



**Department of Economic Development,
Jobs, Transport and Resources**

Western Distributor

Preliminary Environmental Assessment

November 2015

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1. Introduction

The Western Distributor Project connects the West Gate Freeway to CityLink and provides an alternative crossing of the Yarra River. The Project traverses a corridor that is highly developed with residential, commercial and industrial uses as well as some areas of public open space. The alignment crosses four waterways: the Kororoit Creek, Stony Creek, the Maribyrnong River, and Moonee Ponds Creek.

The overall Project has four sections:

1. West Gate Freeway – widening of the West Gate Freeway between the junction of the M1 and M80 freeways and Williamstown Road in the vicinity of the Westgate Bridge to facilitate movement of traffic to and from Western Distributor, and increase capacity.
2. Western Distributor – a southern tunnel portal near the Jemena Terminal Station in the vicinity of Hyde Street and Stephens Street, Yarraville, a 1.6km tunnel under Yarraville, a northern portal on the west bank of the Maribyrnong River, a bridge over the river to an elevated road above Footscray Road, secondary bridge structures providing direct access to the Port of Melbourne and ramps from the elevated road providing connections to CityLink and the arterial road network on the north and west sides of the CBD.
3. Cook Street/Webb Dock – upgrade of Cook Street from 2 lanes to 4 between Todd Street and Salmon Street with realignment of the ramp east of Salmon Street to CityLink, to improve safety and access to Webb Dock.
4. Monash Freeway Upgrade.

The Cook Street/Webb Dock works and Monash Freeway Upgrade will be implemented separately from the Western Distributor and associated upgrades to the West Gate Freeway. The Western Distributor Project ('the Project') as referred to in this document includes only the West Gate Freeway and Western Distributor components as described above and in the following section.

The Victorian Government is considering the Transurban market-led proposal in respect of the Project at Stage Three of the market-led proposal process, in accordance with the Victorian Government's Market-led Proposals Interim Guideline.

This Preliminary Environmental Assessment Report outlines the potential benefits and impacts of the State's Project scope for the business case. This scope is set out below in Section 2.1.

The business case was undertaken to inform government of the merit of investment in the Project. The scope of the Project presented in Section 2.1 should not be considered to be the finalised scope for the Project. This scope was developed in order to have a reasonable basis on which to develop a range of assessments as part of the typical business case development process. Should the Project proceed past the business case stage, the State will undertake a more exhaustive consultation and engagement process on all aspects of the Project scope to ensure that all appropriate and relevant views have been considered before refining the scope through a detailed, inclusive and transparent planning approval phase.

2. Understanding the environmental impacts of Western Distributor

2.1 Project description

The scope of the Western Distributor Project for the purpose of the business case can be separated into five components. Each of these components is discussed in Table 1 below.

Table 1 Description of Project components

Project component	Description
West Gate Freeway - Widening	<p>Widening, associated pavement rehabilitation and carriageway separation of the West Gate Freeway in both directions to provide overall capacity of 6 lanes each direction (additional 2 lanes each way) between Williamstown Road and M80 configured as 3 lanes on each of the separated carriageways.</p> <p>Separated carriageways with braided connections with the following features:</p> <ul style="list-style-type: none"> • Eastbound – The outer carriageway destined for the Western Distributor and inner carriageway destined for the West Gate Bridge with grade separated connections at each end as well a flyover connection from the outer to inner carriageway near the standard gauge freight railway overpass (west of Williamstown Road). Arterial road connections provided along the outer carriageway. • Westbound – The outer carriageway destined for M80 and the central carriageway destined for Princes Freeway West grade separated connections to both carriageways from the Western Distributor and the West Gate Bridge. Williamstown and Millers Road access via the outer carriageway and Grieve Parade access from the central carriageway via a braided flyover of the M80 carriageway. <p>Strengthening of bridges along the West Gate Freeway to 75% SM1600 to accommodate High Productivity Freight Vehicles (HPFV) at higher mass limits</p> <p>Separation of carriageways via solid safety barrier, provision of emergency lanes in the central carriageways and stopping bays along the outer carriageways</p> <p>Posted speed of 100km/h from M80 to west of Williamstown Road</p> <p>Replacement of two existing pedestrian bridges spanning over the West Gate Freeway in the vicinity of Wembley Avenue and Rosala Avenue</p> <p>Upgrade noise walls along the West Gate Freeway with concrete and Perspex noise walls.</p>
Western Distributor – Yarraville alignment (including tunnel)	<p>Connections between the West Gate Freeway and the tunnel portals and rebuilding of the Williamstown Road interchange bridges</p> <p>New west-facing ramps for vehicles to access Hyde Street from the elevated connection</p> <p>Two 15.5m diameter bored, 1.6km tunnels ultimately catering for three traffic lanes in both directions, operating only as two lanes with shoulders initially, using a single tunnel boring machine</p> <p>Southern portal on the north side of the West gate Freeway near Hyde Street</p> <p>Northern portal east of Whitehall Street, north of Somerville Road, west of the Maribyrnong River</p>

Project component	Description
Western Distributor – Elevated road and port access	<p>Single span bridge across the Maribyrnong River</p> <p>Direct access to the Port of Melbourne at Mackenzie Road (to/from West Swanson Dock)</p> <p>Viaducts in both directions above Footscray Road</p> <p>Eastbound viaduct connection to Appleton Dock Road at the existing intersection with Footscray Road (to access East Swanson Dock, Victoria Dock, Appleton Dock) with a return westbound viaduct connection from Footscray Road</p> <p>Grade separated shared user facility at Appleton Dock Road, Footscray Road and Mackenzie Road intersections</p>
Webb Dock Access	<p>Single lane widening of Cook Street (Eastbound) from Todd Road to the West Gate Freeway ramp terminal intersection.</p> <p>Dedicated new connection and an upgrade to the West Gate Freeway-to-CityLink northbound ramp(Ramp M) including widening for ramp metering, realignment and regrading along the ramp and signalisation of the Cook Street/Salmon Street intersection.</p>
Western Distributor – Eastern interchange and CBD bypass	<p>Inbound and Outbound: Connections to CityLink via modified Dynon Road ramps</p> <p>Access via ramps onto Footscray Road with additional connections to Dynon Road and Wurundjeri Way. Final resolution of scope will include consultation with Melbourne City Council, other stakeholders and the community.</p>
Freeway Management System	<p>Ramp metering upgrades (increased storage provisions) and new installations including the West Gate Freeway, Western Distributor and Princes Freeway West, including metering of the West Gate Freeway/CityLink connections (East-to-North and North-to-West)</p> <p>Installation of LUMS and supporting ITS along the West Gate Freeway and Western Distributor, including adjacent sections of the Princes Freeway West and M80.</p>

As explained above in section 1, this document focuses on the West Gate Freeway and Western Distributor components as described above and does not consider Webb Dock Access.

2.2 Information sources

This assessment is informed by:

- Relevant findings from the Technical Reports prepared by technical specialists for VicRoads in relation to the Truck Action Plan project in 2009.
- Desktop assessments of groundwater, contamination and noise and vibration issues undertaken by GHD.
- A desktop social impact assessment undertaken by GHD which reviews and updates the Truck Action Plan assessment.

Together, these assessments provide an initial basis for predicting the potential environmental impacts that may arise from the Western Distributor Project and identifying appropriate strategies to assess and manage these impacts.

3. Overview of potential environmental benefits and impacts

This assessment focuses on the potential benefits and impacts arising from the West Gate Freeway and Western Distributor components.

The environmental benefits and impacts associated with the Project are summarised below. This assessment does not include a discussion of traffic and transport-related benefits and impacts – refer to the separate *Network Impact Assessment* and *Freight Strategy* documents (GHD, 2015).

3.1 Potential benefits

The potential environmental and social benefits of the Western Distributor Project arise from the Project's contribution to:

- Reducing the number of trucks from local streets in inner west suburbs (by redirecting this traffic to the freeway network and providing a more direct link to the Port of Melbourne), making these areas safer, quieter and more attractive places to live.
- Freeing up road space at surface level, which could be used to prioritise public transport (e.g. buses along Footscray Road).
- Reducing Victoria's greenhouse gas emissions through more efficient vehicle movements (noting this offset would need to be offset against any increase in emissions due to energy consumption required to ventilate the tunnel).
- Alleviating major congestion bottlenecks and relieving congestion on inner west city streets, allowing for improvements in noise and air quality.
- Generating opportunities to clean up contaminated land and industrial sites required for construction activity and for permanent structures associated with the Project.
- Opening up prospects for urban renewal projects that could assist in creating more compact, accessible and liveable communities and improving public transport services and cycling and walking routes.
- Making general improvements to shared use paths, access to public open space and recreational facilities.

3.2 Overview of potential impacts

Adverse environmental impacts potentially occur where a major infrastructure project interfaces with residential activities, open spaces, parkland, recreational areas and waterways. While many of these potential impacts may be avoided or minimised by the proposed tunnelling of a 1.6 km section of the Western Distributor Project under Yarraville, the West Gate Freeway upgrade will generate interface issues.

Some environmental issues would be associated with surface works and above ground structures, tunnel ventilation structures and tunnel portals. Construction activities can also generate temporary impacts in relation to amenity (noise, odour, dust and vibration), traffic and access arrangements and site occupation.

A number of detailed specialist studies would be undertaken to investigate and clearly understand these potential impacts. Specific management plans would be developed for all components of the Project to facilitate the mitigation of adverse impacts.

The West Gate Freeway and the proposed alignment of the Western Distributor traverse established residential areas, as well as significant areas of industrial land between Whitehall Street and the Maribyrnong River. Environmental impacts may arise in the suburbs of Footscray, Seddon, Yarraville, Kingsville, Altona North, and Tottenham and, as well as along waterways such as the Maribyrnong River, Stony Creek and Kororoit Creek.

The potential impacts for the West Gate Freeway widening and the Western Distributor components are expected to encompass the following matters.

3.3 Air quality

3.3.1 Existing conditions and potential impacts

Air quality is a significant issue both in the inner west and the nearby Tottenham/Brooklyn area, primarily due to existing industrial land uses and heavy vehicle traffic generation. The Project area was once dominated by industrial land uses however it now has a more diversified mix of land uses with a growing residential population. With this comes a higher expectation for improved amenity.

The potential air quality impacts that will need to be managed during construction and operation of the Project include:

- Changes to air emissions from vehicles due to re-distributed traffic flows and proximity of traffic lanes to residential areas adjacent to the West Gate Freeway. This requires particular consideration where housing and other sensitive receptors are near to road corridors such as West Gate Freeway east and west of Millers Road (south side), between Newport to Sunshine (Brooklyn Loop) railway and Williamstown Road, Francis Street, Hyde Street and Whitehall Road.
- Emissions to air associated with the design and location of tunnel ventilation structures. The Project would have ventilation structures as new point sources of air emissions. A vented tunnel would require regulatory licencing by EPA Victoria (EPA) to minimise air quality impacts to residents and other sensitive receivers.
- In-tunnel air quality would be required to meet regulatory limits.
- Dust emissions associated with construction activity. Road works and tunnel construction would involve substantial civil construction work. Dust mitigation and monitoring would be required.

EPA has a long history of road-side ambient air quality monitoring in the local area that provides an indication of the existing conditions within the Project area. This includes:

- Francis Street, Yarraville ((EPA Victoria publication 1546.1) - 2001 and 2012/2013.
- West Gate Freeway (EPA Victoria publication 974) –1996-97 and 2004.

EPA has recently completed a 12-month near-road monitoring campaign in Francis Street, Yarraville, with the results used to update initial monitoring undertaken 10 years previously. This area experiences a high percentage of truck traffic in close proximity to residential areas. Francis Street in Yarraville is a thoroughfare for an estimated 20,000 vehicles per day of which 5,000 are trucks (EPA 2013).

The prevalent air pollutant measured in Francis Street was small particles (PM₁₀ and PM_{2.5}). *“Results for PM_{2.5} monitoring did not breach the daily advisory reporting standard but were slightly above the annual advisory reporting standard during the 12 months of monitoring for this fine particle”* (EPA, 2013, p.1). In calendar year 2013, there were a total of seven days when PM₁₀ 24-hour averaged concentrations were above the National Environment Protection Measure (NEPM) daily standard; this exceeds the NEPM goal of no more than five days.

Nitrogen Dioxide (NO₂) levels measured at Francis Street were generally higher than levels measured elsewhere in Melbourne, but remained well within the state and national daily and annual air quality objectives, as did air toxics.

The West Gate Freeway longitudinal study (1996-97 compared to 2004) found that the increase in traffic numbers experienced over the period was off-set by the reduction in fleet emission factors, so that despite a 30% increase in traffic volume, the impact levels did not significantly increase. The EPA concluded that "*Air quality along the Westgate Freeway is likely to continue to meet air quality objectives in the foreseeable future*" (EPA 2005, p.1).

3.3.2 Management measures and further investigations

The Project is expected to result in localised improvements in air quality in the inner west suburbs where heavy vehicle traffic movements would be reduced (i.e. Francis Street and Somerville Road in Yarraville). Near-road dispersion modelling would be undertaken to quantify the expected improvement in air quality.

In other areas there may be a localised reduction in air quality associated with traffic lanes in closer proximity to existing residential areas (i.e. along the West Gate Freeway). New at-grade and elevated roadways could also impact on air quality in surrounding areas (in particular the E - Gate precinct where housing developments may occur close to running lanes). An Air Quality Impact Assessment would be conducted as required under the VicRoads Screening Toolkit, including hot spot near-road modelling. Improved traffic flows resulting from the Project along with an expectation that fleet emission factors will continue to improve over time (EPA 2006) would be expected to reduce local air quality impacts.

Tunnel ventilation structures would be a new point source of air emissions. Numerous studies have found ventilation systems used by tunnels create better results for air quality as there are less emissions present at ground level where people breathe (AMA, 2013). A detailed assessment would be required in the next phase of the Project to inform the design of the tunnel ventilation structures. This would involve selection of a dispersion model, suitable site representative meteorology (the EPA Victoria weather data from Footscray or Altona North is suitable); an estimation of background levels and definition of worst case pollutant emissions. Based on prior experience with comparable operating road tunnels in Melbourne and elsewhere, such as CityLink and EastLink tunnels (refer EPA Publications 864 and 889) it is expected that the Project could be designed to meet regulatory standards.

Road works and tunnel construction involve substantial civil construction work and would generate dust which would need to be controlled. While water is most often used as a dust suppressant, extreme weather conditions can occasionally cause issues and it is often a requirement to include real-time reactive dust monitoring measures. These measures would typically be implemented as part of a Dust Management Plan.

Quantities of spoil from tunnelling activity would need to be transported to off-site disposal. Covered loads and wheel washes are often used to minimise dust on egress, and beyond, on road segments. Routes could also be selected, where practicable, to minimise distances travelled, co-mingled traffic and to avoid residential areas.

3.4 Noise and vibration

3.4.1 Existing conditions and potential impacts

Traffic noise has long been a significant issue in some parts of the Project area, especially for residential communities adjacent to Francis Street and Somerville Road in the inner west, and near major freight routes or industrial areas. EPA's Francis Street program (2013) measured

noise levels high enough to impact residents. Noise levels measured during 2012 - 13 were found to be greater than previous measurements in 2001 and 2002 on Francis Street, Yarraville.

The potential noise and vibration impacts that will need to be managed during construction and operation include:

- Short-term noise and vibration during the construction phase, including the impacts of tunnelling activity. Noise impacts would depend on construction equipment selection, schedule and methodology, and would be greatest in the event of evening and night time work.
- Any changes in the level of noise exposure for communities adjacent to the West Gate Freeway and the Western Distributor associated with freeway widening and elevated structures within the freeway or providing connections to the wider network. Road alignment design also has the potential to affect heavy vehicle exhaust/engine braking frequency and intensity depending on speed limits and lengths and placement of transitions, road bend curvature, and slope grading. Generally straighter flatter roads with longer speed limit transitions would be expected to decrease noise effects from brake use. Conversely down-hill roads approaching intersections would have the potential to increase noise effects from brake use (Austroads, 1993). Changes in the level of noise exposure are more likely to be an issue where housing and other sensitive receptors are near to road corridors (refer Section 3.3.1).
- Noise impacts from the operation of tunnel ventilation systems. Noise would be dependent on equipment selection, installation/structure locations and operating conditions. The tunnel ventilation systems would be subject to regulatory licensing and designed to be compliant with relevant standards.

A review of aerial photography identified that residential dwellings are likely to comprise the majority of noise and vibration - sensitive receivers within 500 m of the Project, along with a number of school and kindergarten premises.

3.4.2 Management measures and further investigations

Overall, the Project is expected to reduce noise issues in the inner west suburbs due to reduced truck and other traffic movements in this area.

Other communities however, may be exposed to increased noise levels associated with their proximity to the freeway widening and elevated roadways. Further investigation and modelling is required to determine the potential increase in traffic noise due to traffic volume projections and traffic volume spread within the existing and new lanes, and to consider noise associated with heavy vehicle supplementary braking systems, including the cumulative impacts from both elevated roads and West Gate Freeway widening. Noise modelling would need to consider the various heights of heavy vehicle-related noise sources, including exhausts, engines, braking and wheel/tyre interface. The height of a noise source is particularly important when determining noise mitigation strategies such as noise barriers.

Further assessment would review the sufficiency of the existing noise barriers along the West Gate Freeway to mitigate increases in noise due to the Project (noting that the noise barriers would have been designed to counter future projected increases in noise with increased traffic). Upgrades to the barriers may be required to mitigate increased traffic noise, and this could include replacement and relocation of existing noise walls, application of absorptive treatments and increasing the height of noise walls to achieve better noise attenuation. Acoustic mitigation via road design could also be considered such as road surfacing treatment and engine braking signage.

Noise from tunnel ventilation structures has the potential to impact upon sensitive receivers (such as residential areas). Therefore, surrounding land uses would need to be considered when locating the ventilation structures and appropriate engineering standards in tunnel ventilation system design would be adopted in order to support meeting noise limits.

Short-term noise and vibration impacts could also occur for some properties during the construction phase. Road construction in close proximity to residential areas would need to be carefully planned and managed to minimise construction noise and vibration impact.

Regenerated noise and vibration from a tunnel boring machine may temporarily affect individual properties as the machine passes beneath them. Vibration impact on any nearby heritage structures, underground services and buildings would require investigation. Mitigation measures are available to reduce these impacts (such as choice of construction equipment and hours of operation) and would depend on the topographical and the geological characteristics.

3.5 Greenhouse gas emissions

The Project could result in:

- Changes to the relative contribution and distribution of greenhouse gas emissions of road traffic.
- Greenhouse gas emissions associated with energy requirements to operate the tunnel and the tunnel ventilation systems.
- Greenhouse gas emissions from construction activities.

By making transport movements more efficient, the Project may contribute to a reduction in Victoria's transport related greenhouse gas emissions. Energy requirements to operate the tunnel, would, however, contribute to greenhouse gas emissions.

3.5.1 Management measures and further investigations

A greenhouse gas assessment in accordance with relevant standards would be undertaken for the Project and opportunities to reduce energy consumption and greenhouse gas emissions would be evaluated.

A best practice approach to energy consumption and greenhouse gas management would be adopted in accordance with EPA's Protocol for Environment Management – Greenhouse Gas Emissions and Energy Efficiency in Industry.

3.6 Contaminated land

Poor waste management and other industrial practices have led to the contamination of soils and groundwater in Melbourne's western region. Management of residual contamination is a key issue in the region as land uses change with redevelopment and residential growth.

Geology

The Project area is within the basalt plains to the west of Melbourne and the Yarra Delta sediments near the Port of Melbourne.

Table 2 outlines the likely geology that would be encountered along the proposed Project route.

Table 2 Likely geology in the Project area

Geology	West Gate Freeway	Western Distributor Tunnel	Western Distributor elevated roadway - Footscray Road to CityLink	East of CityLink
Surface geology	Newer Volcanics	Fill, Newer Volcanics, Coode Island Silt, Brighton Group	Rail ballast, fill, Coode Island Silt	Rail ballast, Fill, Coode Island Silt, Older Volcanics
Underlying Stratigraphy	Brighton Group, Newport Formation, Werribee Formation	Brighton Group, Newport Formation, Older Volcanics, Werribee Formation	Fisherman's Bend Silt, Moray Street Gravels	Older Volcanics, Melbourne Formation
Basement rocks	Melbourne Formation	Melbourne Formation	Melbourne Formation	Melbourne Formation

Potentially contaminating activities and areas of contaminated fill

A review of the 1966 Melways Street Maps identified potentially contaminating activities in the area, including:

- Former ESSO terminal immediately south of Stony Creek. This area occupies land now to the south of the West Gate Freeway between Hall Street and Simcock Avenue. Potential contaminants of concern include petroleum hydrocarbons, perfluorinated compounds (PFCs), metals and polychlorinated biphenyls (PCBs).
- Proposed Footscray and Williamstown combined tip. This area is now occupied by the Stony Creek Park backwash.
- Former municipal landfill south of the Jemena Yarraville Terminal Station and immediately west of Hyde Street.
- SEC terminal at Vockler Street. This land is now occupied by Jemena Yarraville Terminal and an area of vacant land. Potential contaminants of concern include petroleum hydrocarbons, metals, PCBs and asbestos.
- SEC substation at corner of Kyle Road and West Gate Freeway. Potential contaminants of concern include petroleum hydrocarbons, metals, PCBs and asbestos.
- Melbourne Metropolitan Board of Works sewer outfall reserve approximately 100m north of West Gate Freeway near the intersection with Millers Road. Potential contaminants of concern include nutrients such as nitrates, phosphates and microbial contaminants.

There are also likely to be areas of contaminated fill across the extent of the Project area, due to former and current industrial activities. For example, historical quarrying of clay and basalt rock occurred throughout metropolitan Melbourne and the resulting pits were often used for uncontrolled filling. Six closed landfills have been identified within close proximity to the proposed route. These include:

- Kyle Road landfill, Altona North.
- Hardie Road Landfill in Yarraville, immediately north of West Gate Freeway.
- Ex-municipal landfill near the corner of Grieve Parade and Blackshaws Road, Altona.
- Crofts Reserve in Knapp Street, Altona.
- 22 New Street landfill in South Kingsville.

- Ex-private landfill adjacent to Stony Creek and Hall Street, Yarraville.

It is possible that such pits may also occur elsewhere within the vicinity of the proposed works. Potential contaminants of concern associated with fill material will vary depending on site uses but typically include:

- Metals.
- Total petroleum hydrocarbons (TPHs).
- Polycyclic aromatic hydrocarbons (PAHs).
- Asbestos.
- Polychlorinated biphenyls (PCBs) – where transformers are located.

3.6.1 Existing conditions and potential impacts

Based on this high-level assessment, likely contamination issues associated with specific key sections of the proposed Project are summarised below.

West Gate Freeway – Widening

- Contaminated soil and groundwater from the chemical storage, industrial activities, automotive works, etc. Potential contaminants of concern are likely to be TPHs, metals, VOCs, asbestos and possibly PFCs associated with the former ESSO site to the south of Stony Creek.
- Former landfills in the area. Potential contaminants of concern are typically metals, TPHs, PAHs, asbestos, VOCs and nutrients (nitrogen compounds). The material is likely to have aesthetic issues as well. Leachate can develop from landfills and impact groundwater.
- Sub-stations. Potential contaminants of concern are likely to be metals, TPHs, PCBs, asbestos and PAHs.
- Possible elevated lead in soils adjacent to the freeway due to former use of leaded petrol.

Western Distributor – Yarraville alignment (including tunnel)

- Acid sulphate soils. This material would need to be assessed for acid sulphate potential should off-site disposal be required.
- Industrial contaminants from the Mobil terminal and other industrial properties. Contaminants associated with this site are likely to be petroleum hydrocarbons in soil and groundwater, metals, VOCs, PCBs and PFCs.
- Former ESSO site to the south of Stony Creek. Contaminants associated with this site are likely to be similar to those at Mobil terminal (see above).
- Possible uncontrolled tipping in the area.
- Former landfills near Stony Creek and Hall Street. Potential contaminants of concern are typically metals, TPHs, PAHs, asbestos, VOCs and nutrients (nitrogen compounds). The material is likely to have aesthetic issues as well. Leachate can develop from landfills and impact groundwater.
- Elevated salinity of groundwater and potential naturally occurring elevated ammonia and methane.

Western Distributor – elevated road and Port access

- Acid sulphate soils. This material would need to be assessed for acid sulphate potential should off-site disposal be required.
- Rail ballast along the rail line immediately south of Footscray Road. Potential contaminants include TPHs, PAHs, oils and greases and asbestos.
- Possible uncontrolled land filling in the area.
- Elevated salinity of groundwater and potential naturally occurring elevated ammonia and methane. Note that methane pockets in the CIS and FBS may be under pressure.

Western Distributor – eastern interchange and CBD bypass

- Contaminated fill across the region due to former and current industrial activities and land reclamation from former swamps. Potential contaminants associated with the fill include metals, TPHs, PAHs, cyanide, ammonia and asbestos.
- Acid sulphate soils. This material would need to be assessed for acid sulphate potential should off-site disposal be required.
- Rail ballast near the E-Gate site. Potential contaminants include TPHs, PAHs, oils and greases and asbestos.
- Possible uncontrolled land filling in the area.
- Any fuel storage areas may contribute petroleum hydrocarbons to soil and groundwater.
- Elevated salinity of groundwater and potential naturally occurring elevated cyanide, ammonia and methane.
- Land potentially subject to flooding near Moonee Ponds Creek.

3.6.2 Management measures and further investigations

Further investigations to inform approvals during Project planning

Contamination issues are commonly very site specific. Given the large area covered by the Project, a number of data gaps currently exist. While most industrial sites will have had some level of assessment, this may be limited and/or outdated, and the purpose of the assessment may vary from the requirements of this Project. A Project-specific assessment would be required at the planning stage, particularly for areas where extensive earthworks would occur, such as at tunnel portals and piling locations. This would include the following:

- A more detailed assessment of historical contamination and site inspections.
- Engagement with the EPA to establish guidelines around soil re-use.

Management measures to consider during design and construction

A Project-specific assessment would also be required during the design and tender phase. A staged approach in accordance with the National Environment Protection Measures (NEPMs) would include:

- Compilation of existing soil and groundwater information into a database and GIS including contaminant concentrations and types, depth to groundwater and groundwater quality. This would be used to identify sampling areas.
- Selection of sampling areas based on the type of work likely to be conducted. Sampling locations may coincide with geotechnical drilling locations. If significant earthworks are required for works to the West Gate Freeway, a higher density of sampling may be required.

Any soil from the area that is excavated or drilled would require classification for waste disposal purposes in accordance with Industrial Waste Resource Guidelines (IWRG) and for acid sulphate potential. Some soils may require treatment before off-site disposal. PFCs are of particular concern as there is currently no accepted Australian guidance on disposal of PFC soil and groundwater. Soils impacted by PFCs may not be able to be disposed to landfill.

The need for active remediation is not established and may only be required if an unacceptable risk is posed by the soils with respect to the disposal or re-use (notably if the soils are classified as Category A according to the EPA industrial Waste Resource Guidelines) and cannot be disposed of off-site or if acid sulphate soils are exposed (which may need stabilisation and neutralisation), or if required by the site auditor. Other methods of soil management may be more appropriate such as on-site encapsulation, or off-site soil treatment. The soil management approach would need to meet EPA requirements.

3.7 Groundwater

3.7.1 Existing conditions and potential impacts

Identified aquifers

A summary of the hydrostratigraphy within the Project area based on existing geological and hydrogeological information is provided in Table 3, along with a description of the likely level of confinement of the aquifer systems.

Table 3 Hydrostratigraphic summary

Formation	Morphological region	Aquifer	Aquifer type	Indication of confinement
Fill material	Port Phillip Basin and Yarra Delta	Aquifer (perched /or hydraulically connected with water table)	Porous media	Unconfined
Coode Island Silt	Yarra Delta	Aquitard – generally considered incapable of transmitted large volumes of water	Porous media	Deeper sand / shell beds may be confined. May form the water table aquifer in the eastern parts of the study area. May have thin sand seams.
Fishermans Bend Silt	Yarra Delta		Porous media	
Moray Street Gravel	Yarra Delta	Aquifer	Porous media	Confined – by overlying Coode Island Silt and Fishermans Bend Silt
Newer Volcanics	Port Phillip Basin and Yarra Delta Main aquifer in the western areas.	Aquifer	Fractured rock	Unconfined – constitutes the water table aquifer in the western parts of the study area. Deeper flows may exhibit some semi-confinement / leaky confinement by interflow clays / massive zones.

Formation	Morphological region	Aquifer	Aquifer type	Indication of confinement
Brighton Group	Port Phillip Basin and Yarra Delta Can be thin to absent in the western areas.	Aquifer	Porous media	Confined to semi-confined. In the western parts of the study area the Newer Volcanics may impart some confinement to the Brighton Group system.
Newport / Fyansford Formation	Port Phillip Basin and Yarra Delta	Variable. Aquifer where coarse grained. Aquitard where fine grained.	Porous media	Confined to semi-confined. In the western parts of the study area it tends to be fine grained.
Older Volcanics	Port Phillip Basin and Yarra Delta	Aquifer	Fractured rock	Confined to semi-confined.
Werribee Formation	Port Phillip Basin and Yarra Delta. In the western areas this aquifer is located at considerable distance below the surface. Tunnel grades will influence whether or not it is intersected. It is overlain by other aquifers, e.g. Newer and Older Volcanics, Brighton Group.	Aquifer	Porous media	Confined to semi-confined.
Dargile / Melbourne Formation	Port Phillip Basin and Yarra Delta. In the western areas this aquifer is located at considerable depth below the surface. Tunnel alignment and gradeline will influence whether or not it is intersected. It is overlain by other aquifers, e.g. Newer and Older Volcanics, Brighton Group).	Aquifer	Fractured rock	Confined to semi-confined (by overlying Tertiary and Quaternary).

A review of the hydrostratigraphy suggests that a key issue for tunnel designers could be the mixed face ground conditions, and the variable aquifer hydraulic properties of the formations being tunnelled. In addition, characterisation of aquifer hydraulic parameters can be difficult in fractured rock owing to the inherent variability of these aquifer types. Data documented by Leonard (1992, 2006) indicates permeability can be highly variable and range over orders of magnitude.

The fractured rock aquifers, e.g. Newer and Older Volcanics, are likely to have low storage coefficients and therefore may not necessarily release large volumes of water. High permeability of the Werribee Formation, particularly where it is coarse grained, may yield significant volumes.

Another consideration is the interaction between aquifers, i.e. leakage. This has potential implications for subsidence.

Groundwater use and quality

Groundwater use in the region is likely to be limited, being influenced by the following factors:

- High density industrial use and reticulated water is readily available in the study area.
- Poor groundwater quality.

Groundwater in the Project area has high salinity. The South Western Victoria Water Table Aquifers Map, (DNRE Beneficial Use Series 1995), indicates that the salinity of the regional groundwater falls within Segment C (or higher) which is too saline for potable or irrigation applications, and with increasing salinity, its use in industrial applications becomes constrained.

The prevalence of contaminated sites (as described in section 3.6) and the history of industrial development in the Project area, indicates that groundwater contamination is likely to be intercepted by the Project.

Stony Creek and the Maribyrnong River are classified as Groundwater Dependent Ecosystems (GDEs) (Bureau of Meteorology GDE Atlas). The generally saline nature of groundwater would suggest that its value as a water supply (either as permanently or opportunistically) to flora within the Project area is limited. At this downstream end of the Stony Creek catchment, groundwater inflows to the creek are likely to be low given the flatter hydraulic gradients, or at least a less dominant process relative to tidal processes.

Groundwater levels and flow direction

The DELWP Water Measurement Information System indicates that groundwater levels range between 0.3m to 1.8m above sea level. Groundwater levels are likely to be influenced by tidal fluctuations owing to the proximity of the coast.

The lack of groundwater use in the region suggests that abstractive influences on water levels are likely to be minimal. One dewatering bore was identified in the Project area.

Water levels within the shallow fill may be perched above the regional water table.

A deep sewer may be locally influencing (depressing) water levels in the Whitehall Street area. The sewer runs along Whitehall Street and through the centre of the Mobil Terminal on Francis Street.

Potential impacts

Potential impacts that could arise from the Project's interaction with groundwater and need to be managed are likely to be:

- Handling and management of extracted groundwater from tunnel construction and operation.
- Potential for the tunnel to contribute to migration of existing contaminated groundwater plumes.
- Potential for local subsidence associated with dewatering of aquifers hydraulically connected with a compressible material.
- Groundwater contamination from potential spills and leaks during construction or operation.
- Changes in groundwater and surface water interactions from works over waterways.

The tunnelling method can significantly influence interactions with groundwater, as well as the impacts to the groundwater environment. Tunnel Boring Machines (TBMs) with shields/earth pressure balance can significantly reduce changes to the groundwater level.

3.7.2 Management measures and further investigations

Treatment options for extracted groundwater from the tunnel may involve the establishment of packaged treatment plants or trade waste agreements. The management strategy for extracted groundwater would need to consider whether the groundwater quality and loads are acceptable for disposal to sewer and the capacity in nearby sewers. There may also be specific constituents that may necessitate groundwater treatment. For example, the volcanic aquifer (basalt) can contain iron rich groundwater which can lead to fouling risk. In addition, with increasing focus on recycled water, water authorities prefer lower salinity waters within their system.

Changes in groundwater flow can result in the dislocation or mobilisation of contaminated groundwater plumes, e.g. a drained tunnel may create a sink in the regional water table and draw contamination toward it. For identified plumes, there would be a need to characterise their extent and to undertake technical studies to determine whether these plumes would be influenced by the proposed construction and to develop management measures, i.e. for health and safety, sterilising sites for future clean up, and how to mitigate their effects on the Project. Management and monitoring plans and consultation with various parties (landholders, regulators) would be required.

Reductions in water level have the potential to result in mobilisation of volatile contaminants in groundwater. This can pose a risk to construction workers, but also to the public at surface level. Construction methods (and lining system) can minimise water level changes. Contaminated groundwater would also influence construction through the need to handle contaminated cuttings, waste rock and tunnelling slurries.

Where dewatering or depressurisation of compressible materials occurs, there is a risk of consolidation settlement. Weak materials, e.g. Coode Island Silt consolidate under their own weight. Within the Project area, the basalts (and Palaeozoic rocks) are not a compressible material and the former may act as a raft to support against consolidation of underlying sediments. The likelihood of subsidence is influenced also by interactions between adjoining aquifers, e.g. dewatering of an aquifer that is hydraulically connected with a compressible material. Depressurisation of the Moray Street Gravels, or permeable beds within the Coode Island Silt of Fisherman's Bend Silt, can lead to consolidation of these compressible sediments.

These materials are mostly absent from the tunnel alignment, but investigations are required at the eastern portal to confirm the likelihood of them being encountered, i.e. close to the Maribyrnong River.

Groundwater quality could be affected by spills of hazardous materials, either during construction or operation of the Project, where the materials migrate vertically to the water table. Construction environment management practices and emergency service response procedures are considered sufficient to manage these potential risks. The Newer Volcanic basalt tends to have clay rich soils which also tend to retard the vertical migration of substances.

The Project would also bridge over waterways. Changes in flow dynamics can alter the interaction between surface and groundwater. Any bridging structure (and associated pylons/columns) should take due consideration of preserving floodplain function. Under these conditions, changes to the groundwater environment (and groundwater surface water interaction) are not expected, or can be managed.

3.8 Surface water

Melbourne Water has the primary responsibility for waterway, drainage and floodplain management within the Project area. This work is undertaken with the support of Councils, landowners, and community groups (including but not limited to the Friends of Lower Kororoit Creek, Friends of Stony Creek, Friends of the Maribyrnong Valley and Friends of Moonee Ponds Creek).

The Project would involve a number of waterway crossings, as follows:

- Widening of the existing West Gate Freeway crossing of the Kororoit Creek, to the east of the M80.
- A new elevated roadway crossing Stony Creek between Hyde Street and the railway line, where the West Gate Freeway would branch into the new Western Distributor tunnel.
- Bridging over the Maribyrnong River near Lyons Street in Yarraville, connecting to Sims Street and a new elevated roadway above Footscray Road.
- Bridging over Moonee Ponds Creek associated with a new road connection to the city.

The following discussion of existing conditions and potential impacts draws from AECOM's *Truck Action Plan – Stage 1: Surface Water & Hydrologic Assessment Existing Conditions and Constraints Report for VicRoads* (11 December 2009) and the *East West Link – Eastern Section Surface Water Impact Assessment* (GHD 2013).

In addition, relevant information from Melbourne Water's *Healthy Waterways Strategy* (November 2013) is summarised for the key waterways within the Project area. The Strategy was developed to guide investment in waterway health in the Port Phillip and Westernport region from 2013/14–2017/18. It identifies priority areas and a vision for future management for smaller management units within each 'system' or sub-catchment.

Investigation of the potential implications of climate change for the Project has not been undertaken at this stage; however it is noted that Melbourne Water is currently considering adaptation and mitigation strategies to prepare for the potential effects of climate change, including rising sea levels, heavier storms and reduced streamflow (Melbourne Water n.d).

3.8.1 Existing conditions and potential impacts

Key waterways, drainage paths and existing flood conditions

Kororoit Creek

Kororoit Creek runs in a north-south direction close to the western edge of the Project area. The lower section of the creek begins just upstream of Deer Park and passes through Sunshine and the industrial areas of Brooklyn and Altona before entering Port Phillip Bay.

The section of the Kororoit Creek in the Project area is within the Lower Kororoit Creek Management Unit. Melbourne Water's management objective for the Lower Kororoit Creek Management Unit is to improve amenity. The vision to 2030 for the Lower Kororoit Creek includes the installation of extensive water sensitive urban design features throughout the catchment to improve water quality, development of a continuous and linked open space network along the creek corridor, and the establishment of a diverse community of urban tolerant native fish with allowance for migratory fish to pass through barriers in the lower part of the catchment.

The banks of the Kororoit Creek within the Project area are subject to flood inundation during the 1 in 100 year storm event and are affected by a Land Subject to Inundation Overlay (LSIO).

Stony Creek

Stony Creek runs north-south before becoming parallel to the West Gate Freeway just west of Williamstown Road. The creek originates in Sunshine and flows through Tottenham, West Footscray and Yarraville before opening into a naturally occurring salt marsh (Stony Creek Backwash) just to the east of Hyde Street, and flowing into the Yarra River. The vision to 2030 for the Stony Creek Management Unit includes the installation of extensive water sensitive urban design features to improve water quality, reduce litter and provide an alternate source of water to irrigate parklands. Melbourne Water's aim is to minimise impacts on the creek from industrial processes, and to establish native streamside vegetation such as mangroves in parts of the catchment.

The land on the northern bank of the creek between Hyde Street and the railway line is known as the Stony Creek Reserve. The Stony Creek Reserve is at risk from flooding when there are high water levels within the creek. An LSIO applies to this area, as well as to the north-south section of the creek that is perpendicular to the West Gate Freeway. Numerous residential properties are also likely to be flooded in a 1 in 100 year ARI flood event.

Maribyrnong River

The Maribyrnong River runs in a north-south direction in the eastern section of the Project area, separating Yarraville and Seddon from West Melbourne and the Port of Melbourne. The Maribyrnong River services a catchment of approximately 143 square kilometres and yields an average annual flow volume of 120,000 million litres. The river joins the Yarra River estuary at Yarraville.

Within the Project area, improvement of amenity within the Maribyrnong River Management Unit has been identified as a priority. The vision to 2030 is for remnant vegetation patches to have been linked through revegetation programs and for constructed and restored natural wetlands to contribute to improving water quality and amenity.

A small number of industrial properties along the Maribyrnong River upstream of Shepherds Bridge are currently subject to flood inundation during the 1 in 100 year storm event and are covered by an LSIO.

Moonee Ponds Creek

Moonee Ponds Creek flows along the CityLink corridor before joining the Yarra River at Docklands.

This lower reach of Moonee Ponds Creek plays a significant role in conveying floodwaters within the region and has been widened and straightened to form what is called 'railway canal'. It is tidal influenced, receiving tidal flushing and providing habitat for a number of estuarine fish species.

The section of the Moonee Ponds Creek that is within the Project area is within the Moonee Ponds Creek Management Unit. Of relevance to the Project area is the priority to maintain amenity around the creek. Melbourne Water's vision for 2030 is for improvement of streamside condition along the urbanised sections of the creek.

The area surrounding the proposed new bridge over Moonee Ponds Creek is subject to flooding and is affected by an LSIO.

Drains

Melbourne Water also has three major drains located within the Project area. The locations of these drains are described as follows:

- Drain 1 – runs in a north-west direction towards the intersection of Lyons Street and Hyde Street and then along Lyons Street until it meets the Maribyrnong River.
- Drain 2 – runs in a north-south direction from the intersection of Blackwood Street and Fehon Street to Stony Creek.
- Drain 3 – runs in a south-north direction adjacent to Melbourne Road between the intersection of Mary Street and Cullen Street and Stony Creek.

These underground drainage networks are designed to cater for flows up to the 1 in 5 year storm event; however flows in excess of the pipe capacity will follow an overland flow path. During a 1 in 100 year ARI flood event there is overland flooding.

Potential impacts on flood conditions, water quality and riparian vegetation cover

Construction and permanent works along and within waterways have the potential to affect the frequency and depth of flooding in the Project area. Increased flood levels and flooding may result from:

- During construction:
 - Locating temporary stockpiles or structures, equipment or plant within the floodplain.
 - The use of temporary cofferdams or diversions.
 - The location of access and/or working platforms.
 - Modifications to banks and levees
- During operation:
 - Modification of overland flow paths by Project components such as elevated and at-grade road structures, ventilation structures, proposed grade changes as part of the Project alignment and any perimeter swales or bunds required around the tunnel portals.
 - Concentration and acceleration of drainage flows from the elevated structures
 - Bridge piers constructed within the waterways (i.e. if required within the Maribyrnong River).

It is possible that flood conditions could result in inundation of the tunnel portals without any mitigation. In addition, if any sections of fill are required as part of the Project, this could prevent flows from extending across the floodplain and could further increase upstream flood levels.

Water quality and overall waterway health will require management during construction and operation. During construction, there is the potential for construction area runoff of sediments and pollutants to enter the waterways. During operation, the Project would increase impervious surfaces and the resulting increase in surface/stormwater flows of transportation/vehicle pollutants and litter could have an impact on waterway quality. The impact would be more significant if drainage systems associated with new roadways constructed as part of the Project were to discharge untreated runoff into the waterway/s to satisfy road drainage requirements.

Introducing elevated structures over the waterways could reduce rainfall and daylight to vegetated areas. This would potentially reduce riparian and instream vegetative cover and bank stability, and increase exposed soil surfaces and the potential for erosion. If not managed, ongoing erosion has the potential to result in an ongoing reduction in water quality.

3.8.2 Management measures and further investigations

It is anticipated that Melbourne Water could have the following requirements for works associated with the Project:

- Any structure to be at least 600 mm above the 1 in 100 year ARI flood level.
- Existing flooding conditions are not to be exacerbated as a result of the proposed works. Residential properties are currently at risk of inundation and it will be of high importance that these properties do not experience an increase in that risk as a result of the Project. Consideration will need to be given to proposed grade changes as part of the Project alignment to ensure that the existing overland flow paths can be retained or redirected without adversely impacting on upstream or downstream properties.
- If water surface levels are increased, works will be required to offset the impact.

Works can be undertaken to increase the flow conveyance area. It would be preferable to undertake these works outside of the permanent waterway where this opportunity exists. Works within the floodplain (i.e. to increase its area/volume) are more cost effective and often have more manageable environmental implications than in-stream works. Protection of private property from increased flood levels (e.g. by constructing a low earth embankment or retaining wall) is not a preferred alternative and should only be considered if other mitigation options are not suitable.

Works associated with the Project would need to ensure that high concentrations of pollutants associated with increased traffic volumes are not washed into the river during storm events. This could be achieved through Water Sensitive Road Design techniques, if necessary including the treatment of runoff prior to allowing this to enter the waterway/s. If restrictions on the available land limit treatment options available at the source/s, then an offset treatment upstream could be considered. This could be an opportunity to employ an innovative treatment technology.

To minimise the potential for erosion along waterways and within the floodplains and any associated reduction in water quality, bank surfaces would need to be revegetated or stabilised following construction.

Detailed Project-specific design, hydraulic modelling and aquatic ecology investigations are required to determine the suitability of these potential solutions and discussion with and approval from Melbourne Water would be required in developing any mitigation options.

3.9 Flora and fauna

3.9.1 Ecological values in the Project area

The Project area is predominately industrial and residential in nature, and as such has been extensively cleared of almost all remnant vegetation. However some remaining areas of ecological sensitivity have been identified, including:

- **Stony Creek, Stony Creek Reserve and the Stony Creek Backwash** – These areas support aquatic and semi-aquatic native vegetation communities (Remnant Coastal Saltmarsh EVC 9 and Mangrove Shrubland EVC 140) as well as habitat for waterbirds and waders and threatened flora and fauna species. The coastal saltmarsh vegetation in this location is also considered to be part of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed Subtropical and Temperate Coastal Saltmarsh community.
- **Maribyrnong River** – Whilst highly modified, threatened and other aquatic fauna are present within the river or use the river as a migratory pathway. The Maribyrnong River has potential for the EPBC Act-listed Australian Grayling to be present.
- **Kororoit Creek** – A small patch of Riparian Woodland (EVC 641) is located along the creek, however the majority of the vegetation has the appearance of being planted. Whilst no population of Growling Grass Frog is known to occur within the Project area, individuals may disperse along Kororoit Creek very occasionally. No habitat critical to the species occurs within the Project area.
- **Moonee Ponds Creek** – Brackish wetland vegetation (EVC656) lines Moonee Ponds Creek between Dynon Road and Footscray Road.

General parklands and road reserves throughout the Project area provide foraging and roosting habitat for a range of native and non-native species that are common in urbanised environments.

Threatened flora and fauna species and communities

The heavily disturbed nature of the Project area and surrounding urbanised and industrialised landscapes limits the potential of the area to support threatened flora and fauna populations.

One threatened ecological community listed as vulnerable under the EPBC Act was recently recorded within the Stony Creek and Stony Creek Backwash area – the Subtropical and Temperate Coastal Saltmarsh community.

The estuarine reach of Stony Creek, the Maribyrnong River corridor and exposed mud banks of the Moonee Ponds Creek at low tide may occasionally attract small numbers of threatened shorebirds and waterbirds.

The EPBC Act listed Australian Grayling possibly occurs in the upper reaches of the Maribyrnong River. If present, larvae would drift downstream to Port Philip Bay along the Maribyrnong River through the Project area and juveniles would return to freshwater river habitat by swimming upstream.

The threatened Grey-headed Flying-fox (EPBC and FFG Act listed), Swift Parrot (EPBC and FFG Act listed) and EPBC listed migratory bird species are considered to have the potential to use habitats within the Project area, but these habitats are not considered critical for these species' survival.

3.9.2 Potential impacts

Tunnelling underneath ecologically sensitive areas would avoid most ecological impacts. However, impacts may arise from:

- Construction activity, particularly within the Maribyrnong River and the Kororoit Creek and Stony Creek corridors which could potentially affect riparian and instream environments
- Potential loss of native vegetation and habitat for threatened flora and fauna species.

3.9.3 Management measures and further investigations

Bridges would span the Maribyrnong River and the Kororoit, Stony and Moonee Ponds Creeks. Bridge spans over the Kororoit, Stony and Moonee Ponds Creeks would need to be designed to avoid permanent in-stream structures. However it is expected that pier/s would be required within the Maribyrnong River.

Any construction works in the vicinity of the waterways would need to minimise disturbance to riparian and aquatic environments and habitat for threatened species. Free passage for aquatic species would be required to be maintained throughout construction and water quality would be protected and monitored through sediment control and other management measures incorporated within a Construction Environment Management Plan (CEMP). Risks to threatened species could be further reduced by avoiding any in-stream or bank works during fish migratory seasons.

Tunnelling would avoid impacting most areas of native vegetation and habitat for threatened flora and fauna species in the Project area. Careful placement of above ground infrastructure, such as surface roads and tunnel portals, would be required to further minimise any loss of native vegetation, including the remnant coastal saltmarsh and mangrove vegetation communities along Stony Creek and Stony Creek Backwash, which provide habitat to threatened and migratory bird species. Appropriate mitigation techniques for threatened species during construction would be required to be incorporated into the CEMP. Any unavoidable loss of native vegetation would need to be offset.

3.10 Aboriginal cultural heritage

3.10.1 Existing conditions and impacts

The Project is being constructed through a highly modified urban environment, nevertheless there is potential for Aboriginal places (archaeological sites) to occur within the project area. If present, Aboriginal places will most likely to occur in proximity to waterways, but may also occur in pockets of relatively undisturbed land away from water. Due to the modified nature of the project area the potential for undisturbed Aboriginal places to occur is low.

No registered Aboriginal places have been identified in the project area; however, they do occur in the wider region, indicating that they could be present in the project area. Creeks and rivers are known to have increased potential to contain Aboriginal places.

Kororoit Creek, Stony Creek, Moonee Ponds Creek, the Yarra River and the Maribyrnong River dissect, or occur in proximity, to the project area, but have been variably disturbed/modified in the post contact period. Their integrity will have affected their archaeological potential. The Kororoit Creek and Stony Creek corridors appear to be less modified in parts of the project area and may contain Aboriginal cultural heritage. This is supported by the presence of numerous Aboriginal places in the Kororoit Creek corridor adjacent to the project area.

If present, Aboriginal cultural heritage will most likely comprise stone artefact scatters in surface or subsurface deposits. However, the presence of other types of cultural heritage, such as freshwater shell middens and hearths, cannot be ruled out. [REDACTED]

3.10.2 Management measures and further investigations

In order to fully understand any risks to Aboriginal cultural heritage values, a cultural heritage assessment would be undertaken, with particular focus given to areas adjacent to waterways and areas of remnant vegetation where the probability of finding such cultural material is highest.

Under the Aboriginal Heritage Act, a Cultural Heritage Management Plan (CHMP) is required if all or part of a proposed activity is in an area of culture heritage sensitivity, and all, or part of the activity is a high impact activity.

A cultural heritage advisor would undertake desktop and field assessments and work with Aboriginal community representatives to identify and assess cultural heritage values. The CHMP would contain the results of an assessment of the potential impacts on Aboriginal cultural heritage and measures to be taken before, during and after the Project in order to manage and protect Aboriginal cultural heritage values.

3.11 Historic heritage

3.11.1 Existing conditions and impacts

The project boundary intersects or is in close proximity to a series of heritage places, predominantly associated with Melbourne's industrial and maritime history. These include archaeological sites listed in the Victorian Heritage Inventory (VHI), as well as sites included in the Schedule to the Heritage Overlay under the Maribyrnong and Hobsons Bay planning schemes and a small number of Victorian Heritage Register (VHR) sites. Of these, it is noted that relatively few sites are actually within the project boundary.

At its western end the project boundary is close proximity to the VHR-registered Main Outfall Sewer (H1932); this is also included in the Victorian Heritage Inventory (H7822-0273) and is reflected in the Heritage Overlay HO2 in the Wyndham Planning Scheme.

West of Williamstown Road in Yarraville, the project is located in close proximity to the former Bradmill Factory (HO125), which is included in the Schedule to the Heritage Overlay of the Maribyrnong Planning Scheme.

In the vicinity of the proposed southern portal (abutting or in close proximity) are a number of archaeological sites included in the Victorian Heritage Inventory associated with the Stony Creek and its backwash. Also in close proximity in the same area are the Jemena Yarraville terminal station (HO130) and the Old Yarraville Primary School (HO37), both of which are included in the Schedule to the Heritage Overlay of the Maribyrnong Planning Scheme, and various buildings and structures on the Vacuum Oil Company Ltd Depot site (HO130 in the Hobsons Bay Planning Scheme). Just south of the southern portal is the VHR and VHI-registered Spotswood pumping station (H1555; HI7822-0145).

While in tunnel, the project abuts the Yarraville Gardens site (HO138) and abuts or intersects with a series of further industrial sites on the Maribyrnong River in Yarraville and Footscray; these are the Cuming Smith site (HO179, demolished), the Powder Magazine HO177), Mowlings Soap and Candle (HO178) and Barnett Glass & Rubber (HO78). Some distance east of the project boundary is the VHR-registered CSR complex (H1311; HO75) and the VHI registered Yarraville Sugar Refinery wharves (H7822-0527; HO75).

There are a number of archaeological (Heritage Inventory) sites adjacent to the Maribyrnong River near the proposed river crossing. A number are within the project boundary while others fall outside it. Those that are within the boundary are the Victorian Heritage Register (VHR) listed Saltwater River Crossing and Footscray Wharves H1397 (also Heritage Overlay HO50), the Sims Street unidentified timber slipways and boatyard (H7822-0487), the Shepherd Swingbridge abutment foundations (H7822-0434) and the Botterill and Fraser slipways, concrete landing and boatyard (H7822-0442).

There may also be archaeological sites in the Maribyrnong River, such as the shipwrecks Ecina Bow (S199) and an unidentified Maribyrnong River mud hopper barge wreck (S781) and there may be others not previously identified.

In the vicinity of the proposed Footscray Road elevated structure and CityLink are the VHI-listed archaeological sites the West Melbourne Rubbish Tips (H7822-0312) and the Dudley Flats rubbish dump and ash tipping site (H7822-0167).

At the eastern end of the Project boundary the North Melbourne Locomotive Shed is identified in the Heritage Inventory (H7822-0166).

Also at its eastern end the Project boundary intersects with a proposed Heritage Overlay precinct. Amendment C207 to the Melbourne Planning Scheme proposes to apply the Heritage Overlay to the Moonee Ponds Creek and Infrastructure Precinct (proposed HO1092); this amendment has been considered by an independent Panel (reporting in January 2014) however the amendment has not yet been gazetted.

3.11.2 Management measures and further investigations

Impacts on heritage sites could be minimised by avoiding physical or visual impacts on sites where possible and through a range of other measures. These would include expert archaeological investigations, management of impacts associated with vibration and ground settlement, a program of community involvement in heritage and archaeological investigations, and provisions in the Environmental Management Plan for specific processes to be followed if a previously unknown heritage site is found during construction. Actions to mitigate losses where destruction occurs would include the preparation of measured drawings and an archival photographic record.

3.12 Urban form and visual impact

3.12.1 Overview

Historically, the area within the corridor of the Western Distributor component of the Project was predominantly industrial and generally considered to have low landscape and visual significance. However, recent growth in residential and mixed use commercial activities has led to higher community expectations relating to visual amenity.

The potential benefits and impacts of the Project on urban form and the visual landscape are likely to be associated with:

- Direct and indirect impacts of Project structures on surrounding urban form, local character and streetscapes.

- The introduction of elevated roadways and bridges, ventilation structures and tunnel portals, with associated changes to local visual amenity, community facilities (including recreational and health services), open space and significant areas of heritage built form.
- Urban renewal initiatives or opportunities in the vicinity of the Project.

3.12.2 Urban Design Principles

The following principles align with other Freeway developments and corridors across Melbourne:

- A distinctive identity for the Freeway corridor and the surrounding areas.
- Clear and legible wayfinding.
- Flexibility to support changes in land use of surrounding areas over time.
- Positive integration of the Freeway corridor into the surrounding environment.
- Enhanced visual and functional amenity along and adjacent to the Freeway corridor.

As a general principle, the Project should mitigate adverse impacts including the severance of communities, whilst enhancing opportunities for urban renewal and investment. In addition, the proposal should improve the existing functionality of the surrounding precincts and places it traverses, and enhance the local environment.

3.12.3 West Gate Freeway – Widening

The West Gate Freeway component traverses a combination of residential and industrial/commercial environments. In certain locations, it will place pressure on residential amenity through the widening of the freeway, the need to relocate and reconfigure access ramps and noise walls and the possible reconfiguration or removal of landscape buffers.

There are two distinct locations where widening of the Freeway will place pressure on the adjacent residential environment. Properties at the northern ends of Freemans Road, Misten Avenue, Rosala Avenue and Irwin Avenue in Altona North are potentially affected by the Freeway widening, the relocation of noise walls and the loss of connectivity between pairs of roads. These are roads or streets that were originally severed by the construction of the West Gate Freeway, and residential land acquisition to maintain local connectivity may be an outcome of the proposed upgrade of the West Gate Freeway.

The relocation and reconfiguration of noise walls (potential increase in height) and the loss of amenity and landscape planting along the margin of the West Gate Freeway have the potential to reduce visual amenity, particularly through visual dominance, shading and loss of green buffer characteristics.

These impacts will be most likely to occur at Hick Street, Vernier Street and Derham Street west of Williamstown Road. Existing pedestrian overbridges need to be lengthened in these areas. These bridges also need to be designed to be compliant with the requirements of the Disability Discrimination Act 1992, to enable disabled access and use of these connections between communities on either side of the Freeway.

There are two urban renewal projects immediately adjacent to the West Gate Freeway corridor. The redevelopment of the Bradmill Site on Francis Street in Yarraville is anticipated to result in a high density residential (1,900 dwellings) and mixed use development. The site of the former Don's Small goods factory in Altona North is estimated to be capable of supporting approximately 2,000 dwellings in a high density development on Blackshaws Road. Both of these developments will result in additional pressures on arterial roads within their local communities, but both will also benefit from good accessibility to the West Gate Freeway through the Millers Road and Williamstown Road interchanges.

3.12.4 Western Distributor – Yarraville alignment (including tunnel)

Within the Western Distributor component of the Project there are a number of issues relating to urban form and visual impact that will need to be resolved. The most significant of these relates to the southern portals in the vicinity of the Jemena site at Hyde Street and Stephens Street, and the impact on the Stony Creek Reserve and the surrounding natural and built environment.

Stony Creek Reserve is reserved Crown Land, with the City of Maribyrnong acting as the Committee of Management. The bed of the creek is a separate parcel of reserved Crown land managed by Melbourne Water. In 2014 the City of Maribyrnong adopted the Stony Creek Future Directions Plan which is a masterplan for the length of the Creek from Paramount Road to the confluence of the creek and the Maribyrnong River.

The at-grade components of the Western Distributor, linking the eastbound and westbound ramps to the tunnel portals and the West Gate Freeway, divide the reserve into two principal parts between the Williamstown railway line and the Stony Creek backwash. In addition, the proposed at grade connections to Hyde Street would further constrain movement through the reserve.

At the same time, the Project creates an opportunity to reconfigure the Stony Creek Reserve and incorporate features that would assist in mitigation of adverse impacts on adjacent residential and mixed use activities to the west and north of the tunnel portals. This would enable the integration of the remaining components of Stony Creek with Francis Street via Hughes Street, Lorimer Street and Stephens Street.

Reconfiguration would require a re-focusing of Stony Creek Reserve towards the creek and Hyde Street. Potential enhancements include incorporating the land on the opposite side of Stony Creek within the City of Hobson Bay, an accelerated planning and rehabilitation programme and the integration through to Francis Street proposed above. This should also include reconfiguration of shared bicycle and pedestrian pathways so that the "Critical Route Corridor" is maintained in the vicinity of Stony Creek (Daff, 2014).

The proposed northern portals are located in industrial zoned land that is immediately north-east of the intersection of Somerville Street and Whitehall Street. A short, at-grade section of freeway will transition onto an elevated structure or structures over the Maribyrnong River.

The elevated structure will have limited impact on urban form within the immediate vicinity, but will have a visual impact over a relatively wide area depending on the nature of its design. The current design concept is based on a clear span of the river. There are likely to be a range of structural engineering and architectural responses available to achieve this objective. This provides an opportunity for a positive integration of Project elements into the surrounding urban environment.

Ancillary bridging of the Maribyrnong to provide direct access to the Port of Melbourne will also need to be integrated in a design sense with local urban form. The location of these bridges may have adverse impacts on visual amenity along the margins of the Maribyrnong River in the vicinity of Shepherds Bridge. There may need to be a specific design response for separate

lengths of the river margin immediately upstream and downstream of these structures, linked back to Whitehall Street.

3.12.5 Western Distributor – Elevated road and Port access

The elevated structure on Footscray Road will become a significant element in the local urban environment. The proposal should establish a memorable arrival sequence when approaching the city from the west. This includes providing drivers with a unique elevated view of the city when traversing the structure over the Maribyrnong River.

The extent to which this structure impacts on urban form will depend on the future use options for the land immediately north of Footscray Road and currently occupied by the Melbourne Markets site, which is in the process of being de-commissioned. Elevated structures should be set back as far as possible from property boundaries, to safeguard potential future development precincts such as the land between Footscray Road and Dynon Road.

In terms of visual amenity the proposed structure will have a significant impact on the existing visual amenity associated with Footscray Road, particularly when approached from Footscray. This structure will impact on views from Footscray Road west of Shepherds Bridge towards the Melbourne CBD.

3.12.6 Western Distributor – Eastern interchange and city bypass

In addition, there are significant areas of existing or proposed urban renewal within close proximity to the corridor, including North and South Dynon precincts, E-Gate and the Arden-Macaulay precincts. These urban renewal precincts are potentially affected by changes to accessibility and traffic flows in the vicinity of the north-eastern side of the Melbourne CBD. Precinct Structure Plans for areas such as Arden-Macaulay have emphasised the development of communities that place less reliance on motor vehicles and greater reliance on properly integrated public transport or active transport options. The PSP does acknowledge that through traffic on arterial streets will still need to be accommodated.

The city connections at the eastern end of the Project will have significant impacts on urban form, particularly in relation to the development of E-Gate, assuming that the Project will seek to provide more direct connections to Wurrundjeri Way, Dynon Road and Dudley Street.

High quality urban design principles would be applied so that any new elements introduced into the landscape, such as ventilation structures, noise barriers and bridges, minimise potential visual impacts and complement existing local landscape characteristics.

3.13 Land use planning

This assessment considers the following in relation to the overall Project and its specific components where appropriate:

- The compatibility of the proposal with existing land uses in the vicinity of relevant alignment alternatives.
- The likely opportunities and constraints resulting from the Project for future land use in the vicinity of the corridor.
- Opportunities to minimise impacts of the Project on the use and development of surrounding land uses (for relevant alternatives).

Based upon the above, the Project has been assessed against the following land use planning assessment criteria:

- Extent of change to existing land use.

- Extent of impact on proposed land use.
- Potential impacts to safe access and land use severance.

3.13.1 West Gate Freeway – Widening

The widening and upgrade of the West Gate Freeway places the greatest pressure on existing land uses within commercial and industrial precincts on the northern side of the alignment. Between Grieve Parade and Millers Road, and south of Buchanan Road a limited amount of land acquisition will be required to facilitate widening of the Freeway. This land is zoned Industrial 1 Zone (IN1Z), and existing activities are of low density.

In addition, some Crown Land (reserved) north of the existing Princes Freeway/West Gate Freeway will be required to facilitate construction of the new ramp from the Princes Freeway to the collector/distributor west of Grieve Parade. While a Planning Scheme Amendment (PSA) and Public Acquisition Overlay (PAO) would be required to rezone the land to Road Zone 1 (RDZ1), there are no particular planning issues triggered by the re-zoning.

There is additional pressure on industrial land uses in the precinct east of Millers Road north of the Freeway. There are a number of established industrial, commercial, transport and logistics businesses off Export Drive and Link Court which back onto the Freeway. Widening of the Freeway would potentially require land acquisition and some reconfiguration of the rear of some premises. Again, while a Planning Scheme Amendment and Public Acquisition Overlay would be required to rezone the land to RDZ1, there are no particular planning issues triggered by the re-zoning.

On the opposite side of the Freeway between Freemans Road and Irwin Avenue in Altona North, there will be pressure on land zoned for Residential purposes at the road ends. Widening of the Freeway, the relocation or extension of a pedestrian overbridge (and work to make the overbridge DDA compliant), relocation of utilities and the relocation and heightening of noise walls will bring this infrastructure closer to existing residential activities. Currently local road connections and walkways parallel with the Freeway provide some scope to absorb the physical widening without direct impingement on residential property.

This situation is replicated just west of the Williamstown Road interchange in the vicinity of Hick Street, Vernier Street and Durham Street. This is generated by the realignment of the westbound on-ramp at Williamstown Road. While there may be no direct impingement on residential property, there will be impacts on connectivity at road ends, either by removing existing links between road ends for vehicles and pedestrians.

At the northern end of Vernier Street there will be a significant loss of amenity planting and given the relative levels between the Freeway carriageway and Vernier Street, it is likely that the residential properties at the edge of the Freeway widening will be faced with a combination of retaining walls and noise walls. This will compromise residential amenity for a limited number of dwellings at the road end.

3.13.2 Western Distributor – Yarraville alignment (including tunnel)

For the purposes of this analysis, the Western Distributor component (as described in Table 1) is assumed to include the ramps and elevated structures from the West Gate Freeway commencing immediately west of Williamstown Road, crossing the Freeway and landing in Stony Creek Reserve.

The principal planning issue in the Project corridor from Williamstown Road through to the southern portals at Hyde Street/Stephens Street in Yarraville will be the re-zoning of land from Public Park and Recreation Zone (PPRZ) and Special Use Zone 2 (SUZ2) to RDZ1 on the northern side of the Project corridor. A PSA/PAO would be required to facilitate the rezoning.

This will affect the following recreational and open space assets:

- Westgate Golf Course (within the City of Hobson Bay).
- Crown land (reserved) east of the Williamstown railway line and south of Stony Creek (within the City of Hobson Bay).
- Crown land (reserved) forming the bed of Stony Creek, with management delegated to Melbourne Water.
- Stony Creek Reserve (Crown land reserved), on the northern side of Stony Creek.

The elevated structures to and from the West Gate Freeway will impinge on the West Gate Golf course immediately to the north of the Freeway. The course is already impacted by the elevated portion of the existing Freeway and careful design and placement of piers should not compromise the playability of the course.

The most significant impacts will be felt in Stony Creek Reserve. The Maribyrnong Planning Scheme at Clause 21.05 Environment and Landscape Values notes that;

“There is significant potential to expand and enhance the open space corridor along Stony Creek and improve links as opportunities arise. However, the potential to extend the shared trail west of Paramount Road is limited due to private land ownership and physical barriers. Access to this section of the creek will be from local roads that will form key nodes along the creek.”

The stated objective is “To enhance the landscape character along the Maribyrnong River and Stony Creek.” The associated strategies are primarily focused on the Maribyrnong River, although the policy guidelines emphasise protecting and improving the Stony Creek open space corridor and expanding the interpretation of cultural heritage values associated with the Maribyrnong River and Stony Creek.

The Planning Scheme also references the Stony Creek Future Directions Plan which has recently been updated.

The at-grade components of the approaches to the tunnel portals and the connections to Hyde Street would divide the existing Reserve into two principal components. There would be a loss of east-west connectivity based on the current concepts in the Future Directions Plan, but there is potential for a reconfiguration of the Reserve to offset these impacts. This could include utilising the balance of the land around the tunnel portals to provide complementary open space, better connections through to Francis Street via Stephens Street, Lorimer Street and Beverley Street.

Consideration could also be given to incorporating the land on the southern side of Stony Creek into a wider environmental and landscape management plan than that currently envisaged by the Stony Creek Future Directions Plan. This could be achieved in conjunction with the Maribyrnong and Hobson Bay City Councils.

The actual portal site is zoned SUZ4 and nominally forms part of the Yarraville Terminal Station site. This land is currently vacant apart from two HV transmission towers. The portal location would reduce the future use of the site for its zoned purpose and acquisition of the whole of the currently vacant land is the likely outcome. This would allow consideration of future re-zoning options, including a combination of RDZ1, PPRZ and Mixed Use Zone (MUZ).

It should also be noted that an Environmental Significance Overlay (ESO) applies to the site, which is intended to manage potential conflicts between land in the port environs and the adjoining Port of Melbourne. The Western Distributor and its components are not inconsistent with the purpose of the overlay.

This is also consistent with the MUZ which lies immediately north of the proposed tunnel portals. The Francis Street Mixed Use Policy seeks to see the MUZ transition from a predominantly residential use to a range of other activities that are less susceptible to risks emanating from major hazard facilities in the Yarraville Port Industrial Precinct.

At the northern portals, the land required for the at-grade tunnel approaches and ramps to the elevated structure over the Maribyrnong River is zoned either IN1Z or Public Utility Zone 4 (PUZ4). This industrial zone is primarily intended for large scale industrial activities that require access to port facilities. The PUZ4 zone incorporates land that was previously used for railway purposes. This land is now used primarily for container storage.

The Project components in this vicinity are not inconsistent with the current zoning or the current use. It is likely that land in the immediate vicinity of the tunnel portals will be required for laydown and construction purposes and for the launching of tunnel boring machines (assuming that this is the preferred construction methodology). Temporary occupation of land within the IN1Z for these purposes is not inconsistent with the long term objectives for the zone. Given the accessibility available to this land from Youell, Whitehall and Somerville Road (east of Whitehall Street) the medium to long term development of land not required for the Project would not be compromised.

The principal planning issues will arise in relation to the IN1Z land between Youell and Lyon Street. At grade and elevated components of the direct access to the Port of Melbourne across the Maribyrnong River will require acquisition of land and the relocation of a number of existing businesses. Reconfiguration of titles in this area could also trigger consideration of the most appropriate long term zoning for the balance of the land between Youell and Lyon Street.

The elevated structure over the Maribyrnong River transitions into the Special Use Zone 1 (SUZ1) of the Port of Melbourne Planning Scheme, including the western bank of the Maribyrnong extending south from Footscray Road. The Maribyrnong itself is contained within the SUZ4, while the bridge traverses SUZ1 land on the eastern side of the river in the vicinity of McKenzie Road, Dahlenburg Street and Coode Road within the Port of Melbourne.

It is likely that the elevated structures and associated Project footprint will be represented in the Port of Melbourne Planning Scheme by way of an Overlay in the same manner as applies to CityLink in the City of Melbourne Planning Scheme.

3.13.3 Western Distributor – Elevated road and Port access

The elevated structure along Footscray Road and the proposed connections to Appleton Dock Road and CityLink are largely consistent with the existing RDZ1 zoning for Footscray Road. The intention is for the structure to be located in the centre of the road reserve, with the at-grade lanes on Footscray Road reconfigured on either side of the piers. The proposed connections at Appleton Dock Road may require some reconsideration of the extent of the Public Use Zone 7 (PUZ7) which currently provides for activities associated with the former Melbourne Wholesale Markets and the Fish Markets site. It is assumed that at-grade components will be rezoned RDZ1 where required, while elevated components will be the subject of an Overlay.

3.13.4 Western Distributor – Eastern interchange and city bypass

The connections to the wider road network on the north-western side of the Melbourne CBD, may require an extensive land use planning response. There are a number of significant interface issues to be considered in the context of how to distribute traffic at the edge of the CBD frame. The planning issues include:

- The degree to which the distribution of traffic would benefit/impact upon existing communities and arterial roads in North Melbourne
- The degree to which connection options would enhance the continued development or re-development of Docklands, E-Gate, and North and South Dynon precincts
- The degree to which the connections are consistent with the objectives of the PSP for the Arden-Macaulay urban renewal area.

4. Environmental management framework

Environmental assessment documentation prepared for the Project would consider the potential impacts associated with its construction and operation phases, and include an Environmental Management Framework (EMF) that outlines how any impacts are mitigated, monitored and managed appropriately.

The EMF would provide a transparent and accountable framework for managing environmental aspects of the Project's delivery in accordance with applicable legislation and approval conditions. The EMF would also outline the structure of environmental management documentation, including the need for an Environmental Management System and environmental management plans (EMPs) for construction and operation.

Clear commitments on how environment issues will be managed and mitigated during construction would be described within the EMPs for construction and operation. The results of various specialist studies would be incorporated into the EMPs, where appropriate.

Management measures would be developed to address specific Project issues, such as:

- Dust, noise and vibration from construction activities which could potentially cause disturbance to the community.
- Potential impacts to Kororoit Creek, Stony Creek, Maribyrnong River (including navigation) and Moonee Ponds Creek.
- Management, handling and transport of extracted groundwater and spoil which may be contaminated.
- The potential for acid sulphate soils and contaminated land to be encountered and disturbed during construction.
- Erosion, soil stability and sedimentation hazards.
- Temporary disruption to businesses.
- Temporary disruption to Port of Melbourne infrastructure.
- Potential impacts on road network function as a result of construction activities.
- Potential impacts to rail infrastructure.
- Potential impacts to utilities and services.
- Greenhouse gas emissions from construction activities.
- Waste management.

Standard measures are available to manage a number of these issues.

A separate Communications Strategy would be prepared to address ongoing community engagement associated with the Project.

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