SECTION 2. RECOMMENDATIONS

2.1 APPLICATION

The following recommendations are based on the results of our assessment, and are made in accordance with *SEPPs (Waters of Victoria)*, the *Code of Practice - Onsite Wastewater Management*, E.P.A. Publication 891.4, July 2016, *AS 1726*, and *AS/NZS 1547:2012*.

They are based on the mean saturated hydraulic conductivity of the limiting clayey materials and are designed to demonstrate the viability of on-site effluent disposal for a residence and a daily effluent production of up to 750 litres and are considered to be conservative.

2.2 SUBSURFACE IRRIGATION

2.2.1 General. Based on the results of the water balance analysis and considering the prevailing surficial and subsurface conditions including soil profile thickness[d] and slope and on condition that adequate site drainage is provided (as described in Section 2.4, below), on-site irrigation systems are appropriate for effluent disposal for land-soil units A and B.

2.2.2 Effluent. For each allotment, effluent will be generated from a residence and will include black and grey water (all wastes).

2.2.2.1 Effluent Quality. Effluent shall be treated by AWTS or sand filter to a standard that meets or exceeds the water quality requirements of the 20/30 standard for BOD/SS.

2.2.2.2 Effluent Quantity. The daily effluent volume of 750 litres has been calculated from *Code of Practice - Onsite Wastewater Management*, E.P.A. Publication 891.4, July 2016, Table 4 and assumes mains water (equivalent) and WELS-rated water-reduction fixtures and fittings – minimum 4 Stars for dual-flush toilets, shower-flow restrictors, aerator taps, flow/pressure control valves and minimum 3 Stars for all appliances.

2.2.2.3 Load Balancing. Transient hydraulic loads in excess of the expected daily load may occur. In addition, and in the case of power outages and/or mechanical breakdown, the load balancing tank/function can act as a temporary storage.

We recommend that the effluent treatment system be fitted with a load balancing facility or equivalent function to allow transient high hydraulic loads to be retained and distributed to the irrigation area during periods of low load.

2.2.3 Application Rates and Irrigation Areas. An irrigation area and application rate has been determined from the results of the water and nutrient balance analyses and *AS/NZS 1547:2012, Appendix M*.

The *Code, Table 9* recommends for Category 6 soils an upper design irrigation rate of 2mm/day, assuming appropriate ameliorative measures are applied and before the impact of rainfall is considered.

Note: The irrigation area is directly proportional to the design daily hydraulic loading. The irrigation area can be reduced for smaller design daily hydraulic loads.

2.2.3.1 Hydraulic Loading. To satisfy the requirement for no surface discharge in the mean wet year, effluent shall be applied at an application rate not exceeding 1.9mm/day.

2.2.3.2 Nutrient Loading. The requirements of *SEPPs (Waters of Victoria)* would be satisfied with effluent applied at an application rate not exceeding 2.5mm/day.

2.2.3.3 Design Loading. To satisfy the requirement for no surface discharge in the mean wet year and on-site attenuation of nutrients, the effluent shall be applied at a rate not exceeding **1.9mm/day**.

[d] Minimum 1400mm required for evapotranspiration-absorption trenches.

2.2.4 General Requirements. For subsurface irrigation, it is assumed that the design, construction, operation and maintenance are carried out in accordance with *AS/NZS1547:2012* and a "system specific" JAS/ANZ accreditation, as appropriate.

The irrigation area is to be a dedicated area. To prevent stock, excessive or persistent pedestrian and vehicular movements over the area, the effluent area shall be "fenced". Such "fencing" can consist of formal fencing, log or rock barriers (where there is no stock) or landscaping.

2.2.5 Subsurface Distribution System. A distribution network design similar to that shown in *AS/NZS1547:2012, Figure M1* is appropriate.

2.2.5.1 Ground Preparation and Excavations. Preparation of the ground is to include the redistribution of topsoil to form a free draining, smooth surface. Pipe excavations shall only be undertaken in drier periods when soil moisture contents are relatively low and when heavy rainfall and storms are not normally expected.

2.2.5.2 Pump System and Pipe works. Uniform delivery pressure of the effluent throughout the distribution system is essential. Percolation or drip rates shall not vary by more than 10% from the design rate over the whole of the system (i.e. pressure compensated).

The distribution pipes shall be placed coincident with slope contours and/or level. The dripper system is to provide an effective even distribution of effluent over the whole of the design area. Line spacing shall be no closer than 1000mm.

2.2.6 Sequential Zoned Irrigation. The efficiency of irrigation effluent disposal systems can be highly variable. We recommend that as part of the daily irrigation process, the effluent area be irrigated sequentially by zones or time to promote the creation of transient aerobic and anaerobic soil conditions.

The inspection regime described in Section 2.2.7, below, is to be strictly adhered to.

2.2.7 Inspections and Monitoring. We recommend that the mandatory testing and reporting as described in the *Code of Practice - Onsite Wastewater Management,* E.P.A. Publication 891.4, July 2016, include an annual (post spring) report on the functioning and integrity of the distribution system and on the functioning and integrity of the cut-off drains and outfall areas.

It is expected that the frequency of inspections and monitoring will intensify as systems age.

2.2.8 Soil Renovation. To improve the subsoil permeability and to maintain stable soil peds, the exchangeable Calcium needs to be increased while the exchangeable Magnesium and Sodium need to be decreased.

To achieve a suitable cation balance, gypsum needs to be added to the soil.

Application rates are related to water (irrigation and mean rainfall) available to dissolve the gypsum. The water required to dissolve 1 kilogram of gypsum is about 400 litres.

In this instance, where irrigation water is expected to be continuous, available water is sourced from mean rainfall plus irrigation water.

For all lots a suitable amelioration technique is to initially broadcast gypsum over the irrigation area at a rate of 0.25kg/m^2. After smoothing of the surface, the irrigation network can be constructed.

Assuming a March start, after two months gypsum is to be broadcast over the irrigation area at a rate of 0.25kg/m^2 (actual deep seepage from evapotranspiration, effective rainfall and irrigation is at least 50mm/month) and then bi-monthly at a rate of 0.25kg/m^2 for a total of 6 months.

Following the initial application cycle, gypsum is to be broadcast over the irrigation area every three years at a rate of 0.25kg/m^2.

Gypsum is to be fine ground "Grade 1" agricultural quality.

2.2.9 AWTS and Sand Filter. It is assumed that the design, construction, operation and maintenance of all treatment elements are carried out in accordance with *AS/NZS1547:2012* and a current JAS-ANZ accreditation.

The AWTS or sand filter are to be sized to successfully treat a daily hydraulic load of 750 litres and a nutrient load of 300 grams BOD.

The sand filter shall have a minimum plan area of $15m^2$ with the sand media complying to the *Code* Appendix G. The sand media must have less than 5% fines, effective size (D10) between 0.25 and 0.60mm and uniformity coefficient (D60/D10) less than 4mm.

Note: The sand filter plan area can be proportioned to suit different design hydraulic loads. The plan area is determined by dividing the hydraulic load by 50.

2.2.10 Effects of Irrigation on Existing Trees. A study[i] by Dr Nick O'Brien (Melbourne University) regarding impacts of 20/30 standard irrigation on remnant *Eucalyptus* forest at Ringwood North has shown that trees would not be adversely affected by subsurface 20/30 standard irrigation provided the distribution slots did not exceed about 150mm in depth.

2.3 RESERVE AREA

The expected design life of fifteen years may vary due to construction and maintenance vagaries and possible effluent volume increases through the chain of ownership.

There is sufficient available area on the allotment for extension/duplication of the effluent areas.

2.4 SITE DRAINAGE.

Our recommendations for on-site effluent disposal have allowed for incident rainfall only and are conditional on the installation of a shallow cut-off drain, which shall be placed upslope of the disposal area.

Care shall be taken to ensure that the intercepted and diverted surface waters are discharged well away and down slope of the disposal field.

A suitable cut-off drain detail is shown in Drawing 3.

The owner shall also ensure that any upslope site works do not divert and/or concentrate surface water flows onto the disposal area.

2.5 BUFFER DISTANCES

The water balance analysis has shown that potential surface (rain water) flows from the effluent area would be restricted to episodic events.

The estimated hydraulic properties of the upper soil materials and hydraulic gradient have been used to evaluate (via Darcy's Law) the buffer distances with respect to subsurface flows.

Our analysis and evaluation have shown that the default setback distances given in *Code of Practice - Onsite Wastewater Management,* E.P.A. Publication 891.4, July 2016, Table 5 and *Approaches for Risk Analysis of Development with On-site Wastewater Disposal in Open, Potable Water Catchments,* Dr Robert Edis, April 2014 are conservative and can be applied without amendment.

For a building located downslope of an effluent field, your engineer shall evaluate the integrity of building foundations with respect to the assigned buffer distance.

2.6 SUMMARY OF RECOMMENDATIONS

The prevailing soils throughout the site are Category 6 sandy clays and clayey sands that require amelioration, as detailed in Section 2.2.8 and in the Management Plan.

Trench and bed systems are not recommended.

In accordance with the *Golden Plains Shire Domestic Wastewater Management Plan*, the minimum recommended allotment area is 4,000m^2.

For allotments with an area less than 6,000m^2, the maximum design dwelling population is five persons, which equates to a 4-bedroom dwelling.

Our capability assessment has shown that at least one rational and sustainable on-site effluent disposal method (20/30 standard subsurface irrigation) is appropriate for the proposed development, subject to specific design criteria, described above.

A management plan is presented in Appendix D, to this report.

Paul R. WILLIAMS B.App.Sc.
PRINCIPAL HYDROGEOLOGIST
Building Practitioner No. EC-1486

Paul Williams & Associates Pty Ltd

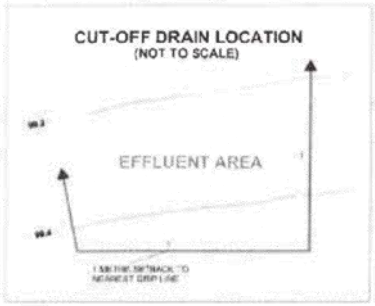
LOCATION OF SUBJECT SITE		
LOT A PS529738, BAKERS LANE ESTATE, BANNOCKBURN-SHELFORD ROAD, TEESDALE		
GOLDEN PLAINS SHIRE COUNCIL		
Scale: 1:40,000	Drawn: P.R.W.	Report Number: A180806
Contour Interval: 10m	Date: June, 2019	Drawing Number: 1

Paul Williams & Associates Pty Ltd

0 50 100 150 200
SCALE OF METRES

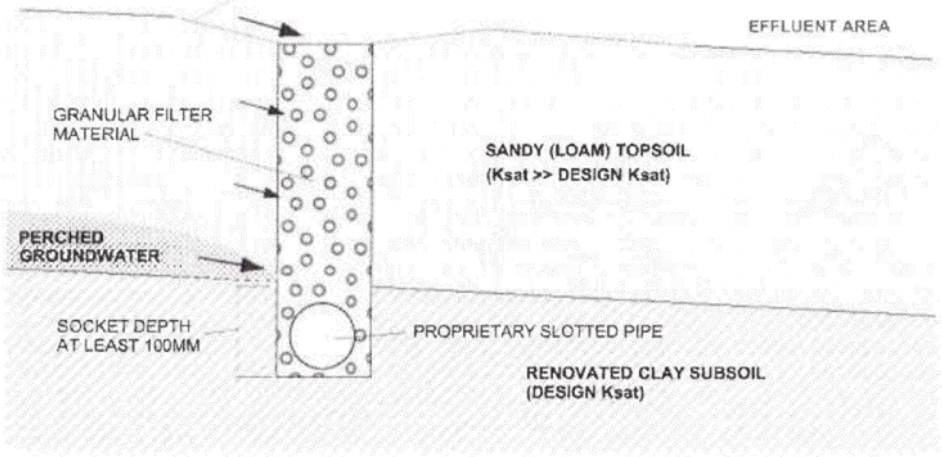
LOCATION OF BOREHOLES SHOWING CONTOURS		
LOT A PS529738, BAKERS LANE ESTATE, BANNOCKBURN-SHELFORD ROAD, TEESDALE		
GOLDEN PLAINS SHIRE COUNCIL		
Scale: 1:2,500	Drawn: P.R.W.	Report Number: A180606
Contour Interval: 0.5m	Date: June 2019	Drawing Number: 2

Paul Williams & Associates Pty Ltd



NOTE: CUT-OFF DRAIN LOCATION IS SCHEMATIC ONLY. FINAL LOCATION TO BE DETERMINED BY DESIGN ENGINEER AS PART OF SITE DRAINAGE DESIGN.

SURFACE REGRADED BY CUTTING TO FACILITATE COLLECTION OF SURFACE FLOWS - DEGREE OF CUT SLOPE LIMITED BY REQUIREMENTS FOR SAFE & EFFICIENT MOWING/MAINTENANCE



NOTES:
1. DRAIN TO BE DESIGNED, CONSTRUCTED & MAINTAINED TO ENSURE THAT NO SURFACE & PERCHED GROUNDWATER FLOWS ENTER THE IRRIGATION AREA.
2. DRAIN TO BE LOCATED ON ALL UPSLOPE SIDES OF IRRIGATION AREA (NO CLOSER THAN 1M FROM NEAREST SUBSURFACE DISTRIBUTION LINE).
3. DRAIN TO HAVE UNSPECIFIED FALL.
4. MINIMUM SOCKET DEPTH OF 100MM INTO CLAY SUBSOIL (WHERE ENCOUNTERED) OR AT LEAST 300MM DEEP.
5. DRAIN CROSS SECTIONAL AREA RELATED TO DESIGN FLOWS AS DETERMINED BY A SUITABLY QUALIFIED AND EXPERIENCED ENGINEER.
6. OFF-SITE DRAIN OUTFALL TO LEGAL POINT OF DISCHARGE SUBJECT TO LOCAL AUTHORITY REQUIREMENTS.
7. ON-SITE DRAIN OUTFALL TO INCLUDE APPROPRIATE ENERGY DISSIPATION TO AVOID EROSION.
8. ALL DRAINS AND OUTFALL AREAS SUBJECT TO POST-SPRING INSPECTION.

NOTE: DRAWING NOT TO BE USED FOR SET-OUT PURPOSES

CUT-OFF DRAIN DETAIL FOR 20/30 STANDARD EFFLUENT IRRIGATION FIELDS		
DUPLEX/GRADATIONAL SOIL PROFILES		
GOLDEN PLAINS SHIRE COUNCIL		
Scale: 1:10 (Approximately)	Drawn: P.R.W.	Report Number: SPEC 014
Contour Interval: N/A	Date: June 2019	Drawing Number: 3

APPENDICES

APPENDIX A1
SOIL PERMEABILITY

The *in-situ* permeability tests were attempted on 4th March and 10th April 2019.

The field testing was abandoned due to spontaneous dispersion of the soil clay fraction.

Where the soils are dispersive *insitu* permeability testing realises inaccurate, low or nil results.

The hydraulic conductivity can be estimated by using test waters containing calcium chloride and/or by laboratory assessment of colloid stability and determination of ameliorant quantities (e.g. gypsum/lime requirement) and swell potential.

A conservative estimate of permeability has been deduced as follows (see Code 3.6.1):-

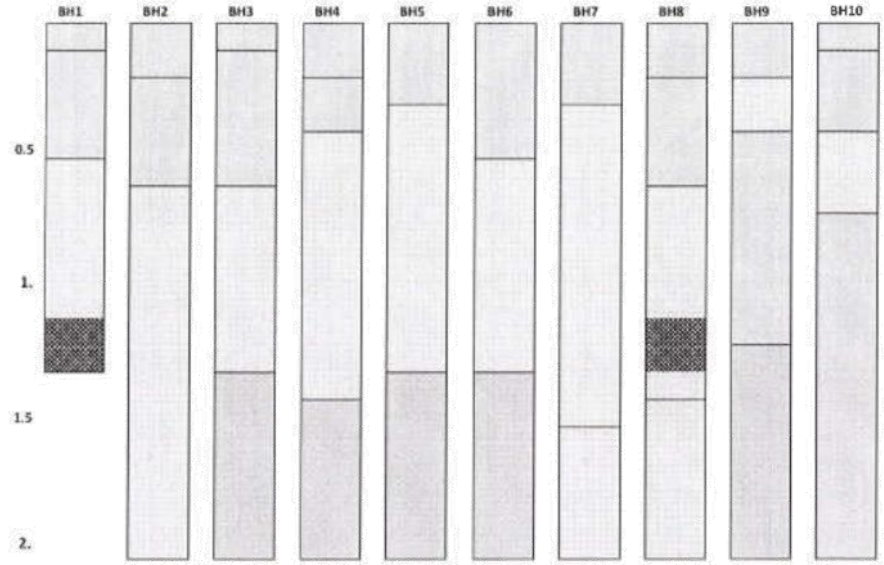
Profile analysis in accordance with AS/NZS 1547:2012 and our laboratory determined dispersion and swell potential shows the alluvial clay soils (and clay fractions) to be dispersive. They are therefore by definition Category 6 soils with saturated hydraulic conductivity less than 0.06m/day.

Similar dispersive soils have responded positively (with sufficiently improved hydraulic capability) following applications of gypsum.

For the limiting poorly-structured clay and clayey soils and assuming renovation by gypsum application we have adopted an estimated and conservative design saturated hydraulic conductivity of 0.030m/day.

Peak deep seepage is conservatively estimated at 3mm/day (<10% k_{sat}). Average daily deep seepage is 1.6mm.

APPENDIX A2
LOGS OF BOREHOLES



Silty SAND/SAND; grey-brown, yellow-grey, red-brown, sand fine to medium, (**loam/sandy loam**) **TOPSOIL**

Clayey SAND; orange, orange-brown, sand fine to medium, dispersive clay fraction, (**loam**) **ALLUVIUM**

SAND; white, orange-grey, sand fine to medium (**sand**) **ALLUVIUM**.

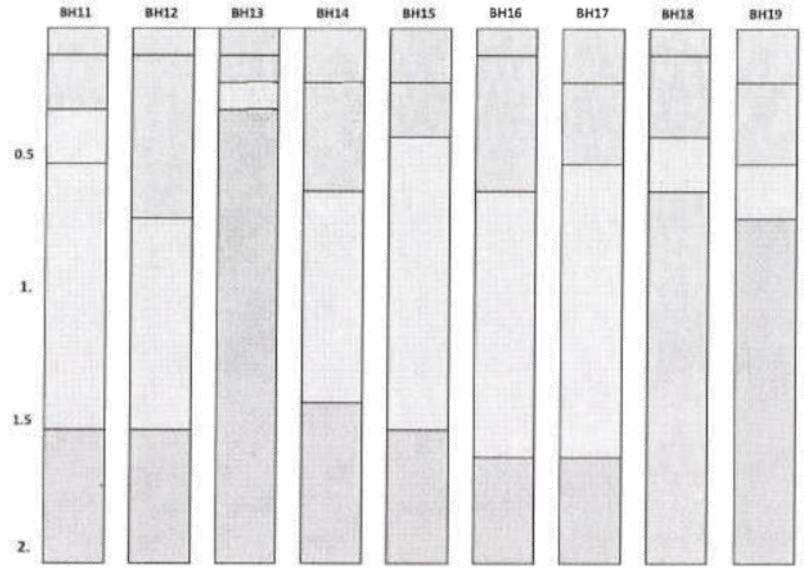
Sandy CLAY; orange, red-brown, medium plasticity, sand fine to medium, dispersive, (**medium clay**) **ALLUVIUM**.

Clayey SAND & Sandy CLAY (Interbeds); yellow-brown, orange-brown, medium plasticity, dispersive **(medium clay) ALLUVIUM**.

Indurated zone

For locations of boreholes refer Drawing 2.
All boreholes terminated at required depth (2m) or refusal.

APPENDIX A2 (continued)
LOGS OF BOREHOLES



Silty SAND/SAND; grey-brown, yellow-grey, red-brown, sand fine to medium, (**loam/sandy loam**) **TOPSOIL**

Clayey SAND; orange, orange-brown, sand fine to medium, dispersive clay fraction, (**loam**) **ALLUVIUM**

SAND; white, sand fine to medium (**sand**) **ALLUVIUM**.

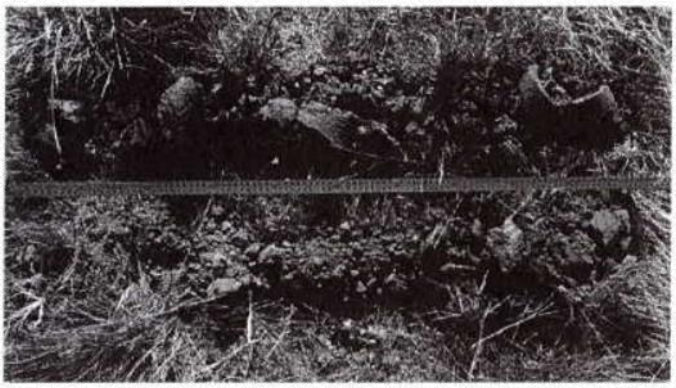
Sandy CLAY; orange, red-brown, medium plasticity, sand fine to medium, dispersive clay, (**medium clay**) **ALLUVIUM**.

Clayey SAND & Sandy CLAY (Interbeds); yellow-brown, orange-brown, medium plasticity, dispersive **(medium clay) ALLUVIUM.**

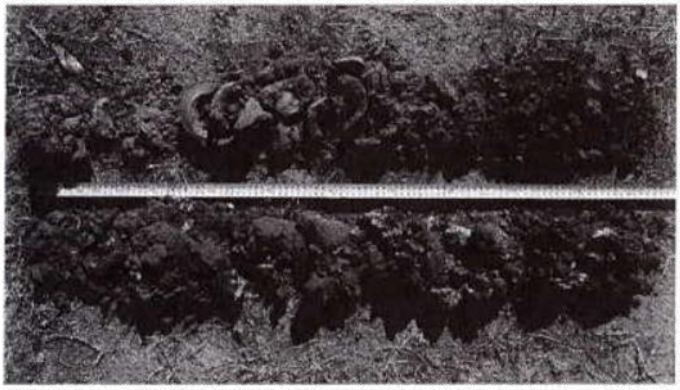
Indurated zone

For locations of boreholes refer Drawing 2.
All boreholes terminated at required depth or refusal

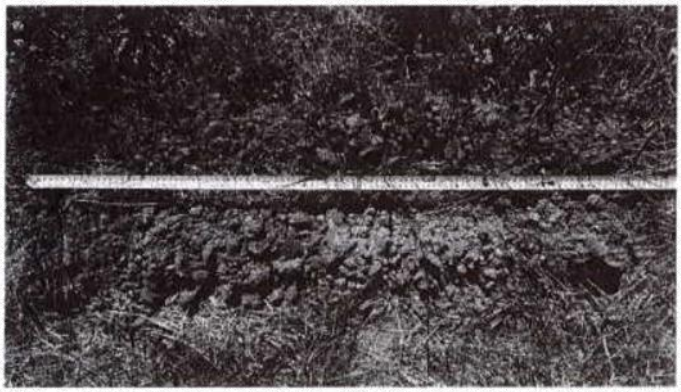
APPENDIX A3
SELECTED SOIL PROFILE PHOTOGRAPHS



BOREHOLE BH4.



BOREHOLE BH 9.



BOREHOLE BH 12.

APPENDIX A4
SUMMARY OF LABORATORY TEST RESULTS

COMPOSITE ALLUVIAL CLAY PROFILE

Property	LAND-SOIL UNIT A			
Depth (average)	0-20cm	20-60cm	60+cm	Desirable
Horizon	A	A_L	A_L	-
pH	5.9-6.1	7.4-7.8	5.9-7.7	-
EC (dS/m)	0.29-0.34	0.56-1.02	0.40-0.62	-
Exchangeable Sodium %	-	23.6	11.9	0.5%-5%
Exchangeable Magnesium %	-	42.2	47.5	12%-15%
Exchangeable Calcium %	-	17	9.3	65%-70%
CEC ($cmol^+/kg$)	-	1.82	16.29	15+
Calcium/Magnesium Ratio	-	0.4	0.2	2-4
Gypsum Req (t/ha)	-	4.01	10.27	-
Lime Req (t/ha)	-	0	0	-
Emerson	5-2	2	2	-
Dispersion Index	0-11	9-13	9-13	-
Free Swell (%)	-	5-45	20-45	-
Ksat (m/day)[1]	<0.6	<0.06	<0.06	-
Soil Permeability Category[1]	6	6	6	-
AS/NZS 1547 Classification	sandy loam	medium clay	medium clay	-

1. After renovation including gypsum application. Estimated by visual tactile methods, AS/NZS1547, AS1289 and database or by insitu measurement as shown.

All test results in green highlight from SWEP Analytical Laboratories.
All test results in blue highlight from in-house laboratory.

APPENDIX B

Paul Williams & Associates Pty Ltd A180806

WATER/NITROGEN BALANCE (20/30 irrigation): With no wet month storage.

Rainfall Station: Bannockburn/ **Evaporation Station:** Dundidwarrah
Location: Bannockburn
Date: June, 2019
Client: Golden Plains Shire Council

ITEM		UNIT	#	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Days in month:			D	31	28	31	30	31	30	31	31	30	31	30	31	365
Evaporation (Mean)		mm	A	161	142	102	66	40	24	31	47	63	93	111	146	1026
Rainfall (Mean)		mm	B1	31	35	36	41	43	43	43	46	51	53	49	41	509.2
Effective rainfall		mm	B2	31	35	36	41	43	43	43	46	51	53	49	41	512
Peak seepage Loss[1]		mm	B3	93	84	93	90	93	90	93	93	90	93	90	93	1095
Evapotranspiration(KA)		mm	C1	113	99	72	46	28	11	12	21	35	60	78	102	683
Waste Loading(C1-B3-B2)		mm	C2	175	148	129	86	70	58	63	68	74	101	119	154	1246
Net evaporation from lagoons (10(0.8A-B1)xlagoon area/ha))		L	NL	0	0	0	0	0	0	0	0	0	0	0	0	0
Volume of Wastewater		L	E	23250	21000	23250	22500	23250	22500	23250	23250	22500	23250	22500	23250	273750
Total Irrigation Water(E-NL)/G		mm	F	60	54	60	58	60	58	60	60	58	60	58	60	702
Irrigation Area(E/C2)annual		m²	G													390
Surcharge		mm	H	-115	-95	-69	-31	-11	0	-3	-8	-16	-41	-61	-94	0
Actual seepage loss		mm	J	-22	-11	24	59	82	90	90	85	74	52	29	-1	
Direct Crop Coefficient:			I	0.7	0.7	0.7	0.6	0.5	0.45	0.4	0.45	0.55	0.65	0.7	0.7	Pasture
Rainfall Retained:	100	%	K	1. Seepage loss (peak) equals deep seepage plus lateral flow: 3mm - after renovation												
Lagoon Area:	0	ha	L													
Wastewater(Irrigation):	750	L	M	0.7	0.7	0.7	0.6	0.5	0.45	0.4	0.45	0.55	0.65	0.7	0.7	Pasture
Seepage Loss (Peak):	3	mm	N	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	Shade
Irrig'n Area(No storage):	390	m²	P1	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	Buffalo
Application Rate:	1.9	mm	Q	1	1	1	1	1	1	1	1	1	1	1	1	Ryegrass
Nitrogen in Effluent:	30	mg/L	R													
Denitrification Rate:	20	%	S													
Plant Uptake:	220	kg/ha/y	T													
Average daily seepage:	1.8	mm	U													
Annual N load:	6.57	kg/yr	V													
Area for N uptake:	299	m²	W													
Application Rate:	2.5	mm	X													

NITROGEN UPTAKE

Species	Kg/ha.yr	pH	Species	Kg/ha.yr	pH	Species	Kg/ha.yr	pH
Ryegrass	200-280	5.6-8.5	Bent grass	170	5.6-6.9	Grapes	200	6.1-7.9
Eucalyptus	90	5.6-6.9	Couch grass	250	6.1-6.9	Lemons	90	6.1-6.9
Lucerne	220	6.1-7.9	Clover	180	6.1-6.9	C cunn's	220	6.1-7.9
Tall fescue	150-320	6.1-6.9	Buffalo (soft)	150-320	5.5-7.5	P radiata	150	5.6-6.9
Rye/clover	220		Sorghum	90	5.8-6.9	Poplars	115	5.8-8.5

PART 2

RAINFALL DATA

Station: Bannockburn Number: 87009 Opened: 1898 Now: Open
Lat: 38.02° S Lon: 144.16° E Elevation: 106 m

Statistic	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	31.3	35.0	35.8	41.4	42.9	42.9	42.9	46.1	50.9	52.9	48.7	41.2	509.2
Lowest	0.0	0.0	0.0	0.0	5.1	5.3	8.3	8.3	15.2	2.8	0.0	0.5	275.9
5th %ile	1.0	2.2	3.9	7.3	10.0	14.4	17.4	15.2	18.6	12.9	11.5	4.9	335.4
10th %ile	3.0	4.6	7.1	11.4	15.1	18.3	20.3	18.4	21.5	19.2	15.3	10.4	369.0
Median	24.8	25.1	27.4	37.1	43.5	40.0	40.6	45.9	48.7	51.3	41.6	36.0	515.5
90th %ile	70.7	85.9	74.0	83.0	71.2	73.5	70.6	69.5	79.7	90.2	95.9	79.2	658.8
95th %ile	81.9	98.8	94.9	96.1	79.8	86.3	83.9	80.0	93.8	94.9	102.8	95.9	677.9
Highest	108.2	203.2	159.0	143.6	112.5	153.4	96.3	143.2	189.5	134.8	145.6	119.2	848.2

APPENDIX C1

LAND CAPABILITY ASSESSMENT TABLE
(Potable water supply catchments)
LAND-SOIL UNIT A-ALLUVIAL SOILS & TERRACES

LAND FEATURE	LAND CAPABILITY RISK RATING LOW	MEDIUM	HIGH	[illegible]	AMELIORATIVE MEASURE & RISK REDUCTION
Available land for LAA	Exceeds LAA and duplicate LAA requirements	Meets LAA and duplicate LAA requirements	Meets LAA and partial duplicate LAA requirements	Insufficient LAA area	Non-limiting for trenches & beds: Full reserve area available. Non-limiting for subsurface irrigation: Full reserve area available
Aspect	North, north-east and north-west	East, west, south-east, south-west	South	South, full shade	South-easterly aspects.
Exposure	Full sun and/or high wind or minimal shading	Dappled light (partial shade)	Limited light, little wind to heavily shaded all day	Perpetual shade	Full winter sunshine and full wind exposure.
Slope Form	Convex or divergent side slopes	Straight sided slopes	Concave or convergent side slopes	Locally depressed	Regrade finished LAA surface by smoothing and redistribution of topsoil.
Slope gradient:					
Trenches and beds	<5%	5% to 10%	10% to 15%	>15%	<1%: Non-limiting for trenches.
Subsurface irrigation	<10%	10% to 30%	30% to 40%	>40%	<1%: Non-limiting for irrigation.
Site drainage: runoff/run-on	LAA backs onto crest or ridge	Moderate likelihood	High likelihood	Cut-off drain not possible	Cut-off drain required upslope
Landslip[5]	Potential	Potential	Potential	Existing	Unremarkable
Erosion potential	Low	Moderate	High	No practical amelioration	All runoff to be dispersed without concentrating flows. LAA stabilised with gypsum
Flood/inundation	Never		<1%AEP	>5% AEP	Unremarkable
Distance to surface waters (m)	Buffer distance complies with Code requirements		Buffer distance does not comply with Code requirements	Reduced buffer distance not acceptable	LAA located at least 30m from watercourse (see Drawings 1 and 2)
Distance to groundwater bores (m)	No bores on site or within a significant distance	Buffer distances comply with Code	Buffer distances do not comply with Code	No suitable treatment method	No bores within a significant distance.
Vegetation	Plentiful/healthy vegetation	Moderate vegetation	Sparse or no vegetation	Propagation not possible	All land application areas to be seeded (rye/clover mix) after regrading.
Depth to water table (potentiometric) (m)	>2	2 to 1.5	<1.5	Surface	Water table 2 to 5+m.
Depth to water table (seasonal perched) (m)	>1.5	<0.5	0.5 to 1.5	Surface	Perching probable. (Install cut-off drain and design LAA for limiting clay soils)
Rainfall[6] (9th decile) (mm)	<500	500-750	750-1000	>1000	Non-limiting for trench systems. Non-limiting for subsurface irrigation - Design by water balance.
Pan evaporation (mean) (mm)	1250 to 1500	1000 to 1250	750 to 1000	<750	Design by water balance.
SOIL PROFILE CHARACTERISTICS					
Structure	High or moderately structured	Weakly structured	Structureless, massive or hardpan		Improve and maintain structure by gypsum application.
Fill materials	Nil or mapped good quality topsoil	Mapped variable depth and quality materials	Variable quality and/or uncontrolled filling	Uncontrolled poor quality/unsuitable filling	No fill present.
Thickness: (m)					
Trenches and beds	>1.4		<1.4	<1.2	Non-limiting for trench systems.
Subsurface irrigation	1.5+	1.0 to 1.5	0.75 to 1.0	<0.75	Non-limiting for irrigation systems.
Permeability[7] (limiting horizon) (m/day)	0.15-0.3	0.03-0.15 0.3-0.6	0.01-0.03 0.6-3.0	>3.0 <0.03	After renovation; design by water balance
Permeability[8] (buffer evaluation) (m/day)	<0.3	0.3-3	3 to 5	>5.0	Evaluate flow times via Darcy's Law (assume 1m/day for alluvial clayey sands)
Stoniness (%)	<10	10 to 20	>20		Unremarkable
Emerson number	4, 5, 6, 8	7	2, 3	1	Non-dispersive and dispersive. Apply gypsum to maintain stable peds.
Dispersion index	0	1-8	8-16		Non-dispersive and dispersive. Apply gypsum to maintain stable peds.
Reaction trend (pH)	5.5 to 8	4.5 to 5.5	<4.5>8		Ideal range for grasses.
E.C. (dS/m)	<0.8	0.8 to 2	2-4	>4.0	Non-limiting for trench systems. Non-limiting for irrigation.
Exchangeable Na (%)	0.5-5	5 to 10	10-15		11.9-23.6: Non-limiting for trenches and irrigation.
Exchangeable Mg (%)	12-17	17 to 25	25-40	>40	42.2-47.5: Limiting for trenches, non-limiting for irrigation.
Exchangeable Ca (%)	65-70	40-65	5-40	<5	9.3-17: Non-limiting for trenches, non-limiting for irrigation.
Adjusted CEC	15+	10 to 15	5 to 10		1.82-16.29: Non-limiting for trenches.
Free swell (%)	<40	40-80	80-120	>120	Low-swelling clay fraction.

There are limiting and high-risk factors for primary effluent trench systems (colloid stability).

There are no limiting factors for secondary effluent subsurface irrigation.

[5] Landslip assessment based on proposed hydraulic loading, slope, profile characteristics and past and present land use.
[6] 9th decile monthly rainfalls used in water balance analyses.
[7] Saturated hydraulic conductivity derived from laboratory testing and data base.
[8] Saturated hydraulic conductivity estimated from AS/NZS1547:2012 and data base.

APPENDIX D

MANAGEMENT PLAN

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LAND CAPABILITY ASSESSMENT LAND USE MAPPING TERRAIN MODELLING HYDROGEOLOGY HYDROLOGY GEOLOGY SOIL SCIENCE LAND-SOIL RISK ASSESSMENT

A180806-JUNE 2019

MANAGEMENT PLAN
FOR
ON-SITE EFFLUENT DISPOSAL VIA SUBSURFACE IRRIGATION
AT
LOT A PS529738, BAKERS LANE ESTATE, BANNOCKBURN-SHELFORD ROAD, TEESDALE

1. INTRODUCTION

This document identifies the significant land-soil unit constraints (as identified in A180806) and their management and day-to-day operation and management of the on-site effluent system.

2. SIGNIFICANT LAND-SOIL UNIT CONSTRAINTS

2.1 Allotment Size. The day-to-day operation and management of on-site effluent systems, as described below, is not constrained by lot size or geometry.

Although all requirements of *SEPPs* have been met or exceeded through conservative design, prudence dictates that individual lot owners assiduously follow the management programme given in Section 4, below.

2.2 Nitrogen Attenuation. To reduce nitrates to insignificant levels, the effluent should not contain more than 30mg/litre total nitrogen.

Provided the irrigation areas are at least as large as those required to satisfy the nitrogen loading, as described in A180806 Sections 1.3.1.13, 1.3.2.13 and 2.2.3.2, and that the (specified) grass is cut and (periodically) harvested, nitrogen will be attenuated on-site.

2.3 Hydraulic Conductivity. The limiting soils of this site are dispersive, low-swelling clays and clayey sands with a low hydraulic conductivity. The hydraulic conductivity is significantly influenced by soil structure, soil colloid stability and swell characteristics. Breakdown or reduction of these soil parameters over time may manifest as reduced performance of the irrigation system. The monitoring and inspection regime detailed in Section 4.7.2, below, should be adhered to.

2.4 Site Drainage. Our recommendations for on-site effluent disposal have allowed for incident rainfall (not surface flow or lateral subsurface flow) and are conditional on the installation of a cut-off drain, which should be placed upslope of the disposal area. Care should be taken to ensure that the intercepted and diverted surface waters and any perched groundwater is discharged well away and down slope of the disposal field (see Drawing 5).

The owner should also ensure that any upslope works do not divert and/or concentrate surface water flows onto the disposal area.

2.5 Vegetation. The effluent disposal areas have been sized via water balance analyses utilising crop factors for pasture (rye/clover mix).

3. THE ONSITE EFFLUENT SYSTEM

The onsite effluent system consists of the influent (toilets, kitchens, bathroom, laundry), a load balancing tank/facility, the treatment plant/sand filter (a device to treat the effluent to at least the 20/30 standard), the irrigation area including effluent distribution system (delivery pipes and drippers), prescribed irrigation area vegetation, associated infrastructure (cut-off drains, outfall areas, fencing), a service and maintenance programme and on-going management.

4. MANAGEMENT

The owner is required to understand (and ensure that users understand) that sustainable operation of the onsite effluent system is not automatic. Sustainable operation requires on-going management, as outlined below.

4.1 Effluent. Effluent will be generated from a residence and will include black and grey water (all wastes).

4.1.2 Effluent Quality. Effluent should be treated to a standard that meets or exceeds the water quality requirements of the 20/30 standard.

4.1.3 Effluent Quantity. The daily effluent volume of 750 litres has been calculated from *Code of Practice - Onsite Wastewater Management*, E.P.A. Publication 891.4, July 2016, Table 4 and assumes mains water supply (equivalent) and WELS-rated water-reduction fixtures and fittings – minimum 4 Stars for dual-flush toilets, shower-flow restrictors, aerator taps, flow/pressure control valves and minimum 3 Stars for all appliances.

4.2 Treatment Plant. For subsurface irrigation, it is assumed that the design, construction, operation and maintenance are carried out in accordance with *AS/NZS1547:2012* and a current JAS-ANZ accreditation.

4.3 Irrigation Area. The irrigation area has been determined from the results of the water and nutrient balance analyses and AS/NZS 1547:*2012, Appendix M*.

4.3.1 Effluent Area Requirement. For a daily effluent flow of 750 litres and to satisfy the requirement for no surface rainwater flow in the mean wet year and on-site attenuation of nutrients, the effluent should be applied to an irrigation area of 390m^2.

Effluent distribution is as detailed in Section 4.3.2, below.

In case of an increase in effluent production through the chain of ownership, there is sufficient area available for duplicating the irrigation areas.

Any landscaping and/or planting proposals require endorsement from the Golden Plains Shire.

4.3.2 Distribution System. The distribution system must achieve controlled and uniform dosing over the irrigation area. A small volume of treated effluent should be dosed at predetermined time intervals throughout the day via a pressurised piping network that achieves uniform distribution over the entire irrigation area.

Uniform delivery pressure of the effluent throughout the distribution system is essential. Drip rates should not vary by more than 10% from the design rate over the whole of the system.

To minimise uneven post-dripper seepage, the distribution pipes must be placed parallel with slope contours.

Line spacing shall be not closer than 1000mm under any circumstances.

To facilitate the creation of transient aerobic and anaerobic soil conditions we recommend that as part of the daily irrigation process, the effluent area be irrigated sequentially by zones or time.

4.3.3 Soil Renovation. To improve the subsoil permeability and to maintain stable soil peds, the exchangeable Calcium needs to be increased while the exchangeable Magnesium and Sodium need to be decreased.

To achieve a suitable cation balance, gypsum needs to be added to the soil.

Application rates are related to water (irrigation and mean rainfall) available to dissolve the gypsum. The water required to dissolve 1 kilogram of gypsum is about 400 litres.

In this instance, where irrigation water is expected to be continuous, available water is sourced from mean rainfall plus irrigation water.

For all lots a suitable amelioration technique is to initially broadcast gypsum over the irrigation area at a rate of 0.25kg/m^2. After smoothing of the surface, the irrigation network can be constructed.

Assuming a March start, after two months gypsum is to be broadcast over the irrigation area at a rate of 0.25kg/m^2 (actual deep seepage from evapotranspiration, effective rainfall and irrigation is at least 50mm/month) and then bi-monthly at a rate of 0.25kg/m^2 for a total of 6 months.

Following the initial application cycle, gypsum is to be broadcast over the irrigation area every three years at a rate of 0.25kg/m^2.

Gypsum is to be fine ground "Grade 1" agricultural quality.

4.3.4 Buffer Distances. The water balance analysis has shown that potential surface rainwater flows from the effluent area would be restricted to episodic events.

The estimated hydraulic properties of the upper soil materials and hydraulic gradient (equivalent to the ground slope and regional gradients) have been used to evaluate (via Darcy's Law) the buffer distances with respect to subsurface flows.

Our analysis and evaluation have shown that the default setback distances given in *Code of Practice - Onsite Wastewater Management*, E.P.A. Publication 891.4, July 2016, Table 5 are conservative and can be applied without amendment.

For a building located downslope of an effluent field, your engineer should evaluate the integrity of building foundations with respect to the assigned buffer distance.

Buffer distances are to be applied exclusive of the irrigation area.

4.3.5 Buffer Planting. All downslope (Title inclusive) buffers may be required to filter and renovate abnormal surface discharges. Hence, they are to be maintained with existing or equivalent groundcover vegetation.

4.3.6 Buffer Trafficking. On all allotments, buffer trafficking should be minimised to avoid damage to vegetation and/or rutting of the surface soils.

Traffic should be restricted to 'turf' wheeled mowing equipment and to maintenance, monitoring and inspections by pedestrians, where possible.

4.4 Vegetation. The system design for on-site disposal includes the planting and maintenance of suitable vegetation, as specified in A180806 and/or similar documents.

Specifically, this irrigation area has been sized (in part) utilising crop factors and annual nitrogen uptake for a rye/clover eq mix.

The grass needs to be harvested (mown and periodically removed from the irrigation area).

Where a variation to recommended grass species is proposed, it must be demonstrated that the nitrogen uptake and crop factors (as specified in A180806 Appendix B – water balance) are met or exceeded.

4.5 Verification. The Council is to be satisfied that the effluent system has been constructed as designed.

4.6 Associated Infrastructure. The following items are an integral part of the onsite effluent system.

4.6.1 Cut-off drains. Cut-off drains are designed to prevent surface and near-surface water flows from entering the effluent area. They should be constructed and placed around the effluent area, as detailed in Drawing 3.

4.6.2 Outfall areas. All pipe outfalls should be at grade and designed to eliminate scour and erosion.

A grassed outfall would normally be adequate. However, should monitoring and inspections reveal rill or scour formation, the outfall will need to be constructed so that energy is satisfactorily dissipated.

Should this situation occur, professional advice is to be sought.

4.6.3 Fencing. The disposal area is to be a dedicated area. Adequate fencing must be provided to prevent stock, excessive pedestrian and vehicular movements over the area.

4.7 Service and Maintenance Programme. The minimum requirements for servicing and maintenance are set out in the relevant Certificate of Approval and the manufacturer's recommendations.

4.7.1 Treatment Plant. Aerated treatment plants and sand filters should be serviced at least one time per year (or as recommended in the JAS-ANZ accreditation and the effluent should be sampled and analysed as required by the JAS-ANZ accreditation. The local authority is to ensure compliance.

The manufacturer's recommendations are to be followed. Generally, low phosphorous and low sodium (liquid) detergents should be used. Plastics and other non-degradable items should not be placed into the tanks. Paints, hydrocarbons, poisons etc should not be disposed of in sinks or toilets. Advice from a plumber should be obtained prior to using drain cleaners, chemicals and conditioners. It is important to ensure that grease does not accumulate in the tanks or pipes. Grease and similar products should be disposed of by methods other than via the on-site effluent system.

4.7.2 Monitoring and Inspections. We recommend that the mandatory testing and reporting as described in the *Code of Practice - Onsite Wastewater Management*, E.P.A. Publication 891.4, July 2016, include an annual (post spring) and post periods of heavy and/or prolonged rainfall report on the functioning and integrity of the distribution system and on the functioning and integrity of the cut-off drains, outfall areas and soil media.

The effluent areas should be regularly inspected for excessively wet areas and vegetation integrity.

The inspection regime described in A180806, Section 2.2.7, should be strictly adhered to.

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[1] Dr Nick O'Brien (Research Fellow, School of Botany, University of Melbourne, 2000: *Comment on the irrigation of remnant native vegetation with municipal effluent associated with the proposed subdivision at the rear of 111 Hall Road, North Ringwood.*

Bakers Lane Teesdale

Vegetation Assessment Report

A Report to
Golden Plains Shire

Final Report

Prepared by

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Contents

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1 INTRODUCTION

1.1 Project Background

An area of land at Bakers Lane Teesdale, is proposed to be developed as a low density residential sub-division. This report was commissioned by the Golden Plains Shire to assess the quantity and significance of any indigenous flora and fauna habitat that might be present in the subject site.

Under Clause 52.17 of the Victorian Planning Scheme, the State has gazetted the Native Vegetation Removal Regulations (revised in December 2017). The reforms 'introduce a risk based approach to assessing applications to remove native vegetation' (DELWP Website i) Refer to Section 4.2 for further discussion.

1.2 Objectives

The objectives of this investigation are to:

- Describe the flora values of the land.
- Evaluate the conservation significance of the land.
- Assess any potential impacts of the proposed development.
- Discuss the implications of relevant government policy and legislation.
- Determine any vegetation offset implications.

1.3 Study Area

The study area is comprised of land at Bakers Lane Teesdale (Lot A PS529738, approximately 21 ha), located within the Golden Plains Shire. The site is within the Victorian Volcanic Plains bioregion and is located within the Corangamite Catchment Management Authority region (DELWP website ii). The study area is currently zoned Low Density Residential Zone (LDRZ) under the Golden Plains Shire Planning Scheme (DPCD website i).

The site appears to have a history of disturbance. Areas of indigenous vegetation (mature River Red Gum trees and native understorey vegetation) occur within the proposed development area, located along the western margin.

The location of the study area is shown on Figure 1.

1.4 Proposed Development

The proposed use is to develop the land for low-density residential use. It is anticipated that the proposed use will impact upon the majority of the study area, with appropriate protection to be provided for areas of recorded native vegetation.

Figure 1 Study area location

Figure 1. Study area location.

2 METHODS

2.1 Taxonomy

Scientific names for plants follow the Flora of Victoria (RBG Website i). Common names for plants follow the Flora of Victoria Vols 2-4 (Walsh and Entwisle 1994-1999).

2.2 Literature and Database Review

Relevant literature, online resources and databases were reviewed to provide an up to date assessment of ecological values associated with the study area and surrounds, including:

- The Victorian Department of Environment, Land, Water and Planning (DELWP) NVIM Interactive Map (DELWP website ii) for:
  - Modelled data for remnant vegetation patches and habitat for rare or threatened species and
  - the extent of historic and current Ecological Vegetation Classes (EVC)s.
- The Victorian Biodiversity Atlas (VBA) (DELWP website iii) for previously documented flora and fauna records within the project locality (to approximately 10 kilometres of the study area)
- Aerial photography of the study area (Google maps).

2.3 Field Survey

The site was inspected on foot on the 3rd of July 2017. The entire site was traversed. Records were made of all indigenous vascular plant species. Records were made of the existing habitat values and dominant exotic vascular plant species.

2.4 Limitations

The assessment was conducted in winter, a time of year that is suitable for the detection of most flora species likely to occur on site. Due to the relatively degraded nature of the understorey vegetation of the study area, the site inspection is considered to be sufficient to assess the ecological values of the site. As a result, there are not considered to be any significant limitations to the study.

The survey includes only vascular flora. Habitat Hectare assessments were not undertaken. Consequently non-vascular flora (mosses, lichens, fungi, etc.) were not recorded. Fauna was not surveyed.

2.5 Defining Significance

A number of criteria are applied in order to assess the significance of flora species and vegetation communities. The definition of the criteria is detailed in Appendix 1.

2.6 Defining and Assessing Vegetation

For the purposes of determining offset requirements, Native vegetation in Victoria has been defined by DELWP as belonging to two categories. These are:

Patch native vegetation

A patch of native vegetation is either:

- any area of vegetation where at least 25 per cent of the total perennial understorey plant cover is native
- any area with three or more native canopy trees where the canopy foliage cover is overlapping.

Scattered Tree native vegetation

A scattered tree is:

- a native canopy tree that does not form part of a remnant patch.

(DELWP website ii).

Habitat hectares

Habitat hectares (Vegetation Quality Assessment) is a site-based measure that combines extent and condition of native vegetation. The current condition of native vegetation is assessed against a benchmark for its Ecological Vegetation Class (EVC). EVCs are classifications of native vegetation types. The benchmark for an EVC describes the attributes of the vegetation type in its mature natural state, which reflects the pre-settlement circumstances. The condition score of native vegetation at a site can be determined through undertaking a habitat hectare assessment. The habitat hectares of native vegetation is calculated by multiplying the current condition of the vegetation (condition score) by the extent of native vegetation.

(DELWP website ii).

3 RESULTS

3.1 Vegetation Condition

The study area carries predominately exotic vegetation. Areas of native vegetation consisting of River Red Gum (*Eucalyptus camaldulensis*) mature trees occur across part of the western sector of the site. The majority of the study area appears to have been de-rocked, strip mined for gravel, subjected to improved pasture and is currently under crop.

With the exception of the specimens of mature River Red Gum and associated native understory vegetation, the vegetation of the study area is assessed to be substantially modified as a result of repeated cultivation.

Several non-indigenous native trees and shrubs have been planted.

Refer to Figures 4 and 5 for the location of the native vegetation. Refer to Plates 1-3 for photographs of the vegetation existing conditions.

3.1.2 Faunal Habitat Values

No fauna assessment was undertaken. Due the number of mature River Red Gums present, the study area is likely to provide habitat and a food source for a number of faunal species, including significant avi-faunal species.

The vegetation of the majority of the study area, being exotic pasture, is unlikely to provide more than negligible faunal habitat value.

3.2 *Ecological Vegetation Class*

Ecological Vegetation Classes (EVCs) are the primary level of classification of vegetation communities within Victoria. An EVC contains one or more plant (floristic) community, and represents a grouping of vegetation communities with broadly similar ecological attributes. Classification of EVCs in this report follows Oates and Taranto (2002).

The pre-1750 EVC mapping of the study area undertaken by DELWP (DELWP website i) indicates that the study area and surrounds were comprised of EVC 55 Plains Grassy Woodland and EVC 132 Plains Grassland.

The current study records vegetation that accords with EVC 55 Plains Grassy Woodland.

EVC 55 Plains Grassy Woodland is currently listed as 'Endangered' in the Victorian Volcanic Plain bioregion (DELWP website ii). Endangered refers to an EVC that has less than 10% of its pre-european distribution remaining within the bioregion. Refer to Figure 2 for DELWP EVC mapping.

Figure 2 EVC Distribution

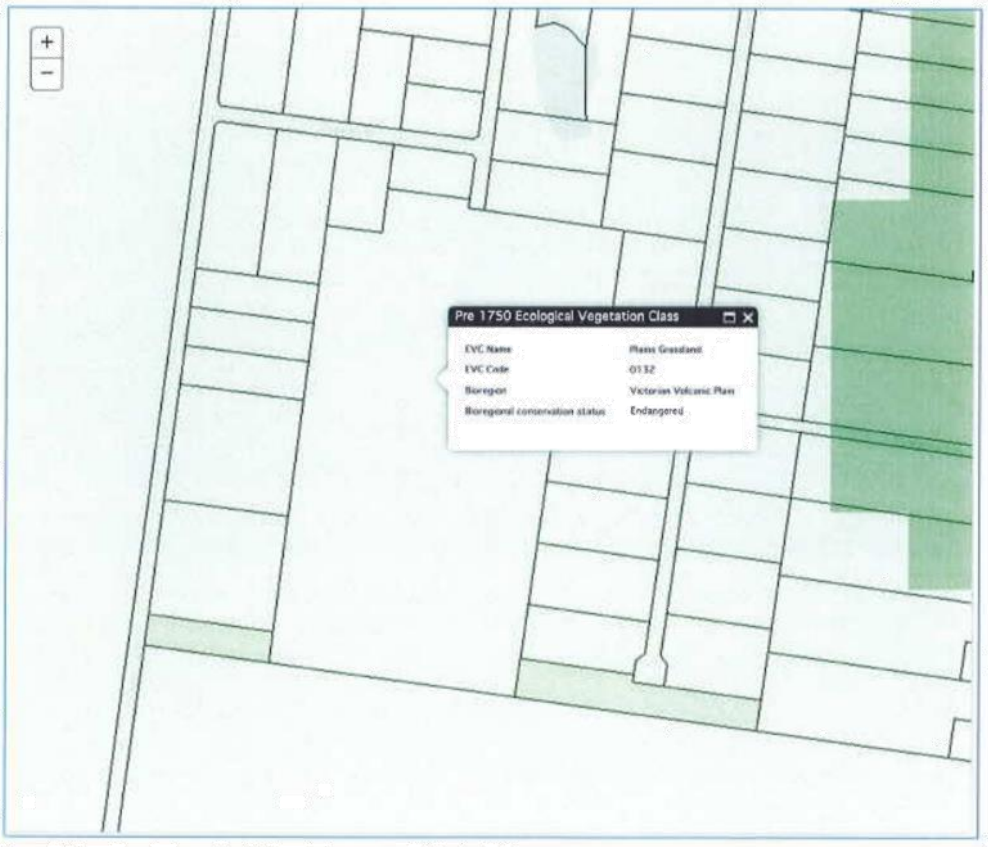


Figure 2. Distribution of EVCs pre-1750. Data by DELWP (DELWP website ii).

3.3 Flora

A total of 10 indigenous vascular plant species were recorded from the study area.

Refer to Table 1 for a list of indigenous vascular plant species and conservation significance recorded during this survey. Refer to Table 2 for a list of exotic vascular plant species recorded during this survey.

Refer to Figures 4 and 5 for the location of vegetation. Refer to Plates 1-3 for photographs of vegetation existing conditions.

Table 1 Indigenous Plant Species and Conservation Significance

Botanical Name	Common Name	Significance
Acacia implexa	Lightwood	Regional
Acacia mearnsii	Late Black Wattle	Local
Acacia paradoxa	Hedge Wattle	Local
Acacia pycnantha	Golden Wattle	Local
Austrostipa spp	Spear-grass	Local
Eragrostis brownii	Common Love-grass	Local
Eucalyptus camaldulensis	River Red Gum	Local
Juncus subsecundus	Finger Rush	Local
Microleana stipoides	Weeping Grass	Local
Rytidosperma racemosum	Slender Wallaby-grass	Local

Table 2 Exotic Plant Species

Botanical Name	Common Name
Arctotheca calendula	Capeweed
Avena spp	Wild Oat
Briza maxima	Large Quaking Grass
Cirsium vulgare	Spear-thistle
Cynodon dactylon	Couch Grass
Dactylis glomeratus	Cock's-foot Grass
Ehrharta calycina	Perennial Veldt-grass
Eucalyptus cladocalyx	Sugar Gum
Galenia pubescens	Blanket Weed
Lolium sp	Rye-grass
Lycium ferrocisimum	Boxthorn
Melaleuca armillaris	Giant Honey-myrtle
Romulea spp	Onion-grass
Ulex europeaus	Gorse

3.4 Flora Significance

One recorded indigenous plant species, Lightwood, was recorded that is of Regional conservation significance. The remaining nine recorded indigenous plant species are assessed to be of Local conservation significance.

No plant species of State or National conservation significance were recorded for the study area.

Refer to Table 1 for significance. Refer to Appendix 1 for the rational for assessing conservation significance.

4 LEGISLATION AND GOVERNMENT POLICY

4.1 Commonwealth

4.1.1 Environment Protection and Biodiversity Conservation Act (1999)

The Environment Protection and Biodiversity Conservation (EPBC) Act (1999) was established to 'promote the conservation of biodiversity by providing strong protection for listed species and communities in the Commonwealth and for protected areas, Ramsar sites, Commonwealth Reserves, conservation zones and World Heritage sites, etc'.

The EPBC Act applies to developments and associated activities that have the potential to significantly impact on matters protected under the Act. Under the Act, unless exempt, actions require approval from the Australian Government Minister for Environment and Heritage if they are likely to significantly impact on a 'matter of national environmental significance'. There are currently seven matters of national environmental significance (NES):

- World Heritage properties;
- National Heritage properties;
- nationally listed threatened species and ecological communities;
- listed migratory species;
  Ramsar wetlands of international significance;
- Commonwealth marine areas; and
- nuclear actions (including uranium mining).

Any person proposing to take an action that may, or will, have a significant impact on a matter of national environmental significance must refer the action to the Australian Government Minister for Environment and Water Resources for determination as to whether the action is a 'controlled action' or is not approved.

Grassy Eucalypt Woodland of the Victorian Volcanic Plain is an ecological community that is listed as 'Critically Endangered' under the EPBC Act (EPBC Website i). The study area carries vegetation that is part of this community.

4.1.2 Implications

An application to remove significant amounts of the mature River Red Gum is likely to create implications for the Grassy Eucalypt Woodland of the Victorian Volcanic Plain community under the EPBC Act. The current proposal is assessed as not requiring referral, as no impacts are proposed.

4.2 State Native Vegetation Permitted Clearing Regulations

Under Particular Provision (Native Vegetation Clause 52.17) the State has gazetted the Native Vegetation Permitted Clearing Regulations (the 'Regulations'), revised in December 2017. The reforms introduce a risk-based approach to assessing applications to remove native vegetation.

The purpose of Clause 52.17 is to ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation. This means permitted clearing has a neutral impact on Victoria's biodiversity. This is achieved by applying the following three step approach in accordance with the *Guidelines for the removal, destruction or lopping of native vegetation* (Department of Environment, Land, Water and Planning, 2017):

1. Avoid the removal, destruction or lopping of native vegetation.

2. Minimise impacts from the removal, destruction or lopping of native vegetation that cannot be avoided.

3. Provide an offset to compensate for the biodiversity impact if a permit is granted to remove, destroy or lop native vegetation.

To manage the removal, destruction or lopping of native vegetation to minimise land and water degradation. (DELWP Website i).

When native vegetation removal is permitted, an offset must be secured which achieves a no net loss outcome for biodiversity. To achieve this the offset makes a contribution to Victoria's biodiversity that is equivalent to the contribution made by the native vegetation that was removed. The type and amount of offset required depends on the native vegetation being removed and the contribution it makes to Victoria's biodiversity.

Implications for the current proposal are discussed as follows. Refer to Figure 3 for Location mapping (DELWP data).

Figure 3 Location

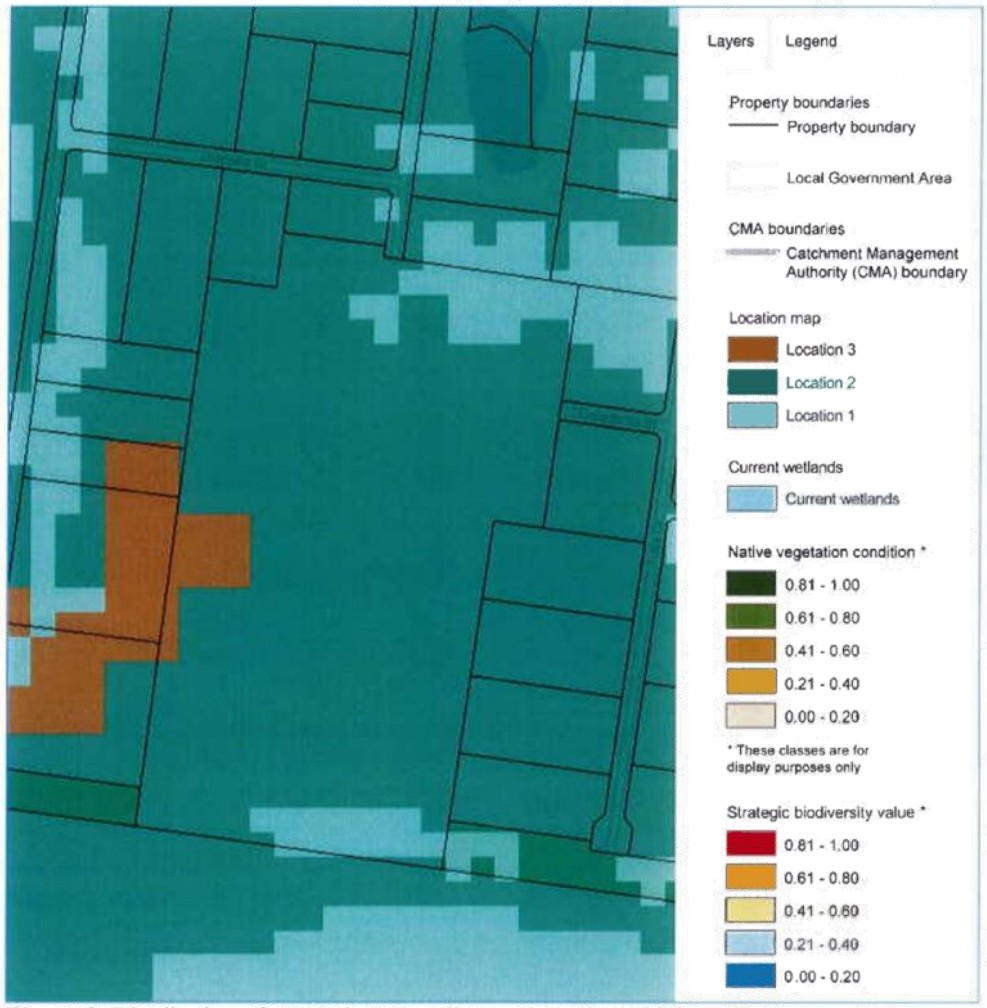


Figure 3. Distribution of vegetation according to 'Location'. Light green equates to 'Location 1' (i.e. least risk). Dark green equates to 'Location 2' (i.e. medium risk), Orange equates to 'Location 3' (i.e. high risk) (DELWP Website i). The study area is sited within areas of Location 1, 2 and 3.

4.2.1 Patch native vegetation

Under the Native Vegetation Removal Regulations, any areas of remnant patch native vegetation that are proposed to be removed are subject to protection/and or recruitment offsets, depending upon the characteristics of the site.

A single area of patch native vegetation (containing large trees) was recorded for the study area.

4.2.2 Scattered tree native vegetation

Under the Native Vegetation Removal Regulations, any scattered native canopy trees that are proposed to be removed are subject to protection/and or recruitment offsets, depending upon the characteristics of the site.

Within the VVP bioregion, EVC 55 has *Eucalyptus* spp as 'canopy trees'.

For practicality, a standard extent amount has been developed for scattered trees, depending upon the size of the tree.

A total of 2 scattered trees, all River Red Gum were recorded for the study area.

Table 3 gives the following data for the recorded trees; scattered trees and patch, tree number, species name, circumference at beast height and Tree Protection Zone. Figures 4 and 5 show the location of the scattered trees.

Table 3 Native trees

Tree Number	Tree Name	Tree Trunk circumference (cm)	Tree Protection Zone (m)	Status	Tree Size
A	*Eucalyptus camaldulensis*	220	8.1	P	Large
B	*Eucalyptus camaldulensis*	250	9.2	P	Large
C	*Eucalyptus camaldulensis*	220	8.1	P	Large
D	*Eucalyptus camaldulensis*	270	10.1	P	Large
E	*Eucalyptus camaldulensis*	300	11.2	P	Large
F	*Eucalyptus camaldulensis*	300	11.2	P	Large
G	*Eucalyptus camaldulensis*	180	6.6	P	Large
H	*Eucalyptus camaldulensis*	190	7.1	P	Large
I	*Eucalyptus camaldulensis*	160	5.9	ST	Large
J	*Eucalyptus camaldulensis*	220	8.1	ST	Large

ST- Scattered tree, P - Patch

Tree protection zones are calculated in accordance with Australian Standard AS4970-2009 *Protection of trees on development sites.* Refer to Appendix 2.

For a tree to be protected it is required to be given an appropriately sized Tree Protection Zone.

4.2.3 Implications

The results show that the current native vegetation condition is comprised of one area of patch mantive vegetation and two scattered tree native vegetation.

The total extent of native vegetation is 0.852 ha.

Under Clause 52.17 an application to remove the patch and scattered tree native vegetation located within Location 2 and Location 3 would be classified a high risk-based application that would require a Detailed Pathway Assessment application.

It is the intent of the proposal that all native vegetation be given appropriate protection measures. Consequently, there are no implications for the proposal under Clause 52.17.

Refer to Figures 4 and 5 for the location of native vegetation. Refer to Plates 1-3 for photographs of vegetation existing conditions.

Figure 4 Location of native vegetation

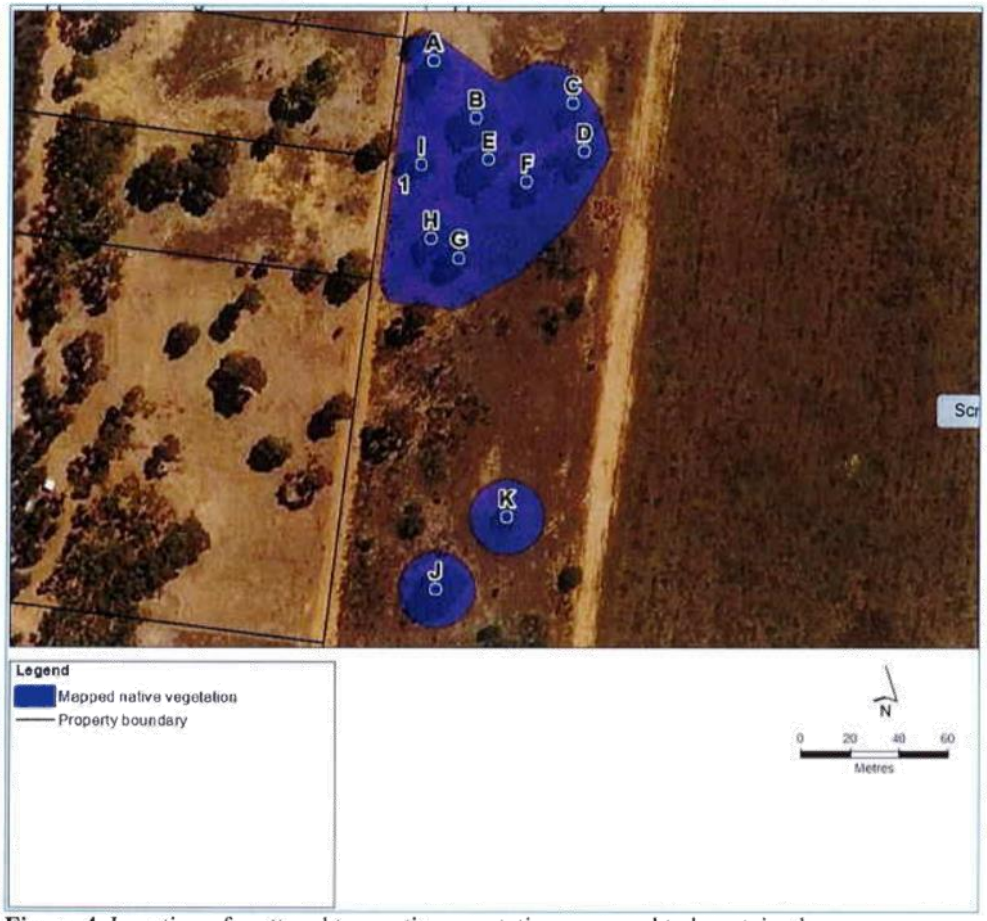


Figure 4. Location of scattered tree native vegetation proposed to be retained.

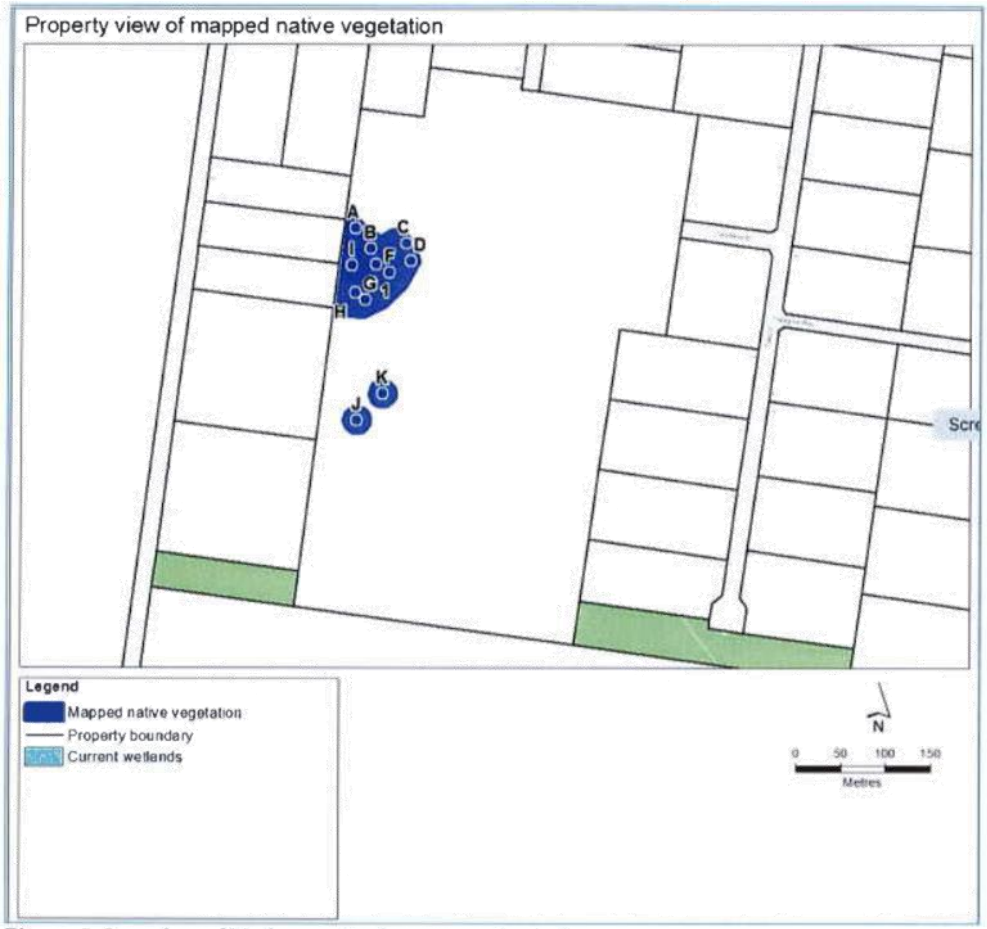


Figure 5. Location of Native vegetation, property view.

5 CONCLUSIONS

Description

The of approximately 21 ha of land, located at at Bakers Lane Teesdale (Lot A PS529738 Teesdale), that is the subject of this report, is proposed to be developed as a low-density residential sub-division.

Results

The study area contains the following vegetation:

- A total of 2 mature River Red Gum scattered tree native vegetation.
- One patch of native vegetation containing nine mature
- Degraded predominately exotic vegetation.

One recorded pant species, Lightwood, was recorded that is of Regional conservation significance. The remaining nine recorded indigenous plant species are assessed to be of Local conservation significance.

The current study records vegetation that accords with EVC 55 Plains Grassy Woodland. EVC 55 Plains Grassy Woodland is listed as 'Endangered' in the Victorian Volcanic Plain bioregion.

Faunal habitat values for sections of the study area are of potentially high significance, due to the mature woodland trees.

An application to remove significant amounts of the mature River Red Gum is likely to create implications for the Grassy Eucalypt Woodland of the Victorian Volcanic Plain community under the EPBC Act. The current proposal is assessed as not requiring referral under the Act, given no impacts are proposed.

Under Clause 52.17 an application to the recorded native vegetation would be classified as a high risk-based application.

It is the intent of the proposal that all native vegetation be given appropriate protection measures. Consequently, there are no implications for the proposal under Clause 52.17.

Limitations

There are not considered to be any significant limitations to this study.

Appendix 1 - ASSESSING CONSERVATION SIGNIFICANCE

Conservation significance is assessed at a range of scales, including global, international, national, state, regional and local. Criteria used for determining the conservation significance of flora and fauna at national to local scales are presented below for botanical and zoological conservation significance.

Botanical Significance

National botanical significance applies to an area when it supports one or more of the following attributes:

a population of at least one nationally threatened plant species listed by Briggs and Leigh (1996) or plant species listed on the schedules to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

A nationally threatened ecological community listed on the schedules of the *Environment Protection and Biodiversity Conservation Act 1999*.

State botanical significance applies to an area when it supports one or more of the following attributes:

A population of at least one plant species threatened in Victoria, as listed by Gullan et al. (1990), NRE (2000a) or more recently in the unpublished records of the Flora Information System (NRE), or on the schedules to the Victorian *Flora and Fauna Guarantee Act 1988*.

An ecological community considered threatened in Victoria through its listing on the schedules of the *Flora and Fauna Guarantee Act 1988*.

Regional botanical significance applies to an area that supports one or more of the following attributes:

Supports a population of one or more regionally depleted species defined in a valid regional assessment of biodiversity (eg. Regional Native Vegetation Plan, Environment Conservation Council Report or Comprehensive Regional Assessment documents).

An ecological vegetation class that is considered endangered or vulnerable in a particular bioregion (based on Conn 1993 and the Regional Native Vegetation Plan), in which case the area is of **High Regional** significance.

An ecological vegetation class that is considered depleted in a particular bioregion (based on Conn 1993 and the Regional Native Vegetation Plan), in which case it is of **Regional** significance.

Local botanical significance applies to all remnant native vegetation that does not meet the above criteria. In much of Victoria native vegetation has been so depleted by past clearing and disturbance that all remaining vegetation must be considered to be of at least local conservation significance.

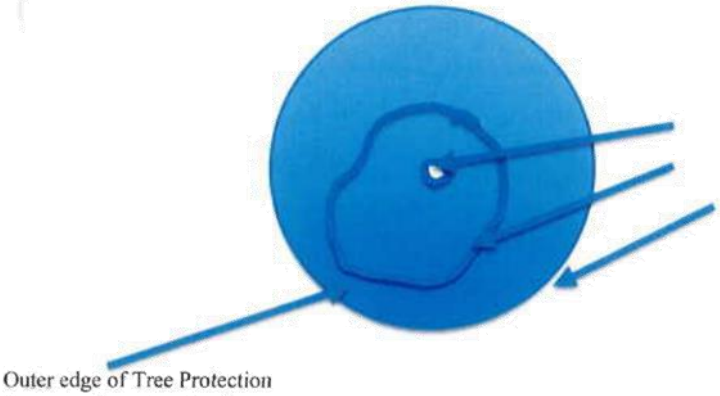
Appendix 2 Determining the Tree Protection Zone

Determining the Tree Protection Zone (TPZ)
The radium of the TPZ is calculated for each tree by multiplying its DBH x 12. TPZ = DBH x 12 (Australian Standard AS4970-2009 *Protection of trees on development sites)*
Where
DBH = trunk diameter measured at 1.4 metres above ground Radius is measured from the centre of the stem at ground level.

A TPZ should not be less than 2 metres no greater than 15 metres (except where crown protection is required.). Some instances may require variations to the TPZ.

A tree is deemed to be impacted upon if greater than 10% of the TPZ area is to be disturbed.

Indicative Size of Tree Protection Zone



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https://www.environment.vic.gov.au/native-vegetation/native-vegetation

DELWP website iii. EVC Benchmarks.
http://www.depi.vic.gov.au/environment-and-wildlife/biodiversity/evc-benchmarks

DELWP website iv. Native Vegetation Information Management tool.
https://nvim.delwp.vic.gov.au/.

DELWP Website v.
https://www.environment.vic.gov.au/__data/assets/pdf_file/0021/50448/Advisory-List-of-Rare-or-Threatened-Plants-in-Victoria-2014.pdf

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http://planningschemes.dpcd.vic.gov.au/__data/assets/pdf_file/0007/180169/goldenplains.pdf

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Plates 1-3 Vegetation existing conditions

Plate 1. Degraded vegetation, western sector, typical conditions.

Plate 2. Patch native vegetation with mature River Red Gum, western sector.

Plate 3. Degraded exotic vegetation, majority of study area, typical conditions.