

***Acacia mearnsii* scrub (modified EVC 22 / 47)**



Acacia mearnsii scrub is a vegetation type that appears to have recolonised in formerly cleared unimproved pasture since Sugarloaf Reservoir was established in recent decades. It has affinities with both Grassy Dry Forest and Valley Grassy Forest EVCs. This vegetation type is characterised by an *A. mearnsii* dominated low woodland/scrub to 10 - 15m tall, over a species-poor ground layer dominated by either native or introduced graminoids and forbs.

Location	Refer to Figure 4
Dominant Overstorey Species	Black Wattle (<i>Acacia mearnsii</i>)
Dominant Understorey Species	Burgan (<i>Kunzea ericoides</i>) Prickly Tea-tree (<i>Leptospermum continentale</i>)
Dominant Ground Cover	* Sweet Vernal-grass (<i>Anthoxanthum odoratum</i>) Kidney-weed (<i>Dichondra repens</i>) Weeping Grass (<i>Microlaena stipoides</i>)
Condition	Poor to moderate (structurally modified, weed cover varies from 5 to 30%)
Habitat Hectare Score	NA. Likely to be of Low to Medium conservation significance.
Issues	Poor to moderate condition woodland/scrub. Impact area should be minimised, but priority not as high as remnant Grassy Dry Forest and Valley Grassy Forest.
Threatened Species	None recorded. Moderate potential for threatened species to occur, e.g. many <i>Thelymitra</i> (Sun Orchid) individuals not yet flowering at the time of assessment, some of which may be threatened.

* Introduced species
NA Not applicable

Mosaic of non-native vegetation / *Microlaena stipoides* native grassland / *Pteridium esculentum* fernland



This vegetation mapping unit comprises a mosaic of three distinct vegetation types that are generally treeless as a result of past land clearing: a) areas of non-native vegetation (grassland) usually dominated by introduced graminoids such as *Anthoxanthum odoratum* (Sweet Vernal-grass); b) areas of derived native grassland dominated by *Microlaena stipoides* (Weeping Grass); and c) areas dominated by a dense sward of *Pteridium esculentum* (Austral Bracken). Sections of this mosaic have affinities with both Grassy Dry Forest and Valley Grassy Forest EVCs.

Location	Refer to Figure 4
Dominant Overstorey Species	None usually present
Dominant Understorey Species	Austral Bracken (<i>Pteridium esculentum</i>)
Dominant Ground Cover	Sheep's Burr (<i>Acaena echinata</i>) * Sheep Sorrel (<i>Acetosella vulgaris</i>) * Sweet Vernal-grass (<i>Anthoxanthum odoratum</i>) Kidney-weed (<i>Dichondra repens</i>) Weeping Grass (<i>Microlaena stipoides</i>)
Condition	Poor (highly structurally modified, weed cover varies from 5 to 50%)
Habitat Hectare Score	NA in some areas (<25% benchmark cover of native species). In areas of modified native vegetation, likely to be of Low to Medium conservation significance.
Issues	Poor condition modified grassland/fernland. Priority area to site pipeline if possible.
Threatened Species	None recorded. Moderate potential for threatened species to occur e.g. many individual <i>Thelymitra</i> (Sun Orchid) individuals not yet flowering at the time of assessment, some of which may be threatened.

* Introduced species

NA Not applicable



Fauna Summary

There are seven identified habitat types within the Sugarloaf Reservoir and Reserve LU. These are; dry woodland, scattered indigenous trees and shrubs, rocky grassland, exotic and non-indigenous/planted vegetation, ephemeral waterways, ephemeral wetlands and farm dams (See Appendix G for details).

In total 106 fauna species {73 (3) birds, 20 (3) mammals, 6 reptiles and 7 amphibians} were detected within the Sugarloaf Reservoir Reserve during field investigations (Appendix H, H.6.15). Several threatened species within Victoria and migratory species listed under the EPBC Act (e.g., Powerful Owl *Ninox strenua*, Chestnut-rumped Heathwren, Satin Flycatcher *Myiagra cyanoleuca*, Common Bent-wing Bat and Southern Toadlet *Pseudophryne semimarmorata*) were detected during the current survey. In addition to threatened species, species which confirm the presence of the FFG Listed 'Temperate Woodland Bird Community' (Table 16) were detected within this LU throughout remnant areas of native vegetation. Eleven species listed as Marine under the EPBC Act were detected during the field investigations.

The survey corridor within the Sugarloaf Reservoir Reserve, which surrounds Sugarloaf Reservoir, contains low undulating hills, dominated by *Eucalyptus radiata* and *Eucalyptus cypellocarpa* and several moist gullies dominated by *Eucalyptus ovata* and *Eucalyptus oblique*. There are six major and one minor fauna survey site within the Sugarloaf Reservoir Reserve (Figure 4). There is a good range of shrubby species throughout the mid-storey and grasses and forbs dominate the understorey.

A diverse group of species associated typically with both wet and dry woodland habitats have been recorded within Sugarloaf Reservoir Reserve. High diversity and presence of some uncommon species from within the survey corridor reflect good quality habitat in the area. Some of these species include Tawny Frogmouth *Podargus strigoides*, Sacred Kingfisher, Leaden Flycatcher, Scarlet Robin, Brown-headed Honeyeater *Melithreptus brevirostris*, Olive-backed Oriole, White-winged Chough and Greater Glider.

Sugarloaf Reservoir itself provides a constant source of water within the local area for wildlife resulting in a large diversity of fauna to the area. A range of micro-climates exist within the survey corridor that provides a range of fauna habitats for many species. Such habitats include:

- Woodland areas which are dominated by a suite of woodland-dependent birds species (a range of cuckoos within this LU shows a large diversity of avian fauna)
- Hollow-bearing trees and stags; which are utilised by a range of possums, gliders and microbats
- Moist gullies which provide suitable habitat for a range of frogs species, including the state significant Brown Toadlet, *Pseudophryne bibroni*



- A good covering of understorey vegetation and ground litter (including leaf litter and fallen debris) all of which provides habitat for a range of reptiles.

There has been a history of clearing and fire within Sugarloaf Reservoir, however, there are no obvious areas dominated by weedy flora species. The species diversity, the wide variety of fauna habitats and the wildlife corridor values, means that the habitat within Sugarloaf Reservoir is of a high condition. The high condition of the fauna habitat within the Sugarloaf Reservoir means that it has a strong potential to support a range of threatened fauna.

The fauna habitat throughout Sugarloaf Reservoir also contains good wildlife corridor values to other areas of the reservoir and to surrounding private property throughout the Yarra Glen area, which ultimately connects with Kinglake National Park



5. Potential Impacts, Mitigation and Management Measures

A range of potential ecological impacts are relevant to the construction and ongoing operation of the Sugarloaf Pipeline Project. The significance of these impacts has been determined using the *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines, Matters of National Environmental Significance* (DEH 2006).

Potential ecological impacts relevant to the construction and ongoing operation of the Sugarloaf Pipeline Project have been identified based on desktop reviews, field assessments (refer to Table 1 for the extent of project area surveyed) and consultation with relevant specialists. These impacts, as described in Table 12 and Table 13, may be direct or indirect, short or long term, temporary or permanent and have been identified based on the present understanding of the ‘preferred’ pipeline corridors and associated infrastructure locations. The significance of these impacts has been determined using the *EPBC Act Policy Statement 1.1 – Significant Impact Guidelines, Matters of National Environmental Significance* (DEH 2006).

There are a variety of measures available to avoid, minimise and offset potential impacts. These general measures are further outlined after the table within sections 5.1 and 5.2 of this report. More detailed measures will be developed for the Environment Management Plan (EMP) as the ‘preferred’ pipeline corridors and other associated infrastructure are refined.



Table 12 - Summary of potential impacts and mitigation measures for the Sugarloaf Pipeline Project Landscape Units 1 - 8

Potential Impacts	Description and nature of impact for the 15 Landscape Units							Proposed Mitigation	
	Goulburn River Floodplain	Yea Rise	Yea River Floodplain	Melba Highway Agricultural Zone	Toolangi North	Upper Yea River Riparian Forest	Central Toolangi Agricultural Zone		Private Forest: Upper Yea River to Healesville-Kinglake Road
1. Loss or damage to a known area of native vegetation (threatened communities or EVCs)	Floodplain Riparian Woodland (EVC 56) in Goulburn River riparian zone	Grassy Woodland (EVC 175) – both grassland and woodland communities in private and public land	Not assessed	Grassy Woodland (EVC 175) ⁴⁸	Not applicable	Not applicable	Swampy Riparian Woodland (EVC 83) and Fern Swamp (EVC 721) – both very localised occurrences	Not assessed	B, C, E, F, I, N, P
2. Loss or damage to a known area of native vegetation (non-threatened EVCs and scattered trees) – total impact area of native vegetation (both threatened and non-threatened EVCs) estimated at 87.7 ha based on desktop assessment	No impact	Not applicable	Not assessed	Grassy Dry Forest (EVC 22), Herb-rich Foothill Forest (EVC 23) – generally within the Melba Highway road reserve	Extensive impact on large areas of Lowland Forest (EVC 16), Herb-rich Foothill Forest (EVC 23) and Damp Forest (EVC 29) and small patch of Wet Forest (EVC 30)	Riparian Forest (EVC 18) – Yea River	Lowland Forest (EVC 16), Damp Forest (EVC 29), Shrubby Foothill Forest (EVC 45)	Not assessed	B, C, E, F, I, N, P
3. Removal of fauna habitat	Permanent loss of part of a larger area of habitat, plus indirect impacts associated with habitat loss (e.g. reduced fauna carrying capacity and population viability). While most cleared habitat may be restored post-construction, there will be permanent loss of high quality habitat within some areas ; Particularly Striped Legless Lizard habitat in the Yea Rise LU and Spot-tail Quoll and Southern Brown Bandicoot within the Toolangi North LU								B, C, I, J, N, O
4. Fragmentation of native vegetation and fauna habitat	Creation of new habitat-free corridor within existing high quality habitat (e.g. through Toolangi State Forest). This process fragments the habitat and may expose fauna to increased levels of predation as non-native predators gain easier access to habitats. Predation is considered to be a major threat to ground dwelling mammals such as Southern Brown Bandicoot.	Loss of hollow bearing trees, which are a critical resource for many fauna types, including threatened species – applicable to all LUs	Loss of habitat in roadside reserves used as wildlife corridors for native fauna; Particularly throughout developed landscapes where little remnant vegetation remains: e.g., Goulburn River Floodplain , Yea Rise , Yea River Floodplain and Melba Highway Agricultural Zone LUs.	Loss of 'stepping stone' corridor habitat in the form of scattered indigenous trees or shrubs. Disturbance to fauna using nearby retained scattered trees during the construction phase (e.g. fauna moving away from immediate area during construction, or reducing or abandoning breeding activity). Particularly throughout 'stepping stone' areas in the Goulburn River Floodplain , Yea Rise , Yea River Floodplain and Melba Highway Agricultural Zone LUs	Temporary loss of habitat during the construction phase; Particularly dense vegetation through areas such as Toolangi North LU . Whilst the majority of cleared habitat may be restored post-construction, there will be permanent loss of high quality habitat within Toolangi North LU .				
5. Loss or damage to a population of a threatened flora species	Not assessed	Possible loss of individuals of two species: <i>Dianella amoena</i> (Matted Flax-lily) (Endangered under)	Not assessed	Possible loss of unrecorded species	Possible loss of individuals of four species: <i>Caladenia oenochila</i> (Wine-lipped Spider-orchid)	Possible loss of unrecorded species	Possible loss of unrecorded species	Possible loss of individuals of one species: <i>Pomaderris vacciniifolia</i> (Round-leaf Pomaderris) (vulnerable)	A, B, C, D, E, F

⁴⁸ Note: Perts River Reserve not yet assessed for flora



Potential Impacts		Description and nature of impact for the 15 Landscape Units						Proposed Mitigation		
		Goulburn River Floodplain	Yea Rise	Yea River Floodplain	Melba Highway Agricultural Zone	Toolangi North	Upper Yea River Riparian Forest	Central Toolangi Agricultural Zone	Private Forest: Upper Yea River to Healesville-Kinglake Road	
6. Loss or damage to a population of a threatened fauna species			EPBC Act) – 1 patch on Killingworth Road; <i>Desmodium varians</i> (Slender Tick-trefoil) (poorly known in Vic) – c. 10 plants near Goulburn River, and other unrecorded species.			(vulnerable in Vic) – 2 plants: <i>Goodia latifolia</i> var. <i>pubescens</i> (Silky Golden Tip) (rare in Vic) – 7 patches (at least 96 plants); <i>Hibbertia pedunculata</i> (Stalked Guinea-flower) (rare in Vic) – c. 50 plants; <i>Acacia leprosa</i> (type variant) (Eastern Cinnamon Wattle) (poorly known in Vic) – 3 plants; and other unrecorded species			in Vic) – 1 patch (no. of individuals to be confirmed) near Melba Highway in headwaters of Yea River; and other unrecorded species.	
7. Loss or damage to a population of migratory birds		Habitat Loss, fragmentation and disturbance has the potential to affect populations of any threatened species present within these LUs Habitat Loss, fragmentation and disturbance caused by this project: <ul style="list-style-type: none"> Is likely to impact a known population of Striped Legless Lizard; and May impact several other threatened species, including Regent Honeyeater, Australian Painted Snipe, Hardhead, Musk Duck, Blue-billed Duck, Royal Spoonbill, Nankeen Night Heron, Australasian Shoveler, Powerful Owl, Sooty Owl, Turquoise Parrot, Diamond Firetail, Azure Kingfisher, Pied Cormorant, Brown Tree-creeper, Growing Grass Frog, Golden Sun Moth and Damselfly. 				Habitat Loss, fragmentation and disturbance has the potential to affect populations of any threatened species present within these LUs Habitat Loss, fragmentation and disturbance caused by this project: <ul style="list-style-type: none"> Is likely to impact several threatened species, including Regent Parrot, Powerful Owl, Spot-tail Quoll, Southern Brown Bandicoot, Common Bent-wing Bat, Growing Grass Frog and Golden Sun Moth. 			A, B, C, D, G, H, I, J, L, O	
8. Loss or damage to a threatened fauna community		Habitat Loss, fragmentation and disturbance has the potential to impact several EPBC-listed migratory bird species. However, due to the population numbers of these species, this impact is not expected to be significant. This loss is most likely to affect populations utilising low-lying areas of farmland within Goulburn River Floodplain, Yea Rise, Yea River Floodplain and Melba Highway Agricultural Zone LUs If appropriate mitigation techniques are implemented, this project should result in a minimal impact on migratory species. Timing of construction is the most relevant mitigation measure for this impact category in all LUs One FFG-listed threatened fauna community: 'Temperate Woodland Bird Community', has the potential to be impacted through habitat loss and fragmentation resulting from the project. This community is known to be present within: Yea Rise, Melba Highway North Agricultural Zone and Toolangi North LUs This community is expected to occur also within: Goulburn River Floodplain , Yea River Floodplain and Central Toolangi Agricultural Zone LUs				May impact several other threatened species, including Swift Parrot , Bush Stone-curlew , Little Egret , Intermediate Egret , Barking Owl , Sooty Owl , Masked Owl , Turquoise Parrot , Hooded Robin , Painted Honeyeater , Diamond Firetail , Chestnut-rumped Heathwren , Speckled Warbler , Black-eared Cuckoo , Spotted Quail-thrush , Brush-tail Phascogale , Common Dunnart , Hardhead , Azure Kingfisher , Tree Goanna , Brown Toadlet and Southern Toadlet .			A, B, C, D, I, J, O	
9. Injury and/or mortality to native fauna species		Accidental injury to or mortality of animals during the tree-removal phase (e.g. non-mobile individuals in hollows or nests), particularly throughout Toolangi North LU Accidental injury to or mortality of animals that fall into open trenches (e.g. small mammals, reptiles, frogs), throughout all LUs, particularly where vegetation is dense Excavation of existing burrows, which would be disturbed or destroyed during the proposed construction activities throughout all LUs, particularly where vegetation is dense								A, G, H, I, L, O
10. Restricting the movement of ground dwelling fauna		Barrier to movement of ground-dwelling fauna during construction phase. This is particularly an issue for threatened species; Striped Legless Lizard (known to occur), Spot-tail Quoll , Southern Brown Bandicoot , Tree Goanna , Growing Grass Frog , Brown Toadlet , Southern Toadlet and Golden Sun Moth (all likely to occur). Temporary barrier (or hindrance) to fauna moving along waterways (e.g. Platypus, Water Rat, snake, frogs, turtles) Creation of new habitat-free corridor within existing high quality habitat (e.g. through Toolangi State Forest). This process fragments the habitat and may expose fauna to increased levels of predation as non-native predators gain easier access to habitats. Predation is considered to be a major threat to ground dwelling mammals such as Southern Brown Bandicoot .								A, D, G, H, I, O



Potential Impacts	Description and nature of impact for the 15 Landscape Units						Proposed Mitigation	
	Goulburn River Floodplain	Yea Rise	Yea River Floodplain	Melba Highway Agricultural Zone	Toolangi North	Upper Yea River Riparian Forest		Central Toolangi Agricultural Zone
11. Deterioration and deterioration of wetlands, rivers and streams	Damage to rivers and streams throughout the northern section of the alignment. This is particularly relevant to perennial rivers (e.g., Yea River, Katy's Creek etc) where there is the potential for native fauna (including Growing Grass Frog, Brown Toadlet, Southern Toadlet and Murray River Tortoise) Temporary or permanent reduction in water quality during and after construction phase (e.g. increased sedimentation), affecting fauna downstream that use the waterway for foraging (e.g. Platypus, Water Rat, snakes, frogs, turtles)							A, B, C, D, I, J, L
12. Introduction of environmental weeds	Adverse impacts on aquatic invertebrate lifeforms (prey items for terrestrial fauna)							A, D, E, K
13. Spread of existing environmental weeds	Bank erosion would be a particular risk if construction occurred during an unexpected flood or high flow event							A, D, E, K
14. Introduction and spread of <i>Phytophthora cinnamomi</i>	Pipeline construction could pose a serious risk for the introduction of environmental weeds, especially in areas of intact native vegetation such as the Toolangi North LU							A, D, E, M
15. Infection of amphibians with Chytrid Fungus, resulting in chytridiomycosis	Existing environmental weeds may be spread throughout the survey corridor by construction machinery							A, B, D, G, I, J, L
16. Increased predation of native wildlife by the cat, Felis catus and Red Fox, Vulpes vulpes	Potential for <i>Phytophthora cinnamomi</i> pathogen to be introduced and/or spread throughout the survey corridor, particularly within Toolangi North LU. Would lead to significant negative impacts on the ecological integrity of this area.							A, B, C, D, H, I, O
17. Erosion and/or sedimentation	<i>Chytridiomycosis</i> , the disease caused by the Amphibian Chytrid Fungus is listed under the EPBC Act as a Key Threatening Process Potential for Chytrid Fungus pathogen to be introduced and/or spread to parts of the study area, particularly damp areas. Spread of <i>chytridiomycosis</i> could lead to significant and potentially catastrophic impacts on amphibians within these areas, and may impact populations of Growing Grass Frog, Brown Toadlet and Southern Toadlet if found to be present within these LUs.							A, D, J, J
18. Altered surface water runoff into waterways	Reduction of habitat and ground cover that provide shelter for native fauna species Increased mobility by predators (particularly cats and foxes) along newly cleared construction corridors through areas of native vegetation. This is particularly relevant to areas like Toolangi North LU where current access for predators is limited by the naturally occurring vegetation. A new and permanent habitat-free corridor through areas such as these would be likely to have a significant impact on ground-dwelling mammals within the area. Predation is considered to be a major threat to semi arboreal mammals such as Brush-tail Phascogale and ground dwelling such as Southern Brown Bandicoot and Common Dunnart .							A, D, J, J
19. Inhibition of plant photosynthesis and reproductive capability due to airborne dust	Erosion and sedimentation could occur if construction occurred where intermittent waterways contain flowing water. This could affect fauna (e.g. frogs) downstream that use the water for foraging and other activities. Erosion would be a particular risk if construction occurred during an unexpected flood or high flow event.							A, D, J, J
20. Altered hydrology	Potential for polluted water from construction site to be transported into nearby waterways following rainfall, resulting in detrimental impacts on aquatic, semi-aquatic and riparian indigenous vegetation and fauna							A, D, J, J
	Potential for dust associated with construction activities to settle on leaves and inhibit plant photosynthesis and reproductive capability, leading to reduced plant growth and seed viability in the vicinity of the construction area							D
	Potential for hydrological changes in the landscape due to the large amount of cut and fill that would be required in some sections of the study area, especially in steep sections of the Toolangi North LU. This may affect the composition of native vegetation communities over time.							B

Table 13 - Summary of potential impacts and mitigation measures for the Sugarloaf Pipeline Project Landscape Units 9 - 15

Potential Impacts	Description and nature of impact for the 15 Landscape Units							Proposed Mitigation
	Toolangi South	Melba Highway South Agricultural Zone/Dixon's Creek Flats	Hunt's Lane Rise	Steels Creek Flats	Christmas Hills Escarpment	Yarra Glen Bypass	Sugarloaf Reservoir and Reserve	
1. Loss or damage to unknown area of native vegetation (threatened communities or EVCs)	Not applicable	Small areas of Valley Grassy Forest (EVC 47) (grassland and woodland communities), Swampy Riparian Woodland (EVC 83), Creeklane Herb-rich Woodland (EVC 164), Reed Swamp (EVC 300) and Gully Woodland (EVC 902) within public and/or private land.	Valley Grassy Forest (EVC 47) (grassland and woodland communities) and Gully Woodland (EVC 902)	Not applicable	Small areas of Valley Grassy Forest (EVC 47) on the western side of Steels Creek Road	Small areas of Valley Grassy Forest (EVC 47) (grassland and woodland communities)	Valley Grassy Forest (EVC 47). Pipeline alignment will attempt to avoid and/or minimise disturbance to this EVC.	B, C, E, F, I, N, P
2. Loss or damage to unknown area of native vegetation (non-threatened EVCs and scattered trees) – total impact area of native vegetation (both threatened and non-threatened EVCs) estimated at 87.7 ha based on desktop assessment	Extensive impact on large areas of Healthy Dry Forest, Herb-rich Foothill Forest, Damp Forest and Shrubby Foothill Forest	Narrow bands of Lowland Forest (EVC 16), Grassy Dry Forest (EVC 22) and Herb-rich Foothill Forest (EVC 23) generally within road reserves	Not applicable ⁴⁹	Riparian Forest (EVC 18) – Steels Creek riparian zone and adjacent alluvial terraces	Small areas of Grassy Dry Forest (EVC 22) and Herb-rich Foothill Forest (EVC 23) on the western side of Steels Creek Road	No impact identified at this stage	Grassy Dry Forest (EVC 22). Pipeline alignment will attempt to avoid and/or minimise disturbance to this EVC.	B, C, E, F, I, N, P
3. Removal of fauna habitat	Permanent loss of part of a larger area of habitat, plus indirect impacts associated with habitat loss (e.g. reduced fauna carrying capacity and population viabilities). While most cleared habitat may be restored post-construction, there will be permanent loss of high quality habitat within some areas. Temporary loss of habitat during the construction phase. Particularly dense vegetation through areas such as Toolangi South, Hunt's Lane Rise, Christmas Hills Escarpment and Sugarloaf Reservoir Reserve LUs. Whilst the majority of cleared habitat may be restored post-construction, there will be permanent loss of high quality habitat within Toolangi South LU, Hunt's Lane Rise, Christmas Hills Escarpment and Sugarloaf Reservoir LUs. Loss of habitat in roadside reserves used as wildlife corridors for native fauna. Particularly throughout developed landscapes where little remnant vegetation remains: e.g., Melba Highway South Agricultural Zone/Dixon's Creek Flats, and Yarra Glen Bypass. Loss of 'stepping stone' corridor habitat in the form of scattered indigenous trees or shrubs. Disturbance to fauna using nearby retained scattered trees during the construction phase (e.g. fauna moving away from immediate area during construction, or reducing or abandoning breeding activity). Particularly throughout 'stepping stone' areas in the Melba Highway South Agricultural Zone/Dixon's Creek Flats and Yarra Glen Bypass LUs. Loss of hollow bearing trees, which are a critical resource for many fauna types, including threatened species: including Powerful Owl , Masked Owl , Barking Owl , Sooty Owl , Brush-tail Phascogale and Common Bent-wing Bat – applicable to all LUs. Creation of new habitat-free corridor within existing high quality habitat (e.g., through Toolangi State Forest or Sugarloaf Reserve). This process fragments the habitat and may expose fauna to increased levels of predation as non-native predators gain easier access to habitats. Predation is considered to be a major threat to ground dwelling mammals such as Southern Brown Bandicoot and Common Dunnart .							B, C, I, J, N, O

⁴⁹ Note: Major area of remnant vegetation along ridge line not assessed



Potential Impacts		Description and nature of impact for the 15 Landscape Units					Proposed Mitigation		
		Toolangi South	Melba Highway South Agricultural Zone/Dixon's Creek Flats	Hunt's Lane Rise	Steels Creek Flats	Christmas Hills Escarpment	Yarra Glen Bypass	Sugarloaf Reservoir and Reserve	
4. Fragmentation of native vegetation and fauna habitat	Habitat fragmentation resulting in more limited movements of all fauna, but particularly ground-dwelling fauna including Spot-tail Quoli, Southern Brown Bandicoot, Common Dunnart, Brown Toadlet and Southern Toadlet in the Toolangi South, Christmas Hills Escarpment, and Sugarloaf Reservoir Reserve LU. Fragmentation of woodland habitat, particularly where Swift Parrot, Regent Honeyeater, Brush-tail Phascogale and Common Bent-wing Bat occur. A loss of genetic diversity as a result of habitat fragmentation. This may affect a range of significant species (if present) throughout the southern sections of the alignment, particularly less mobile species such as Growing Grass Frog and Golden Sun Moth . Creation of new habitat-free corridor within existing high quality habitat (e.g., through Toolangi State Forest). This process fragments the habitat and may expose fauna to increased levels of predation as non-native predators gain easier access to habitats. Predation is considered to be a major threat to ground dwelling mammals such as Southern Brown Bandicoot and Common Dunnart .								
5. Loss or damage to a population of a threatened flora species	Possible loss of one species: <i>Acacia leprosa</i> (type variant) (Eastern Cinnamon Wattle) (poorly known in Vic) – 3 patches (at least 13 plants); and other unrecorded species	Possible loss of individuals of three species: <i>Dianella amoena</i> (Matted Flax-lily) (Endangered under EPBC Act) – 8 patches on Melba Highway, Gulf Road and Melbourne Water aqueduct; <i>Euclalyptus fulgens</i> (Green Scentbark) (rare in Vic) – >150 trees ⁵⁰ north of Hunts Lane (private and public land); <i>Euclalyptus yarraensis</i> (Yarra Gum) (rare in Vic) – 37 plants in Gulf Road road reserve; and other unrecorded species.	Possible loss of one species: <i>Euclalyptus fulgens</i> (Green Scentbark) (rare in Vic) – >75 trees scattered along Hunts Lane (public and private land); and other unrecorded species.	Possible loss of unrecorded species	Possible loss of individuals of three species: <i>Dianella amoena</i> (Matted Flax-lily) (Endangered under EPBC Act) – 25 patches on west side of Steels Creek Road; <i>Dianella tarda</i> (Late-flower Flax-lily) (vulnerable in Vic) – 1 plant in Steels Creek Road road reserve; <i>Euclalyptus yarraensis</i> (Yarra Gum) (rare in Vic) – 1 tree in Steels Creek Road road reserve; and other unrecorded species.	Possible loss of individuals of two species: <i>Dianella amoena</i> (Matted Flax-lily) (Endangered under EPBC Act) – 2 patches; <i>Euclalyptus yarraensis</i> (Yarra Gum) (rare in Vic) – 8 scattered trees (possibly more once surveys have been completed) (both private and public land); and other unrecorded species.	Possible loss of two species: <i>Carex chlorantha</i> (Green-top Sedge) (poorly known in Vic) – scattered plants at two locations (but possibly more widespread); <i>Hypoxis vaginata</i> var. <i>brevistigmata</i> (Yellow Star) (poorly known in Vic) – 1 plant recorded (but possibly more widespread); and other unrecorded species		
6. Loss or damage to a population of a threatened fauna species	Habitat Loss, fragmentation and disturbance has the potential to affect populations of any species present within these LUs and protected under the EPBC Act Habitat Loss, fragmentation and disturbance caused by this project; <ul style="list-style-type: none"> Is likely to impact several threatened species (known to occur), including Regent Honeyeater, Brown Tree-creeper, Powerful Owl, Pied Cormorant, Hooded Robin, Azure Kingfisher, Chestnut-rumped Heathwren, Great Egret, Spot-tailed Quoli, Southern Brown Bandicoot, Brush-tail Phascogale and Southern Toadlet. May impact several other threatened species (if present), including Swift Parrot, Ballions Crane, Bush Stone-curlew, Little Egret, Intermediate Egret, Grey Goshawk, Barking Owl, Sooty Owl, Masked Owl, Turquoise Parrot, Speckled Warbler, Eastern Horseshoe Bat, Glossy Ibis, Royal Spoonbill, Musk Duck, Black Falcon, Southern Myotis, Tree Goanna, Glossy Grass Skink, Growing Grass Frog and Brown Toadlet .								
7. Loss or damage to a population of migratory birds	Habitat Loss, fragmentation and disturbance has the potential to impact several EPBC-listed migratory bird species. However, due to large population numbers of these species, this impact is not expected to be significant. This loss is most likely to affect populations utilising low-lying areas of farmland and areas of high quality remnant habitat within Melba Highway South Agricultural Zone/Dixons Creek Flats, Steels Creeks Flats, Yarra Glen Bypass and Sugarloaf Reservoir Reserve LU Sugarloaf Reservoir and Reserve LU contained the highest numbers and diversity of migratory species during the assessment of the study area. If this project is to have any impact on migratory species, it is most likely to occur within the Sugarloaf Reservoir and Reserve LU If appropriate mitigation techniques are implemented, this project should result in a minimal effect on migratory species. Timing of construction is the most relevant mitigation measure for this impact category in all LUs								
8. Loss or damage to a threatened fauna community	One FFG-listed threatened fauna community: <i>Temperate Woodland Bird Community</i> . This community is known to be present within; Toolangi South, Melba Highway South Agricultural Zone/Dixons Creek Flats, Hunt's Lane Rise, Yarra Glen Bypass and Sugarloaf Reservoir and Reserve LUs . This community is expected to occur also within; Steels Creek Flats and Christmas Hills Escarpment LU								

⁵⁰ Note: Vehicle-based assessment indicates that the number of trees recorded is likely to be substantially higher once flora surveys have been completed



Potential Impacts	Description and nature of impact for the 15 Landscape Units						Proposed Mitigation
	Toolangi South	Melba Highway South Agricultural Zone/Dixon's Creek Flats	Hunt's Lane Rise	Steels Creek Flats	Christmas Hills Escarpment	Yarra Glen Bypass	
9. Injury and/or mortality to native fauna species	Accidental injury to or mortality of animals during the tree-removal phase (e.g. non-mobile individuals in hollows or nests), particularly throughout Toolangi South , Hunt's Lane Rise , Christmas Hills Escarpment and Sugarloaf Reservoir and Reserve LU						A, G, H, I, L, O
10. Restricting the movement of ground dwelling fauna	Accidental injury to or mortality of animals that fall into open trenches (e.g. small mammals, reptiles, frogs), throughout all LUs, particularly where vegetation is dense Accidental injury to or mortality of animals during the excavation process (e.g. small mammals, reptiles, frogs), throughout all LUs, particularly where vegetation is dense Excavation of existing burrows, which would be disturbed or destroyed during the proposed construction activities, throughout all LUs, particularly where vegetation is dense Visual, acoustic, vibrational and/or physical disturbance to fauna throughout the study area during the construction phase (and potentially in the longer term at the Booster pump station site) (e.g. fauna moving away from immediate area during construction, reduced or abandoned breeding activity), particularly Powerful Owl , Sooty Owl , Masked Owl , Barking Owl , Brown Tree-creeper and Common Bent-wing Bat . Barrier to movement of ground-dwelling fauna during construction phase. This is particularly an issue for threatened species; Brush-tail Phascogale and Southern Toadlet (known to occur) Spot-tail Quoll , Southern Brown Bandicoot , Tree Goanna , Growing Grass Frog and Brown Toadlet (all likely to occur). Temporary barrier (or hindrance) to fauna moving along waterways (e.g. Platypus, Water Rat, snake, frogs, turtles) Creation of new habitat-free corridor within existing high quality habitat (e.g. through Toolangi State Forest). This process fragments the habitat and may expose fauna to increased levels of predation as non-native predators gain easier access to habitats. Predation is considered to be a major threat to ground dwelling mammals such as Southern Brown Bandicoot and Common Dunnart .						A, D, G, H, I, O
11. Degradation and deterioration of wetlands, rivers and streams	Damage to rivers and streams throughout the northern section of the alignment, particularly perennial rivers (e.g., Steels Creek etc) where there is the potential for native fauna (e.g. Growing Grass Frog , Brown Toadlet , Southern Toadlet and Murray River Tortoise) Temporary or permanent reduction in water quality during and after construction phase (e.g. increased sedimentation), affecting fauna downstream that use the waterway for foraging (e.g. Platypus, Water Rat, snakes, frogs, turtles) Adverse impacts on aquatic invertebrate life forms (prey items for terrestrial fauna) Bank erosion would be a particular risk if construction occurred during an unexpected flood or high flow event						A, B, C, D, I, J, L
12. Introduction of environmental weeds	Pipeline construction could pose a serious risk for the introduction of environmental weeds, especially in areas of intact native vegetation such as the Toolangi South, Hunts Lane Rise, Christmas Hills Escarpment, and Sugarloaf Reservoir and Reserve LUs						A, D, E, K
13. Spread of existing environmental weeds	Existing environmental weeds may be spread throughout the survey corridor by construction machinery						A, D, E, K
14. Introduction and spread of Phytophthora cinnamomi	Potential for <i>Phytophthora cinnamomi</i> pathogen to be introduced and/or spread throughout the survey corridor, particularly within the Toolangi South, Hunts Lane Rise, Christmas Hills Escarpment, and Sugarloaf Reservoir and Reserve LUs. Would lead to significant negative impacts on the ecological integrity of these areas.						A, D, E, M
15. Infection of amphibians with Chytrid Fungus, resulting in chytridiomycosis	<i>Chytridiomycosis</i> , the disease caused by the Amphibian Chytrid Fungus is listed under the EPBC Act as a Key Threatening Process Potential for Chytrid Fungus pathogen to be introduced and/or spread to parts of the study area, particularly damp areas. Spread of <i>chytridiomycosis</i> could lead to significant and potentially catastrophic impacts on amphibians within these areas, and may impact populations of Growing Grass Frog , Brown Toadlet and Southern Toadlet if found to be present within these LUs.						A, B, D, G, I, J, L
16. Increased predation of native wildlife by the cat, Felis catus and Red Fox, Vulpes vulpes	Reduction of habitat and ground cover that provide shelter for native fauna species Increased mobility by predators (particularly cats and foxes) along newly cleared construction corridors through areas of native vegetation. This is particularly relevant to areas like Toolangi South , Christmas Hills Escarpment and Sugarloaf Reservoir and Reserve LUs where current access for predators is limited by the naturally occurring vegetation. A new and permanent habitat-free corridor through areas such as these would be likely to have a significant impact on ground-dwelling mammals within the area. Predation is considered to be a major threat to ground dwelling mammals such as Southern Brown Bandicoot and Common Dunnart .						A, B, C, D, H, I, O
17. Erosion and/or sedimentation	Erosion and sedimentation could occur if construction occurred where intermittent waterways contain flowing water. This could affect fauna (e.g. frogs) downstream that use the water for foraging and other activities (e.g. frogs). Erosion would be a particular risk if construction occurred during an unexpected flood or high flow event.						A, D, J



Potential impacts	Description and nature of impact for the 15 Landscape Units						Proposed Mitigation
	Toolangji South	Melba Highway South Agricultural Zone/Dixon's Creek Flats	Hunt's Lane Rise	Steels Creek Flats	Christmas Hills Escarpment	Yarra Glen Bypass	
18. Altered surface water runoff into waterways	Potential for polluted water from construction site to be transported into nearby waterways following rainfall, resulting in detrimental impacts on aquatic, semi-aquatic and riparian indigenous vegetation and fauna						A, D, J
19. Inhibition of plant photosynthesis and reproductive capability due to airborne dust	Potential for dust associated with construction activities to settle on leaves and inhibit plant photosynthesis and reproductive capability, leading to reduced plant growth and seed viability in the vicinity of the construction area						D
20. Altered hydrology	Potential for hydrological changes in the landscape due to the large amount of cut and fill that would be required in some sections of the study area, especially in steep sections of the Toolangji South, Hunts Lane Rise, Christmas Hills Escarpment, and Sugarloaf Reservoir and Reserve LUs. This may affect the composition of native vegetation communities over time.						B



5.1 Potential Impacts

A total of 20 potential ecological impacts have been identified in relation to the Sugarloaf Pipeline Project. These impacts are predominantly applicable to areas of native vegetation and/or the location of threatened species habitat identified through the option corridors (E, F, and H). These potential impacts are described below.

1) Loss or damage to native vegetation (threatened communities or EVCs)

No vegetation communities listed under the EPBC Act or FFG Act are expected to be impacted by the project. However, a total of eight threatened EVCs - Valley Grassy Forest (EVC 47) (regarded by DSE as vulnerable in the Highlands Southern Fall bioregion), Floodplain Riparian Woodland (EVC 56) (endangered in Central Victorian Uplands), Swampy Riparian Woodland (EVC 83) (vulnerable in Highlands Northern Fall), Creekline Herb-rich Woodland (EVC 164) (endangered in Highlands Southern Fall), Grassy Woodland (EVC 175) (endangered in Central Victorian Uplands), Reed Swamp (EVC 300) (endangered in Highlands Southern Fall), Fern Swamp (EVC 721) (vulnerable in Highlands Northern Fall) and Gully Woodland (EVC 902) (vulnerable in Highlands Southern Fall) occur within the survey corridors. Although the flora surveys are incomplete, there are unlikely to be impacts to additional threatened EVCs not described above⁵¹. The overall potential impacts that may occur include the direct loss of threatened EVCs, as well as the fragmentation of native vegetation. Until further survey is completed and construction techniques are known (e.g. trenching vs. boring), the final impact of the pipeline corridor, including the extent of impact upon each EVC, remains unknown.

2) Loss or damage to native vegetation (non-threatened EVCs and scattered trees)

A total of eight non-threatened EVCs (i.e. regarded by DSE as having a conservation status of 'Least concern' or 'Depleted') may be impacted by the project, with most if not all of these EVCs undergoing some degree of impact. These EVCs are Lowland Forest (EVC 16), Riparian Forest (EVC 18), Heathy Dry Forest (EVC 20), Grassy Dry Forest (EVC 22), Herb-rich Foothill Forest (EVC 23), Damp Forest (EVC 29), Wet Forest (EVC 30) and Shrubby Foothill Forest (EVC 45). It is possible but unlikely that other non-threatened EVCs may be impacted by the project.

The overall potential impacts that may occur include the extensive direct loss of non-threatened EVCs, as well as the fragmentation of native vegetation, particularly through Toolangi State Forest. Until further survey is completed and construction techniques are

⁵¹ Based on knowledge of the EVCs within the study area and a vehicle-based assessment of the survey corridors.



known (e.g. trenching vs. boring), the final impact of the pipeline corridor, including the extent of impact upon each EVC, remains unknown.

The final impact of the project on scattered trees is unknown at present. Depending on the mitigation measures employed, it is expected that there will be some loss of scattered trees that will include:

- Trees that will be removed to construct the pipeline; and
- Trees that could be impacted as the impact zone passes under the drip line of their canopy.

3) Removal of fauna habitat

All of the identified fauna habitats are likely to be impacted as a result of this project. The potential impacts are similar for most of the habitats (e.g. loss of habitat, fragmentation, disturbance to fauna during construction). However, the implications of each impact vary and depend entirely upon the significance and sensitivity of the habitat in question at each site⁵². These impacts are likely to be most significant in areas of high quality habitat (e.g. Sugarloaf Reservoir, Toolangi State Forest, most remnant woodlands, native grasslands, rocky grasslands, perennial streams) and least where lower quality habitats occur (e.g. agricultural areas, exotic vegetation, constructed features, farm dams). However, throughout these lower quality habitat areas, it is important to retain all areas of moderate-high quality habitat (which occur mostly within roadside reserves) as these areas form important habitat corridors for fauna moving across the modified landscape.

Potential impacts resulting from the construction and operation of the pipeline and pump stations are summarised for all LU in Table 12 and Table 13. Fauna are considered generally within these tables.

4) Fragmentation of native vegetation and fauna habitat

Fragmentation of fauna habitat occurs when removal of vegetation results in habitats that were once linked, being separated. This is particularly threatening when habitat corridors (habitat which links two sections of habitat together) are removed. Fragmentation of fauna habitat will occur in all LU throughout the survey corridor.

Fragmentation, whilst occurring throughout the survey corridor, will have the greatest effect throughout areas of intact vegetation, including; Yea Rise, Toolangi State Forest, Christmas Hills Escarpment and Sugarloaf Reservoir and Reserve.

⁵² The fauna habitat values present within each landscape unit are summarised in Chapter 5 of this report.



The immediate effects of fauna habitat fragmentation include; reduced mobility throughout the study area, reduced area suitable for foraging, reduced ability to reproduce and increased predation of native species by introduced predators.

5) Loss or damage to a population of a threatened flora species

One flora species listed as endangered under the EPBC Act and endangered in Victoria (DSE 2005), *Dianella amoena* (Matted Flax-lily), was recorded within multiple survey corridors during the present survey. The species was recorded at 15 separate locations in at least 39 discrete patches. Until the final pipeline alignment is determined and mitigation measures are determined, it is not possible to ascertain if the construction works will impact on this species.

In addition, there is potential habitat within the survey corridor for four other flora species listed under the EPBC Act that were not identified during the current survey.

A total of 13 species listed as threatened within Victoria were recorded within the survey corridors during the current survey. These species are *Acacia leprosa* (type variant) (Eastern Cinnamon Wattle) (poorly known), *Caladenia oenochila* (Wine-lipped Spider-orchid) (vulnerable), *Carex chlorantha* (Green-top Sedge) (poorly known), *Desmodium varians* (Slender Tick-trefoil) (poorly known), *Dianella amoena* (Matted Flax-lily) (endangered), *Dianella tarda* (Late-flower Flax-lily) (vulnerable), *Eucalyptus fulgens* (Green Scentbark) (rare), *Eucalyptus yarraensis* (Yarra Gum) (rare), *Goodia lotifolia* var. *pubescens* (Silky Golden-tip) (rare), *Grevillea repens*⁵³ (Creeping Grevillea) (rare), *Hibbertia pedunculata* (Stalked Guinea-flower) (rare) *Pomaderris vacciniifolia* (Round-leaf Pomaderris) (Vulnerable) and *Hypoxis vaginata* var. *brevistigmata* (Yellow Star) (poorly known). Until the final pipeline alignment is determined and mitigation measures are determined, it is not possible to ascertain if and how the construction works will impact on these species.

In addition, there is potential habitat within the survey corridor for three other flora species listed under the FFG Act and 21 flora species listed under DSE (2005) that were not identified during the current survey. Further survey may indicate that some of these species are present within the corridor.

6) Loss or damage to a population of threatened fauna species

Due to the large scale of this project, it has the potential to impact directly on populations of a number of threatened species. Seventy-five threatened fauna species are considered in relation to the survey corridors. Of these species:

⁵³ Identification to be confirmed with National Herbarium of Victoria.



- two EPBC-listed species (Regent Honeyeater⁵⁶ and Striped Legless Lizard⁵⁴) have been identified as occurring within the survey corridor.
- an additional seven FFG-listed species have been identified as occurring within some option corridors ⁵⁵ (Great Egret, Powerful Owl, Hooded Robin, Chestnut-rumped Heathwren, Brush-tailed Phascogale, Common Bent-wing Bat and Damselfly); and
- an additional five species listed as threatened on the DSE Advisory List (DSE 2007b) have been recorded during the current assessment (Pied Cormorant, Hardhead, Azure Kingfisher, Brown Treecreeper and Southern Toadlet).

Of the remaining species,

- 61 have the potential to occur within the study area;
- 11 are listed on the EPBC Act;
- 36 are listed on the FFG Act; and
- 61 are listed on the 2007 DSE Advisory list of threatened vertebrate fauna in Victoria (DSE 2007b).

Many of these species, including a number of EPBC-listed species, have the potential to utilise at least one of the survey corridors. As many of these species have been recorded within the study area within the past ten years, it is likely that they still persist within the survey corridors. Because some threatened species have been detected within the study area, and others have the potential to occur within the survey corridor, this project is highly likely to cause the loss of or damage to a population of threatened fauna species. Where possible, the final corridor should be chosen to minimise the impact on areas of high quality fauna habitat. Where this is not possible, impacts should be reduced through the implementation of mitigation measures outlined in the Mitigation and Management Section 5.2.

7) Loss of or damage to a population of migratory birds

Five migratory species were detected within the study area during the field investigations. Suitable habitat occurs within the study area for an additional 14 migratory species. Due to the large population sizes of most of the migratory species, it is unlikely that this project will have a significant effect on any population of a migratory species.

Despite this, there is a possibility that the project could result in damage to a population of migratory birds and where possible this should be avoided and/or mitigated by timing

⁵⁴ Detected within Pitfall Traps within the Yea Rise LU

⁵⁵ Through the current study and through discussions with DSE Senior Flora and Fauna Officer and Senior Ranger for Toolangi State Forest.



construction to avoid the active lifecycle stage (e.g. breeding seasons) for most/all species involved.

8) Loss or damage to a threatened fauna community

The FFG-listed '*Victorian Temperate Woodland Bird Community*' is known to occur at a number of sites within the study area, and is expected to occur at a number of other sites⁵⁶. Impacts to this community along the final chosen alignment will include:

- Loss of large areas of woodland habitat at a number of sites (where native trees are to be removed or lopped), plus indirect impacts associated with loss of habitat (e.g. reduced carrying capacity and population viability);
- A permanent gap (~10m) in canopy along sections of the pipeline alignment; and
- Disturbance to nearby suitable habitat during the construction phase (e.g. fauna moving away from construction zone, or reducing or abandoning breeding activity)

Whilst none of these impacts are expected to result in the outright loss or extirpation of this community from the local area, it is likely that this project will result in the loss of or damage to this community within some areas of the final alignment. In addition to localised impacts on this community, this project will also contribute to the ongoing incremental loss of and disturbance to the habitat of this community in Victoria.

9) Injury to and/or mortality of native fauna species

The pipeline is likely to be constructed using open-cut trenching (averaging *c.* 3m deep and *c.* 3m wide) for most of its length. Similarly, the pump station/s will require the excavation of substantial pits during its/their construction. There is a risk that native fauna species may be injured or killed during the construction process. Causes of injury or death include:

- Hollow-dependant species injured or killed during the removal of trees (e.g. Powerful Owl and gliders);
- Fauna, particularly ground-dwelling fauna, with poor mobility falling into and becoming trapped in trenches. This is particularly a risk overnight when no construction activity is occurring but nocturnal fauna are on the move;
- Fossorial (soil- and litter-dwelling) fauna, such as reptiles and frogs, being injured or killed during excavation or other earth works (e.g. Striped Legless Lizard)

It is likely that fauna species (including listed threatened species) may be injured or killed during construction of the Sugarloaf Pipeline Project. Whilst the threat of injury and/or

⁵⁶ See Table 9 in Chapter 4.



mortality of native fauna during construction cannot be totally eliminated, it can be mitigated against by;

- avoiding areas of fauna habitat where populations of threatened species are known to occur,
- avoiding areas of high quality fauna habitat where populations of threatened species are likely to occur, and
- implementing the mitigation measures outlined below to minimise the project's impact on native fauna.

10) Restricting the movement of ground dwelling fauna

Complete or partial barriers that restrict the movement of fauna, particularly ground-dwelling fauna, may occur during and after construction of the project. Trenches and construction machinery have the potential to restrict the movement of small ground-dwelling fauna such as mammals, reptiles and frogs. Restricting the movement of ground-dwelling fauna can influence their ability to breed, forage, and find suitable habitat to shelter from predation. Restricting the movement of ground-dwelling fauna can have a significant effect on threatened species, such as Striped Legless Lizard, when it reduces their ability to reproduce. By implementing the mitigation measures outlined below, the likelihood of fauna movement being restricted can be greatly reduced. Mitigating against the restriction of movement of ground dwelling fauna is particularly important throughout LUs that contain high species diversity in fauna groups that are considered most at risk to this potential impact (i.e., mammals, reptiles and frogs) i.e. Yea Rise, Toolangi State Forest, Christmas Hills Escarpment and Sugarloaf Reservoir.

11) Degradation and deterioration of wetlands, rivers and streams

The deteriorating condition of many wetlands, rivers and streams within Victoria has resulted in the decline of native terrestrial and aquatic flora and fauna and associated ecological processes. Some of the main sources of degradation are related to removal of native vegetation within catchments, siltation and erosion, and chemical or pollution input. In some cases, degradation has been the result of land clearance for agricultural purposes. Accordingly, modification to the natural flow regimes of rivers and streams and their floodplains has been recognised as one of the key threatening processes to the loss of biodiversity and ecological functioning in aquatic ecosystems. Other operations such as watercourse/channel widening and other associated earthworks or construction activities can also lead to degradation of waterways.



The Yea Wetlands are not considered to be within the survey corridor, but several perennial rivers and creeks do occur within the study area. The final pipeline alignment will need to cross several of these rivers (e.g. Yea River) and streams so the project has the potential to impact on rivers and streams within the survey corridor. Where possible, multiple river crossings should be avoided. Where this is not possible, it is important for an ecologist to help select the most appropriate crossing point, and it is important that mitigation measures are developed to ensure impacts are minimised.

12) Introduction of environmental weeds

Weeds could establish and/or spread along the whole of the pipeline alignment during the construction phase. Although the alignment already comprises a high proportion of introduced vegetation, increased weed invasion could impact on the flora and fauna values by invading adjacent areas of native vegetation and degrading fauna habitat. This is particularly concerning in areas of high quality habitat, where few weedy species currently persist, such as areas of Sugarloaf Reservoir and the majority of the Toolangi State Forest.

Weeds could be introduced and spread via construction vehicles or by soil or materials brought into the site. Weed invasion may also increase through areas of native vegetation with the disturbance of soils during the construction process.

13) Spread of existing environmental weeds

In addition to the impact identified above, existing environmental weeds within the survey corridor may be spread on- and off-site by the various trucks and construction vehicles moving elsewhere after visiting the pipeline construction area.

14) Introduction and spread of *Phytophthora cinnamomi*

Phytophthora cinnamomi, commonly known as ‘root rot’, is an aggressive, microscopic, lethal pathogen that causes the roots of susceptible plant species to rot. This pathogen lives inside plant roots and may gradually kill the host plant by obstructing the uptake of water and nutrients. “Dieback caused by *Phytophthora cinnamomi*” is listed as a key threatening process under the *EPBC Act 1999* (Environment Australia 2001).

In areas where environmental conditions favour the pathogen (e.g. warm, moist sites) and the dominant species of communities are susceptible to the pathogen, impacts can be substantial and may include the following: (a) major disruption of community composition and structure, (b) extinction of populations of some flora species, and (c) loss of species habitat (Environment Australia 2001).

The introduction and spread of ‘Root rot’ may be accelerated via a number of ways, including alteration to the natural hydrology of a site, timber harvesting and the introduction of infected



soil, particularly on construction vehicles during the infective period in spring (Environment Australia 2001).

There was no evidence of *Phytophthora cinnamomi* within the survey corridor. However, this does not preclude the presence of this pathogen. Soil testing is the only way to ascertain with certainty whether the pathogen is present within the survey corridor.

15) Introduction and spread of Chytrid Fungus

Chytridiomycosis is a disease that results from the infection of frogs with the Amphibian Chytrid Fungus. Chytridiomycosis has been responsible for catastrophic declines in many species of frogs worldwide, and it is now recognised under the EPBC Act as a Key Threatening Process. The Amphibian Chytrid Fungus infects the keratin in a frog's skin, and is thought to attack the frog's nervous system and reduce the frog's ability to respire. This disease is spread primarily during frog-to-frog contact, and also when humans handle multiple frogs at any one time without following strict disinfection and hygiene protocols. To lesser degrees, it may also be spread by infected water or wet soil being moved across the landscape on boots, equipment or machinery. Maintaining strict protocols, including routine washing of hands between handling of frogs, and cleaning of boots, equipment and machinery throughout the construction area can greatly reduce the spread of this disease.

As three threatened frogs are expected (Growling Grass Frog, Brown Toadlet) or known (Southern Toadlet) to occur within the study area, the introduction or spread of Chytrid Fungus has the potential to have a highly significant impact on local frog populations. This impact is most likely to occur in sections of rivers and streams that are in good condition (e.g. Katy's Creek) and throughout damp forest areas such as Toolangi State Forest and Sugarloaf Reservoir. It should be noted that if appropriate mitigation measures are implemented and adhered to by field staff and contracted workers, the risk of this occurring can be reduced.

16) Increased predation of native wildlife by non-native predators, particularly the cat, *Felis catus* and Red Fox, *Vulpes vulpes*

One of the major risks to native wildlife is predation from introduced species such as the Cat, *Felis catus* and Red Fox, *Vulpes vulpes*. The Cat and Red Fox preferentially move along cleared edges of habitat (e.g. along the edges of woodlands and along paths/tracks throughout forests). Removal of native habitat and fragmentation of habitat patches increases the opportunities for these two predatory species and reduces the area in which native species can live and forage safely. This can result in increased predation, and can even result in species becoming locally extinct from an area. Increases in predation are likely to be an impact of the Sugarloaf Pipeline Project and may have a significant effect in areas where native wildlife



(particularly small mammals) are currently abundant, simply because their habitat has remained relatively intact until now (e.g. Toolangi State Forest and Sugarloaf Reservoir).

17) Erosion and/or sedimentation

Some of the soils within the survey corridor are highly erodable (the extent of this is to be confirmed with geomorphologists). Considerable evidence for soil erosion occurs along 4WD and trail bike tracks in the Toolangi North LU. The construction of the pipeline may result in an increase in on-site erosion, with a corresponding increase in levels of sedimentation. In the absence of mitigation measures, increased erosion may damage or destroy localised areas of retained native vegetation, while sedimentation may have a deleterious effect on aquatic, semi-aquatic and riparian flora.

18) Altered surface water runoff into waterways

Following rainfall, surface water runoff may be altered into waterways flowing through the survey corridor. In the absence of any mitigation measures, any such runoff may collect chemicals/pollutants spilled at the site during the construction phase (e.g. vehicle oil leaks and fuel spills). Any such polluted run-off would have the potential to result in deleterious impacts upon aquatic, semi-aquatic and riparian indigenous vegetation.

19) Inhibition of plant photosynthesis and reproductive capability due to airborne dust

During the construction phase of the pipeline there will be extensive soil disturbance, which is likely to lead to the generation of large amounts of dust. In addition, large volumes of traffic (particularly heavy machinery) are likely to use temporary gravel and dirt roads at the site, also facilitating dust generation. Recent research suggests that high levels of airborne dust particles may inhibit plant photosynthesis (Anthony 2001) and even negatively influence the reproductive capability of certain plant species. Therefore, there is the potential for a negative impact on plant species growth and seed viability in the vicinity (i.e. <100m) of the works footprint. The duration of this potential impact is unknown.

20) Altered hydrology

Construction of the project may result in changes to landscape hydrology. Earthworks associated with construction (e.g. large amount of cut into hillsides to create flat surfaces) may facilitate localised changes to the groundwater table, which may subsequently influence vegetation community structure and composition in nearby areas. This risk is most significant within steep areas supporting native vegetation, such as Toolangi State Forest, Christmas Hills Escarpment and Sugarloaf Reservoir.

5.2 Mitigation and Management Measures

A number of mitigation measures can be undertaken to minimise the potential impacts of the proposed pipeline. Generally speaking, the avoidance and/or minimisation of impacts will be an



overarching principle for the entire project, irrespective of the conservation significance or the ecological sensitivity of a given area.

One of the most important measures for the pipeline construction is the avoidance of any significant EVCs, habitat types, or threatened flora and fauna species if possible. Such a measure would significantly reduce the long-term impact of the pipeline on threatened vegetation communities and species.

Detailed management plans (i.e. Environmental Management Plan, Vegetation Management Plan, and Weed Management Plan) will be developed prior to the construction phase. Therefore, detailed measures that would be contained within these various management plans are not outlined here. In addition, more detailed and site-specific mitigation measures will be able to be developed once the final pipeline alignment is chosen in early 2008. In the interim, the following mitigation measures provide broader overriding principles by which impacts associated with the development will be minimised.

A. Auditing

An auditing process should be established prior to the commencement of construction. The auditing should occur at regular intervals during the construction process (and post-construction) to ensure that all of the ecological measures outlined below are appropriately implemented.

B. Minimising or altering the footprint of disturbance

Substantial efforts to avoid and minimise native vegetation losses should be implemented during the planning stages of the project. Currently, the Alliance is working towards selecting an alignment that minimises the loss of native vegetation as much as possible. Particular emphasis is being placed on avoiding areas of threatened EVCs or areas identified as being of very high conservation significance.

For any unavoidable native vegetation losses, appropriate net gain offsets will be undertaken in agreement with DSE and in accordance with *Victoria's Native Vegetation Management – A Framework for Action* (NRE 2002). The Off Set Management Plan currently being prepared.

- Further opportunities to avoid loss or damage to native vegetation and fauna habitat are being investigated. These may include the following items, which will need to be developed in greater detail once the final pipeline alignment is determined and factored into the EMP.
- Narrowing the construction footprint through sites of ecological significance wherever possible (e.g. vehicle parking and stockpiling materials in cleared areas away from native vegetation);



- Boring/tunnelling under sites of ecological significance, within Toolangi State Forest and/or at waterway crossings;
- Where waterway crossings are proposed for the pipeline, vehicles should only cross the waterways at existing public roads or existing bridge crossings within private land. New waterway crossings should not be created for vehicles or machinery unless absolutely needed, following consultation with Project Environmental Officers. Wherever possible, pipeline installation should be undertaken using machinery and vehicles located above the banks of the waterway (rather than in the channel itself);
- Lopping overhanging branches rather than completely removing trees;
- Implementing micro-realignments to the pipeline to avoid the loss of large old trees during the construction phase; and
- Using appropriate measures to minimise impacts to tree root zones.

C. Avoiding accidental loss or damage to native vegetation

Areas of retained native vegetation should be flagged clearly prior to operations commencing and maintained accordingly, in order to avoid any inadvertent damage to vegetation that is proposed to be retained.

D. Development of an Environmental Management Plan

An Environmental Management Plan (EMP) is being developed prior to the construction phase. The EMP will incorporate recommendations made within this report and by Government. The EMP will include dust suppression measures to minimise the impact of dust upon plant growth and reproduction.

E. Development of a Vegetation Management Plan

A Vegetation Management Plan will be developed prior to the construction phase. The VMP will include measures to protect and manage threatened species and EVCs within the final pipeline alignment. Mitigation measures for dealing with the direct loss of any threatened EVCs and flora or fauna species will be considered, with the principles of such mitigation to be outlined in the Plan. The Plan will also incorporate aspects of weed and fire management. Development of a VMP would also help to ensure that retained vegetation is appropriately managed for conservation purposes.

F. Retaining a seed bank for threatened species

In areas proposed to be disturbed, and the area is proposed to be rehabilitated following disturbance (i.e. the majority of the pipeline alignment), topsoil will be carefully scraped from the surface (c. 10 cm depth) and stockpiled, in order to retain as much of the soil seed bank as possible, particularly seed of threatened species. Retained topsoil will then be used for rehabilitation works. Soil will be



stockpiled for the shortest possible time to prevent ‘premature’ germination prior to use in site rehabilitation works. In addition, topsoil stockpiling should be no deeper than 1 m, in order to maintain biological activity within the retained soil. Where threatened species are known to not typically recruit from soil-stored seed, seed should be collected prior to vegetation clearing, in order to be used in rehabilitation works⁵⁷.

G. Protective Fencing/Wildlife Fencing

Temporary protective fencing will be installed around retained areas of native vegetation during the construction phase for three main reasons:

- To protect areas of native vegetation and fauna habitat that are to be retained against accidental damage during the construction process (from activities such as vehicle parking, access, and stockpiling of materials and wastes);
- To provide extra protection for known sites containing threatened flora species in the vicinity of the construction activities; and
- To reduce the frequency with which fauna fall into open trenches during the construction process.

The use of temporary fencing to protect sites of ecological significance will include the following components:

- Temporary protective fencing is required on both sides of the construction footprint at all sites where it either intercepts native vegetation or occurs within 20 metres of native vegetation. Once the final alignment has been completed, specific areas which will require fencing will be able to be determined;
- Prior to construction works commencing at a site, a qualified botanist (and/or DSE representative) will oversee installation of **all protective fencing** to ensure that the significant vegetation and habitat has been identified, marked and protected adequately. The fencing should be clearly visible to construction personnel. Additionally, to reduce entry into the site by ground-dwelling fauna (and hence animals falling into open trenches), the fencing should also: a) be constructed from Hessian (or equivalent plastic sediment-trap material), b) extend at least 50 cm above ground level, c) be relatively taut, and d) have the base of the fence weighed down against the ground to prevent animals moving underneath;
- High visibility fencing should also be placed around any construction sites that occur within 50m of known threatened flora species or which are significant for other reasons (as outlined in Chapter 4 of this report);

⁵⁷ Note: seed collection within Toolangi State Forest commenced in December 2007.



- A qualified ecologist (and/or DSE representative) will check fenced areas regularly during the construction period to identify any damage within fenced areas and to ensure protective fencing remains intact.

H. Open Trench Maintenance

In addition to these fencing measures identified above, one or more of the following measures should also be used to minimise the risk of injury or mortality to animals that fall into the trenchline. There is a higher priority for the implementation of these measures along sections of the pipeline that occur within an identified site of significance and up to 30 metres from a site of significance.

- At the completion of construction each day, any open trenches should be filled in as much as possible. Boards, temporary fences or other preventative measures should also be placed entirely around or over an open trench if possible;
- Each morning, prior to the commencement of construction, an ecologist could check any open trenches to collect any fauna that have fallen in, and move them to a safe (and appropriate) nearby location. A permit would be required under the *Wildlife Act 1975* to implement either of these techniques; and
- Develop protocols prior to construction to address the situation that an injured or dead animal is found either during the soil disturbance process or in the morning within an open trench.

I. Pipeline Installation Techniques

As a general rule, the use of trenchless techniques, where practical (e.g. ‘drilling’ or ‘boring’) to install a pipeline underneath a site of ecological significance will have less impact than open-cut trench installation. However, it is acknowledged that:

- Trenchless techniques are significantly more expensive than open-cut trenching for pipeline installation;
- Trenching should maintain a safe working distance from native vegetation to ensure protection of the root zone; and
- From a geotechnical perspective, trenchless techniques may not be suitable at certain road and waterway crossings within the pipeline corridor.

Therefore, whenever it is not possible to avoid the loss of an area of ecological significance, the use of trenchless techniques should be considered. As very large areas of high conservation significance vegetation are proposed to be removed, it is recommended that drilling/boring be considered as an appropriate mitigation measure, particularly within the forested sections of Toolangi State Forest.