Environment
Effects Statement

Technical Report G
Arboriculture

NORTH EAST LINK PROJECT

NORTH EAST LINK ENVIRONMENT EFFECTS STATEMENT

EES TECHNICAL REPORT G – ARBORICULTURAL ASSESSMENT

PREPARED FOR NORTH EAST LINK

APRIL 2019

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Executive summary

This technical report is an appendix to the North East Link Environment Effects Statement (EES). It has been used to inform the EES required for the project, and defines the Environmental Performance Requirements (EPRs) necessary to meet the EES objectives.

Overview

North East Link ('the project') is a proposed new freeway-standard road connection that would complete the missing link in Melbourne's ring road, giving the city a fully completed orbital connection for the first time. North East Link would connect the M80 Ring Road (otherwise known as the Metropolitan Ring Road) to the Eastern Freeway, and include works along the Eastern Freeway from near Hoddle Street to Springvale Road.

The Major Transport Infrastructure Authority (MTIA) is the proponent for North East Link. The MTIA is an administrative office within the Victorian Department of Transport with responsibility for overseeing major transport projects.

North East Link Project (NELP) is an organisation within MTIA that is responsible for developing and delivering North East Link. NELP is responsible for developing the reference project and coordinating development of the technical reports, engaging and informing stakeholders and the wider community, obtaining key planning and environmental approvals and coordinating procurement for construction and operation.

On 2 February 2018, the Minister for Planning declared North East Link to be 'public works' under Section 3(1) of the Environment Effects Act 1978, which was published in the Victorian Government Gazette on 6 February 2018 (No. S 38 Tuesday 6 February 2018). This declaration triggered the requirement for the preparation of an EES to inform the Minister's assessment of the project and the subsequent determinations of other decision-makers.

The EES was developed in consultation with the community and stakeholders and in parallel with the reference project development. The reference project has been assessed in this EES. The EES allows stakeholders to understand the likely environmental impacts of North East Link and how they are proposed to be managed.

Landscape Dept was commissioned to undertake an arboricultural impact assessment for the purposes of the EES.

Arboricultural and urban forest context

The scoping requirements for the EES issued by the Minister for Planning set out the specific environmental matters to be investigated and documented in the project's EES, which informs the scope of the EES technical studies. The scoping requirements include a set of evaluation objectives. These objectives identify the desired outcomes to be achieved in managing the potential impacts of constructing and operating the project.

The following evaluation objective is relevant to this assessment:

- To minimise adverse effects on landscape values, visual amenity, recreational and open space values and to maximise the enhancement of these values where opportunities exist

- To avoid or minimise adverse effects on vegetation (including remnant, planted and regenerated), listed rare and threatened species and ecological communities, habitat for listed threatened species, listed migratory species and other protected flora and fauna, and address offset requirements for residual environmental effects, consistent with relevant State policies.

This report provides a high-level arboricultural impact to complement the ecology impact assessment (refer to Technical report Q – Ecology) which addresses impacts to trees in Ecological Vegetation Classes (EVCs) and individual scattered trees.

Existing conditions

The arboricultural assessment identified planted amenity trees that would be removed for the permanent infrastructure and construction of the reference project. Additionally, all other planted amenity trees within the project boundary were documented, as these are considered to be at risk of removal (or damage) and broadly categorised as *potentially impacted*. This approach has provided a conservative assessment of impacts.

The treed character and associated impacts to planted amenity trees are summarised below, separating the total study area into 10 precincts across the project's three key components. Precincts within each major component are defined at convenient geographic points (intersections or waterways) to break up a significant amount of tree data into more manageable sections.

The over-riding treed character within the study area is defined by planted indigenous, Victorian and Australian native trees, with relatively few exotic trees encountered. The scale and canopy cover provided by trees through the study area varies significantly, as described below.

Component 1 – M80 Ring Road to River Gum Walk

As for much of the study area, the treed character within this component is defined by native tree plantings. The scale and canopy cover varies across the four precincts.

- **Precinct 1.A – M80 Ring Road**. In the north of the precinct, the M80 Ring Road road reservation set back from the running lanes is densely planted with large-scale native trees, forming a near continuous over-canopy on each side of the reservation.
- **Precinct 1.B – Greensborough Bypass, M80 Ring Road to Grimshaw Street**. At the termination of the M80 Ring Road, the adjacent road reserves of the Greensborough Bypass are densely planted, although with generally smaller-scale trees that do not provide the same large-scale canopy cover as plantations to the M80 Ring Road. This vegetation provides a buffer to the bypass and adjacent residential precincts.
- **Precinct 1.C – Greensborough Bypass/Greensborough Road, Grimshaw Street to Yallambie Road.** The Greensborough Bypass/Greensborough Road reserves have a distinctively open landscape character, with relatively few large trees. Large-scale trees are generally confined to adjacent recreational reserves (AK Lines Reserve and Gabonia Avenue Reserve, Watsonia, and Winsor Reserve, Macleod) and a treed reserve within Service Road, Watsonia.

- **Precinct 1.D – Greensborough Road, Yallambie Road to River Gum Walk**. Greensborough Road reserve has an open, relatively treeless character. To the east side of the road reserve lies a near-continuous band of large-scale, predominantly indigenous trees within Simpson Barracks and adjacent Commonwealth land (assessed in Technical report Q – Ecology) and Borlase Reserve at the southern end of Greensborough Road.

Component 2 – Manningham Road to Koonung Creek, Bulleen

Component 2 of the study area comprises a single precinct, 2.E, which features significant variation in treed character.

Banksia Park and the Yarra River parklands in the north of the precinct are well treed compared with the relatively sparsely treed streetscapes of the commercial and light industrial precinct to the south and east of these parklands. Although Bulleen Road contains limited street tree plantations in the south of the precinct, extensive, large-scale plantings within the adjacent school playing fields and Bulleen Park and at the Veneto Club provide a leafy outlook to the streetscape. Plantings primarily comprise indigenous, Victorian and Australian native species.

Component 3 – Eastern Freeway

The treed character along the Eastern Freeway in the five precincts of this component varies from west to east, reflecting the staged development of the freeway and changes in topography along its route. Adjacent parklands are uniformly well-treed, with a strongly native landscape character.

- **Precinct 3.F – Hoddle Street to Belford Road.** The freeway road reserve is open and relatively treeless. Any tree plantations in this precinct are clustered at entry and exit ramps. Public reserves adjacent to the freeway are strongly indigenous in character, with dense plantings of large native trees. The vacant VicRoads site to the west of Chandler Highway comprises native and exotic species of varying scale.

- **Precinct 3.G – Belford Road to Bulleen interchange.** Trees planted within the freeway road reserve are generally planted in single species plantations which in combination form strong elements in the broader landscape. The landscape character of public parklands (including the Freeway Public Golf Course) is consistent throughout this precinct, dominated by large-scale Eucalypts, including locally indigenous, Victorian and Australian native species.

- **Precinct 3.H – Bulleen interchange to Doncaster Road**. The treed character of this precinct is dominated by large, indigenous and other native trees within the freeway reserve on its north side and freeway plantations that intergrade into adjacent parkland plantations within Koonung Creek Reserve to the south. The scale of the trees and canopy, especially those on the north side of the freeway, provides useful over-shadowing of adjacent traffic lanes. Adjacent parklands, especially Koonung Creek Reserve, have a decidedly indigenous, semi-natural character, and include trees within Plains Grassy Woodland and Swampy Riparian Woodland EVCs.

- **Precinct 3.I – Doncaster Road to Tram Road**. Vegetation along the Koonung Creek Trail to the south of the freeway intergrades with freeway plantations, providing a strong, treed character to this section. Extensive portions of vegetation along the south side of the freeway along the Koonung Creek Trail are categorised as Riparian Woodland EVC. Public reserves to the north of the freeway,

namely Stanton Street and Katrina Street reserves, have broadly native planting themes, including locally indigenous, Victorian and Australian native species.

- **Precinct 3.J – Tram Road to Springvale Road**. This section of the Eastern Freeway has a more treed character than older sections of the freeway west of Doncaster Road. The freeway reserve contains extensive native tree plantations. Plantings have been undertaken in large blocks or monocultures of generally indigenous and Victorian native trees that are now maturing and provide important canopy cover along sections of the freeway within this precinct. Adjacent reserves are predominantly native in character, and comprise indigenous, Victorian and Australian native species.

Planted amenity trees within the Banyule Flats and Warringal Parklands, over the main sections of bored tunnel have not been assessed as part of this study. Root growth for planted amenity trees is generally shallow, confined to depths of less than one metre. It is assumed that because of the relatively shallow root systems of planted amenity trees, it is unlikely they are drawing on groundwater which is understood to be at depths considerably deeper than root growth. The depth of the North East Link bored tunnels means that tunnelling activities would have no potential to impact the roots of trees.

Key findings

Impact assessment – Construction impacts

The greatest impact to trees and canopy cover would be planned removals of trees (risk AR01) to allow for the construction of new roadways, tunnel portals, flyovers, viaducts and access to construction compounds, as well as associated infrastructure such as shared user paths, detention basins and water sensitive urban design (WSUD) features and modifications to existing road functional layouts. All other trees within the project boundary, including those well separated from proposed works are conservatively considered potentially impacted.

The estimated numbers of planted amenity trees planned for removal within each component and precinct are listed in the Table below. Trees are categorised as medium and long-term viable (MLTV) trees; that is trees that already contribute to the public realm, being semi-mature, mature and over-mature trees that have an assessed useful life expectancy of more than 10 years, a period from 2018 to beyond the planned delivery of North East Link Project. The Table includes trees located within the road zone (Category 1 – RDZ1 and Category 2 – RDZ2). Trees within the road zone are located within VicRoads-managed land where road improvement, widening and other works are an expected consequence of the use of this land and trees in this zone are at greater risk of damage or removal with or without the project.

Planted amenity trees planned for removal with the reference project

	MLTV	Non-MLTV	Total	Within road zone
Precinct within Component 1 – M80 Ring Road to River Gum Walk				
Precinct 1.A – M80 Ring Road	2,886	726	**3,612**	3,605
Precinct 1.B – Greensborough Road to Grimshaw Street	1,289	1,434	**2,723**	2,644
Precinct 1.C – Greensborough Road, Grimshaw Street to Yallambie Road	734	582	**1,316**	781

	MLTV	Non-MLTV	Total	Within road zone
Precinct 1.D – Greensborough Road, Yallambie Road to River Gum Walk	168	63	**231**	47
Component 2 – Manningham Road to Koonung Creek, Bulleen – Precinct 2.E	636	269	**905**	95
Precinct within Component 3 – Eastern Freeway Precinct 3.F – Hoddle Street to Belford Road	411	149	**560**	528
Precinct 3.G – Belford Road to Bulleen interchange	1,148	573	**1,721**	906
Precinct 3.H – Bulleen interchange to Doncaster Road	1,488	981	**2,469**	1,282
Precinct 3.I – Doncaster Road to Tram Road	547	160	**707**	605
Precinct 3.J – Tram Road to Springvale Road	1,317	253	**1,570**	966
TOTAL	**10,624**	**5,190**	**15,814**	**11,459**

The estimated numbers of planted amenity trees potentially impacted within each component and precinct are listed in the Table below, including trees within the road zone.

Planted amenity trees potentially impacted within the project boundary

	MLTV	Non-MLTV	Total	Within road zone
Precinct within Component 1 – M80 Ring Road to River Gum Walk Precinct 1.A – M80 Ring Road	561	214	**775**	725
Precinct 1.B – Greensborough Road to Grimshaw Street	450	200	**650**	278
Precinct 1.C – Greensborough Road, Grimshaw Street to Yallambie Road	316	219	**535**	29
Precinct 1.D – Greensborough Road, Yallambie Road to River Gum Walk	117	31	**148**	67
Component 2 – Manningham Road to Koonung Creek, Bulleen – Precinct 2.E	201	117	**318**	86
Precinct within Component 3 – Eastern Freeway Precinct 3.F – Hoddle Street to Belford Road	1,276	911	**2,187**	1,140
Precinct 3.G – Belford Road to Bulleen interchange	668	493	**1,161**	1,059
Precinct 3.H – Bulleen interchange to Doncaster Road	731	368	**1,099**	39
Precinct 3.I – Doncaster Road to Tram Road	674	206	**880**	558
Precinct 3.J – Tram Road to Springvale Road	1,665	715	**2,380**	1,881
TOTAL	**6,659**	**3474**	**10,133**	**5,862**

Of the approximately 25,947 planted amenity trees planned for removal or potentially impacted, approximately two-thirds are categorised as MLTV trees. 67 per cent of trees planned for removal or potentially impacted are located within the road zone.

There is scope to retain trees on the periphery of construction works through detailed design that seeks to minimise the removal or potential impacts (risk AR02 and risk AR03) to MLTV trees (EPR AR1).

Protection of trees on the boundaries of construction compounds and construction areas should be achieved with implementation of a Tree Protection Plan prepared in accordance with AS4970-2009 *Protection of Trees on Development Sites* (EPR AR2).

There is also the possibility of reducing the number of trees removed (risk AR01) for the construction of shared use paths at various locations in Component 2 and Component 3 through detailed design (EPR AR1) where these trees provide shade for path users.

Impact assessment – Operation impacts

The long-term loss of trees and canopy cover can be mitigated with the development of a comprehensive Tree Canopy Replacement Plan (EPR AR3) including a hierarchical tree replanting strategy that includes replanting in areas outside the defined project boundary and undertaking replacements. The program would seek to re-establish canopy cover within 15 years from the project's completion.

The Tree Canopy Replacement Plan would ensure new tree plantings are selected for their location to secure the best possible growth outcomes, and would consider soil type, micro-climate as well as modifications to local environment such as wind and shading caused by new freeway structures including flyovers and sound walls (risk AR05).

Other potential risks identified during the project's construction and operation are potential impacts to trees caused by groundwater drawdown and droughting (drying up) of root systems, which is considered an unlikely scenario due to the generally shallow depth of tree roots for relatively young planted trees, and the much deeper depths of underlying groundwater. Similarly, where ground settlement is predicted to be greatest, this is in areas where trees are planned for removal for the project's construction. Ground settlement is not anticipated to impact trees with the potential to be retained elsewhere within the project boundary.

Structure of the EES

Abbreviations

DBH	Diameter at Breast Height (of a tree)
DELWP	Department of Environment, Land, Water and Planning
EES	Environment Effects Statement
EPR	Environmental Performance Requirement
ESO	Environmental Significance Overlay
EVC	Ecological Vegetation Class
GNSS	Global Navigation Satellite System
HO	Heritage Overlay
MLTV	Medium and long term viable trees that already contribute to the public realm
MTIA	Major Transport Infrastructure Authority
NELP	North East Link Project
PAO	Public Acquisition Overlay
RDZ1, RDZ2	Category 1 (RDZ1) and Category 2 (RDZ2) road zones
SLO	Significant Landscape Overlay
TPP	Tree Protection Plan
ULE	Useful life expectancy (of a tree)
VPO	Vegetation Protection Overlay

Glossary

Department of Transport	The Victorian Department of Transport is responsible for delivering the government's transport infrastructure agenda. It was formed on 1 January 2019 when the former Victorian Department of Economic Development, Jobs, Transport and Resources transitioned into the Department of Transport and the Department of Jobs, Precincts and Regions.
Major Transport Infrastructure Authority	The Major Transport Infrastructure Authority is the proponent for North East Link. The MTIA is an administrative office within the Victorian Department of Transport with responsibility for overseeing major transport projects.
Medium and long term viable trees	Semi-mature, mature and over-mature trees which are considered to be viable from 2018 to beyond the approximate time frame of delivery of the project (10 years or more)
North East Link Project	North East Link Project is an organisation within MTIA that is responsible for developing and delivering North East Link. NELP was formerly known as the North East Link Authority prior to 1 January 2019. NELP is responsible for developing the reference project and coordinating development of the technical reports, engaging and informing stakeholders and the wider community, obtaining key planning and environmental approvals and coordinating procurement for construction and operation.
Road Zone	Land Zoned for Category 1 (RDZ1) and Category 2 (RDZ2) roads, managed by VicRoads
Tree Protection Plan	A plan prepared in accordance with AS4970-2009 *Protection of Trees on Development Sites* for the management of trees to be retained within and adjacent to construction and other works.

1. Introduction

1.1 Purpose of this report

North East Link ('the project') is a proposed new freeway-standard road connection that would complete the missing link in Melbourne's ring road, giving the city a fully completed orbital connection for the first time. North East Link would connect the M80 Ring Road (otherwise known as the Metropolitan Ring Road) to the Eastern Freeway, and include works along the Eastern Freeway from near Hoddle Street to Springvale Road.

The Major Transport Infrastructure Authority (MTIA) is the proponent for North East Link. The MTIA is an administrative office within the Victorian Department of Transport with responsibility for overseeing major transport projects.

North East Link Project (NELP) is an organisation within MTIA that is responsible for developing and delivering North East Link. NELP is responsible for developing the reference project and coordinating development of the technical reports, engaging and informing stakeholders and the wider community, obtaining key planning and environmental approvals and coordinating procurement for construction and operation.

On 2 February 2018, the Minister declared the works proposed for North East Link as Public Works and issued a decision confirming that an Environment Effects Statement (EES) is required for the project due to the potential for significant environmental effects.

Similarly, the project was referred to the Australian Government's Department of the Environment and Energy on 17 January 2018. On 13 April 2018 the project was declared a 'controlled action', requiring assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Separate to this EES, a Public Environment Report (PER) is required to be prepared to satisfy the EPBC Act requirements, and assess the impacts of the project on Commonwealth land and matters of national environmental significance (MNES).

The purpose of this report is to assess the potential arboriculture impacts associated with North East Link, specifically planted amenity trees, and to define the Environmental Performance Requirements (EPRs) necessary to meet the EES objectives

1.2 Why understanding arboriculture and the urban forest canopy is important

Greater Melbourne's urban forest is the sum of all trees across Melbourne. When considered as a whole population rather than individual trees, Melbourne's urban forest is a critical civic asset that directly determines our liveability, improves human health and wellbeing and helps our city become more resilient in the face of climate change, particularly in coping with urban heat islands. Urban heat islands are created by human activities, vegetation clearance and constructed elements such as roofs and pavements.

Trees and the overall urban forest has a strong influence on community health and wellbeing. Tree canopy cover is crucial to help cool our city during hot summers, to encourage active transport particularly walking and cycling and to provide much needed shade from the sun's ultraviolet radiation. Just as important are the links between trees, the urban forest and the transition towards a water sensitive city as well as urban ecology. Urban trees sequester carbon, intercept stormwater run-off and provide habitat corridors for a range of fauna. State and local policy across Melbourne, including Resilient Melbourne (City of Melbourne, 2016) now widely recognises the value in actively enhancing and managing our urban forest for these reasons.

Recent research has found that despite strong local government public tree planting programs, Melbourne's overall canopy cover continues to decline. In the absence of effective planning and commitments in relation to canopy, major infrastructure projects could potentially contribute to further reducing Melbourne's canopy cover.

The loss of trees and associated canopy during construction projects such as North East Link is inevitable. Impacts to trees surrounding construction zones also require careful management to prevent additional damage or loss of trees. Incorporating urban forest priorities, including planned tree replacement and canopy re-establishment into the planning of North East Link is critical for the future liveability and resilience of Melbourne.

2. EES scoping requirements

2.1 EES evaluation objectives

The scoping requirements for the EES issued by the Minister for Planning set out the specific environmental matters to be investigated and documented in the project's EES, which informs the scope of the EES technical studies. The scoping requirements include a set of evaluation objectives. These objectives identify the desired outcomes to be achieved in managing the potential impacts of constructing and operating the project.

The following evaluation objectives are relevant to the arboricultural impact assessment:

- To minimise adverse effects on landscape values, visual amenity, recreational and open space values and to maximise the enhancement of these values where opportunities exist.
- To avoid or minimise adverse effects on vegetation (including remnant, planted and regenerated), listed rare and threatened species and ecological communities, habitat for listed threatened species, listed migratory species and other protected flora and fauna, and address offset requirements for residual environmental effects, consistent with relevant State policies.

2.2 EES scoping requirements

The aspects from the scoping requirements relevant to the landscape values, visual amenity, recreational and open space values evaluation objective are shown in Table 2-1, as well as the location where these items have been addressed in this report.

Table 2-1 Scoping requirements relevant to arboriculture

Aspect	Scoping requirement	Section addressed
Key issues	Potential adverse effects on urban landscapes that provide a range of functions (eg visual amenity, drainage, flood storage and cooling from vegetation and shade). Potential loss of landscape values and visual amenity (eg visual, shading, tree canopy cover) from direct and indirect impacts to vegetation within the project boundary and the broader urban environment.	Existing conditions: Section 6.1 – 6.3. Impact assessment: Sections 8.1, 8.2, 8.3, 8.4 Technical report H – Landscape and visual
Priorities for characterising the existing environment	Identify condition and uses of existing and planned public open space and recreational facilities that could be occupied or otherwise adversely affected by project construction and operation. Identify current status, condition and arboricultural value of trees within the study area and those within construction areas via desktop and field study. Determine species, origin, dimension, health and lifespan of trees that may be affected by the project assuming current conditions continue and appropriate care is provided.	Technical report I – Social Existing conditions: Section 6.1 – 6.3. Impact assessment: Sections 8.1, 8.2, 8.3, 8.4 Tree assessment data: Appendix B

Aspect	Scoping requirement	Section addressed
Design and mitigation measures	Describe design, management or offset measures to enhance or alternatively avoid or minimise adverse effects on landscape, visual amenity and recreational and open space values, especially with regard to long-term effects. Develop rehabilitation strategies to enable the recovery or restoration of vegetation that can provide habitat for protected and listed threatened species and amenity to local community consistent with any threat abatement plan or conservation action plan.	Impact assessment: Sections 8.1, 8.2, 8.3, 8.4 Environmental Performance Requirements: Section 9, EPR AR1, EPR AR2, EPR AR3. Technical report Q – Ecology
Assessment of likely effects	Assess likely extent and duration of residual adverse effects on, or improvements to, landscape aesthetics and functions. Assess the potential direct and indirect effects of the project on arboricultural elements (including remnant, planted and regenerated trees). Assess consistency with any relevant built-form frameworks or urban plans.	Technical report H – Landscape and visual Impact assessment: Sections 8.1, 8.2, 8.3, 8.4
Approach to manage performance	Describe the environmental performance requirements to set landscape, visual amenity, recreational and open space values outcomes that the project must achieve. Describe the environmental performance requirements to set arboricultural value outcomes that the project must achieve.	Technical report H – Landscape and visual Environmental Performance Requirements: Section 9, EPR AR1, EPR AR2, EPR AR3.

2.3 Linkages to other reports

This report relies on or informs the technical assessments as indicated in Table 2-2.

Table 2-2 Linkages to other technical reports

Specialist report	Relevance to this assessment
Technical report K – Historical heritage	Provides an assessment of impacts on heritage trees and landscapes.
Technical report L – Aboriginal cultural heritage	Provides an assessment of impacts on Aboriginal values due to tree loss and other impacts associated with the project.
Technical report Q – Ecology	Provides an assessment of trees (and other vegetation) located within ecological vegetation class (EVC) communities, as well as indigenous trees categorised as 'scattered trees'. Includes an assessment of indigenous trees and considerers potential impacts of the project relating to habitat value and function of wildlife corridors. Technical report G – Arboriculture has been prepared to supplement Technical report Q, providing an assessment of planted amenity trees, as well as mitigation for impacts to the entire urban forest comprising remnant vegetation as well as planted amenity trees.

Specialist report	Relevance to this assessment
Technical report H – Landscape and visual	Provides an assessment of landscape and visual impacts, including removal of trees and other vegetation.
Technical report N – Groundwater	Provides an assessment of predicted changes to groundwater levels across the study area and has been used as the basis for assessing potential impacts to planted amenity trees due to changes in groundwater conditions.

3. Project description

3.1 Overview

The North East Link alignment and its key elements assessed in the Environment Effects Statement (EES) include:

- M80 Ring Road to the northern portal – from the M80 Ring Road at Plenty Road, and the Greensborough Bypass at Plenty River Drive, North East Link would extend to the northern portal near Blamey Road utilising a mixture of above, below and at surface road sections. This would include new road interchanges at the M80 Ring Road and Grimshaw Street.
- Northern portal to southern portal – from the northern portal the road would transition into twin tunnels that would connect to Lower Plenty Road via a new interchange, before travelling under residential areas, Banyule Flats and the Yarra River to a new interchange at Manningham Road. The tunnels would then continue to the southern portal located south of the Veneto Club.
- Eastern Freeway – from around Hoddle Street in the west through to Springvale Road in the east, modifications to the Eastern Freeway would include widening to accommodate future traffic volumes and new dedicated bus lanes for the Doncaster Busway. There would also be a new interchange at Bulleen Road to connect North East Link to the Eastern Freeway.

These elements are illustrated in Figure 3-1.

The project would also improve existing bus services from Doncaster Road to Hoddle Street through the Doncaster Busway as well as pedestrian connections and the bicycle network with connected cycling and walking paths from the M80 Ring Road to the Eastern Freeway.

For a detailed description of the project, refer to EES Chapter 8 – Project description.

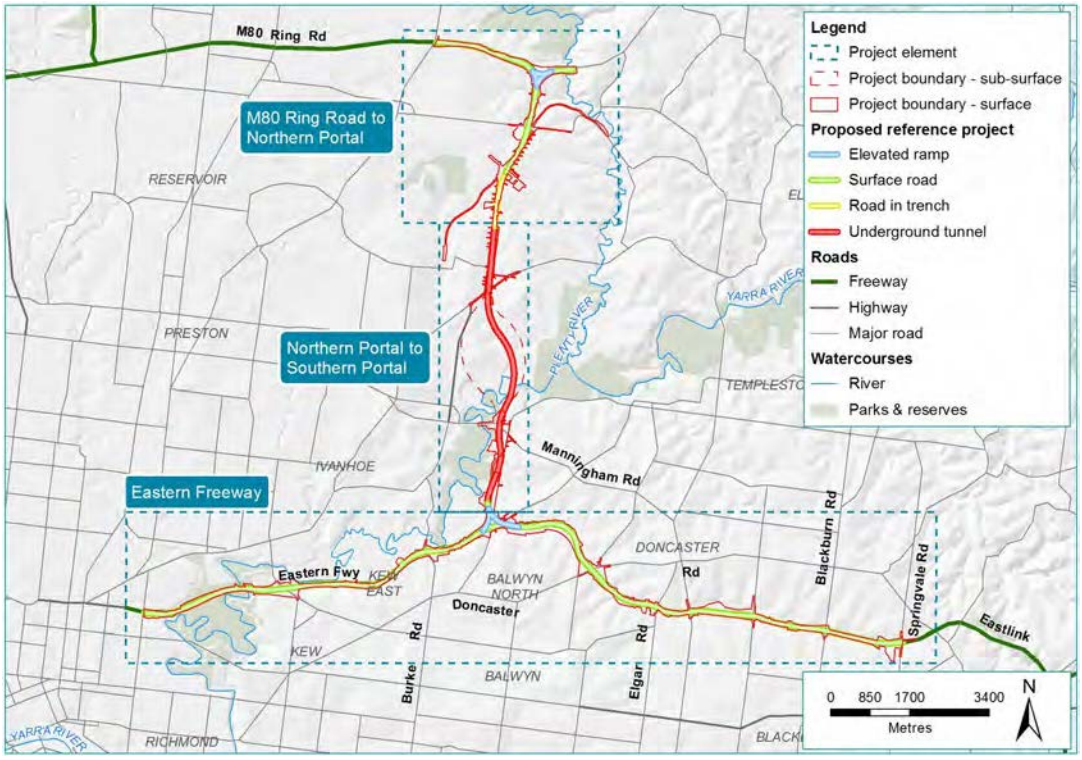

Figure 3-1 Overview of North East Link

3.2 Construction

Key construction activities for North East Link would include:

- General earthworks including topsoil removal, clearing and vegetation removal
- Relocation, adjustment or installation of new utility services
- Construction of retaining walls and diaphragm walls including piling
- Ground treatment to stabilise soils
- Tunnel portal and dive shaft construction
- Storage and removal of spoil
- Construction of cross passages, ventilation structures and access shafts
- Installation of drainage and water quality treatment facilities
- Installation of a Freeway Management System
- Tunnel construction using TBMs, mining and cut and cover techniques
- Installation of noise and flood protection barriers
- Tree planting, landscaping and urban design
- Restoration of surface areas.

3.3 Operation

Following the construction of North East Link, the key operation phase activities would include:

- Operation and maintenance of new road infrastructure
- Operation and maintenance of Freeway Management System
- Operation of North East Link motorway control centre
- Operation and maintenance of the tunnel ventilation system
- Operation and maintenance of water treatment facilities
- Operation and maintenance of the motorways power supply (substations)
- Maintenance of landscaping and Water Sensitive Urban Design (WSUD) features.

4. Legislation, policy, guidelines and criteria

4.1 Primary legislation, policy and guidelines

Numerous legislative, policy and guidance documents were found to be relevant to this arboricultural impact assessment and are discussed further in this report. The key legislation, policy and guidelines that apply to the arboricultural impact assessment for the project are summarised in Table 4-1.

Legislation, policy and guidelines for native vegetation are included in Technical report Q – Ecology, including the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* ('EPBC Act'), the Victorian *Flora and Fauna Guarantee Act 1988* ('FFG Act') as well as Clause 52.17 Native Vegetation provisions under local planning schemes.

Technical report K – Historic heritage provides an overview of statutory controls and guidelines for trees and landscapes assessed of cultural heritage significance, including the EPBC Act, the Victorian *Heritage Act 2017* and Heritage Overlay provisions that apply within individual planning schemes.

Table 4-1 Primary legislation, policy and guidelines

Legislation/policy/guideline	Relevance to this impact assessment
Council planning schemes	Planning schemes of relevance to North East link: ▪ Banyule Planning Scheme ▪ Boroondara Planning Scheme ▪ Manningham Planning Scheme ▪ Nillumbik Planning Scheme ▪ Whitehorse Planning Scheme ▪ Yarra Planning Scheme. All retrieved from <http://planning-schemes.delwp.vic.gov.au/>
Planning scheme overlays	Overlays in planning schemes are the primary control instrument of a planning scheme for protecting non-native vegetation. These controls are primarily implemented through the Environmental Significance Overlay (ESO), Significant Landscape Overlay (SLO), and Vegetation Protection Overlay (VPO), as mapped within each planning scheme, although other clauses, such as the Public Acquisition Overlay (PAO) also place restrictions on the removal of trees and vegetation. Banyule City Council (VPO) and Whitehorse City Council (SLO) implement planning scheme overlays as their primary mechanism for the broad-scale protection of trees within their municipalities. Details of individual overlays that apply within the project boundary are covered in Section 6 of this report.

Legislation/policy/guideline	Relevance to this impact assessment
Council local laws	Applied to trees on private land, the Boroondara Tree Protection Local Law (2016) and Yarra General Local Law – Part 14 (2016) place restrictions on the removal of trees from private property, based on the trunk size of trees. The local laws do not apply to trees on council-managed or other public lands such as those managed by VicRoads and the Department of Education and Training. Tree protection local laws do not apply to any of the trees assessed as part of this study.
Urban Forest Strategic Plan Banyule City Council Enspec and Banyule City Council	Banyule's Urban Forest Strategic Plan has four objectives: People (Healthier communities), Planet (Healthy landscapes), Place (enhancing urban character) and Performance (leadership in urban forest management). Banyule City Council only has a stratified tree inventory (11,000 trees of a total population of 10 approx. 110,000 street and park trees). Strategic plan goals relevant to North East Link: 1. Increase tree canopy cover on public land 2. Encourage increase in tree canopy cover on private land 3. Maintain and improve landscape character.
Tree Strategy 2017 City of Boroondara. 2017	Boroondara's Tree Strategy sets the framework for tree management decision-making. The strategy sets the vision for: Boroondara continues to be a place of shady trees, with leafy streets and green parklands. Our trees enable us to experience the seasons, connect with nature and contribute to our sense of wellbeing. Key issues: Ageing tree population, low species diversity, risk and damage to infrastructure. Key focus areas: Strategic renewal of ageing street trees, increase community knowledge and engagement, tree planting for increased shade in areas of need, tree planting to support biodiversity. The Tree Strategy is implemented through the Street Strategy Action Plan. Boroondara City Council holds a limited inventory for street trees only. Park trees are currently being collected and budget has been granted to undertake a new street tree inventory.
Manningham City Council Tree Management Plan Manningham City Council. 2017	Manningham's Tree Management Plan provides guidance to the ongoing management of trees in the City of Manningham. Relevant issues to consider: Tree removal – the council has a strict tree removal decision-making framework. A replacement tree will be planted where applicable. Tree planting – a minimum of one tree per residential property frontage where service and road safety requirements permit. Planting is carried out as per the Manningham Streetscape Character Study. Manningham City Council has an inventory of all its street trees.

Legislation/policy/guideline	Relevance to this impact assessment
Streetscape Character Study Manningham City Council. 2009	The purpose of Manningham's Streetscape Character Study is to coordinate the enhancement of the municipalities residential areas with a view to strengthening their sense of identity. The council's policy is that 'physical character of the municipality continues to reflect the qualities of the natural environment'. Street trees are recognised as a significant component of the urban forest. Major aims of street tree planting: ▪ Consistency ▪ Visual interest ▪ Tree size – the largest canopy tree suitable for the street should be planted. There are eight streetscape character typologies: ▪ Main roads ▪ Doncaster Hill precinct ▪ Historic precincts ▪ Pine theme precincts ▪ Residential grid precincts ▪ Residential curvilinear precincts ▪ Low density precincts ▪ Rural. The council has proposed themes and a palette of tree species suitable for planting in each streetscape character. Trees are planted as per each precinct typology through the council's capital works program, streetscape improvement program and in subdivision street tree planting.
Tree Management Policy Nillumbik Shire Council. 2015	Nillumbik's Tree Management Policy sets out an agreed standard of service for the management and planting of public trees. Two of its four core objectives are to: 1. Maintain and enhance the Municipalities tree population 2. Engage the community in restoration and enhancement of the rural and urban environment. Of the existing policies the following are relevant. Council will: ▪ Inform and consult with residents regarding local tree works, major works and policy change ▪ Avoid tree removal where possible ▪ Plant replacements where applicable ▪ Meet the requirements of Nillumbik planning scheme which may require indigenous vegetation planted on public or private land in response to vegetation removal ▪ Plant predominantly indigenous species ▪ Meet AS 2303:2015 regarding quality tree stock ▪ Consider planting in relation to existing bushfire mitigation treatments.

Legislation/policy/guideline	Relevance to this impact assessment
City of Whitehorse Streetscape Policy and Strategy City of Whitehorse. 2002	Whitehorse's Streetscape Policy and Strategy is an extensive document outlining the councils key directions for urban tree planting. Key objectives relevant to North East Link are: 1. Maximise opportunities for planting native/indigenous street trees 2. Reinforce the character of different areas of Whitehorse through selection of species suited to the local environment 3. Preserve existing exotic streetscapes. The policy stipulates strict criteria around tree removal.
City of Whitehorse Tree Study City of Whitehorse and Planisphere. 2016	Whitehorse's Tree Study provides an adopted pathway for the protection of trees on private property, which was highlighted as one of the challenges for Whitehorse's urban forest. The result of the tree study was an approval by the Minister to extend the Significant Landscape Overlay to all residential-zoned land in the municipality.
Urban Forest Strategy 2017 Yarra City Council & Urban Forest Consulting. 2017	The objectives of Yarra's Urban Forest Strategy are to enhance Yarra's healthy and growing urban forest and engage the community. Target: Increase canopy cover by 25 per cent, from 17 per cent to 21.25 per cent. Key actions: Plant trees in areas of need, increase annual planting, work with others to achieve greater outcomes. A decision matrix has been developed to identify areas where tree canopy is required (to mitigate heat and maximise health and wellbeing outcomes) which will inform a 10-year planting plan (currently in development).
City of Yarra Street Tree Policy City of Yarra. 2014	Public street trees are one of Yarra's greatest assets. The council supports an increase in the quality and quantity of street trees, and recognises that existing poor-quality plantings may sometimes need to be removed for this to occur. The vision for Yarra's streetscapes is enhanced liveability and amenity through green streets. Key objectives relevant to North East Link are: 1. A net increase in number of street trees and overall street tree canopy 2. Improve quality of street trees 3. Integrated streetscape design (WSUD) 4. Education and communication. Yarra has a strict decision-making framework for removing trees on council-managed land, and an appeals process.

4.2 Arboricultural assessment criteria

4.2.1 Construction criteria

The majority of arboricultural and urban forest impacts from North East Link would be due to the project's construction. The assessment of arboricultural impacts is therefore primarily based on an assessment of each tree or tree group identified as impacted by or potentially impacted by the project's construction.

An estimate is provided of the total number of planted amenity trees that would require removal to construct the reference project. All other trees within the project boundary are categorised as potentially impacted.

Impacted trees have been categorised as medium and long-term viability (MLTV) or non-MLTV trees. MLTV trees are those that already contribute to the landscape (semi-mature, mature and over-mature trees) that have an estimated useful life expectancy of more than 10 years, which is the approximate time it would take to construct the project. MLTV trees are considered to be of greater value than non-MLTV trees. The same approach has been used for the assessment of planted amenity trees on other Melbourne major infrastructure projects such as the Metro Tunnel and West Gate Tunnel Project.

5. Methodology

5.1 Overview of methodology

This section describes the method that was used to assess the potential impacts of North East Link.

A risk-based approach was applied to prioritise the key issues for assessment and inform measures to avoid, minimise and offset potential effects. Figure 5-1 shows an overview of the assessment method.

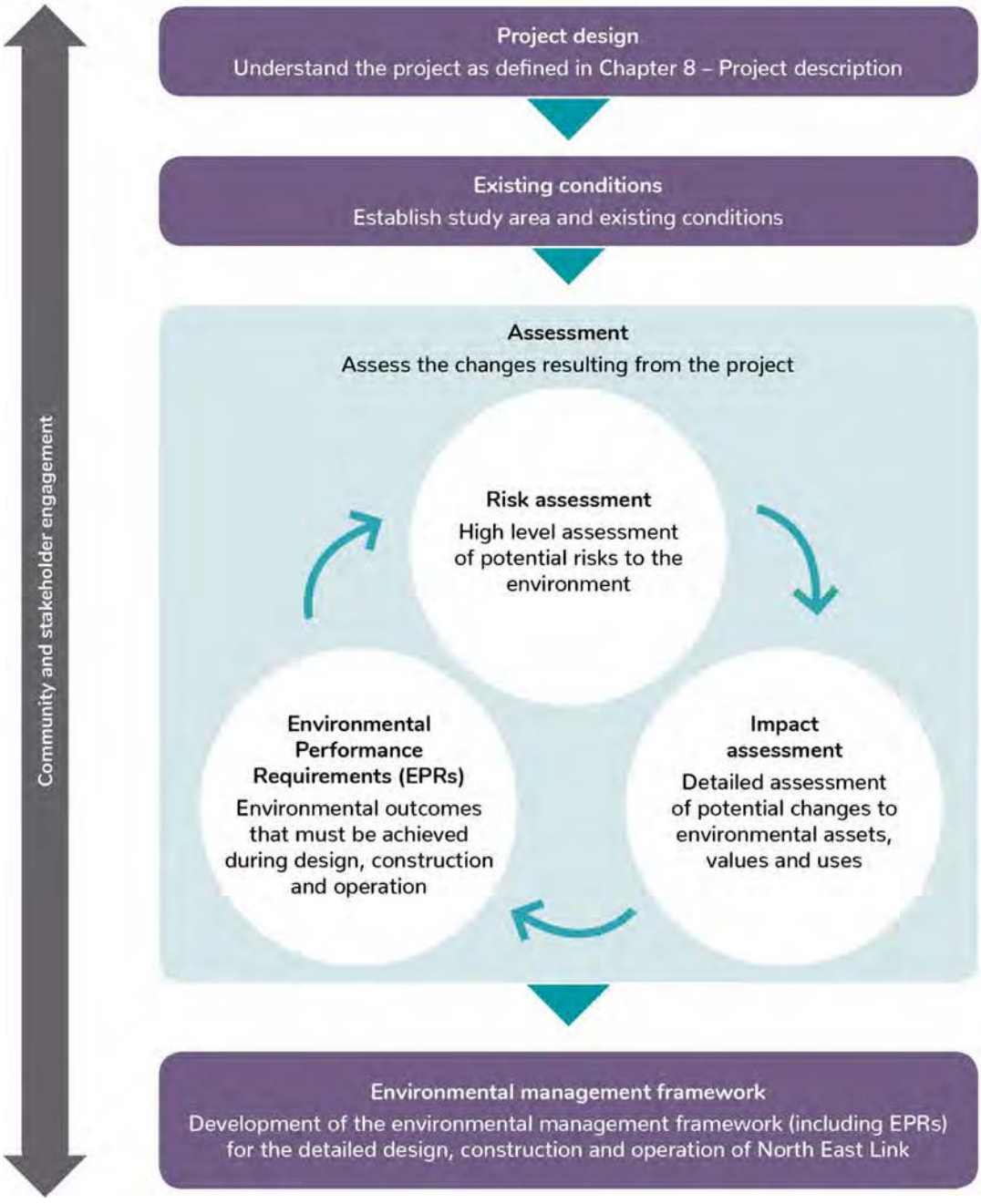

Figure 5-1 Overview of assessment method

The following sections outline the method for the Arboricultural impact assessment.

5.2 Study area

The study area for the arboricultural assessment is defined as the area within the proposed project boundary, as shown in Figure 5-2 on the next page.

This study is limited to an assessment of planted amenity trees to supplement the ecological flora assessment provided in Technical report Q – Ecology. That report includes an assessment of impacts to vegetation, including trees in Ecological Vegetation Classes (EVCs) and native trees classified as 'Scattered Trees'.
A scattered tree is defined by in the Department of Environment, Land, Water and Planning (DELWP) *Guidelines for the removal, destruction or lopping of native vegetation* as a native canopy tree that does not form part of a patch (DELWP, 2017, p. 6). Trees assessed in Technical report Q – Ecology include those subject to the EPBC Act, the FFG Act as well as Clause 52.17 Native Vegetation provisions under local planning schemes. Planted amenity trees are therefore those trees and tree groups that are not considered scattered trees nor are located within EVCs. Planted amenity trees are assessed in this report.

The project boundary includes the area where permanent infrastructure associated with the reference project would be located, as well as the footprint of works required during construction. A conservative approach has been taken in assessing impacts to trees. As well as assessing the tree removals required to facilitate construction of the project (that is, trees that would be within the direct footprint of proposed infrastructure), all other trees assessed within the broader project boundary are considered as potentially impacted by the project's construction. Potentially impacted trees include those located within the project boundary but which are physically separated from the proposed construction activities and where the risk of removal (or damage) is considered very low. These trees are conservatively assumed to be potentially impacted and include:

- Trees on escarpments vertically separated from works
- Trees behind existing sound walls that would likely be retained as part of the project
- Trees in areas adjacent to locations where works would likely be confined within existing freeway lanes.

The study area is generally limited to sites with planted amenity trees located on land managed by public authorities. This land includes freeway and public road reserves, VicRoads properties, public parks and a portion of the Hurstbridge rail line between Macleod railway station and Greensborough railway station. Trees within portions of Marcellin College, Trinity Grammar School Sporting Complex, Carey Grammar Sports Complex and at the Veneto Club, all located in Bulleen, have also been assessed. The study area for the purposes of the arboricultural assessment does not otherwise include trees located in private residential or commercial properties.

5.2.1 Banyule Flats and Warringal Parklands

Planted amenity trees within the Banyule Flats and Warringal Parklands over the main sections of the North East Link tunnels constructed with tunnel boring machines (TBMs) have not been assessed. Root growth for planted amenity trees is generally shallow (AS4970-2009 Protection of Trees on Development Sites, p. 25) and confined to depths of less than one metre. The depth of the North East Link bored tunnels means that tunnelling activities would have no potential to impact the roots of trees.

It is assumed that because of the relatively shallow root systems of planted amenity trees, it is unlikely they are drawing upon groundwater which is understood to be at depths considerably deeper than root growth.

For this reason, potential groundwater drawdown is not anticipated to impact planted amenity trees. Therefore in Figure 5-2 which shows the overall study area, the alignment of the bored tunnels was excluded from the arboricultural impact assessment.

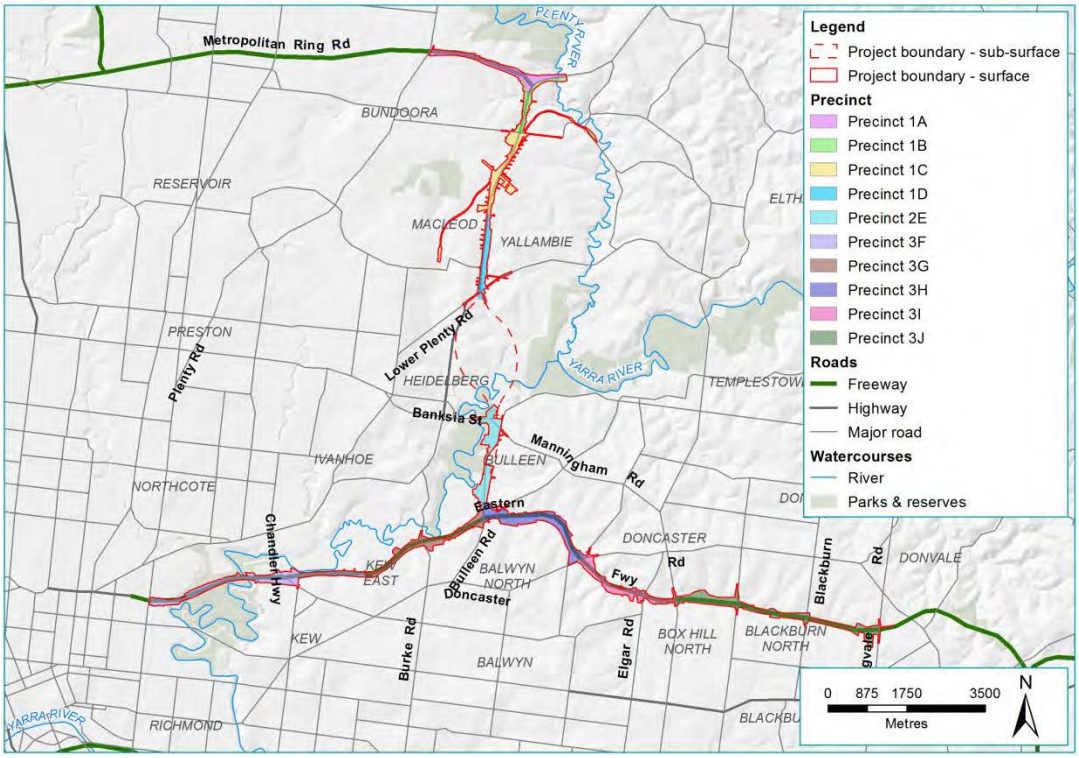

Figure 5-2 Overall study area

5.3 Existing conditions

Existing conditions have been established by undertaking an inventory of planted amenity trees and tree groups located within the project boundary.

Ground-based assessments were undertaken within precincts of the study area between April and October, 2018. Precincts are defined in Section 6 of this report.

Each tree or tree group has been identified to the specific level wherever possible and the following data was collected for each tree or tree group:

- Taxon
- Common name
- Origin
- Diameter at breast height (DBH) [estimated]
- Height of tree [as a range]
- Width of crown [estimated]
- Age
- Health

- Structure
- Useful life expectancy (ULE).

Definitions for each of these descriptors are included with the tree assessed data provided in Appendix B.

For the purposes of this report, a tree is defined as a woody perennial, usually having one dominant vertical trunk. The threshold of a canopy tree, as defined in the DELWP *Guidelines for the removal, destruction or lopping of native vegetation* of three metres high has been used as the minimum size for assessments (DELWP, p. 35).

The assessment does not include shrubs nor shrubby forms of species such as Cotoneaster (*Cotoneaster* spp.), Swamp Paperbark (*Melaleuca ericifolia*) and Sweet Bursaria (*Bursaria spinosa*). Arborescent (tree-like) forms of these species have been assessed, where they occur.

Collection of data for each tree or tree group on age and useful life expectancy (ULE) allows for the identification of planted amenity trees in the public realm that have been assessed as contributing to the urban landscape (semi-mature, mature and over-mature trees) and which are considered to be viable beyond the estimated construction timeframe of the project; that is trees with an ULE of 10 years or more. This category is described as MLTV trees (medium and long-term viability). Conversely, trees described as non-MLTV are those that do not yet contribute significantly to the public realm (juvenile trees) as well as those that have an assessed ULE of < 10 years and so are anticipated to be removed within the next 10 years. Removal of juvenile trees or those with very limited ULEs (less than 10 years) is assumed to have a low impact.

Tree assessments were undertaken by consultant arborists with a minimum Australian Qualification Framework (AQF) Level 5 in arboriculture (or equivalent). All data was entered into hand-held computers and tree or tree group locations were recorded on satellite imagery or recorded using a Global Navigation Satellite System (GNSS) receiver and Trimble TerraFlex software. Tree location plans have been generated using aerial imagery.

5.4 Risk assessment

An environmental risk assessment has been completed to identify environmental risks associated with construction and operation of North East Link. The risk-based approach is integral to the EES as required by section 3.1 of the Scoping Requirements and the *Ministerial guidelines for assessment of the environmental effects under the Environment Effects Act 1978*.

Specifically the EES risk assessment aimed to:

- Systematically identify the interactions between project elements and activities and assets, values and uses
- Focus the impact assessment and enable differentiation of significant and high risks and impacts from lower risks and impacts
- Inform development of the reference project to avoid, mitigate and manage environmental impacts
- Inform development of EPRs that set the minimum outcomes necessary to avoid, mitigate or manage environmental impacts and reduce environmental risks during delivery of the project.

This section presents an overview of the EES risk assessment process. EES Attachment III Environmental risk report describes each step in the risk assessment process in more detail and contains a consolidated risk register.

This technical report describes the risks associated with the project on [technical discipline]. Wherever risks relating to this study are referred to, the terminology 'risk XX01' is used. Wherever EPRs relating to this study are referred to, the terminology 'EPR XX1' is used. The risk assessment completed for this study is provided as Appendix A.

5.4.1 Risk assessment process

The risk assessment process adopted for North East Link is consistent with AS/NZS ISO 31000:2009 Risk Management Process. The following tasks were undertaken to identify, analyse and evaluate risks:

- Use existing conditions and identify applicable legislation and policy to establish the context for the risk assessment
- Develop likelihood and consequence criteria and a risk matrix
- Consider construction and operational activities in the context of existing conditions to determine risk pathways
- Identify standard controls and requirements (Environmental Performance Requirements (EPRs) to mitigate identified risks
- Assign likelihood and consequence ratings for each risk to determine risk ratings considering design, proposed activities and standard EPRs.

While there are clear steps in the risk process, it does not follow a linear progression and requires multiple iterations of risk ratings, pathways and EPRs as the technical assessments progress. Demonstrating this evolution, a set of initial and residual risk ratings and EPRs are produced for all technical reports. Figure 5-3 shows this process.

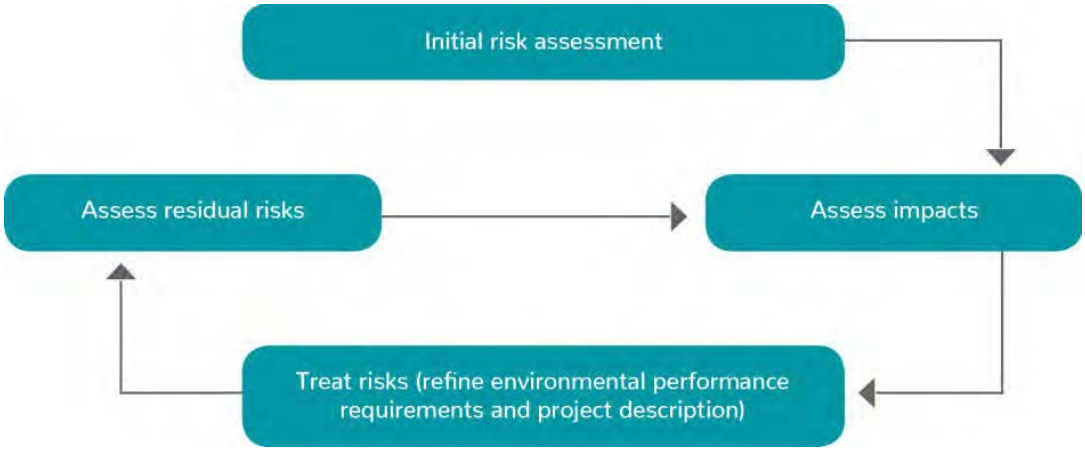

Figure 5-3 Risk analysis process

Rating risk

Risk ratings were assessed by considering the consequence and likelihood of an event occurring. In assessing the consequence, the extent, severity and duration of the risks were considered. These are discussed below.

Assigning the consequences of risks

'Consequence' refers to the maximum credible outcome of an event affecting the objectives in relation to an asset, value or use. Consequence criteria as presented in Chapter 4 – EES assessment framework, were developed for the North East Link EES to enable a consistent assessment of consequence across the range of potential environmental effects. Consequence criteria were assigned based on the maximum credible consequence of the risk pathway occurring. Where there was uncertainty or incomplete information, a conservative assessment was made on the basis of the maximum credible consequence.

Consequence criteria have been developed to consider the following characteristics:

- Extent of impact
- Severity of impact
- Duration of threat.

Severity has been assigned a greater weighting than extent and duration as this is considered the most important characteristic.

Each risk pathway was assigned a value for each of the three characteristics, which were added together to provide an overall consequence rating.

Further detail on the consequence criteria is provided Chapter 4 – EES assessment framework.

Assigning the likelihood of risk

'Likelihood' refers to the chance of an event happening and the maximum credible consequence occurring from that event. The likelihood criteria are presented in Table 5-1.

Table 5-1 Likelihood of an event occurring

Planned	The event is certain to occur
Almost certain	The event is almost certain to occur one or more times a year
Likely	The event is likely to occur several times within a five-year timeframe
Possible	The event may occur once within a five-year timeframe
Unlikely	The event may occur under unusual circumstances but is not expected (ie once within a 20-year timeframe)
Rare	The event is very unlikely to occur but may occur in exceptional circumstances (ie once within a 100-year timeframe)

5.4.2 Risk matrix and risk rating

Risk levels were assessed using the matrix presented in Table 5-2.

Table 5-2 Risk matrix

Likelihood	Consequence				
	Negligible	Minor	Moderate	Major	Severe
Rare	Very low	Very low	Low	Medium	Medium
Unlikely	Very low	Low	Low	Medium	High
Possible	Low	Low	Medium	High	High
Likely	Low	Medium	Medium	High	Very high
Almost certain	Low	Medium	High	Very high	Very high
Planned	Planned (negligible consequence)	Planned (minor consequence)	Planned (moderate consequence)	Planned (major consequence)	Planned (severe consequence)

5.4.3 Planned events

North East Link would result in some planned events, being events with outcomes that are certain to occur (ie planned impacts such as land acquisition), as distinct from risk events where the chance of the event occurring and its consequence is uncertain. Although planned events are not risks, these were still documented in the risk register as part of Attachment III – Risk report for completeness and assigned a consequence level in order to enable issues requiring further assessment or treatment to be prioritised.

These planned events were assessed further through the impact assessment process.

5.4.4 Risk evaluation and treatment

The risk assessment process was used as a screening tool to prioritise potential impacts and the subsequent level of assessment undertaken as part of the impact assessment. For example, an issue that was given a risk level of medium or above, or was identified as a planned event with a consequence of minor or above, would go through a more thorough impact assessment process than a low risk.

Where initial risk ratings were found to be 'medium' or higher, or were planned events with a consequence of 'minor' or higher, options for additional or modified EPRs or design changes were considered where practicable. It should be noted that the consequence ratings presented in the risk register are solely based on the consequence criteria presented in Attachment III – Risk report. Further analysis and evaluation of the impacts potentially arising from both risks and planned events and information on how these would be managed is provided in section 8.

5.5 Impact assessment

5.5.1 Construction assessment method

This study is primarily aimed at assessing the impacts to planted amenity trees and by extension, impacts to the urban forest from the project's construction. This assessment has involved:

- Assessing and mapping trees and tree groups within the proposed project boundary
- Reviewing detailed mapping of the reference project and identifying those trees within and close to construction areas
- Identifying the trees that would be impacted or potentially impacted which are categorised as MLTV trees.

Environmental Performance Requirements (EPRs) to define the performance outcomes to be achieved have been developed to:

- Avoid or minimise impacts to trees identified as potentially impacted by construction
- Mitigate the long-term impacts of tree removals and impacts on the urban forest.

For the purpose of this assessment it has been assumed that areas affected by construction works for the permanent infrastructure, or within construction compounds, would be impacted by the project. It has been assumed that some trees around the periphery of construction compounds may be able to be retained to screen surrounding properties where possible, and these have been classified as 'potentially impacted'. Trees located beyond the footprint of permanent infrastructure, but within the project boundary, have been indicated as 'potentially impacted', since the footprint of the final design is subject to change.

5.5.2 Operation assessment method

It is anticipated the operation of North East Link would have limited potential to impact planted amenity trees.

Risks would primarily be related to the growth of trees, including new plantings, and environmental changes that may limit their future growth and viability.

5.6 Rationale

This study has been prepared in reference to the scoping requirements and is focused on identifying potential adverse impacts on planted amenity trees within the study area. Planted amenity trees are a component of many valued landscapes.

An assessment has been made of all trees identified as impacted or potentially impacted by the project's construction. The primary focus is on trees that have been assessed as established and already contributing to the public realm (semi-mature, mature and over-mature trees) and which are likely to remain viable for more than 10 years, which is the estimated construction timeframe of the project. The removal of juvenile trees as well as larger trees that would likely need to be removed within the next 10 years regardless of the project is assumed to be a lower adverse impact in terms of the scoping requirements.

5.7 Limitations, uncertainties and assumptions

5.7.1 Assessment against reference project

This assessment has been undertaken against a reference project using a hand-held Global Navigation Satellite System (GNSS) and marked up tree locations (such as aerial photography). Estimates of the number of trees that would be removed in this assessment would likely be different to those required to construct the final design of the project.

5.7.2 Data collection

Data collected for this study is intended for a high-level assessment of arboricultural impacts for trees within the study area for the reference project and is consistent with previous EES assessments. Due to the location of many trees in inaccessible locations such as freeway road reserves, many tree assessments, particularly trees in fenced freeway road reserves, were undertaken at some distance. Project safety requirements prevented pedestrian access to freeway road reserves. In many instances along the Eastern Freeway and M80 Ring Road, assessments were made from overpasses, pedestrian bridges or from vehicle drive-bys.

Map-based collection of tree locations is insufficient to undertake a detailed arboricultural impact assessment based on the guidelines of AS4970-2009 *Protection of Trees on Development Sites*. A detailed arboricultural assessment would be undertaken once the project's detailed design was confirmed.

5.7.3 Measurement of urban forest canopy impacts

Mapping and quantifying of the urban forest cover—that is, measuring the actual total area of tree canopies—has not been undertaken for the arboricultural assessment. The Department of Environment, Land, Water and Planning (DELWP) is currently mapping urban forest cover for the entire Melbourne metropolitan area, expected to be complete in late-2018. Once the data is available, the total impact to canopy cover, including planted amenity trees as well as trees in EVCs, can be measured and quantified.

5.8 Stakeholder engagement

Stakeholders and the community were consulted to support the preparation of the North East Link EES and to inform the development of the project and understanding of potential impacts. Table 5-3 lists specific engagement activities that have occurred in relation to arboriculture, with more general engagement activities occurring at all stages of the project. Feedback received during community consultation sessions is summarised in Section 5.9.

Table 5-3 Stakeholder engagement undertaken for arboricultural assessment

Activity	When	Matters discussed	Outcome
Email communication with Banyule City Council	10 April 2018	Request for existing tree data for the municipality area in the vicinity of the project.	Tree data provided in April 2018
Email communication with Boroondara City Council	14 May 2018	Request for existing tree data for the municipal area in the vicinity of the project.	Tree data provided in May 2018

Activity	When	Matters discussed	Outcome
Email communication with Manningham City Council	10 April 2018	Request for existing tree data for the municipal area in the vicinity of the project.	Tree data provided in May 2018
Email communication with Yarra City Council	10 April 2018	Request for existing tree data for the municipal area in the vicinity of the project.	Tree data provided in May 2018
Email communication with Whitehorse City Council	10 April 2018	Request for existing tree data for the municipal area in the vicinity of the project.	No tree data available.
Meeting with DELWP	3 October 2018	Availability of state data relating to existing canopy	Interim historical data provided
Meeting with Yarra City Council	23 October 2018	Provided overview on urban forest canopy strategy and requested list of opportunity sites for canopy re-establishment	Council emailed a list of possible tree planting sites, 24 October 2018
Meeting with Banyule City Council	24 October 2018	Provided overview on urban forest canopy strategy and requested list of opportunity sites for canopy re-establishment	Council emailed a list of possible tree planting sites, 2 November 2018
Meeting with Whitehorse City Council	25 October 2018	Provided overview on urban forest canopy strategy and requested list of opportunity sites for canopy re-establishment	Council emailed a list of possible tree planting sites, 2 November 2018
Meeting with Nillumbik Shire Council	25 October 2018	Provided overview on urban forest canopy strategy and requested list of opportunity sites for canopy re-establishment	Shire emailed a list of possible tree planting sites, 5 November 2018
Meeting with Melbourne Water (MW)	30 October 2018	Provided overview on urban forest canopy strategy and requested list of opportunity sites for canopy re-establishment	MW confirmed they have no sites to add at this time due to lack of detailed data and planning near study area. Agreed to share and partner when data is available, 7 November 2018
Meeting with Boroondara City Council	7 November 2018	Provided overview on urban forest canopy strategy and requested list of opportunity sites for canopy re-establishment	Council emailed a list of possible tree planting sites 14 November 2018
Teleconference with Manningham City Council	14 November 2018	Provided overview on urban forest canopy strategy and requested list of opportunity sites for canopy re-establishment	Council has no data to provide opportunities, 26 November 2018

5.9 Community feedback

In addition to consultation undertaken with specific stakeholders, consultation has been ongoing with the community throughout the design development and the EES process. Feedback relevant to the arboriculture assessment is summarised in Table 5-4, along with where and how we have addressed those topics in this report.

Table 5-4 Community consultation feedback addressed by arboriculture

Issues raised during community consultation	How it's been addressed
Loss of trees along the entire project corridor, particularly in Koonung Creek Reserve and at Simpson Barracks.	This report has assessed the number of planted amenity trees expected to be affected by the project in Section 8 of this report, and their locations are identified in Appendix C. Trees and other vegetation comprising ecological vegetation classes is discussed in Technical report Q – Ecology.
Number of trees expected to be removed and how these will be replaced.	The expected number of planted amenity trees affected is discussed in Section 8 of this report. Tree retention opportunities will be maximised during detailed design to minimise canopy loss. Where they can't be avoided, EPR AR3 has been designed to mitigate the impact of lost canopy cover through tree replanting.
Keeping as many trees as possible along the entire project alignment.	Tree retention opportunities will be maximised during detailed design to minimise canopy loss, as specified in EPR AR1.
Replacing trees that are removed with mature trees, or for new trees to be planted as soon as possible.	Opportunities for early replanting outside of the construction areas will be considered as part of the Tree Canopy Replacement Program (EPR AR3). Replanting with larger nursery stock will be limited due to poorer growth performance than smaller, more vigorous specimens.
Loss of old growth trees on Simpson Barracks land, including Red Gum, Yellow Box and Scribbly Gum trees.	As discussed in Section 12.1.1 of Technical report Q – Ecology, vegetation within the project boundary at Simpson Barracks is expected to be lost due to the project, including large trees. Where the removal of native vegetation is unavoidable the project would be required to meet the assessment and offset requirements of the DELWP *Guidelines for the removal, destruction or lopping of native vegetation.*
Potential damage to areas of environmentally significant tree habitat, particularly at Banyule Flats.	The impact on the areas of Banyule Flats and Warringal Parkland has been minimised by tunnelling beneath these sensitive areas.
Historic River Red Gum at the Caltex service station on Manningham Road.	This tree is expected to be lost due to the project. Its historical value and impacts are discussed in the Technical report K – Historical heritage.

6. Existing conditions

The existing conditions are described within 10 distinct precincts across the three components of the project.

Component 1 – M80 Ring Road to River Gum Walk

There are four precincts in Component 1 which are discussed in Section 6.1.

- Precinct 1.A – M80 Ring Road
- Precinct 1.B – M80 Ring Road, Greensborough Bypass to Grimshaw Street. Hurstbridge rail reserve, north of Grimshaw Street to Greensborough railway station
- Precinct 1.C – Greensborough Bypass/Greensborough Road, Grimshaw Street to Yallambie Road. Hurstbridge rail reserve, south of Grimshaw Street to Macleod railway station
- Precinct 1.D – Greensborough Road, Yallambie Road to River Gum Walk

Component 2 – Manningham Road to Koonung Creek, Bulleen

There is one precinct in Component 2, discussed in Section 6.2.

- Precinct 2.E

Component 3 – Eastern Freeway

There are five precincts in Component 3, which are discussed in Section 6.3.

- Precinct 3.F – Hoddle Street to Belford Road
- Precinct 3.G – Belford Road to Bulleen interchange
- Precinct 3.H – Bulleen interchange to Doncaster Road
- Precinct 3.I – Doncaster Road to Tram Road
- Precinct 3.J – Tram Road to Springvale Road

As discussed in Section 5.2.1, planted amenity trees over the areas with bored tunnels beneath have not been assessed, except where ground improvement works are proposed at the southern and northern portals of the tunnels.

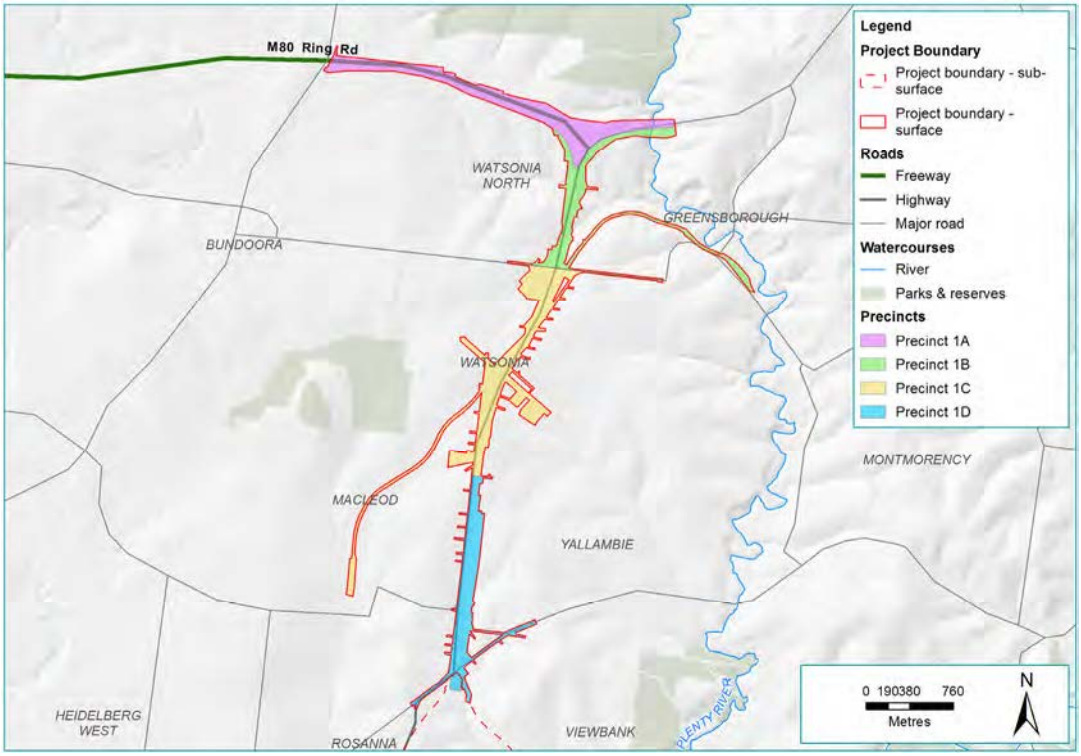

Figure 6-1 Precincts 1.A – 1.D

6.1 Component – M80 Ring Road to River Gum Walk

The four precincts within Component 1 are shown in Figure 6-1 above.

6.1.1 Precinct 1.A – M80 Ring Road

Precinct 1.A is the northern-most portion of the project boundary, comprising trees planted along the M80 Ring Road between Plenty Road and the Greensborough Bypass.

The municipal boundary between Banyule and Nillumbik bisects the centre of the M80 Ring Road.

Treed character

The treed character of this precinct is defined by:

- Dense plantations located to each side of the M80 Ring Road, including a linear buffer between the M80 Ring Road and neighbouring houses to the south
- Large groupings of trees in monocultures within a large, isolated island of land between the M80 Ring Road on and off-ramps at Greensborough Bypass
- Groupings of trees in the east of the precinct forming a treed buffer to residential precincts to the north.

The precinct has an overwhelming native landscape character such as Yellow Box shown in Figure 6-2 on the next page, including locally indigenous, Victorian and Australian native species planted as amenity trees. The six species comprising over 68 per cent of the trees assessed within this precinct are summarised in Table 6-1.

Plantations of large-growing trees, including those within Valley Grassy Forest EVCs, provide a near continuous canopy cover along the reserves to both sides of this section of the M80 Ring Road.

Table 6-1 Most common taxa recorded within Precinct 1.A

Taxon	Common name	% of trees in precinct
Eucalyptus melliodora	Yellow Box	22%
Eucalyptus cladocalyx	Sugar Gum	11%
Corymbia maculata	Spotted Gum	13%
Eucalyptus camaldulensis	River Red Gum	7.5%
Eucalyptus sp.	Eucalypt	9%
Eucalyptus leucoxylon	Yellow Gum	6%
TOTAL		**68.50%**

Many of the of the trees within this precinct are located behind fenced (or walled) sections of the M80 Ring Road reserve and assessments were undertaken at a distance from adjacent publicly accessible reserves, a pedestrian crossover and, as a last resort, vehicle drive-bys. The tree plantations shown in Figure 6-3 located on the central island at the termination of the M80 Ring Road (an inaccessible zone) were especially difficult to assess due to the physical distances from adjacent vantage points.

Statutory controls

There are no planning overlays that apply to planted amenity trees within this precinct.

Figure 6-2 Yellow Box (*Eucalyptus melliodora*) planted on the south side of the M80 road reserve

Figure 6-3 Trees on the isolated central island at the eastern end of the M80 Ring Road

6.1.2 Precinct 1.B – M80 Ring Road, Greensborough Bypass to Grimshaw Street

Precinct 1.B includes the eastern side of the Greensborough Bypass from the Plenty River crossing, and both sides of the bypass from the M80 Ring Road to Grimshaw Street. The precinct also includes the railway reserve north of Grimshaw Street, extending to Greensborough railway station.

All trees within this precinct are located within the City of Banyule.

Treed character

The treed character of this precinct is defined by large numbers of smaller-scale native trees, including locally indigenous, Victorian and Australian native species. While both sides of the Greensborough Bypass are well vegetated, this is generally with smaller-scale species, most notably Giant Honey Myrtle (*Melaleuca armillaris*) grouped in substantial plantations, and recently planted and naturalised Lightwood (*Acacia implexa*) which are yet to develop mature proportions. Examples are shown in Figure 6-4. These two generally smaller sized species comprise 48 per cent of all trees assessed within this precinct, as shown in Table 6-2.

The generally limited scale of canopy cover within this precinct has reduced capacity to provide shading to adjacent roadways, especially when compared with the plantations in Precinct 1.A, but the canopy does provide a green buffer to adjacent areas of public open space and housing. Trees assessed in adjacent local streets and council reserves are generally of a larger scale, such as a number of Eucalypt species including Yellow Box and Red Ironbark, amongst others.

Table 6-2 Most common taxa recorded within Precinct 1.B

Taxon	Common name	% of trees in precinct
Acacia implexa	Lightwood	24%
Melaleuca armillaris	Giant Honey Myrtle	24%
TOTAL		**48%**

Figure 6-4 Typical smaller-scale planted and naturalised trees within Precinct 1.B

Statutory controls

The central portion of Greensborough Bypass is subject to Schedule 5 of the Vegetation Protection Overlay (VPO5) as part of the Banyule Planning Scheme, as shown in Figure 6-5. This overlay specifically seeks to protect large trees, including indigenous, native and exotic species that contribute to the landscape character of the area.

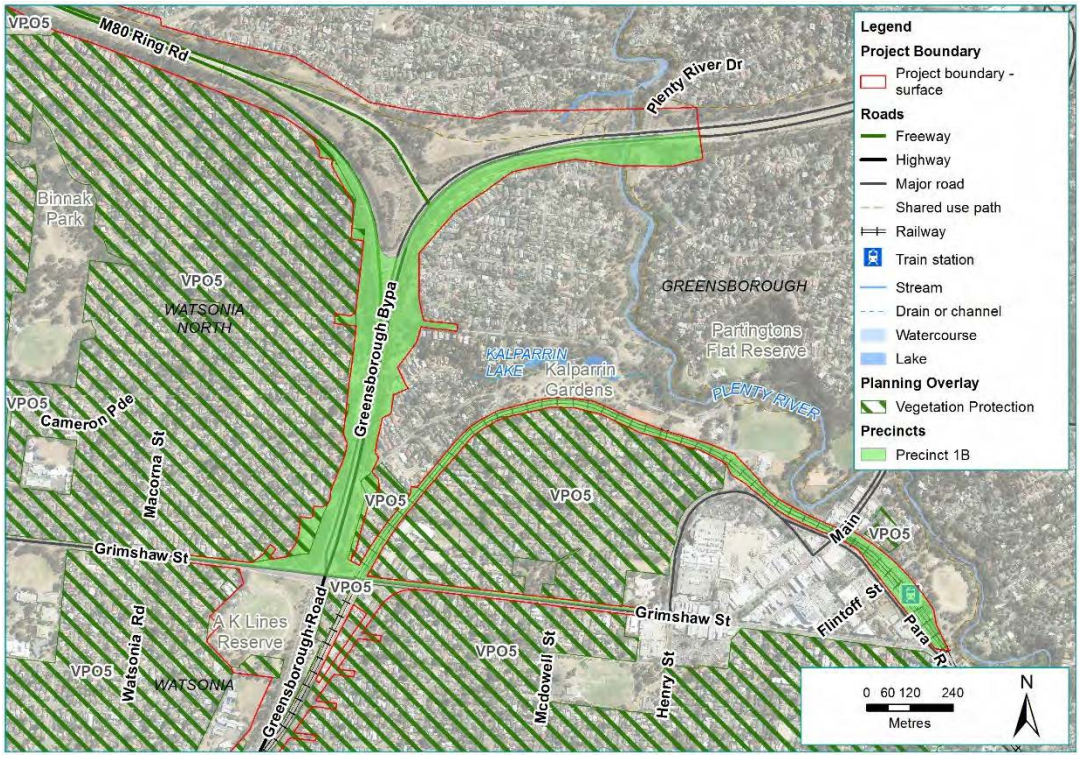

Figure 6-5 Extent of VPO5 within Precinct 1.B

6.1.3 Precinct 1.C – Greensborough Bypass/Greensborough Road, Grimshaw Street to Yallambie Road

Precinct 1.C includes Greensborough Bypass/Greensborough Road from Grimshaw Street in the north to Yallambie Road in the south. The precinct includes planted amenity trees located within:

- The Greensborough Bypass/Greensborough Road road reserve and adjacent local road reserves, including a plantation of substantial trees in a reserve between Greensborough Bypass and Service Road, Watsonia
- The Watsonia railway station car park and environs
- AK Lines Reserve and Gabonia Avenue Reserve, Watsonia, and Winsor Reserve, Macleod
- The high voltage powerline easement between Gabonia Avenue Reserve and the Greensborough Bypass
- Watsonia Primary School
- Hurstbridge railway reserve, south of Grimshaw Street to Macleod railway station.

All trees within this precinct are located within the City of Banyule.

Treed character

The treed character of this precinct varies significantly. The Greensborough Bypass/Greensborough Road alignment and Watsonia railway station area have a generally open, sparsely treed character, punctuated by small informal clusters of trees and shrubs such as at the intersection of Watsonia Road. There is limited, large-scale canopy along the Greensborough Bypass.

In contrast, each of the three recreational reserves within the precinct are ringed by groves of large, predominantly indigenous and native trees which provide important, large-scale canopy cover to boundaries adjacent to residential pockets and local streets. The linear reserve between Service Road and the Greensborough Bypass is also planted with large-scale native trees that provide a buffer between the residential precinct to the east and the bypass, located on higher ground to the west.

The precinct contains a diversity of species and trees of varying scale, as listed in Table 6-3. While comprising the greatest proportion of trees within the precinct, Lightwood (*Acacia implexa*) mainly occurs as smaller-scaled specimens and naturalising regrowth. The larger-scaled Eucalypts (*Eucalyptus* spp., *Corymbia* spp.) are generally confined to each of the three reserves within the precinct.

Table 6-3 Most common taxa recorded within Precinct 1.C

Taxon	Common name	% of trees in precinct
Acacia implexa	Lightwood	18%
Melaleuca armillaris	Giant Honey Myrtle	5.5%
Eucalyptus melliodora	Yellow Box	4.5%
Eucalyptus camaldulensis	River Red Gum	4%
Acacia melanoxylon	Blackwood	4%
Eucalyptus sideroxylon	Red Ironbark	3.5%
Acacia baileyana	Cootamundra Wattle	3.5%
Eucalyptus mannifera	Brittle Gum	3%
Acacia saligna	Orange Wattle	2.5%
Cupressus macrocarpa	Monterey Cypress	2.5%
TOTAL		**51%**

Statutory controls

VPO5, which applies to much of the adjacent residential and commercial precincts, applies to three areas within Precinct 1.C, as shown in Figure 6-6. These areas are:

- The southern side of AK Lines Reserve
- The western end of Nell Street West, Watsonia
- A portion of the Service Road road reserve managed by the City of Banyule.

The objectives of VPO5 are discussed in Section 6.1.2 of this report.

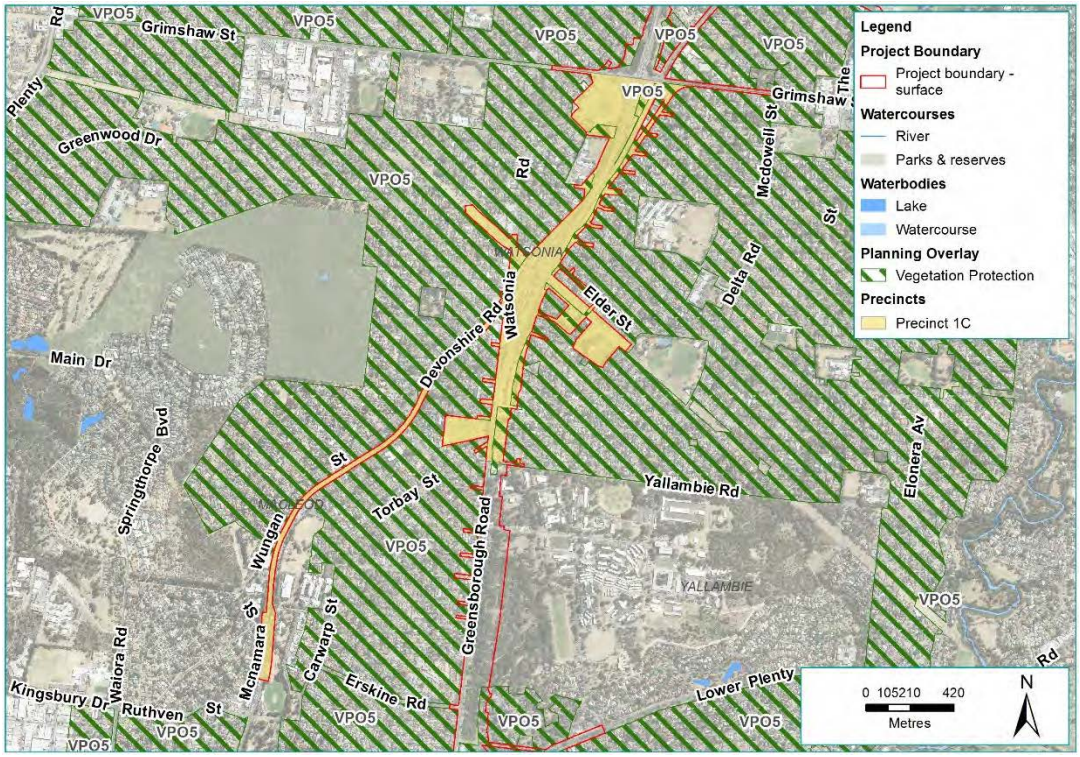

Figure 6-6 Extent of VPO5 within Precinct 1.C

Three individual trees within the Service Road road reserve plantation are subject to Schedule 4 to the Environmental Significance Overlay (ESO4) as part of the Banyule Planning Scheme, as shown in Figure 6-7. ESO4 protects trees identified as significant within Banyule from the *Banyule City Council Significant Trees Register*. The objective of the overlay is specifically to protect and enhance trees and areas of vegetation that are significant. The three trees, all Yellow Box (*Eucalyptus melliodora*) are identified as Trees 051 (Tree C-669), 052 (Tree C-637) and 053 (Tree C-613) in the table of significant vegetation within ESO4.

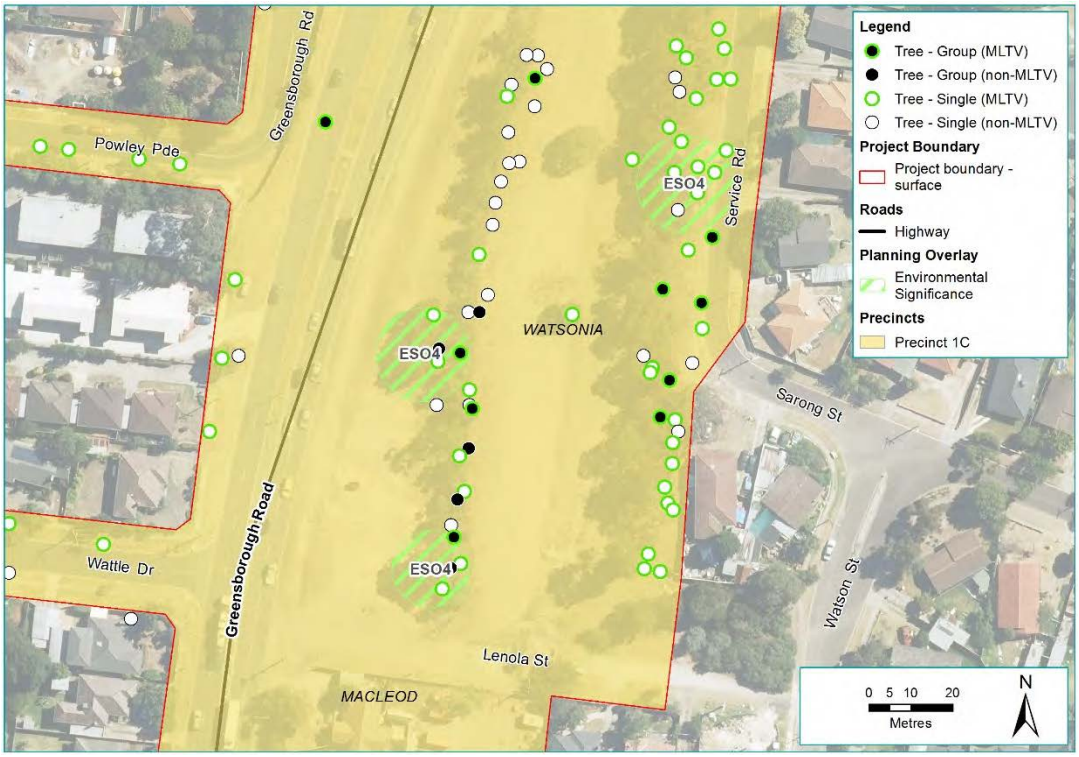

Figure 6-7 Trees subject to ESO4 within Precinct 1.C

6.1.4 Precinct 1.D – Greensborough Road, Yallambie Road to River Gum Walk

Precinct 1.D includes the southern extent of Greensborough Road from Yallambie Road in the north to Lower Plenty Road and River Gum Walk in the south. The precinct includes planted amenity trees located within:

- The Greensborough Road and adjacent local road reserves
- The Lower Plenty Road road reserve
- Borlase Reserve
- Simpson Barracks
- The publicly accessible Commonwealth land south of Simpson Barracks
- The northern end of River Gum Walk linear reserve.

All trees within this precinct are located within the City of Banyule.

Treed character

The treed character of this precinct, like Precinct 1.C to the north, varies significantly. Greensborough Road contains only a limited number of street trees with a generally open landscape character. The most notable vegetative feature within this precinct is the band of trees within Borlase Reserve extending along the eastern side of Greensborough Road into the Plains Grassy Woodlands native vegetation patch within Simpson Barracks. This provides near continuous, large-scale canopy cover along an approximately one-kilometre section of Greensborough Road.

Only a limited number of planted amenity trees have been assessed within Simpson Barracks, with most of the vegetation in the west of that site subject to native vegetation provisions covered in Technical report Q – Ecology.

To the south of Simpson Barracks and the unfenced section of Commonwealth land, Borlase Reserve contains a mix of locally indigenous, Victorian and Australian native trees, as well as a number of exotic species. The northern end of River Gum Walk has a stronger indigenous character, although a grove of Willow (*Salix babylonica*) have naturalised within a portion of the reserve.

River Red Gums (*Eucalyptus camaldulenis*) comprise the greatest proportion of planted amenity trees within the precinct, widely planted in Borlase Reserve and River Gum Walk (Table 6-4).

Table 6-4 Most common taxa recorded within Precinct 1.D

Taxon	Common name	% of trees in precinct
Eucalyptus camaldulensis	River Red Gum	12%
Eucalyptus melliodora	Yellow Box	9%
Pinus radiata	Monterey Pine	5%
Acacia implexa	Lightwood	5%
Fraxinus angustifolia	Desert Ash	4%
TOTAL		**35%**

Statutory controls

VPO5, which applies to much of the adjacent residential and commercial precincts, applies to two areas within Precinct 1.D, as shown on Figure 6-8. These areas are:

- Borlase Reserve, including the Drysdale Street and Borlase Street road reserves
- A portion of the western side of River Gum Walk.

The objectives of VPO5 are discussed in Section 6.1.2 of this report.

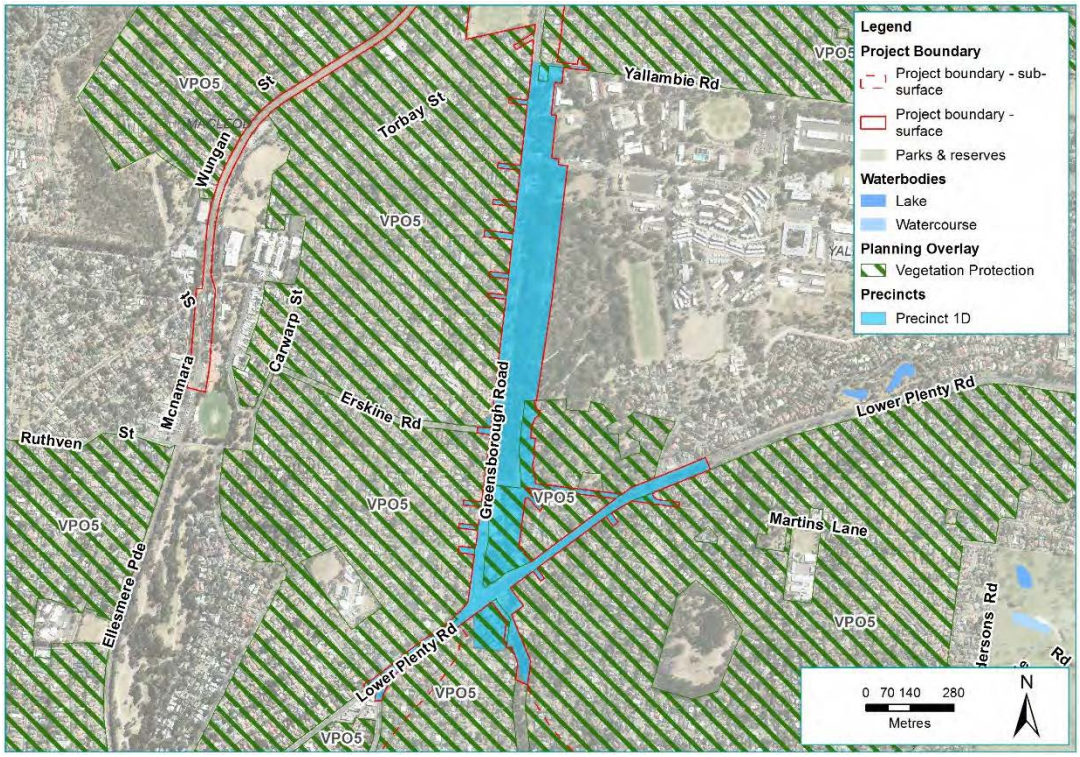

Figure 6-8 Extent of VPO5 within Precinct 1.D

The portion of River Gum Walk assessed as part of this study is subject to Schedule 4 to the Environmental Significance Overlay (ESO4) as part of the Banyule Planning Scheme, identified as 043 in the table of significant vegetation within ESO4 and shown at Figure 6-9. The vegetation protected is noted as Yellow Box (*Eucalyptus melliodora*) and River Red Gum (*E. camaldulensis*) but does not identify which individual specimens within the extensive parkland are subject to protection.

The objectives of ESO4 are discussed at Section 6.1.3 of this report.

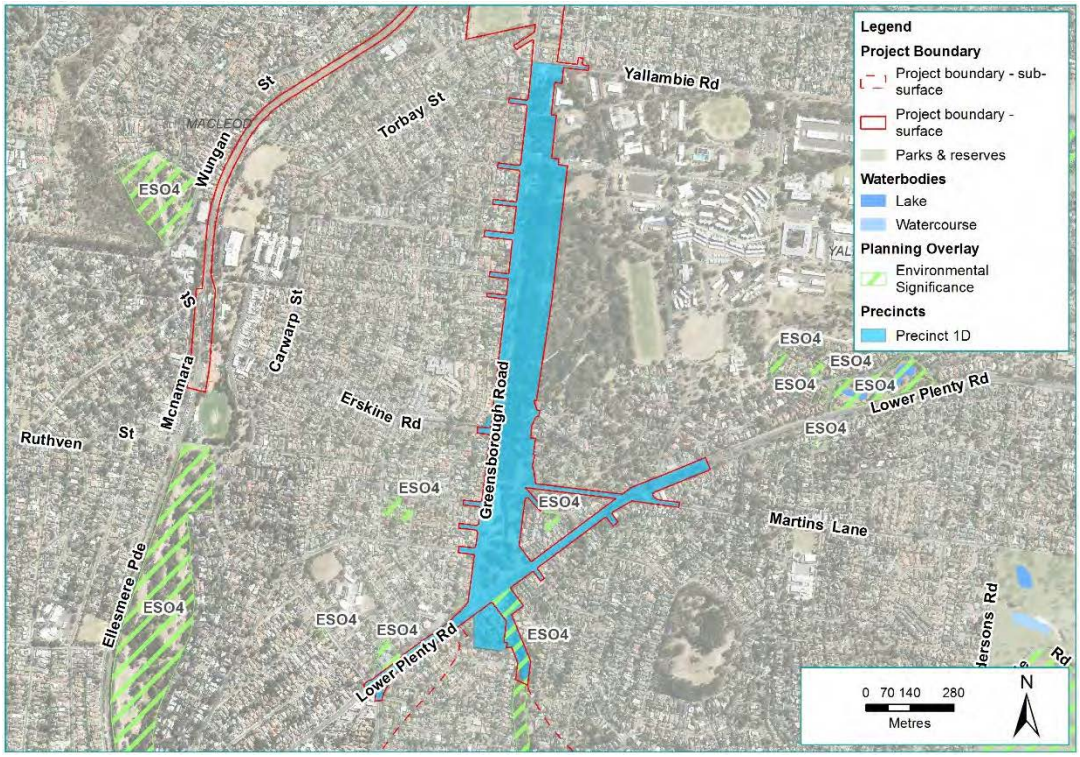

Figure 6-9 Extent of ESO4 within Precinct 1.D

The western side of Borlase Reserve is subject to the Public Acquisition Overlay (PAO) as part of the Banyule Planning Scheme (Figure 6-10). The purpose of the overlay is for road construction or widening for the Roads Corporation (VicRoads).

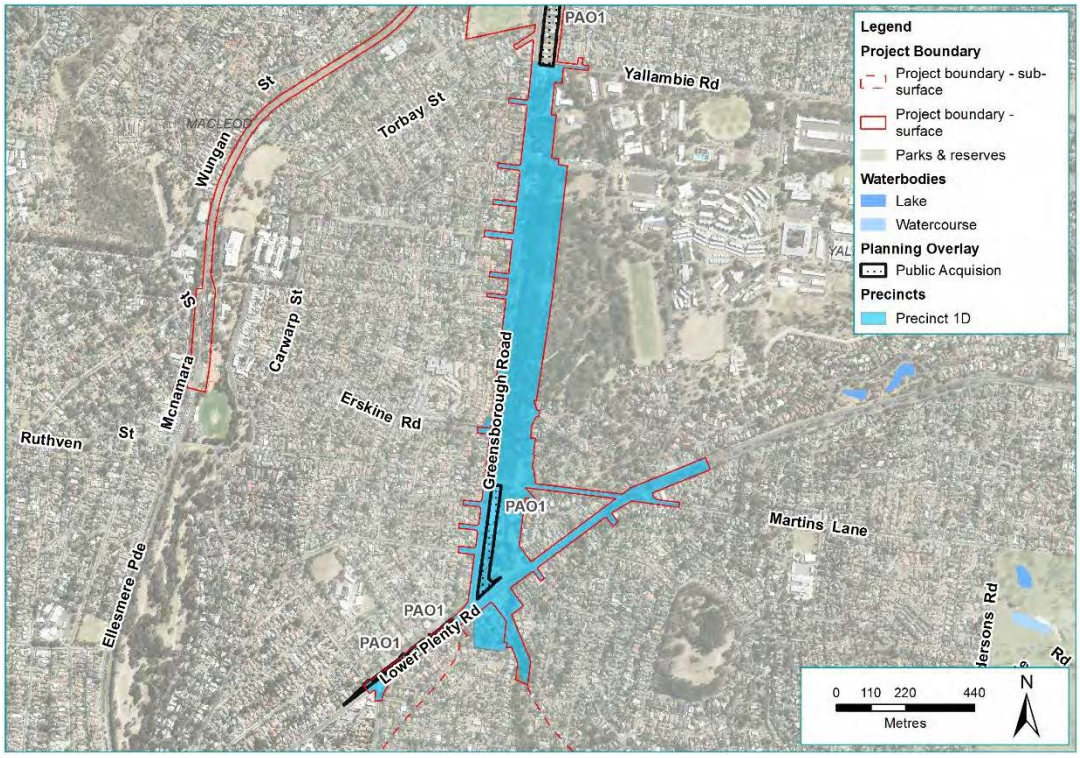

Figure 6-10 Extent of PAO within Precinct 1.D

6.2 Component 2 – Manningham Road to Koonung Creek, Bulleen

Component 2 of the study area comprises a single precinct, 2.E. Component 2 includes the proposed interchange at Manningham Road, extending southwards to the southern portal and Koonung Creek, Bulleen, as shown in Figure 6-11 on the next page. The precinct includes planted amenity trees located within:

- Road reserves, including Bulleen Road and Manningham Road and adjacent local streets
- The southern portion of Banksia Park and adjacent Yarra River parklands to the south of Manningham Road
- Bulleen Park
- Portions of Marcellin College, Trinity Grammar School Sporting Complex, Carey Grammar Sports Complex and the Veneto Club.

No access was available to the former Bulleen Drive-in site, although prominent, larger tree plantings have been assessed from adjacent road reserves.

All trees within this precinct are located within the City of Manningham.

Treed character

There is significant variation in the treed character of this precinct, with Banksia Park and Yarra River parklands in the north of precinct well treed compared with the relatively sparsely treed streetscapes of the commercial and light industrial precinct to the south and east of these parklands.

Further to the south, although Bulleen Road contains limited street tree plantations, extensive, large-scaled plantings within the adjacent school playing fields, Bulleen Park and at the Veneto Club provide a much leafier outlook to the streetscape. These trees are of a scale where they provide shade at various times of the day to the adjacent Bulleen Road road reserve.

While there are some exotic plantings throughout the precinct, the overall planted character is defined by large-scaled locally indigenous, Victorian and Australian native trees. This is confirmed in a review of the most widely planted amenity trees within the precinct, which reveals large trees from the Eucalypt group (*Eucalyptus* spp., *Corymbia* spp.) and River She-oaks (*Casuarina cunninghamiana*) comprise almost half the tree plantings) assessed within this precinct, as shown in Table 6-5.

Table 6-5 Most common taxa recorded within Precinct 2.E

Taxon	Common name	% of trees in precinct
Eucalyptus camaldulensis	River Red Gum	19%
Corymbia maculata	Spotted Gum	9.5%
Eucalyptus melliodora	Yellow Box	8%
Casuarina cunninghamiana	River She-oak	3.5%
Eucalyptus leucoxylon	Yellow Gum	3%
Corymbia citriodora	Lemon-scented Gum	3.5%
TOTAL		**46.5%**

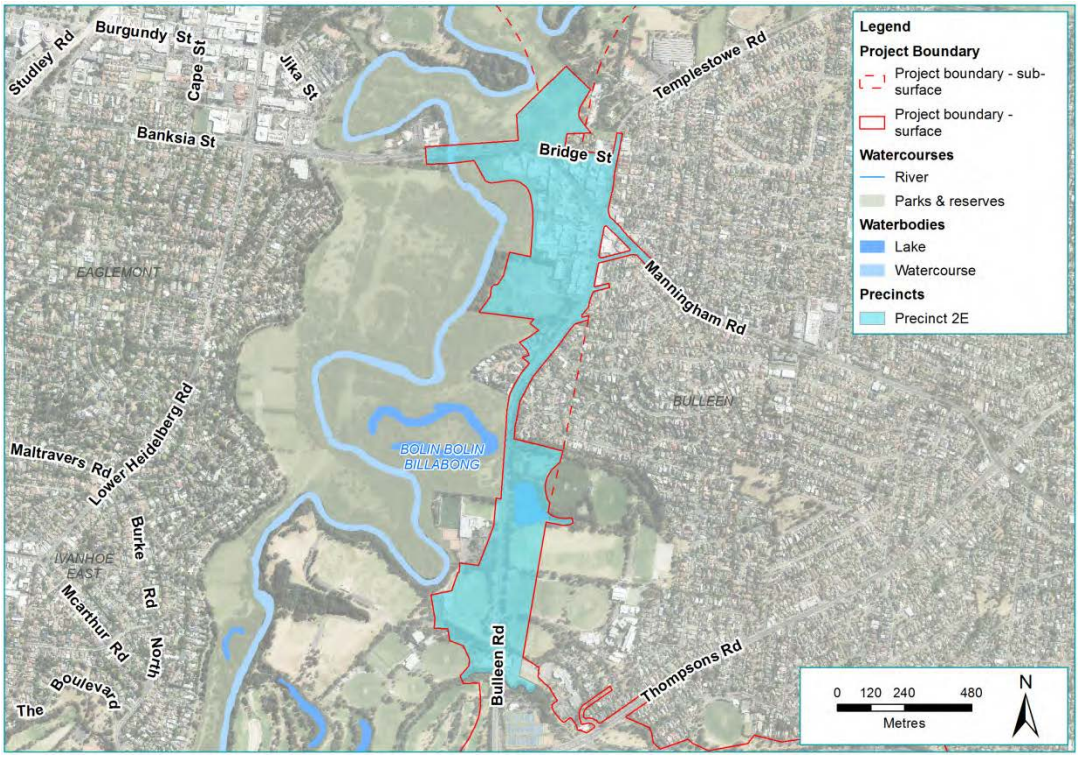

Figure 6-11 Precinct 2.E

Statutory controls

Substantials areas within Precinct 2.E are subject to Schedules 2 and/or 3 of the Environmental Significance Overlay as part of the Manningham Planning Scheme as shown on Figure 6-12 on the next page.

These areas include:

- Banksia Park and the Yarra River Parklands
- The former Bulleen Drive-in site
- Bulleen Park, Trinity Grammar School Sporting Complex, Carey Grammar Sports Complex and the Veneto Club.

ESO2 seeks to protect sites of biological significance which comprise some of the most intact and significant areas of indigenous vegetation within the City of Manningham, known as Core and Critical Conservation areas.

ESO3 has a slightly broader scope, seeking to protect sites assessed as being either buffer habitat or land with values that supports Core and Critical Conservation areas (and protected under ESO2). Buffer Conservation Areas, while usually more modified from their presumed 'natural' condition than Core Conservation Areas, nevertheless have environmental values in their own right, and also provide additional (usually adjacent) habitat that supports the ecological integrity and function of Core Conservation Areas.

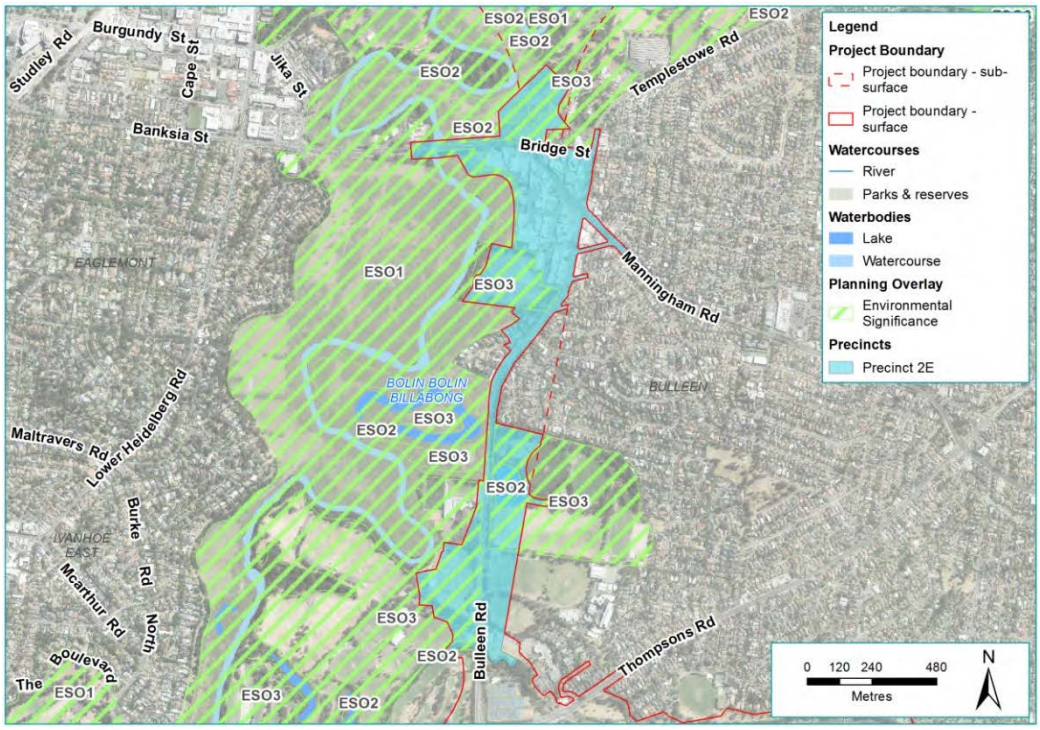

Figure 6-12 Extent of ESO2 and 3 within Precinct 2.E

All the land to the west side of Bulleen Road within Precinct 2.E is subject to Schedule 2 to the Significant Landscape Overlay (SLO2) that applies as part of the Manningham Planning Scheme, as shown in Figure 6-13.

SLO2 seeks to protect the Yarra (Birrarung) River Corridor Environs, the near continuous vegetated landscape experience that provides a highly valued, secluded natural environment, enjoyed by local and metropolitan communities.

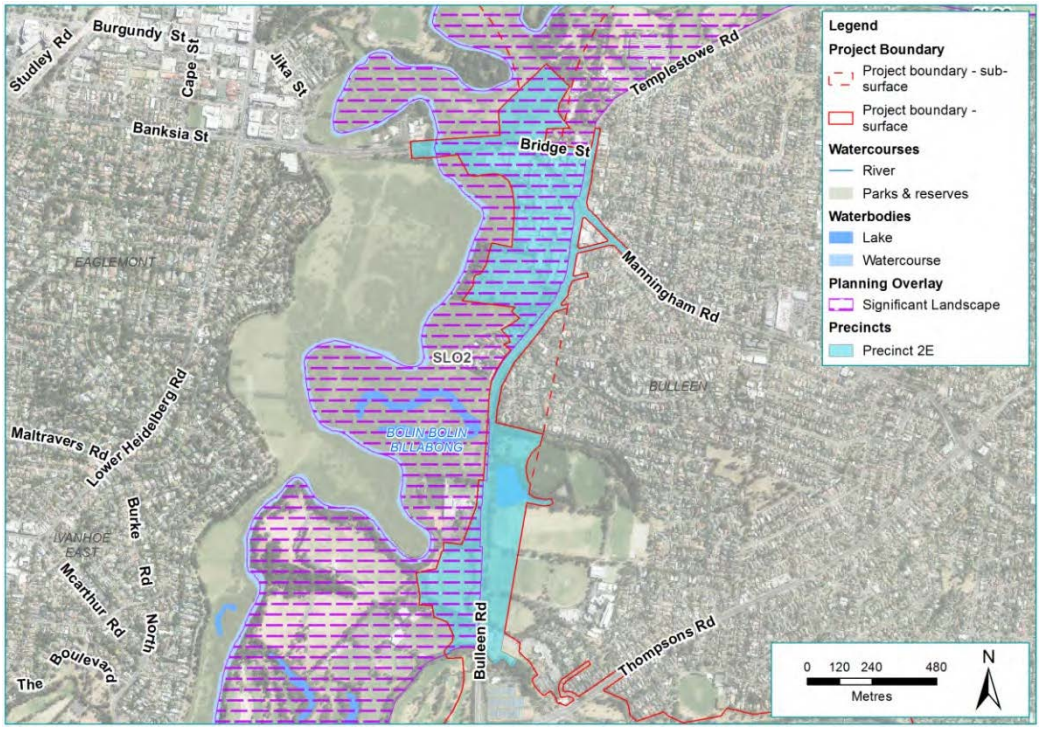

Figure 6-13 Extent of SLO2 within Precinct 2.E

6.3 Component 3 – Eastern Freeway

The five precincts within Component 3 are shown in Figure 6-14.

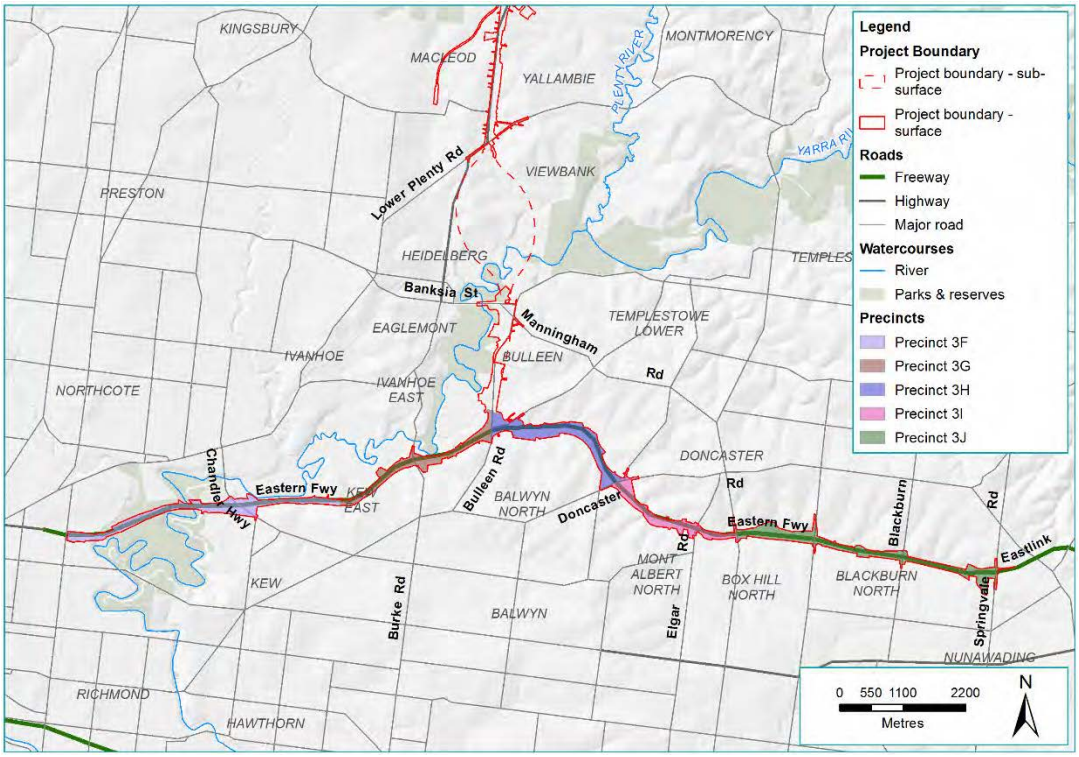

Figure 6-14 Precincts 3.F – 3.J

6.3.1 Precinct 3.F – Hoddle Street to Belford Road

Precinct 3.F is located in the most western section of the study area starting near Hoddle Street, Clifton Hill to just beyond Belford Road, Kew East in the east. The precinct includes planted amenity trees located:

- Within the Eastern Freeway road reserve
- Along the Main Yarra Trail, including Kew Recreation Reserve
- Within Fairlea Reserve and Merri Creek Parklands, Fairfield Park
- Within a vacant VicRoads site to the west of Chandler Highway.

Trees assessed within this precinct are located within the City of Yarra and City of Boroondara.

Treed character

The treed character within this precinct can be broken into three broad categories:

- The relatively open, treeless road reserve of the western sections of the Eastern Freeway, with tree plantations where they do occur clustered at entry and exit ramps, including the Hoddle Street intersection
- Well-vegetated reserves adjacent to the freeway, planted with large indigenous and Victorian native tree species
- Broadly native and exotic institutional plantings of the vacant VicRoads site.

The Eastern Freeway at its western extents has a very open landscape character due to a general lack of roadside tree plantings and the sheer width of the running lanes as shown in Figure 6-15. However, where tree plantings do occur, such as at the outbound Chandler Highway exit, they offer high value within the broader landscape and are of a scale where they can provide shading to adjacent running lanes.

Figure 6-15 Open landscape character of the Eastern Freeway within Precinct 3.F

The tree species recorded within this precinct are listed in

Table 6-6. It reveals the strong, native landscape character of planted trees, especially River Red Gums (*Eucalyptus camaldulensis*) which are planted as clusters within the Eastern Freeway at Chandler Highway, as well as extensively through adjacent public parklands. Giant Honey Myrtle (*Melaleuca armillaris*) is a ubiquitous small-scale tree forming extensive monocultures along the margins of the freeway.

Table 6-6 Most common taxa recorded within Precinct 3.F

Taxon	**Common name**	**% of trees in precinct**
Eucalyptus camaldulensis	River Red Gum	21%
Melaleuca armillaris	Giant Honey Myrtle	21%
Casuarina glauca	Swamp She-oak	4.5%
Corymbia maculata	Spotted Gum	11%
TOTAL		**57.5%**

Statutory controls

The south-western portion of the Merri Creek Parklands within Precinct 3.F is subject to Schedule 2 of the Environmental Significance Overlay (ESO2) as part of the Yarra Planning Scheme, shown in Figure 6-16 on the next page. ESO2 seeks to protect the Merri Creek and Environs, including its ecological, archaeological and landscape values.

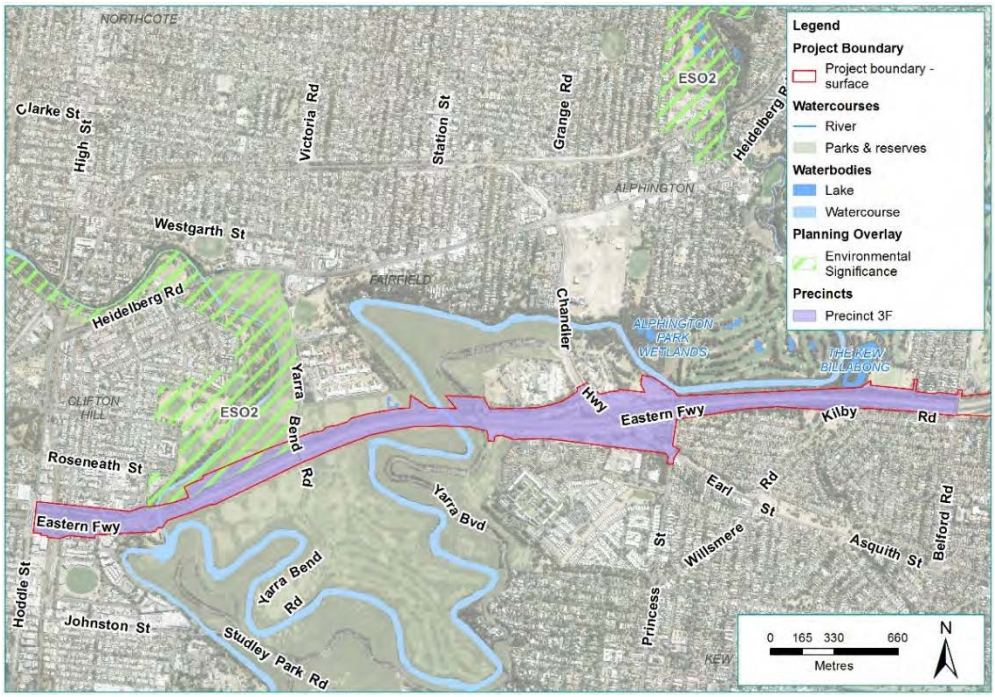

Figure 6-16 Extent of ESO2 within Precinct 3.F

The western portions of the Eastern Freeway between Bulleen Road, Mont Albert North and Trennery Crescent, Abbotsford are subject to Schedule 1 of the Significant Landscape Overlay (SLO1) as part of the Yarra and Boroondara planning schemes (and also implemented as SLO2 as part of the Manningham Planning Scheme in Precinct 2.E). These overlays recognise and seek to protect the environmental, aesthetic, cultural, recreational and tourism values of the Yarra (Birrarung) River Corridor Environs, as shown in Figure 6-17 and Figure 6-18.

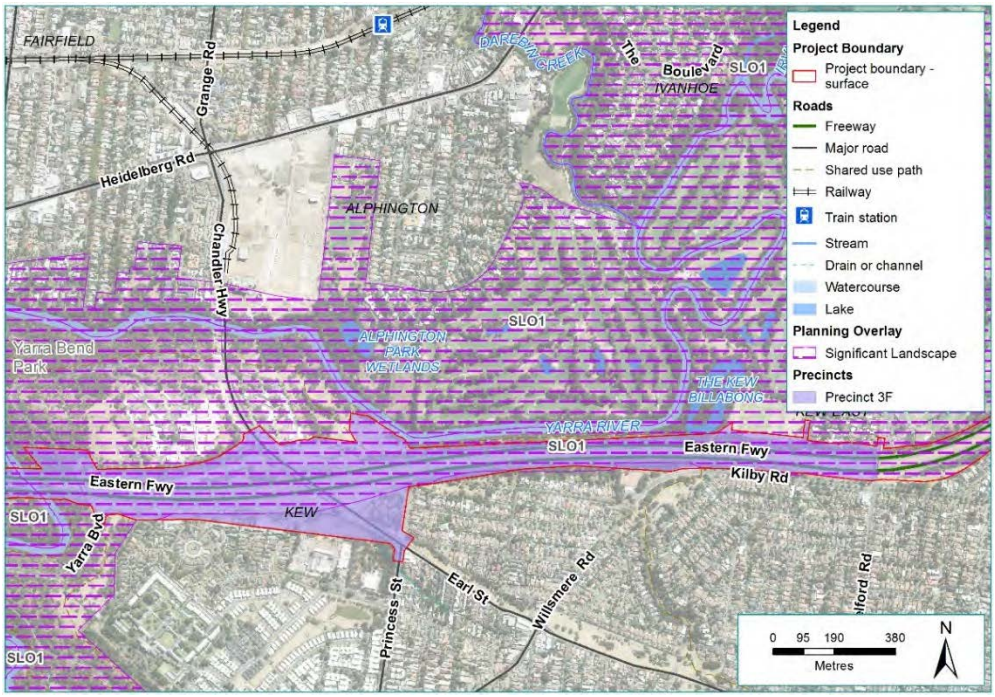

Figure 6-17 Extent of SLO1 within Precinct 3.F, eastern section

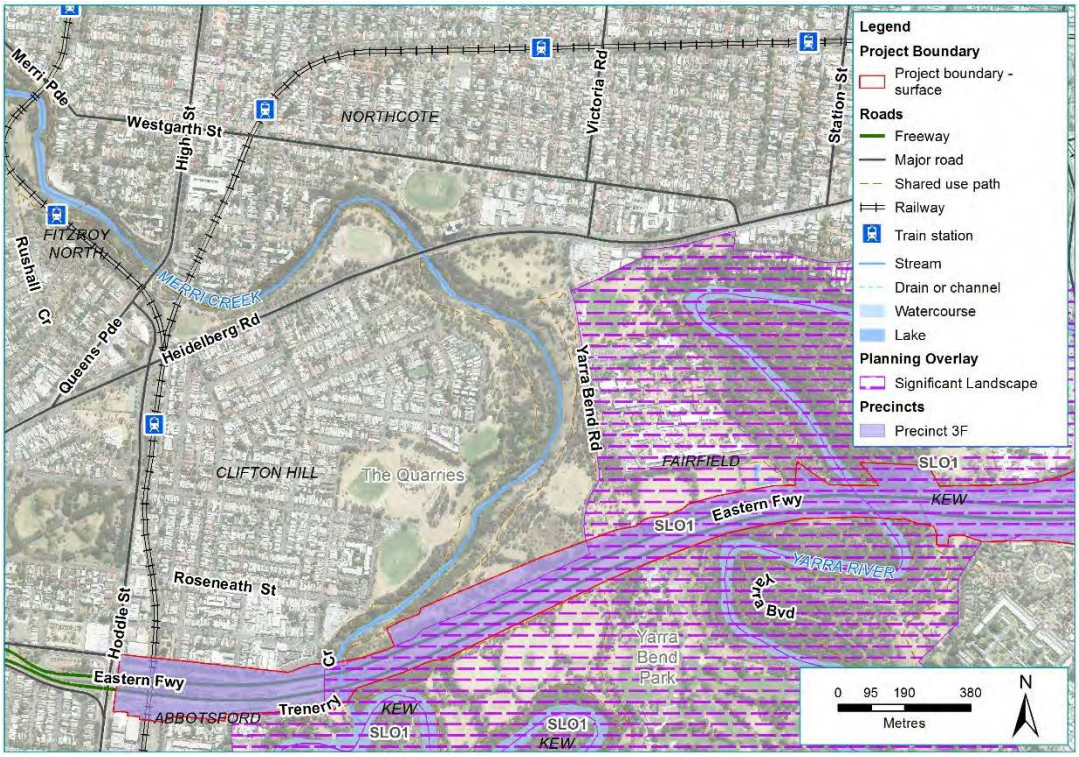

Figure 6-18 Extent of SLO1 within Precinct 3.F, western section

6.3.2 Precinct 3.G Belford Road to Bulleen interchange

Precinct 3.G comprises sections of the Eastern Freeway and areas of adjoining parkland from Belford Road in the west to the Bulleen interchange at Mont Albert North. The precinct includes planted amenity trees located:

- Within the Eastern Freeway road reserve
- Along the Main Yarra Trail, including Yarra Flats Parkland, Burke Road, Balwyn North
- Within Musca Street Reserve, Balwyn North
- Within Koonung Trail Parklands, Balwyn North.

Trees assessed within this precinct are located within the City of Boroondara.

Treed character

The treed character within this precinct changes slightly to that of Precinct 3.F to the west, due to closer proximity of trees to each side of the freeway because of the more constrained width of the freeway reserve and larger numbers of trees planted at on and off ramps. Trees planted within the freeway road reserve are generally planted in single species plantations which in combination form strong elements in the broader landscape, as shown in Figure 6-19.

The landscape character of public parklands is consistent throughout this precinct, dominated by large-scaled Eucalypts, including locally indigenous, Victorian and Australian native species, supplemented by generally smaller growing trees, also of broadly native origin.

Figure 6-19 Plantations of Spotted Gum and Giant Honey Myrtle at the Burke Road off-ramp

Tree species recorded within this precinct are listed in Table 6-7 which shows that three species comprise 50 per cent of all planted trees here—River Red Gum (*Eucalyptus camaldulensis*), Spotted Gum (*Corymbia 44erticil*) and Giant Honey Myrtle (*Melaleuca armillaris*). Each species is planted extensively throughout this section of the Eastern Freeway and within adjacent parkland, contributing to the over-riding native landscape character of the precinct. The River Red Gums and Spotted Gums provide large-scale canopy cover where they occur as well as shade to adjacent running lanes and pavements.

Table 6-7 Most common taxa recorded within Precinct 3.G

Taxon	Common name	% of trees in precinct
Eucalyptus camaldulensis	River Red Gum	24.5%
Corymbia maculata	Spotted Gum	11 %
Melaleuca armillaris	Giant Honey Mytle	14.5%
TOTAL		**50%**

Statutory controls

All of Precinct 3.G is subject to SLO1 which applies as part of the Boroondara Planning Scheme.

The objectives of SLO1 are discussed at Section 6.3.1 of this report.

6.3.3 Precinct 3.H – Bulleen interchange to Doncaster Road

Precinct 3.H comprises sections of the Eastern Freeway and areas of adjoining parkland from Bulleen Road, Mont Albert North in the west to Doncaster Road. The precinct includes planted amenity trees located:

- Within the Eastern Freeway road reserve
- At Boroondara Tennis Centre
- Within Koonung Reserve, Bulleen, including a section of Thompsons Road
- Along the west side of Manningham Park reserve and Koonung Creek Trail, Bulleen
- Within Koonung Creek Reserve, Balwyn North
- At the Bulleen Park and Ride.

Trees assessed within this precinct are located within the City of Boroondara and City of Manningham.

Treed character

The Eastern Freeway within this precinct is set within a treed landscape that includes large, indigenous and other native trees within the freeway reserve on its north side and freeway plantations that intergrade into adjacent parkland plantations within Koonung Creek Reserve to the south. The scale of the trees and canopy provides useful over-shadowing of adjacent running lanes, especially on the north side of the freeway.

There is a subtle difference in the treed character within this precinct. Trees within Manningham parklands and the freeway road reserve comprise a broader range of indigenous, Victorian and Australian native species, while the parklands within Boroondara, especially Koonung Creek Reserve, have a decidedly strong, locally indigenous and semi-natural character. This is reflected in large portions of Koonung Creek Reserve categorised as Plains Grassy Woodland and Swampy Riparian Woodland, assessed in Technical report Q – Ecology.

The most commonly recorded planted trees within this precinct are listed in Table 6-8. Large Eucalypts are most numerous within this precinct and provide the greatest contribution to the strongly native local landscape character. Sweet Bursaria (*Bursaria spinosa*) and Golden Wattle (*Acacia pycnantha*) are planted extensively as understorey specimens through Koonung Creek Reserve.

Table 6-8 Most common taxa recorded within Precinct 3.H

Taxon	Common name	% of trees in precinct
Eucalyptus camaldulensis	River Red Gum	28.5%
Eucalyptus cladocalyx	Sugar Gum	8%
Eucalyptus melliodora	Yellow Box	8.5%
Eucalyptus leucoxylon	Yellow Gum	5%
Acacia pycnantha	Golden Wattle	4%
Casuarina cunninghamiana	River She-oak	4%
Bursaria spinosa	Sweet Bursaria	4%
TOTAL		**62%**

Statutory controls

There are no planning overlays that apply to planted amenity trees within this precinct.

6.3.4 Precinct 3.I – Doncaster Road to Tram Road

Precinct 3.I comprises sections of the Eastern Freeway and areas of adjoining parkland from Doncaster Road in the west to Tram Road. The precinct includes planted amenity trees located:

- Within the Eastern Freeway road reserve
- Along portions of the Koonung Creek Trail to the north and south of the freeway
- At the Doncaster Park and Ride
- Within Elgar Park
- Within Stanton Street Reserve, Doncaster
- At the southern section of Katrina Street Reserve, Doncaster.

Trees assessed within this precinct are located within the City of Boroondara, City of Manningham and City of Whitehorse.

Treed character

Opened in 1997, the section of Eastern Freeway between Doncaster Road and Springvale Road has a different landscape character to older sections of the freeway between Doncaster Road and Hoddle Street to the west. This is due to the narrower width of the freeway reserve, primarily due to no central median, close proximity of escarpments to the edge of the emergency lane, especially to the north side of the freeway reserve, and more extensive tree plantations within and adjacent to the freeway. The scale of these plantings is increasing as the trees approach mature proportions, and provide important canopy at various points within the precinct.

Vegetation along the Koonung Creek Trail to the south of the freeway intergrades with freeway plantations, providing a strong, treed character to this section. Extensive portions of vegetation along the south side of the freeway along the Koonung Creek Trail are categorised as Riparian Woodland and is assessed in Technical report Q – Ecology.

Beyond the freeway reserve, tree plantings at the Doncaster Park and Ride reflect the urban character of an extensive car park, with greater numbers of exotic trees, most conspicuously Oriental Planes (*Platanus orientalis*) planted as shade trees amongst the parking bays. This is the only site within the entire project boundary that has a discernibly exotic landscape character similar to other areas of metropolitan Melbourne such as parts of Boroondara and Whitehorse that are characterised by large deciduous species such as Planes, Elms (*Ulmus* spp.) and Oak (*Quercus* spp.).

Public reserves to the north of the freeway, namely Stanton Street and Katrina Street reserves, have broadly native planting themes, including locally indigenous, Victorian and Australian native species.

The most commonly recorded planted trees within this precinct are listed in Table 6-9. Of planted trees assessed within this precinct, 36 per cent are Yellow Box (*Eucalyptus melliodora*), planted as extensive monocultures along the freeway reserve, as well as being a ubiquitous planting through adjacent public parks and linear reserves. River She-oak (*Casuarina cunninghamiana*) are planted extensively in blocks along sections of the freeway and form an especially notable feature to the northern freeway boundary to Koonung Reserve.

Table 6-9 Most common taxa recorded within Precinct 3.I

Taxon	Common name	% of trees in precinct
Eucalyptus melliodora	Yellow Box	36%
Acacia implexa	Lightwood	11%
Eucalyptus camaldulensis	River Red Gum	9.5%
Casuarina cunninghamiana	River She-oak	6%
Bursaria spinosa	Sweet Bursaria	5%
Corymbia 47erticil	Spotted Gum	3.5%
TOTAL		**74.42%**

Statutory controls

The alignment of Koonung Creek that meanders along (and under) the Eastern Freeway within the City of Manningham is subject to Schedule 5 to the Significant Landscape Overlay (SLO5) as part of the Manningham Planning Scheme. The overlay seeks to protect watercourses within the City of Manningham that have been identified of visual, landscape, environmental, heritage and recreational significance.

6.3.5 Precinct 3.J – Tram Road to Springvale Road

Precinct 3.J comprises the eastern sections of the Eastern Freeway and areas of adjoining parkland from Tram Road in the west to Springvale Road. The precinct includes planted amenity trees located:

- Within the Eastern Freeway road reserve
- Along portions of the Koonung Creek Trail to the north and south of the freeway
- Within the Koonung Creek Linear Park, Doncaster
- Within the Eastern Freeway Linear Reserve, Nunawading.

Trees assessed within this precinct are located within the City of Whitehorse and City of Manningham.

Treed character

To the immediate west of Precinct 3.I, the section of the Eastern freeway has a more treed character than older sections of the freeway west of Doncaster Road. Although enclosed by high sound walls and mounds along much of its length, extensive native tree plantations within the freeway reserve considerably soften what would otherwise be a hard, highly urbanised environment. Typical of the newer, 1997 section of the Eastern Freeway, plantings have been undertaken in large blocks or monocultures of generally indigenous and Victorian native trees. These are now maturing and provide important canopy cover along sections of the freeway within this precinct.

Koonung Creek Linear Park and Eastern Freeway Linear Reserve comprise expansive, grassed parklands dotted with copses of trees across each site. These are predominantly native in character, and comprise indigenous, Victorian and Australian native species. A large-scale and mature row of Monterey Pines (*Pinus radiata*) is a notable exotic planting within Eastern Freeway Linear Reserve.

The strongly native character of the precinct is reflected in the list of the most commonly recorded planted trees provided in Table 6-10.

Yellow Box (*Eucalyptus melliodora*), Manna Gum (*E. viminalis* subsp. *Viminalis*), Red Ironbark (*E. sideroxylon*) and Drooping She-oak (*Allocasuarina 48erticillata*) planted extensively in single-section blocks along the freeway are the most commonly assessed taxa within Precinct 3.J.

Table 6-10 Most common taxa recorded within Precinct 3.J

Taxon	Common name	% of trees in precinct
Eucalyptus melliodora	Yellow Box	18.39%
Eucalyptus viminalis subsp. *Viminalis*	Manna Gum	14.73%
Eucalyptus sideroxylon	Red Ironbark	13.26%
Allocasurina verticillata	Drooping She-oak	12.21%
Eucalyptus sp.	Eucalypt	5.61%
Eucalyptus camaldulensis	River Red Gum	5.21%
TOTAL		**69.41%**

Statutory controls

The alignment of Koonung Creek that meanders along the Eastern Freeway in Precinct 3.1 within the City of Manningham is subject to Schedule 5 to the Significant Landscape Overlay (SLO5) as part of the Manningham Planning Scheme.

7. Risk assessment

A risk assessment of project activities was performed in accordance with the methodology described in Section 5. The risk assessment has been used as a screening tool to prioritise the focus of the impact assessments and development of EPRs. The risk pathways link project activities (causes) to their potential effects on the environmental assets, values or uses that are considered in more detail in the impact assessment. Risks were assessed for the construction and operation of the project.

The residual arboricultural and urban forest risks associated with the project are listed in Table 7-1. The likelihood and consequence ratings applied during the risk assessment process and the adopted EPRs are provided in Appendix A.

Table 7-1 Arboriculture and urban forest risks

Risk ID	Potential threat and effect on the environment	Risk rating
Construction		
Risk AR01	Removal of trees for construction resulting in reduction of urban forest canopy cover	Planned (major consequence)
Risk AR02	Damage to trees on periphery of construction leading to death, damage or destabilisation, including mechanical impacts from cranes, piling rigs and vehicular access resulting in damage to tree crowns; lopping of tree crowns for installation of temporary aerial services leading to damage to trees by poor pruning practices	Low
Risk AR03	Modification to adjacent soil profiles resulting in droughting, waterlogging and/or deoxygenation of root zones leading to reduced tree health or death primarily due to construction access through parkland, including set down areas resulting in soil compaction and reduced tree health.	Low
Operation		
Risk AR04	North East Link roads, bridges, tunnels and associated infrastructure would prevent the re-establishment of urban forest canopy within the vicinity of the project.	Medium
Risk AR05	Modification to growing conditions by new structures, such as shading, wind modification and drawdown of groundwater resulting in poor growing conditions and reduction of urban forest canopy cover	Low

8. Impact assessment

This section describes the potential impacts of the project's construction on trees and the urban forest.

A conservative approach has been undertaken in this assessment, with the assumption that all trees within or close to the reference project footprint would be removed to facilitate works and that all other trees located within the broader project boundary have been assessed as potentially impacted by the project.

8.1 Construction impacts

This section describes the potential impacts to arboricultural assets, values and uses from the construction of North East Link.

The most significant impact to trees and the urban forest would occur during the project's construction, specifically the planned removal of trees to allow for:

- Construction of new roads, over-passes, tunnel portals and dedicated busways
- Widening of the Eastern Freeway and M80 Ring Road
- Construction of new shared access paths
- Associated infrastructure such as new water structures, detention basins, water sensitive urban design (WSUD) features and alterations and the installation of above and below ground services
- Site access and egress points to temporary construction compounds.

There are opportunities to reduce the number of trees required to be removed for temporary construction compounds and for the construction of shared use paths during the project's detailed design phase, which are discussed below.

The following sections provide an overview of trees that would require removal to facilitate the project's construction (risk AR01 – planned works) and also consider the management of trees proposed to be retained that may be impacted (risk AR02, risk AR03). Environmental Performance Requirements (EPRs) that could reduce tree loss or damage on the periphery of construction works are considered as well as opportunities to re-establish the canopy cover over the long term to prevent any impacts from the project's operation (risk AR04).

8.1.1 Component 1 – M80 Ring Road to River Gum Walk

The planned removal of trees and loss of canopy cover would occur within the M80 Ring Road to River Gum Walk component of the project (risk AR01). Project works here would include:

- Widening the M80 Ring Road within the existing road reserve
- Constructing new lanes and flyovers for the interchange at Greensborough Bypass
- Widening the Greensborough Bypass including constructing viaducts and land bridges, interchanges at Grimshaw Street, Watsonia Road, Greensborough Road, Yallambie and Lower Plenty Road

- Providing access and egress turn pockets into temporary construction compounds
- Changing the road functional layout of Service Road, Watsonia and adjacent streets, as well as the configuration of Watsonia railway station car park.

In addition, construction proposed at Borlase Reserve, Winsor Reserve, Gabonia Avenue Reserve, AK Lines Reserve and at the M80 Ring Road interchange may require additional removal of trees.

The total numbers of planted amenity trees planned for removal within Component 1 are listed in Table 8-1. The list includes trees within the road zone (Category 1 – RDZ1 and Category 2 – RDZ2). Trees within the road zone are located within VicRoads-managed land where road improvement, widening and other works are an expected consequence of the use of this land and where trees are potentially at greater risk of damage or removal with or without the project.

Table 8-1 Planted amenity trees planned for removal within Component 1 – M80 Ring Road to River Gum Walk

Precinct within Component 1 – M80 Ring Road to River Gum Walk	MLTV	Non-MLTV	Total	Within road zone
Precinct 1.A – M80 Ring Road planned removals	2,886	726	**3,612**	3,605
Precinct 1.B – Greensborough Road to Grimshaw Street planned removals	1,289	1,434	**2,723**	2,644
Precinct 1.C – Greensborough Road, Grimshaw Street to Yallambie Road planned removals	734	582	**1,316**	781
Precinct 1.D – Greensborough Road, Yallambie Road to River Gum Walk planned removals	168	63	**231**	47
	5,077	**2,805**	**7,882**	**7,077**

The total numbers of planted amenity trees potentially impacted (that is, all other trees within the project boundary) within Component 1 are listed in Table 8-2, including trees within the road zone.

Table 8-2 Planted amenity trees potentially impacted within Component 1 – M80 Ring Road to River Gum Walk

Precinct within Component 1 – M80 Ring Road to River Gum Walk	MLTV	Non-MLTV	Total	Within road zone
Precinct 1.A – M80 Ring Road trees potentially impacted	561	214	**775**	725
Precinct 1.B – Greensborough Road to Grimshaw Street trees potentially impacted	450	200	**650**	278
Precinct 1.C – Greensborough Road, Grimshaw Street to Yallambie Road trees potentially impacted	316	219	**535**	29
Precinct 1.D – Greensborough Road, Yallambie Road to River Gum Walk trees potentially impacted	117	31	**148**	67
	1444	**664**	**2108**	**1,099**

Of the planted amenity trees planned for removal and those potentially impacted within the project boundary, 65 per cent are MLTV trees; that is semi-mature, mature and over-mature trees with an assessed useful life expectancy greater than 10 years, the estimated construction timeframe of the project. Approximately 82 per cent of trees in Component 1 are within the road zone.

There is considerable scope to retain trees on the periphery of the reference project in the project's detailed design stage to minimise the removal of MLTV trees (EPR AR1). This would most likely be achieved at the locations of temporary construction compounds where the extent and nature of activities are as yet unknown, as well as within the project boundary where trees would be well separated from proposed construction works.

Protection of trees on the boundaries of construction compounds and the creation of fenced protection zones for key groups elsewhere within these compounds would be achieved with implementation of a Tree Protection Plan prepared in accordance with AS4970-2009 *Protection of Trees on Development Sites* (EPR AR2) and would prevent damage to retained trees and their soil profiles (risk AR02 and risk AR03). Tree Protection Plans would be prepared in consultation with the relevant local authority or landscape manager.

Adoption of AS4970-2009 as part of the project requires that detailed consideration should be given to the location of infrastructure at detailed design to minimise tree loss, including with shared use paths and water sensitive urban design (WSUD) features. Modified construction measures should also be explored to minimise the impact of encroachment. Detailed impact assessments, such as tree root investigations and consideration of tree species and development tolerances should also be undertaken to gain a more detailed overview of potential impacts and maximise potential for tree retention.

An overview of the planned tree removals and those potentially impacted within each precinct of Component 1 is provided in Appendix D.

8.1.2 Component 2 – Manningham Road to Koonung Creek, Bulleen

Planned removal of trees and loss of canopy cover would occur within the Manningham Road to Koonung Creek, Bulleen component of the project (risk AR01) for:

- Constructing new lanes and flyovers for the Manningham Road interchange
- The cut and cover tunnelling and changes to the road functional layout along Bulleen Road, which would include trees located within Trinity Grammar School Sporting Complex, Marcellin College, Bulleen Oval, Carey Grammar Sports Complex and at the Veneto Club
- Ground improvement within Banksia Park, near Manningham Road
- Access and egress turn pockets into temporary construction compounds
- Provision of new shared use paths to the east side of Bulleen Road.

Additional trees may also need to be removed for temporary construction works proposed at Marcellin College, Trinity Grammar School Sporting Complex, Bulleen Oval, the former Bulleen Drive-in and at the Manningham Road interchange.

There is also the possibility of limiting the impact of planned tree removals (risk AR01) within this precinct for the construction of a shared use path along a section of Bulleen Road between Golden Way and the Trinity Grammar School Sporting Complex.

The potential impact to trees in a reserve that provide shading for an existing footpath to the east side of Bulleen Road and the neighbouring residential precinct may be avoided or limited with root sensitive pavement construction such as a decked structure (EPR AR1).

Further to the south, trees along the alignment of the proposed shared use path would be removed to enable the construction works for the cut and cover tunnels.

The total numbers of planted amenity trees planned for removal in Component 2 are listed in Table 8-3, including trees within the road zone.

Table 8-3 Planted amenity trees planned for removal within Component 2 – Manningham Road to Koonung Creek, Bulleen

Component 2 – Manningham Road to Koonung Creek, Bulleen 2.E	MLTV	Non-MLTV	Total	Within road zone
Planned removals	636	269	**905**	95

The total number of planted amenity trees that would be potentially impacted (that is, all other trees within the project boundary) within Component 2 are listed in Table 8-4, including trees within the road zone.

Table 8-4 Planted amenity trees potentially impacted within Component 2 – Manningham Road to Koonung Creek, Bulleen

Component 2 – Manningham Road to Koonung Creek, Bulleen 2.E	MLTV	Non-MLTV	Total	Within road zone
Trees potentially impacted	201	117	**318**	86

Of the planted amenity trees that would be planned for removal and those potentially impacted, 68 per cent are MLTV trees; that is semi-mature, mature and over-mature trees with an assessed useful life expectancy greater than 10 years, the estimated construction timeframe of the project. Approximately 15 per cent of trees within Component 2 are located within the road zone.

The risks and EPRs to mitigate against these risks for planned tree removals are the same as those for Component 1 in Section 8.1.1.

An overview of the planned tree removals and those potentially impacted within the project boundary in Component 2 is provided in Appendix D.

8.1.3 Component 3 – Eastern Freeway

Planned removal of trees and loss of canopy cover would occur within Component 3 of the project (risk AR01) for the:

- Widening of the Eastern Freeway, including providing dedicated busways and new shared use paths outside the existing running lanes at:
  - Chandler Highway interchange
  - Burke Road interchange
  - Koonung Reserve (Manningham)
  - Koonung Creek Reserve (Boroondara)
  - Koonung Creek Trail between Macleod Street and Stanton Crescent (Manningham)
  - Koonung Creek Trail (Boroondara and Manningham)
  - Elgar Road interchange, including a portion of Sargent Street, Doncaster
  - Tram Road interchange
  - Koonung Creek Linear Park
  - Koonung Creek Trail (Whitehorse)
  - Middleborough Road interchange
  - Blackburn Road interchange
  - Springvale Road interchange
- Construction of new lanes and flyovers for the Bulleen interchange
- Modification to the road functional layout of Thompsons Road
- Site access and egress turn pockets at temporary construction compounds.

In addition, temporary construction works are proposed at the following sites that may require additional removal of trees:

- Eastern Freeway Linear Reserve
- Elgar Park
- South end of Katrina Street Reserve
- Doncaster Park and Ride
- Koonung Creek Reserve
- Koonung Reserve
- Musca Street Reserve
- Yarra Flats Park
- Chandler Highway interchange

- Kew Recreation reserve
- Vacant VicRoads Site, Chandler Highway.

Within this component of the project there is also the possibility of limiting the impact of tree removals (risk AR01) for the construction of shared use paths at the following locations:

- South side of Fairlea Reserve and Merri Creek Reserve, Fairfield
- Chandler Highway outbound off-ramp
- Belford Road, Kew East
- Koonung Creek Trail, Koonung Creek Reserve, Balwyn North.

The potential impact to trees could be limited with root-sensitive pavement construction such as decked structures and/or on-grade pavement systems. It is noted that in most locations, minor re-alignment of paths in combination with root-sensitive pavement construction would significantly reduce potential impacts to trees. The total numbers of planted amenity trees planned for removal within Component 3 are listed in Table 8-5, including trees within the road zone.

Table 8-5 Planted amenity trees planned for removal within Component 3 – Eastern Freeway

Precinct within Component 3 – Eastern Freeway	MLTV	Non-MLTV	Total	Within road zone
Precinct 3.F Hoddle Street to Belford Road planned removals	411	149	**560**	528
Precinct 3.G Belford Road to Bulleen interchange planned removals	1148	573	**1,721**	906
Precinct 3.H Bulleen interchange to Doncaster Road planned removals	1,488	981	**2,469**	1,282
Precinct 3.I Doncaster Road to Tram Road planned removals	547	160	**707**	605
Precinct 3.J Tram Road to Springvale Road planned removals	1,317	253	**1570**	966
	4,911	**2116**	**7,027**	**4,287**

The total numbers of planted amenity trees potentially impacted (that is, all other trees within the project boundary) within Component 3 are listed in Table 8-6, including trees within the road zone.

Table 8-6 Planted amenity trees potentially impacted within Component 3 – Eastern Freeway

Precinct within Component 3 – Eastern Freeway	MLTV	Non-MLTV	Total	Within road zone
Precinct 3.F Hoddle Street to Belford Road	1,276	911	**2,187**	1,140
Precinct 3.G Belford Road to Bulleen interchange	668	493	**1,161**	1,059
Precinct 3.H Bulleen interchange to Doncaster Road	731	368	**1,099**	39

Precinct 3.I Doncaster Road to Tram Road	674	206	**880**	558
Precinct 3.J Tram Road to Springvale Road	1,665	715	**2,380**	1,881
	5,014	**2693**	**7,707**	**4,677**

Of the planted amenity trees that are planned for removal and those potentially impacted, 67 per cent are MLTV trees; that is semi-mature, mature and over-mature trees with an assessed useful life expectancy greater than 10 years, the estimated construction timeframe of the project. Approximately 61 per cent of trees within Component 3 are located within the road zone.

The risks and EPRs to mitigate against these risks for planned tree removals as well as for trees potentially impacted are the same as those covered at Section 8.1.1 of this report.

An overview of the planned tree removals and those potentially impacted within Component 3 is provided in Appendix D.

8.2 Operation impacts

This section describes the impacts that have the potential to result on impacts to arboricultural assets, values and uses from the operation of North East Link.

8.2.1 Canopy loss

The long-term loss of trees and canopy cover can be mitigated with implementation of a comprehensive Tree Canopy Replacement Plan (EPR AR3) that would require replacement of canopy lost due to the project, and achieve a net gain in tree canopy over time. The plan would require the canopy cover was re-established within 15 years after the project's completion.

While construction of widened and new road infrastructure limits replanting opportunities within the immediate project boundary (risk AR04), a hierarchical tree canopy replacement program could realistically achieve canopy replacement within the broader urban area, in the following order of priority:

1. Where canopy is lost within the project boundary
2. Adjacent to the project alignment
3. Within Victorian Government and local council land within the municipalities of Manningham, Boroondara, Nillumbik, Yarra, Whitehorse and Banyule
4. Within the wider north-east region.

A key directive of the Tree Canopy Replacement Plan would be that trees should be selected for their location to secure the best possible growth outcomes, and so consider soil type and micro-climate as well as modifications to local environment such as wind and shading caused by new freeway structures including flyovers and sound walls.

The program must be developed in consultation with the relevant local council and land managers with regard to local policies, strategies and relevant existing vegetation initiatives and would follow the methodology set out below.

Measuring baseline

Existing tree canopy for the study area and any impacted areas would be calculated before any trees were removed. Spatially mapped height stratified vegetation cover data by DELWP would provide the most detailed and accurate measure of canopy baseline.

Measure all tree removals

Tree removal reports by contractors would be collated and verified using tree IDs and spatial canopy data to measure the extent of canopy cover lost (in m^2) as works progressed. A final tally of tree numbers and canopy extent lost must be reported once trees were removed.

Tree replacements

The hierarchy of tree planting locations is as follows.

Located as close as possible to North East Link in the following order of consideration:

1. Where canopy was lost within the project boundary
2. Adjacent to the project alignment
3. Within Victorian Government and local council land within the municipalities of Manningham, Boroondara, Nillumbik, Yarra, Whitehorse and Banyule
4. Within the wider north-east region.

As well as replacing trees removed to facilitate the project's construction in parks and road reserves, it would be a requirement that new trees are located where the tree can best achieve the local community and environment benefits. New tree plantings and canopy re-establishment must be considered as additional to other tree and urban forest planting programs already planned by councils and other land managers so that an actual, long-term improvement to urban forest canopy cover is achieved from the project.

Consideration includes opportunities to:

- Improve shade cover in in areas of social vulnerability that may be subject to higher than average heat impacts
- Reduce the impact of thermal hotspots with a priority for improving pedestrian and cycling comfort
- Increase the canopy cover in the suburbs with lower than average tree canopy coverage
- Optimise opportunities to capture, treat and slow the flow of stormwater
- Benefit biodiversity by enhancing habitat corridors for fauna, birds and other pollinators.

These locations would need to be selected in consultation with each of the tree asset owner stakeholders. Replacement plantings should occur as early as possible in the delivery program so that trees can establish and develop canopies to provide the greatest benefit to the urban environment.

Measuring canopy in relation to EPR AR3

Landscape plans for the project would be required to determine number and species type of each tree planted. Future canopy can then be modelled based on species type, number of trees and planting location, such as street, park or tree pit.

Prioritising locations for canopy outside project boundary

Locations would need to be identified within each municipality where canopy is needed for community and environmental benefit. Areas where social vulnerability, pedestrian intensity and heat intersect are those which should be targeted for quality shade. Generally, these areas are socio-economically disadvantaged and research shows there is a high correlation between disadvantage and low canopy cover. The methodology to pinpoint these locations should include:

- Spatially map social vulnerability – measuring concentrated percentages of those people vulnerable to heat as defined by Loughnan et al., Monash University, 2013: the socio-economically disadvantaged, older people living alone, young children, those not fluent in English or in public housing. Where multiple indicators occur at SA1 level, social vulnerability is present.
- Spatially map pedestrian intensity – where there is high pedestrian activity and people are exposed to heat. This is generally correlated with high imperviousness and urban density and defined as retail/commercial/shopping strips, public transport hubs, schools, playgrounds, community facilities.
- Spatially map thermal heat using satellite thermal imagery.
- Assess vegetation cover mapping – spatially distributed feature class of height stratified vegetation. This will highlight where the gaps in canopy occur.
- Consider mapping areas of valued biodiversity to pinpoint locations for corridors/buffer zones and also local flooding to determine appropriate locations for stormwater management.

8.2.2 Groundwater and ground settlement

Tunnelling and excavation works for the project that cause the drawdown of groundwater and droughting (drying up) of root systems have potential to impact trees including existing and new tree plantings (risk AR05). This is considered an unlikely scenario, as the root systems of planted trees are generally shallow and confined to the upper metre of soil, well above existing likely groundwater profiles (AS4970-2009 Protection of Trees on Development Sites. Appendix B 2.4). It is acknowledged that root systems of old, indigenous trees such as River Red Gums (*Eucalyptus camaldulensis*) have the capability to extend down to greater depths and access underlying groundwater. The risk to these trees is assessed in Technical report Q – Ecology.

Potential for ground settlement is also noted in parts of the study area, primarily at the tunnel portals and adjacent to trenched sections of the new roadway. Where settlement is predicted to be greatest, trees are planned for removal to facilitate construction works, including for proposed ground improvement works. The magnitude of ground settlement away from these works areas is minor and is unlikely to impact the viability of trees to be retained.

8.3 Alternative design options

Although the reference project for North East Link has largely been finalised, there are currently two design options being considered for the arrangement of the Manningham interchange, and two locations for the launch of the tunnel boring machine (TBM) being considered. For information on the design options, refer to EES Chapter 8 – Project description.

This potential arboriculture impacts associated with the alternative design options would not differ from the impacts associated with the reference project assessed in Section 8.1 and Section 8.2.

Modelling of the drawdown associated with the TBM retrieval shaft is shown in Technical Report N Groundwater. The drawdown would not have impacts on trees in the vicinity due to relatively shallow depth of root growth, and the existing depth to groundwater is greater than 10 metres.

8.4 Cumulative impacts

North East Link is one of several major infrastructure projects planned or under construction within Victoria. In the Melbourne metropolitan area, work is underway on the Metro Tunnel, West Gate Tunnel Project as well as a number of Level Crossing Removal projects.

The loss of trees and associated canopy is inevitable when constructing such large-scale, transformative projects. In addition, consolidation of housing density, especially in inner urban and around suburban activity centres has seen the loss of trees, especially where traditional single dwellings have made way for more intensive multi-unit developments.

The cumulative impact of infrastructure projects and the intensification of urban development is the continuing decline of overall canopy cover across Melbourne. In recognition of the importance of the urban forest, especially its mitigating effects on urban heat islands, the re-establishment of trees and urban forest canopy lost due to major infrastructure is now seen as essential an component of project delivery. The Metro Tunnel and the West Gate Tunnel Project both provide performance requirements that seek to replace trees lost due to their construction.

Similarly, the importance of the urban forest has been recognised in the planning of North East Link with an objective to ensure that a long-term goal of the project is the re-establishment of urban canopy cover.

9. Environmental Performance Requirements

Table 9-1 lists the recommended Environmental Performance Requirements (EPRs) relevant to the arboricultural and urban forest assessment.

Table 9-1 Environmental Performance Requirements

EPR ID	Environmental Performance Requirement
EPR AR1	**Develop and implement a Tree Removal Plan** Develop and implement a Tree Removal Plan, as part of the CEMP, that identifies all trees within the project boundary and specifies: ▪ Trees to be removed or retained as part of the works ▪ The condition and landscape value of the trees to be removed ▪ A protocol for tree removal that addresses the requirements of EPR FF1, EPR FF2 and EPR FF5. Tree retention must be maximised to the extent practicable through detailed design and selection of construction methods to minimise canopy loss, and in accordance with EPR FF1, including by retaining trees where practicable and minimising potential impacts to trees. Arboricultural assessments are to inform the detailed design, Tree Removal Plan and Tree Canopy Replacement Plan (required by EPR AR3) in order to maximise tree retention and long-term viability of amenity plantings in accordance with Australian Standard AS4970:2009 Protection of Trees on Development Sites. The Tree Removal Plan must be informed by a pre-construction site assessment to confirm the area and number of trees and other vegetation proposed to be impacted. Trees to be retained must be protected in accordance with EPR AR2. Vegetation removal is to occur in a staged manner with removal only occurring once necessary for the current stage of works. The area and number of trees and other vegetation actually removed is to be confirmed through a post-construction assessment.
EPR AR2	**Implement a Tree Protection Plan(s) to protect trees to be retained** The CEMP must include a Tree Protection Plan(s), which is to be developed and implemented in accordance with Australian Standard AS4970-2009 Protection of Trees on Development Sites. The Tree Protection Plan(s) must provide details of any tree protection actions that will ensure that trees proposed to be retained are adequately protected from the impact of construction or related activities, prior to those works being undertaken. Tree Protection Plans must be prepared based on detailed construction drawings and surveyed tree locations. Trees subject to protection must be monitored for a two-year period following completion of construction works in that location to assess ongoing viability, with maintenance or replacement of stressed or damaged specimens to be undertaken.

EPR ID	Environmental Performance Requirement
EPR AR3	**Implement a Tree Canopy Replacement Plan** Develop and implement a Tree Canopy Replacement Plan to replace the loss of canopy cover and achieve a net gain in tree canopy cover by 2045. The plan must show the location, size and species of replacement trees, in consultation with relevant land managers. The plan must specify requirements to support the long-term viability of replacement plantings including appropriate soil requirements, establishment works and ongoing maintenance.

10. Conclusion

The purpose of this report is provide a high-level impact assessment for trees to inform the preparation of the EES required for the project, supplementing the ecology impact assessment which covers impacts to EVCs and individual scattered trees.

The treed character and associated impacts to planted amenity trees are summarised below.

10.1 Existing conditions

The existing conditions work undertaken for this study has separated the total study area into three components and a further 10 precincts across the components. The over-riding treed character within the study area is defined by planted indigenous, Victorian native and Australian native trees, with relatively few exotic trees encountered. The scale and canopy cover provided by trees across the study area varies significantly, as described below:

10.1.1 Component 1 – M80 Ring Road to River Gum Walk

As for much of the study area, the treed character within Component 1 is defined by plantings of native trees. The scale and canopy cover varies between each precinct.

Precinct 1.A – M80 Ring Road. In the north of the project boundary the M80 Ring Road road reservation set back from the running lanes is densely planted with large-scale native trees, forming a near-continuous over-canopy to each side of the reservation.

Precinct 1.B – M80 Ring Road, Greensborough Bypass to Grimshaw Street. At the termination of the M80 Ring Road, the adjacent road reserves of the Greensborough Bypass are densely planted but with generally smaller-scale trees that do not provide the same, large-scale canopy cover as plantations along the M80 Ring Road. This vegetation provides a buffer to the bypass and adjacent residential precincts.

Precinct 3 – 1.C Greensborough Bypass/Greensborough Road, Grimshaw Street to Yallambie Road. The Greensborough Bypass/Greensborough Road reserves have a distinctively open landscape character, with relatively few large trees. Large-scale trees are generally confined to adjacent recreational reserves (AK Lines Reserve and Gabonia Avenue Reserve, Watsonia, and Winsor Reserve, Macleod) and a treed reserve within Service Road, Watsonia.

Precinct 4 – 1.D Greensborough Road, Yallambie Road to River Gum Walk. The Greensborough Road reserve has an open, relatively treeless character. To the east side of the road reserve lies a near-continuous band of large-scale, predominantly indigenous trees within Simpson Barracks and adjacent Commonwealth land (assessed in Technical report Q – Ecology) and Borlase Reserve at the southern end of Greensborough Road.

10.1.2 Component 2 – Manningham Road to Koonung Creek, Bulleen

Component 2 of the study area comprises a single precinct, 2.E, which features significant variation in treed character.

Banksia Park and the Yarra River parklands in the north of the precinct are well treed compared with the relatively sparsely treed streetscapes of the commercial and light industrial precinct to the south and east of these parklands. While Bulleen Road contains limited street tree plantations in the south of the precinct, the extensive, large-scaled plantings within the adjacent school playing fields and Bulleen Park and at the Veneto Club provide a leafy outlook to the streetscape. Plantings primarily comprise indigenous, Victorian and Australian native species.

10.1.3 Component 3 – Eastern Freeway

In Component 3, the treed character along the Eastern Freeway varies from west to east, reflecting the staged development of the freeway and changes in topography along its route. Adjacent parklands are uniformly well-treed, with a strongly native landscape character.

Precinct 3.F – Hoddle Street to Belford Road. The freeway road reserve is open and relatively treeless. Any tree plantations in this precinct are clustered at entry and exit ramps. Public reserves adjacent to the freeway are strongly indigenous in character, with dense plantings of large native trees. The vacant VicRoads site to the west of Chandler Highway comprises native and exotic species of varying scale.

Precinct 3.G – Belford Road to Bulleen interchange. Trees planted within the freeway road reserve are generally planted in single species plantations which in combination form strong elements in the broader landscape. The landscape character of public parklands (including the Freeway Public Golf Course) is consistent throughout this precinct, dominated by large-scale Eucalypts, including locally indigenous, Victorian and Australian native species.

Precinct 3.H – Bulleen interchange to Doncaster Road. The treed character of this precinct is dominated by large, indigenous and other native trees within the freeway reserve on its north side and freeway plantations that intergrade into adjacent parkland plantations within Koonung Creek Reserve to the south. The scale of the trees and canopy, especially those on the north side of the freeway, provides useful over-shadowing of adjacent running lanes. Adjacent parklands, especially Koonung Creek Reserve, have a decidedly indigenous, semi-natural character, and include trees within Plains Grassy Woodland and Swampy Riparian Woodland EVCs.

Precinct 3.I – Doncaster Road to Tram Road. Vegetation along the Koonung Creek Trail to the south of the freeway intergrades with freeway plantations, providing a strong, treed character to this section. Extensive portions of vegetation along the south side of the freeway along the Koonung Creek Trail are categorised as the EVC Riparian Woodland. Public reserves to the north of the freeway, namely Stanton Street and Katrina Street reserves, have broadly native planting themes including locally indigenous, Victorian and Australian native species.

Precinct 3.J – Tram Road to Springvale Road. This section of the Eastern Freeway has a more treed character than older sections of the freeway west of Doncaster Road. Extensive native tree plantations within the freeway reserve considerably soften the highly urbanised freeway environment. Plantings have been undertaken in large blocks or monocultures of generally indigenous and Victorian native trees that are now

maturing and provide important canopy cover along sections of the freeway within this precinct. Adjacent reserves are predominantly native in character, and comprise indigenous, Victorian and Australian native species.

10.2 Impact assessment

10.2.1 Construction impacts

The greatest impact to trees and canopy cover would be planned removals of trees (risk AR01) to allow for construction of new roadways, tunnel portals, flyovers, viaducts and access to construction compounds, as well as associated infrastructure such as shared user paths, detention basins and water sensitive urban design (WSUD) features and modifications to existing road functional layouts. Trees located within temporary construction compounds, where the eventual use is unknown, are considered to be potentially impacted.

The approximate numbers of planted amenity trees planned for removal within each component and precinct are listed in Table 10-1, including trees located within the road zone.

Table 10-1 Planted amenity trees planned for removal with the reference project

	MLTV	Non-MLTV	Total	Within road zone
Precinct within Component 1 – M80 Ring Road to River Gum Walk				
Precinct 1.A – M80 Ring Road	2,886	726	**3,612**	3,605
Precinct 1.B – Greensborough Road to Grimshaw Street	1,289	1,434	**2,723**	2,644
Precinct 1.C – Greensborough Road, Grimshaw Street to Yallambie Road	734	582	**1,316**	781
Precinct 1.D – Greensborough Road, Yallambie Road to River Gum Walk	168	63	**231**	47
Component 2 – Manningham Road to Koonung Creek, Bulleen – Precinct 2.E	636	269	**905**	95
Precinct within Component 3 – Eastern Freeway				
Precinct 3.F – Hoddle Street to Belford Road	411	149	**560**	528
Precinct 3.G – Belford Road to Bulleen interchange	1,148	573	**1,721**	906
Precinct 3.H – Bulleen interchange to Doncaster Road	1,488	981	**2,469**	1,282
Precinct 3.I – Doncaster Road to Tram Road	547	160	**707**	605
Precinct 3.J – Tram Road to Springvale Road	1,317	253	**1,570**	966
TOTAL	**10,624**	**5,190**	**15,814**	**11,459**

The approximate numbers of planted amenity trees potentially impacted within each component and precinct are listed in Table 10-2, including trees located within the road zone.

Table 10-2 Planted amenity trees potentially impacted within the project boundary

	MLTV	Non-MLTV	Total	Within road zone
Precinct within Component 1 – M80 Ring Road to River Gum Walk				
Precinct 1.A – M80 Ring Road	561	214	**775**	725
Precinct 1.B – Greensborough Road to Grimshaw Street	450	200	**650**	278
Precinct 1.C – Greensborough Road, Grimshaw Street to Yallambie Road	316	219	**535**	29
Precinct 1.D – Greensborough Road, Yallambie Road to River Gum Walk	117	31	**148**	67
Component 2 – Manningham Road to Koonung Creek, Bulleen – Precinct 2.E	201	117	**318**	86
Precinct within Component 3 – Eastern Freeway				
Precinct 3.F – Hoddle Street to Belford Road	1,276	911	**2,187**	1,140
Precinct 3.G – Belford Road to Bulleen interchange	668	493	**1,161**	1,059
Precinct 3.H – Bulleen interchange to Doncaster Road	731	368	**1,099**	39
Precinct 3.I – Doncaster Road to Tram Road	674	206	**880**	558
Precinct 3.J – Tram Road to Springvale Road	1,665	715	**2,380**	1,881
TOTAL	**6,659**	**3,474**	**10,133**	**5,862**

Of the approximately 25,947 planted amenity trees planned for removal or potentially impacted, approximately two-thirds are categorised as MLTV trees; that is semi-mature, mature and over-mature trees that have an assessed useful life expectancy of more than 10 years, the estimated construction timeframe of North East Link. 67 per cent of trees planned for removal or potentially impacted are located within the road zone.

There is scope to retain trees peripheral to construction activities and within the project boundary through detailed design that seeks to minimise the removal or potential impacts to MLTV trees (EPR AR1).

Protection of trees on the boundaries of construction compounds, and the creation of fenced protection zones for key groups elsewhere within these compounds could be achieved with implementation of a Tree Protection Plan prepared in accordance with AS4970-2009 *Protection of Trees on Development Sites* (EPR AR2) and would prevent damage to retained trees and their soil profiles (risk AR02 and risk AR03).

The requirement to remove trees to construct shared use paths could be reduced in various locations in Component 2 and Component 3 with root sensitive pavement construction, such as using decked structures and/or on-grade pavement systems (EPR AR1).

10.2.2 Operation impacts

The long-term loss of trees and canopy cover (risk AR04) can be mitigated with the development of a comprehensive Tree Canopy Replacement Plan (EPR AR3). A Tree Canopy Replacement Plan will seek to replace lost canopy cover, and would include a hierarchical tree replanting strategy that can mitigate against canopy loss within the broader urban area, including replanting in areas outside the defined project boundary if required.

Risks identified during North East Link's operation are potential impacts to trees caused by drawdown of groundwater and droughting (drying up) of root systems, which is considered an unlikely scenario due to the shallow depth of tree roots, and much deeper underlying groundwater. Similarly, where ground settlement is predicted to be greatest, this is in areas where trees are planned for removal for the project's construction, including ground improvement works. Ground settlement is not anticipated to impact trees with the potential to be retained elsewhere within the project boundary.

Potential risks to the growth of new tree plantings from overshadowing and wind modification caused by new structures (risk AR05) can be effectively mitigated with careful specification of plant material as part of the Tree Canopy Replacement Plan.

11. References

AS4970-2009 *Protection of trees on development sites* 2000, Standards Australia.

Boroondara Tree Protection Local Law 2016.

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City of Whitehorse 2002, *City of Whitehorse Streetscape Policy and Strategy*.

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Planning schemes:

- Banyule Planning Scheme
- Boroondara Planning Scheme
- Manningham Planning Scheme
- Nillumbik Planning Scheme
- Whitehorse Planning Scheme
- Yarra Planning Scheme

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