Peninsula Link

Southern Brown Bandicoot Management Plan Pines Flora and Fauna Reserve

March 2010

LINKING MELBOURNE AUTHORITY

State Government Victoria

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Glossary of terms

DEWHA	Department of Environment, Water, Heritage and the Arts
PV	Parks Victoria
DSE	Department of Sustainability and the Environment
KTRI	Keith Turnbull Research Institute
SUP	Shared Use Path
DECCW	NSW Department of Environment, Climate Change and Water
EPBC	Environment Protection and Biodiversity Conservation Act
FFG	Fauna and Flora Guarantee Act
RBGC	Royal Botanic Gardens Cranbourne
SBB	Southern Brown Bandicoot, *Isoodon obesulus obesulus*
PL	Peninsula Link
LMA	Linking Melbourne Authority
FEM	Federal Environment Minister

This report was prepared for Linking Melbourne Authority by Rodney van der Ree and Will Sowersby (ARCUE). We would also like to acknowledge assistance from Parks Victoria and Department of Sustainability and Environment.

1. Introduction

1.1 Project Information

The Australian Research Centre for Urban Ecology (ARCUE) was commissioned by Linking Melbourne Authority (LMA) (formerly known as Southern and Eastern Integrated Transport Authority (SEITA) to prepare a detailed management plan for the nationally threatened Southern Brown Bandicoot Isoodon obesulus as part of the proposed Peninsula Link Project, Victoria (formerly known as Frankston Bypass).

Linking Melbourne Authority is responsible for the Peninsula Link planning process, including obtaining statutory and planning approvals for the construction. Southern Way (a Bilfinger Berger/Royal Bank of Scotland/Abigroup consortium), has been awarded a contract by the State Government to design, construct, operate and fund Peninsula Link in accordance with the State's performance requirements. Compliance with the State's requirements will be audited and verified by LMA and an Independent Reviewer, appointed by the State Government. Post construction, the responsibility for operation of Peninsula Link will be transferred to VicRoads. Additional areas of land, surplus to the requirements for the Peninsula Link freeway will be returned to other agencies such as Parks Victoria and Local Council.

This management plan has been developed in order to satisfy the obligations under the Environment Protection and Biodiversity Conservation Act (Cwth) 1999 (EPBC Act) and the assessment by the Victorian Government Minister.

Peninsula Link is a 27 kilometre roadway connecting the EastLink in Carrum Downs to the Mornington Peninsula Freeway in Mount Martha (Figure 1). The project provides a freeway standard roadway with interchanges at key arterial cross-roads largely within the existing road reserve corridor and includes the construction of a shared use path along the alignment from Patterson River to south of Baxter.

An Environment Effects Statement (EES) was prepared for the Peninsula Link Project which identified the potential for the Southern Brown Bandicoot to occupy habitats within the road corridor and in particular within the Pines Flora and Fauna Reserve in Frankston.

Evidence of Southern Brown Bandicoot (SBB) was found within the Pines Flora and Fauna Reserve (FFR) during the EES field surveys. However the population was considered to be small (Biosis Research 2008) . Construction of Peninsula Link through the Pines FFR would remove habitat for this species that may impact any existing populations. Additional potential impacts may include the creation of barriers to movement, increased rates of mortality due to collision with vehicles and degradation of habitat due to other impacts such as weeds, noise, light and chemical pollution.

As detailed in the EES, impacts on the SBB would be mitigated by construction of a large fauna underpass and other smaller culverts to provide habitat connectivity. Additionally, the habitat area will be expanded through revegetation and rehabilitation within the Reserve.

The following document has been developed to provide a strategy and management plan for the SBB within the Pines FFR before, during and after the construction of Peninsula Link.

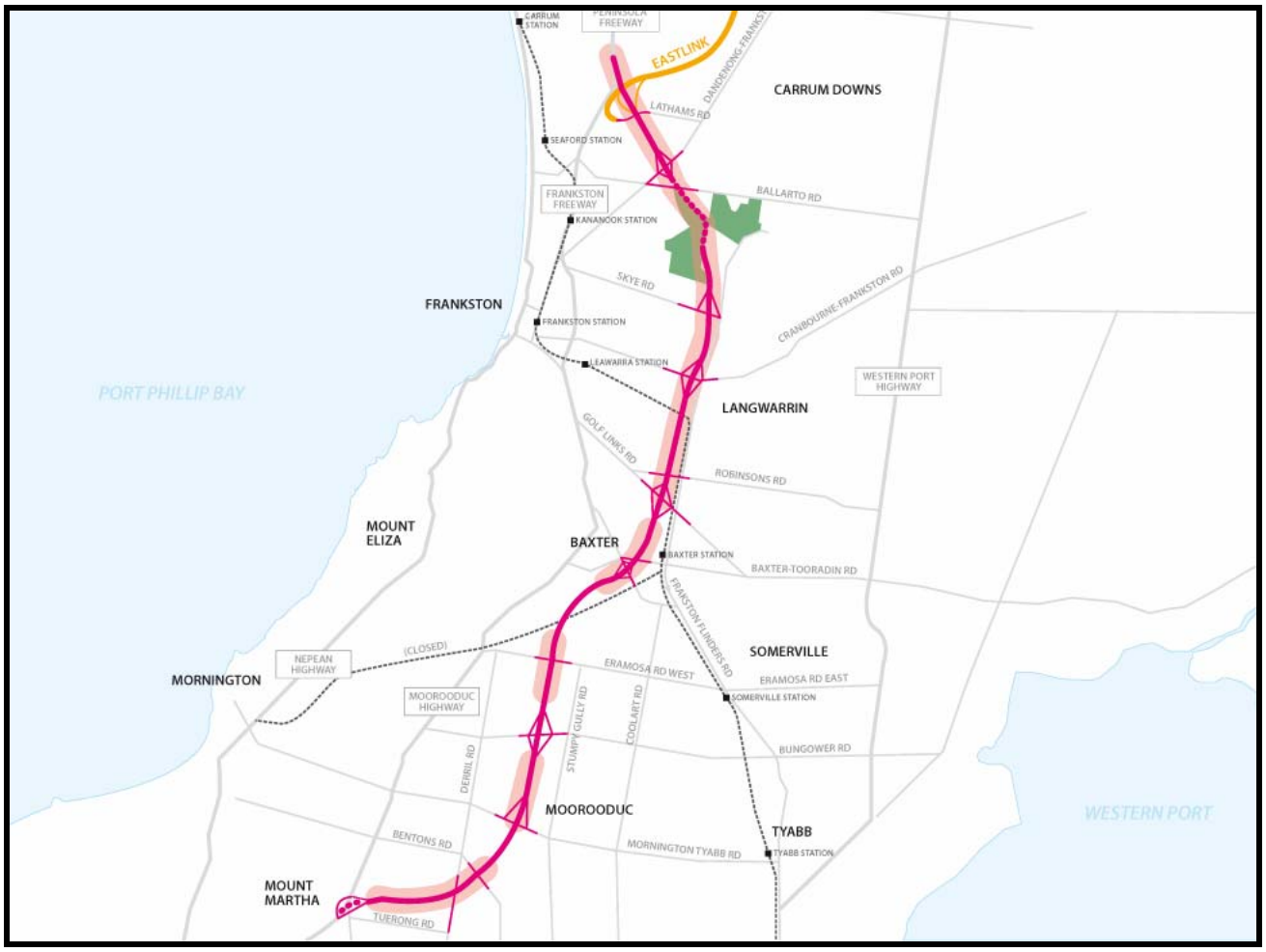


Figure 1 - Location of Peninsula Link, connecting to Eastlink in Carrum Downs and the Moorooduc Highway in Mount Martha

1.2 The Southern Brown Bandicoot and its conservation status

The Southern Brown Bandicoot (SBB) Isoodon obesulus is a medium sized, ground dwelling marsupial native to southern, eastern and south-western Australia. Different subspecies are recognised across its range, with an eastern (Isoodon obesulus obesulus) and western (Isoodon obesulus fusciventer) form described.

Once common across its mainland range, the SBB has rapidly declined and is now restricted to isolated remnant habitat patches. The animal is characterised by a long pointed snout, small rounded eyes and coarse brown/grey fur.

SBBs readily associate with areas of dense ground vegetation across a range of habitats. Adequate vegetation ground cover is pivotal to their habitat choice. SBBs forage for insects and fungi and construct shelter/nests out of leaf litter and loose soil. Bandicoots aerate soil with their distinct conical shaped diggings and spread fungi that fertilise and recycle nutrients.

Unless otherwise noted, all references to SBBs in this management plan relate to the eastern subspecies, Isoodon obesulus obesulus, at The Pines FFR.

The SBB is listed as endangered by the Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth) and listed as Threatened in July 2009 under the Flora and Fauna Guarantee Act 1988 (Victoria). These listings require that any action which may impact upon the species must be approved by the Federal and State Government with strict controls and conditions in place.

The population of SBB at the Pines FFR appears to be particularly vulnerable and appears to have declined rapidly over the last 10 – 20 years (Coates et al. 2008).

1.2.1 Habitat Requirements of the Southern Brown Bandicoot

The SBB occurs naturally in heathland, heathy woodland and shrubland communities over southern Australia (Brougham & Dickman 1991; Coates et al. 2008). The species associates with sandy and well drained soils like those occurring at the Pines FFR, where it preferentially forages on relatively infertile soils (Haby & Long 2005). Areas of dense cover and ground vegetation are pivotal habitat requirements for SBBs. In degraded and altered landscapes, the SBB is known to utilise vegetation along abandoned rail lines, roads and weed infested drainage lines.

1.3 The Pines Flora and Fauna Reserve

The Pines Flora and Fauna Reserve (FFR) is a 220 ha area containing significant remnants of heathy woodland and heathland vegetation and is located approximately 40 km south east of Melbourne and 3 km north east of the Frankston CBD. It was established in 1989 as a 108 ha reserve and was expanded to its present size in 2006. The Pines FFR is located within the Gippsland Plains bioregion.

The reserve is located within an urbanised environment surrounded by residential properties, Ballarto Rd, Tamarisk Dr, McClelland Dr, the Peninsula Country Golf Club and the Centenary Golf Course. The reserve is a Biosite of State significance and provides habitat for species protected under the Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth) (EPBC Act) and the Flora and Fauna Guarantee Act 1988 (Victoria).

The Ecological Vegetation Classes (EVCs) within the Pines FFR are regionally endangered and are of High Conservation Significance under the Native Vegetation Framework (NRE 2002). A number of National and State significant flora species have also been recorded at the reserve, including River Swamp Wallaby-grass (Amphibromus fluitans). Other Nationally and State significant fauna species recorded at the reserve include dwarf galaxias (Galaxias pusilla) and swamp skink (Egernia coventryi).

The Pines FFR and surrounding lands represent an important core habitat patch including heathy woodland and historic sites for the SBB (Biosphere 2006). Although SBBs once occurred in the wider Frankston area and were considered common (pre-1970's), records indicate that Pines FFR recently had one of the last confirmed populations of SBB on the Mornington Peninsula. The Pines FFR (although small and isolated) would present a genetic provenance and good habitat diversity for SBB populations.

The immediate landscape surrounding the Pines FFR has rapidly become urbanised. Without effective management, any existing SBB population at the Pines FFR will further decline and may face localised extinction (Coates et al. 2008).

Parks Victoria is responsible for the management of the Pines FFR, which includes the Department of Agriculture and Rural Affairs (DARA) land and a section of the former Keith Turnbull Research Institute (KTRI) site. An additional area of the former KTRI site is also to be incorporated into the Pines FFR (refer to section 4.7.1) to offset some of the losses from Peninsula Link.

1.4 Occurrence of the Southern Brown Bandicoot within the Pines Flora and Fauna Reserve

The SBB was reportedly common throughout the Mornington Peninsula and Melbourne in the 1800's, however by the second half of the 20th century the Victorian population was in decline (Coates et al. 2008). The SBB was known to exist at some sites in the Melbourne region until relatively recently, but during the last 30 years it is likely that many of these persisting populations are at the least, functionally extinct.

SBBs and signs of its presence (e.g. scats and characteristic diggings) were once common at the Pines FFR. A 2006 survey of the Pines FFR and DARA land identified 18 SBB diggings and scats (Biosis Research 2008). This survey demonstrated the continuing presence of the SBB at the reserve, albeit in a very low abundance.

Evidence of the species was found (diggings and a hair sample collected) within the Pines FFR during the recent EES field survey (Frankston Bypass Project, Environmental Effects Statement 2008). The SBB population within The Pines FFR is thought to have declined considerably in the last decade and if current trends continue, faces extinction in the near future (Coates et al. 2008).

Surveys of the distribution of the SBB within The Pines FFR, adjacent habitat and various control sites are being undertaken as part of the pre-construction research and monitoring program (Appendix 4). These surveys will be undertaken in Spring 2009, Summer 2009/10, and Autumn 2010. The results for the survey undertaken in September 2009 are attached in Appendix 4.

1.5 Distribution of the Southern Brown Bandicoot in Surrounding Area

There have been many historical SBB sightings in the greater Frankston area (Coates et al. 2008). Most records occur in or around large patches of remnant heathy woodland in Frankston, Langwarrin and Cranbourne (e.g. conservation reserves, golf courses, privately owned bush blocks and small council reserves).

The SBB population has rapidly declined in recent years across the south-eastern suburbs and Mornington Peninsula, including at the Pines FFR. SBBs have not been recorded at the Langwarrin FFR since the 1980's. Presently there are only two known populations within 15 kms of the Pines FFR, namely the Royal Botanic Gardens Cranbourne (RBGC) and at Quail Island, Western Port Bay, directly west of Warneet. The population at RBGC is the only population in the greater Melbourne area large enough and managed appropriately to be considered secure.

2. EPBC Conditions

2.1 EPBC conditions of approval for Peninsula Link

The Federal Environment Minister - Department of Environment, Water, Heritage and The Arts (DEWHA) approved the construction of Peninsula Link subject to a number of conditions of approval. Those conditions that relate specifically to SBB, that are addressed in this plan, are as follows:

2 Prior to the construction in the Pines FFR a Southern Brown Bandicoot Management Plan is to be prepared which addresses the following requirements:

a) Acquisition of the land within the former Keith Turnbull Research Institute (KTRI), followed by its inclusion into the existing Pines FFR;

b) Rehabilitation of the vegetation on the former orchard and Keith Turnbull Research Institute to provide approximately 16 ha of additional SBB habitat;

c) Predator control measures that include:

- **1** Initiation and maintenance of a predator control and monitoring program in the Pines FFR;
- **2** Installation and maintenance of a predator proof fence around the boundary of the Pines FFR;
- **3** Identification of impact thresholds that will trigger management intervention;

d) Monitoring and recovery actions for the Southern Brown Bandicoot that include:

- **1** Provision of a large underpass and a number of smaller culverts under Peninsula Link;
- **2** Assessment of the effectiveness of the underpass and culverts for connectivity of habitat for SBBs. Which includes a pre-construction survey for approximately 6 months and post-construction monitoring that continues for 10 years at which point the need for further monitoring will be reviewed;
- **3** The development of a Population Viability Analysis to determine the effectiveness of management measures and recovery actions. The report needs to include a peer review of the completed PVA by a qualified expert.

e) Discuss a range of options for offsets in the event that the SBB population in the Pines FFR continues to decline, including a last option of translocation;

f) Arrangements to fund the implementation of the plan;

g) Schedule of proposed works, timings and responsibilities;

h) Review the opportunities for maintenance and creation of corridors for the Southern Brown Bandicoot to enhance the connectivity of habitat in the region;

i) A description of its objectives, performance criteria and corrective actions as well as provisions to review the plan regularly.

Construction within the Pines FFR can not commence until the plan is approved. The approved SBB Management Plan must be implemented.

State Minister's Assessment

As part of the State Minister's Assessment, a specific plan for the protection of the Southern Brown Bandicoot within the Pines FFR is to be prepared to the satisfaction of the Secretary DSE before works proceed in the Reserve. The plan is to include a long-term monitoring program of the SBB population to assist evaluation of the effects of the bypass on its viability. The program is to be implemented to the satisfaction of the Secretary DSE.

The following sections address EPBC Conditions and the requirements of the State Minister's Assessment.

2.2 General Timings and Responsibilities

The following table outlines a time and schedule and the agencies responsible for the implementation of the SBB Management Plan and EPBC Conditions.

EPBC Condition	Condition Details	Deliverable	Reference in Plan	Timing	Responsibility
2	Prepare a Southern Brown Bandicoot Management Plan	Southern Brown Bandicoot Management Plan. Implementation of SBB management plan pre construction and during construction. Implementation of SBB management plan post construction.		Draft to Federal Environment Minister Feb 2010 Feb 2010 – Jun 2013 July 2013 onwards	Linking Melbourne Authority Linking Melbourne Authority Parks Victoria and Department of Sustainability and Environment *
2(a)	The acquisition of the land within the former Keith Turnbull Research Institute followed by its inclusion into the existing Pines Flora and Fauna Reserve.	Land transfer from Department of Primary Industries to Department Sustainability and Environment and Parks Victoria for management.	Section 4.7	Anticipated mid 2010, however no later than Dec 2010	Department of Sustainability and Environment
2(b)	Rehabilitation of the vegetation on the former orchard and Keith Turnbull Research Institute to provide approximately 16 ha of additional habitat for the Southern Brown Bandicoot.	Draft Master Plan for the Pines to be finalised. Pines Revegetation Plan. Revegetation plan will provide the staging and timeframe for the works. Implementation of works.	Section 4.7	April 2010 Draft Rehab Plan to FEM for approval by June 2010 From July 2010	Linking Melbourne Authority and Parks Victoria *

EPBC Condition	Condition Details	Deliverable	Reference in Plan	Timing	Responsibility
2(c)	Predator control measures that include:				
	Initiation and maintenance of a predator control and monitoring program in the Pines Flora and Fauna Reserve	Pre construction predator control and monitoring program.	Section 3.5	Commenced Oct 2009 to March 2010	Linking Melbourne Authority and Parks Victoria
		During construction predator control and monitoring program.	Section 4.2	April 2010 to Jun 2013	Linking Melbourne Authority and Parks Victoria
		Post construction predator control and monitoring program.	Section 5.3	Long-term pred. control plan to be provided to Federal Environment Minister for approval by Dec 2012	Parks Victoria *
	Installation and maintenance of a predator proof fence around the boundary of the Pines Flora and Fauna Reserve	Design Report Installation	Section 6.2.1	December 2012 2013	Linking Melbourne Authority, Parks Victoria and Department of Sustainability and Environment *
	Identification of impact thresholds that will trigger management intervention	Impacts to be identified after completion of pre-construction and during construction monitoring and incorporated into a report (to be submitted to Federal Environment Minister 2012), as well as conclusion of PVA and pre-construction fox predator control program.	Section 6.4.3	Formal review of plan – 2012	Linking Melbourne Authority, Parks Victoria and Department of Sustainability and Environment

EPBC Condition	Condition Details	Deliverable	Reference in Plan	Timing	Responsibility
2(d)	Monitoring and recovery actions for the Southern Brown Bandicoot that include:				
	Provision of a large underpass and a number of smaller culverts	Preliminary design in accordance with EES Requirements and Project Scope and Requirements	Section 4.5	2010	Southern Way
	Assessment of the effectiveness of the culverts and underpass for retaining connectivity of habitat for the Southern Brown Bandicoot, which includes pre-construction monitoring for six months and post-construction monitoring that continues for 10 years at which point the need for further monitoring will be reviewed.	Pre-construction monitoring program. During construction monitoring program – to be developed after pre-construction monitoring program completed and results analysed. Formal review of monitoring program. Long term monitoring program developed after during construction monitoring and two years post construction program completed and results analysed.	Section 3.1 Section 4.8 Section 5.1	Sept 2009 – Mar 2010 Apr 2010 - Jun 2013 Jun 2015	Linking Melbourne Authority Linking Melbourne Authority Parks Victoria *

EPBC Condition	Condition Details	Deliverable	Reference in Plan	Timing	Responsibility
	Development of a Population Viability Analysis (PVA) to determine the effectiveness of all management measures and recovery actions undertaken for the Southern Brown Bandicoot. The report needs to include a peer review of the completed PVA by a qualified expert.	The scope of the population viability analysis has been developed. The analysis is currently being undertaken and will consider management scenarios for Federal Environment Minister approval and will produce preliminary results Peer review of PVA and update of PVA. Formal submission of Final PVA report	Section 6.1	Jan 2010 June 2010 early 2011 Dec 2012	Linking Melbourne Authority
2(e)	Discuss a range of options for offsets in the event that the Southern Brown Bandicoot population in the Pines Reserve continues to decline, including the last resort option of translocation.	Offsets to be identified after completion of pre-construction and during construction monitoring and incorporated into plan.	Section 6.4.2	Formal review 2012.	Linking Melbourne Authority, Parks Victoria and Department of Sustainability and Environment

EPBC Condition	Condition Details	Deliverable	Reference in Plan	Timing	Responsibility
2(f)	Arrangements to fund the implementation of the plan. Arrangements to fund the implementation of the plan.	Pre-construction and during construction phase Post construction phase	Section 2.4.1		Linking Melbourne Authority Linking Melbourne Authority to facilitate
2(g)	Schedule of proposed works, timings and responsibilities		Section 3.6 Section 4.9 Section 5.6 Section 6.5 Section 2.2 (this table)		
2(h)	Review the opportunities for maintenance and creation of corridors for the Southern Brown Bandicoot to enhance the connectivity of habitat in the region.	Plan detailing connectivity of habitat initiatives in the region	Section 6.3		Department of Sustainability and Environment and local Councils.
2(i)	A description of its objectives, performance criteria and corrective actions as well as provisions to review the plan regularly.		Section 2.3 & 2.4		

* Refer to condition 2(f)

2.3 Management Plan Objectives

2.3.1 Goals for the management of Southern Brown Bandicoots

On the basis that the Pines FFR is considered strategically significant (state wide and regionally) for the conservation of SBBs in the south east region of Melbourne, the goal of this management plan is to maximise the SBBs long-term viability in the Pines FFR.

The specific goals for the management of SBBs at The Pines FFR during construction and operation of Peninsula Link include:

- To ensure that the construction and operation of Peninsula Link does not prejudice the long term viability of the population of SBB within the Pines FFR;
- To ensure animal welfare and population viability by achieving zero mortality of SBB as a result of construction works and operation of Peninsula Link;
- To allow for the movement of SBBs and other native species across and along Peninsula Link during construction and operation;
- To facilitate movement required for dispersal (gene flow), and a low rate of daily movements (i.e. to allow for regular [daily or once per week] crossings of SBBs, as they undertake daily foraging/home range types of movements).

The plan provides comprehensive management measures which facilitate the ongoing protection and maintenance of SBB population and their associated habitats and features four main stages:

1. Pre-construction (as outlined in section 3)
2. During construction (as outlined in section 4
3. Post construction (as outlined in section 5)
4. Strategic Management (as outlined in section 6)

2.4 Management Plan Implementation, Timeframe and Review

The actions detailed in this management plan will be implemented by various State authorities over at least 10 years pre, during and post construction of Peninsula Link.

Linking Melbourne Authority will implement the management plan during the pre-construction and construction phases of the Peninsula Link Project (September 2009 to early 2013).

Parks Victoria is the land manager for the Pines FFR and will be responsible for the implementation of the plan in the post-construction phase. The Department of Sustainability and Environment is responsible for the management of wildlife within Victoria, and will take on a shared responsibility with Parks Victoria for the strategic management of SBBs both within the Pines FFR and surrounding environs.

The pre-construction surveys of the distribution of SBBs within the Pines FFR commenced in Spring 2009 and will be completed by March 2010 (see Appendix 4 for details). Construction of Peninsula Link in the Pines FFR will commence after 1st of April 2010, and is expected to take approximately three years.

The management plan has been written to allow a staged process as certain management actions are dependent on the outcomes of research (population viability analysis), monitoring (pre and during construction) and on strategic State Government management plans for the SBB. Therefore, the plan outlines key decision milestones, the responsible agency for each decision, and the commitments at key decision milestones.

2.4.1 Funding

The implementation of the plan requires a whole of government approach. Linking Melbourne Authority will fund the plan for the initial five years and then facilitate funding arrangements for the implementation of the plan for the remaining five year period (until year 2020), at which point the need for further monitoring and management measures will be reviewed.

It should be noted that LMA may transfer, assign or novate its functions and obligations under the Southern Brown Bandicoot Management Plan to another public entity (which may be a Victorian government department, statutory authority or corporation), who will then assume all of LMA's functions and obligations under the SBB Management Plan including funding of the commitments. It is initially expected that LMA will assign its functions and obligations under the SBB Management Plan to Parks Victoria post construction, potentially in mid 2013. LMA will consult with and provide sufficient notice in writing to the Federal Environment Minister prior to any proposed transfer, assignment or novation including the notification of funding allocation.

2.4.2 Formal Review

The management plan will undergo a series of formal and informal reviews during its lifetime. Consultation with key stakeholders will take place in February 2010.

A formal review will occur:

- Towards the end of the construction of Peninsula Link and prior to operation of the freeway (Dec 2012). Completion of construction of Peninsula Link is scheduled for early 2013.
- two years after completion of construction (2015); and
- at the end of the remaining five years (2020).

Informal reviews of progress will be undertaken annually throughout the life of the plan.

2.4.3 Corrective Action

As part of the above-mentioned formal reviews, performance will be measured and recommendations will be made as to whether corrective actions need to be implemented. Proposed corrective actions have been detailed within each of the management action tables (refer to sections 3, 4 & 5).

3. Pre-construction management of Southern Brown Bandicoots

3.1 Pre-construction Research and monitoring

3.1.1 Distribution and abundance of Southern Brown Bandicoots at the Pines FFR

Baseline monitoring for SBB was undertaken during the EES phase of the Peninsula Link project. The baseline monitoring program recorded SBB at several locations within the Pines FFR.

An independent research and monitoring program will accompany the pre-construction, construction and post-construction stages of Peninsula Link. **This monitoring program addresses EPBC condition 2(d).**

The details of the pre-construction research and monitoring are given in Appendix 4. In summary, the objectives of the pre-construction monitoring are to:

1. Determine the presence of SBB across The Pines FFR and adjacent potential habitat;
2. Provide pre-construction census data on the distribution and abundance of SBBs across the Pines FFR and nearby habitat; and
3. Have a sufficiently broad and reliable pre-construction data set to enable the development of a scientifically robust, long-term (10 years) monitoring program.

A wide range of survey techniques will be used, including hairtube surveys, sand-pad tracking, active searches for diggings, remotely triggered cameras, trapping and predator-scat analysis. Survey plots within the Pines FFR and adjacent potential habitat will be distributed in a 400 m grid, with additional survey plots to target areas with recent SBB sightings or areas with high quality habitat. There will be a minimum of 50 survey points within the Pines FFR and will include an additional 15 target survey points in high quality habitat as well as in areas where the most recent records of SBBs occurred. Six control sites with known populations of SBBs will be surveyed simultaneously with those in the Pines FFR.

Also, any foxes trapped during the predator control program will be dissected and stomach contents examined for signs of bandicoots.

The pre-construction monitoring program commenced in September 2009 and will include a spring, summer and autumn survey period. The survey techniques and methodology (including number of survey points) used for the initial research and monitoring program will be adopted for the summer and autumn surveys. The locations of the additional survey plots to target areas will alter depending on the results of the previous surveys and will be moved as necessary to locations which may provide the best possible opportunity to confirm the presence of bandicoots.

The results of the baseline research and monitoring program undertaken in spring (September 2009) are attached in Appendix 4B. The initial research and monitoring program results (spring) did not confirm the presence of bandicoots in the Pines FFR. During this initial program no scats, sightings, hair samples or diggings were obtained. The stomach contents of foxes examined did not provide signs of bandicoots. Preliminary indications are that bandicoot numbers in the Pines FFR are very small. It should be noted that surveys at control sites outside the Pines FFR confirmed presence of SBB, therefore indicating that the survey techniques are appropriate.

Results from the summer 2010 surveys have confirmed the presence of SBB in the Pines FFR with a single hair sample identified. The hair was analysed and confirmed to be that of a SBB. The stomach contents of foxes examined did not provide signs of bandicoots. Indications continue that bandicoot numbers in the Pines FFR are extremely small. The results of the research and monitoring program undertaken in summer (December –February 2010) are attached in Appendix 4B.

The third pre-construction research and monitoring program will be undertaken in March 2010 and results will be available in June 2010. These will be appended to the plan.

The detailed design and methods for the subsequent construction and post-construction long term monitoring will be based on the outcomes of the pre-construction surveys.

3.2 Threatening process: Habitat loss and clearing

The clearance of native vegetation for agriculture and urban development has lead to the decline and localised extinction of populations of SBBs across south-east Australia (Menkhorst and Seebeck 1990; NSW DEC 2006). A dense understorey of vegetation is critical habitat for SBBs, providing resources and protection from predators.

3.2.1 Vegetation clearing for Construction Fencing

The removal of native vegetation for Peninsula Link should be avoided or minimised where possible. Only land essential to road infrastructure will be cleared in order to minimise the loss of SBB habitat.

Prior to construction or commencement of activity within the construction area, construction fencing will be installed around the boundary of the construction area to clearly define the “no-go” area, and to restrict construction activities to the approved footprint.

Access to the reserve from the construction site will be restricted. It is proposed that the construction fencing will be installed in early 2010. Vegetation will be required to be cleared for the erection of this construction fencing and will be kept to a minimum.

The construction fencing will be erected as soon as possible to allow baiting of predators within the secure area inside the fence (if OHS Regulations permit). Clearing of vegetation to construct Peninsula Link will commence after 1 April 2010.

Prior to clearing any area of vegetation a fauna specialist will walk through the area and look for individual bandicoots and bandicoot signs, including conical shaped diggings, scats, footprints and mound burrows.

The pre-clearing walk-through will be conducted on the day that clearing is to be undertaken. Any area walked-through on a previous day and not cleared on that day will be walked through again on the next day, when vegetation is to be cleared. A walkthrough will be conducted immediately after clearing to aid any bandicoots injured by machinery or remaining on site after clearing. Injured animals will be taken to a local vet clinic or wildlife shelter and dealt with in accordance with the requirements of the Wildlife Act (Vic) 1975.

Southern Way will develop a Flora and Fauna Management Plan that will define protected areas and 'no-go' zones (areas to be fenced to prevent access during construction). The above procedures will be implemented and incorporated into the Site Environmental Management Plan to ensure that potential damage due to construction outside the construction area is avoided, and to minimise damage within the construction area.

3.3 Threatening process: Habitat Degradation

There has been a history of disturbance at the Pines FFR, including the removal of native vegetation, invasion by woody weeds and other exotic plants, prescribed burning and wildfire events. The construction of Peninsula Link may present an opportunity for invasive weeds and pathogens to penetrate further into the reserve.

3.3.1 Weed and pathogen invasion

The clearance of native vegetation and disturbance of soils during the pre-construction phase of Peninsula Link must not lead to an increase in the abundance or diversity of invasive weeds. Invasive weeds should not be allowed to colonise recently disturbed areas that have been cleared.

The area of disturbance for the installation of construction fencing will be minimised. The width of the construction area for the fencing will be kept as narrow as possible and the disturbance to soil will be kept to a minimum.

Southern Way will develop a weed management plan. The plan will aim to prevent the introduction of noxious and environmental weeds into the construction area. The plan will outline steps to prevent the introduction and spread of weeds, and will outline control mechanisms aimed at their eradication and/or control on-site. Specifically, the plan will include:

- Procedures for identification and management of weed risks;
- Hygiene regime to prevent the spread of plant/animal pathogens during construction; and
- Training of construction personnel.

This plan will be implemented during the construction phase of Peninsula Link and is discussed in detail in section 4.4 of this plan.

3.4 Threatening process - Loss of habitat connectivity

Connectivity is important because animals need to move around the landscape to find food, mates and shelter. When barriers prevent or reduce the rate of movement, local populations may decline or go extinct. The installation of construction fencing along the alignment without opportunities for wildlife to cross may have detrimental impacts on the species.

Southern Way will minimise impact on local wildlife and will develop measures in consultation with a fauna specialist and DSE and will include appropriate fauna underpasses and fauna proof fencing in key areas of fauna habitat. Southern Way will provide an open fauna underpass and a number of small culvert underpasses within the Pines FFR. These will include 4 specialised fauna crossings (2m x 2m Box Culverts) and a fauna underpass (2 x 30m wide x 5m high). These crossings are identified in Figure 2. Refer to section 4.5 for further discussion on fauna crossings.

There are options to minimise the effects of construction fencing on SBBs, depending on the distribution of SBBs within the Pines FFR. The distribution of SBB within the Pines FFR will not be known until after the pre-construction monitoring has been completed. The options include:

1. If SBBs are detected within close proximity (perhaps < 100 m) to the easement where the crossing structures are likely to be installed, then culverts across the entire easement should be installed as a high priority at those sites to reduce the likely impact of the barrier. If the exact levels and locations of the culverts has not been determined prior to establishing the construction fence then a perimeter fence and temporary culverts will need to be installed.

   An alternative option would be to install construction fencing along Peninsula Link with a section (corresponding with the approximate location of the future Peninsula Link underpass) remaining unfenced for as long as possible, providing SBBs an opportunity to move across Peninsula Link during construction. This approach would need to ensure that SBBs are not allowed to access the areas where construction vehicles are working, otherwise increased mortality may occur.

2. If SBBs are only located far from Peninsula Link or on one side of the alignment, then the urgency to maintain connectivity during the construction stage is reduced.

3. An alternative arrangement approved by DSE.

Southern Way will develop measures in consultation with a fauna specialist and DSE to provide habitat connectivity during construction. Depending on the outcome of the pre-construction monitoring one of the above measures will be adopted to maintain connectivity during construction.

3.5 Threatening Process: Introduced Predators

3.5.1 Preconstruction – the need for Predator Control

Predator control measures have been addressed throughout this plan, addressing EPBC requirement 2(c). Predator control measures will be implemented during the pre-construction phase. Reducing the predation pressure on the SBB by foxes and cats will increase the species potential to survive the construction phase of Peninsula Link. Predator control measures will be intensive and coordinated in order to have reduction in the predator population. Three predator control methods (baiting, trapping and den fumigation) are proposed to maximise the effectiveness of the control program. However, given the location of the Pines FFR, poison baiting is not feasible in the pre-construction phase (until such time as the construction site fence is erected and OHS Regulations permit the use of bait within a construction zone).

3.5.2 Predator Control Program

A pre-construction predator control program has been implemented in the Pines FFR to promote survival of SBB and other fauna within the Pines FFR. Details of the scope of the predator control program are attached in Appendix 3. The predator control program includes soft jaw trapping, den fumigation and collection of data on predators. A rabbit control program has also been implemented. In summary, the pre-construction program consists of the following:

- Soft Jaw trapping
- Cat traps (cage traps)
- Fox den fumigation
- Rabbit control (poison carrots).

Initial predator control works (October – December 2009) trapped 12 foxes, 3 cats and fumigated 3 dens. A second round of predator control works is currently being undertaken (January – March 2010), which also includes rabbit control.

Poison Baiting

The use of poison baiting is an accepted method of controlling feral predators, particularly foxes. However, baiting during the pre-construction phase of Peninsula Link is difficult due to the high risks posed to domestic pets gaining entry via breaches in fencing or through gates left open and risks of baits being moved by foxes into surrounding residential areas.

If Occupational Health and Safety Act/Regulations permit, fox baiting will be undertaken during the pre-construction stage of Peninsula Link within the construction zone which will be securely fenced. The construction site fence will be installed as soon as possible, and baiting will commence as soon as the fence is built, and before the vegetation is cleared for construction of Peninsula Link. The fence will be checked regularly due to the risk of vandalism, and any breaches of security will be repaired immediately. LMA will facilitate the possibility of baiting within the construction zone.

Baiting within the Pines FFR itself is not possible due to risk and public safety concerns. Linking Melbourne Authority will however explore the possibility of baiting within private property surrounding the Pines FFR such as the golf courses.

Soft Jaw Trapping

Trapping of foxes is an appropriate control method when and where poison baiting is unacceptable, for example in unsecured habitat in urban areas. LMA has facilitated implementation of a soft jaw trapping program during the pre-construction phase. LMA has engaged Parks Victoria to undertake this program.

An intensive trapping program has been undertaken at the Pines FFR, with 10 days per month in October, November and December 2009. No less than 100 soft jaw-traps per session were set up to cover the Pines FFR.

Further intensive trapping will be undertaken for the period January to 1 April 2010. The project briefs for the predator control program for October 2009 to December 2009 and January to April 2010 is attached in Appendix 3). The October to December 2009 dates for the trapping and fumigating program were altered due to on-site conditions. The program was run for 30 days over the October 2009 to December 2009 period (a copy of the results are attached in Appendix 3B). The results of the January to April 2010 program will be available in April 2010 and will be appended (Appendix 3D) to this plan.

Den Fumigation

Active fox dens will be fumigated during the pre-construction predator control program. Any active dens found between October 2009 and the commencement of the construction of Peninsula Link will be fumigated on an as-needs basis. LMA will facilitate the implementation of the den fumigation program in the pre-construction stage of Peninsula Link. LMA has engaged Parks Victoria to undertake this program.

Collection of data on predators

Data on the number and distribution of foxes trapped and dens fumigated is necessary to evaluate the success of the predator control program. It is especially important in the pre-construction stage to collect baseline information on the abundance and distribution of foxes within the Pines FFR to compare with the construction and post-construction stages. The data that will be collected is detailed in Appendix 12. The type of data that will be collected during the pre-construction phase includes the total number of foxes trapped, sex, age, size, number of dens fumigated and trapping locations. Information gathered as part of the SBB monitoring program includes recording of foxes on cameras and sandpads.

It is currently difficult to obtain an accurate index of fox abundance within the Pines FFR as methodologies used to obtain such estimates provide ambiguous data. Therefore setting predator reduction targets based on poor quality data is not appropriate. Linking Melbourne Authority is working to develop accurate estimates of fox abundance within the Pines FFR, and will use data collected from the remote cameras and sand pads used during the pre-construction monitoring program. Further data is required to increase confidence of fox abundance estimates. Linking Melbourne Authority will utilise data collected from other recent studies within the Pines FFR including a dataset that has been gathered over 2 years. This data will be reviewed following the conclusion of the pre-construction survey program to gather information regarding fox densities and to obtain an index of fox abundance.

The review will provide direction for improved survey methodologies and provide fox abundance estimates at the Pines FFR. Linking Melbourne Authority will then be in a position to set a fox reduction target. During the construction phase the predator control methodologies will be refined and then the long term target for fox control will be set based on the results of the population viability analysis and the relative importance of predation on the persistence of SBB's, relative to other threats.

Further detail on predator control measures is provided in Appendix 12 of this plan.

3.6 Pre Construction Management Action Table

Management Activity	Performance Criteria	Timing/ Duration	Corrective Action	Responsibility
Research and monitoring				
Abundance & distribution of SBBs within Pines FFR	Conduct 6 months of monitoring (3 seasonal SBB surveys) to obtain reliable information on the distribution of SBBs within The Pines FFR.	September 2009- April 2010	Reduce survey effort at control sites and increase survey effort at Pines FFR, especially in area where SBB hair identified.	LMA
Fox density	Collection of reliable information on the density of foxes and cats within the Pines FFR.	October 2009-ongoing	Investigate methods for obtaining more accurate fox density estimates.	LMA
Habitat Loss & Clearing				
Vegetation clearance for construction site fence	Keep width of clearing for construction site fence to a minimum width. Construction site fence installed after award of contract.	April 2010		Southern Way
Native vegetation	Prepare environmental management plan to ensure vegetation cleared during construction phase is minimised. Retain as much native vegetation as possible where the mitigation structures will be installed (culverts, underpasses and elevated SUP) EMP to specify clearing controls at key locations near wildlife crossing structures, including location, extent and management procedures (ie no-go zones, induction procedures) Restrict access to the reserve from the construction site.	Prior to on-site works	Southern Way to review environmental management plans and environmental management system.	Southern Way
Flora and Fauna Management Plan	Develop a Flora and Fauna Management Plan to define protected areas.	Prior to on-site works		Southern Way

Management Activity	Performance Criteria	Timing/ Duration	Corrective Action	Responsibility
Pre-clearing and post-clearing walk-throughs	Walk-throughs to locate SBB within clearing area.	The day that clearing is to be undertaken and immediately after clearing		Southern Way
Habitat Degradation Weed and pathogen invasion	Develop weed management plan to prevent spread of weeds and pathogens during works. Minimise the area of disturbance for the installation of construction fencing.	Prior to on-site works	Southern Way to review environmental management plans and environmental management system.	Southern Way
Habitat Connectivity If SBBs are located in close proximity to Peninsula Link easement If SBBs are located away from Peninsula Link easement	Build construction site fence with break to allow SBBs or install temporary culverts across easement to allow passage during construction phase. Minimise loss of habitat connectivity due to vegetation clearing.	As part of installation of construction fencing Initiate after vegetation cleared		Southern Way Southern Way
Introduced Predators Predator control program	Control foxes and cats across Pines FFR and adjacent sites using Soft Jaw Trapping, Den Fumigation and Cat Cages. This will assist in reducing predator populations before construction begins. Undertake a rabbit control program. 1080 Poison Baiting of Peninsula Link within construction zone (if OH&S requirements are met and baiting permitted). Collect data on predators.	October 2009 – 1st April 2010 Den fumigation October 2009 - March 2010	Investigate options for reducing fox population. This includes reducing available food sources (baiting of rabbits) to increase the number of foxes caught.	LMA and PV

4. Management of Southern Brown Bandicoots during the Construction of Peninsula Link

This section of the SBB Management Plan details the management actions that will occur during the construction phase of Peninsula Link (April 2010 until approximately early 2013).

4.1 Threatening Process - Mortality of Southern Brown Bandicoots during construction of Peninsula Link

Southern Brown Bandicoots burrow into leaf litter and loose soil and could easily go unnoticed during vegetation clearing and consequently unintentionally killed. In small populations, the death of one individual could significantly increase the risk of local extinction.

Southern Way's environmental management plan is to state that no SBB mortality can occur during any clearing of vegetation associated with the construction of Peninsula Link through the Pines FFR or adjacent potential bandicoot habitat. This includes clearing of vegetation for the installation of construction fencing or road construction. Furthermore, no mortality of SBB is to occur during any other stage of construction of Peninsula Link, including surveying, earthworks, fencing, and travel around the site.

Walkthroughs will be conducted prior to any clearing of vegetation within The Pines FFR or nearby habitat that may be supporting SBBs. A walkthrough will be conducted immediately after clearing to aid any bandicoots injured by machinery or remaining on site after clearing.

All works within the Pines FFR subsequent to the clearing will only occur within the Peninsula Link easement after it has been confirmed that SBB are absent. Access to the construction area will be restricted. Any access roads constructed or used to transport soil, machinery and people will be directed around the Pines FFR or remain within the fenced and cleared section of the construction area.

4.1.1 Pre-clearing walkthroughs

Prior to clearing any area of vegetation a fauna specialist will walk through the area and look for individual bandicoots and bandicoot signs, including conical shaped diggings, scats, footprints and mound burrows. The pre-clearing walk-through will be conducted on the day that clearing is to be undertaken. Any area walked-through on a previous day and not cleared on that day will be walked through again on the next day, when vegetation is to be cleared. A walkthrough will be conducted immediately after clearing to aid any bandicoots injured by machinery or remaining on site after clearing. Injured animals will be taken to a local vet clinic or wildlife shelter and dealt with in accordance with the requirements of the Wildlife Act (Vic) 1975.

4.1.2 Induction Process

Prior to the commencement of construction, Southern Way's Environmental Manager will conduct an induction for all personnel accessing or working within the construction area. The purpose of the induction is to inform individuals of their obligations to protect threatened fauna species. As part of this process:

- Awareness posters and flyers will be developed and distributed to Southern Way's personnel and sub-contractors and others as necessary, highlighting the presence or potential presence of SBB;.
- Information on the posters and flyers will include descriptions of their size and appearance;
- Awareness posters and flyers will include the obligations under the EPBC Act and FFG Act of Southern Way, its personnel and subcontractors regarding this species;
- The induction will include protocols on what actions to take if SBB are found within the construction area.

4.2 Threatening Process - Introduced Predators

The European red fox Vulpes vulpes and the domestic cat Felis catus have been implicated in the decline of many small to medium sized native mammals (Coates 2008; Richards and Short 2002). Both cats and foxes are versatile and have adapted extremely well to Australia's modified landscapes (Poole and McKillop 2002; Coates 2008). Predation by foxes is considered a major reason for the decline in the abundance and distribution of SBBs within The Pines FFR and more broadly across the landscape. The clearance of vegetation at the Pines FFR could present an opportunity for foxes to further penetrate into native woodland.

A predator control program will be developed and implemented during the construction phase of Peninsula Link. The program will include:

4.2.1 Baiting

Fox baiting will be undertaken during the construction phase of Peninsula Link within the construction zone which will be securely fenced. Baiting within the Peninsula Link easement will occur at the same time that the soft jaw trapping program is implemented elsewhere in the reserve (see below). The general public and domestic pets will be prevented from entering the construction zone due to the risk posed by machinery and earth works.

In addition, the baited sandpads within the Peninsula Link easement will be clearly flagged and Peninsula Link construction workers and staff informed of their whereabouts. Only professional contractors will remove uneaten bait and fox carcasses. Workers are to report any fox carcasses and take care not to handle them as they may carry diseases such as hydatidos and sarcoptic mange that can affect humans. Furthermore, the number of baits taken, and the species taking the baits (identified from footprints) will be recorded.

4.2.2 Soft Jaw Trapping

Trapping of foxes using soft-jaw traps during the construction of Peninsula Link will continue across the Pines FFR. As a minimum, one three month trapping program per year during construction will be undertaken at the Pines FFR, with 10 days per month each year during February - April (2010 to 2012). There will be no less than 100 soft jaw-traps set up to cover the Pines FFR per session. The dates for the trapping and fumigating program may alter depending on site conditions and number of foxes caught, however as a minimum the program will run for 30 days over the February to April period every year during the construction phase. The results of the program will be available in the following May/June period.

4.2.3 Den Fumigation

All known fox dens will be checked for fox activity in February, March and April during the construction stage (2010 to 2012) of Peninsula Link and active fox dens will be fumigated. Active dens located outside of this time period will be fumigated on an as-needs basis. Further details on fumigation techniques are given in Appendix 12.

4.2.4 Fox data collection

Information on the predator control works and the success (see Appendix 12 for full details) will be collated and reported to DSE, PV and LMA at the end of each trapping program each year.

4.3 Threatening Process - Habitat Destruction

The clearance of native habitat for agriculture and urban development has lead to the decline and localised extinction of SBB's across Victoria (Menkhorst and Seebeck 1990; NSW DEC 2006). A dense understorey of vegetation is critical habitat for SBB's, providing resources and protection from predators. Any further loss of habitat and an increased edge effect on habitat patches could pose a threat to the viability of the SBB population at the Pines FFR.

Habitat destruction (albeit short term) may be caused by wildfire which is highly likely based on fire history at the Pines FFR and may pose a threat to SBB viability.

4.3.1 Minimising Habitat Removal

The removal of native vegetation at the Pines FFR for the construction of Peninsula Link will only occur when absolutely necessary. Wherever possible vegetation clearance will be avoided or minimised and no more than 11ha of native vegetation will be removed within the reserve. Southern Way will develop a Flora and Fauna Management Plan. The construction footprint will be minimised to minimise the impact on native vegetation including scattered trees.

Substantial efforts to minimise habitat removal within the construction area will be undertaken during the planning stages of the works. To minimise the potential impacts on the habitat, the width of the construction area will be kept as narrow as possible. This will be achieved through the following measures:

- No-go zones will be clearly marked and fenced and all construction activities will be undertaken within the construction area ensuring that the minimal width of the construction area is identified and maintained;
- The site environmental officer will supervise the maintenance of the no-go zones;
- Access routes for vehicles and machinery will be restricted to specific, ecologically-safe locations that are identified prior to construction; and
- All vehicles, machinery and construction activities are prohibited in areas of known or possible habitat areas outside the construction area.

4.3.2 Habitat Destruction – need for an appropriate fire regime

The vegetation at the Pines FFR has been subject to a high fire frequency due to deliberately lit fires, wildfires and prescribed burning since the 1960s. Some parts of the reserve have been repeatedly burnt with an interval of only one or two years (Biosis 2008). Most of the former 108 ha Pines FFR was burnt by a wildfire in 1988 (Pines FFR Draft Management Plan, DCNR 1993) and a significant part of the same area was burnt again in 2003.

Evidence suggests SBBs benefit from occasional fire events (~once every 5 – 6 years). However if fire events occur more frequently the SBB may suffer from a loss of dense understorey habitat, leaving them more vulnerable to predation.

Similarly if long periods separate fire events, an excess of fuel leads to more intense fires, which again leaves SBB without critical habitat and vulnerable to predation.

The development of a suitable fire strategy is required for the Pines FFR and will need to involve the input of appropriate stakeholders. Any fire strategy would however require a degree of flexibility to account for unplanned fires which can be significant and burn large areas. Flexibility or adaptiveness would also take into account the results of monitoring (distribution of the SSB). Ideally, the Pines FFR will be a mosaic of areas with different fire frequencies and intensities, ensuring sufficient habitat of the optimal age and structure is always available for SBBs. This will require careful planning to ensure that sufficient high quality habitat is always available.

The probability of fire related threats occurring is moderately high and the impacts of fires may also be high given the relatively small size of the reserve and risks of rapid fire spread under high fire danger conditions due to the undulating topography and nature of the vegetation communities.

A fire management strategy will be developed as part of the Parks Victoria overall management plan for the Pines FFR. The preparation of a suitable fire management strategy will consider protection of identified key SSB habitat areas, protection of revegetation areas balanced with asset protection. The fire management strategy will be developed by September 2010.

4.3.3 Perimeter of Construction Zone

Construction activities will be confined within the fenced areas and must not occur outside of the construction area. This includes activities such as the storage of spoil and construction materials, and the movement and storage of construction vehicles and equipment. Construction fencing will indicate the perimeter of the construction area which is to be kept at a minimum. The site environmental officer will check fencing daily during the construction period to ensure that the fencing remains intact.

4.4 Threatening Process - Habitat Degradation

Invasion of native vegetation communities is often exacerbated by disturbance events, such as construction activities and roads and traffic. The construction of Peninsula Link may facilitate the spread of exotic weeds and other pathogens (e.g. PC) along the Peninsula Link alignment and into the adjacent reserve unless carefully managed. Degradation of habitat at the Pines FFR due to weed or pathogen invasion may be detrimental to the long-term survival of the SBB population.

4.4.1 Weed Invasion

A weed management plan will be developed and implemented for the construction and post-construction phases of the project to prevent the introduction of noxious and environmental weeds into the construction area. This plan will outline steps to prevent the introduction and spread of weed species, and will outline control mechanisms aimed at their eradication and/or control on-site.

The plan will also include preventative measures, such as vehicle wash-down procedures and the restriction of vehicle and personnel movements within and around sites, and measures to control weed establishment on soil stockpiles (see Phytophthora and topsoil management protocols below).

4.4.2 Weed Management within the Pines FFR

In addition to the weed management undertaken by Southern Way within the construction zone, LMA will contribute towards weed management within the greater Pines FFR.

LMA will consult with Parks Victoria to identify areas of infestation, particularly within high quality vegetation. LMA will work with Parks Victoria to develop a five year weed management program for the Pines FFR to provide improved habitat for the SBB. At the end of the five year program, a review of the program will be undertaken to assess the success of the weed management program and determine what weed management measures are required for the next five years. A weed management program for the greater Pines Reserve will be prepared the same time as the revegetation plan (see below). This weed management plan will be completed by June 2010.

4.4.3 *Phytopthora cinnamomi*

The spread of Phytophthora (*Phytophthora cinnamomi*) (also known as Root Rot Fungus) from infected sites into parks and reserves (including roadsides under the control of a state or local government authority) and use of Phytophthora-infected gravel for the construction of roads, bridges and reservoirs is considered a potentially threatening process and therefore must be managed.

It will be necessary for Southern Way to ensure that Phytophthora is not introduced to the construction area, and if it is detected within the construction area, quarantine measures are instigated to ensure that it is contained. This is particularly important in areas that are adjacent to Heathy Woodland remnants (which is highly susceptible to Phytophthora) and in particular, within the Pines FFR.

All soils and construction materials introduced to the construction area will be free from Phytophthora. Similarly, any soils to be transported from site-to-site within the construction area will also be free from Phytophthora before being disturbed. Southern Way will maintain vehicle hygiene (particularly in relation to all earth-moving equipment) to prevent the spread of Phytophthora between infested and uninfected sites.

If Phytophthora is detected on site then the following actions will be taken:

- The site environment officer will be notified immediately;
- All works within the vicinity are to cease;
- Infected areas are to be quarantined and fenced off;
- Soil containment protocols are to be implemented; and
- A decontamination and eradication program is to be developed in conjunction with qualified experts.

4.5 Threatening Process - Loss of Habitat Connectivity

Regardless of the distribution of SBBs within the Pines FFR in relation to Peninsula Link, the same level of connectivity as what currently exists across the Peninsula Link easement must be achieved in the long term. In other words, animals need to be able to move from one side of the Peninsula Link to the other with minimal restrictions.

The key consideration is the maintenance of habitat permeability – a slightly different concept to connectivity. Connectivity can be achieved with a single culvert, while maintaining permeability requires multiple structures. Permeability is about ensuring animals can cross the road without major detours to reach the crossing structure.

The implementation of habitat connectivity measures such as wildlife underpasses and smaller culverts are required to mitigate the loss of connectivity within the Pines FFR.

Southern Way will minimise impact on local wildlife corridors and will provide habitat connectivity along and across the freeway, particularly in the vicinity of the Pines FFR. Measures will be developed in consultation with a fauna specialist and DSE and will include an open fauna underpass and a number of smaller underpasses of the freeway within the Pines FFR.

The proposed location of these crossings has been identified in Figure 2. The preliminary design was prepared in consultation with a fauna expert during the bid phase for Peninsula Link and is consistent with the EES recommendations outlined within the Pines Master Plan and the Flora and Fauna Assessment. During the evaluation of the bids, the proposed preliminary design was reviewed by the Australian Research Centre for Urban Ecology (ARCUE) and DSE, prior to award of contract.

A copy of the preliminary design, including a report providing justification for placement and design of these structures is attached in Appendix 10. The detailed design for construction of the crossings will be completed late 2010, however it is anticipated that there will be very little change from the preliminary design. In the event, there is a substantial change between the preliminary design and detailed design of the fauna crossings that reduces the effectiveness of the fauna crossings for SBB, then a new design report will be submitted to the Federal Environment Minister for approval prior to commencement of construction of the crossings. A substantial change includes major shifts in location or dimensions where it adversely impacts the SBB.

It will also be important to consider the needs of other species when designing the underpasses and culverts. Other species in the Pines FFR that will need assistance in crossing the road includes Swamp rats, Black Wallabies, echidnas, possums and gliders, a wide range of reptiles and amphibians, and small bush-birds. Crossing structures that achieve connectivity for a wide range of species will have the greatest cost-effectiveness

The rate of use (i.e. success) of the underpasses under Peninsula Link and the SUP will be related to the extent of vegetation cover at the entrances to the culverts, underpass and elevated boardwalks. It is preferable to retain as much native vegetation as possible where the mitigation structures will be installed, rather than trying to rehabilitate it later. Strict controls and the exclusion zones will be established before any clearing commences. The importance of protecting this vegetation will be stressed to all construction personnel via the induction process. Southern Way will be responsible for ensuring compliance with these controls and exclusion zones.

4.6 Threatening Process - Visual and Noise Impacts.

Roads and traffic exert a wide range of negative impacts on organisms and the natural environment (e.g. chemical, noise and light pollution). Potential sources of pollution emitted by Peninsula Link will need to be mitigated. Noise and light attenuation barriers will be constructed along Peninsula Link, in order to minimise negative visual and noise impacts when the bypass opens.

Similar to traffic once in operation, the noise of the construction process may also have negative impacts on wildlife. However, the extent to which noise from the relatively temporary nature of construction, as well as it being restricted to daylight hours impacts on wildlife is unknown.

4.6.1 Noise Barrier/Light Attenuation Barrier

The construction of light / noise attenuation barriers will act to mitigate any potential negative impacts of noise and visual pollution on SBBs. The noise/light attenuation barriers also have the potential to act as a predator barrier along the alignment of Peninsula Link. The noise/light barriers will help to prevent ingress of foxes from the Peninsula Link alignment into the Pines FFR.

The design of the noise/light barriers and retaining walls along Peninsula Link will be such that they prevent SBBs from digging and accessing the road. Southern Way will include the use of retaining walls in critical locations within the Pines FFR.

Minimising construction at night when SBBs are most active will reduce the negative impact of machinery noise. The use of flood lights would be unnecessary if construction is limited to the daytime, reducing the visual impact of construction on SBBs.

The design and construction activities that may potentially affect the Pines FFR will comply with the principles in the Frankston Bypass EES (2008). Any public lighting through the Pines FFR will be designed to minimise light spill into the Reserve.

Southern Way will develop a Noise, Vibration and Light Emissions Management Plan that will demonstrate compliance with EPA Environmental guidelines, identify specific controls for noise sensitive receptors (including the Pines FFR), and demonstrate intention that disturbance to native fauna in sensitive areas, including the Pines FFR, will be limited to daylight working hours.

4.7 Increase in Habitat

4.7.1 KTRI Land

Large areas of land in close proximity to the Pines FFR were used by other organisations (e.g. Keith Turnbull Research Institute) and have the potential to be restored and rehabilitated to provide high quality habitat for the SBB.

It is intended that approximately 24.2 ha of surplus KTRI land (**refer to EPBC Approval condition 2a**) will be formally incorporated into the Pines FFR to expand habitat for the SBB and other fauna within the Reserve.

Linking Melbourne Authority has commenced discussions with the Department of Primary Industries (DPI) for the acquisition of KTRI land with the objective to then include it as part of the Pines FFR. Linking Melbourne Authority has written to the Secretary of the Department of Primary Industries (DPI) on 14 August 2009 seeking clarification about which parts of the KTRI site might be revoked and be re-reserved and added to the Pines FFR. A response from the Secretary of DPI was received on 15 December advising that the Minister for Agriculture has agreed to declare the land targeted for re-reserving surplus to departmental requirements and will be made available to DSE.

Linking Melbourne Authority wrote to DSE on 17 December 2009 requesting that the transfer of the land commence. DSE has since responded and advised that they have commenced the process of including the land in the Pines Flora and Fauna Reserve (Appendix 1). This process will take approximately 4 - 6 months as plans for excision and reservation must be prepared, followed by submission of plans to the Minister for Environment and Climate Change for consideration, and then for endorsement by Order of the Government in Council. The Federal Environment Minister will be formally notified when the process has been finalised. It is likely that this will occur by mid to late 2010, however no later than December 2010.

4.7.2 Rehabilitation of 16 ha of former orchard

As detailed in **EPBC condition 2(b),** 16 hectares of area of the former orchard will be rehabilitated to provide high quality habitat for the SBB. A walk through of the Pines FFR was undertaken in January 2010. The area to be rehabilitated has been identified in Figure 2.

The revegetation will be consistent with the recommendations of the Frankston Bypass EES Study (2008), where revegetation of a portion of the cleared land, including the orchards, east of the KTRI 2 Block should be with appropriate indigenous species from Heathy Woodland (on deep nutrient poor sands), Damp Sands Herb-rich Woodland (on moderately fertile well drained deep sands), and Swampy Riparian Woodland (adjacent to Boggy Creek and any offline constructed wetlands). These actions would aim to improve habitat connectivity between the Dara Block and the remainder of the Reserve.

During the walk through, further areas for weed control were also identified for consideration by Parks Victoria. This will further promote improved habitat connectivity for SBB and other fauna species.

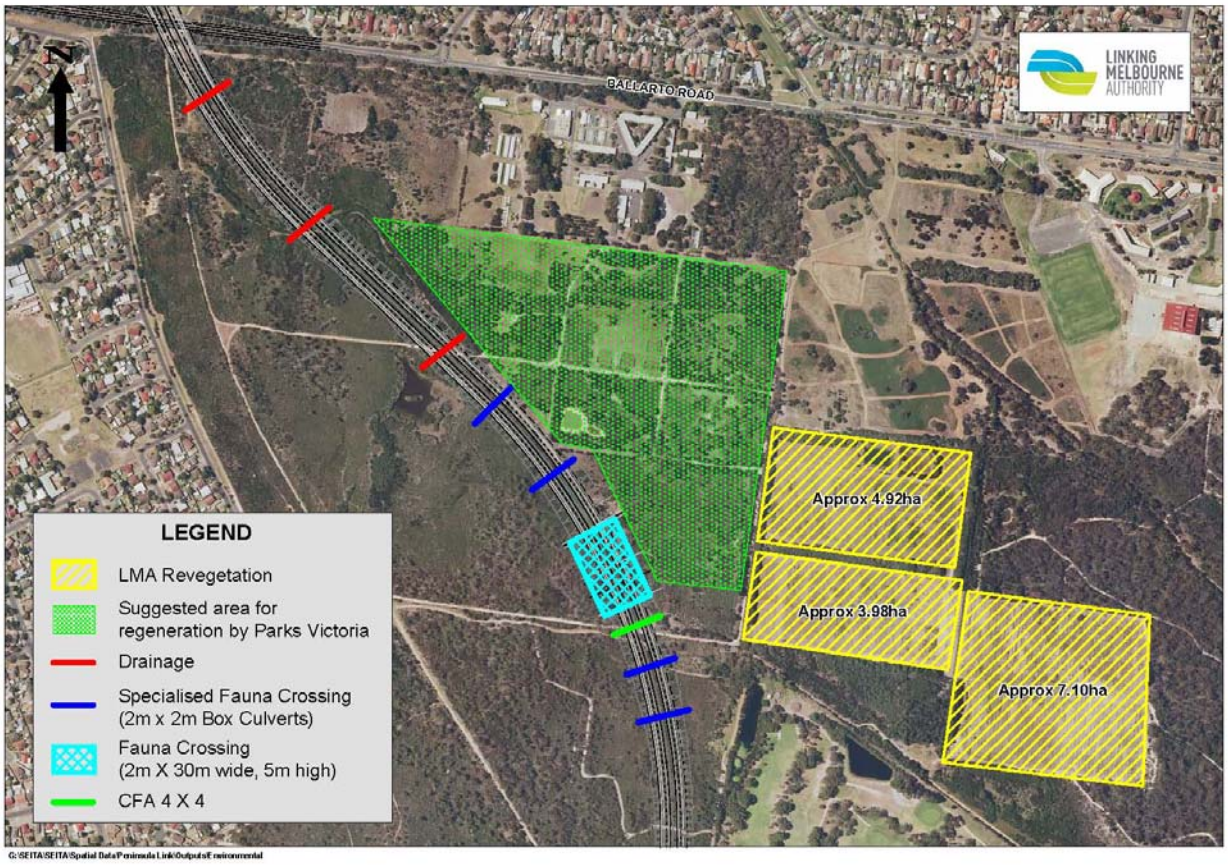
A plan detailing the 16 ha of revegetation works will be developed by June 2010. The plan will address the following:

- Details of site preparation
- A list of plant species to be used
- Maps and diagrams indicating location of planting

- Methods proposed to revegetate the sites
- Staging of the planting (when the planting will occur, staged over time if required)
- Sourcing of plants and seeds.
- Any environmental management requirements
- Establishment requirements (maintenance during critical establishment phase)
- Protection from browsing/grazing
- Estimate of costs
- Five year weed management plan (removal of woody weeds) for the Pines Reserve
- Any other details as necessary.

As stated above the revegetation plan will be developed by June 2010 in consultation with DSE, Parks Victoria and DEWHA. It will be submitted to the Federal Environment Minister for approval prior to being implemented.

Figure 2: Proposed Fauna Crossings and Revegetation Area



4.8 During-construction research and monitoring of SBBs

The detail of the research and monitoring of SBBs during the construction phase of Peninsula Link will be dependent upon the outcomes of the pre-construction surveys. However, in broad terms the during-construction monitoring will include:

1. Determining the distribution and abundance of SBB across The Pines FFR and adjacent potential habitat
2. Providing construction census data on the distribution and abundance of SBBs across The Pines FFR and nearby habitat
3. Providing sufficiently broad and reliable data set to enable the development of a scientifically robust long-term (10 – 25 years) monitoring program
4. Fox numbers and distribution, and potentially movement. Movement data will assist in identifying fox dens, which can then be fumigated. As well as assist in determining number of foxes, this may assist in establishing a relationship between fox predation within the Pines FFR and foxes denning in adjacent suburban areas, golf courses or quarries; andReviewing of temporary measures developed to provide habitat connectivity during construction

The survey techniques and methodology (including number of survey points) used for the summer research and monitoring program will be adopted for the during construction surveys. One research and monitoring program per year will be undertaken during the construction phase. The program will be undertaken in late spring of each year. The locations of the additional survey plots to target areas will alter depending on the results of the previous surveys and will be moved as necessary to locations which may provide the best possible opportunity to confirm the presence of bandicoots.

As for the pre-construction monitoring, a 400 m x 400 m grid will be established across the study area and survey plots will be established at each grid intersection. This equates to approximately 50 survey plots across The Pines FFR and adjacent potential habitat. This same methodology was used during the pre-construction surveys.

4.9 Public Awareness

The Linking Melbourne Authority will undertake a number of actions during the construction phase to promote the importance of the Pines FFR, including its role in providing habitat for local fauna.

Signage

Permanent signs will be erected in the Pines FFR to educate people about the history of the SBB in the region. The signs will also include information about other fauna species found within the Pines FFR and how local people can help protect and improve habitat for these species.

Staff volunteer days

Members of the LMA and Southern Way teams will play an active role in improving habitat for local fauna in the Pines FFR. Linking Melbourne Authority, together with Southern Way, will hold regular events aimed at helping local efforts towards planting, weeding, rubbish pick up and general improvement activities within the Pines FFR.

Booklet

A booklet will be developed to provide people with information about the SBB, the Pines FFR and tips for improving habitat for native fauna.

Project newsletter

Quarterly newsletters will be distributed to people living along the Peninsula Link corridor during the project design and construction phase. These newsletters will feature regular articles about the Pines FFR and include details about how local flora and fauna is being considered as part of the Peninsula Link project.

Website

The Linking Melbourne Authority website will feature information about the SBB and other environmental initiatives being undertaken as part of the Peninsula Link project. A specific page will be dedicated to the key features of this plan including monitoring, weed management, predator control and rehabilitation within the Pines FFR.

Info Hub

Thousands of people are expected to visit the Peninsula Link Info Hub during the construction of the freeway. Located in Frankston, the Info Hub provides a great opportunity to promote the importance of the Pines FFR and local environmental initiatives. Linking Melbourne Authority will invite local community groups and schools to receive presentations about Peninsula Link which will include information about the Pines FFR and how they can help improve habitat for local fauna.

4.10 During Construction Management Action Table

Management Activity	Performance Criteria	Timing/ Duration	Corrective Actions	Responsibility
SBB mortality during construction				
Pre-clearing walk throughs	Conduct walkthrough of proposed Peninsula Link site.	Immediately prior vegetation clearance	Cessation of works and review of procedures in the event of SBB mortality as a result of construction activities.	Southern Way
Mortality	Zero records of mortality of SBB due to vegetation clearing and construction activities.	Immediately after clearance of vegetation		
Induction Process	Conduct induction for all personnel accessing or working within the construction area	Prior to on-site works		
Introduced predators				
Baiting within fenced Peninsula Link alignment	If OHS Regulations permit, conduct fox baiting within construction area as part of predator control program. Baiting program – one three month program per year during breeding season (10 days per month for 3 months).	Feb, March & April (during construction)		LMA and PV
Soft Jaw Trapping	Conduct trapping of foxes, one three month program per year during breeding season (10 days per month for 3 months). Use no less than 100 soft-jaw traps set up to cover the Pines Reserve.	Feb, March & April (during construction)	Investigation of methods to reduce no. foxes across the Pines FFR.	LMA and PV

Management Activity	Performance Criteria	Timing/ Duration	Corrective Actions	Responsibility
Den Fumigation	All active dens fumigated. Continual reduction in the number of active dens each year. All active dens fumigated within 5 days of identification of it being active.	Inspection of all known dens in Feb, March & April.		LMA and PV
Data collection	Density of foxes and cats continuously declining within Pines FFR during construction stage. Rate of bait uptake reducing each year. Prepare report on results of predator control program.	May of the following year		LMA and PV
Habitat Destruction				
Habitat removal	Remove native vegetation for construction only when absolutely necessary. Minimise vegetation clearance to less than 11ha of native vegetation. Develop a flora and fauna management plan. Keep width of clearing for construction a minimum. EMP to address vegetation clearance and to be implemented during construction.	EMP to be prepared prior to construction	Southern Way to review environmental management plans and environmental management system.	Southern Way
Fire Management Strategy	Develop a Fire Management Strategy that considers protection of identified key SBB habitat areas.	September 2010	Parks Victoria to review Fire Management Strategy.	Parks Victoria
Perimeter of Construction Zone	Confine construction activities within fenced area and must not occur outside of construction area. Site environmental officer to check fencing daily to ensure fence remains intact.	During construction	Remediate promptly, within 48 hrs of detecting damage	Southern Way

Management Activity	Performance Criteria	Timing/ Duration	Corrective Actions	Responsibility
Habitat Degradation				
Weed Invasion	Develop and implement weed management plan.	Prior to and during construction	Southern Way to review environmental management plans and environmental management system.	Southern Way
Weed management for the Pines FFR	Prepare five year weed management plan for the Greater Pines Reserve. Implement five year weed management program.	June 2010	LMA and PV to regularly review 5 year weed management program.	LMA and PV
Phytopthora cinnamomi	Ensure all soils and materials introduced to the construction is free from phytopthora. Maintain vehicle hygiene to prevent spread of phytopthora.	During construction	Southern Way to review environmental management plans and environmental management system.	Southern Way
Habitat Connectivity				
	Temporary culverts installed to maintain connectivity during construction. Establish temporary culverts under Peninsula Link at the beginning of construction if SBBs detected in close proximity and on both sides of Peninsula Link. Construct permanent wildlife crossing structures and rehabilitate entrance/exits of underpass/culverts ASAP. Retain as much native vegetation as possible.	Prior to construction commencing within affected area		Southern Way

Management Activity	Performance Criteria	Timing/ Duration	Corrective Actions	Responsibility
	Wildlife crossing structures built and functioning as intended.	Construction completed ASAP, and the adjacent vegetation restored ASAP		Southern Way
	Crossing structures on SUP built and functioning as intended.	Construction completed as soon as practicable and the adjacent vegetation restored		Southern Way
Noise/Light Barriers				
Construction of a light/noise attenuation barrier for when Peninsula Link is operational	Develop a noise, vibration and Light Emissions Management Plan. Installation of light/noise attenuation barriers Construction limited to daylight hours within the Pines FFR. Limit negative impact of traffic and artificial lighting on SBB behaviour.	During Construction	Southern Way to review environmental management plans and environmental management system.	Southern Way
Increase in Habitat				
KTRI Land	Commence process for inclusion of KTRI land into Greater Pines Reserve.	2010		DSE
Rehabilitation of 16 Ha of former orchard	Develop revegetation plan which is to be approved by Federal Environment Minister	June 2010		LMA and PV
	Implement approved revegetation plan.	July 2010 onwards		

Management Activity	Performance Criteria	Timing/ Duration	Corrective Actions	Responsibility
Research and monitoring				
Surveying for SBBs within the Pines	Complete annual Spring survey of bandicoots across The Pines and adjacent areas following protocols of the pre-construction surveys. If possible, also survey within Peninsula Link alignment.	Spring – during construction		LMA
Evaluate use of crossing structures by SBBs and other species	Assess effectiveness of mitigation structures.	As soon as the crossing structures are built and fencing allows animal movement		LMA
Public Awareness				
	Undertake a public awareness campaign including installation of signage, preparation of a booklet, distribution of project newsletters, website updates, information hub and staff volunteer days.	During construction		LMA and Southern Way
Formal Review				
	Undertake formal review of SBB plan and submit to Federal Environment Minister for approval. This will also include a review of the monitoring program to consider the most appropriate season(s) for surveying.	2012		LMA

5. Managing Southern Brown Bandicoots at The Pines FFR after the Construction of Peninsula Link

This section of the Southern Brown Bandicoot Management Plan details the management actions that will occur during the post construction phase of Peninsula Link (Early 2013 until approximately early 2020).

5.1 Monitoring

5.1.1 SBB Monitoring

Monitoring of SBB will continue after the construction phase of Peninsula Link has been completed. A post construction monitoring program will be developed once a review of the pre-construction and during construction monitoring data has been undertaken. The long term monitoring program will form an appendix to this plan (Appendix 11).

The during construction monitoring program (one session in spring) will continue for two additional years. At this point, over 5 years of monitoring will have been completed (6 months of pre-construction monitoring, 3 years of construction monitoring and 2 years of post-construction monitoring). A formal monitoring review will be undertaken and the monitoring program for the next 5 years will then be determined and implemented.

5.1.2 Monitoring Effectiveness of Underpass

The effectiveness of the culverts and underpasses will be assessed in a survey, post construction. The survey will involve the use of cameras as well as physical inspection for tracks, diggings and scats. The survey will occur twice per year over a two year period. The cameras will monitor for SBB movement across the underpass for two months during each survey period (twice per year).

This addresses EPBC Condition 2(d).

The rate of use and effectiveness of the mitigation structures will be investigated as part of the long-term population monitoring. This will include using direct and indirect approaches, such as sand pads/cameras within the crossing structures, as well as genetic techniques to estimate rates of gene flow across Peninsula Link. Evaluation of the use and effectiveness of the SBB crossing structures will commence as soon as possible after installation, and if possible during the construction stage. This however is dependent on the state of the vegetation cover to these structures during construction and if revegetation works are necessary. The use of the culverts and underpasses by feral predators will also be assessed. The scope and details of how this will be undertaken will be developed using the data gathered during the pre and during construction phases and will be incorporated into this plan as part of the formal review in 2013.

5.2 Mortality

No SBB's are expected to be found along Peninsula Link within the Pines FFR. The road design includes barriers to prevent fauna from entering the road.

5.3 Predator Control

The data gathered during the pre-construction and during construction phases, together with the details of fox abundance will provide direction for long term predator control measures. A long term predator control plan will be prepared by Dec 2012 and submitted to the Federal Environment Minister for approval.

At this stage it is anticipated that a predator control program consistent with the predator control works undertaken during the construction phase will be undertaken The dates for the trapping and fumigating program may alter depending on site conditions and number of foxes caught, however as a minimum the program will run for 30 days over the February to April period each year for two years after construction of Peninsula Link. A total of 5.5 years of predator control works would have been undertaken at this point (6 months pre-construction, 3 years during construction (30 days per year) and 2 years post construction (30 days per year)). The effectiveness of the predator control program will be formally reviewed at this point, and recommendations for further predator control works at the Pines FFR for the next five years will be assessed and implemented.

5.4 Habitat Degradation

5.4.1 Weed Management

Weed management will be undertaken after the construction phase to minimize the likelihood of impacts from the construction of the freeway on native vegetation and flora species. A roadside management plan will be prepared and implemented by Southern Way which includes weed management within the road reservation for the duration of the Concession Period.

Refer to section 4.4.2 for weed management within the Pines FFR.

5.4.2 Fire Management

Parks Victoria is responsible for fire management within the Pines FFR. Fire protection will be undertaken in accordance with the Port Philip East Fire Protection Plan and includes maintenance of perimeter firebreaks, maintenance of the track network and prescribed burning. Fire management will be reviewed by Parks Victoria in preparing a management plan for the Pines FFR. Refer to section 4.3.2.

5.6 Post Construction Management Action Table

Management Activity	Performance Criteria	Timing/Duration	Corrective Actions	Responsibility
Research & Monitoring				
Surveying for SBBs within the Pines	Complete annual Spring surveys of bandicoots across The Pines FFR and adjacent areas for 2 years post construction. Assess monitoring data and then prepare monitoring program for next 5 years.	Post construction		LMA and PV
Monitor effectiveness of underpass	Survey for two monthly period twice/year for 2 years post construction.	Post construction		LMA and PV
Mortality	No SBB are expected to be found on Peninsula Link due to physical barriers to entrance onto roadway. Zero mortality of SBB as a result of operation of Peninsula Link.	Post construction		Southern Way
Predator Control				
Predator Control program targeting foxes and cats	Conduct baiting, trapping of foxes, one three month program per year during breeding season (10 days per month for 3 months). Use no less than 100 soft-jaw traps set up to cover the Pines Reserve. Density of foxes and cats continuously declining within Pines FFR. The rate of fox capture declining due to reduced density of foxes, not trap-shyness. Review predator control program and prepare and implement long term predator control plan.	For two years, in Oct, Nov, Dec 2012	Investigation of methods to reduce no. foxes across the Pines FFR.	LMA and PV

Management Activity	Performance Criteria	Timing/Duration	Corrective Actions	Responsibility
Habitat Degradation				
Weed Management	Prepare and implement roadside management plan. Weed management within road reservation.	Post construction	Southern Way to review environmental management plans and environmental management system.	Southern Way
Weed Management Pines Reserve	Review weed management plan and prepare and implement program for next five years.	2015		Parks Victoria
Fire Management Strategy	Review Fire Management Strategy as required.	PV ongoing Fire Management Strategy		Parks Victoria
Post construction Review	Formal Review of SBB Management Plan, two years after completion of construction.	2015		LMA, PV and DSE

6. Strategic Management

This section of the Southern Brown Bandicoot Management Plan details the specific strategic management actions for the species in the Pines FFR and the general actions for the species in the greater south east region of Melbourne.

6.1 Population Viability Analysis

Population Viability Analysis (PVA) is a mathematical modelling tool used to calculate the potential risk of extinction for a population of a particular fauna species within a particular period of time and habitat area given the constraints and variables for the given site and species. The broad objective of this analysis is to evaluate and rank proposed management options and the impacts on the long term viability of the SBB in The Pines FFR. Performance of the management options will be evaluated in terms of their expected minimum population sizes and probability of extinction. This information will be used to recommend the most effective and efficient management options for maintenance of this population during the construction and operation of Peninsula Link. Specifically, the aims are:

1. To identify viable management options and their relative effects on the SBB population within the Pines FFR and the adjacent landscape. The output of the model will be estimates of population size at relevant time intervals.
2. Evaluate any uncertainty around each management option
3. Perform a simple cost-benefit analysis based on predicted outcomes
4. Recommend the most effective and efficient management options for the SBB in the Pines FFR.

The RAMAS Landscape model will be used, which combines landscape models (how vegetation changes over time) and metapopulation models which predict the viability of multiple populations over time. The combination is important because it allows predictions of how the vegetation may change due to management actions (e.g. time since fire, habitat restoration works) and then how the SBB will respond to the changing quality of the habitat.

A preliminary report will be submitted to DEWHA by June 2010, and will summarise the management scenarios for approval as well as preliminary results of the PVA. This report will also outline the scope for possible offsets and translocation scenarios. Once approved by the Federal Environment Minister, the PVA will be progressed to include recommendations for the long-term management options at The Pines FFR. This PVA will help inform strategic management initiatives detailed in Section 6.0 and will be completed by Dec 2012. The report will also detail the various input parameters and assumptions to ensure maximum transparency and repeatability of the modelling. This report will be peer reviewed in 2011. **This addresses EPBC Condition 2(d).**

6.2 Predator Control

6.2.1 Predator Proof Fence

The construction of a predator proof fence around the boundary of the Pines FFR will be undertaken after construction of Peninsula Link is completed. This is scheduled to occur in early 2013. The planning for the fence will be undertaken in consultation with DSE and Parks Victoria and will consider fire management and potential impact on bandicoots and other fauna, vegetation removal for the installation of the fence, physical aspects of the fence (including public recreation and accessibility), access points, creek crossings and long term management of the reserve. The planning will be completed by December 2012 with implementation in 2013. A design report will be prepared by December 2012 and will form an appendix to this plan (Appendix 9). **This addresses EPBC Condition 2(c).**

The current monitoring programs and strategic reviews will help guide if a predator proof fence is beneficial to the SBB population within the Pines FFR, and this assessment will be incorporated into the formal review process of this plan.

6.2.2 Predator Control

LMA has committed to predator control in the Pines FFR pre-construction, during construction and a further 2 years post construction after which a review will be undertaken to assess the effectiveness of the predator control program and what will be required for the next five years. This will be detailed in the long term predator control plan.

6.3 Habitat Connectivity

Southern Way will minimise impact on local wildlife corridors and will provide habitat connectivity along and across the freeway, particularly in the Pines FFR. Measures will be developed in consultation with a fauna specialist and DSE and will include an open fauna underpass and a number of smaller underpasses of the freeway within the Pines FFR. The connectivity of habitat will be well developed and implemented within the Pines FFR.

Habitat connectivity to the Pines FFR requires a strategic approach and a number of initiatives are being undertaken in the region relevant to habitat connectivity. These include:

- Department of Sustainability and Environment Sub Region Strategy - The strategic importance of the Pines Flora and Fauna Reserve to SBB populations will be assessed by DSE. This assessment is part of the Sub Region Strategy for SBB in the South East of Melbourne. This Strategy will be completed by early 2010. The outcomes of the Strategy will then feed into the next phase of this management plan. The report will form an appendix to this plan (Appendix 7).

- Ecological Connectivity Plan for South East Melbourne -The Draft Ecological Connectivity Plan for South East Melbourne is a strategy to identify potential biolinks for general flora and fauna connectivity in the 4 Council areas of Mornington Peninsula, Frankston, Casey and Cardinia. The strategy is partnered by a number of state agencies (Melbourne Water, PPWP CMA, DSE, GAA, RBGC) as well as the 4 Local Governments. It focuses on ecological links around the Royal Botanic Gardens Cranbourne. The November Draft is currently under revision and is expected to be finalised by March 2010. The plan uses criteria to assess potential biolinks to link areas of core habitat and nodes in the study area.
- National Southern Brown Bandicoot Recovery Plan – The plan is being prepared by Arthur Rylah Institute for Environmental Research for the recovery of SBB across NSW, Vic and SA. The plan focuses on 10 major areas including biology and genetics, land tenure and connectivity. This plan is subject to DEWHA's approval. The final release date for the document is not known at this stage.
- Living Links Project -undertaken by the Port Phillip and Westernport Catchment Management Authority (PPWP CMA). The Living Links Project will be implemented over 25 years. Living Links will develop new and enhance existing vegetation corridors along roadsides, waterways, public open spaces and coastal zones, and improve the accessibility and connectivity between environmental, social and recreational assets in the south east of Melbourne.
- Preparation of the PPWP CMA 2010 – 2016 Regional Catchment Strategy (RCS). The main focus of the RCS is the land, water and biodiversity in the region including coastal and marine areas. It provides a framework for effort, an investment guide, a means of integrating policy and an action plan for catchment works and will consider habitat connectivity.
- Regional Recovery Program for the SBB (Biosphere Foundation). The Biosphere Foundation has adopted the recovery of the Southern Brown Bandicoot as a flagship project in order to raise community awareness of declining biodiversity and the need to live more sustainably. In collaboration with other organisations, the Biosphere Foundation's research committee has established a Southern Brown Bandicoot recovery team. A recovery plan is being developed specifically for the Mornington Peninsula and Western Port region. The release date for this draft document is not known.
- WesternPort BioLinks – prepared by the Royal Cranbourne Botanical Gardens. This document deals with connectivity to the gardens.

As stated above the strategic importance of the Pines FFR within the region will be assessed. This assessment is being undertaken by Department of Sustainability and Environment as part of the Sub Region Strategy for Southern Brown Bandicoots in the South East of Melbourne. This Strategy will be completed by early to mid 2010 and will include a review of habitat connectivity, opportunities for maintenance and creation of corridors and in particular between the RBGC, Langwarrin FFR, and the Pines FFR.

These documents, in particular the sub regional strategy, are critical to guiding the management actions that need to be implemented within the Pines FFR to contribute to the long term survival of the SBB in the region.

LMA will contribute information obtained from Peninsula Link studies into the above-mentioned initiatives. Once these strategies have been drafted, LMA will then assess the level of further contribution that may be required to support regional recovery of SBB through improved habitat connectivity.

LMA will also review the above-mentioned initiatives and prepare a report that identifies opportunities to improve connectivity adjacent to the Pines FFR. It is anticipated that this report will be available to DEWHA in Dec 2012. **This addresses EPBC condition 2(g).**

6.4 Offsets and Translocation

The Pines FFR cannot be treated independently of the rest of the south east of Melbourne when considering habitat for SBB and making decisions regarding the long term management of the species.

The results of the two pre-construction monitoring programs undertaken to date have confirmed the presence of bandicoots within the Pines FFR, with a single SBB hair identified in a hairtube survey. The SBB is likely to be in very low numbers. The third pre-construction monitoring program will be undertaken in March 2010.

A population viability analysis is also being undertaken and the findings of the Sub Regional Strategy will give direction as to the long term management of the SBB and the Pines Reserve.

As stated above a report will be prepared that identifies opportunities to improve connectivity. As part of this report, a review of the data obtained during the pre-construction monitoring and population viability analysis will be undertaken. The identification of impact thresholds that will trigger management measures and the discussion on the range of options for offset, in the event that the SBB population in the Pines Reserve continues to decline, including a last option of translocation will be addressed in this report. The report will be prepared in consultation with DSE, Parks Victoria and DEWHA. Any measures which will be identified in this report will be implemented. **The following addresses EPBC Condition 2(e).**

6.4.1 Translocation

As SBB are likely to be in very low numbers within the Pines FFR, then there is the question as to the potential re-introduction of the species into the reserve. Further work will need to be undertaken in consultation with Parks Victoria and DSE to determine the source population, the potential for long term survival of the species in the area and long term management.

The population of SBB within the Pines FFR is unfortunately not unique in respect to its rapid and recent decline. While most populations of SBBs across the greater region are also small and fragmented they are not yet subjected to the intense urbanisation pressures faced at the Pines FFR. Should a small population be identified within the Pines FFR, a possible management strategy may be to translocate the population out of the Pines FFR and into a more secure area, as a last resort.

6.4.2 Offsets

If the long-term management options not considered feasible at the Pines FFR may be possible at other currently semi-urban/rural areas. It may be more cost-effective to use resources proposed for managing and monitoring the Pines FFR population of SBBs at an alternative population in the region. If supporting an alternative population is deemed to be more appropriate, the re-vegetation of the former orchard lands, construction of a wildlife underpass and long-term fox control will still occur at the Pines FFR for the benefit of several other regionally significant species.

The following populations are located in areas that are not yet highly urbanised but are vulnerable and require management. Fox control, exclusion fencing and the purchase of land for conservation would aid in maintaining viable populations of SBBs in these areas.

These populations present an opportunity to ensure the long term viability of a SBB population in the greater region. Management actions at these locations may be considered by Parks Victoria and the DSE as more cost effective and feasible in comparison to the Pines FFR.

The alternative population sites include:

- **Koo Wee Rup -** The Koo Wee Rup Swamp, Koo Wee Rup drains and The Inlets provide core habitat, habitat patches and habitat links for SBB while also supporting several vegetation communities. It has been recommended that these areas are protected by predator proof fencing and Biosis have produced a management plan for The Inlets. The population is currently under threat due to a lack of adequate fox control and key habitat areas are not currently protected for conservation or from zoning (Ecology Australia 2009);
- **Bayles -** Bayles Fauna Reserve, Bandicoot Corner and Yallock Creek are known to support bandicoots and are classed as core habitat for the species. These areas are considered important as long term habitat and the two reserves are protected by predator proof fencing and are managed for bandicoots. Fox control is still an issue in the area, the Yallock Creek area is not secure for conservation, not protected by zoning and under threat by cattle grazing (Ecology Australia 2009);

- **Cardinia-Rythdale-** Within the area there are habitat patches located on private property, roadside reserves and drains and creeks. The occupied habitat in this area faces multiple threats including predation by foxes and domestic pets, cattle grazing, not protected from zoning, vegetation clearance, urban expansion, adjacent landuse practices and isolation (Ecology Australia 2009);
- **Garfield-Longwarry -** Core habitat has been identified within the abandoned railway line and road corridors (Nar Nar Goon- Longwarry Rd). SBB have been observed utilising habitat and anthropogenic structures on private properties in the town of Bunyip. The population faces threats from fox predation, vegetation clearance and road mortality (Ecology Australia 2009);
- **Quail Island -** The Quail Island population is one of the few remaining in the wider area. This population could represent an important refuge for the SBB. Focusing resources on a population such as Quail Island may prove more cost effective and achievable given it is not located in an urban growth area.

6.4.3 Impact Thresholds to Trigger Management Intervention

A population viability analysis is being undertaken and the findings of the Sub Regional Strategy will give direction as to the long term management of the SBB and the Pines Reserve. It is therefore difficult at this stage, based on the information available, for the identification of impact thresholds that will trigger management intervention, or to provide offset and translocation details.

However, a number of reviews will be undertaken as part of this project that will help guide management intervention, if necessary. These include the following:

- The PVA management scenarios and preliminary results will be submitted to DEWHA in June 2010. Once approved, the PVA will be progressed to develop management recommendations. These will guide SBB Management strategies.
- Following conclusion of the pre-construction SBB monitoring, an estimate of fox abundance will be derived based on data collected from remote cameras and sand pads during the pre-construction monitoring program. Additional fox abundance data will be obtained from other recent data sets in the Pines FFR. The data will be reviewed to obtain an index of fox abundance. Once LMA is confident with the quality of data and is satisfied with the methodology required to obtain an estimate of fox abundance, more rigorous fox reduction targets can then be established. Baiting and trapping programs can then be reviewed and improved. The long term target for fox control will be based on the results of the population viability analysis and the relative importance of predation on the persistence of SBB's, relative to other threats.

- The strategic importance of the Pines FFR within the region will be assessed by Department of Sustainability and Environment as part of the Sub Region Strategy for Southern Brown Bandicoots in the South East of Melbourne. This document is critical to guiding the management actions that need to be implemented within the Pines FFR to contribute to the long term survival of the SBB in the region.

6.6 Strategic Management Action Table

Management Activity	Performance Criteria	Timing/Duration	Responsibility
Population Viability Analysis			
Conduct PVA	Conduct PVA, results will aid PV and DSE in determining strategic significance of Pines FFR	Commenced Jan 2010. Preliminary PVA will be submitted to the Federal Environment Minister for approval in June 2010	LMA
	PVA will be updated during construction and post construction phase as required.	Completed by 2012.	
Update PVA as more data becomes available	Increase accuracy of PVA prediction	As required	LMA
Predator Control			
Predator Proof Fence	Predator Proof Fence Plan to be developed	Design Report will be submitted to Federal Environment Minister for approval in December 2012	LMA
	Fence to be installed	2013	
Predator Control	Predator control program to be developed for next five years based on results of previous programs	Long term predato control plan will be submitted to Federal Environment Minister for approval in December 2012	PV
Habitat Connectivity			
Open underpass and smaller underpasses to connect habitat	Design and Installation of underpasses	During construction	Southern Way

Management Activity	Performance Criteria	Timing/Duration	Responsibility
Connectivity opportunities	Contribute information to strategic studies undertaken by others Review strategic documents and other initiatives and prepare report that identifies opportunities to improve connectivity adjacent to Pines FFR.	As required Strategy to enhance connectivity will be submitted to Federal Environment Minister for approval by Dec 2012	LMA
Offsets & Translocation	Review pre-construction research and monitoring data, population viability analysis and strategic assessments. Prepare report that discusses a range of offsets in the event that the SBB population in the Pines continues to decline, including a last option of translocation Implement any measures identified in the above report	Strategy to provide an offset will be submitted to Federal Environment Minister for approval by Dec 2012	LMA
Post construction Review	Formal Review of SBB Management Plan	2020	PV and DSE

7. Outstanding Requirements

The actions detailed in this management plan will be implemented by various State authorities over at least 10 years pre, during and post construction of Peninsula Link. The management plan has been written to allow a staged process as certain management actions are dependent on the outcomes of research (population viability analysis), monitoring (pre and during construction) and on strategic State Government management plans for the SBB.

The research and monitoring programs including SBB surveys, predator surveys and population viability analysis will have resulted in an increased knowledge base of fauna within the Pines FFR. This information will also contribute to strategic initiatives currently being undertaken in the surrounding area and help guide management actions.

In order to satisfy the EPBC conditions, there is a requirement to gather a substantial amount of information in relation the Southern Brown Bandicoot within the Pines Flora and Fauna Reserve, prior to the establishment of long term management measures. The data will inform the population viability analysis and discussions surrounding offsets and translocation and other measures. Therefore this plan requires a stage approval process and is conditional upon the delivery of a number of outstanding actions within the next three years. These items have been described within this document, and have been summarised in the table below.

Summary of Outstanding Requirements

EPBC Condition	Commitment in this plan	Outstanding items	Timing for delivery	Approval requirements
2 (a) Acquisition of KTRI land	It is intended that approximately 24.2 ha of surplus KTRI land will be formally incorporated into the Pines FFR. LMA has written to DSE requesting land transfer commence. DSE has advised that they have commenced the process, which will take 4-6 months	Formal transfer of land (land revoked and be re-reserved for addition into Pines FFR)	Mid 2010, however no later December 2010.	LMA will advise DEWHA when transfer of KTRI land into the Pines FFR has occurred. A letter will be sent to DEWHA with this advice.
2 (b) Rehabilitation of former orchard and KTRI to provide approximately 16 ha of additional habitat for SBB	The 16 ha of former orchard has been identified for revegetation. A revegetation plan will be developed by June 2010. The revegetation works will then be subsequently implemented	Plan for revegetation of approx. 16 ha of former orchard	June 2010 Implementation of revegetation plan.	Federal Environment Minister to approve revegetation Plan in June 2010. Operation of road will not commence until revegetation plan has been approved

EPBC Condition	Commitment in this plan	Outstanding items	Timing for delivery	Approval requirements
2 (c) Predator Control measures:				
Initiation and maintenance of a predator control and monitoring program in the Pines FFR	Pre-construction predator monitoring is being collected. This will be reviewed to estimate fox density in Pines FFR.	Predator control commenced. Monitoring commenced using sand pads and cameras. Long term predator control plan to be prepared and submitted	December 2012	Approval required by Federal Environment Minister. Operation of road will not commence until long term predator control plan has been approved.
Installation and maintenance of a predator proof fence around the boundary of the Pines FFR	LMA will construct a predator proof fence around the boundary of the Pines FFR. Planning will be completed by Dec 2010 in consultation with DSE and Parks Victoria. Design report will be prepared.	Design report of predator proof fence to DEWHA Fence to be installed following construction of Peninsula Link	December 2012 2013	Approval required by Federal Environment Minister. Operation of road will not commence until fence design report has been approved.
Identification of impact thresholds that will trigger management intervention	Impact thresholds will be developed with formal reviews of this SBB Plan and after data has been obtained including PVA and review of predator control program.	Details provided after review of PVA, strategic assessment undertaken. Included as part formal review of plan	Dec 2012	

EPBC Condition	Commitment in this plan	Outstanding items	Timing for delivery	Approval requirements
2 (d) Monitoring and recovery actions for SBB that include:				
Provision of a large underpass and a number of small culverts under Peninsula Link. As proposed in EES.	An open fauna underpass and a number of smaller underpasses will be installed.	None unless substantial changes to design which detrimentally impact SBB	If substantial changes proposed, then prior to construction of crossings	None unless substantial changes to design which detrimentally impact SBB, If design substantially changes then require approval by Federal Environment Minister.
Assessment of the effectiveness of the culverts and underpass for retaining connectivity for SBB, which includes pre-construction monitoring for 6 months and post-construction monitoring that continues for 10 years at which point of time the need for further monitoring will be reviewed.	The effectiveness of the culverts and underpasses will be assessed in a survey, post construction.	Pre construction monitoring commenced. During construction monitoring will be implemented. Scope and details of long term monitoring including the effectiveness of the underpass to be developed and incorporated into the SBB plan as part of formal review and provided in the Post-construction SBB management plan	December 2012	Approval of post-construction SBB management plan required by Federal Environment Minister. Operation of road will not commence until monitoring report has been approved.

EPBC Condition	Commitment in this plan	Outstanding items	Timing for delivery	Approval requirements
Development of a Population Viability Analysis to determine effectiveness of all management measures and recovery actions for SBB. Report to be peer reviewed of completed PVA by a qualified expert.	PVA to be undertaken that includes recommendation and long-term management options.	PVA report to be submitted for approval to Federal Environment Minister to DEWHA that provides management scenarios and preliminary results. Once approved by Federal Environment Minister, PVA will be progressed to final stage to provide management recommendations. Report to be submitted to Federal Environment Minister	June 2010 Dec 2012	Preliminary PVA report must be approved by Federal Environment Minister. Approval of final PVA report required by Federal Environment Minister. Operation of road will not commence until PVA report has been approved.
2 (e) Discuss a range of options for offsets in the event that the SBB population in the Pines Reserve continues to decline, including the last report of translocation.	A report will be produced that identifies opportunities to improve habitat connectivity. A review of the data obtained during pre-construction monitoring and the PVA will be undertaken. The identification of options for offset and translocation will be addressed in this report.	A strategy to Federal Environment Minister that identifies opportunities to improve habitat connectivity and discusses offsets and translocation, if required. The report will be prepared in consultation with DEWHA, DSE and Parks Victoria.	Dec 2012	Provision of strategy that discusses habitat connectivity, offsets and translocation options. Approval required by Federal Environment Minister. Operation of road will not commence until strategy has been approved.

EPBC Condition	Commitment in this plan	Outstanding items	Timing for delivery	Approval requirements
2 (f) Arrangements to fund the implementation of the plan	LMA will facilitate funding of this plan	Details of funding arrangements for subsequent plans and strategies will be provided when these are lodged for approval by Federal Environment Minister.		
2 (g) Schedule of proposed works, timings and responsibilities	As detailed in sections 3,4,5 & 6	No outstanding items		
2 (h) Review the opportunities for maintenance and creation of corridors for the SBB to enhance connectivity of habitat in the region	A number of habitat connectivity initiatives are currently being undertaken, including the Sub Region Strategy for SBB. LMA will contribute information obtained from Peninsula Link Studies and assess level of further contribution.	A report to DEWHA that identifies opportunities to improve habitat connectivity	Dec 2012	Approval required by Federal Environment Minister. Operation of road will not commence until plan has been approved.
2 (i) Description of objectives, performance criteria and corrective actions as well as provisions to review the plan regularly	As detailed in sections 3,4,5 & 6	Update as part of formal review	Dec 2012	

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