

CHAPTER 2

METHODOLOGY

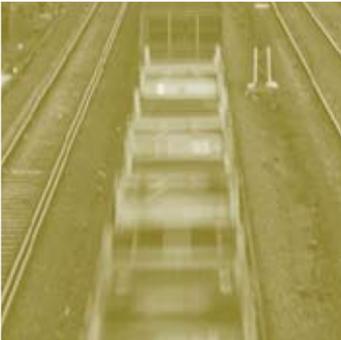


This chapter describes the methodology used to identify the recommended route location.

2.1 KEY ISSUES ADDRESSED IN THE PAR

Two broad types of key issues are considered in this document, those that influence the choice of route option selected and those that need to be managed whichever route is selected. Identifying a key issue as a route-influencing issue or needing to be managed depends on the specific circumstances of the planning project.

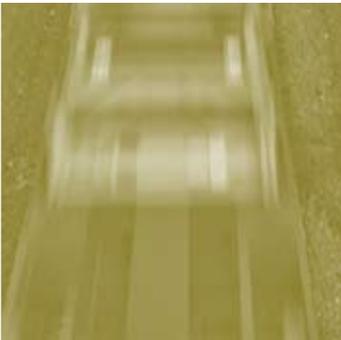
An outline of how issues affecting the Outer Metropolitan Ring / E6 (OMR/E6) Transport Corridor have been classified is provided below.



2.1.1 ROUTE INFLUENCING ISSUES

“Route-influencing” issues are:

- > Transport demands (what areas are to be served by the corridor; interchange locations);
- > Concentrations of urban development (housing, industrial buildings);
- > Areas where development planning is well-advanced (such as approved planning scheme amendment for residential or industrial development);
- > Areas where future land-use development is planned and it is desired to create viable, well-functioning communities;
- > The location of major public and private facilities (such as current and future quarries, correctional facilities, power transmission lines);
- > Major geographic features (such as large hills, deep valleys, major rivers, creeks);
- > Features and areas of social and cultural heritage significance (such as heritage-listed buildings, avenues of honour, scatter sites, burials, places of religious significance);
- > Areas of high biodiversity value;
- > The location of existing major roads and railways which require connections via interchanges; and
- > Design standards for the transport corridor (such as maximum grade, curvature requirements, cross-sectional requirements).



2.1.2 ISSUES TO BE MANAGED

Issues to be managed for the route chosen include:

- > Surface water;
- > Groundwater;
- > Visual and landscape character;
- > Localised land use planning;
- > Air quality;
- > Greenhouse gas emissions;
- > Noise;
- > Economic impacts (other than issues that are route influencing); and
- > Social impacts (other than issues that are route influencing – such as access restoration for roads and properties that have had their existing access severed).

2.1.3 ALIGNMENT OPTION DEVELOPMENT PROCESS

The process of developing the recommended alignment has involved the following key broad steps:

- > Identifying a broad study area, initially between Geelong/Werribee and north of Craigieburn, and later to the E6 reservation at Findon Road, Epping;
- > Identifying broad opportunities and constraints within the study area, including route - influencing issues such as:
 - Geographic features including major hills, creeks and deep valleys, such as the You Yangs, Deep Creek and Jacksons Creek;
 - The existing Urban Growth Boundary;
 - Existing communities such as Werribee, Caroline Springs, Rockbank, Melton, Bulla, Craigieburn and Epping;
 - Future planned residential, business and industrial land uses;
 - Current and future quarries;
 - Existing infrastructure, including
 - the Princes, Western, Calder and Hume Freeways;
 - arterial roads;
 - the Melbourne-Geelong, Melbourne-Ballarat, Melbourne-Bendigo, and Melbourne-Sydney railways; and
 - major power transmission and gas lines;

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- planned infrastructure, including the Regional Rail Link, Epping-South Morang railway and the Donnybrook /Beveridge Interstate Rail Terminal;
 - Locations of sensitive flora and fauna sites, such as the Western Plains Grasslands;
 - Locations of parkland, such as Organ Pipes National Park; and
 - Locations of sensitive heritage sites.
- > Developing of potential OMR/E6 transport corridor options that were technically feasible and met the major known existing constraints;
 - > Identifying the interactions and opportunities of these transport corridor options with proposals for the Urban Growth Boundary, the Regional Rail Link and protection of the grasslands areas. As these proposals were being developed concurrently, this phase was integrated so that transport constraints also influenced land use plans; and
 - > Finally, the recommended transport corridor was chosen based upon overall compatibility with existing constraints and proposed land use plans. Details such as road and rail interchanges, access restoration and formation batter widths were then refined in order to establish a final transport corridor.

2.1.4 EVALUATION METHODOLOGY

The content and style of this document is aligned with the evaluation methodology of this PAR, so that it provides a clear analysis of the potential effects of the OMR/E6 Transport Corridor.

Key elements of the PAR that supported the assessment of potential effects include:

- > A description of the existing environment, in terms of flora and fauna, heritage and geotechnical issues, particularly where these are relevant to the assessment of potential impacts; and
- > Measures for avoiding, minimising, managing and monitoring impacts, including a statement of commitment to implement the measures.

This PAR also incorporates an assessment of the alternatives for the alignment and interchanges for the proposed OMR/E6 Transport Corridor. It explains how the potential alternatives were identified and evaluated, and why the recommended proposal was selected.

2.1.5 ASSESSMENT OBJECTIVES

The objectives that have guided the assessment of potential impacts of the proposed OMR/E6 Transport Corridor are as follows:

- The overall project objective for the Outer Metropolitan Ring/E6 Transport Corridor is to contribute to Australia's and Victoria's economic and social development by providing a high speed transport link for freight and people that:
 - Serves key international transport hubs, for example, Melbourne and Avalon Airports, Port of Geelong, other intermodal freight hubs and freight and service economy areas;
 - Serves key interstate and major regional destinations; and
 - Provides better links to residential and employment growth areas to the north and west of Melbourne, for example, Werribee, Melton and Mickleham.
- As with all infrastructure projects other key objectives based on compliance with government legislation or good planning practice were to:
 - Ensure that the project is capable of performing its function of providing safe and efficient movement;
 - Ensure that the project is technically feasible;
 - Avoid as far as possible, minimise where unavoidable, and provide offsets for any biodiversity impacts;
 - Avoid as far as possible, minimise where unavoidable, and prepare (at the appropriate time prior to construction) a Cultural Heritage Management Plan to mitigate any Cultural Heritage impacts; and
 - Minimise socio-economic impacts in relation to existing and future residential and industrial development and maximise opportunities for future urban development.

2.2 FLORA AND FAUNA

VicRoads participated in an integrated flora and fauna study with the Growth Areas Authority (GAA), Department of Sustainability and Environment (DSE), Department of Planning and Community Development (DPCD) and Department of Transport (DoT). The Growth Areas Authority managed the Native Vegetation and Fauna Habitat Assessment Project on behalf of the Department of Sustainability and Environment. The aim of this project was to identify key areas of biodiversity, including identifying key areas of grassland to be preserved for the future.

As much of the proposed OMR would pass through the flora and fauna study area, VicRoads contributed to the project to minimise the time and cost involved in undertaking its own studies. This culminated in the following reports being prepared for the Growth Areas Authority:

- > Biosis: Growth Areas Authority Investigations areas west of Melbourne: Biodiversity values, constraints and opportunities; and
- > SMEC: Flora and Fauna Desktop Analysis – Area 3a; and
Flora and Fauna Desktop Analysis – Area 3b.

VicRoads engaged Brett Lane and Associates Pty Ltd to investigate flora and fauna impacts within the proposed OMR/E6 Transport Corridor Right of Way (ROW) and to produce a habitat hectare assessment.

A detailed Flora and Fauna Study including survey work along the entire alignment will be undertaken as part of further planning before construction.

Further information on nationally significant protected species and ecological communities, wetlands of international importance, migratory species and national heritage is contained in the related document “Strategic Assessment of the Program to Revise Melbourne’s Urban Growth Boundary – Impact Assessment Report” (DSE, 2009).

2.2.1 OMR

2.2.1.1 VEGETATION

The proposed OMR ROW is dominated by exotic grassland and planted vegetation associated with farming and urban land uses. Approximately 26% of the proposed ROW supports native vegetation of varying quality. Twelve different Ecological Vegetation Classes (EVC’s) occur within the proposed ROW boundary. The dominant EVC’s are Plains Grassland (84%) and Plains Grassy Woodland (11%), both of which are endangered in the bioregion. Remaining vegetation occurs in wetlands, waterways and associated escarpments, which are landscape features that are comparatively limited in extent.

2.2.1.2 FLORA

Two flora species listed under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999 (Clth)* have been recorded within the proposed ROW. The species include Large-headed Fireweed (vulnerable) and Swamp Fireweed (vulnerable). Three EPBC listed species have the potential to occur within the ROW boundary. These species include Clover Glycine (vulnerable), Matted Flax-lily (endangered) and Spiny Rice-flower (critically endangered).

Two flora species listed as threatened under the *Flora and Fauna Guarantee (FFG) Act 1988 (Vic)* have been recorded in the proposed ROW. The species include Buloke and Large-headed Fireweed. Four FFG species listed as threatened have the potential to occur within the proposed ROW. These species include Small Milkwort, Small Scurf-pea, Spiny Rice-flower and Tough Scurf-pea.

One ecological community listed as critically endangered under the *EPBC Act*, the Natural Temperate Grassland of the Victorian Volcanic Plain is likely to occur in the proposed OMR/E6 ROW in areas of Plains Grassland.

Two threatened ecological communities listed under the *FFG Act* are likely to occur throughout the OMR/E6 proposed ROW. The Western (Basalt) Plains Grasslands Community is likely to occur in areas of Plains Grassland. The Western Basalt Plains (River Red Gum) Grassy Woodland Floristic Community is likely to occur in areas of Plains Grassy Woodland.

2.2.1.3 FAUNA

The Golden Sun Moth, listed as critically endangered under the *Environment Protection and Biodiversity Conservation Act 1999*, has been recorded within the proposed ROW.

Fourteen EPBC fauna listed species have the potential to occur within the proposed ROW. These species include Australian Grayling (vulnerable), Azure Kingfisher (lower risk near threatened), Bush Stone-curlew (endangered), Common Dunnart (vulnerable), Eastern Dwarf Galaxias (vulnerable), Freckled Duck (endangered), Grey-headed Flying-fox (vulnerable), Growling Grass Frog (vulnerable), Nankeen Night Heron (lower risk near threatened), Plains Wanderer (vulnerable), Southern Toadlet (vulnerable), Striped Legless Lizard (vulnerable), Swift Parrot (endangered) and Yarra Pygmy Perch (vulnerable).

The Golden Sun Moth, listed as threatened under the *Flora and Fauna Guarantee Act 1988 (Vic)*, has been recorded in the proposed ROW. Fourteen FFG fauna species listed as threatened have the potential to occur within the ROW boundary. These species include Barking Owl, Blue-billed Duck, Brown Toadlet, Bush Stone-curlew, Diamond Dove, Diamond Firetail, Eastern Great Egret, Freckled Duck, Grey-headed Flying-fox,

Growling Grass Frog, Plains Wanderer, Red-chested Button-quail, Speckled Warbler and Striped Legless Lizard.

2.2.1.4 FAUNA HABITAT OMR/E6 PROPOSED ROW

The four types of habitat within the OMR/E6 proposed ROW, native grassland, Plains Grassy Woodland, aquatic and Riparian Woodland are discussed below.

Native grassland within the west and north-west of Melbourne is dominated by Basalt Plains Grassland. This habitat was once widely distributed, however due to extensive development and agricultural intensification the extent of native grasslands has been significantly reduced. This habitat has high potential to support a variety of threatened flora and fauna species.

A characteristic feature of Plains Grassy Woodland is the seasonal presence of wetlands and swamps which may be essential for a number of species found within this habitat. This habitat was once wide-spread however its distribution has been greatly reduced due to agricultural and urban expansion, leaving only fragmented and dispersed patches. This habitat has high potential to support threatened flora and fauna species.

Aquatic habitats encompass a number of habitats including rivers, creeks, reservoirs and seasonal and permanent waterbodies. Habitat structure varies depending on the presence and type of bank vegetation, submerging vegetation, flow and water quality. Threats to aquatic habitats include changes in water flow, salinity and quality, and bank vegetation structure. Within rural areas, intensification of agriculture has significantly impacted aquatic habitats. This habitat has high potential to support threatened fauna species.

Riparian Woodland is a habitat which is generally flooded. This habitat is threatened by a number of factors including changes to the natural flow regime, habitat degradation through loss of natural embankment regeneration, loss of water quality and stock grazing. This habitat has high potential to support threatened fauna species.

2.2.2 E6

2.2.2.1 NATIVE VEGETATION

The proposed E6 ROW is dominated by exotic grassland and planted vegetation associated with farming and urban land uses. Approximately 25% of the proposed ROW supports native vegetation of varying quality. Eight different EVC's occur within the proposed ROW. The dominant Ecological Vegetation Classes are Plains Grassy Woodland (78%) and Grassy Woodland (8%) both of which are endangered in the bioregion. Remaining vegetation occurs in wetlands, waterways and associated escarpments, or on the limited area of sedimentary upland.

2.2.2.2 FLORA

No flora species listed under the *Environment Protection and Biodiversity Conservation Act 1999* have been recorded within the proposed ROW. Four EPBC flora listed species have the potential to occur within the proposed ROW. These species include Adamson's Blown-grass (endangered), Clover Glycine (vulnerable), Curly Sedge (endangered) and Matted Flax-lily (endangered).

No flora species listed under the *Flora and Fauna Guarantee Act 1988* have been recorded within the proposed ROW. Four FFG flora species listed as threatened have the potential to occur within the proposed ROW. These species include Adamson's Blown-grass, Plump Swamp Wallaby-grass, Small Milkwort and Tough Scurf-pea.

One ecological community listed as critically endangered under the *EPBC Act*, the Natural Temperate Grassland of the Victorian Volcanic Plain is likely to occur in the proposed OMR/E6 ROW in areas of Plains Grassland.

Two threatened ecological communities listed under the *FFG Act* are likely to occur throughout the OMR/E6 proposed ROW. The Western Basalt Plains (River Red Gum) Grassy Woodland Floristic Community is likely to occur in areas of Plains Grassy Woodland. The Western (Basalt) Plains Grasslands Community is likely to occur in areas of Plains Grassland.

2.2.2.3 FAUNA

No fauna species listed under the *Environment Protection and Biodiversity Conservation Act 1999*, has been recorded within the proposed ROW. Ten fauna EPBC listed species have the potential to occur within the proposed ROW. These species include Azure Kingfisher (lower risk near threatened), Common Dunnart (vulnerable), Eastern Dwarf Galaxias (vulnerable), Freckled Duck (endangered), Grey-headed Flying-fox (vulnerable), Growling Grass Frog (vulnerable), Nankeen Night Heron (lower risk near threatened), Southern Toadlet (vulnerable), Striped Legless Lizard (vulnerable) and Swift Parrot (endangered).

No fauna species listed under the *Flora and Fauna Guarantee Act 1988* has been recorded within the proposed ROW. Eleven FFG listed fauna species listed as threatened have the potential to occur within the ROW boundary. These species include Barking Owl, Blue-billed Duck, Brown Toadlet, Diamond Dove, Eastern Great Egret, Freckled Duck, Grey-headed Flying-fox, Growling Grass Frog, Red-chested Button-quail, Speckled Warbler and Striped Legless Lizard.

Fauna habitat for the OMR/E6 proposed ROW is described in section 2.2.1.4.

2.2.3 NET GAIN ASSESSMENT

A preliminary Net Gain assessment was carried out to determine an initial offset target for the removal of all native vegetation within the OMR/E6 proposed ROW. The preliminary total offset target required for the OMR/E6 proposed ROW is approximately 704 habitat hectares.

The net gain assessment used habitat scores provided by DSE incorporating Growth Area Authority (GAA) data, DSE ground truthed data and recently updated DSE vegetation modelling. Where overlaps existed between these datasets the GAA data was used as a priority, followed by ground truthed data from DSE and then modelled data from DSE. In practice, a Net Gain assessment based on ground truthed data, would lead to a significantly lesser area of native vegetation being affected.

2.3 CULTURAL HERITAGE

Desktop studies of cultural heritage impacts were undertaken for the study area by Andrew Long and Associates for the OMR and by Ochre Imprints for the E6. A detailed cultural heritage study including survey work along the entire alignment would be undertaken as part of a further planning study.

2.3.1 OMR

2.3.1.1 INDIGENOUS CULTURAL HERITAGE

The desktop assessment identified 128 Indigenous cultural heritage sites that have been previously recorded. Of these sites, 28 Indigenous heritage sites are potentially impacted within the proposed ROW boundary. These sites include 2 earth features, one scarred tree and 26 artefact scatters. Note: one site contained an artefact scatter and earth feature.

On the basis of the nature of the known archaeological record in the wider region and the landforms present in the project area, it has been determined that land within 200m of river and major creek valleys are of high archaeological potential. Such land is likely to contain Indigenous cultural heritage sites especially where a large degree of native vegetation and relatively undisturbed land surface survive. Alluvial terraces associated with these rivers and creeks have the potential for cultural heritage to be preserved in a depositional environment.

2.3.1.2 NON-INDIGENOUS CULTURAL HERITAGE

The study found that 100 Non-Indigenous cultural heritage sites have been previously recorded within the study area. Of these sites, 14 Non-Indigenous heritage sites are potentially impacted within the ROW boundary. The Rockbank Inn is listed on the Heritage Register and is of State significance. The Rockbank Bridge, Gidney Dam, Gidney Farm, Donnybrook Station Site and two Donnybrook Quarry Dry Stone Walls are listed on the Heritage Inventory and are of local significance. Eight Non-Indigenous cultural heritage sites are listed on Heritage Overlays and are of local significance. Note that the Rockbank Inn is listed on both the Heritage Register and Heritage Overlay.

No specific areas of known Non-Indigenous cultural heritage sensitivity have been defined. However, historical places such as stone walls, domestic dwellings and historical artefact scatters could occur along the OMR Transport Corridor.

2.3.2 E6

2.3.2.1 INDIGENOUS CULTURAL HERITAGE

The desktop assessment found 57 Indigenous heritage sites have been previously recorded within the study area. Of these sites, 9 Indigenous heritage sites are potentially impacted within the ROW boundary. These sites include one earth feature and 8 artefact scatters.

Creek corridors have been identified as high sensitivity to contain Indigenous cultural heritages sites. The remainder of the E6 Transport Corridor has low-moderate sensitivity for containing Aboriginal sites. Scarred trees and in situ Aboriginal cultural material located in creek corridors are site types highlighted as having an increased significance.

2.3.2.2 NON-INDIGENOUS CULTURAL HERITAGE

The study found 22 Non-Indigenous sites have been previously recorded within the study area. Of these sites, 10 Non-Indigenous sites are potentially impacted within the ROW boundary. Herhs Pine Park Farm, Donnybrook Station Site, Epping Road Bridge, two bluestone houses, two bluestone and granite foundation sites and one house are listed on the Heritage Inventory and are of local significance. Three Non-Indigenous cultural heritage sites are listed on Heritage Overlays and are of local significance. Note that the Hehrs Pine Park Farm is listed on both the Heritage Inventory and Heritage Overlay.

No specific areas of known Non-Indigenous cultural heritage sensitivity have been defined. However, as yet unrecorded historical places such as stone walls, domestic dwellings, historical artefact scatters and quarries are predicted to occur along the E6 Transport Corridor.

2.4 GEOTECHNICAL

A geotechnical desktop study was undertaken for the OMR and E6 study area by VicRoads Technical Consulting. The study considered the geology and geomorphology of the proposed transport corridor and identified any significant constraints. Existing borehole data, aerial photography, the EPA priority sites register for contaminated sites have been reviewed. Brief site visits and discussion with Councils and quarry operators in close proximity to the proposed corridor have been undertaken.

2.4.1 OMR

2.4.1.1 GEOLOGY

Quaternary Newer Basalt and associated residual soils dominate much of the length of the proposed OMR corridor. Outcrops of Lower and Upper Silurian sediments are exposed in road cuts along the proposed OMR corridor near the intersection of Old Sydney Rd and Donnybrook Rd. Small exposures of Ordovician sediments occur in the basal sections of Jacksons Creek and Deep Creek, where the deeply incised creek beds have cut down through Quaternary basalt flows.

Significant areas of Quaternary and Recent Alluvium are present immediately around the major waterways intersected by the OMR transport corridor, in particular, around Jacksons Creek and Deep Creek where large alluvial fans exist. These fluvial alluvium deposits consist primarily of sand, silt and clay, but may contain minor amounts of gravel. Several small deposits of lagoon and swamp deposits exist in the Little River/Werribee area along with Aeolian dune deposits on the ancestral floodplains of Little River and Werribee River. The lagoon and swamp deposits consist primarily of silt and clay, while the dune deposits consist primarily of sand, clay and calcareous sand. Fluvial deposits of considerable surface extent are present immediately to the north of the transport corridor study area to the east of the Wallan township. These deposits overlie the basalt and commonly consist of gravel, sand and silt.

Two sites of Regional significance are recorded on “Geological and Geomorphological Register of Significant Sites in the Western Region of Melbourne” are located within the ROW boundary.

The two sites include:

- > SW3 - Kororoit Creek Floodplain – the valley of Kororoit Creek upstream of Beattys Rd bridge is a wide floodplain with abandoned stream channels. Regional significance as an illustration of the influence of lava flows on drainage patterns and of the hydrological complexity of Kororoit Creek; and
- > SW4 – Deans Marsh Intermittent Lakes – enclosed depressions on the surface of the lava plain between Kororoit Creek and the Western Freeway. Sites are marshy, indicating they are fed from groundwater springs. Water is brackish and alkaline, with sulphate concentration. Regional significance as important remnants to illustrate the formerly complex drainage and surface water distribution of the plains.

2.4.1.2 QUARRIES

Bulla Quarry north of Sunbury Road is potentially impacted by the proposed ROW boundary. A future quarry site south of Sunbury Road is potentially impacted by the proposed ROW boundary.

Key Considerations

The following geotechnical issues have been identified that will warrant further investigation before or during construction:

- > High to extremely high strength, slightly weathered to fresh basalt is present at the natural surface level in many areas. As such, any subsurface excavations (even shallow drainage lines) may encounter substantial quantities of “non-rippable” basalt. If blasting of the basalt rock is required then close monitoring of ground vibrations and air blast vibrations would be highly desirable during construction.
- > The bridge structure across the Deep Creek valley, is likely to be in the order of 1.4Km long and the pier heights will be approximately 70-80m high. The number of pier locations required and height will have a substantial impact on the creek valley and likely pose a number of major construction issues to effectively minimise the impact. It may be appropriate, in the instance of Deep Creek, to investigate the use of alternative types of structures (e.g. large “cable stay” bridge) rather than the normal type of bridge structure. In this way, the impact on the Deep Creek valley and the intersection of difficult pier foundations would be largely avoided. A more detailed study of the bridge structure and foundation options is recommended.

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- > The stability of the cut excavations in the Silurian sediments may be a potential issue. A comprehensive defect and cut stability analysis will need to be considered prior to construction.
 - > On the north side of Bulla-Sunbury Road a substantial land fill area exists. The site was previously used as a quarry. The quality and quantity of the landfill placed is largely unknown and will need to be investigated in more detail, so that the impact and costs of the construction of the transport corridor across this area is more fully understood.
 - > There is a possible risk of contamination via emissions from the previous operation of a refuse incinerator in close proximity to the proposed transport corridor. This will need to be examined prior to construction.
 - > The Department of Defence has previously operated an aircraft gunnery and artillery range adjacent to the transport corridor in the vicinity of Greens Road, Newtons Road and Edgars Road. Unexploded bombs have previously been uncovered in recent excavations in this area. While unlikely that they would be located within the transport corridor this should be investigated prior to construction.
 - > The existing waterways were considered to be in poor condition due to vegetation removal on stream banks, grazing, erosion and sedimentation. In a number of locations this is leading to salinisation. Water quality monitoring and surface runoff control should be incorporated as part of the construction program to minimise potential impacts on these waterways.
 - > Existing borehole data indicates that groundwater is located between 4m and 90m. While groundwater has not been detected at the natural surface it was detected as close as 4m in several bores. It is possible that areas will be encountered where springs emanate at the natural surface. These will need to be considered prior to construction.
 - > There is the likelihood of salinity discharge within existing drainage lines in the northern section of the proposed corridor. Appropriate management measures will need to be developed as part of the detailed design and for implementation during construction to ensure the works will not modify the hydrological balance and/or cause enlargement of the existing saline discharge areas.
 - > There is the risk of increased surface runoff which has the potential to increase erosion and impact on water quality. The protection of existing remnant native vegetation and dense planting of new vegetation, provision of appropriate subsurface drainage and providing suitable waterway structures would minimise these risks.

From a geotechnical perspective, no major impediments exist apart from the presence of possible challenging foundation conditions at some major structure sites and the presence of high to extremely high strength “non rippable” basalt.

2.4.2 E6

2.4.2.1 GEOLOGY

Quaternary Newer Basalt covers much of the E6 Transport Corridor. Major basalt flows have occurred down the ancient flood plains of the Merri Creek, Darebin Creek and Plenty River. Scattered outcrops of Silurian, interbedded shale, mudstone and greywacke are visible in very close proximity to the E6 Transport Corridor. In the vicinity of Findon and Bindts Road the Silurian sediments have been metamorphosed to a hornfels, which is extracted and crushed at the Boral Wollert quarry.

Significant areas of Quaternary river alluvium are present around some of the major waterways adjacent to the proposed transport corridor, in particular the Darebin Creek area. These river alluvium deposits consist primarily of sand, silt and clay, but may contain minor amounts of gravel.

2.4.2.2 QUARRIES

Two current quarry sites, Boral Wollert and Hanson Wollert and one future quarry site, Hanson Wollert, are potentially impacted by the proposed ROW boundary.

2.4.2.3 KEY CONSIDERATIONS

The following geotechnical issues have been identified that will warrant further investigation prior to or during construction:

- High to extremely high strength, slightly weathered to fresh basalt is present at the natural surface level in many areas. As such, any subsurface excavations (even shallow drainage lines) may encounter substantial quantities of “non-rippable” basalt. If blasting of the basalt rock is required then close monitoring of ground vibrations and air blast vibrations would be highly desirable during construction.
- The stability of the cut excavations in the Silurian sediments may be a potential issue. A comprehensive defect and cut stability analysis will need to be considered prior to construction.
- Foundation conditions at Darebin Creek and Merri Creek may be less favourable with considerable depths of soft weak material likely within the flood plain requiring further consideration prior to construction.

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- > The former “GB Landfill” site is located at the former Boral Bundoora Quarry. It is recommended that a more comprehensive investigation and assessment be undertaken to determine likely issues and impacts.
 - > Existing borehole data indicates that groundwater was located at natural surface in several bores around Merriang Road to the north and south of Donnybrook and north of Bridge Inn Road. It is likely that groundwater may be encountered close to the natural surface in other areas. There may also be the possibility of encountering springs in the existing drainage lines. Further consideration of these matters will be required prior to construction.
 - > There is the likelihood of salinity discharge within existing drainage lines in the northern section of the proposed transport corridor. Appropriate management measures will be need to be developed as part of the detailed design and for implementation during construction to ensure the works will not modify the hydrological balance and/or cause enlargement of the existing saline discharge areas.
 - > There is the risk of increased surface runoff which has the potential to increase erosion and impact on water quality. The protection of existing remnant native vegetation and dense planting of new vegetation, provision of appropriate subsurface drainage and providing suitable waterway structures would minimise these risks.

From a geotechnical perspective, no major impediments exist in regard to the construction of the E6 corridor apart from the common presence of near surface, high to very high strength, basalt (including basalt boulders) and possibly the above mentioned large landfill area.

