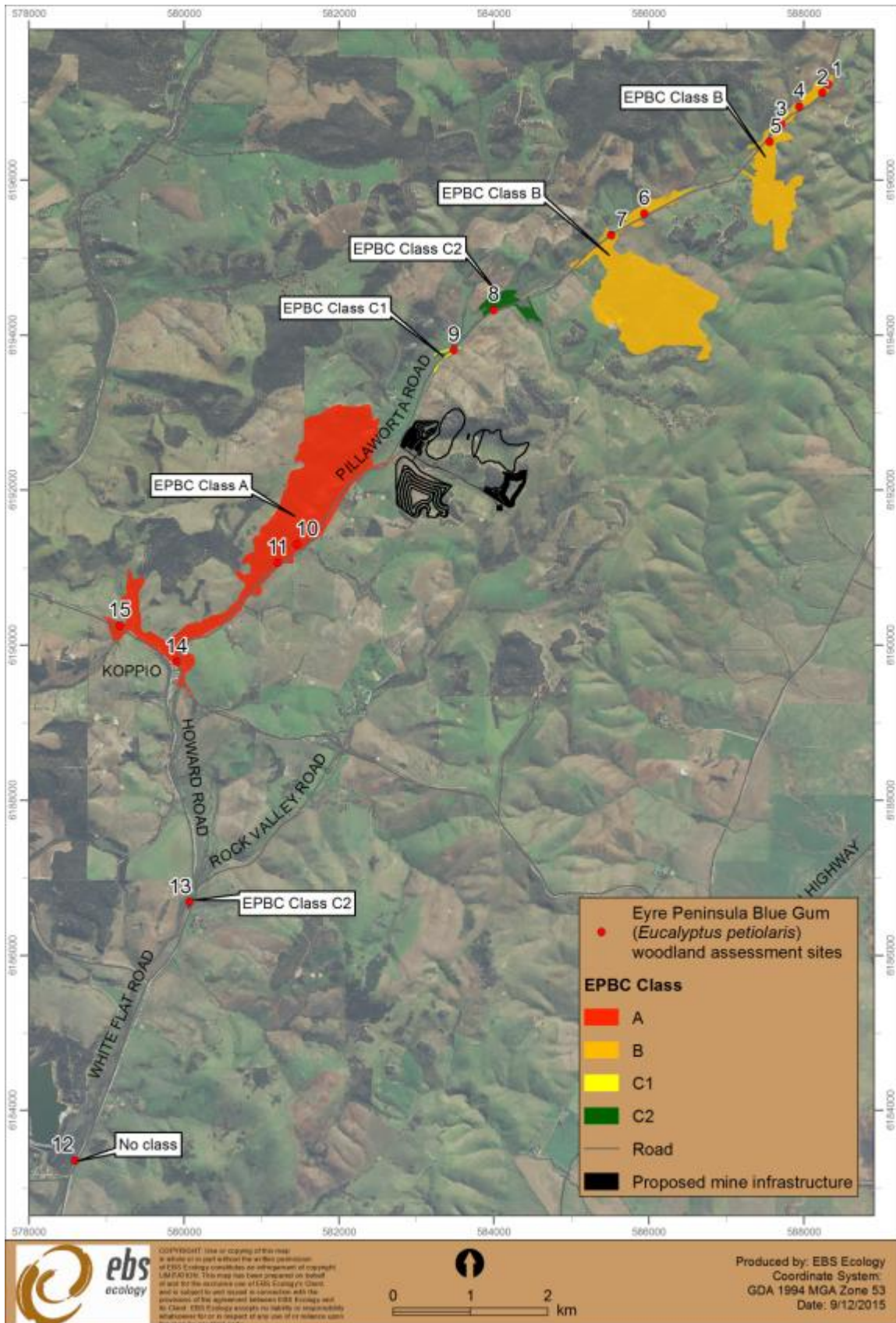


Figure 34. Threatened Ecological community Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) Class ratings and assessment sites

Table 3. Condition thresholds results for the Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) Grassy Woodland

Site	Fits Key Diagnostic Characteristics (Y or N)*	A - Exceptional Quality**			B - High Quality**			C1 - Medium Quality**			C2 - Medium Quality**			C3 - Medium Quality**		Potential for Comm. Referral (Yes or No)	
		The patch size is ≥ 1ha	≥70% of total vegetative cover ² in the mid and ground layers are comprised of native species ³	18 or more native species from Appendix B, Table B1 (Listing Advice) document) in the mid and ground layers	The patch size is ≥ 0.2ha	≥50% of total vegetative cover ² in the mid and ground layers are comprised of native species ³	12 or more native species from Appendix B, Table B1 (Listing Advice) document) in the mid and ground layers	The patch size is ≥ 0.2ha	≥50% of total vegetative cover ² in the mid and ground layers are comprised of native species ³	4 or more native species from Appendix B, Table B1 (Listing Advice) document) in the mid and ground layers	The patch size is ≥ 0.2ha	≥30% of total vegetative cover ² in the mid and ground layers are comprised of native species ³	4 or more native species from Appendix B, Table B1 (Listing Advice) document) in the mid and ground layers	The patch is contiguous with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) that is ≥1ha in area	Same criteria as C2, and		The patch has at least 1 tree with hollows or at least 1 large tree (≥80cm dbh4) from the upper layer species list in Table B1. Where patches are ≥1 ha, a density of at least one mature tree or tree with hollows per hectare is required.
1	Y	Y	N	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	N	Y	N
2	Y	Y	N	N	Y	N	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y (C2)
3	Y	Y	N	N	Y	N	N	Y	N	Y	Y	N	Y	Y	N	N	N
4	Y	Y	N	Y	Y	Y	Y										Y(B)
5	Y	Y	N	Y	Y	Y	Y										Y(B)
6	Y	Y	N	N	Y	N	N	Y	N	Y	Y	Y	Y	Y			Y(C2)
7	Y	Y	N	Y	Y	Y	Y										Y (B)
8	Y	Y	N	N	Y	N	N	Y	N	Y	Y	Y	Y	Y			Y (C2)
9	Y	N	N	N	Y	Y	N	Y	Y	Y							Y (C1)
10	Y	Y	Y	N	Y	Y	Y										Y (B)
11	Y	Y	Y	Y													Y (A)
12	Y	N	N	N	Y	N	N	Y	N	Y	Y	N	Y	N	N	N	N
13	Y	N	N	N	Y	N	N	Y	N	Y	Y	Y	Y	Y			Y (C2)
14	Y	Y	N	N	Y	Y	Y										Y(B)
15	Y	Y	Y	Y													Y (A)

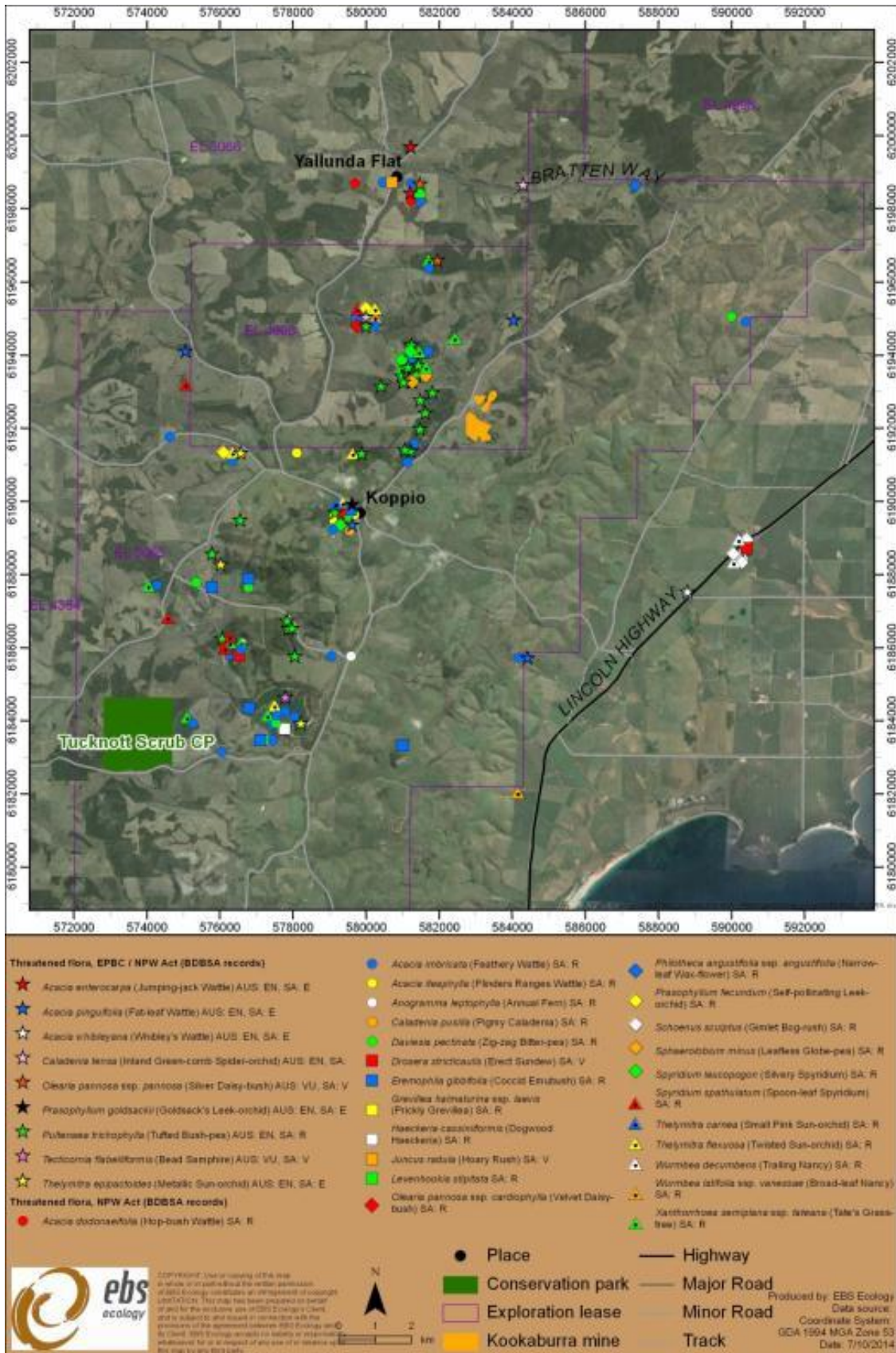


Figure 35. Threatened Flora Records (EPBC and BDBSA)

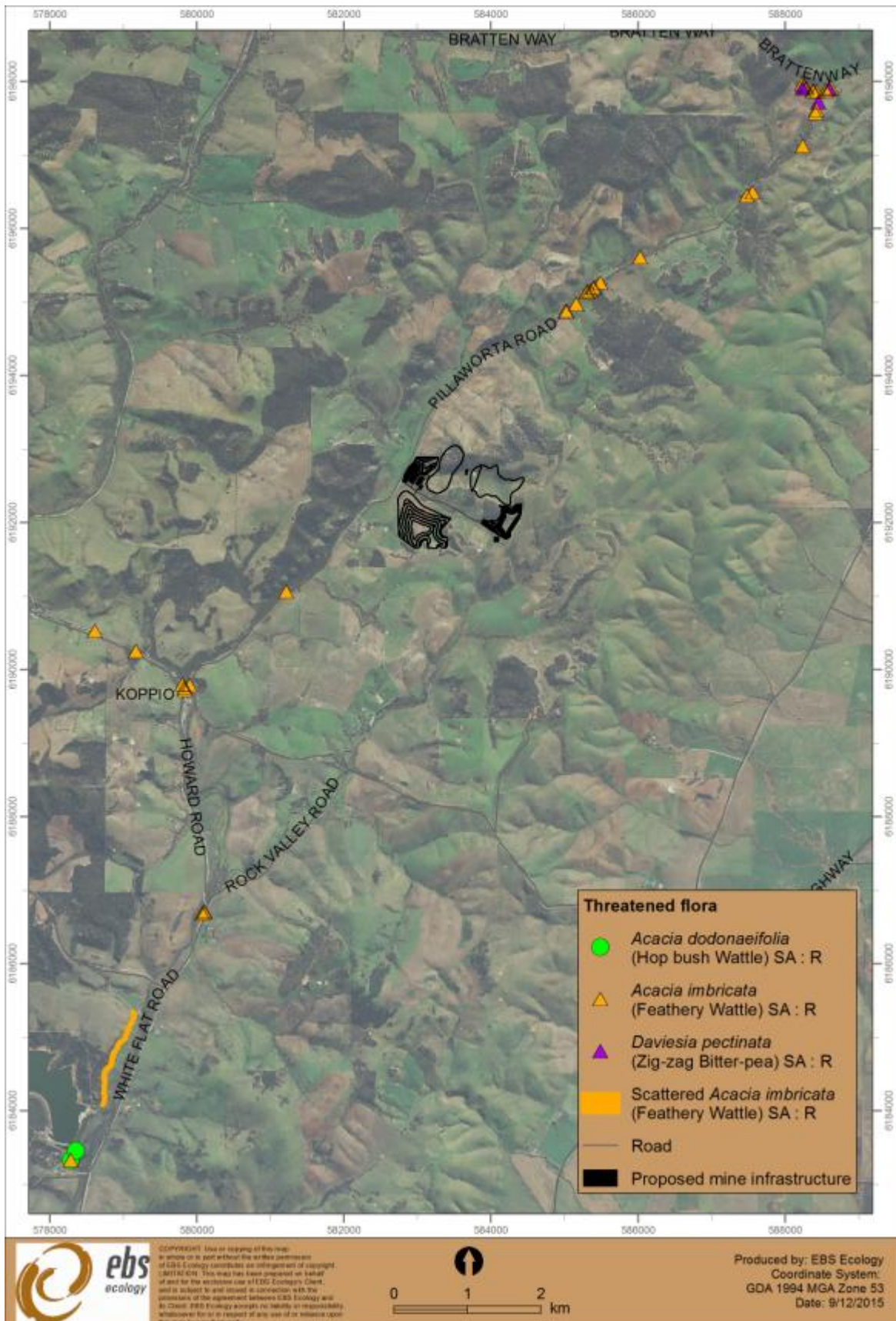


Figure 36. Threatened flora species recorded in November 2015 survey

4 DISCUSSION

4.1 Nationally threatened flora and threatened Ecological Communities

No nationally threatened flora species were recorded during the current survey. The survey was undertaken in the late spring (late November) which is not ideal for the detection of the potential threatened orchids within the area. In the Eyre Peninsula Threatened Ecological Community found onsite as a category A (Figure 4), there was some evidence of orchids that were dried but these were not easy to identify. This also does not account for the earlier flowering orchid species such as the *Arachnorchis brumalis* (Winter Spider-orchid), which flowers between late June and early September, and *Prasophyllum goldsackii* (Goldsack's Leek-orchid) which flowers late September- October. Due to timing of surveys impacts to orchids is unknown, if clearance is kept to a minimum on roadsides and confined to the poorer quality areas, potential impacts are likely to be minimal.

Three State rare species: *Daviesia pectinata* (Zig-zag Bitter Pea), *Acacia dodonaeifolia* (Hop-bush Wattle) and *Acacia imbricata* (Feathery Wattle) were recorded, the latter being widespread throughout the areas surveyed (in 2013 to 2015 as recorded in EBS's previous surveys).

Bratten Way

No EPBC listed species were found in this section during the assessment conducted in November 2015. Orchids are unlikely to occur in the majority of this area as it degraded and heavily infested with weeds. There is a section of better quality vegetation along Bratten Way which may support orchids. Due to the timing of the November survey, these were not detected. *Acacia imbricata* was found in patches along this roadside.

Pillaworta Road

From the northern end of Pillaworta Road until the entrance to the proposed mine; there are multiple patches of *Eucalyptus petiolaris* (Eyre Peninsula Blue Gum). Multiple sites were assessed with two patches recorded as Category B TEC, one Category C2 and one Category C1.

There are patches of good quality Blue Gum along the roadside but there are also very degraded roadside patches but due to linkage with a larger area of Blue Gum some patches are still considered as Category B. While there were no EPBC listed species recorded in this section, it may still be possible in some of the better patches and there is potential for orchids, but due to timing of the survey they cannot be ruled out.

The Blue Gum patches, mid and ground layer can show considerable variation in floristic composition and structure, being greatly influenced by the history of disturbance and management of remnant patches.

About 1km south of the entrance to the proposed Mine, there is a large patch of Blue Gum, which connects with the Blue Gum road side vegetation. In this larger patch, 3 assessments were completed against the criteria with two sites receiving Category B and the third a Category A. This classifies the entire connecting patch as category A. Once again in this area no Nationally Threatened species were recorded within the roadside. The Category A area was severely burnt during the Wangary 2005 fires and is still in a stage of recovery.

Pipe Line route SA water area along channel

Vegetation around the SA Water channel alignment was assessed for vegetation associations and SEB. Vegetation consists of *Allocasuarina verticillata* (Drooping sheoak) and *Eucalyptus cladocalyx* (Sugar Gum) associations. There was no dominant Blue Gum association along this alignment. There is a significant road clearing either side of the original pipe at the southern end of the alignment. Therefore impact should be minimal depending on placement of the proposed pipeline. Where the alignment occurs next to the channel way there is still a significant road on the eastern side of the channel way. Vegetation on the Western side of the channel way is of high quality and is known to have EPBC listed species occurring within the site. If alignment is to stay within the road and channel boundary, there should be no impact on these areas. If alignment was to follow the western side of the channel then areas need to be re assessed.



Figure 37. SA Water site, proposed pipeline route.



Figure 38. *Acacia imbricata* along SA Water road running alongside channel way

Pipe Line route along road White Flat Road, onto Howard Road.

Small degraded patches of Blue Gum occur along the roadside heading north to White Flat Road toward Koppio. These patches are mostly highly degraded areas that do not qualify under the criteria, or if they do, do not contain >30% cover in the lower and mid storey. One area qualifies as a Category C2 (site 13) Threatened Ecological community.

4.2 Discussion on impacts

Based on conversations with the Dwayne Povey from Lincoln Minerals, truck access to the mine will be from Bratten Way, heading south down Pillaworta Road to the proposed mine area. He has indicated that a small amount of road widening and tree pruning will need to occur in some sections of the Pillaworta Road to improve site distances and safe passage. This will be limited as much as possible. In areas of TEC other road management options may be required to limit the impact on the TEC communities that may include speed restrictions, signage and truck communication policies.

If the pipeline along SA Water channel route is to stay within the roadway, there should be no impact on vegetation. If the pipeline goes along the alternate route of White Flat Road, a footprint of the layout would be necessary to properly determine impacts. The most degraded side of the road should be selected, with minimal clearance.

Addendum 4- Eyre Peninsula Blue Gum (*Eucalyptus petiolaris*) woodland and roadside vegetation assessments.

Bailla Hill Road vegetation was mapped but is only considered to be used as a public access road for light vehicles travelling into and from the mine therefore no impact will occur to the vegetation in this area.

Threatened Orchids were not detected during the November 2015 surveys, due to timing of the surveys. For orchids to be detected surveys should be undertaken in August to early September. Much of the roadside vegetation is degraded through high levels of weeds, therefore in the degraded areas it is considered unlikely for orchid species to exist. In the higher quality areas, it is unknown as to whether they would occur. If clearance is kept to a minimum on roadsides and confined to the poorer quality areas, potential impacts are likely to be minimal.

EBS recommends Lincoln Minerals provide a layout of intended areas of impacts such as pruning and any road widening necessary as the project moves from conceptual to actual.



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