MAJOR ROAD PROJECTS VICTORIA

HEALESVILLE – KOO WEE RUP ROAD UPGRADE - STAGE 1B

FAUNA MANAGEMENT PLAN

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Healesville – Koo Wee Rup Road Upgrade - Stage 1B
Fauna Management Plan

Major Road Projects Victoria

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1 INTRODUCTION

This document provides the commitments and technical requirements for fauna sensitive road design and fauna management that are discussed further in *Healesville – Koo Wee Rup Road Upgrade - Stage 1B Background Technical report for the Fauna Management Plan* (WSP 2020b) (herein referred to as 'the BT'). The BT is based on the *Healesville - Koo Wee Rup Road Upgrade - Fauna Management Plan* prepared by Practical Ecology in June 2019 (Practical Ecology 2019), with a number of updates and departures from the original report, as described in the BT. Threatened fauna species addressed in the BT are listed in Table 1.1.

Table 1.1 Threatened fauna addressed in the BT

COMMON NAME	SCIENTIFIC NAME	EPBC ACT	FFG ACT	ADVISORY LIST
Southern Brown Bandicoot	*Isoodon obesulus obesulus*	Endangered	Listed	Near Threatened
Growling Grass Frog	*Litoria raniformis*	Vulnerable	Listed	Endangered
Dwarf Galaxias	*Galaxiella pusilla*	Vulnerable	Listed	Endangered
Swamp Skink	*Lissolepis coventryi*	-	Listed	Vulnerable
Glossy Grass Skink	*Pseudemoia rawlinsoni*	-	-	Vulnerable

Note: EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*; FFG Act = *Flora and Fauna Guarantee Act 1988*; Advisory List = Advisory List of Threatened Vertebrate Fauna in Victoria.

Subsequent to the initial FMP (Practical Ecology 2019), a Dwarf Galaxias survey has been undertaken which concluded that Dwarf Galaxias are unlikely to occurs in Deep Creek or other waterways and water bodies in proximity to the Project (Aquatica Environmental 2020).

Subsequent to the initial FMP (Practical Ecology 2019), a Swamp Skink survey as a part of baseline monitoring in (WSP 2020a) has been undertaken which concluded that Swamp Skink are unlikely to occur in the project area due to the suboptimal habitat quality and lack of records found. However, three Glossy Grass Skinks were recorded baseline monitoring in (WSP 2020a), with two at the Deep Creek site and one at the Manks Road wetland.

This document provides a summary of the management actions required for the project (Section 2) and splits the actions into project phases; pre-construction (Section 3), construction (Section 4), post-construction (Section 5). Other commitments are summarized in Section 6.

2 FAUNA SENSITIVE ROAD DESIGN

This section summarises the main mitigation measures to be utilised across the project to protect threatened fauna.

2.1 CULVERTS AND FAUNA CROSSING STRUCTURES

Drainage culverts are designed primarily to convey water flows beneath the road and fauna crossing structures are dedicated for use by wildlife to safely cross roads. However, some drainage culverts on HKWR Rd may be designed to also be used as crossing structures by Southern Brown Bandicoot and Growling Grass Frog.

Where drainage culverts are intended to also allow fauna passage in high-priority locations, drainage culverts must meet the same minimum standards as required for fauna crossing structures so that use by wildlife is not compromised.

2.1.1 FAUNA CROSSING STRUCTURES

2.1.1.1 LOCATION OF FAUNA CROSSING STRUCTURES

The first step in the identification and prioritization of locations for fauna crossing structures along HKWR Rd was ecological, and was based on the occurrence of recent records (within last five years) of Growling Grass Frog and/or Southern Brown Bandicoot, and/or the presence of existing habitat or connectivity for either species. The ecological priority of each crossing location is detailed in Appendix B.

The second step was to assess feasibility of installing the required type of crossing structure that was commensurate with the ecological priority of each location based on the current reference design for the project. Section 2.1.1.2 outlines the various constraints to installing fauna crossing structures along HKWR Rd. Section 2.1.1.3 outlines the characteristics of optimal, suitable and incidental crossing structures and how they align with the ecological need at each location. The final habitat linkages and priority locations for fauna crossing structures are shown in Appendix A.

2.1.1.2 LOCATION CONSTRAINTS

Several engineering and design constraints exist when considering the locations and sizing of culverts along the Project. These include:

- Existing topography: The landscape of the former Koo Wee Rup swamp is predominantly flat, with very few variations in grade along the project length.
- Limited available land: Works must be contained within the existing road reserve and Public Acquisition Overlay (PAO).
- Limitations of road height: Road height is generally set by the height of the existing HKWR Rd which is re-purposed as the northbound carriageway for a large part of the Project alignment. This approach has the benefit of significantly reducing the overall construction footprint, but restricts achievable height of the roadway.
- Tie-ins to existing property accesses and side-roads
- Road height cannot be varied greatly from existing so as to allow safe transitions/grades back into the property accesses along the alignment and also side roads (e.g. Ellett Road, Hall Rd, Ballarto Road). As these property accesses are dispersed along the length of the project, this restriction is present for most of the project.
- Future HKWR Rd Upgrade Stage 2 considerations (ultimate freeway conversion, not part of this Project): This imposes further constraints on what road heights can be adopted (particularly near Hall Road and Ballarto Road where future road interchanges will be located in the future).

The project design has already adopted steeper batter grades where possible. Any raising of road height would also increase the construction footprint, and hence further vegetation would be impacted.

2.1.2 FAUNA CROSSING STRUCTURE DESIGN STANDARDS

Three fauna crossing design standards for Growling Grass Frog and Southern Brown Bandicoot have been developed to correspond with ecological priority of each location:

- 'Optimal' crossing structures: optimised to facilitate wildlife crossings and are to be installed at high priority locations
- 'Suitable' crossing structures: meet optimal standard where possible and are to be installed at moderate priority locations, and at a small number of high priority locations with location constraints
- 'Incidental' crossing structures: meet optimal or suitable standards where possible and are to be installed in low priority locations and a small number of moderate and high priority locations with severe location constraints.

The number of optimal, suitable and incidental structures that are required based on ecological priority (i.e. unconstrained design) and those that can fit within the current reference design are shown in Table 2.3 and explained in Section 2.1.3.

Locations where only drainage is required will not have culverts that are also designed as wildlife crossings. Wildlife crossing culvert designs are detailed below for Growling Grass Frog and Southern Brown Bandicoot.

2.1.2.1 GROWLING GRASS FROG

Details and rationale for the culvert recommendations are provided in Section 3.6.2.1 of the BT. Three standards for optimal, suitable and incidental Growling Grass Frog crossing structures are outlined in the Table 2.1 below.

Table 2.1 Standards for Growling Grass Frog crossing structures

FEATURES	'OPTIMAL' CROSSING STRUCTURE FOR HIGH PRIORITY GROWLING GRASS FROG CROSSINGS	'SUITABLE' CROSSING STRUCTURE	'INCIDENTAL' CROSSING STRUCTURE
Design	This design is consistent with *Growling Grass Frog Crossing Design Standards* (DELWP 2017a) Either 4 box culverts, each 2.4m wide x 1.2m to 1.5m high, or a 3-cell slab-linked box culvert, with the outer two cells being 2.4 m wide box culverts and the central cell being a 3.6m slab link Three culverts (or two (including the central culvert) if a 3-cell slab link) shall remain inundated at all times, made possible by setting the slab floor approximately 20 – 30 cm below the height of the standing water, ensuring that a minimum of approximately 20 – 30 cm of water depth is in the culvert at all times. See Figure 2.1. An open span bridge designed in accordance with Growling Grass Frog Crossing Design Standards (DELWP 2017a) is acceptable, and where feasible, is preferable to culverts.	This design has been derived from the *Growling Grass Frog Crossing Design Standards* (DELWP 2017a) for use in areas of slightly lower priority for Growling Grass Frog One or preferably two inundated (water to a depth of ~20 cm) box-cell culverts, 1.2m high and 2.4 m wide. The height can be reduced to 900 mm where clearance is an issue. Width of culvert at 2.4m should be maintained because the opening of culverts relative to length appears to be an important feature to facilitate successful crossings. See Figure 2.1.	This design is not aiming to be consistent with *Growling Grass Frog Crossing Design Standards* (DELWP 2017a) and are for use in areas where Growling Grass Frog may occasionally occur. Box culverts of any size (e.g. 0.6m wide x 0.9m high) that are primarily designed for drainage and contain water during low-flow events Pipe culverts less than 1m in diameter are not considered suitable to the movement of Growling Grass Frog.
Ponds	Ponds shall be constructed at the locations shown in the mapping in Appendix A. Ponds shall be designed, built and managed in accordance with the requirements in Section 2.2.	Ponds shall be constructed at the locations shown in the mapping in Appendix A. Ponds shall be designed, built and managed in accordance with the requirements in Section 2.2.	Ponds shall be constructed at the locations shown in the mapping in Appendix A. Ponds shall be designed, built and managed in accordance with the requirements in Section 2.2.
Inundation and fauna furniture	One cell shall be dry outside of flooding events, with the floor set 10 - 20 cm above frequent flood levels and will be designed to not hold water. The remaining cells are to be inundated, ensuring a minimum of approximately 20-30 cm of water depth at all times. Include a low-profile (50 cm wide x 30 cm tall) rock gabion wall running the full length of any dry culverts and at least one wet culvert. Gabion baskets will be filled with large rocks that provide extensive inter-rock shelters for frogs. The gabion wall shall be graded at both ends of the culvert in order to slope into the frog ponds or natural ground.. The gabion wall should be pinned to the base of the culverts to prevent movement under flood conditions. A low-profile gabion wall is likely to be substantially better than a few scattered rocks concreted into the floor of the dry culvert, for both Growling Grass Frog and Southern Brown Bandicoot, because it provides a more natural habitat, structural complexity, and shelter from potential predation than scattered rocks. If the culvert is not combined with a Southern Brown Bandicoot culvert, a dry passage option (such as a ledge) must be included on the outer wall of any inundated outer cells. To this end, the dry culvert(s) must be positioned on the outside of the array of culverts so Southern Brown Bandicoot can access from the banks of the waterway without walking through water.	Include a low-profile gabion wall running the full length of at least one of the culverts, if flood modelling permits. If a gabion wall is not possible, include a few large rocks embedded into the concrete floor of one culvert or a concrete (or other non-biodegradable material) ledge to provide dry passage and resting spots throughout the culvert. All culverts must include a ledge or equivalent on the outer wall of the outer cell on both sides of culvert array to allow Southern Brown Bandicoot or other terrestrial fauna to cross.	No gabion walls or rocks are required inside the culvert.

FEATURES	'OPTIMAL' CROSSING STRUCTURE FOR HIGH PRIORITY GROWLING GRASS FROG CROSSINGS	'SUITABLE' CROSSING STRUCTURE	'INCIDENTAL' CROSSING STRUCTURE
Light well	If the median is sufficiently wide, create a Growling Grass Frog pond in the centre median to reduce the overall length of the culverts into two shorter culverts. Where the median is too narrow for a pond, install a light well, at least 1.5 m across, and as wide as possible.	Include a light well in the centre median, at least 1.5m across.	Light wells not required.
Fencing	Must be fenced using Growling Grass Frog suitable fencing to at least 200m each side (i.e. at least 400 m in length in total), consistent with terrestrial buffer distance for Growling Grass Frog in (DEWHA 2009). Where this intersects with driveways or other access routes, this distance may be reduced to prevent animals from becoming trapped on the road side of fencing. If the distance is reduced, the fencing should terminate at the same spot on both sides of the road, to reduce trapping.	Short lengths of fencing – e.g. 50 m each side of each culvert entrance (100m in total). Where this intersects with driveways or other access routes, this distance may be reduced to prevent animals from becoming trapped on the road side of fencing. If the distance is reduced, the fencing should terminate at the same spot on both sides of the road, to reduce trapping.	Fencing not required. Where this intersects with driveways or other access routes, this distance may be reduced to prevent animals from becoming trapped on the road side of fencing. If the distance is reduced, the fencing should terminate at the same spot on both sides of the road, to reduce trapping.
Street lighting	Ideally, no street lighting to be installed within 200 m of the culvert entrances or light well. Where required to meet safety standards, ensure lighting conforms to the National Light Pollution Guidelines (DoEE 2020) , including the use of adaptive light controls to manage intensity, timing and color, lowest intensity possible, shielded to prevent light spill into adjacent habitat, the entrances to culverts and the light wells and no use of lights within the blue, violet and ultraviolet wavelengths.	Ideally, no street lighting to be installed within 100 m of the culvert entrances or light well. Where required to meet safety standards, ensure lighting conforms to the National Light Pollution Guidelines (DoEE 2020), including the use of adaptive light controls to manage intensity, timing and color, lowest intensity possible, shielded to prevent light spill into adjacent habitat, the entrances to culverts and the light wells and no use of lights within the blue, violet and ultraviolet wavelengths.	Ideally, no street lighting to be installed within 50 m of the culvert entrances or light well. Where required to meet safety standards, ensure lighting conforms to the National Light Pollution Guidelines (DoEE 2020), including the use of adaptive light controls to manage intensity, timing and color, lowest intensity possible, shielded to prevent light spill into adjacent habitat, the entrances to culverts and the light wells and no use of lights within the blue, violet and ultraviolet wavelengths.

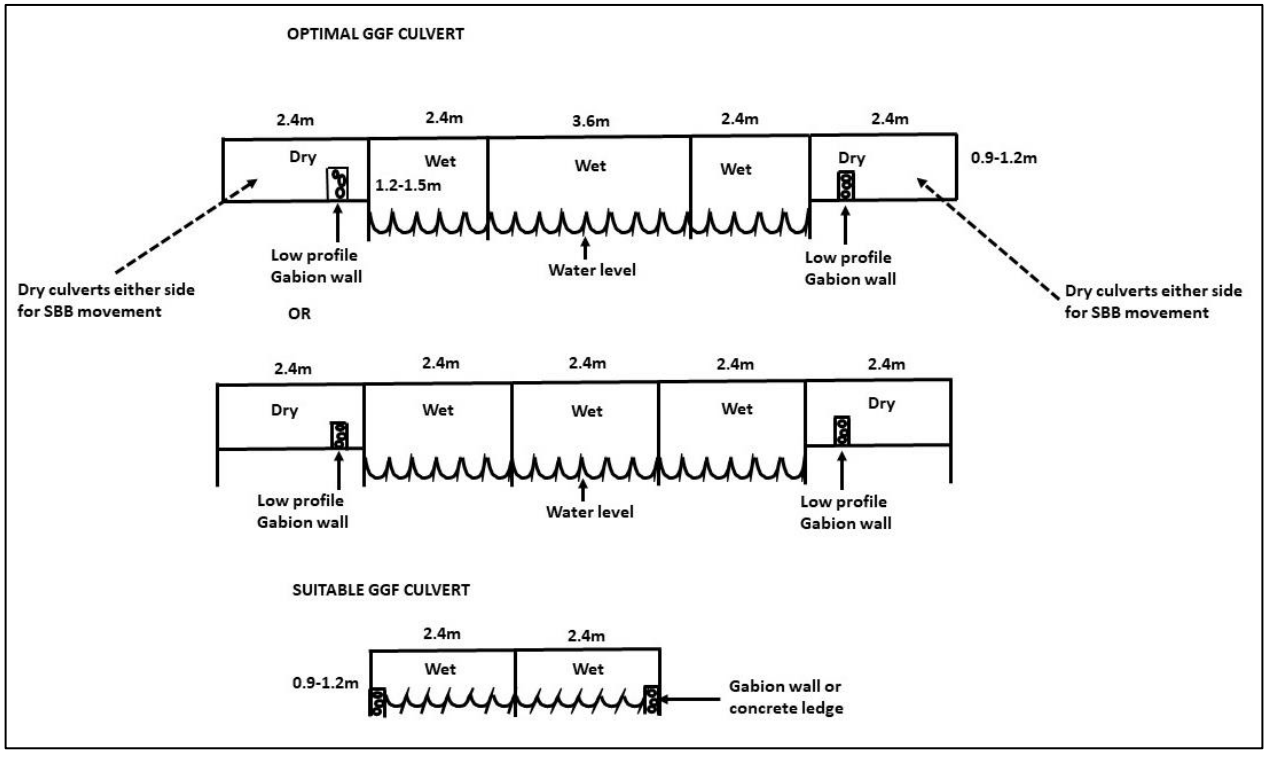

Figure 2.1 Growling Grass Frog culvert design examples

2.1.2.2 SOUTHERN BROWN BANDICOOT

Details and rationale for the culvert recommendations are provided in Section 3.6.2.2 of the BT. Subsequently, three standards for optimal, suitable and incidental crossing structures are outlined in the table below.

Table 2.2 Standards for Southern Brown Bandicoot crossing structures

FEATURES	'OPTIMAL' CROSSING STRUCTURE FOR HIGH PRIORITY SOUTHERN BROWN BANDICOOT CROSSINGS	'SUITABLE' CROSSING STRUCTURE	'INCIDENTAL' CROSSING STRUCTURE
Design	Open span bridge with continuous natural vegetation and/or artificial hides/shelters underneath. Where open span bridge is not feasible, box culverts should be used and be a minimum of 2.4 m wide and wherever possible, 1.2 to 1.5 m high, with a natural substrate floor. This is larger than the minimum specified in the Draft DELWP guidelines because Southern Brown Bandicoots need to traverse a dual-carriageway, four-lane road, and as culvert length increases, height and length must also be increased. Where height space is constrained and a culvert of 1.2 to 1.5m cannot be achieved, a minimum culvert height of 0.6m must be used. Culvert entrances to be level with adjacent terrestrial land or not exceed a slope of 20 degrees and be capable of supporting suitably dense vegetation. If part of multi-cell culverts for drainage, the two outside cells should be optimized for Southern Brown Bandicoot movement.	Box culverts, a minimum of 0.9m high and 1.2 m wide, preferably 2.4 m wide. Where height space is constrained and a culvert of 0.9m cannot be achieved, a minimum culvert height of 0.45m must be used. Ideally a natural substrate floor. If part of multi-cell culverts for drainage, the two outside culverts should be made suitable for Southern Brown Bandicoot movement.	Box culverts, minimum of 0.45 m high and 1.2 m wide. Where height space is constrained and a culvert of 0.45m cannot be achieved, a minimum culvert height of 0.3m must be used. Concrete base to culvert. Pipe culverts do not qualify as fauna crossing structures. Alternatively, concrete (or other non-biodegradable material) ledges must be installed within wet culverts designed for Growling Grass Frog movement to allow for incidental Southern Brown Bandicoot passage.
Inundation and fauna furniture	The culvert will be as high as practicable within the road formation with an invert at least 300mm above the invert of the lowest wet culvert in the group. The dry culvert will be designed to be free draining such that any flood water will dissipate. Preferable a 'dry' culvert never be flooded, as this can remove/dislodge wildlife furniture. Include a ledge, shelf, or alternative structure on the outer wall of the outer cells of the crossing which is a minimum of 450 mm wide and level and continuous with the embankment that provides dry passage during flood events. This should be made from non-biodegradable materials such as concrete. See Figure 2.3. At the culvert entrance, include raised logs, rocks, dense plantings (following the revegetation guidelines in Appendix C4) and a combination of wood and non-biodegradable material (such as concrete) artificial shelters. Within the culvert, include artificial shelters every 5 m along the culvert length. Wood shelters should be constructed from treated pine planks fastened into a rectangular frame with a partition in the middle to form two chambers, as per design for shelter (Appendix C). Otherwise hardwood or marine ply for greater longevity, painted with non-toxic paint. Other shelters should be lengths of pipe made from non-biodegradable materials such as concrete approximately 15 cm diameter, of varying lengths from 40 cm up to 1 m.	The culvert will be as high as practicable within the road formation with an invert at least 300mm above the invert of the lowest wet culvert in the group. The dry culvert will be designed to be free draining such that any flood water will dissipate. Include a ledge, shelf, or alternative structure on the outer wall of the outer cells of the crossing which is a minimum of 450 mm wide and level and continuous with the embankment that provides dry passage during flood events. This should be made from non-biodegradable materials such as concrete. See Figure 2.3.	Does not hold water for extended periods after rain. Shelves and ledges not required.

FEATURES	'OPTIMAL' CROSSING STRUCTURE FOR HIGH PRIORITY SOUTHERN BROWN BANDICOOT CROSSINGS	'SUITABLE' CROSSING STRUCTURE	'INCIDENTAL' CROSSING STRUCTURE
Light well	The culvert should be as short as possible, and where the central median is sufficiently wide, include split culverts under each carriageway with a fenced opening in the median to reduce the tunnel effect of the culvert. The longer the underpass, the higher and wider it should be. Include light wells in the median if a single culvert crosses both carriageways (i.e. >30 m in length).	If more than 30 m in length, include a light well in centre median.	No light well required.
Fencing	Must be fenced – at least 200 m on each side of each entrance (i.e. 400 m total at each end). Where this intersects with driveways or other access routes, this distance may be reduced to prevent animals from becoming trapped on the road side of fencing. If the distance is reduced, the fencing should terminate at the same spot on both sides of the road, to reduce trapping.	50 m of fencing on each side of each culvert. Where this intersects with driveways or other access routes, this distance may be reduced to prevent animals from becoming trapped on the road side of fencing. If the distance is reduced, the fencing should terminate at the same spot on both sides of the road, to reduce trapping.	No fencing required. Where this intersects with driveways or other access routes, this distance may be reduced to prevent animals from becoming trapped on the road side of fencing. If the distance is reduced, the fencing should terminate at the same spot on both sides of the road, to reduce trapping.
Street lighting	Ideally, no street lighting to be installed within 200 m of the culvert entrances or light well. Where required to meet safety standards, ensure lighting conforms to the National Light Pollution Guidelines (DoEE 2020), including the use of adaptive light controls to manage intensity, timing and color, lowest intensity possible, shielded to prevent light spill into adjacent habitat, the entrances to culverts and the light wells and no use of lights within the blue, violet and ultraviolet wavelengths.	Ideally, no street lighting to be installed within 100 m of the culvert entrances or light well. Where required to meet safety standards, ensure lighting conforms to the National Light Pollution Guidelines (DoEE 2020), including the use of adaptive light controls to manage intensity, timing and color, lowest intensity possible, shielded to prevent light spill into adjacent habitat, the entrances to culverts and the light wells and no use of lights within the blue, violet and ultraviolet wavelengths.	Ideally, no street lighting to be installed within 50 m of the culvert entrances or light well. Where required to meet safety standards, ensure lighting conforms to the National Light Pollution Guidelines (DoEE 2020), including the use of adaptive light controls to manage intensity, timing and color, lowest intensity possible, shielded to prevent light spill into adjacent habitat, the entrances to culverts and the light wells and no use of lights within the blue, violet and ultraviolet wavelengths.
Predator control	Predator control to be undertaken at each entrance and within 500 m of each underpass as part of a co-ordinated and strategic program.	Predator control to be undertaken at each entrance and within 500 m of each underpass as part of a co-ordinated and strategic program.	

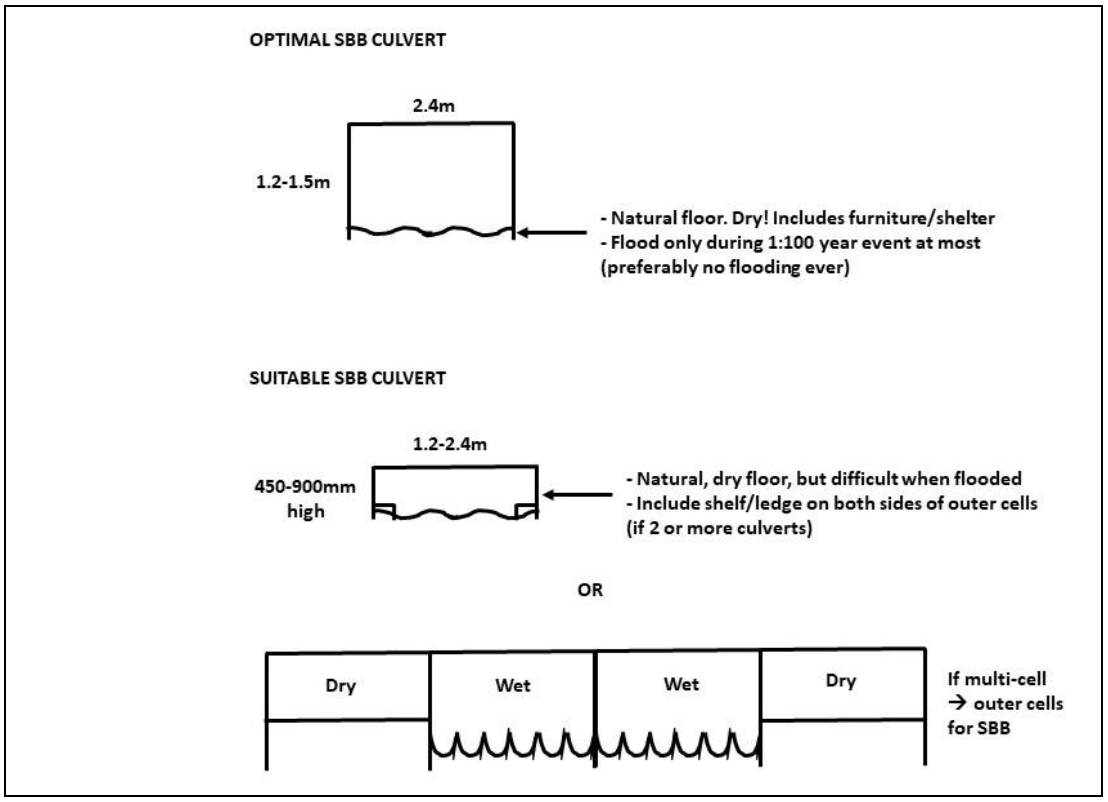

Figure 2.3 Southern Brown Bandicoot culvert design examples (refer to Table 2.2 for caveats on culvert heights)

2.1.3 SUMMARY OF FAUNA CROSSING STRUCTURES

In summary, a total of 41 crossing locations along HKWR Rd have been identified and prioritized as either High ecological priority (18 locations), medium (11 locations) or low (12 locations), depending on the needs of the Growling Grass Frog and/or Southern Brown Bandicoot (Table 2.3). Based on the constraints at each location, 13 out of the 17 identified optimal crossing structure types for high priority locations will be built under the current design, 10 out of 11 suitable structures at medium priority locations will be built, and 14 incidental structures will be built at the remainder of the locations. The location of these crossings is provided on Fauna Mitigation maps in Appendix A with more details of fauna crossing structures provided in Appendix B. Crossings at C4 and C5 have a low feasibility as they occur under existing pavement and as such are unlikely to be realized as a part of the Project. Crossing C3 has also been identified as having a low feasibility of being constructed due to flooding constraints and will not be realized as a part of the Project.

Specific refinement of the fauna crossing structures will be required during detailed design once a preferred tenderer is chosen. Likewise, small changes to the type, size and location of all culverts will need to be assessed in the rerun of the surface water and hydraulic modelling in detailed design.

Table 2.3 Summary of current and ideal culvert types

CROSSING STRUCTURE TYPE (PRIORITY)	NUMBER OF CROSSING STRUCTURES FEASIBLE WITH CURRENT ROAD DESIGN	NUMBER OF CROSSING STRUCTURES FEASIBLE WITH AN UNCONSTRAINED IDEAL DESIGN
Bridge (high priority)	1	1
Optimal (high priority)	13*	17*
Suitable (medium priority)	10	11
Incidental (low priority)	14	12
Total	38	41

*Includes two new optimal crossing structures – C33 and C34, since the earlier version of the Fauna Management Plan (Practical Ecology 2019).

2.1.4 FENCING

Wildlife exclusion fencing must be installed to funnel fauna towards each culvert and the bridge over Deep Creek. Construction materials and design are as described in Section 2.3.

2.1.5 DEEP CREEK BRIDGE

Two new bridges will be constructed over Deep Creek. Design considerations for the Deep Creek Bridges are described in Section 3.9 of the BT:

- Revegetation plantings and habitat features for the Southern Brown Bandicoot shall be installed as per the new bridge over the Bunyip River Drain Complex during Stage 1A.
- Include the construction of habitat ponds at this location, in accordance with the *Growling Grass Frog Habitat Design Standards* (DELWP 2017b) and described in Section 2.2, below.
- There are no standards to inform the design of the bridge crossing of Deep Creek, however the following are adopted as minimum:
  - The bridge will include at least 2 – 3 m of flat or gently sloping river bank on each abutment, to provide space for wildlife movement. This area will include placement of logs and other shelter (including artificial shelters for Southern Brown Bandicoot), and as much planted vegetation as possible. The gap between the two carriageways is as large as possible, ideally at least 5 m, to allow light and moisture to support the growth of vegetation between the carriageways and under the bridge structure.

- Artificial shelters for Southern Brown Bandicoot must be constructed in accordance with the design in Appendix C1.
- Revegetation must be undertaken in accordance with the guidelines in Appendix C3
- Ideally, no street lighting to be installed within 200 m of the bridge, and none within 100 m. Where required to meet safety standards, ensure lighting conforms to the National Light Pollution Guidelines (2020), including the use of adaptive light controls to ensure the lowest intensity possible, shielded to prevent light spill into adjacent habitat, and no use of lights within the blue, violet and ultraviolet wavelengths.

2.2 GROWLING GRASS FROG HABITAT PONDS

Growling Grass Frog habitat ponds will be designed in accordance with the *Growling Grass Frog Crossing Design Standards* (DELWP 2017a) and where there is adequate space within the Project Area, the *Growling Grass Frog Habitat Design Standards* (DELWP 2017b) will be used. These standards are described in Section 3.10 of the BT and summarised below:

- Growling Grass Frog underpasses must include the construction of habitat ponds at both entrances for high priority culverts where feasible to construct within the Project Area (as shown in the mapping in Appendix A).
- Growling Grass Frog habitat ponds must be used exclusively as a habitat pond – it must not also be used for stormwater run-off or receive direct run-off from the road surface due to the risk of pollution entering the habitat pond. Groundwater or surface run-off from grassed areas and areas of native vegetation is acceptable. Indirect road run-off is also acceptable where it has undergone treatment, such as via vegetated swales, and is shown to meet the water quality standards detailed in Growling Grass Frog Habitat Design Standards (DELWP 2017b).
- The bank of each individual pond must vary in degree and slope, include different microhabitats (rocks, logs, vegetation). In addition to the gabion walls running through the culverts, include rock piles at underpass entrances for cover from predators.
- Where space permits ponds should be 0.15 to 0.3ha. Where ponds of this size are not possible within the available space, the largest possible pond should be constructed but no less than the minimum size of 240m^2 as per (Koehler & Gilmore 2014).
- Habitat ponds must hold permanent water. To this end at least half of the pond must be deep-water zone (at least 1.5m deep, ideally 3m deep), grading to a shallow-water zone (at least 0.2m deep, ideally 1m deep).
- Where two ponds are located in close proximity, separate ponds are preferred. However, where separate ponds are not feasible due to space constraints, or where greater pond size will enable key pond parameters (e.g. depth and gradients) to be achieved, combining ponds located in close proximity is considered acceptable.
- Clay liner must be included to prevent leakage.
- Vegetation plantings must be included.

In summary, a total of 21 pond locations have been proposed and reviewed for their priority depending on the priority of the culverts/crossing structures that they are adjacent to and the space available for the construction of ponds within the Project Area. All high (12) and all moderate feasibility ponds (2) are to be constructed. Low feasibility ponds are not proposed due to the lack of room to build them within the PAO.

Table 2.4 Summary of prioritised habitat ponds

	FEASIBILITY BASED ON ROOM IN PROJECT AREA			
PRIORITY FOR PONDS	**HIGH**	**LOW**	**MODERATE**	**GRAND TOTAL**
High	1	2	2	5
Medium-high	5	2		7
Medium	2	3		5
Low	4			4
Grand Total	**12**	**7**	**2**	**21**

Specific refinement of the ponds will be required in detailed design once a preferred tenderer is chosen. Likewise, the specification of the ponds will need to be assessed in the rerun of the surface water and hydraulic modelling in detailed design.

2.3 WILDLIFE EXCLUSION FENCING

2.3.1 TEMPORARY FENCING

Temporary fencing must be installed to prevent fauna from entering the construction area, and to funnel fauna towards culvert and underpass entrances during the construction period.
Design specifications for temporary wildlife exclusion fencing are as follows:

- Fence construction materials and design:
  - Constructed to a height of 1.2m and buried 0.3m below ground.
  - Constructed using star pickets, high tensile wire and shade cloth.
  - Include a 'floppy top' overhang of 0.3m pointing away from the road – this discourages frogs from climbing over the fence.
  - Other design specifications as for permanent wildlife exclusion fencing.
- Fence locations:

As for permanent wildlife exclusion fencing (below) and as shown in Fauna Mitigation Plan maps, with exception of the Deep Creek temporary fence locations. At a minimum, high priority fences must be built with moderate and low priority fence locations to be built where feasible.

Additional background information can be found in section 3.5.1 of the BT.

2.3.2 PERMANENT FENCING

Permanent fencing must be installed to prevent fauna from entering the road, and to funnel fauna towards culvert and underpass entrances. Effective fencing can reduce rates of roadkill by almost 100%.

Design specifications for permanent wildlife exclusion fencing are as follows:

- Fence construction materials and design:
  - Constructed to a height of 1.2 m tall. Height can be reduced to a minimum height of 1 m with the inclusion of a 150 mm overhang lip (recommended ~30º angle).
  - Buried 0.3 m below ground (except where this is not possible, such as above culvert wing walls or head walls)

- Constructed using solid, opaque materials, such as high-density polyethylene (1-5mm thickness), or a sturdy mesh with an aperture size less than 10 mm.
- If the above is not possible, fence can be constructed as per temporary wildlife exclusion fencing (above). However, this is not considered to be viable in the long-term because of increased maintenance requirements.

- Where fence is installed to funnel fauna towards culvert and underpass entrances:
  - Must be installed flush with the culvert / underpass opening (no gaps between fence and underpass).
  - Must be installed at least 200m either side of culvert / underpass openings for optimal culverts and Deep Creek Bridge, up to 50m for suitable culverts and no fencing for incidental culverts. Where this intersects with driveways or other access routes, this distance may be reduced to prevent animals from becoming trapped on the road side of fencing. If the distance is reduced, the fencing should terminate at the same spot on both sides of the road, to reduce trapping.
  - Set back approximately 10m from the road, where practicable.
  - Where possible, the terminal 10 – 20 m of each section of fence should be angled to extend away from road to create a funnel shape.
- Ideally installed behind guard rails.

Fence maintenance:

- Fencing must be regularly inspected for damage and rapidly repaired.
- Vegetation within 3m of the fence and escape ramp must be slashed or mowed to prevent fauna using vegetation to climb over fence or up the ramp.

- Fence location:
  - At culvert and underpass entrances and at key locations along the roadside, as shown in Fauna Mitigation Plan maps. At a minimum, high priority fences must be built with moderate and low priority fence locations to be built where feasible.

Animals inevitably breach fencing and can become trapped between the fencing and the road, increasing the risk of collision with vehicles. Escape ramps shall be used along HKWR Rd to allow SBB to escape. The design of the escape ramp for Southern Brown Bandicoot is to be based on designs trialed on the Oxley Bypass in NE NSW. These were earthen ramps, approximately 1 m wide and 3 m long, with a 60 – 80 cm drop down, with fauna fencing on either side.

Additional background information can be found in section 3.5 of the BT.

2.4 REVEGETATION AND HABITAT RESTORATION

Requirements for habitat rehabilitation and revegetation are provided in Section 3.15 of the BT. This states that there is a commitment to prepare a Revegetation and Habitat Restoration Plan for the Stage 1B Upgrade. The revegetation plan is to include:

- Establishment of habitat corridors to re-establish connectivity for the Southern Brown Bandicoot
- Revegetating around the fauna crossing culvert entrances
- Establishing vegetation around the created habitat ponds for Growling Grass Frogs
- Revegetation of the Deep Creep corridor

All revegetation will be undertaken with consideration of the habitat requirements of the target species. For Growling Grass Frog the habitat restoration will be done in accordance with the *Growling Grass Frog Habitat Design Standards* (DELWP 2017b), summarised in Section 2.2. Any other aquatic or semi-aquatic revegetation should also follow this

standard. A list of wetland species suitable for revegetation of Growling Grass Frog ponds is provided at Appendix E of the BT.

All terrestrial revegetation and habitat restoration, including beneath the Deep Creek bridge (where possible with agreement from Melbourne Water), must follow the Guidelines for best-practice management of modified habitats for Southern Brown Bandicoots (Masters, Talyor & Maclagan 2019), described at Appendix C3.

Southern Brown Bandicoots can use a wide variety of native and exotic vegetation along the road alignment. As such, management of any terrestrial vegetation, including revegetation areas, must be undertaken in accordance with:

- the Southern Brown Bandicoot pest plants guidelines, described at Appendix C2.
- the Southern Brown Bandicoot vegetation management guidelines, described at Appendix C4
- species suitable for establishing Southern Brown Bandicoot habitat is at Appendix D of the BT.

Specific revegetation requirements for Swamp Skink and Glossy Grass Skink include a dense ground cover of Tussock Grasses, Sedges and low shrubs and avoiding trees.

2.5 LIGHTING

As described in section 3.11 of the BT, streetlights will be designed through positioning and shielding to avoid light spill on to McGregors Drain, Deep Creek, underpasses and culverts designed for fauna passage and other adjacent terrestrial habitat, wherever safety standards allow. Further avoidance of lighting impacts will be achieved by considering fixture height and globe type (intensity and wavelength). Design of street lighting should refer to design principles from the *National Light Pollution Guidelines for Wildlife* (DoEE 2020) including using:

- light for specific purposes only.
- the lowest intensity light for task.
- light with reduced or filtered blue, violet and ultra-violet wavelengths.
- shielded, low, and directional lighting to avoid light spill.
- non-reflective, dark-coloured surfaces where practicable.

Where exclusion zones for lighting placement near culverts and habitat is demonstrated to be unfeasible and in conflict with required standards, the above design principles should be considered to manage light spill.

3 FAUNA MANAGEMENT – PRE-CONSTRUCTION

Management actions to be implemented before construction commences are summarised in Table 3.1, below. Background information and additional guidance on the management actions can be found in the BT.

Table 3.1 Management actions – Pre-construction

ACTION	FREQUENCY AND DURATION	ADAPTIVE MANAGEMENT	IMPLEMENTATION RESPONSIBILITY
Site induction for all construction staff explaining areas of ecological sensitivity – BT Section 3.3	Site personnel will be inducted prior to commencement of work on site. Induction records will be provided to MRPV on a monthly basis.	Hold additional meetings as required. Disseminate additional material to site personnel as required.	The State or delegated to Contractor
Install temporary fencing and signage around areas of sensitive vegetation (ASV) – BT Section 3.5.1 and 3.2	Fence to be in place until construction completed.	N/A	The State or delegated to Contractor
Install temporary wildlife exclusion fencing to prevent fauna from entering the construction area, and to funnel fauna towards culvert and underpass entrances during the construction period – BT Section	Fence to be in place until construction completed.	N/A	The State or delegated to Contractor
Implement a predator control program to reduce fox and cat populations – BT Section 3.4.	Predator Control Program will commence in the autumn or spring prior to main works construction commencing. Fox baiting will occur over at least three consecutive months in autumn and spring (February/March/April and September/October/November)	Respond to monitoring data collected on predator abundance, including predator reduction targets, and adapt control activities as appropriate Introduce new/up-to date control techniques/strategies as they become available.	The State or delegated to Contractor
Implement sediment and erosion control measures in accordance with VicRoads Integrated Water Management Guidelines (VicRoads 2013) – BT Section 3.12	Measures to be in place prior to construction commencing until construction completed.		The State or delegated to Contractor
Implement water quality monitoring Methodology is described in the BT Section 6.	Baseline 'wet' and 'dry' samples collected for at least two seasons prior to commencement of works at 10 sites. Other baseline samples prior to construction as required.		The State or delegated to Contractor
Implement a Southern Brown Bandicoot monitoring program – BT Section 6	Baseline monitoring to be undertaken in autumn. Cameras will be deployed for two weeks at each site.	Consider additional monitoring sites if initial baseline sites do not record Southern Brown Bandicoot.	The State or delegated to Contractor

ACTION	FREQUENCY AND DURATION	ADAPTIVE MANAGEMENT	IMPLEMENTATION RESPONSIBILITY
Implement a Growling Grass Frog monitoring program – BT Section 6	Baseline monitoring during the survey season (October-March). Survey sites visited once during the day for a habitat assessment and for two nights for nocturnal call-playback and spotlighting.	Consider additional monitoring sites if initial baseline sites do not record Growling Grass Frog.	The State or delegated to Contractor
Implement a Glossy Grass Skink monitoring program – BT Section 6	Baseline monitoring during the activity season of the skinks (September to April).		The State or delegated to Contractor
Develop and implement a Habitat Restoration and Revegetation Plan - BT Section 3.15	Restoration of ASV for habitat improvement should commence as soon as possible during the pre-construction phase to enable early restoration and development of revegetation in the retained parts of the road corridor. Planting with indigenous aquatic and terrestrial plants will occur in the autumn and spring.	Undertake additional plantings depending on the success of plant establishment. Supply structures (e.g. logs, rocks) during vegetation establishment, if required.	The State or delegated to Contractor

4 FAUNA MANAGEMENT – DURING CONSTRUCTION

4.1 GENERAL

Management actions to be implemented during construction are summarised in Table 4.1, below.

4.2 TIMING OF CONSTRUCTION ACTVITIES

The BT includes the following recommendations around the timing of certain construction activities. These should be implemented as the preferred option and should only be deviated from where they are deemed not practicable.

- Fauna underpasses and culverts, along with associated revegetation and shelters at entrances, to be installed early during the construction phase to provide wildlife connectivity early and throughout the construction phase.
- Construction activities to occur during daylight hours to reduce disturbance to Southern Brown Bandicoot.
- Pile driving to occur outside of the Southern Brown Bandicoot key breeding season (July to November) to reduce disturbance – BT section 3.9. Where, under exceptional circumstances, pile driving must occur during the breeding season the following mitigation measures will be adopted:
  - Minimise the duration of pile driving works within the breeding season breeding season to a maximum of 17 days
  - Piling to take place during daylight hours only
  - Use of a cushion within the leader of the piling rig
  - Noise and vibration monitoring to be complete during the works
  - Installation of six fauna cameras in the vicinity of the works to monitor bandicoot activity during and after the piling works.
- Construction activities to occur during daylight hours to reduce disturbance to Growling Grass Frog
- Construction in Growling Grass Frog habitat to occur outside of the Growling Grass Frog key breeding season (October to December) to reduce disturbance
- If construction activities occur in winter then salvage and relocation of Glossy Grass Skink will be required. Capture and release protocols described in BT section 4.44.

4.3 HABITAT REMOVAL

- Vegetation removal recommendations:
  - Vegetation removal (both native and exotic) is to be undertaken in a sequential, linear fashion with clearing to be staged so as to direct fauna towards No Go Zones or other areas of refuge (such as vegetation which is not proposed to be cleared). That is, clearing should commence at the cleared edge (or as far from area that would act as a refuge for fauna) and progressively move in the direction of the vegetation that is to remain to maintain a clear escape path for fauna and to prevent animals becoming trapped.
  - Southern Brown Bandicoots use a wide variety of native and exotic vegetation along the road alignment. As such, management of any terrestrial vegetation (including removal of weeds such as Toowoomba Canary Grass *Phalaris aquatica* and Blackberry *Rubus fruticosus*) must be undertaken in accordance with:

  - the Southern Brown Bandicoot pest plants guidelines, described at Appendix B2.
  - the Southern Brown Bandicoot vegetation management guidelines, described at Appendix B4.
- Conduct salvage and relocation of fauna during habitat removal including Southern Brown Bandicoot and Swamp Skinks (if confirmed present). See also section 6.2
- Install temporary Southern Brown Bandicoot shelters where practical and recommended by a qualified zoologist..
- Install temporary skink shelters (to be revised if not confirmed present in (WSP 2020a) where practical and recommended by a qualified zoologist...
- Stockpile branches and logs for use as habitat features in underpasses and habitat restoration.

- Drain removal recommendations
  - Construct new drains and establish vegetation plantings before old drains are removed (where practical).
  - Conduct salvage and relocation of Growling Grass Frog and skinks. Capture and release protocols described in BT section 4.
  - Use standard suction hose protection to prevent Growling Grass Frog and tadpoles being sucked up during dam and drain dewatering.

Table 4.1 Management actions – During construction

ACTION	FREQUENCY AND DURATION	ADAPTIVE MANAGEMENT	IMPLEMENTATION RESPONSIBILITY
Site induction for any new construction staff explaining areas of ecological sensitivity – BT section 3.3	Site personnel will be inducted prior to commencement of work on site. Induction records will be provided to MRPV on a monthly basis.	Hold additional meetings as required. Disseminate additional material to site personnel as required.	The State or delegated to Contractor
Inspect temporary fencing, signage and wildlife exclusion fencing – BT section 3.5.1	Inspections of fences to occur weekly for the entire during of construction.	Repair any failing structure within 48 hours. Extra fencing will be installed if required.	The State or delegated to Contractor
Pre-clearance fauna surveys – BT section 3.7	Prior to and during the removal of any vegetation, a pre-clearance walkthrough will be undertaken to capture and relocate threatened fauna from habitat within construction areas.	If threatened fauna is found then construction works must cease until the animal is observed to have left the activity area of its own accord or until a qualified zoologist has relocated the animal in accordance with fauna salvage and relocation protocols in Section 4 of the BT.	The State or delegated to Contractor
Daily search of construction area prior to work commencing – BT section 3.7.1	Daily and immediately prior to works recommencing.	If threatened fauna is found, then construction works must cease until the animal is observed to have left the activity area of its own accord or until a qualified zoologist has relocated the animal in accordance with fauna salvage and relocation protocols in Section 4 of the BT	The State or delegated to Contractor
Implement Chytrid fungus control measures – vehicle, machinery footwear washdowns between waterbodies and drains undertaken in accordance with the hygiene protocol for control of disease in frogs – BT section 3.14	Chytrid fungus control measures will be undertaken prior to and following supervisory personnel, entering identified Growling Grass Frog habitat areas (i.e. drains, dams, Deep Creek) until vegetation clearing is complete.	The Project Zoologist shall assess the effectiveness of controls on completion of vegetation clearing.	The State or delegated to Contractor

ACTION	FREQUENCY AND DURATION	ADAPTIVE MANAGEMENT	IMPLEMENTATION RESPONSIBILITY
Continue the predator control program to reduce fox and cat population – BT section 3.4	Fox baiting will occur over at least three consecutive months in autumn and spring (February/March/April and September/October/November). Predator Control Program will continue for the duration of construction phase.	Respond to monitoring data collected on predator abundance and adapt control activities as required. Introduce new/up-to-date control techniques/strategies as they become available.	The State or delegated to Contractor
Develop and implement a Weed Management Plan - BT section 3.13 The Weed Management Plan will adopt measures described in the Southern Brown Bandicoot pest plants and vegetation management guidelines, described at Appendix B2 and B4.	The Weed Management Plan will be developed prior to construction and implemented for the duration of the construction phase.	Review success of weed management procedures and techniques. Intensify weed management or introduce new techniques, if considered necessary.	The State or delegated to Contractor
Inspections of sediment and erosion control measures – BT section 3.12	Inspections of sediment and erosion control measures will occur once a week during dry weather and more frequently during periods of heavy rainfall.	Install additional sediment/silt fencing, if required. In the event of an environmental incident (e.g. chemical spill, excessive turbidity), any changes in water quality will be determined, and MRPV, DELWP, and Melbourne Water, will be consulted. If an environmental incident occurs, work should cease immediately, and the cause reviewed and rectified.	The State or delegated to Contractor
Continue water quality monitoring program – BT section 5	During construction, water quality monitoring will be conducted fortnightly and for each rain event as follows: — At intervals no greater than 7 days; and — Immediately after rainfall when the Construction Areas are deemed safe to enter.	Should monitoring detect that water quality impacts have occurred due to construction works, the Site Environment Officer will immediately attempt to identify the source of the impact (contamination) and make every reasonable effort to rectify the cause. Identify sources of turbidity/contamination should monitoring detect water quality impacts. Install additional sediment/silt fencing, if required.	The State or delegated to Contractor
Continue Southern Brown Bandicoot monitoring program – BT section 5	Construction monitoring of 'reference' and 'impact' sites to be undertaken over two two-week periods in autumn. Monitor culverts in Stage 1A and 1B over two two-week periods in autumn. Monitor escape ramps in Stage 1B while doing culvert monitoring.	Consider additional monitoring sites if Southern Brown Bandicoot is not recorded.	The State or delegated to Contractor

ACTION	FREQUENCY AND DURATION	ADAPTIVE MANAGEMENT	IMPLEMENTATION RESPONSIBILITY
Continue Growling Grass Frog monitoring program – BT section 5	Construction monitoring of 'reference' and 'impact' sites to be undertaken over two nights during the optimal survey season (October-March). Monitor culverts in Stage 1A and 1B over two two-week periods in autumn.	Consider additional monitoring sites if Growling Grass Frog is not recorded.	The State or delegated to Contractor
Continue skink monitoring program – BT section 5	Construction monitoring of 'reference' and 'impact' sites to be undertaken during the activity season of the skinks (September to April).		The State or delegated to Contractor
Install fauna underpasses and culverts – BT section 3.6 *An appropriately qualified zoologist with experience in fauna underpass design must inspect and approve all fauna underpasses throughout construction and upon completion.*	*Early* during the construction phase to provide wildlife connectivity early and throughout the construction phase Fauna underpasses and culverts to be installed early during the construction phase to provide long lead-up times for fauna usage.	Following inspection by project zoologist, modify habitat features within underpasses and at entrances if deemed not to function for intended purpose.	The State or delegated to Contractor
Habitat creation/restoration at underpass entrances – BT section 3.6 and 3.15	Early during construction phase and immediately following culvert/ underpass installation.	Undertake additional plantings depending on the success of plant establishment. Supply structures (e.g. logs, rocks) during vegetation establishment, if required.	The State or delegated to Contractor
Staged vegetation removal – BT section 3.8	Staged vegetation removal to occur during construction. Scrub piles to be installed prior to vegetation removal.	Modify progress of vegetation clearing if monitoring or pre-clearance surveys detect threatened species.	The State or delegated to Contractor

5 FAUNA MANAGEMENT – POST CONSTRUCTION

The following table identifies the management actions required in the post-construction phase.

Background information and additional guidance on the management actions can be found in the BT.

Table 5.1 Management actions – Post construction

ACTION	FREQUENCY AND DURATION	ADAPTIVE MANAGEMENT	IMPLEMENTATION RESPONSIBILITY
Maintain sediment and erosion control measures until rehabilitation of exposed slopes has established – BT section 3.12	Inspections of protective fences will occur once a week in dry weather and more frequently during periods of heavy rainfall. Maintenance of protective fencing will occur until revegetation /rehabilitation has occurred.	Install additional sediment/silt fencing, if required. In the event of an environmental incident (e.g. chemical spill, excessive turbidity), any changes in water quality will be determined, and MRPV, DELWP, and Melbourne Water, will be consulted. If an environmental incident occurs, work should cease immediately, and the cause reviewed and rectified.	The State or delegated to Contractor
Remove temporary fencing and signage from around areas of sensitive vegetation (ASV) – BT section 3.5.1	Remove fencing once all construction activities have ceased.	NA	The State or delegated to Contractor
Install permanent wildlife exclusion fencing – BT section 3.5.2	Fence to be in place directly after construction	NA	The State or delegated to Contractor
Inspect permanent wildlife fencing. Ensure fences are functioning as designed. BT Section 3.5.2	Every 3 months for 10 years post-construction.	Repair any failing structure within 1 week.	The State or delegated to Contractor
Inspect culverts and fauna underpasses. Ensure structures are clear of obstructions and functioning as designed. BT Section 3.6	Every 3 months for 10 years post-construction.	Repair any failing structure or clear obstructions within 1 week.	The State or delegated to Contractor
Inspect installed Growling Grass Frog ponds.	Every 3 months for 10 years post-construction.	Restore or revegetate any habitat feature that does not meet the required Growling Grass Frog habitat pond design (with consideration of time required for vegetation planting establishment) within 6 weeks.	The State or delegated to Contractor
Inspect areas of revegetation and habitat restoration.	Every 3 months for 10 years post-construction.	Restore or revegetate any habitat feature that does not meet the required standards (with consideration of time required for vegetation planting establishment) within 6 weeks.	The State or delegated to Contractor

ACTION	FREQUENCY AND DURATION	ADAPTIVE MANAGEMENT	IMPLEMENTATION RESPONSIBILITY
Continue the predator control program to reduce fox population – BT section 3.4	Fox baiting will occur twice per year (autumn and spring). Fox den fumigation and cat trapping will occur on an as needs basis. Predator Control Program will continue for at least 8 years following revegetation/until revegetation has established sufficient height and density Predator abundance will be monitored for an additional year after control has ceased.	Respond to monitoring data collected on predator abundance and adapt control activities, as appropriate.	The State or delegated to Contractor
Continue weed control activities – BT section 3.13	Weed Control Program will continue for 10 years post-construction.	Review success of weed management procedures and techniques. Intensify weed management or introduce new techniques, if considered necessary.	The State or delegated to Contractor
Continue water quality monitoring program – BT section 5	Continue for two years post construction.	Should monitoring detect that water quality impacts have occurred due to construction works, the Site Environment Officer will immediately attempt to identify the source of the impact (contamination) and make every reasonable effort to rectify the cause. Identify sources of turbidity/contamination should monitoring detect water quality impacts. Install additional sediment/silt fencing, if required.	The State or delegated to Contractor
Continue Southern Brown Bandicoot monitoring program – BT section 5	As per frequency for occupancy monitoring: Years 1, 3, and 5, then one monitoring event in Year 10. Monitoring will be undertaken in autumn, with cameras for at least two weeks.	The results from the monitoring of fauna crossing structures, installed habitats, and artificial shelters will used to inform rectification to design standards and the continued improvement of fauna sensitive road design.	The State or delegated to Contractor
Continue Growling Grass Frog monitoring program – BT section 5	Annual monitoring until 5 years post-construction during the survey season (October-March). Survey sites visited once during the day for a habitat assessment and twice at night for nocturnal call-playback and spotlighting.	The results from the monitoring of fauna crossing structures, installed habitats, and artificial shelters will used to inform rectification to design standards and the continued improvement of fauna sensitive road design	The State or delegated to Contractor

ACTION	FREQUENCY AND DURATION	ADAPTIVE MANAGEMENT	IMPLEMENTATION RESPONSIBILITY
Continue Glossy Grass Skink monitoring program – BT section 5	As per frequency for occupancy monitoring: Years 1, 3, and 5, then one monitoring event in Year 10. Monitoring will be undertaken during the activity season of the skinks (September to April).	The results from the monitoring of fauna crossing structures, installed habitats, and artificial shelters will used to inform rectification to design standards and the continued improvement of fauna sensitive road design	The State or delegated to Contractor
Implement a culvert and underpass monitoring program to assess use of the crossing structures by Growling Grass Frog – BT section 5	Monitor culverts/underpasses and created ponds/habitat for Growling Grass Frog as per the Fauna monitoring program. Incorporated into annual monitoring until 5 years post-construction during the survey season (October-March).	Fauna crossing structures will be inspected every 3 months for 10 years post-construction to ensure structures are clear of obstructions and functioning as designed. The results from the monitoring of fauna crossing structures, installed habitats, and artificial shelters will used to inform rectification to design standards and the continued improvement of fauna sensitive road design	The State or delegated to Contractor
Implement a culvert and underpass monitoring program to assess use of the crossing structures by Southern Brown Bandicoot – BT 5	Monitor culverts/underpasses as per frequency for occupancy monitoring: Years 1, 3, and 5, then one monitoring event in Year 10 as per the Fauna monitoring program.. Monitoring will be undertaken in autumn, with cameras for at least two weeks.	Fauna crossing structures will be inspected every 3 months for 10 years post-construction to ensure structures are clear of obstructions and functioning as designed. The results from the monitoring of fauna crossing structures, installed habitats, and artificial shelters will used to inform rectification to design standards and the continued improvement of fauna sensitive road design	The State or delegated to Contractor

6 OTHER COMMITMENTS

This section summarises the other project commitments to be undertaken through the life of the project. More detail on each is provided in the BT.

6.1 PREDATOR CONTROL PROGRAM

Section 3.4 of the BT describe principles for a predator control program. The program specifics will be developed in consultation with the contractor engaged to undertake the work. The general scope of the program will consist of a combination of fox baiting, fox den fumigation, cat trapping and potentially soft jaw trapping and/or shooting where poison baiting is not feasible. The program will be carried out twice annually in Autumn and Spring. The program will commence in the autumn or spring prior to main works construction commencing, run throughout construction and continue post construction for a total of 15 years.

The program will be similar to the fox control works that are currently being undertaken in the Stage 1A upgrade and be consistent with integrated and systematic fox control works being conducted for Southern Brown Bandicoot recovery in the region. Commitments are provided in Tables 4.1 and 5.1 above.

Fauna monitoring at culverts will be able to detect if predators are also utilising the fauna culverts. Findings from the monitoring will help determine if the current program is effective and locations where effort may need to be increased.

6.2 FAUNA SALVAGE AND RELOCATION

Section 4 of the BT describes the fauna salvage and relocation (capture and release) procedures for each species. Tables 3.1, 4.1 and 5.1 above summarises the timing and commitments.

6.3 MONITORING

The HKWR Monitoring Plan (WSP 2020a), summarised in Section 5 of the BT describes the implementation of the following monitoring:

- Southern Brown Bandicoot monitoring program (pre-, during and post construction).
- Growling Grass Frog monitoring program (pre-, during and post construction).
- Glossy Grass Skink monitoring program (pre-, during and post construction).
- Culvert and underpass and escape ramp monitoring program to assess use of the crossing structures and escape ramps.
- Water quality monitoring program

The primary goal of monitoring is to determine the usage and effectiveness of mitigation. A monitoring program for the project has been developed, and provides detail regarding the targets, rationale, and monitoring methods for each species (WSP 2020a). Baseline data for monitoring has been collected across 2019 and 2020 and has informed the development of this program. Monitoring of culvert/underpass usage is proposed using infra-red motion-sensing cameras installed at culvert/underpass entrances. The results of the monitoring program should be reviewed annually to see if any changes to management activities are required. Tables 3.1, 4.1 and 5.1 above summarise the types of monitoring, timing and duration of monitoring throughout all stages of the project.

6.4 IMPLEMENTATION, TIMEFRAME AND REVIEW

Section 3.16 of the BT describes the implementation, timeframe and review requirements for the FMP:

- The FMP should be implemented for 15 years
- A formal review will be undertaken with DELWP at:
  - Completion of construction of key areas (e.g. Deep Creek bridge crossing) and mitigation structures
  - At completion of construction
  - Annually post-construction.
- Annual internal reviews of progress against an Adaptive Management Framework items listed in Tables 5, 6 and 7 above.
- Changes to the design or conservation actions must be discussed with MRPV, DELWP, a qualified zoologist and DAWE.

6.5 REPORTING

6.5.1 REPORTING COMMITMENTS

BT section 3.17 discusses reporting commitments:

- Annual report for the 15-year life of the FMP
- Report detailing results of management actions during construction.
- Report detailing results of management actions post construction.
- Report detailing outcomes of pre-construction surveys and searches of all species.
- Report detailing outcomes of capture and release of all species within 3 months of operations.

6.5.2 ADDITIONAL REPORTS TO BE DEVELOPED

The BT identifies the following additional plans and protocols that will form part of the Construction Environment Management Plan (CEMP) for the project to be developed by the contractor post award:

- Weed management plan (this will include acceptable weed control measures for weed control in vicinity of Growling Grass Frog habitats)
- Chytrid fungus control protocol
- Predator control program

7 REFERENCES

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DELWP (2017b), *Growling Grass Frog Habitat Design Standards - Melbourne Strategic Assessment*.

DEWHA (2009), *Significant Impact Guidelines for the Vulnerable Growling Grass Frog (Litoria raniformis). Nationally threatened species and ecological communities EPBC Act Policy Statement 3.14.* .

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Koehler, SL & Gilmore, DC (2014), 'First documented use of underpass culverts by the endangered Growling Grass Frog (Litoria raniformis) in Australia', *Herpetological Review*, vol. 45, no. 3, pp. 404-8.

Masters, N, Talyor, R & Maclagan, S (2019), *Guidelines for best-practice management of modified habitats for Southern Brown Bandicoots*, The preparation of these guidelines was supported by Metro, Deakin University, Cardinia Shire Council and Southern Brown Bandicoot Recovery Group.

Practical Ecology (2019), *Healesville- Koo Wee Rup Road Upgrade - Fauna Management Plan*, Prepared by Practical Ecology for WSP Australia Pty Limited on behalf of Major Road Projects Victoria.

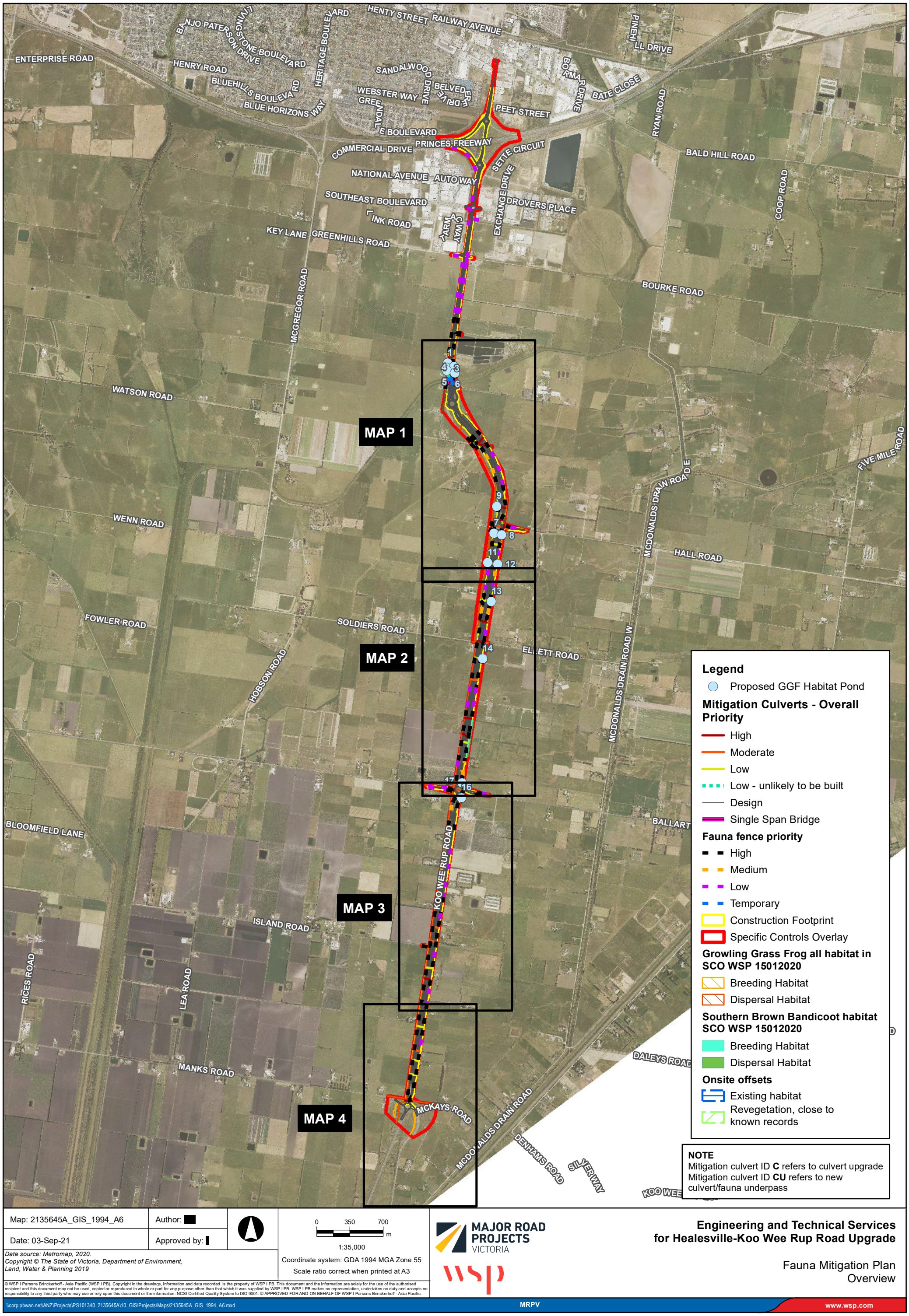
VicRoads (2013), *VicRoads Integrated Water Management Guidelines*, Prepared by VicRoads.

WSP (2020a), *Healesville-Koo Wee Rup Road Upgrade - Fauna Monitoring Program*, Prepared by WSP Australia Pty Limited for Major Road Projects Victoria.

WSP (2020b), *Healesville – Koo Wee Rup Road Upgrade - Stage 1B: Background Technical Report for the Fauna Management Plan*, Prepared by WSP Australia Pty Limited for Major Road Projects Victoria.

APPENDIX A

FAUNA MITIGATION MAPS



Legend

- Proposed GGF Habitat Pond

Mitigation Culverts - Overall Priority

- High
- Moderate
- Low
- Low - unlikely to be built
- Design
- Single Span Bridge

Fauna fence priority

- High
- Medium
- Low
- Temporary
- Construction Footprint
- Specific Controls Overlay

Growling Grass Frog all habitat in SCO WSP 15012020

- Breeding Habitat
- Dispersal Habitat

Southern Brown Bandicoot habitat SCO WSP 15012020

- Breeding Habitat
- Dispersal Habitat

Onsite offsets

- Existing habitat
- Revegetation, close to known records

NOTE
Mitigation culvert ID **C** refers to culvert upgrade
Mitigation culvert ID **CU** refers to new culvert/fauna underpass

Map: 2135645A_GIS_1994_A6	Author:
Date: 03-Sep-21	Approved by:

Data source: Metromap, 2020.
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0 350 700 m

1:35,000

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

MAJOR ROAD PROJECTS VICTORIA

wsp

Engineering and Technical Services for Healesville-Koo Wee Rup Road Upgrade

Fauna Mitigation Plan Overview

MAP 1

MAP 2

C1
1
3
C2
4
5
6
C3
Bridge
WATSON ROAD
C4
C5
C6
C7
KOO WEE RUP ROAD
9
C8
CU1
C9
C34
HALL ROAD
7
C10
8
C11
11
C12
12
13
C13
CU2
SOLDIERS ROAD
C14
ELLETT ROAD
14
C15
KOO WEE RUP ROAD
CU3
C16
CU4
C17
C18
17

Legend

- Proposed GGF Habitat Pond

Mitigation Culverts - Overall Priority

- High
- Moderate
- Low
- Low - unlikely to be built
- Design
- Single Span Bridge

Fauna fence priority

- High
- Medium
- Low
- Temporary
- Construction Footprint
- Specific Controls Overlay

Growling Grass Frog all habitat in SCO WSP 15012020

- Breeding Habitat
- Dispersal Habitat

Southern Brown Bandicoot habitat SCO WSP 15012020

- Breeding Habitat
- Dispersal Habitat

Onsite offsets

- Existing habitat
- reveg, close to known records

NOTE
Mitigation culvert ID **C** refers to culvert upgrade
Mitigation culvert ID **CU** refers to new culvert/fauna underpass

Map: 2135645A_GIS_1994_A7a	Author:
Date: 03-Sep-21	Approved by:

0 50 100 m

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Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

MAJOR ROAD PROJECTS VICTORIA

wsp

Engineering and Technical Services for Healesville-Koo Wee Rup Road Upgrade

Fauna Mitigation Plan
Maps 1 and 2

MAP 3

MAP 4

BALLARTO ROAD

KOO WEE RUP ROAD

ISLAND ROAD

MANKS ROAD

MCKAYS ROAD

KOO-WEE-RUP BYPASS ROAD

MCDONALDS DRAIN ROAD

C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C32 C33

17 16

CU5 CU6

Legend

Proposed GGF Habitat Pond

Mitigation Culverts - Overall Priority

- High
- Moderate
- Low
- Low - unlikely to be built
- Design
- Single Span Bridge

Fauna fence priority

- High
- Medium
- Low
- Temporary
- Construction Footprint
- Specific Controls Overlay

Growling Grass Frog all habitat in SCO WSP 15012020

- Breeding Habitat
- Dispersal Habitat

Southern Brown Bandicoot habitat SCO WSP 15012020

- Breeding Habitat
- Dispersal Habitat

Onsite offsets

- Existing habitat
- Revegetation, close to known records

NOTE
Mitigation culvert ID **C** refers to culvert upgrade
Mitigation culvert ID **CU** refers to new culvert/fauna underpass

Map: 2135645A_GIS_1994_A7b	Author:
Date: 03-Sep-21	Approved by:

0 50 100 m

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Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A3

MAJOR ROAD PROJECTS VICTORIA

wsp

Engineering and Technical Services for Healesville-Koo Wee Rup Road Upgrade

Fauna Mitigation Plan
Maps 3 and 4

APPENDIX B

DETAILS OF FAUNA CROSSING STRUCTURES

B1 DETAILS OF FAUNA CROSSING STRUCTURES

Descriptions for headers at end of table.

GIS_ID	Invert level	Road level	Clearance	Fauna crossing structure design	Fauna crossing structure design - primary species	Priority of location for structure installation	Location flexibility and comments
C1	8.1	9	0.45	Suitable	GGF	High	
C2	7.8	10.6	2.35	Optimal	both	High	The feasibility of this culvert has increased to allow an Optimal fauna crossing
C3	7.6	11.3	3.25	Incidental	both	Low	The feasibility of this culvert upgrade is low and unlikely to be realised as part of this Project.
C4	5.1	6.8	1.25	Optimal	SBB	High	The feasibility of this culvert upgrade is low and unlikely to be realised as part of this Project.
C5	4.9	6.8	1.45	Incidental	both	Low	The feasibility of this culvert upgrade is low and unlikely to be realised as part of this Project.
C6	5.5	7.9	1.95	Optimal	GGF	High	
C7	5.9	7.8	1.45	Optimal	SBB	High	
C8	5.7	6.9	0.75	Incidental	both	High	
C9	4.2	6.4	1.75	Optimal	both	High	
C10	4.7	7.7	2.55	Suitable	GGF	Moderate	
C11	4.7	7.9	2.75	Incidental	both	Low	
C12	4.7	7.4	2.25	Incidental	both	Low	
C13	3.9	6.1	1.75	Incidental	both	Low	
C14	4.3	6.6	1.85	Optimal	both	High	
C15	4.7	6.2	1.05	Incidental	both	Low	
C16	4.1	6	1.45	Optimal	both	High	
C17	4.4	5.8	0.95	Suitable	SBB	Low	Either CU4 or C17
C18	4	5.7	1.25	Suitable	both	Moderate	
C19	2.8	4.7	1.45	Optimal	both	High	
C20	3.8	4.8	0.55	Incidental	GGF	Moderate	
C21	4.2	5.6	0.95	Incidental	both	Low	
C22	3.2	5.3	1.65	Suitable	both	Moderate	
C23	3.4	5.2	1.35	Suitable	SBB	Moderate	
C24	3.2	5.2	1.55	Suitable	GGF	Moderate	
C25	2.2	4.4	1.75	Optimal	both	High	
C26	3.2	4.8	1.15	Suitable	SBB	Moderate	
C27	3.2	5.4	1.75	Optimal	GGF	High	Either CU6 or C27
C28	3.2	5.3	1.65	Incidental	both	Low	Either C28 or C29
C29	4.1	5.6	1.05	Incidental	both	Low	Either C28 or C29
C30	3.2	5.3	1.65	Suitable	both	Moderate	Either C30, C31, C32 or C33 - priority C33.

GIS_ID	Invert level	Road level	Clearance	Fauna crossing structure design	Fauna crossing structure design - primary species	Priority of location for structure installation	Location flexibility and comments
C31	3.6	5.15	1.1	Incidental	both	Low	Either C30, C31, C32 or C33 - priority C33.
C32	3.2	5	1.35	Incidental	both	Low	Either C30, C31, C32 or C33 - priority C33.
CU1	5.8	6.7	0.45	Incidental	both	High	
CU2	4.5	6.2	1.25	Optimal	both	High	Either CU2 or C14
CU3	4.2	6.3	1.65	Suitable	GGF	Moderate	
CU4	4.2	5.9	1.25	Optimal	SBB	High	Either CU4 or C17
CU5	4.1	5	0.45	Incidental	GGF	Moderate	
CU6	3.1	5.3	1.75	Incidental	both	Low	Either CU6 or C27
Bridge	7.2	11.4	3.75	Bridge	both	High	
C33*	3.4	5.2	1.35	Optimal	both	High	Either C30, C31, C32 or C33 - priority C33. If C33 not able to be adopted in proposed location, move north by 50m, include 2 short culverts and SBB habitat in median.
C34*	4.4	6.1	1.25	Optimal	both	High	

Description of column headers:

Header	Description
GIS_ID	Unique identifier
Invert level	Current surface level (in metres)
Road level	Road level of new carriageway (in metres)
Clearance	Clearance between current surface and new carriageway (in metres) (i.e. space available to accommodate a fauna crossing structure)
Priority of location for structure installation	Priority of location for crossing structure installation
Fauna crossing structure design	Recommended fauna crossing structure design. Optimal, Suitable and Incidental structure designs for Growling Grass Frog are detailed in Section 2.1.2.1, and for Southern Brown Bandicoot in Section 2.1.2.2.
Fauna crossing structure design - primary species	Primary species for which crossing structure to be designed to accommodate. Optimal, Suitable and Incidental structure designs for Growling Grass Frog are detailed in Section 2.1.2.1, and for Southern Brown Bandicoot in Section 2.1.2.2.
Location flexibility	Comment on locations where there can be some flexibility in the location of culverts, to relocate north or south of the identified placements in Appendix A. This allows for some flexibility for one crossing where there are constructability constraints but at least one crossing is retained at the identified location to connect habitats either side of roads. This does not imply any crossings to be removed entirely.

APPENDIX C

SOUTHERN BROWN BANDICOOT HABITAT RESTORATION GUIDELINES

C1 SOUTHERN BROWN BANDICOOT HABITAT RESTORATION GUIDELINES

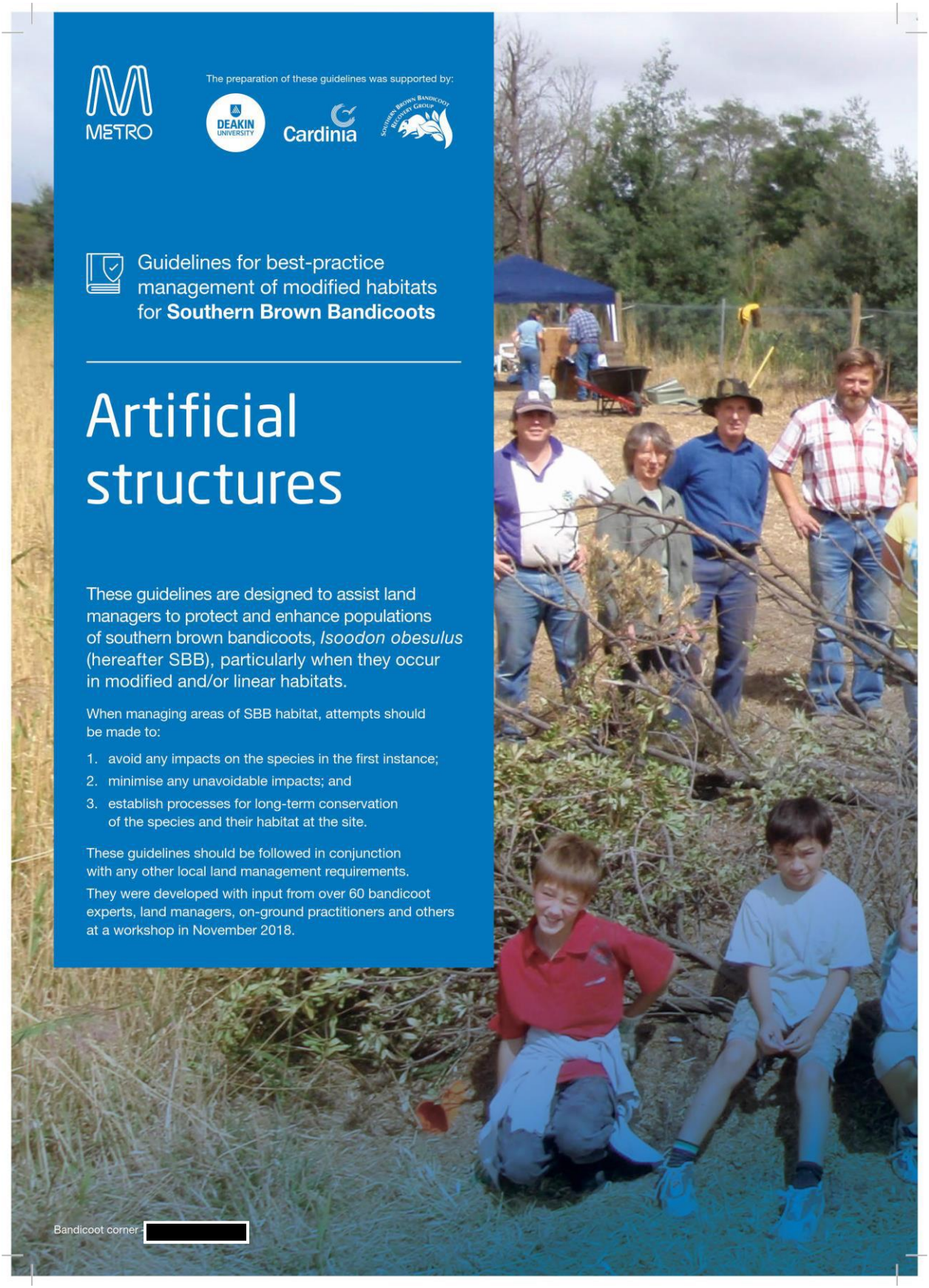
Selected sections from *Guidelines for best-practice management of modified habitats for Southern Brown Bandicoots* (Masters, Talyor & Maclagan 2019)

Guidelines supported by Metro Trains, Deakin University, Cardinia Shire Council and Southern Brown Bandicoot Recovery Group. This also includes Southern Brown Bandicoot artificial shelter Cardinia Shire Council (undated). Available at: https://www.cardinia.vic.gov.au/downloads/download/231/southern_brown_bandicoot.

Selected sections included in this Appendix:

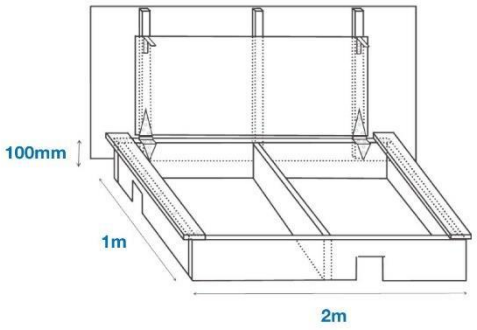
- Appendix C1: Artificial structures
- Appendix C2: Pest plants
- Appendix C3: Revegetation
- Appendix C4: Vegetation management

C2 ARTIFICIAL STRUCTURES



Artificial structures

- Artificial structures can provide SBB with additional cover and protection from introduced predators although they should not be used to replace the cover provided by dense vegetation.
- Man-made structures can be placed in areas where SBB are known to inhabit, and where natural options for cover or nesting are limited.
- A simple design for a DIY SBB hide is provided below:



- Piles of brush and woody debris can also be used to provide shelter. Use existing, natural woody debris (logs, branches etc.) and place it in piles of at least **1.0m²** in areas where SBB are known to occur, especially if vegetation cover is lacking.
- Place shelters a maximum of **10m** apart in areas where the vegetation has been cleared to facilitate the movement of SBB between areas of suitably dense vegetation.
- Monitor structures to determine if they are used by SBB.
- Conduct community education/engagement and install signage in areas containing artificial structures.
- Share or publish findings on the usage of artificial structures, especially with respect to size, shape, material used and spacing.

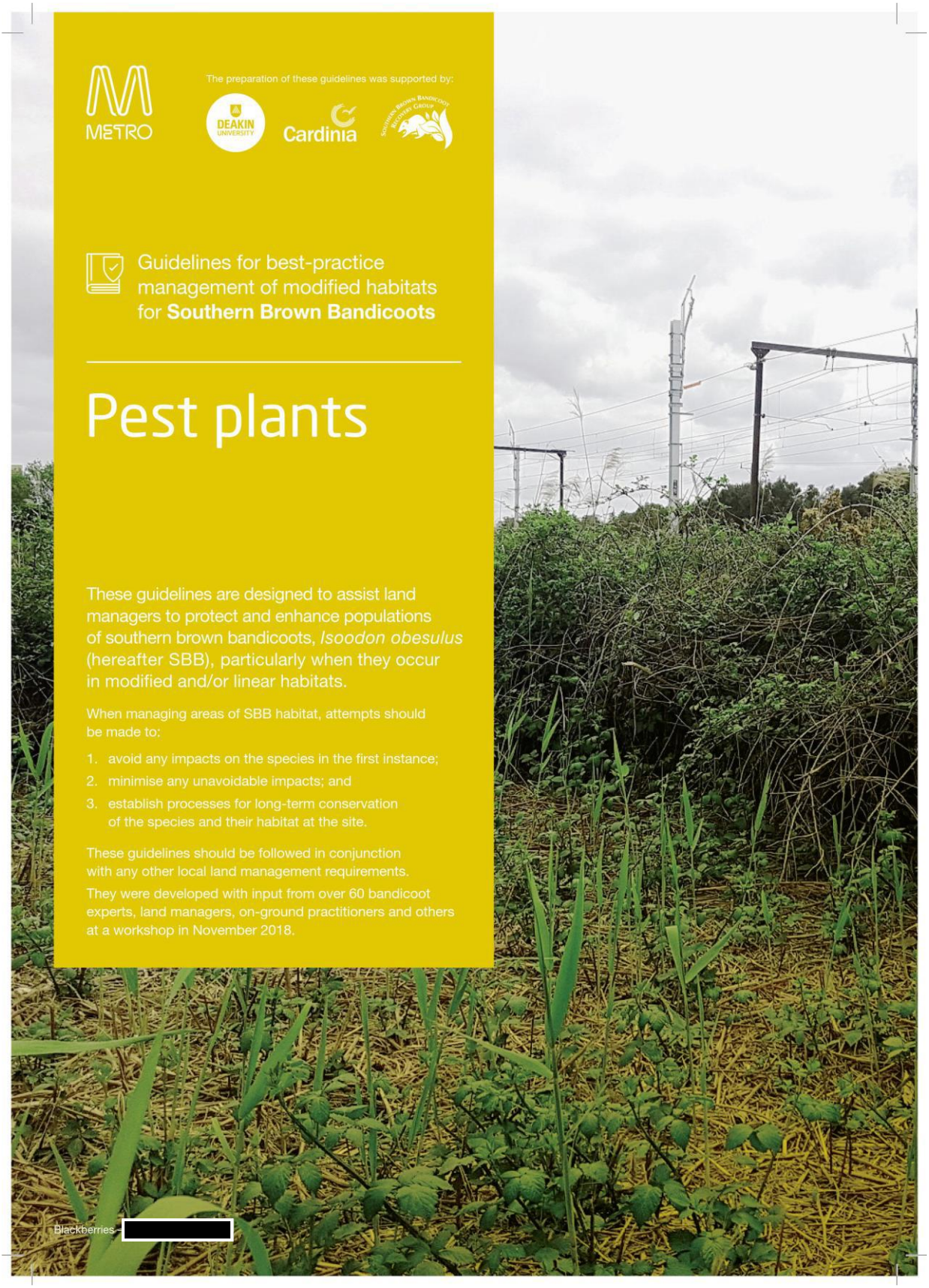
Debris pile - Main Drain – [redacted]

For additional information refer to the other Guidelines:

Artificial structures | Fire | Community engagement | Pest animals | Pest plants | Revegetation | Road and rail impacts | Vegetation management

First published November 2019. Compiled by [redacted]

C3 PEST PLANTS



Pest Plants

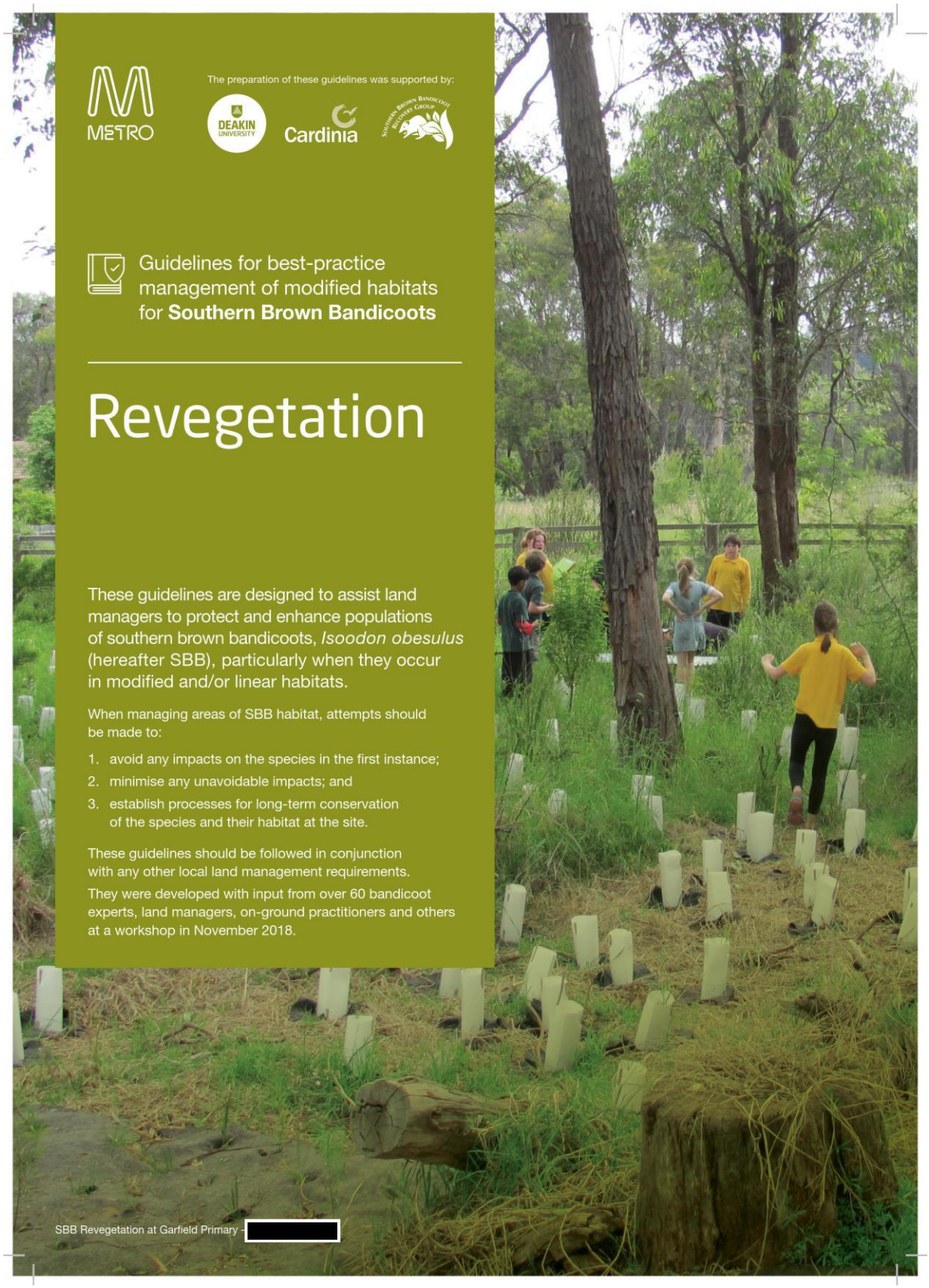
- Identify pest plant species present at a site and check legal obligations to remove them.
- Pest plant species such as blackberry, gorse, flax-leaf broom, boneseed and African boxthorn provide dense, prickly cover and are often used by SBB for shelter and/or food.
- Conduct surveys of SBB usage of areas containing pest plant species to assess the habitat value where the infested area:
  - is greater than **25m²** in size;
  - occurs within **50m** of potential SBB habitat; or
  - contains an understorey vegetation structure of **>50%** average foliage density in the **0.2-1m** height range.
- Ideally, establish suitable vegetation nearby before clearing of pest plant species commences.
- Stagger/stage removal of pest plant species and replace with indigenous / native alternatives over time, while ensuring **>50%** understory vegetation remains at all times.
- Avoid creating gaps **>7m** as these may hinder SBB movement.
- Use targeted spot-spraying, 'wiping' or cut and paint methods rather than spraying more broadly in areas known/likely to provide SBB habitat.
- Herbicide spraying is acceptable in areas **>30m** from known/likely SBB habitat.
- Implement a rapid intense revegetation program following weed removal using bandicoot-suitable plant species, ensuring a high plant density in the understorey to prevent the re-growth of weeds.
- If present, remove pine trees and Sweet Pittosporum, as these suppress the growth of understorey/ groundcover vegetation.
- Only a medium to long-term approach to pest plant management will deliver success, so ensure adequate funding is provided for ongoing monitoring and maintenance works.
- Work collaboratively with adjacent landholders to prevent the re-introduction of pest plant species from adjacent land.
- Implement strict hygiene procedures on maintenance and construction vehicles, machinery, personnel and during revegetation projects to reduce the spread of pest plant species.
- When unable to remove pest plant species, prevent pest plant species from spreading by containing existing infestations.

For additional information refer to the other Guidelines:

Artificial structures | Fire | Community engagement | Pest animals | **Pest plants** | Revegetation | Road and rail impacts | Vegetation management

First published November 2019. Compiled by [redacted]

C4 REVEGETATION



Revegetation

- Aim to provide dense groundcover with **>50%** average foliage density within the **0.2-1 m** height range.
- Consult with the local community to determine their expectations and willingness to get involved in planting and maintenance activities.
- Consider and budget for the use of mulch and/or jute matting to suppress weed competition while the new vegetation establishes.
- Ensure any revegetation works are followed up with a weeding and watering program that lasts for at least **24** months from planting to ensure the successful establishment of new habitat.
- Allow for a contingency planting of **20%** in any revegetation project to replace any plants that fail during the first two years.
- Consider other local animal and plant species' requirements to maximise biodiversity outcomes.
- Where invasive weed species like blackberry or gorse are to be replaced, use native prickly shrubs that are indigenous to the area and/or those recommended in **Table 1**.

Plant advice

- Use indigenous plant species whenever possible.
- Contact your local indigenous plant nursery and visit your council website for advice on plant selection.
- Refer to **Table 1** for a list of recommended bandicoot-friendly plant species.
- Assess local conditions and soil types to identify the most suitable indigenous plants for the specific location.

Provide connectivity corridors

- Corridors should be as wide as possible to maximise habitat potential. Ideally, they should have a minimum width **>10m**, but a width of **30m** or greater is better.
- Corridors as narrow as **5m** wide still have some value for SBB and should be provided wherever possible.

Table 1 – Native plant species recommended for inclusion in revegetation projects to create or restore habitat for Southern Brown Bandicoot. Use indigenous forms wherever possible.

Structural Group	Common Name	Genus/Species
Understorey (0-1m) Planted densely to achieve required 50%–80% cover.	Berry Saltbush	*Atriplex semibaccata*
	Spear Grasses	*Austrostipa spp.*
	Tall Sedge Carex apressa	*Carex apressa*
	Pale Flax Lily	*Dianella longifolia*
	Black Anther Flax Lily	*Dianella revoluta*
	Rounded Noon Flower	*Disphyma crassifolium*
	Nodding Saltbush	*Einadia nutans*
	Ruby Saltbush	*Enchylaena tomentosa*
	Knobby Club Rush	*Ficinia nodosa*
	Thatch Saw Sedge	*Gahnia radula*
	Rushes	*Juncus spp.*
	Sword-sedges	*Lepidosperma spp.*
	Spiny Headed Mat Rush	*Lomandra longifolia*
	Weeping Grass	*Microlaena stipoides*
	Tussock Grasses	*Poa spp.*
	Native Raspberry	*Rubus parvifolius*
	Wallaby Grasses	*Rytidosperma spp.*
	Kangaroo Grass	*Themeda triandra*
	Small Grass Tree	*Xanthorrhoea minor*
Understorey (1-2m)	Health Wattle	*Acacia brownii*
	Common Appleberry	*Billardiera scandens*
	Rock Correa	*Correaq glabra*
	Common Correa	*Correa glabra*
	Red Fruited Saw Sedge	*Gahnia sieberiana*
	Hop Goodenia	*Goodenia ovata*
	Rosemary revillea	*Grevillea rosmarinifolia*
	Purple Coral Pea	*Hardenbergia violacea*
	Seaberry Saltbush	*Rhagodia candolleana*
Mid-storey	Prickly Moses	*Acacia verticillata*
	Hedge Wattle	*Acacia paradoxa*
	Hairpin Banksia	*Banksia spinulosa*
	Riber Bottlebrush	*Callistemon sieberi*
	Small Leaved Clematis	*Clematis microphylla*
	Sticky Hop Bush	*Dodonea viscosum*
	Bushy Needlewood	*Hakea decurrens*
	Yellow Hakea	*Hakea nodosa*
	Burgan	*Kunzea ericoides*
	Prickly Tea Tree	*Leptopermm continentale*
	Silky Tea Tree	*Leptospermum myrsinoides*
	Tree Violet	*Melicytus dentatus*
	Swamp Paperbark	*Melaleuca ericifolia*
Over-storey (>4m)	Silver Wattle	*Acacia dealbata*
	Lightwood	*Acacia implexa*
	Black Wattle	*Acacia mearnsii*
	Blackwood	*Acacia melanoxylon*
	Golden Wattle	*Acacia pycnantha*
	Black Sheoak	*Allocasuarina littoralis*
	Drooping Sheoak	*Allocasuarina verticillata*
	Silver Banksia	*Banksia marginata*
	Coast Banksia	*Banksia integrifolia*
	Saw Banksia	*Banksia serrata*
	Sweet Bursaria	*Bursaria spinosa*
	Gums	*Eucalyptus spp.*

For additional information refer to the other Guidelines:

Artificial structures | Fire | Community engagement | Pest animals | Pest plants | **Revegetation** | Road and rail impacts | Vegetation management

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C5 VEGETATION MANAGEMENT

Vegetation management

- SBB require dense groundcover vegetation with **>50%** average foliage density within the **0.2-1m** height range.
- Aim to maintain habitat connectivity for SBB by avoiding gaps **>7m** wide.
- Where grassy vegetation needs slashing/mowing, retain a **>3m** wide contiguous strip of cover to allow for SBB movement.
- Limit stock grazing and vehicle access in areas of vegetation likely to provide habitat for SBB.
- Provide buffer zones of suitable dense vegetation **>10m** wide between developments and known or likely SBB habitat.
- SBB are often slow to move from the path of vehicles/ machinery. Where vehicles/machinery are required to move through SBB habitat, they should not exceed a speed of **5km/hr** (i.e. walking speed) to allow animals a greater chance of moving out of their path.
- To "push" SBB towards suitable habitat, any vegetation slashing or clearing should be done in a pattern that maintains connectivity of habitat for as long as possible and avoids creating isolated patches (i.e. strip or zig-zag pattern).

Slashing in the Rail Corridor – Katrina Lewis

- Where possible, cutting blades should be set at a height of **20cm** or higher, to avoid the chance of blades striking SBB.
- Where substantial vegetation is being removed, provide artificial structures to provide alternative refuge for SBB (see Guideline on "Artificial Shelters").

For additional information refer to the other Guidelines:

Artificial structures | Fire | Community engagement | Pest animals | Pest plants | Revegetation | Road and rail impacts | **Vegetation management**

First published November 2019. Compiled by [redacted]