20 July 2016

Estimated Net Gain Losses for Alternative Alignments of Western Highway Duplication: Section 2: Beaufort to Ararat, Hillside Rd. Area – Comparison of environmental impacts

Summary

Environmental impacts are compared for two alternative routes for Section 2B of the Western Highway between Beaufort and Ararat. Two 16-metre-wide carriageway footprints supplied by traffic engineers TTM Consulting were used to calculate losses on the "Northern Option". A refined Option 1 footprint sourced from VicRoads (September 2015) was used to calculate losses on Option 1. Vegetation data from two previous studies (Ecology and Heritage Partners 2012 and Foreman 2015) were used.

The "Northern Option" has three clear environmental advantages. It would require roughly one quarter of the number of Large Old Tree-removals compared with Option 1, it would have minimal impact on EPBC protected Matters of National Environmental Significance (MNES) compared with (i) up to 4.3 ha of Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Grassland, (ii) up to 31.1 hectares of suitable Golden Sun Moth Habitat and (iii) up to 26.4 ha of suitable Striped Legless Lizard habitat on Option 1 (McMahon *et al* 2016), and it creates significantly less landscape fragmentation. In addition, the Northern Option has similar Habitat Zone losses to Option 1 according to the calculations presented below. However, significant omitted HabHa losses on Option 1 have been identified that would very likely increase the impact significantly, with no similar omissions identified for the Northern Option.

The construction of the Northern Option will involve significantly less environmental impacts when compared with the construction of Option 1.

TREE LOSS

The loss of Large Old Trees (LOTs) and Very Large Old Trees (VLOTs) would be very significantly less on the Northern Option (21 LOTs or VLOTS compared with 87 LOTs or VLOTS on Option 1). One of the VLOTs on Option 1 is a locally rare and unusually large Yellow Gum. The trees lost on Option 1 are nearly all scattered trees. These have more critical ecological roles in rural landscapes than the patch trees on the Northern Option (Gibbons and Boak 2000).

IMPACT ON EPBC MNES

Option 1 will impact the three EPBC Matters of National Environmental Significance identified on Option 1 (McMahon *et al* June 2016). There are no known impacts on federally listed species or communities on the Northern Option except very small areas of potential Golden Sun Moth Habitat. One federally listed species,

Practical Ecology
PO Box 228 Preston Victoria 3072 Office: 2B Stott Street Preston Victoria p 03 9484 1555 f 03 9484 9133
e enquiries@practicalecology.com.au www.practicalecology.com.au

the Emerald Lipped Orchid, has been mapped by Ecology and Heritage Partners (EHP) in roadside vegetation alongside the Northern Option but impact on this species can be avoided.

FRAGMENTATION

Option 1 would cause:

i. offsite losses to Spring Soak vegetation near Option 1(Foreman 2015);
ii. a loss of quality of EPBC-listed Grassy Woodland and Derived Grassland patches due to fragmentation by Option 1 (this report)
iii. loss of habitat quality due to severance of 4 natural corridors (McMahon *et al*, June 2016);
iv. the loss of quality of State and Federally listed habitat and communities along Hillside Road due to increased traffic and new truck access as it is currently a narrow one lane road that would need significant construction upgrades resulting in significant losses of roadside vegetation;
v. likely severance-related replication of farm infrastructure in areas of High Conservation Significance vegetation (Pers. Comm., MairiAnne Mackenzie, March 2016).

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The additional loss of Habitat Hectares is estimated to exceed at least 1 HabHa and likely extends to several HabHa. It is difficult to be more exact in these estimates without extensive further work. These significant impacts result from a fresh cut and road corridor in the landscape and are largely avoided on a Northern Option.

NET GAIN

Net Gain requirements under the Native Vegetation Framework were calculated for direct losses. Using the data available, the Net Gain requirements for the two routes are similar, at 11.840 Habitat Hectares for the Northern Option and 10.284 Habitat Hectares for Option 1. However, the figure for Option 1 understates its impact as it does not include the loss of an additional 4 ha of remnant patches -at least 1 HabHa - recorded on Option 1 in remapping by Ecology and Heritage Partners (April 2016). This recent remapping covered only part (estimated at "one-third") of the route in question. Practical Ecology has not had access to any further remapping by Ecology and Heritage Partners or anyone else.

COMPARABLE WIDTHS

The 16 metre width for the Northern Option carriageways, which use and run beside the existing Highway, is recommended by an experienced road construction engineer, Mr. D.E. Clarke. He suggested this width is adequate as an upper limit given the moderate terrain and the availability of funding for keeping to this width. The footprint used for Option 1, the design from September 2015, covers approximately 40 ha for the 5.7 km stretch of road studied. This significant reduction in area from the 59.9 ha presented to the Planning Panel in 2012 (EES 2012) reflects recent design work by VicRoads.

The two footprints represent comparable levels of refinement in road design. Note that any design work to further reduce width on the Northern Option will be more productive in reducing Net Gain than the same design work on Option 1, because of the higher quality of roadside vegetation beside the Northern Option.

Introduction

Practical Ecology was commissioned by MairiAnne Mackenzie on behalf of affected persons and concerned locals to calculate vegetation impacts on an alternative route for part of Section 2 of the Western Highway Project, Beaufort to Ararat, in the Hillside Road area, and on the corresponding part of approved Option 1 route. Recent amendments have been made to the design footprints of each option. The impact on a 5.7 km of Section 2B of the approved Option 1 using the footprint presented to the Planning Panel in 2012 was also calculated with the inclusion of data not considered by the Planning Panel in the route selection process.

First, we were requested to calculate the losses of native vegetation and Net Gain Targets according to the procedure required under the Native Vegetation Framework (DNRE 2002) for an alternative, "Northern Option" alignment of the Western Freeway utilising the existing road and a parallel, roughly 15 m wide corridor of treeless land for a new carriage way. These calculations are based on the carriageway construction width of 16m for each carriageway, widening to 26 metres for 300 lineal metres at the railway overpass. The earlier Northern Option estimates of native vegetation loss conducted by Shepherd (2012) used a 25 m width.

Secondly, we were commissioned to present the findings of Paul Foreman's (2015) findings of additional habitat zones in VicRoads Option 1 and compare it with earlier data on remnant vegetation and habitats mapped by Ecology and Heritage Partners (2012) as part of the Environmental Effects Statement (EES) for the Western Highway Bypass. This data indicates that the native vegetation losses under that option would be significantly greater than previously considered and that significant areas of habitat for species and a community listed under the Commonwealth Environmental Protection and Biodiversity Conservation Act not previously taken into account may be affected by construction (Foreman 2015, McMahon 2016).

Thirdly, we were asked to calculate the losses of native vegetation and Net Gain Targets for a refined, narrower design width from VicRoads for Option 1, the VicRoads preferred and approved option in this section of the Western Highway upgrade. Option 1 runs south of the current road and railway, through what was previously thought to be cleared grazing paddocks with scattered indigenous trees. The native vegetation losses and Net Gain Targets were calculated by interpreting the data collected by Foreman (2015) for areas of EVCs and habitat zones he documented and by using data from Ecology and Heritage Partners (2012) for habitat zones they documented. Calculations were done according to requirements under the Native Vegetation Framework (DNRE 2002).

Fourthly, Practical Ecology was requested to estimate losses of Large Old Trees or Very Large Old Trees for both options. This was done by using Large Old Tree data obtained from Ecology and Heritage Partners and the position of trees were mapped in and near the footprint of construction works for both options.

- Map 1 provides an overview of both options and the study area.

This report provides:

1. A quantitative assessment of the native vegetation losses under the Native Vegetation Framework of a revised Northern Option alternative of the Western Highway upgrade

2. A quantitative assessment of the native vegetation losses under the Native Vegetation Framework of the VicRoads Option for the Western Highway upgrade inclusive of data on remnant vegetation collected by Foreman (2015) and Ecology and Heritage Partners (2012)

3. A current map indicating the areas of native vegetation documented by Ecology and Heritage Partners (2012) compared with additional areas recorded by Foreman (2015)

4. An estimate the Large Old Tree and/or Very Large Old Tree losses for both the Northern and VicRoads options

5. Summaries and comparisons of the impact of the Northern Option and VicRoads Option 1

6. Summary and discussion of the findings of the analyses and any relevant issues

I was able to visit the site of the current Western Highway and VicRoads Option 1 on two occasions. On 5th June I inspected the current Western Highway corridor and looked at the Option 1 route where it crossed public roads. On 7 July 2016, after I did the extensive calculations and estimates contained in this report, I was able to walk most of the Option 1 route across the paddocks to the south of the current Western Highway alignment and consider the distribution of large old trees compared to mapped data and Habitat Scores of Habitat Zones along the route.

Methods

The method for calculating native vegetation losses each route option is presented below. A Microsoft Excel spreadsheet was developed to calculate the Habitat Hectare losses and Net Gain Targets. A separate spreadsheet was used for each option with Habitat Zones and associated scores sourced from three reports as explained below.

The other data presented includes a comparison of the Habitat Zones observed by Foreman (2015) and the Habitat Zones found by Ecology and Heritage Partners (2012). The much larger area of remnant vegetation found by Foreman (2015) has been considered in calculating the likely loss of native vegetation in the VicRoads Option 1. Additional records of remnant vegetation on the west end of Option 1, unrecorded until April 2016 by Ecology and Heritage Partners, were not included in calculations, due to time constraints.

Northern Option

This report mostly relies for habitat zone and scoring information from the 2012 Practical Ecology report prepared by Mark Shepherd to consider HabHa losses on the Northern Option. The Habitat Zones compiled by Shepherd for the Northern Option combined with Ecology and Heritage Partners data (2012) and further fieldwork of his own. The losses of Habitat Hectares and Large Old Trees on the likely footprint of the road construction were based on 25 m carriageways in that earlier report. In this report they are based on one carriageway being largely but not completely confined to the existing road zone, and a second carriageway constructed on a 16 m strip largely confined to a power line easement.

The data compiled by Mark Shepherd (Practical Ecology 2012) were modified in regards to Conservation Significance (CS) of some the Ecological Vegetation Classes (EVCs). The Conservation Significance data for some Habitat Zones from Ecological and Heritage Partners (2012) somewhat overstated the impact along Northern Option. In Habitat Zones HDF1, HDF2 and HDF3 we determined that an EVC of Least Concern with a score of between 0.6 and 1.0 is of Medium CS, not High CS. In Habitat Zones HW1, HW2 and HW3 it was determined that a Depleted EVC with a score of between 0.6 and 1.0 is of High Conservation Significance not Very High. The rest of the Conservation Significance levels appear to be correct.

All of the data used to do the calculations of HabHa on both options are presented in Appendix 1.

Data on Large Old Tree, inclusive of a small number of Very Large Old Trees, locations obtained from Ecology and Heritage Partners was the basis for estimating losses in the options being considered. Estimating the loss of Large Old Trees was calculated with a few important principles considered but determining tree losses is

only an estimate because of the scale of the mapping used. The first key principle is that according to DEWLP policy a tree should be considered lost if more than 10% of its Tree Protection Zone, calculated by multiplying its Diameter at Breast Height (DBH) by 12 according to the Australian Arboricultural Standard 2009, is modified by construction. This principle is hard to estimate given the scale of the maps so if any Large Old Trees appeared to have 10 to 30% of their TPZ affected by new construction were deemed to be lost. However, Large Old Trees immediately adjacent to the existing Western Highway will be retained but potentially lost for Net Gain purposes, even if it is estimated that an area greater than 10% of the Tree Protection Zone is already impacted by the existing road. This is because it is assumed that works where the mapped centreline aligns with the existing centreline will not extend significantly beyond the current road footprint and any trees directly adjacent to the existing road would not be further disturbed.

VicRoads Option 1

The source of Habitat Zone scores for areas of native vegetation lost in this option was obtained by interpreting data from Foreman (Oct 2015). The Habitat Zones identified by Foreman (2015) were copied onto a plan by Practical Ecology mapping staff and the areas lost were calculated by intersecting the VicRoads option outline with the Habitat Zones identified by Foreman (2015).

To determine Habitat Scores for his Habitat Zones, Foreman (2015) used a method different the one required under the Native Vegetation Framework (DNRE 2002) and detailed in the *Vegetation Quality Assessment Manual* (2004). Under this method visual estimates of various habitat components are made across a Habitat Zone regardless of its size. Foreman (2015) actually used a method being considered by DEWLP in their ongoing deliberation, as learned in a workshop testing new scoring methods I attended in 2014. This method uses a 30 m square quadrat within the Habitat Zone to do Habitat Scoring; this method is more accurate and can be satisfactorily extrapolated to larger patches if they are fairly uniform. Although it may be problematic to extrapolate the score of a small area across a much larger Habitat Zone it is noted that the Habitat Zones in Option 1 are fairly uniform.

Foreman's data (2015) has been interpreted and put it into the format recognised by VicRoads and DEWLP as appropriate. The scores we have used in our spreadsheet were determined by considering the Habitat Zones that would be cleared and utilising the scores from the quadrats within each Habitat Zone; in limited cases the quadrats from adjacent Habitat Zones were utilised because of the lack of quadrats in some Habitat Zones. The EVCs for the Habitat Zones were determined by reviewing Foreman's (2015) Appendix 12; some of these Habitat Zones had an EVC complex and in those cases the more ecologically significant EVC was selected. This is because land cleared for agricultural use is more likely to be the rarer Grassy Woodland EVC rather than more common EVCs like Hills Herb-rich Woodland that occur more often on public land with their generally poorer soils.

The LOT data provided by Ecology and Heritage Partners was superimposed on top of the map of the VicRoads Option 1. Additional LOT data was gathered to supplement EHP data. It was assumed that any LOT in the corridor would be lost since we know little about the detailed design of the option and are not sure if any trees can be retained in median strips or the edge of the carriageways.

Maps

A range of maps were developed for this project to help in the calculations and present the data used and the methodology that was used. They are attached at the end of this report.

Map 1 is an overview of both the Northern and VicRoads Options with Habitat Zones from Shepherd (2012) along the Northern Option.

Map 2 focuses on VicRoads Option 1 and includes all of the Habitat Zones identified by Foreman (2015) as well the Habitat Zones identified by Ecology and Heritage Partners (2012). This map is provided as an overview of the presence of native vegetation not previously identified by Ecology and Heritage Partners (2012) in their assessment for the EES for the project.

Maps 3, 4, 5 and 6 present all of the Habitat Zones recorded in VicRoads Option 1 either by Foreman (2015) and Ecology and Heritage Partners (2012) at a smaller scale. The codes attached to each Habitat Zones are listed in the Excel spreadsheets used to estimate Habitat Hectare losses and Net Gain Targets as attached below.

Maps 7, 8 and 9 show the LOT data in the Northern Option and VicRoads Option obtained from Ecology and Heritage Partners and further tree positions gathered on the VicRoads Option 1 footprint. I made judgements about the likelihood of removal for the Northern Option, whether tree removal would clearly be part of the construction or if they are close enough to a mapped carriage way to be deemed lost with10% of their root zones are likely to be disturbed by construction. Many of the marginal trees that would possibly be deemed lost have long had their roots disturbed by the previous construction of the existing road and it is suggested that they would not need to be removed in the roadworks. I made similar judgements for Large Old Tree losses along the VicRoads Option 1 footprint. But without a detailed design about the width of any median strip, I assumed that any tree within the revised narrow corridor would be lost.

Results

The following tables summarise estimated LOT losses and the losses of Habitat Hectares.

Table1. Comparison of LOT and VLOT losses

Category	Northern Option	VicRoads Option 1
Potential LOT and VLOT losses calculated by visual assessment of mapped data	21*	87*

*Only includes trees to be physically removed for new construction and are not the actual Net Gain Targets for LOT or VLOT credits required for offsets.

The LOTs potentially lost are calculated by simple visual counts of the maps once all of the trees that were likely to be lost were determined.

Habitat Hectares that would need to be obtained in the offset market, i.e. the final Net Gain Targets, are presented below. They are sourced from the spreadsheets presented in Appendices 1 and 2.

Table 2. Net Gain Targets for the Two Options

Category	Northern Option	VicRoads Option 1
Low Conservation Significance Habitat Hectares – Net Gain Target	-0-	1.050
Medium Conservation Habitat Hectares – Net Gain Target	0.117	0.687
High Conservation Habitat Hectares – Net Gain Target	5.000	3.198
Very High Conservation Habitat Hectares – Net Gain Target	6.724	5.349
Total Habitat Hectares – Net Gain Target	**11.840**	**10.284**

Discussion

Foreman (2015) documented extensive native vegetation along the route of VicRoads Option 1 that was not recorded as part of the original assessment for the Western Highway Upgrade project by Ecology and Heritage Partners (2012). The impact of VicRoads Option 1 will be much greater than the level calculated by Ecology and Heritage Partners (2012). The cleared grazing paddocks are actually open grassy ecosystems with significant areas of native grass, many old paddock trees, habitat for several FFG and EPBC listed species and several ecological communities listed under the EPBC Act.

It was found that the impacts of the two options are roughly similar with the Net Gain Target for the proposed Northern Option being slightly more with the data that was available. However, the likely Large and Very Large Old Tree removal is significantly lower for the Northern Option.

Please note that additional patches of native vegetation, over and above that mapped by Foreman (2015), have been recorded by Ecology and Heritage Partners (April 2016) on Option 1 but this data has not been included here. The mapping has been sighted, and being of lower quality the extra 4 ha could add 1 to 2 Habitat Hectares to the offset requirements for Option 1. Note also that a 16 m construction width is a conservative estimate from a road construction engineer with national experience, and does not include width reduction available from further refinements.

Fragmentation and Indirect Impacts of Roads

One impact that has not been calculated by Ecology and Heritage Partners (2012) is the reduced ecological value of remnant vegetation patches once they are split by road construction. If a Habitat Zone is split by a road, then the patches remaining will often have a reduced Neighbourhood score so there is a loss of Habitat hectares in many cases when Habitat Zones are split or fragmented. For example, when calculations were done on the Peninsula Link in 2009 it was found that approximately 50 Habitat hectares were directly lost but there was a further approximately 7 Habitat hectares lost in habitat value in the retained remnants that were split by the road. If that example is typical then up to approximately 14% of the Habitat hectares lost in clearing for a road could actually be lost in retained remnant vegetation after road construction.

In addition, the impact of roads goes far beyond the actual footprint of a road (Forman *et al* 2003) with edge effects, noise, increased runoff and sedimentation impacts occurring long distances from the actual road. Roads also alter habitats for plants and animals in adjacent native vegetation, provides for movement for

invasive plants, animals and diseases, barriers to fauna movement and wildlife mortality (Donaldson and Bennett 2000). The recovery of land from chemical, hydrological, invasive species and traffic disturbance is much slower on an older road than the impacts can be imposed on the land in the "first cut" of a new road. The road effect zone cannot simply be transferred to a new site when a road is moved to a first-cut site as the road effect zone is partly duplicated even if the older road is much less busy.

The following figures are sourced from Forman *et al* (2003) and summarise a wide range of ecological studies and show how the impacts of roads reach to varying distances:

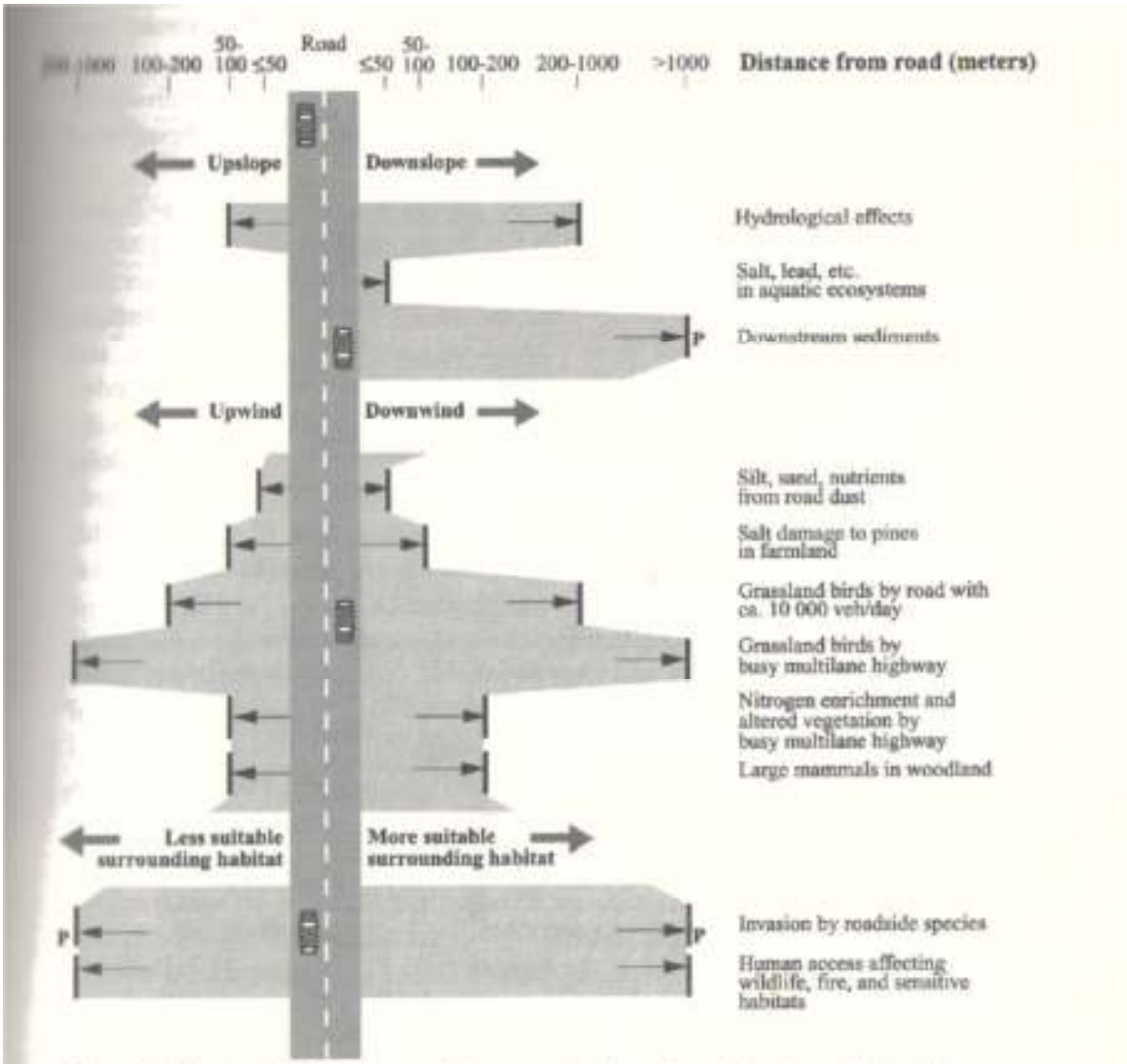
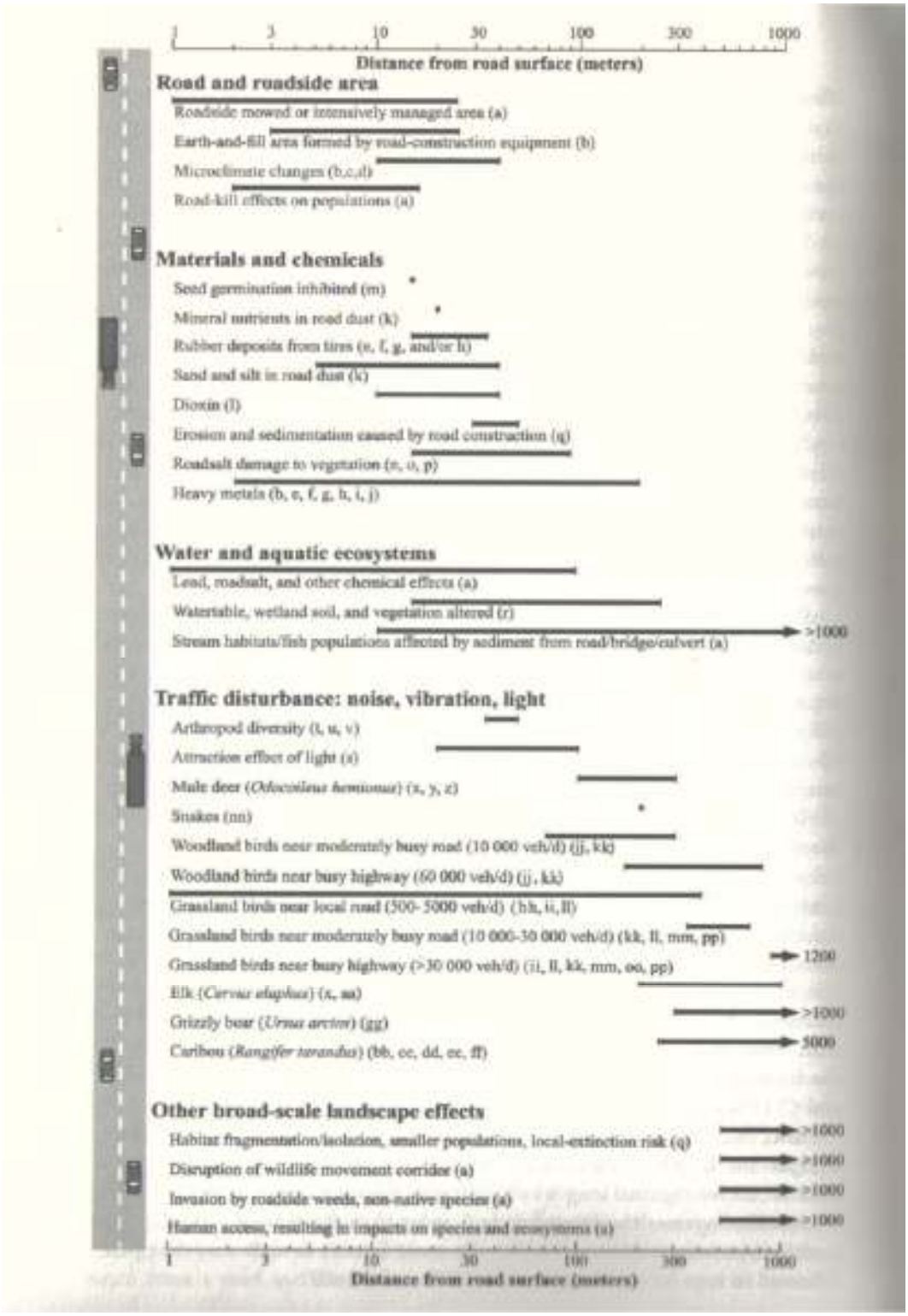


Figure 11.8. Road-effect zone and three mechanisms determining its width and form. Illustrative effects listed on right based on one or more studies. Three mechanisms—gravity (upslope/downslope), wind (upwind/downwind), and behavior or habitat suitability (less/more)—in addition to walls or hills near the road, produce greater effect-distances on one side of the road than on the other. With a scarcity of data, in general distances for the examples are approximately halved on the left side. Shaded area = road-effect zone. Each effect typically extends outward along a stretch of road or road segment; P = an effect extending from a point on the road. Adapted from Forman and Alexander (1998).



There will be a significant advantage to upgrading an existing road corridor because a substantial linear zone of disturbance will simply be expanded. Construction of VicRoads Option 1 means that there would be two significant road corridors with significant ongoing disturbance in each corridor as well as the habitat fragmentation of the new Western Highway proposed as Option 1. Using the Northern Option limits fragmentation of existing habitats and limits the future disturbance from traffic and runoff to one corridor.

Conclusions

The estimated direct removals of Large Old Trees would be much less in the Northern Option than Option 1.

An important factor to consider is the likely lesser impact of upgrading an existing road corridor rather than building a completely new divided road. The option approved under the EES would have far more impact on the local environment by creating two road corridors rather than just upgrading the existing Western Highway in this section.

Net Gain Targets of the two route options are roughly similar although Habitat hectare losses of the Northern Option were slightly larger with the calculations used in this report. The difference between the two options is more than equalised because:

- patch quality losses due to fragmentation and lost Landscape Quality scores of retained remnants by VicRoads Option 1could easily be more than a Habitat hectare;
- refinements in design that could reduce native vegetation losses have not been made for the Northern Option;
- additional lower quality patches recorded this year by Ecology and Heritage Partners (April 2016) have not been included here; and
- various offsite and indirect effects of a "first cut" have not been included in assessment of Option 1's impacts.

On balance, the Northern Option is likely to have significantly less impact on indigenous flora and fauna than VicRoads Option 1 based on this assessment of the most current available data.

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Written by Lincoln Kern

Appendix 1 Northern Option Spreadsheet

Table 1. Habitat Hectare Assessment

			5	10	11	1	2	3	4	6	7	8	9	12	13	14	15	16	17	18	19	20	21
Habitat Zone			**HDF1**	**HDF2**	**HDF3**	**HHRW01**	**HHRW02**	**HHRW03**	**HHRW04**	**HHRW05**	**HHRW06**	**HHRW07**	**HHRW08**	**HHRW09**	**HHRW10**	**HHRW11**	**HHRW12**	**HHRW13**	**HHRW14**	**HHRW15**	**HW1**	**HW2**	**HW3**
Bioregion			CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU
EVC Name (initials)			HDF	HDF	HDF	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HW	HW	HW
EVC Number			20	20	20	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	48	48	48
EVC Conservation Status			LC	LC	LC	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	D	D	D
Size of Zone (ha)			0.69	1.54	0.55	1.72	3.96	0.34	2.69	1.92	2.65	0.13	1.25	1.93	0.2	2.17	2.65	9.22	1.02	5.61	3.27	7.51	2.36
		Max Score	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**
Site Condition	Large Old Trees	10	5	7	3	0	9	0	5	10	0	0	5	7	2	7	3	3	3	3	7	2	0
	Canopy Cover	5	4	4	2	0	4	0	4	4	0	0	4	4	4	4	2	2	2	2	4	4	0
	Understorey	25	25	20	20	25	25	5	25	25	25	25	25	20	20	20	20	20	20	20	20	25	20
	Lack of Weeds	15	13	13	13	7	7	4	7	11	7	7	7	13	13	13	13	13	13	13	13	13	13
	Recruitment	10	10	5	5	6	10	5	10	10	6	6	10	10	10	10	10	10	10	10	10	10	10
	Organic Litter	5	5	5	5	5	5	3	5	5	5	5	5	5	5	5	3	3	3	3	3	5	5
	Logs	5	5	5	3	2	5	0	5	5	2	2	5	5	4	2	3	3	3	3	3	4	0
	EVC Standardiser		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Standardised Score	75	67	59	51	45	65	17	61	70	45	45	61	64	58	61	54	54	54	54	60	63	48
Landscape value	Patch Size	10	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	Neighbourhood	10																					
	Distance to Core	5																					
Habitat points		100	83	75	67	61	81	33	77	86	61	61	77	80	74	77	70	70	70	70	76	79	64
Habitat Score (habitat points/100)		**0.##**	**0.83**	**0.75**	**0.67**	**0.61**	**0.81**	**0.33**	**0.77**	**0.86**	**0.61**	**0.61**	**0.77**	**0.80**	**0.74**	**0.77**	**0.70**	**0.70**	**0.70**	**0.70**	**0.76**	**0.79**	**0.64**
Conservation Significance: Habitat Score x EVC Conservation Status			**Medium**	**Medium**	**Medium**	**Very High**	**Very High**	**High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**High**	**High**	**High**
No. of Large Old Trees																							

Practical Ecology
PO Box 228 Preston Victoria 3072 Office: 2B Stott Street Preston Victoria p 03 9484 1555 f 03 9484 9133
e enquiries@practicalecology.com.au www.practicalecology.com.au

Table 2. Quantity and significance of losses in native vegetation patches

			5	10	11	3	1	2	4	6	7	8	9	12	13	14	15	16	17	18	19	20	21
Habitat Zone			**HDF1**	**HDF2**	**HDF3**	**HHRW03**	**HHRW01**	**HHRW02**	**HHRW04**	**HHRW05**	**HHRW06**	**HHRW07**	**HHRW08**	**HHRW09**	**HHRW10**	**HHRW11**	**HHRW12**	**HHRW13**	**HHRW14**	**HHRW15**	**HW1**	**HW2**	**HW3**
Bioregion			CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU
EVC Name (initials)			HDF	HDF	HDF	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HW	HW	HW
EVC Number			20	20	20	71	71	71	71	71	71	71	71	71	71	71	71	71	71	71	48	48	48
EVC Conservation Status			LC	LC	LC	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	D	D	D
Size of Zone (ha)			0.69	1.54	0.55	0.34	1.72	3.96	2.69	1.92	2.65	0.13	1.25	1.93	0.2	2.17	2.65	9.22	1.02	5.61	3.27	7.51	2.36
		Max Score	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**
Site Condition	Large Old Trees	10	5	7	3	0	0	9	5	10	0	0	5	7	2	7	3	3	3	3	7	2	0
	Canopy Cover	5	4	4	2	0	0	4	4	4	0	0	4	4	4	4	2	2	2	2	4	4	0
	Understorey	25	25	20	20	5	25	25	25	25	25	25	25	20	20	20	20	20	20	20	20	25	20
	Lack of Weeds	15	13	13	13	4	7	7	7	11	7	7	7	13	13	13	13	13	13	13	13	13	13
	Recruitment	10	10	5	5	5	6	10	10	10	6	6	10	10	10	10	10	10	10	10	10	10	10
	Organic Litter	5	5	5	5	3	5	5	5	5	5	5	5	5	5	5	3	3	3	3	3	5	5
	Logs	5	5	5	3	0	2	5	5	5	2	2	5	5	4	2	3	3	3	3	3	4	0
	EVC Standardiser		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1						
	Standardised Site Score	75	67	59	51	17	45	65	61	70	45	45	61	64	58	61	54	54	54	54	60	63	48
Landscape value	Patch Size	10	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16
	Neighbourhood	10																					
	Distance to Core	5																					
Habitat points		100	83	75	67	33	61	81	77	86	61	61	77	80	74	77	70	70	70	70	76	79	64
Habitat Score (habitat points/100)		**0.##**	**0.83**	**0.75**	**0.67**	**0.33**	**0.61**	**0.81**	**0.77**	**0.86**	**0.61**	**0.61**	**0.77**	**0.80**	**0.74**	**0.77**	**0.70**	**0.70**	**0.7**	**0.7**	**0.76**	**0.79**	**0.64**
East bound		ha	0.000	0.000	0.000	0.000	0.000	0.265	0.000	0.149	0.000	0.000	0.000	0.500	0.000	0.000	0.751	0.528	0.360	0.000	1.000	0.000	0.000
West Bound		ha	0.141	0.000	0.000	0.199	0.764	0.113	0.004	0.000	0.793	0.000	0.000	0.034	0.008	0.512	0.000	0.000	0.000	0.000	0.808	2.224	0.213
Area losses (E+W)		ha	0.141	0.000	0.000	0.199	0.764	0.378	0.004	0.149	0.793	0.000	0.000	0.534	0.008	0.512	0.751	0.528	0.360	0.000	1.808	2.224	0.213
Total Habitat-hectare Losses (ha)			**0.117**	**0.000**	**0.000**	**0.066**	**0.466**	**0.306**	**0.003**	**0.128**	**0.484**	**0.000**	**0.000**	**0.427**	**0.006**	**0.394**	**0.526**	**0.370**	**0.252**	**0.000**	**1.374**	**1.757**	**0.136**
Overall Conservation Significance			**Medium**	**Medium**	**Medium**	**High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**Very High**	**High**	**High**	**High**
Net gain multiplier			1.0	1.0	1.0	1.5	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1.5	1.5	1.5
Gain target (HHa)			**0.117**	**0.000**	**0.000**	**0.099**	**0.932**	**0.612**	**0.006**	**0.256**	**0.967**	**0.000**	**0.000**	**0.854**	**0.012**	**0.788**	**1.051**	**0.739**	**0.504**	**0.000**	**2.061**	**2.635**	**0.204**

HZ No.	Habitat Zone	EVC Name	EVC Number	Conservation Significance	Area (ha)	Hab Ha loss	Net Gain Multiplier	Gain target (Hab Zone Ha)	Gain target (Hab Ha)
5	**HDF1**	Heathy Dry Forest (HDF)	20	**Medium**	0.141	0.117	1.0	0.117	**0.117**
10	**HDF2**	Heathy Dry Forest (HDF)	20	**Medium**	0.000	0.000	1.0	0.000	
11	**HDF3**	Heathy Dry Forest (HDF)	20	**Medium**	0.000	0.000	1.0	0.000	
3	**HHRW03**	Hills Herb-rich Woodland (HHRW)	71	**High**	0.199	0.066	1.5	0.099	**0.099**
1	**HHRW01**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.764	0.466	2	0.932	**6.724**
2	**HHRW02**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.378	0.306	2	0.612	
4	**HHRW04**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.004	0.003	2	0.006	
6	**HHRW05**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.149	0.128	2	0.256	
7	**HHRW06**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.793	0.484	2	0.967	
8	**HHRW07**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.000	0.000	2	0.000	
9	**HHRW08**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.000	0.000	2	0.000	
12	**HHRW09**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.534	0.427	2	0.854	
13	**HHRW10**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.008	0.006	2	0.012	
14	**HHRW11**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.512	0.394	2	0.788	
15	**HHRW12**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.751	0.526	2	1.051	
16	**HHRW13**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.528	0.370	2	0.739	
17	**HHRW14**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.360	0.252	2	0.504	
18	**HHRW15**	Hills Herb-rich Woodland (HHRW)	71	**Very High**	0.000	0.000	2	0.000	
19	**HW1**	Heathy Woodland (HW)	48	**High**	1.808	1.374	1.5	2.061	**4.901**
20	**HW2**	Heathy Woodland (HW)	48	**High**	2.224	1.757	1.5	2.635	
21	**HW3**	Heathy Woodland (HW)	48	**High**	0.213	0.136	1.5	0.204	
				TOTAL	**9.366**	**6.812**		**11.840**	**11.840**

Appendix 2 VicRoads Option Spreadsheet

Table 1. Habitat Hectare Assessment

			Map 1A. A	Map 1B. E	Map 1C. C	1	3	3A	4	7	8	8A	17	18	19	20	2	17B	9	10
Habitat Zone			ATHRW4	ATHRW4	HHRW1	HHRW115	HHRW117	HHRW1	HHRW106	HHRW101	HHRW100	HHRW2	HHRW84	HHRW93	HHRW94	HHRW95	GDF116	GDF4	GW99	GW98
Bioregion			CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU
EVC Name (initials)			ATHRW	ATHRW	HHRW1	HHRW	HHRW	HHRW1	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	HHRW	GDF	GDF	GW	GW
EVC Number			67	67	71	71	71	71	71	71	71	71	71	71	71	175	22	22	175	175
EVC Conservation Status			EN	EN	V	V	V	V	V	V	V	V	V	V	V	V	V	V	E	E
Quadra			EHP2012	EHP2012	EHP2012	115	117	EHP2012	106	101	100	EHP2012	84	93	94	95	116	EHP2012	99	98
Size of Zone (ha)																				
		Max Score	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**
Site Condition	Large Old Trees	10	8	8	6	0	3	6	3	3	0	0	3	0	3	0	0	0	3	3
	Canopy Cover	5	5	5	3	0	0	3	3	3	3	3	3	0	3	0	0	0	3	3
	Understorey	25	15	15	15	5	5	15	15	5	15	5	15	5	15	10	5	5	5	5
	Lack of Weeds	15	6	6	2	11	7	2	7	11	11	2	11	11	11	7	11	0	7	7
	Recruitment	10	10	10	10	0	0	10	6	5	6	5	6	3	3	6	0	5	3	0
	Organic Litter	5	5	5	5	5	3	5	3	5	5	4	3	5	3	3	5	4	3	3
	Logs	5	2	2	4	0	0	4	0	3	5	2	0	0	0	0	0	0	0	0
Landscape Value	Patch Size	10	0	0	0	1	2	0	2	1	2	0	1	1	2	2	1	0	2	2
	Neighbourhood	10	16	16	16	2	3	16	2	2	2	16	5	4	5	5	3	8	1	2
	Distance to Core	5	0	0	0	4	4	0	2	4	4	0	4	4	4	4	4	0	4	4
Habitat points		100	67	67	61	28	27	61	43	42	53	37	51	33	49	37	29	22	31	29
Habitat Score (habitat points/100)		**0.##**	**0.67**	**0.67**	**0.61**	**0.28**	**0.27**	**0.61**	**0.43**	**0.42**	**0.53**	**0.37**	**0.51**	**0.33**	**0.49**	**0.37**	**0.29**	**0.22**	**0.31**	**0.29**
Conservation Significance: Habitat Score x EVC Conservation Status			**Very High**	**Very High**	**Very High**	**High**	**Medium**	**Very High**	**High**	**High**	**Very High**	**High**	**Very High**	**High**	**High**	**High**	**Medium**	**Medium**	**High**	**High**
No. of Large Old Trees																				

11	12	13	14	15	16	5	5A	6	17A	20A
GW97	GW96	GW91	GW89	GW87	GW85	HDF103	HDF3	HDF102	HDF3	HW4
CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU
GW	GW	GW	GW	GW	GW	HDF	HDF	HDF	HDF	HW
175	175	175	175	175	175	20	20	20	20	48
E	E	E	E	E	E	LC	LC	LC	LC	D
97	96	91	89	87	85	103	EHP2012	175	EHP2012	EHP2012
Score	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**
3	4	3	3	0	3	0	4	3	4	4
3	3	0	3	0	0	3	5	5	5	5
5	15	5	15	5	5	15	15	15	15	10
7	11	11	11	7	7	11	2	11	2	2
0	3	1	3	0	1	3	10	6	10	5
3	5	5	5	3	3	3	5	3	5	5
0	0	0	0	0	0	2	2	2	2	2
2	2	6	2	1	6	1	0	1	0	0
2	2	5	5	4	4	2	16	2	16	16
4	4	4	4	4	4	2	0	2	0	0
29	49	40	51	24	33	42	59	50	59	49
0.29	**0.49**	**0.40**	**0.51**	**0.24**	**0.33**	**0.42**	**0.59**	**0.50**	**0.59**	**0.49**
High	**Very High**	**Very High**	**Very High**	**High**	**High**	**Low**	**Low**	**Low**	**Low**	**Medium**

Table 2. Quantity and significance of losses in native vegetation patches

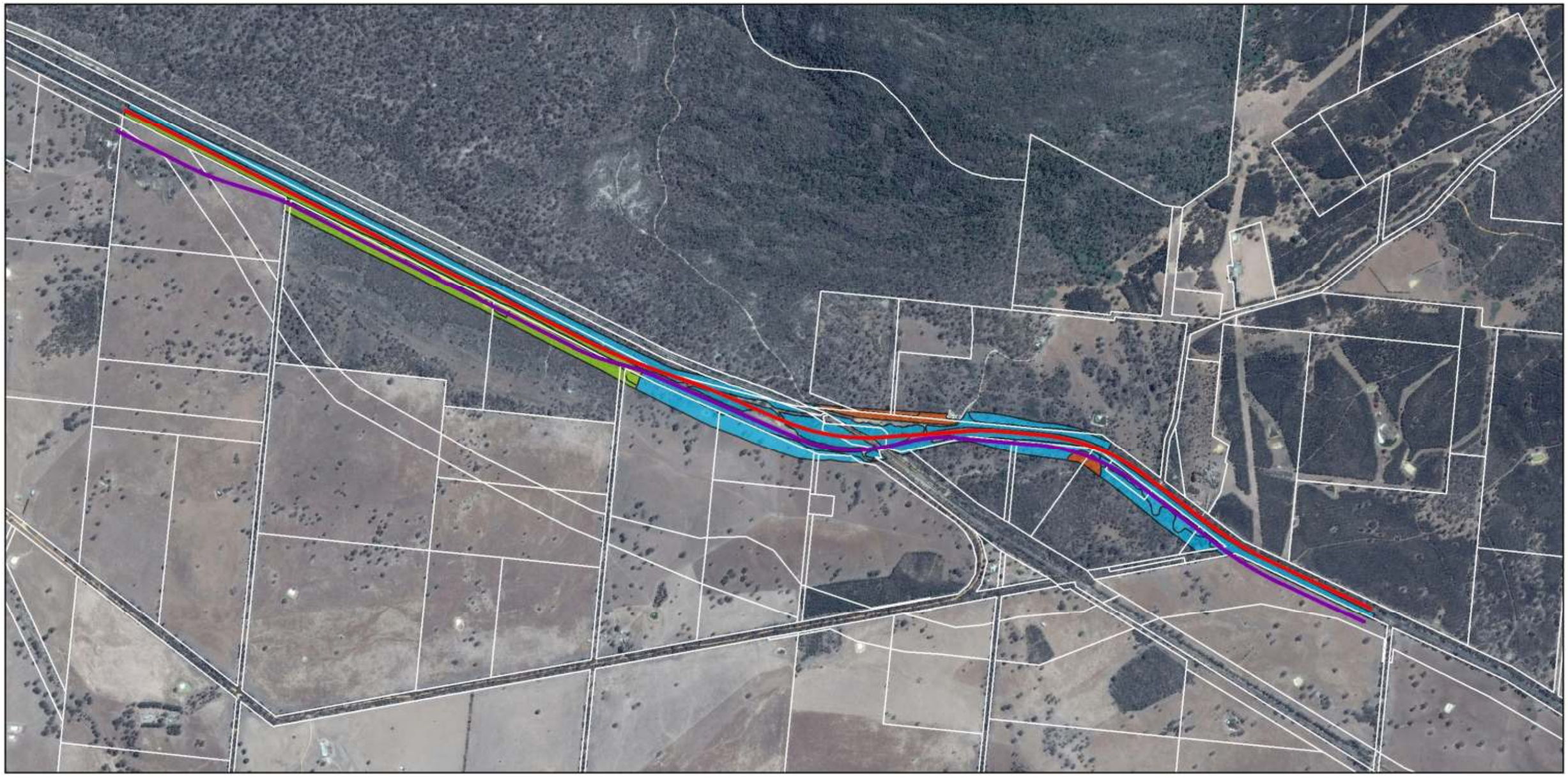
			A	B	C	2	3	3A	4	7	8	8A	17	17B	18	19	20	1	9	10	11	12	13
Habitat Zone			**ATHRW4**	**ATHRW4**	**HHRW1**	**GDF116**	**HHRW117**	**HHRW1**	**HHRW106**	**HHRW101**	**HHRW100**	**HHRW2**	**HHRW84**	**GDF4**	**HHRW93**	**HHRW94**	**HHRW95**	**HHRW115**	**GW99**	**GW98**	**GW97**	**GW96**	**GW91**
Bioregion			CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU
EVC Name (initials)			ATHRW	ATHRW	HHRW1	GDF	HHRW	HHRW1	HHRW	HHRW	HHRW	HHRW	HHRW	GDF	HHRW	HHRW	HHRW	HHRW	GW	GW	GW	GW	GW
EVC Number			67	67	71	22	71	71	71	71	71	71	71	22	71	71	175	71	175	175	175	175	175
EVC Conservation Status			EN	EN	V	V	V	V	V	V	V	V	V	V	V	V	V	V	E	E	E	E	E
Size of Zone (ha)			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Max Score	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**
Site Condition	Large Old Trees	10	8	8	6	0	3	6	3	3	0	0	3	0	0	3	0	0	3	3	3	4	3
	Canopy Cover	5	5	5	3	0	0	3	3	3	3	3	3	0	0	3	0	0	3	3	3	3	0
	Understorey	25	15	15	15	5	5	15	15	5	15	5	15	5	5	15	10	5	5	5	5	15	5
	Lack of Weeds	15	6	6	2	11	7	2	7	11	11	2	11	0	11	11	7	11	7	7	7	11	11
	Recruitment	10	10	10	10	0	0	10	6	5	6	5	6	5	3	3	6	0	3	0	0	3	1
	Organic Litter	5	5	5	5	5	3	5	3	5	5	4	3	4	5	3	3	5	3	3	3	5	5
	Logs	5	2	2	4	0	0	4	0	3	5	2	0	0	0	0	0	0	0	0	0	0	0
Landscape value	Patch Size	10	0	0	0	1	2	0	2	1	2	0	1	0	1	2	2	1	2	2	2	2	6
	Neighbourhood	10	16	16	16	3	3	16	2	2	2	16	5	8	4	5	5	2	1	2	2	2	5
	Distance to Core	5	0	0	0	4	4	0	2	4	4	0	4	0	4	4	4	4	4	4	4	4	4
Habitat points		100	67	67	61	29	27	61	43	42	53	37	51	22	33	49	37	28	31	29	29	49	40
Habitat Score (habitat points/100)		**0.##**	**0.67**	**0.67**	**0.61**	**0.29**	**0.27**	**0.61**	**0.43**	**0.42**	**0.53**	**0.37**	**0.51**	**0.22**	**0.33**	**0.49**	**0.37**	**0.28**	**0.31**	**0.29**	**0.29**	**0.49**	**0.40**
Area losses		ha	0.709	0.146	0.896	0.113	1.041	1.041	0.156	0.320	0.234	0.234	0.153	0.806	0.294	0.134	0.847	0.562	0.714	1.532	0.723	0.185	1.231
Total Habitat-hectare Losses (ha)			0.475	0.098	0.547	0.033	0.281	0.635	0.067	0.134	0.124	0.087	0.078	0.177	0.097	0.066	0.313	0.157	0.221	0.444	0.210	0.090	0.492
Overall Conservation Significance			**Very High**	**Very High**	**Very High**	**Medium**	**Medium**	**Very High**	**High**	**High**	**Very High**	**High**	**Very High**	**Medium**	**High**	**High**	**High**	**High**	**High**	**High**	**High**	**Very High**	**Very High**
Net gain multiplier			2.00	2.00	2.00	1.00	1.00	1.00	1.50	1.50	2.00	1.50	2.00	1.00	1.50	1.50	1.50	1.50	1.50	1.50	1.50	2.00	2.00
Gain target (HHa)			**0.950**	**0.196**	**1.093**	**0.033**	**0.281**	**0.635**	**0.101**	**0.202**	**0.248**	**0.130**	**0.156**	**0.177**	**0.146**	**0.099**	**0.470**	**0.236**	**0.332**	**0.666**	**0.314**	**0.181**	**0.985**

14	15	16	5	6	5A	17A	20A
GW89	**GW87**	**GW85**	**HDF103**	**HDF102**	**HDF3**	**HDF3**	**HW4**
CVU	CVU	CVU	CVU	CVU	CVU	CVU	CVU
GW	GW	GW	HDF	HDF	HDF	HDF	HW
175	175	175	20	20	20	20	48
E	E	E	LC	LC	LC	LC	D
0	0	0	0	0	0	0	0
Score	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**	**Score**
3	0	3	0	3	4	4	4
3	0	0	3	5	5	5	5
15	5	5	15	15	15	15	10
11	7	7	11	11	2	2	2
3	0	1	3	6	10	10	5
5	3	3	3	3	5	5	5
0	0	0	2	2	2	2	2
2	1	6	1	1	0	0	0
5	4	4	2	2	16	16	16
4	4	4	2	2	0	0	0
51	24	33	42	50	59	59	49
0.51	**0.24**	**0.33**	**0.42**	**0.50**	**0.59**	**0.59**	**0.49**
0.888	0.358	0.756	0.724	0.381	0.128	0.814	0.400
0.453	0.086	0.249	0.304	0.190	0.076	0.480	0.196
Very High	**High**	**High**	**Low**	**Low**	**Low**	**Low**	**Medium**
2.00	1.50	1.50	1.00	1.00	1.00	1.00	1.00
0.906	**0.129**	**0.374**	**0.304**	**0.190**	**0.076**	**0.480**	**0.196**

	Low	Medium	High	Very High	Total
Areas to be removed (ha)	**2.047**	**2.361**	**6.629**	**5.482**	**16.518**
Habitat-hectare losses	**1.050**	**0.687**	**2.132**	**2.992**	**6.861**
Net Gain Targets	**1.050**	**0.687**	**3.198**	**5.349**	**10.284**

Maps

Practical Ecology
PO Box 228 Preston Victoria 3072 Office: 2B Stott Street Preston Victoria p 03 9484 1555 f 03 9484 9133
e enquiries@practicalecology.com.au www.practicalecology.com.au



PRACTICAL ECOLOGY
ecological restoration & consulting
p. (03) 9484 1555 e. enquiries@practicalecology.com.au

Disclaimer
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Legend

- Westbound Carriageway (16m wide)
- Eastbound Carriageway (16m wide)
- Parcels

Habitat Zones (Practical Ecology 2012)

- 20 Heathy Dry Forest
- 48 Heathy Woodland
- 71 Hills Herb-rich Woodland

Details
Mapping by: Karen McGregor

Date: 8/07/2016

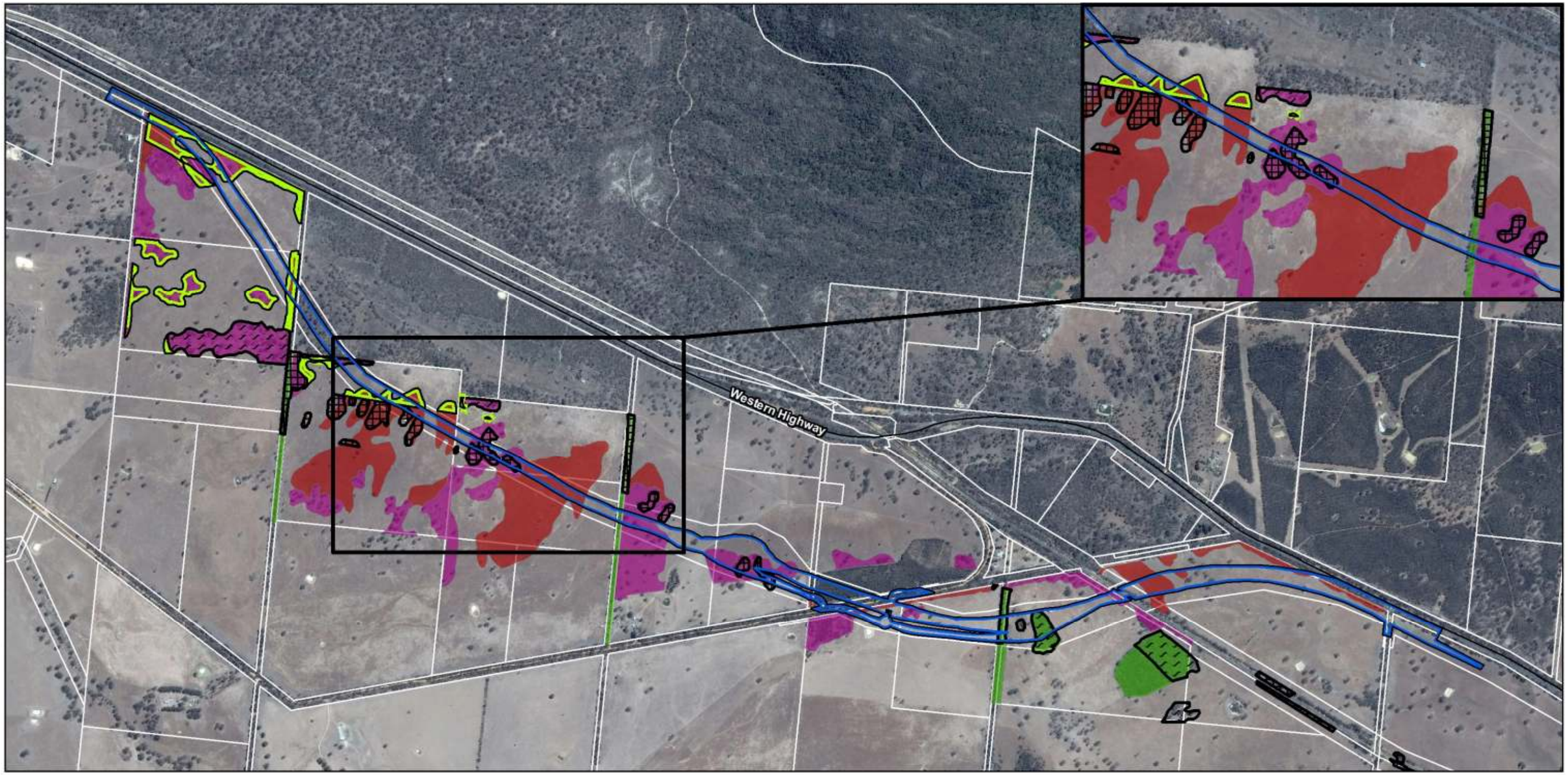
Data Source: Aerial photography from Google Earth Pro.

Map 1. Overview of New Alignment Options for Western Highway Upgrade

0 250 500 750 m

N

Scale 1:16,000 (Page size A3)



PRACTICAL ECOLOGY
ecological restoration & consulting
p. (03) 9484 1555 e. enquiries@practicalecology.com.au

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Legend

- Western Highway
- VicRoads Option 1
- Parcels

Vegetation Assessment (Blue Devil 2015)

- Grassy Forest
- Grassy Woodland
- Disclimax grassland

Vegetation Assessment (EHP 2015)

- BDC mapped Remnant Grassland and Grassy Woodland discounted as DTV in the EES
- Grassy Dry Forest
- Heathy Dry Forest

Note that Option1's severance of two north-south corridors of HDF was not apparent to decision makers due to the truncated mapping of these corridorrs in the EES

Details
Mapping by: Karen McGregor
Date: 8/07/2016
Data Source: Aerial photography from Google Earth Pro.
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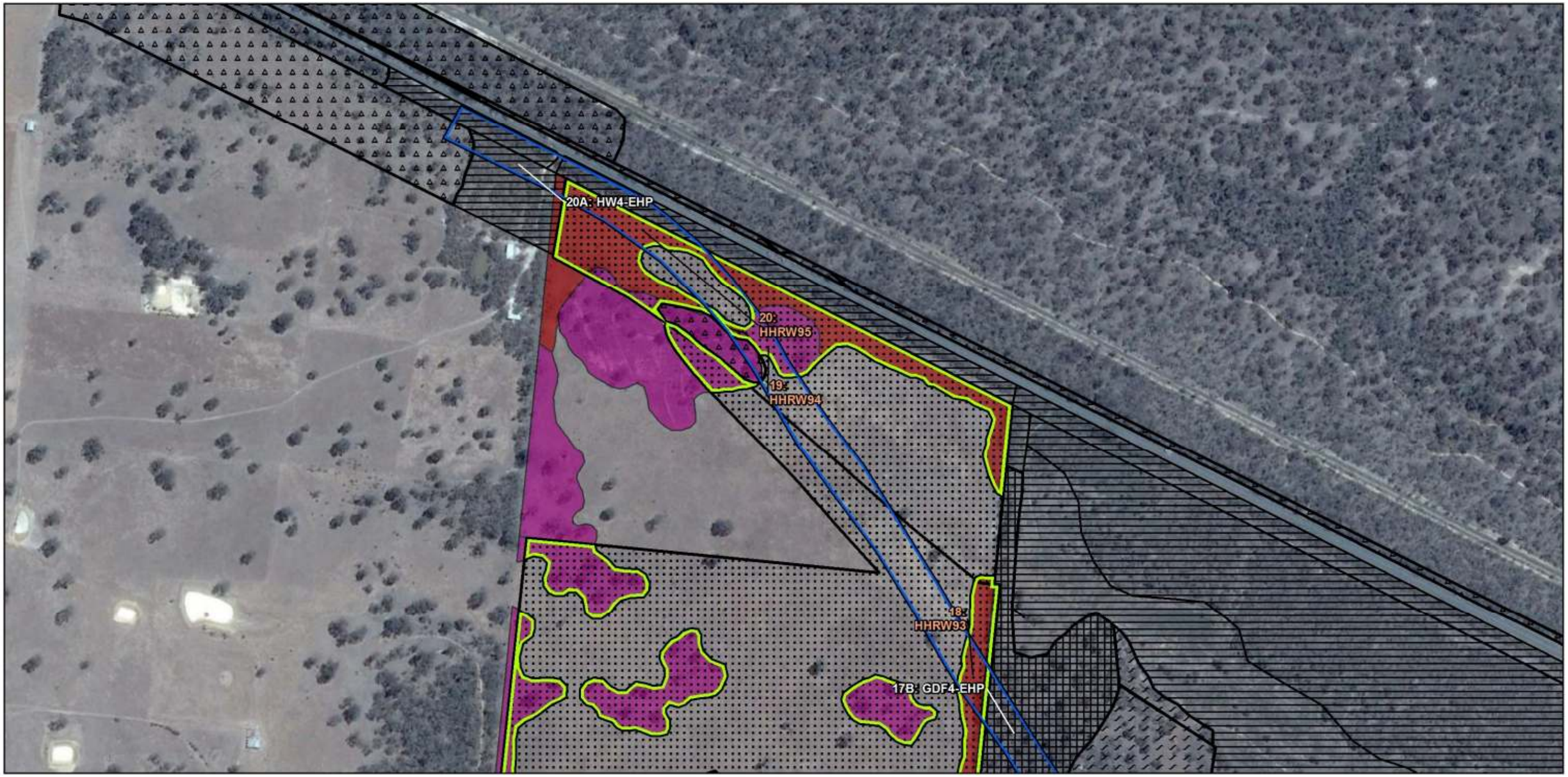
BDC: Blue Devil Consulting,
Vegetation assessment of VicRoads Option 2 By-pass on private land adjoining Langi Ghiran State Park V5.0, October 2015

Map 2. Patch data missing from VicRoads' EES for Western Highway Section 2, Option 1, mapped by BDC 2015

0 250 500 750 m

N

Scale 1:16,254 (Page size A3)



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Legend

VicRoads Option 1

Vegetation Assessment (Blue Devil 2015)
- Grassy Forest
- Grassy Woodland
- Disclimax grassland

Vegetation Assessment (EHP 2012)
- BDC mapped Remnant Grassland and Grassy Woodland discounted as DTV in the EES
- Degraded Treeless Vegetation
- Grassy Dry Forest
- Heathy Dry Forest
- Heathy Woodland
- Hills Herb-rich Woodland

Note that Option1's severance of two north-south corridors of GF was not apparent to decision makers due to the truncated mapping of these corridorrs in the EES

Details
Mapping by: Karen McGregor
Date: 8/07/2016
Data Source: Aerial photography from Google Earth Pro.

BDC: Blue Devil Consulting,
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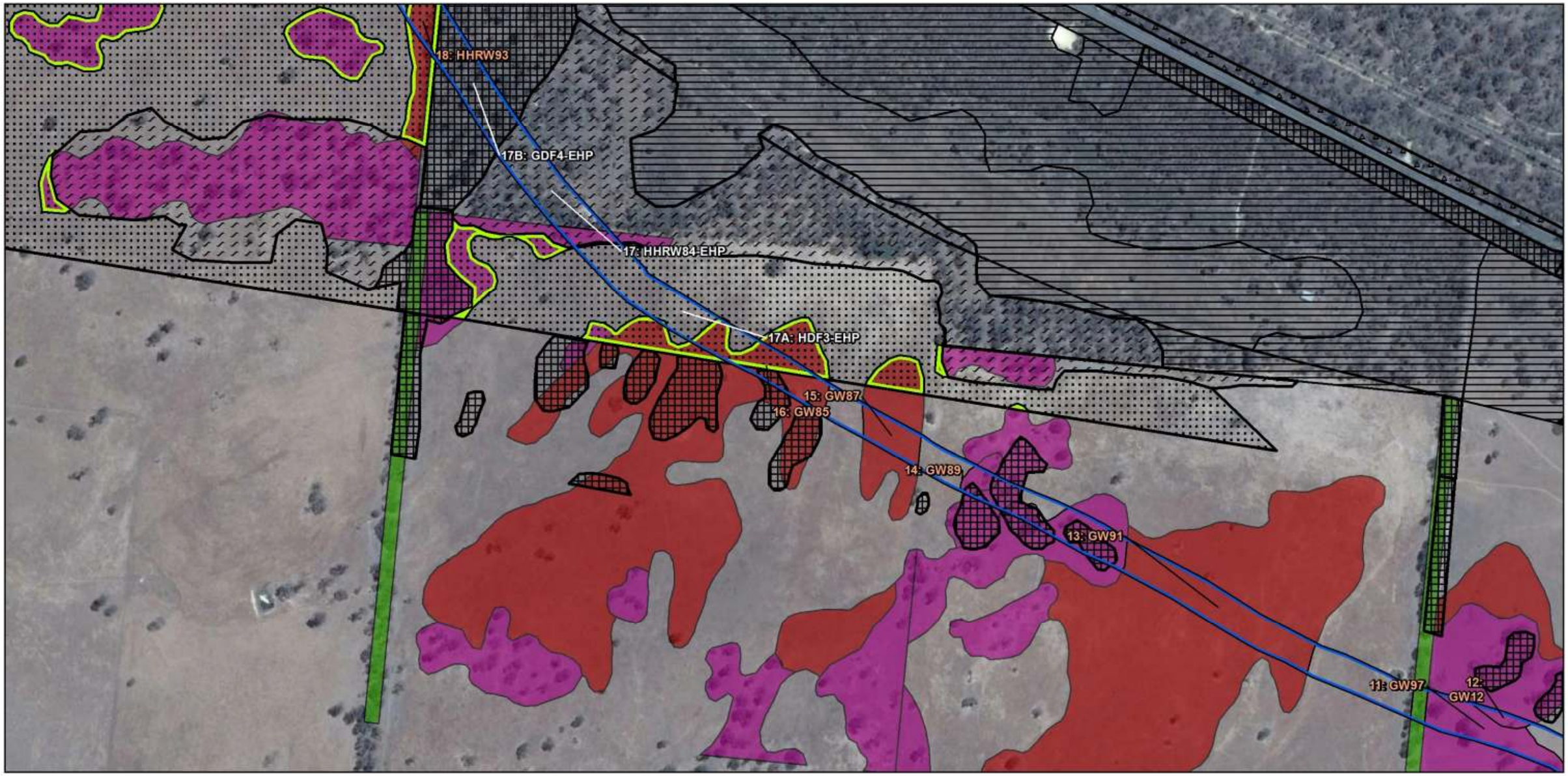
Map 3. Patch data used to calculate pacts from Western Highway Section 2, Option 1,

Map 1 of 4

0 50 100 150 200 m

N

Scale 1:5,660 (Page size A3)



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Legend

VicRoads Option 1

Vegetation Assessment (Blue Devil 2015)

- Grassy Forest
- Grassy Woodland
- Disclimax grassland

Vegetation Assessment (EHP 2012)

- BDC mapped Remnant Grassland and Grassy Woodland discounted as DTV in the EES
- Degraded Treeless Vegetation
- Grassy Dry Forest
- Heathy Dry Forest
- Heathy Woodland
- Hills Herb-rich Woodland

Note that Option1's severance of two north-south corridors of GF was not apparent to decision makers due to the truncated mapping of these corridorrs in the EES

Details
Mapping by: Karen McGregor
Date: 8/07/2016
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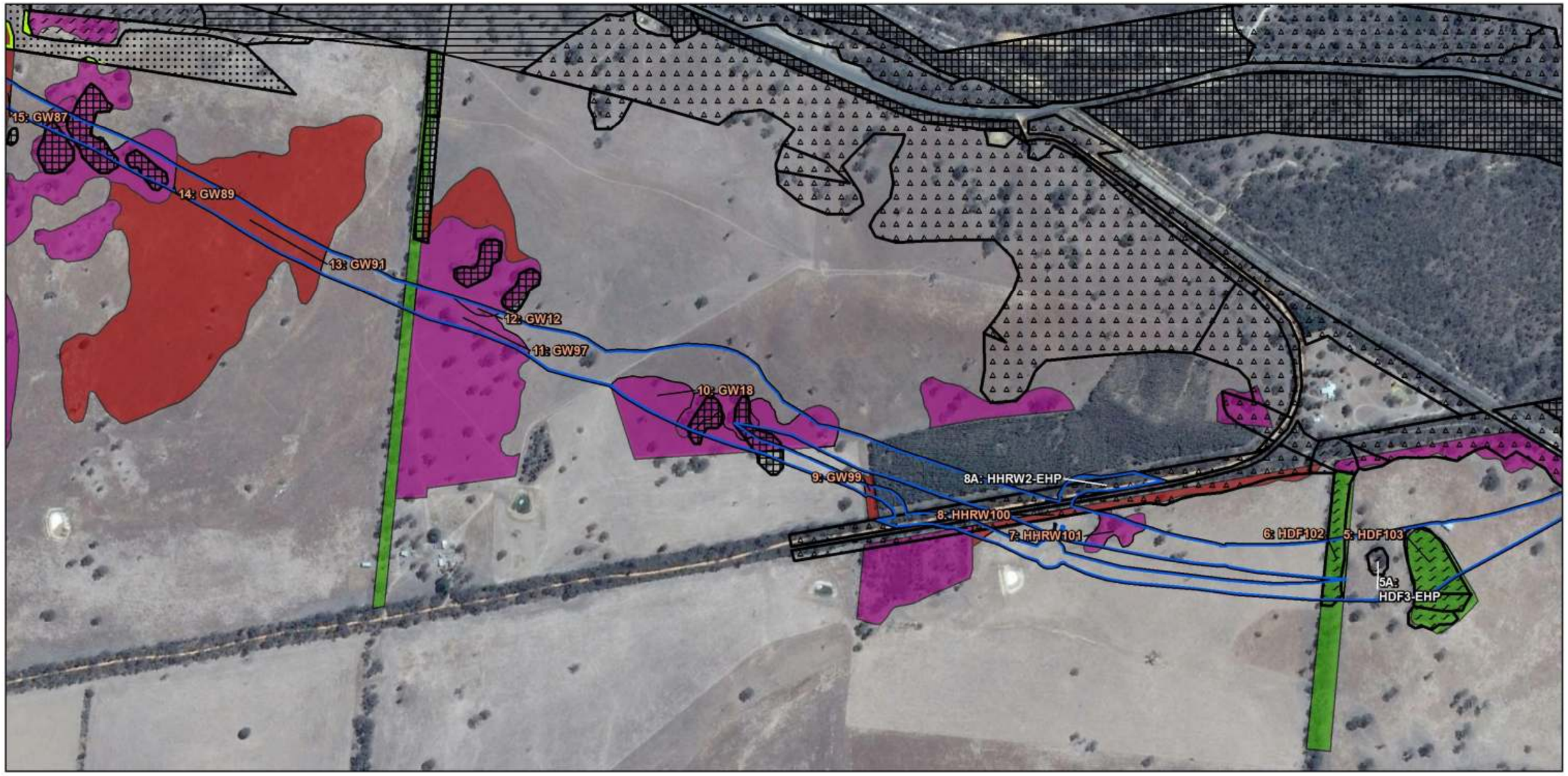
Map 4. Patch data used to calculate pacts from Western Highway Section 2, Option 1,

Map 2 of 4

0 50 100 150 200m

N

Scale 1:5,380 (Page size A3)



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Legend

VicRoads Option 1

Vegetation Assessment (Blue Devil 2015)

- Grassy Forest
- Grassy Woodland
- Disclimax grassland

Vegetation Assessment (EHP 2012)

- BDC mapped Remnant Grassland and Grassy Woodland discounted as DTV in the EES
- Degraded Treeless Vegetation
- Grassy Dry Forest
- Heathy Dry Forest
- Heathy Woodland
- Hills Herb-rich Woodland

Note that Option1's severance of two north-south corridors of GF was not apparent to decision makers due to the truncated mapping of these corridorrs in the EES

Details
Mapping by: Karen McGregor
Date: 8/07/2016
Data Source: Aerial photography from Google Earth Pro.

BDC: Blue Devil Consulting, Vegetation assessment of VicRoads Option 2 By-pass on private land adjoining Langi Ghiran State Park V5.0, October 2015

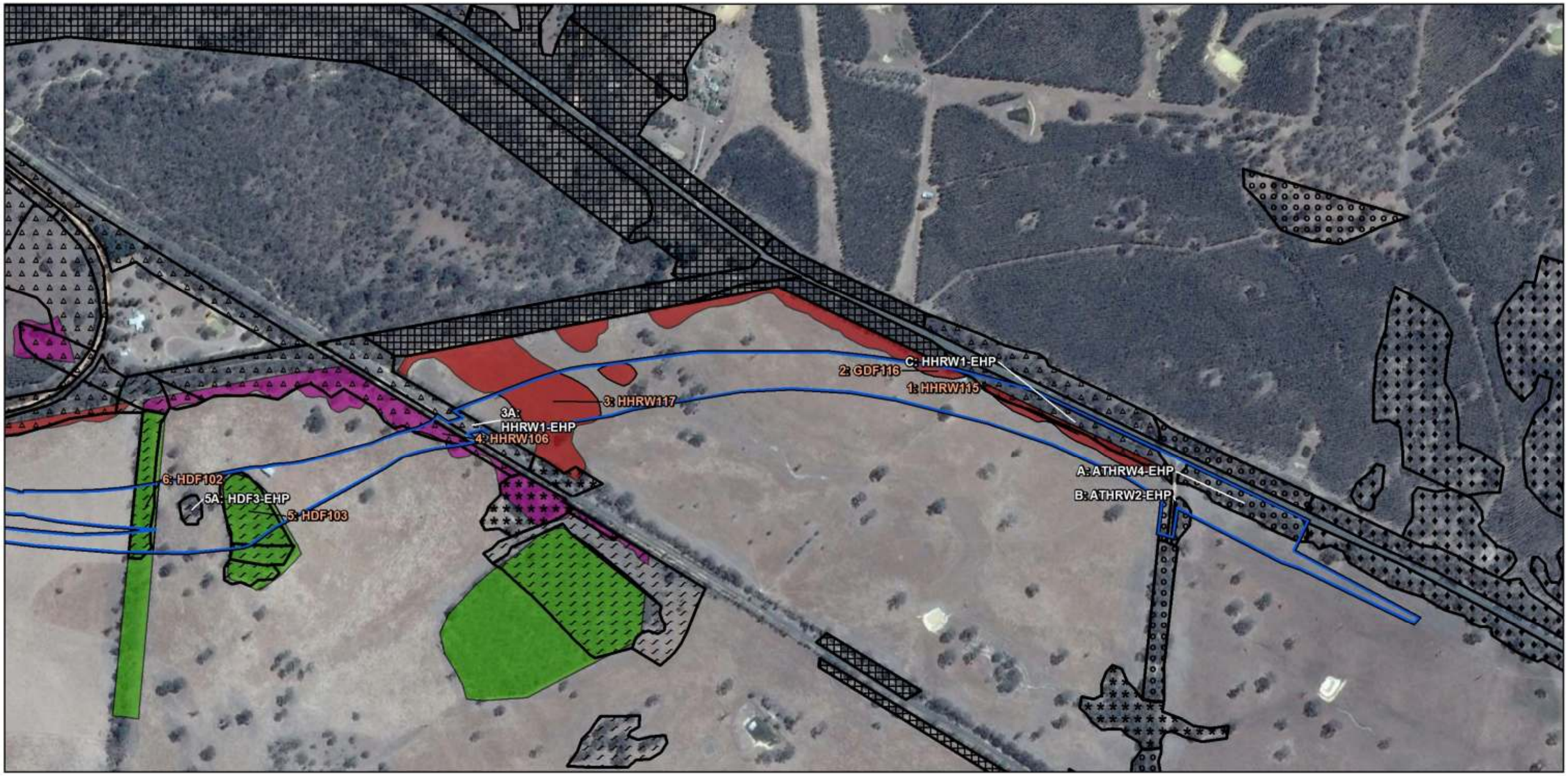
Map 5. Patch data used to calculate pacts from Western Highway Section 2, Option 1,

Map 3 of 4

0 50 100 150 200m

N

Scale 1:6,720 (Page size A3)



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Legend

VicRoads Option 1

Vegetation Assessment (Blue Devil 2015)

- Grassy Forest
- Grassy Woodland
- Disclimax grassland

Vegetation Assessment (EHP 2012)

- BDC mapped Remnant Grassland and Grassy Woodland discounted as DTV in the EES
- Alluvial Terraces Herb-rich Woodland
- Creekline Grassy Woodland
- Grassy Dry Forest
- Heathy Dry Forest
- Hills Herb-rich Woodland
- Plains Grassy Woodland

Note that Option1's severance of two north-south corridors of GF was not apparent to decision makers due to the truncated mapping of these corridorrs in the EES

Details
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Map 6. Patch data used to calculate pacts from Western Highway Section 2, Option 1,

Map 4 of 4

0 50 100 150 200m

N

Scale 1:6,110 (Page size A3)

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Legend

- Parcels
- Alternative alignment ("Northern option")
- VicRoads Option 1

Trees Lost

- Alternative alignment (Northern option)
- VicRoads Option 1

Details
Mapping by: Karen McGregor
Date: 8/07/2016
Data Source: Aerial photography from Google Earth Pro.

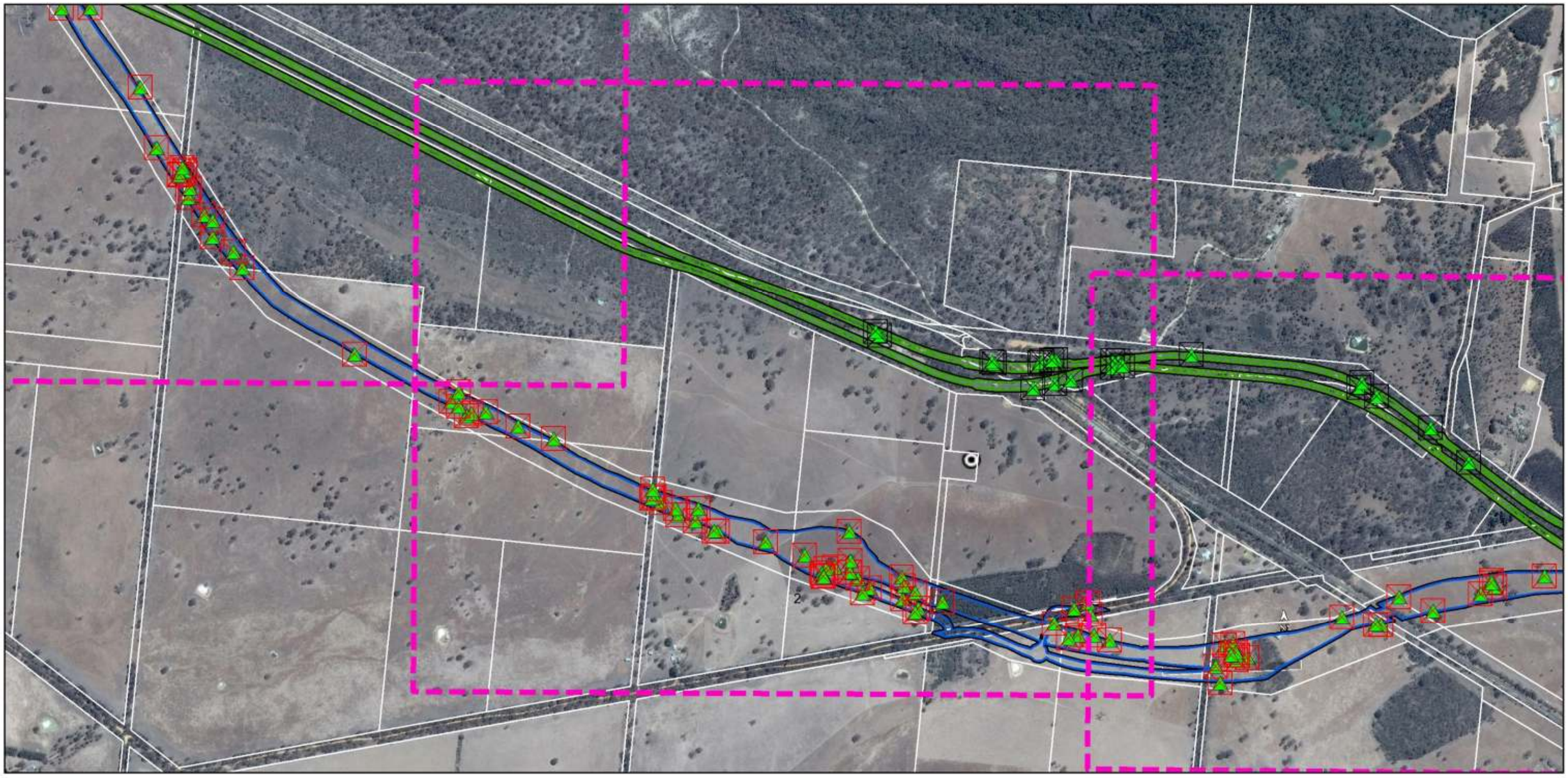
BDC: Blue Devil Consulting, Vegetation assessment of VicRoads Option 2 By-pass on private land adjoining Langi Ghiran State Park V5.0, October 2015

Map 7. Estimating lost large old trees for both alignments

N

0 100 200 300 400 500 m

Scale 1:10,490 (Page size A3)



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Legend

- Parcels
- Alternative alignment ("Northern option")
- VicRoads Option 1

Trees Lost

- Alternative alignment (Northern option)
- VicRoads Option 1

Details
Mapping by: Karen McGregor
Date: 8/07/2016
Data Source: Aerial photography from Google Earth Pro.

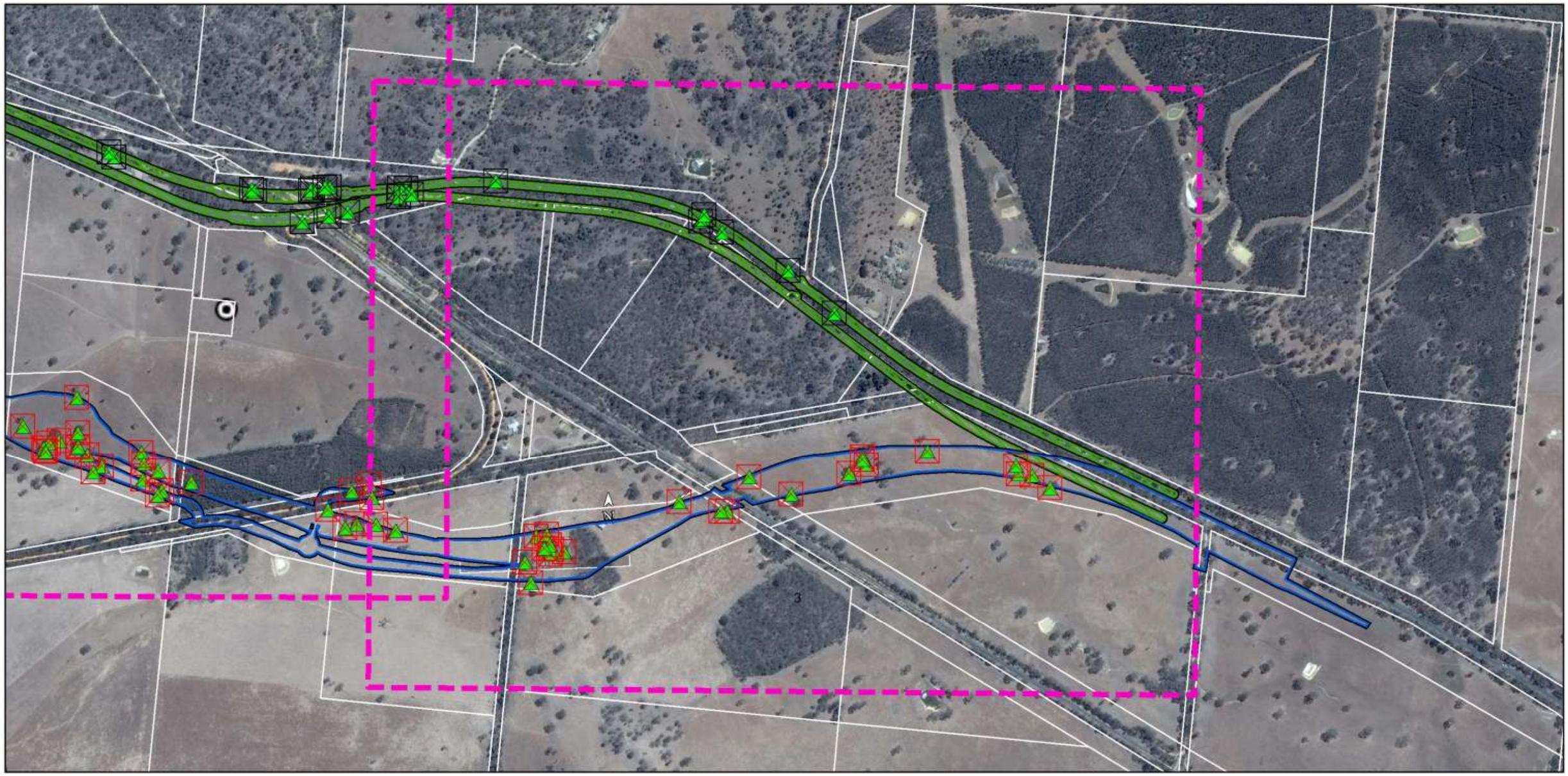
BDC: Blue Devil Consulting,
Vegetation assessment of VicRoads Option 2 By-pass on private land adjoining Langi Ghiran State Park V5.0, October 2015

Map 8. Estimating lost large old trees for both alignments

N

0 100 200 300 400 500 m

Scale 1:11,190 (Page size A3)



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Legend

- Parcels
- Alternative alignment ("Northern option")
- VicRoads Option 1

Trees Lost

- Alternative alignment (Northern option)
- VicRoads Option 1

Details
Mapping by: Karen McGregor
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Map 9. Estimating lost large old trees for both alignments

Page 3 of 3

N

0 100 200 300 400 500 m

Scale 1:9,150 (Page size A3)