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ENVIRONMENT PROTECTION ACT 1970

SO1003145 NORTH EAST LINK TUNNEL PROJECT WORKS APPROVAL ASSESSMENT REPORT

Application No.	SO1003465
Applicant Name	North East Link Project, a division of the Major Transport Infrastructure Authority (MTIA), an administrative office in relation to the Department of Transport
Address of Premises	North East Link Tunnel Project
Proposal	Tunnel ventilation system for North East Link
Scheduled Category	L03 – road tunnel ventilation systems

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ABBREVIATIONS & GLOSSARY

AQM	Air Quality Management
cl	Clause
CHMP	Cultural Heritage Management Plan
CEMP	Construction Environment Management Plan
CO	Carbon monoxide
DDO	Design and Development Overlay
EE Act	*Environment Effects Act 1978*
EES	Environment Effects Statement
EMF	Environmental management framework
EP Act	*Environment Protection Act 1970*
EPR	Environmental performance requirement
GHG	GHG Emissions
GLC	Ground Level Concentrations
HIA	Health Impact Assessment
IAC	Inquiry and Advisory Committee
IEA	Independent Environmental Auditor
km	Kilometres
m	Metres
MFB	Metropolitan Fire and Emergency Services Board
Minister	The Minister for Planning
MTIA	Major Transport Infrastructure Authority
NGL	Natural Ground Level
NEL	North East Link
NELP	North East Link Project, a division of MTIA
NIA	Nosie Impact Assessment

NO_2	Nitrogen dioxide
OEMP	Operation environmental management plan
PEM	Protocol for Environmental Management
PAH's	Polycyclic Aromatic Hydrocarbons
PIARC	World Road Association
PM	Particulate Matter
PSA	Planning Scheme Amendment
the Regulations	*Environment Protection (Scheduled Premises) Regulations 2017*
s22 notice	A notice under the provision of section 22 of the *Environment Protection Act 1970*
SEPP	State Environment Protection Policy
SEPP (AQM)	State Environment Protection Policy (Air Quality Management)
SEPP N-1	State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade No. N1)
TBM	Tunnel boring machine
VOC	Volatile organic compounds
VSD	Variable Speed Drive
WAA	Works Approval Application

1. EXECUTIVE SUMMARY

1.1. Works approval

The North East Link (NEL) is a proposed major new freeway standard road designed to complete the missing link in Melbourne's metropolitan ring road. The project requires the construction of twin tunnels connecting the Eastern Freeway and M80.

The NEL has been assessed under Victoria's Environment Effects Act 1978 (EE Act).

A works approval is required for the proposed construction of the tunnel ventilation system. The environmental segments considered in the application were GHG (GHG), air quality, and noise.

The works approval application (WAA), planning scheme amendment (PSA) and the Environmental Effect Statement (EES), were subject to a joint advertisement under section 20AA of the EP Act and the EE Act. They were placed for exhibition between 10 April and 7 June 2019 for public comments. An Inquiry and Advisory Committee (IAC), appointed by the Minister for Planning (Minister), held public hearings between 25 July and 16 September 2019 to consider the respective EES submissions during the exhibition period.

The main issue relevant to the WAA was the likely air quality impacts, GHG emissions (GHG) and noise emissions. The ventilation system is the core issue of the acceptability and conformity of such a project with the required environmental and safety standards.

The Environment Protection Authority (EPA) has comprehensively assessed the proposed road tunnel ventilation system and its likely impact on those environmental segments. The assessment considers the relevant legislation, referral agencies' comments, public submissions received, the findings and recommendations of the IAC and the Minister's assessment of the NEL.

The EPA is satisfied, subject to conditions, that the proposal will comply with the relevant legislation, polices and guidelines. It is recommended that the WAA be issued, subject to conditions.

1.2. Works approval process

Key stages of the WAA process and technical assessment included (in event order):

Application

- On 7 March 2019, the EPA received the whole package of the works approval application (WAA), including the main application document with appendices (see Appendix A – list of WAA documents).
- On 8 March 2019, the EPA accepted the WAA for assessment.

Further information requirement

- On 6 August 2019, the EPA issued a notice to the North East Link Project (NELP), under section 22 of the *Environment Protection Act 1970* (EP Act) (s22 Notice), requiring additional information.
- On 5 September 2019, NELP responded to the s22 Notice and the EPA subsequently published the response for public comment.

Public consultation

- On 10 April 2019, the Minister invited the public to comment on the EES documents (including WAA) for a duration of 40 business days, from 10 April to 7 June 2019 (Exhibition of EES).
- On 7 June 2019, public comment on the EES was closed.
- Between 25 July and 16 September 2019, the IAC held public hearings to consider the respective EES submissions. The EPA was in attendance at those hearings.
- On 22 October 2019, the IAC made its findings and recommendations on the EES.

Referrals

- On 20 June 2019, the EPA referred the WAA to Manningham City Council.
- On 11 October 2019, the EPA referred the WAA to Metropolitan Fire and Emergency Services Board (MFB).
- On 29 October 2019, the EPA referred the WAA to Banyule City Council.

Statutory approval time extension

- On 2 May 2019, the EPA wrote to NELP requesting an extension of its statutory approval process, under s67A of EP Act, considering the EES process for the NEL.
- On 20 June 2019, NELP agreed to an extension of the works approval statutory timeline by a period which is equivalent to three weeks after the release of the Minister's Assessment of the environmental effects.
- On 18 December 2019, NELP agreed to a further extension until 30 January 2020.
- On 29 January 2020, NELP agreed to a further extension until 28 February 2020.

Decision milestones

- On 3 December 2019, the Minister approved the project EES, subject to Environmental Performance Requirements (EPRs).
- On 28 February 2020, the EPA decided to issue the works approval, subject to conditions.

1.3. Approved works

The WAA was based on a reference project which is a concept design to demonstrate the project feasibility. The final design will be subject to the EPA's assessment of the compliance with the works approval conditions and environmental regulatory compliance. The project will be delivered in line with the environmental management framework for the NEL and EPRs relevant to this application.

1.4. Assessment

The works approval assessment process considered the following issues:

Tunnel ventilation system design

Urban tunnel projects like the NEL tunnel are common. The correct design and operation of the ventilation system is vital for fulfilling the environmental criteria, as well as the tunnel operation related criteria set out in the WAA. The EPA concludes that the final design must consider alternative engineering solutions for the smoke extraction system which provide for an equivalent safety standard for the tunnel users, as required under the condition WA_W1 1. These solutions

are to reduce operational energy consumption (GHG emissions), provide fire incident management and response capacity to meet safety standards and improve in-tunnel air quality. They are consistent with EPRs air quality (AQ2 and AQ3) and GHG emissions (SCC2 and SCC3) (section 3.3).

Climate change and GHG

The EPA has considered the project's potential climate change impacts in its decision and has determined that the proposal has appropriately addressed those impacts.

The EPA has also considered the potential GHG emissions related to power consumption for operating the tunnel ventilation system (excluding traffic emissions). The assessment concludes that the reference design would result in very high ventilation power requirements even during off-peak periods. Thus, alternative engineering solutions for the smoke extraction system of the tunnel ventilation system will be required under the conditions of the WA_W1 1) to reduce power consumption (see section 6.3).

Ambient air emission

The EPA has considered the air quality modelling assessment and concludes that air emissions from the project would meet the relevant environmental standards set in the *State Environment Protection Policy (Air Quality Management)* SEPP (AQM). However, an air quality impact assessment for the detailed design, including a proposal for the air discharge limits for the ventilation stacks, will be required prior to construction under the condition WA_W1 2). Potentially partial portal emissions during off-peak periods, as common practice for the existing tunnels in Victoria, should only be considered after commissioning with an environmental and health risk assessment and supporting monitoring data. Continuous stack emission measurements will be required during the commissioning of the facility and on-going operation to confirm compliance with the required performance standards under the condition WA_R1) (see section 7.3.2).

In-Tunnel air quality

The EPA has considered the in-tunnel air quality. The assessment concludes that carbon monoxide (CO) and the World Road Association's (PIARC) recommendations for visibility can be met. The nitrogen dioxide (NO_2) criterion is the limiting factor for the tunnel ventilation extraction capacity. NO_2 criteria can be achieved as long as the average speed is above 20km/h. The resulting air speeds are quite high, but stay below the threshold value of 10m/s. For most traffic situations, net air flux out of the mainline tunnel portals is avoided, although the situation at the off and on ramp might be different (see section 7.3.3).

Noise emission

The EPA has considered the noise impact assessment and concludes that noise emissions can meet the relevant environmental standards set in the *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade No. N1)* (SEPP N-1). However, a comprehensive noise assessment, reviewed by the appointed environmental auditor with acoustic expert, will be required for the detailed design prior to construction to meet the requirement in EPR NV6. Noise measurements will be required during the commissioning of the facility and on-going operation to comply with the performance standards (see section 8.3)

Human health

The EPA has considered the potential effects on human health posed by this proposal. The assessment concludes that the potential for exposure to emissions for nearest sensitive receptors and the potential for health impacts are negligible. A review of the human health impact on tunnel

users should be undertaken to obtain confirmation of the impact after finalising the design prior to construction (see section 9.3).

Construction impact

The EPA is satisfied that construction impacts can be managed given the comprehensive construction management framework and EPRs (i.e. NVs 4 and 5, AQ1, SCCs 2 and 4), subject to the works approval conditions. A construction environmental management plan (CEMP) for the tunnel ventilation system must be submitted to the EPA for approval, prior to the commencement of construction.

1.5. Decision

The EPA has assessed the WAA and has issued the Department of Transport, a works approval, subject to conditions.

2. BACKGROUND INFORMATION

2.1. North East Link project

NEL is Victoria's largest ever road project. This project is a major new freeway standard road designed to complete the missing link in Melbourne's metropolitan ring road, giving the city a fully completed orbital connection.

NEL has three major components:

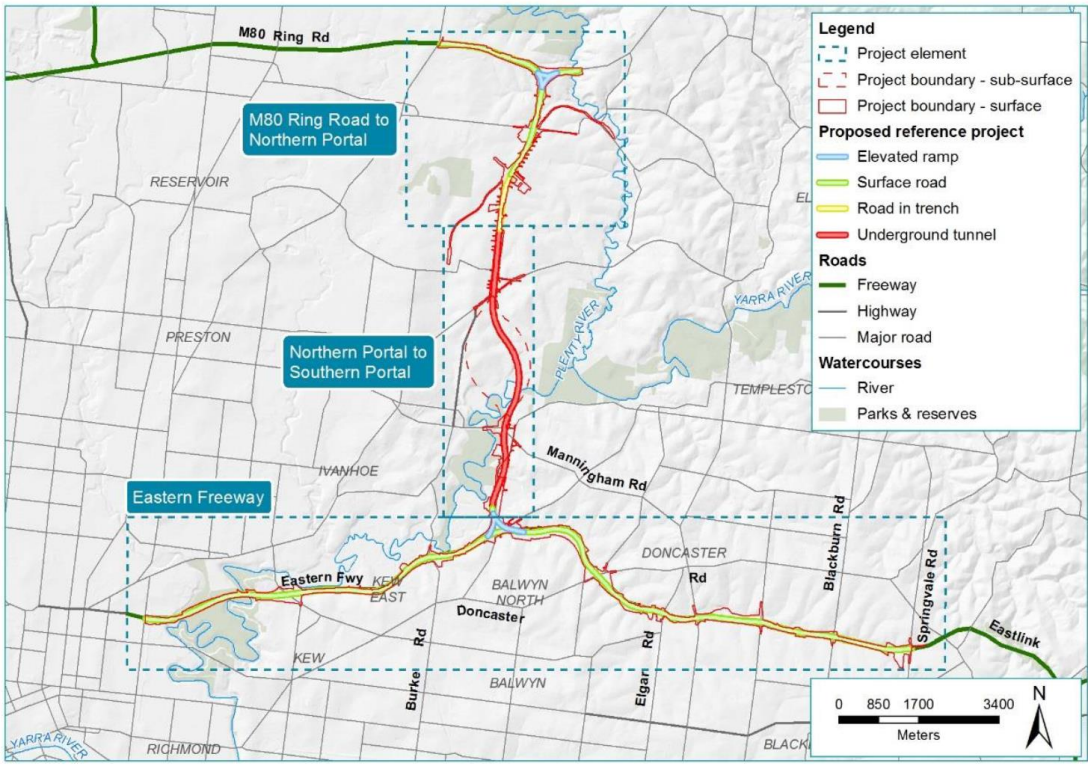
- **M80 Ring Road to the northern portal** – from the M80 Ring Road at Plenty Road, and the Greensborough Bypass at Plenty River Drive, North East Link would extend to the northern portal near Blamey Road utilising a mixture of above, below and at-surface road sections. This would include new road interchanges at the M80 Ring Road and Grimshaw Street.

- **Northern portal to the southern portal** – from the northern portal the road would transition into twin tunnels that would connect to Lower Plenty Road via a new interchange, before travelling under residential areas, Banyule Flats and the Yarra River to a new interchange at Manningham Road. The tunnels would then continue to the southern portal located south of the Veneto Club.

- **Eastern Freeway** – from around Hoddle Street in the west through to Springvale Road in the east, modifications to the Eastern Freeway would include widening to accommodate future traffic volumes and the provision of new dedicated bus lanes for the Doncaster Busway. There would also be provision of a new interchange at Bulleen Road to connect North East Link to the Eastern Freeway.

The project area is illustrated below in Figure 1.

Figure 1 Overview of North East Link Project
(Source: WAA)



The total estimated cost of the Project is $16.5 billion.

The construction of the NEL is expected to commence in 2021 and open to traffic in 2027.

2.2. North East Link Project approval requirements

On 2 February 2018, the Minister declared North East Link to be 'public works' under Section 3(1) of the EE Act.

Section 4(1) of the EE Act provides that prior to commencing any *public works* to which the EE Act applies, the proponent must cause an EES to be prepared and submitted to the Minister for the Minister's assessment of the environmental effects of the works.

Approval for all works, including the roads and tunnel and associated works have been subject to the Minister's assessment of an EES.

The key approvals required are as follows:

- Victorian legislation for the project to proceed are:
  - amendments to the Banyule, Boroondara, Manningham, Nillumbik, Whitehorse, Whittlesea and Yarra planning schemes under the *Planning and Environment Act 1987*
  - works approval for a road tunnel ventilation system under the EP Act
  - a Cultural Heritage Management Plan under the *Aboriginal Heritage Act 2006*.
- *Commonwealth approvals*
  - for construction of operational activities located on Commonwealth land (at Simpson Barracks in Watsonia)
  - approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* to protect matters of National Environmental Significance.

NEL will be delivered in accordance with EPRs that set out the minimum environmental objectives and outcomes the project must achieve across its design, construction and operation phases. The EPRs include requirements to: comply with regulations and guidelines set by government and statutory authorities; achieve specific levels or limits; and meet recognised standards.

3. THE WORKS APPROVAL APPLICATION

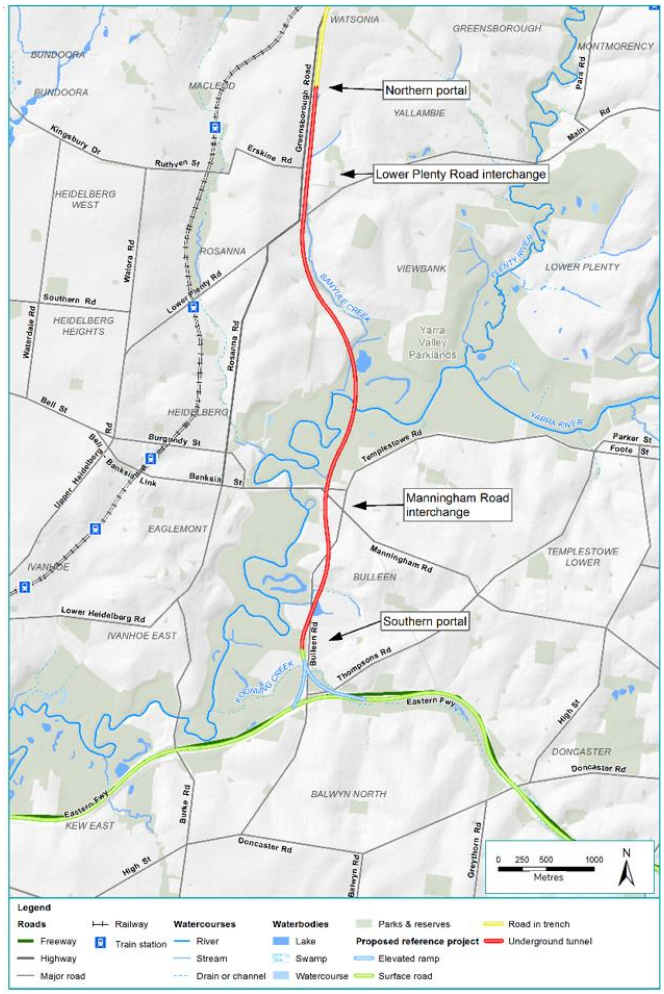
3.1. Description of tunnel works

One of the key NEL components is the proposed twin three-lane tunnels with connections to two interchanges at Manningham Road and Lower Plenty Road respectively, and an associated tunnel ventilation system. The estimated daily capacity of the tunnels would be 140,000 vehicles. The tunnels would carry up to 125,000 vehicles a day by the year 2036 and are expected to be the busiest section of NEL during its operation.[1]

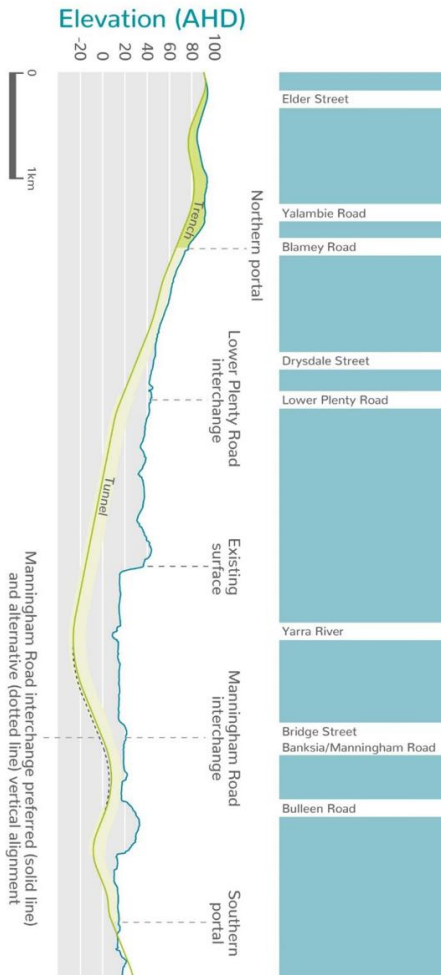
The tunnels would be from the northern portal at Blamey Road to the southern portal south of the Veneto Club in Bulleen—approximately 6 km in length (Figures 2 and 3).

Figure 2 Tunnel alignment[2]

Location of the tunnel



Longitudinal section

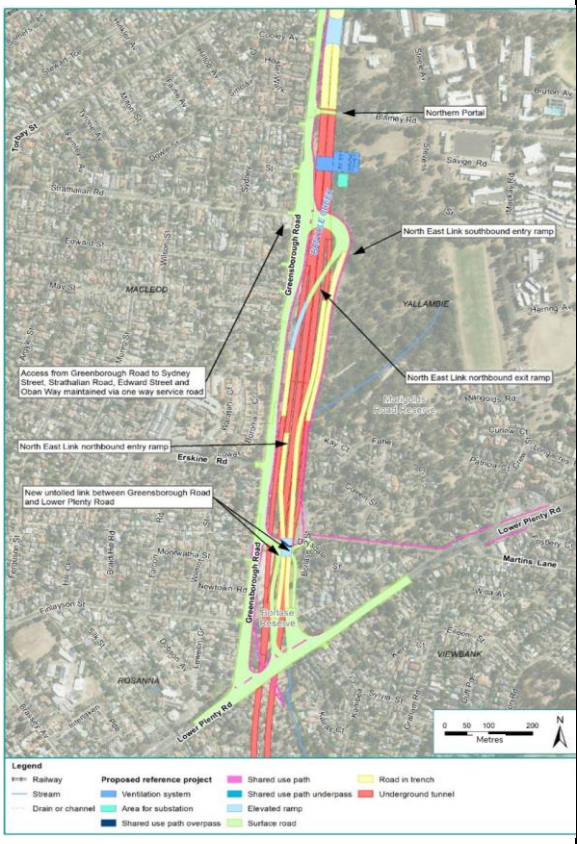


[1] Chapter 6 Project Development of EES documents, pp.6-27.

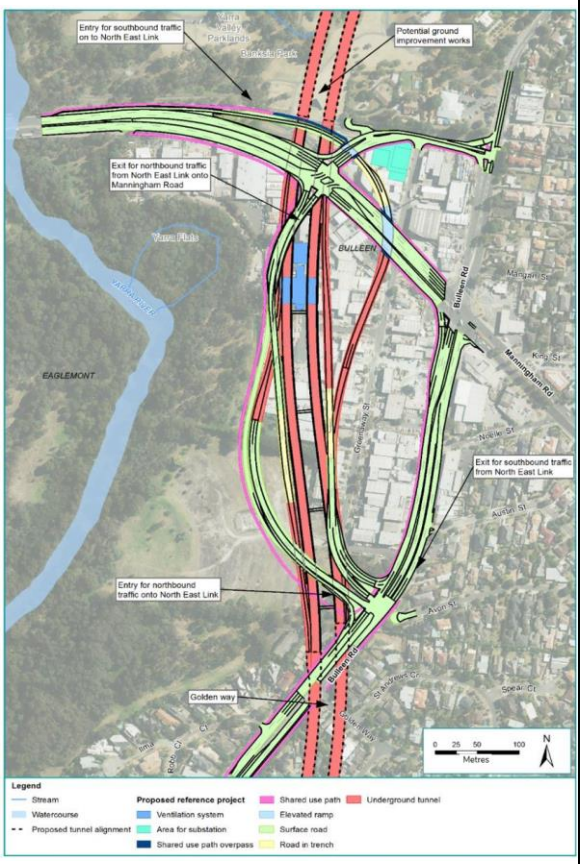
[2] Figures 8-10 and 8-12 of Chapter 8 Project Development of EES documents.

Figure 3 Locations of interchanges

Lower Plenty Road Interchange



Manningham Road Interchange (reference project)



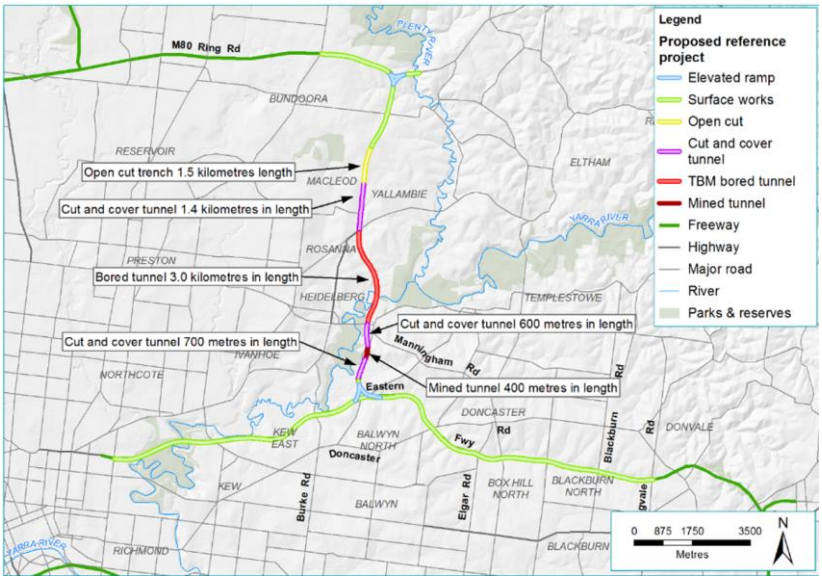
The tunnel works would include twin tunnels catering for three traffic lanes in both directions, constructed using three techniques as described below and shown in (Figure 4):

- a cut and cover tunnel – 2.7 km in the following areas:
  - Blamey Road to Lower Plenty Road (1.4km)
  - Bridge Street to just north of Golden Way (0.6 km)
  - Rocklea Road to Bulleen Oval (0.7 km)
- a tunnel boring machine (TBM) tunnel – 3.0 km from Lower Plenty Road to Bridge Street
- a mined tunnel – 400m from Avon Street to Rocklea Road.

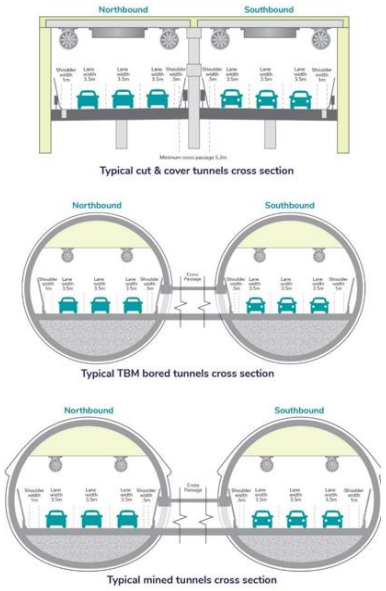
Interconnection to surface road via slip roads are planned at Lower Plenty Road and Manningham Road (Figure 3). At the south portal the connection towards the Eastern Freeway citybound requires a separate off-ramp exiting the tunnel.

Figure 4 Construction methods[3]

Locations of cut and cover, TBM and mined sections



Cross sections of each construction method



The twin tunnels would have:[4]

- an internal vertical clearance of 4.9m, with each lane width 3.5m wide, plus a 1m left shoulder and a 0.5m right shoulder
- cross passages connecting the two tunnels at approximately 120m intervals with vertical clearance of 2.1m.

3.2. Tunnel ventilation system

3.2.1. Ventilation design criteria

The ventilation system is designed to provide:

- acceptable in-tunnel air quality during normal operation
- smoke control in the event of a fire incident.

3.2.1.1. Normal operation

Normal operation is defined as traffic flowing with an average speed of 20km per hour or greater.
The tunnel ventilation system should meet the following standards during normal operation:

- NSW in-tunnel air quality for NO_2 with 0.5 ppm as the rolling 15-minute average based on a tunnel route averaged value

[3] Figures 8-13 & 8-25 of Chapter 8 Project Development of EES documents.
[4] Section 8.4 of Chapter 8 Project Development of EES documents.

- in-tunnel visibility criteria are based on PIARC 2012[1] recommendations
- in-tunnel CO standards at the following values:
  - maximum peak CO value of 150 ppm
  - 15 minute average CO value of 50 ppm
  - 2-hour average CO value of 25 ppm
- maximum air speed in tunnel that does not exceed 10 metres per second
- no null points in the system—i.e. no stagnant or zero net velocity air
- zero portal emissions from all portals.

Ventilation structure/stack emission:

- vehicle and road tunnel emissions are to be discharged from a vertical ventilation outlet to meet the SEPP(AQM) design criteria.

3.2.1.2. Smoke design criteria

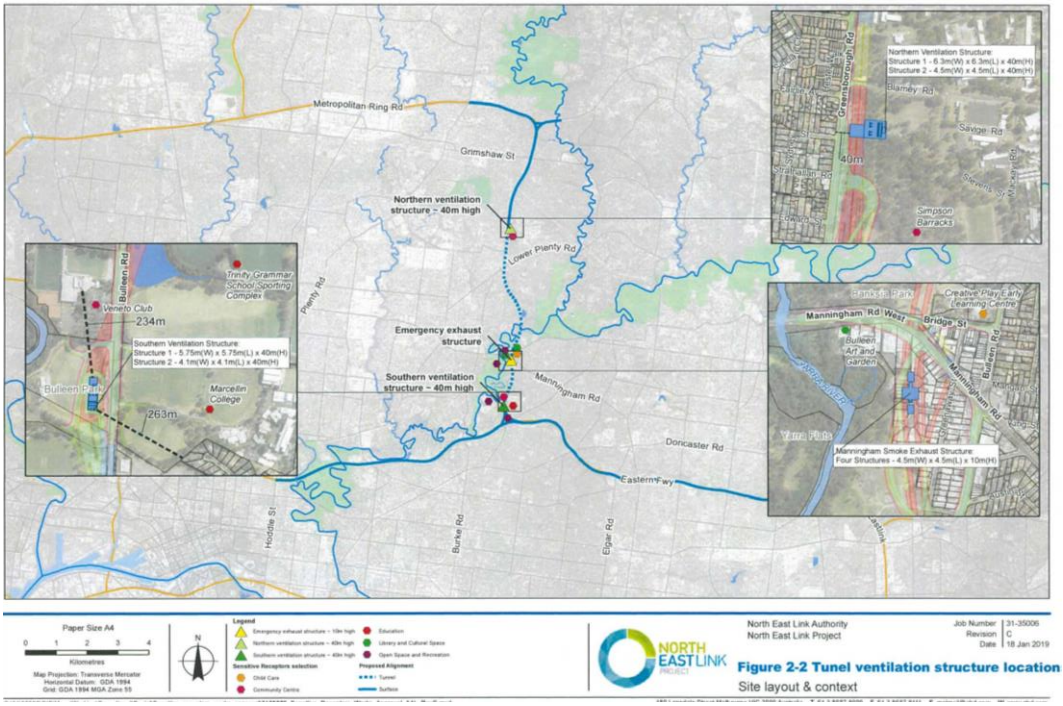
a) Smoke is to be controlled inside the tunnel by configuring jet fans to induce an air velocity inside the tunnel in the vicinity of the fire to push smoke away (critical air velocity is required).
b) Smoke is to be contained within 160 m of a fire incident by configuring jet fans to induce a confinement air velocity.
c) Cross passage pressurisation is to be achieved by pressuring the non-incident tunnel tube using jet fans.
d) The maximum design fire for the calculation of critical velocity (as defined by NFPA 502) is 50 MW.
e) At entry and exit ramps (not mainline tunnel): when a fire is within the first 100 m of a portal, smoke is forced out of the tunnel through the nearest portal.
f) Detailed design has to consider a prevention of back-layering where possible. In cases where this is not practicable or feasibly possible, alternatives have to be part of the Fire Engineering design process.

3.2.2. Tunnel ventilation system installations

The proposed ventilation system comprises of two ventilation structures, an emergency smoke exhaust structure (Figure 5)[5], fire management infrastructure and their associated equipment, as detailed below:

[5] Details refer to section 5.4 of the WAA.

Figure 5 Location of proposed ventilation and emergency discharge structure
(Source: WAA)



- Two tunnel ventilation structures with two ventilation stacks of 40m in height each:
  - the northern ventilation stack at Blamey Road: two discharge outlets: 40 m^2 (primary) and 20 m^2 (secondary) respectively
  - the southern ventilation stack at Bulleen Road: two discharge outlets—33 m^2 (primary) and 17 m^2 (secondary) respectively.
- An emergency smoke discharge structure at Manningham Road Interchange:
  - four outlets—20.25 m^2, each 4m high above local ground level.

A full list of equipment for the tunnel ventilation system is detailed in Tables 5–1 to 5–3 of the WAA. They include:

- axial fans—8 in the northern ventilation structure (1300m^3/s) and 6 in the southern (925 m^3/s)
- in-tunnel jet fans—(155 in southbound and 148 in northbound tunnels, respectively), normal power rating of 45kW
- various dampers.

Other structural installations at tunnel portals and along the tunnels, including:

- overhead smoke ducts (20m^2) throughout the mainline tunnels; there are no smoke ducts in the ramp sections of the tunnel[6]
- flood walls around the south ventilation structure and Manningham Interchange to accommodate a 1-in-200-year flooding event

[6] Section 9 of the Appendix B of the *Response to EPA Victoria S22 Notice, 5 September 2019.*

- in-tunnel monitoring instruments for air speed, direction, CO, NO_2 and visibility[7] and ventilation structure emission monitoring equipment of CO, NO_2, particulates and benzene etc
- two zone power substations to cope with power supply failure close to the ventilation structures
- a maintenance tunnel underneath TBM session.

3.2.3. Tunnel ventilation operation

3.2.3.1. Normal operation

The ventilation system would be operated on a continuous 24/7 basis.

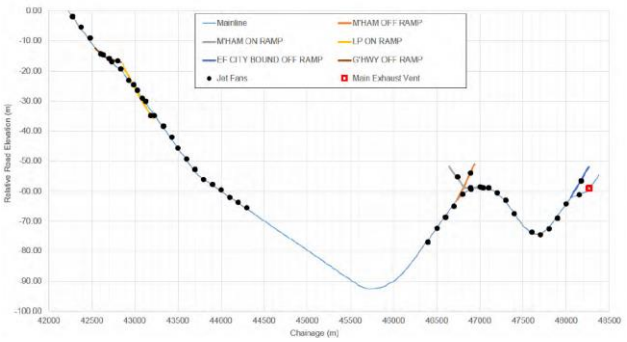
The ventilation system comprises a longitudinal ventilation system for normal (regular) traffic operation and a semi-transverse system with smoke extraction for incident operation.

The current design consists of two portal air extraction stations and jet fans operating against the driving direction in each off ramp. To meet a zero-portal air emission, portal air extraction structures serve for restricting portal emissions (net inflow) in the mainline tunnels and jet fans operating against the driving direction at the exit portals. To avoid polluted air exiting at the various portals, jet fans operating against driving direction are installed between the extraction structures and the exit portals in the mainline tunnels.

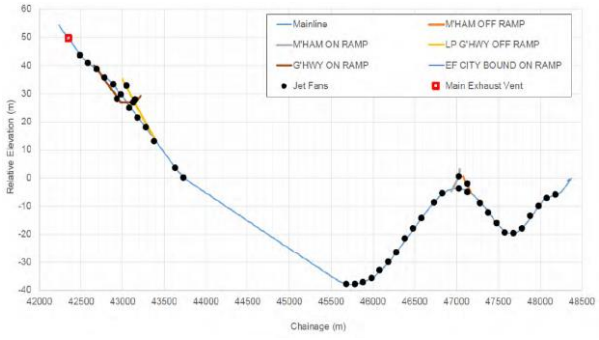
Jet fans would be used to control the air movement inside the tunnel and draw fresh air into the tunnel to comply with in-tunnel air quality criteria during congested periods (Figure 6).

Figure 6 Locations of jet fans[8]

Southbound tunnel jet fan locations



Northbound tunnel jet fan locations



The estimated ventilation rates are shown in Figure 7 below[9].

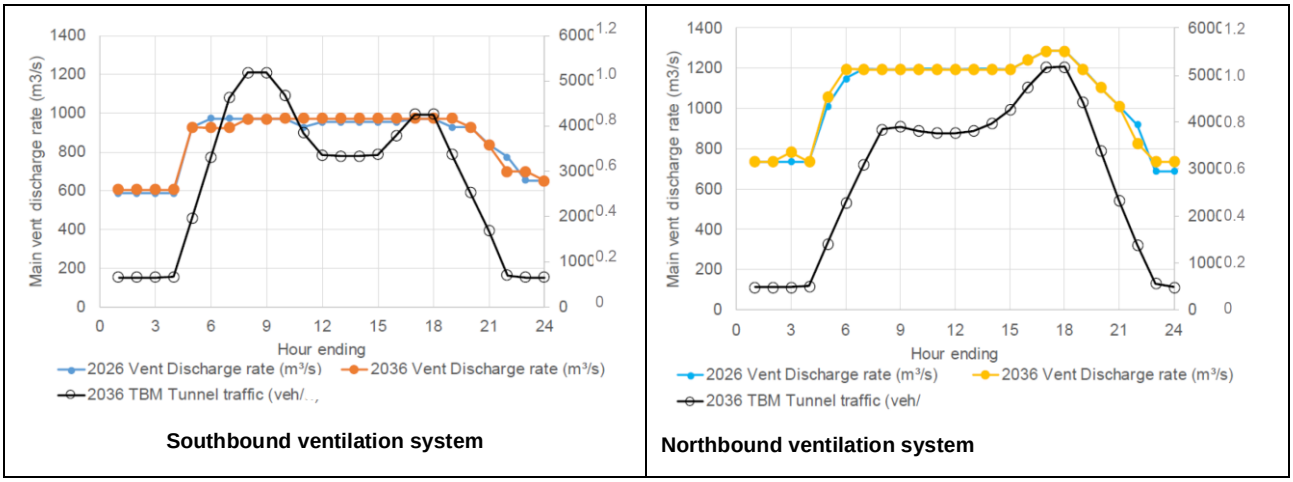
The ventilation structures must be discharging at least 600m^3/s (southbound) and 700 m^3/s (northbound) for hours of the day to prevent portal emissions.

[7] Section 10.5 of the WAA.

[8] Figures 11 and 12 of the Appendix B of the *Response to EPA Victoria S22 Notice, 5 September 2019*

[9] Figures 4 and 5 of the *Response to EPA Victoria S22 Notice, 5 September 2019*

Figure 7 Ventilation system diurnal discharge variation—years 2016 and 2036



The emergency smoke discharge structure has been designed for up to a nominal 100m^3/s for each vent (four fans and vents altogether) air flow capacity.

3.2.3.2. Fire incident management

A smoke duct running throughout the whole tunnel shall serve the purpose of smoke extraction. Smoke shall be extracted via dampers, which are mounted at distances of 80m in the false ceiling (bottom of smoke duct). The proper operation of jet fans will help confine smoke between the fire location and area of extraction. A third ventilation structure at Manningham Road area is planned for additional smoke discharge in fire case only.

3.2.3.3. Traffic management

The tunnels have been designed to prevent low traffic speeds and stationary vehicles. Traffic conditions inside the tunnel can be adjusted prior to vehicles entering the tunnels through traffic management. The tunnels have been designed with multiple exits, interconnecting to the surface roads via slip roads.

3.3. Tunnel ventilation system analysis

3.3.1. Normal operation

A mechanical ventilation system consisting of a longitudinal ventilation concept with portal air management is responsible for keeping the requirements for standard traffic conditions.

In general, a full prevention of portal emissions must result in high ventilation power and, subsequently, high energy costs. Having mainline tunnel exit portal areas of ~145 m² would result in volume flows to be extracted of some 800 to 1200 m³/s. These magnitudes require huge ventilation stations and can't be handled in an economic way. In addition, to avoid portal emissions over the access ramps (Manningham and Greensborough Highway areas) a reasonable number of active jet fans inside the tunnel would be required.

The current system is able to fulfil, theoretically, the requirements of avoiding portal emissions. However, the effort to achieve this goal is huge, due to the very high extraction volumes needed at the portal air management (ventilation) structures.

3.3.2. Fire operation

In this project, there are two main objectives that need to be achieved in case of an incident resulting in a fire:

(a) smoke is to be controlled to prevent smoke 'back layering' and allow for emergency responders to approach an incident in a contra tunnel flow direction
(b) the maximum design fire for the calculation of the critical velocity is 50 MW.

Smoke extraction systems (either built as full or semi-transverse ventilation systems) have been traditionally used for very long tunnels. They have the big advantage in cases of fire of extracting smoke in an area where it is necessary. However, the design shows that smoke extraction, in theory, is possible in this case. The proposed design results in some issues, including:

- Huge extraction volumes that would require:
  - a very good ventilation control scheme to confine the smoke and keep it in the area of the planned smoke extraction
  - big cross sections for smoke dampers in order to ensure efficient smoke extraction.

- A very inefficient extraction system (at velocities >20m/s), as well as sound and vibration problems of the dampers as:
  - smoke extraction would be performed by the fans at two locations (Manningham emergency exhaust structure and one of the portal structures), via dampers with open cross sections for extractions of less than 10 m² each
  - only in extremely rare cases would the extraction volumes at the two locations be similar (due to the different resistances within the two branches); thus, it is to be expected, that at one location the majority of the air/smoke mixture will be extracted.

- Unorthodox design of the smoke extraction duct in the cut and cover section. This results in unfavourable positions for jet fans and hence in a big thrust loss of these fans. Ultimately, it requires a large number of jet fans with poor working efficiency to be installed. In addition, important civil engineering considerations, as well as the requirements for maintenance (accessibility, maintainability, etc.), traffic management, etc, have not been considered, which has strong implications for the overall design, including the number of required jet fans, etc.
- it seems that leakage rates from closed dampers or the smoke extraction duct (casting joints) were not considered. Considering the long tunnel and number of dampers, such leakage rates are not negligible.

It should be noted that the need of a smoke extraction system over the whole tunnel length is not well justified, as it is only based on the requirement of an access possibility for the fire brigade from the direction opposite to the traffic flow.

3.3.3. Overall ventilation design and ventilation control

Urban tunnel projects like the NEL tunnel are common. Mechanical ventilation systems can be designed to meet current requirements for user safety during normal/standard operation and incident cases. The key for fulfilling the environmental criteria, as well as the tunnel operation related criteria, is the correct design and correct operation of the ventilation system.

The proposed ventilation design is driven by the fact that zero portal emissions are required (in normal operation) and smoke shall be extracted within a certain distance. Both factors result in a

ventilation system requiring huge portal air extraction fans, as well as a certain number of jet fans. The achievement of portal air emissions at the on and off ramps at the Manningham area and Lower Plenty Road (Greensborough Road) add complexity and the need for ventilation power to the system.

The need of smoke extraction within 160m of the fire site, in case of an incident, requires a smoke extraction duct. The combination of the achievement of critical velocity upstream of the fire location and smoke extraction result in a high extraction volume and subsequently in high ventilation power demand.

Correct ventilation, especially in the case of semi-transverse systems, needs a very good closed loop ventilation control system. This requires air velocity sensors in sufficient quantity. In order to get a reliable sensor signal, an additional 80 to 100m distance is required between fans and air velocity sensors. Hence, the space for fans (along the tunnel) is further limited.

There are multiple issues concerning the ventilation design (dimensioning and implementation/fan positioning) and the ventilation control possibilities, which influence each other and have a big impact on the correct operation of the ventilation system. According to the current design, the smoke duct in the cut and cover sections of the tunnel poses space restrictions for jet fans, as mentioned above. These restrictions have a negative impact on the efficiency of the jet fans and subsequently, increase the number of required jet fans. The physical requirements for ventilation control for normal and incident operation (simply space requirements) were not considered when distributing the jet fans in the various ventilation sections.[10] Hence, even when, theoretically, ventilation goals can be achieved, it might be a problem to achieve them in the final stage.

Furthermore, the engineering approach should be based on 'typical parameters' and assumptions, as the permanent usage of worst-case assumptions might result in an unwanted oversized ventilation system.

In view of the above, WA_W1 1) requires a final detailed design using the typical parameters and assumptions which must include:

A. Final design of the smoke extraction system. This should consider alternative engineering solutions to provide an equivalent safety standard for the tunnel users:

    a) eliminating the smoke duct in the whole tunnel;

    b) eliminating the smoke duct in the cut and cover sections (at least south of Manningham Interchange); or

    c) a different engineering design of the smoke duct allowing for more efficient usage of the jet fans in the cut and cover section.

B. Report of final design of ventilation design, consisting of:

    a) detailed ventilation design, including all relevant parameters for the design of the ventilation system (jet fans and axial fans), ventilation stations, as well as for the smoke duct which covers leakage rates from closed smoke dampers, casting joints, connections to other structures, etc), if semi-transverse ventilation is required;

[10] Someone could claim that this is typically done in the detailed design. However, as in this special project the space restrictions already influence the number of possible locations for jet fan placements, it has to be considered already at this early stage.

b) description of the final design of the ventilation control system for normal and incident operation, including its physical space requirements with consideration of the effect on positioning and number of jet fans;

c) proposed leakage rates from closed smoke dampers, casting joints, connections to other structures, etc. in the smoke extraction system design, if semi-transverse ventilation is required.

3.4. Tunnel ventilation structures site analysis

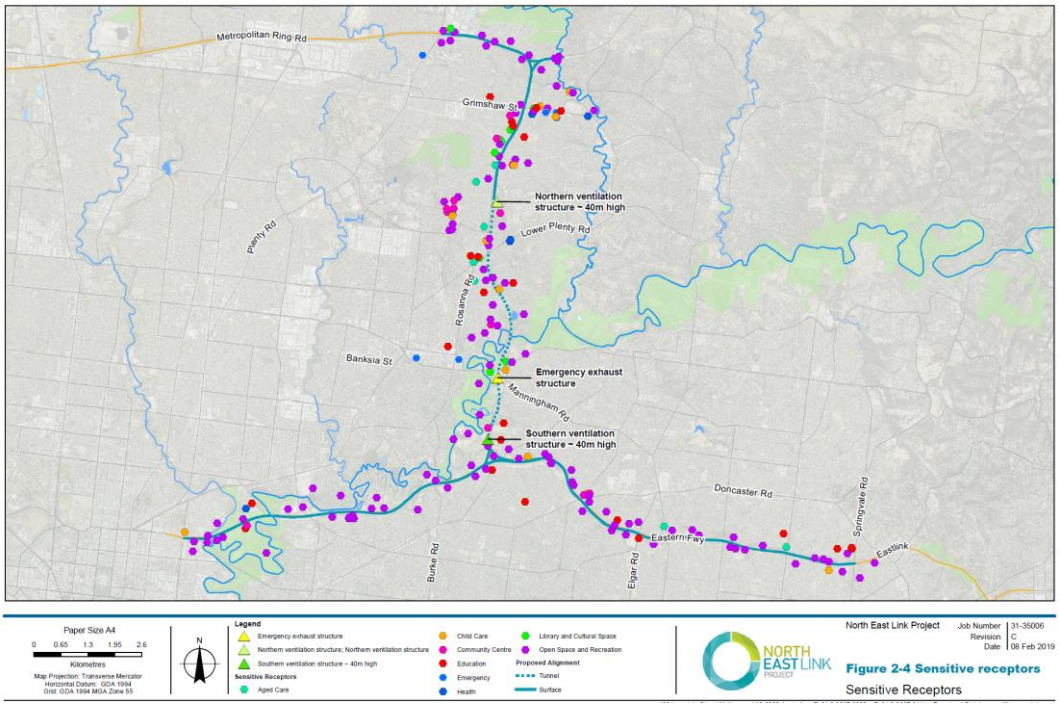
The northern ventilation structure is located on Commonwealth land owned by the Department of Defence, which is not subject to the provisions of Victoria's planning schemes. Nevertheless, NELP has an agreement with the Department enabling NELP to be in occupation or control of the subject land prior to commencing the construction. The subject land would be potentially administrated by Banyule City Council under the Banyule Planning Scheme.

The land for the southern ventilation structure and the emergency smoke discharge structure would be subject to Manningham City Council's planning scheme.

The North East Project is located in a highly urbanised area of Melbourne with long-established residential areas, shopping and commercial centres, industrial precincts, parks, reserves and community and recreational facilities, as shown in Figure 8.

Figure 8 Locations of sensitive receptors

(Source: WAA)



Sensitive receivers relevant to this WAA are mainly around the northern, southern and emergency smoke discharge structures near tunnel portals. Some changes of current land use could occur due to the need for land acquisition for NEL.

The closest sensitive receptors to the northern ventilation structure are between 130 m and 150 m of the proposed location. These closest receptors include the residential area within Simpson Barracks to the east and the residential area of Macleod to the north and west.

The closest sensitive receptors to the southern ventilation structure are approximately 140 m from the proposed location. These closest receptors include the Carey Grammar Sports Complex, the Veneto Club and Marcellin College.

4. CONSULTATION AND ASSESSMENT PROCESS

4.1. Public consultation overview

The NEL has been assessed under the EE Act.

The WAA, PSA and EES were subject to a joint advertisement under section 20AA of the EP Act and the EE Act. They were placed for exhibition between 10 April and 7 June 2019 for public comments by the Minister. The announcement was advertised in the *Australian* for public exhibition and comments. All documents were exhibited on the *Engage Victoria* website (https://engage.vic.gov.au/north-east-link-project).

Under s19B(3B) of the EP Act:

> '*If an application for a works approval is to be jointly advertised under section 20AA with a notice relating to the same proposal under the Environment Effects Act 1978 … comments by any person or body interested in the application must be made as a submission on the environment effects statement or be included in any submission on the environment effects statement.'*

In this regard, the EPA's provision to hold a s20B conference was waived, with submissions regarding the WAA recorded concerning the EES.

Rather than a s20B conference, an inquiry authorised pursuant to s9(1) of the EE Act, and an IAC under s151 of the Planning and Environment Act 1987, were convened to consider the likely environmental effects of the NEL.

The IAC reviewed the EES and public submissions and investigated and considered the environmental effects of the NEL in accordance with Terms of Reference approved by the Minister. They held an approximately seven-week hearing from 25 July to 16 September to consider the EES submissions.

An assessment of the public submissions received concerning the EES (relevant to the WAA) is discussed below in Section 4.2.

An assessment of the IAC recommendations (relative to the WAA) is detailed below in Section 4.3.

The EPA also made its own submission concerning the NEL to the EES through the public exhibition process.

The EPA forwarded a copy of the application to the relevant statutory and non-statutory referral bodies. Their responses are summarised below in Section 4.5

4.2. Public submission

A total of approximately 874 submissions were received during the exhibition of the EES and WAA. 77 submissions were relevant to the WAA. All submissions have been published on the *Engage Victoria* website (https://engage.vic.gov.au/north-east-link-project).

An assessment of the WAA submissions reveals that the main concern of submitters is the likely impact of air quality emissions resulting from the operation of the proposed ventilation structures. To a significant lesser degree in-tunnel air quality was a concern, noise and GHG issues being less of a concern.

The issues raised have been taken into consideration during the assessment of the EES by the IAC.

An assessment of the likely impacts of the proposed tunnel ventilation structures is discussed below in Sections 6 to 9.

4.3. IAC's recommendation

On the 22 October 2019, the IAC made its findings and recommendations into the EES. One of the IAC's roles is to provide advice to the EPA that can be used to inform its consideration of the WAA. Thus, the EPA should consider the IAC's recommendations when making its decision.

Table 1 below summarise IAC findings and an EPA response, where relevant to the WAA, inclusive of air, noise, health and GHG emissions.

Table 1 IAC Findings and EPA responses relevant to the WAA

IAC Findings	EPA Response
Tunnel option	
• Extended tunnels options would realise significant benefits to the local community in environmental, amenity and planning terms.	• Noted. The recommendation was not endorsed by the Minister.
• While extended tunnels are clearly feasible, they would carry a significant additional cost, extended construction period and potential additional land acquisition.	• Noted.
• The SMART taxpayer design concept should be provided to the tenderers.	• Noted. This option has not been endorsed by the Minister. Thus, it is not considered in this assessment.
Air quality	
Tunnel Air Quality	
• The in-tunnel air quality is capable of being managed to an acceptable level through design, the EPR and the provisions of the EPA Licence.	• Noted. See section 7.3.3.
Methodology and results	
• Overall the IAC considers that the modelling demonstrates that the air quality impacts of the reference design can be managed to an acceptable level.	• Noted. See section 7.3.2.
• If there are significant changes to the NEL, such as a longer tunnel, then additional air quality modelling and assessment will be required.	• Noted. See section 7.3.1.
• Air quality monitoring should be undertaken to determine compliance with SEPP ((*Ambient Air Quality)* AAQ) EQOs in Schedule 2.	• Noted. See section 7.3.5.

Tunnel ventilation system pollution control equipment • There is no evidence that pollution control equipment on tunnel ventilation systems is required under the current standards. • Provision for retrofitting of such equipment should be made in the design of the tunnel ventilation stacks.	• Noted. • Noted.
Construction Air Quality • Construction air quality issues, particularly dust, have the potential for very significant impacts given the scale of the NEL and the proximity of sensitive receivers along the route. • Changes are recommended to the EPRs to strengthen reference to maintaining acceptable construction air quality. • The IAC is satisfied that air quality can be managed to an acceptable level through the development, implementation, monitoring, and enforcement of the measures in the Construction Environment Management Plan.	• Noted. A construction environmental management plan and monitoring plan are required (WA_W1 5) in section 11.2). • Noted. • Noted.
GHG Emissions	
• The NEL will be a significant source of GHG, particularly during construction, from embedded energy in construction materials and from electricity used to power the TBMs. • The assessment of GHG in the EES is a satisfactory basis for developing avoidance and mitigation measures for GHG emissions. • The EPRs should be modified generally in accordance with the approach as put by the EPA to provide a higher level of transparency and ensure that targets and objectives for GHG mitigation are tied directly to project approval.	• Noted. See WA_W1 5) in section 11.2. • Noted. • Noted.
Noise	
Construction noise • Construction noise management levels for passive recreation areas should apply to all school grounds along the NEL alignment. • The buildings at the Carey Sports Complex should be considered as classrooms when applying construction noise management levels.	• Noted. • Noted.

Operation noise • The predicted operational noise levels at public open space areas and school recreation grounds shown in the EES should be adopted as noise targets. • Operational noise criteria must be achieved for up to 20 years from the NEL opening. • The EPR be amended to include a requirement for real time noise monitoring stations with data being publicly available at sensitive locations along the Project alignment. • EPRs: NV6—design of permanent tunnel ventilation system and relevant fixed infrastructure to meet EPA requirements for noise. • EPR: NV7—monitor noise from tunnel ventilation system and relevant fixed infrastructure.	• Noted. The requirement is not relevant for this WA assessment as it is related to traffic noise. • Noted. The requirement is not relevant for this WA assessment as it is related to noise barriers for traffic noise. • Noted. This requirement is not relevant to the WA as it is related to traffic noise monitoring. • Noted. See section 8.3.2 and WA_W15). • Noted. See section 8.3.3 and WA_R1.
Health	
• Overall, the HIA is fit for purpose and for most elements the identified risks can be managed including: ➢ air quality (tunnel ventilation, road-based emissions, combined and during construction) ➢ noise and vibration. • For those items identified above, the IAC has recommended changes to EPRs as appropriate.	• Noted. • Noted.

4.4. Minister's EES assessment

On 5 December 2019, the Minster approved the Project EES subject EPRs.

The conclusions of the Minister's assessment where relevant to segments of the environment considered under the WAA and an EPA comment are detailed below at Table 2.

Table 2 Conclusions of the Minister's assessment and an EPA comment

Minister's Conclusions	EPA Comment
The EPA has considered the recommendations and EPRs in this report when determining the WAA.	Noted. The recommendations and EPRs have been considered in the assessment.
Reference design The reference design has been used as a means by which to: • identify and assess the environmental effects of the project	Noted.

• prepare an environmental management framework (EMF), including EPRs, and a UDS that will provide for management and mitigation of those identified impacts. A reference design encourages alternatives or innovations to be explored during assessment, and in the detailed design, that respond to problems or impacts that may be unforeseen in some cases. This may result in improved environmental outcomes. A performance-based EMF and USD, as will be required for this project, is necessary to guide and support the delivery of alternative or innovative design solutions.	Noted. WA_W1 1) requires that consideration be given to modifying the design for the ventilation system. This is to improve the energy efficiency (hence reduce GHG emissions), as well as improve fire management and response of the project.
EMF and EPRs An essential part of the proposed EMF is the EPRs, which are proposed to set relevant environmental standards, mechanisms and outcomes that the proponent and its contractors need to implement to mitigate or manage the environmental effects of the project.	Noted. The requirements of relevant EPRs related to air quality (AQ2, 3, 4 & 5), fixed plant and infrastructure noise emissions (NV 6 and 7), GHG emissions (SCC1–3) and environmental management (EMFs1–4), have been considered in the assessment and form the works approval conditions. See sections 6–9 and conditions WA_W1 and WA_R1.
Modification—tunnel extension The IAC recommended modifications to the reference design in relation to some aspects of the project, including specifically in relation to extending the project's tunnel northwards, and avoiding surface works within Simpson Barracks. I do not support the IAC's recommendations in relation to these aspects, as I consider that these measures are not necessary to ensure that the project achieves acceptable environmental outcomes. This is not to say that the design modifications should not be explored in the detailed design of the project, or that they should not be adopted wholly or in part if they can be demonstrated to be unacceptable, having regard to the EMF, the EPRs and the UDS.	Noted. Environmental impact related to the extension of tunnel lengthening is not considered. Noted. Such design modification would likely require a works approval amendment.
Air Quality—air pollution equipment I agree with and support the IAC's recommendation for the project to include provision for space to allow retrofitting air pollution control equipment on the tunnel ventilation systems.	Noted. This requirement has been incorporated into the WA_W1.
Air Quality—EPRs	

The implementation of the EPRs regarding air quality, consistent with the recommendations of this assessment, will adequately manage potential impacts on air quality from construction and operation for sensitive receptors to an acceptable level.	Noted.
Air Quality—Modelling The IAC concluded it was satisfied the air quality modelling presented in the EES was fit for purpose and of a conservative nature, with the results providing the IAC comfort that the air quality impacts from the project will be within acceptable standards. I agree with this assessment.	Noted. EPA's assessment concludes that air emissions would comply with relevant criteria set in the SEPP (AQM). An air quality assessment will be required to confirm it during the detailed design (WA_W1 2)).
Air Quality—Ambient air quality The IAC recommended air quality monitoring for the project be undertaken with reference to the SEPP (AAQ) environmental quality objectives, given these objectives aim to protect beneficial uses. I agree with this recommendation for the project, and note the IAC considers this should become the standard approach for road projects. I also support the IAC's recommendation for daily reporting of air quality monitoring data online.	Noted. A WAA condition has been imposed requiring a plan detailing this requirement prior to construction (WA_W1 3)).
Air Quality—construction dust The potential impacts to air quality from project construction should be managed through best practice construction measures, as directed by EPRs AQ1 and EMF2, noting this should not rely solely on EPA Publication 480 for guidance. I consider that EPR AQ1 should also include provision of real-time monitoring of particulate matter to manage dust control.	Noted. WA_W1 5) requires that a CEMP to be provided to the EPA prior to the commencement of works, which include dust management and real-time dust monitoring.
GHG The implementation of the EPRs regarding greenhouse gas emissions, consistent with the recommendations of this assessment, will adequately manage greenhouse gas emissions to an acceptable level.	Noted.
Noise and Vibration Construction noise and vibration is to be managed in accordance with the Construction Noise and Vibration Management Plan (CNVMP) as required by EPR NV4.	Noted. The WA _W1 5) is conditioned with the requirement for a CEMP to be provided to the EPA prior to the commencement of works.
Noise Compliance against SEPP N-1 for fixed infrastructure and the tunnel ventilation system is managed through EPRs NV6 and NV7.	Noted. A noise assessment report is required for the detailed design in compliance with NV6 prior to construction (WA_W1 4)).

	A noise monitoring plan is required in compliance with NV7 prior to commissioning (WA-R1).
Human Health • The project can be delivered within acceptable criteria for impacts on human health. • Health outcomes will be contingent on air quality and noise mitigation, and to a lesser degree on social impact. • Environmental standards for the project will adequately manage the potential environmental effects on human health.	Noted.

The EPA's assessment of the proposal is consistent with the Minister's assessment of the EES. Prior to the determination of the works approval, gazettal of the PSA is required. The PSA was gazetted on 3 January 2020.

4.5. Referral agency comments

4.5.1. Manningham City Council

On 20 June 2019, the EPA sent a referral to the Manningham City Council as the proposed southern ventilation structure and emergency smoke discharge structure would potentially be located on land within the municipality of Manningham.

The council responded on 6 August 2019 and commented that there is a broad exemption within the Manningham Planning Scheme for roadworks. There was nothing in the Planning Scheme that prohibits the works. Council has no in-principal objection to the EPA considering or issuing the works approval if appropriate.

The full referral response is in Appendix 3.

4.5.2. Metropolitan Fire Brigade

On 11 October 2019, the EPA sent a referral to MFB regarding whether:

- MFB was satisfied with NEL's proposed fire prevention measures relating to the tunnel design and ventilation system, as well as the fire response management
- any conditions which MFB wishes to be included in the EPA's works approval should the EPA decide to grant an approval.

On 3 December 2019, MFB responded with acknowledgement that due to the early stage of the project, the required fire protection and emergency response measures will depend on the specific design finalised by the successful bidder for the works. MFB has assisted NELP in developing a Fire Safety Strategy document and design requirements and relevant standards. As the specific design has not been proposed, MFB requests the inclusion of conditions that require NELP to consult with MFB in relation to fire safety measures at each stage of the process.

The full referral response is in Appendix 3.

In view of the above, WA_W1 1) D requires that the content of the Fire Engineering Brief and Fire Engineering Report must be reviewed and agreed by the Emergency Services in accordance with the process outlined in AS4825. Fire and life safety systems and facilities must be designed and constructed in consultation with the Emergency Services.

4.5.3. Banyule City Council

On 29 October 2019, the EPA sent a referral to the Banyule City Council as the proposed northern ventilation structure would potentially be located on land within the municipality of Banyule.

No response has been received.

4.6. WAA process

4.6.1. Request for further information

During the assessment and on 6 August 2019, the EPA required further information from NELP through a s22 notice. The required information included the ventilation system concept design; abnormal operation/emergency management; and air emission modelling. On 5 September 2019, NELP provided the required information. A copy of the s22 notice and NELP's response can be found on EPA's website: https://www.epa.vic.gov.au/our-work/major-infrastructure-projects/north-east-link.

The EPA published the additional information for public comment. No comments from the public have been received.

4.6.2. Extension of approval statutory timeline

On 2 May 2019, the EPA wrote to NELP requesting an extension of its statutory approval process under s67A of the EPA Act considering the EES process for the NEL. On 20 June 2019, NELP agreed to an extension by a period which is equivalent to three weeks after the release of the Minister's Assessment of the environmental effects of NEL under the EE Act.

On 18 December 2019, NELP agreed to a further extension until 30 January 2020.

On 29 January 2020, NELP agreed to a further extension until 28 February 2020.

4.6.3. Assessment process

The assessment of the application was undertaken by the EPA's officers in the Development Assessment Unit who have been supported by internal and external subject matter technical specialists. The assessment report has been subject to an internal quality assurance review process.

The EPA has engaged the following experts:

- Dr Graeme Ross, Graeme Ross & Associates Pty Ltd, to undertake air quality modelling
- Professor Peter Sturm, Dean of Studies, Faculty of Mechanical Engineering Graz University of Technology Institute for Internal Combustion Engines and Thermodynamics, Austria, to review the tunnel ventilation system.

Their review reports can be found on EPA's website: https://ref.epa.vic.gov.au/our-work/major-infrastructure-projects/north-east-link

5. REGULATORY COMPLIANCE OVERVIEW

5.1. Compliance with Environment Protection Act 1970

The application has been considered with regard to the EP Act. Key sections of the EP Act, relevant to consideration of this WAA are discussed below:

- Section 1A – Purpose of the EA Act

  The EP Act 1970 sets out principles of environment protection. The relevant principles of environment protection are:

  1B Principle of integration of economic, social and environmental considerations
  (1) Sound environmental practices and procedures should be adopted as a basis for ecologically sustainable development for the benefit of all human beings and the environment.
  (2) This requires the effective integration of economic, social and environmental considerations in decision making processes with the need to improve community well-being and the benefit of future generations.
  (3) The measures adopted should be cost-effective and in proportion to the significance of the environmental problems being addressed.

  1C The precautionary principle
  (1) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
  (2) Decision making should be guided by—
  (a) a careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and
  (b) an assessment of the risk-weighted consequences of various options.

  1D Principle of intergenerational equity
  The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

  This is the policy context for consideration of the EPA's arguments for provision for retrofitting during the EES. The EPA submitted that:
  (a) emissions from the tunnel ventilation system—traffic-related air pollution—do pose a threat to human health, the extent of which is still being investigated but may be large
  (b) a requirement to provide for retrofitting constitutes a cost-effective way to ensure that those emissions can be dealt with in the future, consistent with intergenerational equity
  (c) best practice, demonstrated by adoption of the practice of requiring provision for retrofitting and consistency with the principles above.

  The EPA is supportive of the recommendation made by the IAC and Minister that provision for retrofitting of tunnel ventilation pollution control equipment should be included in the detailed design (EPR AQ2 and WA_W1 1) D).

  The EPA is satisfied that the project can meet the requirement of s1A of the EPA Act.

- Section 19A – Scheduled Premises

The proposal to install ventilation structures within the proposed road tunnels is defined as a *scheduled premises* at clause L03 (road tunnel ventilation systems) of Schedule 1 of the Regulations.

- Section 19B – Works Approval

  The EPA is satisfied that the WAA has been made in accordance with the EP Act.

- Section 19B5(c)

  The WAA may not be determined until such time that the proposed PSA is gazetted.

- Section 20AA – Joint Advertisement and Section 20B – Conference

  The WAA was advertised as a joint advertisement with the EES (inclusive of the proposed PSA) in accordance with this section of the EP Act.

  Rather than a s20B conference, an IAC was convened to consider the likely environmental effects of the NEL, including the WAA. The outcomes of the inquiry, relevant to the WAA are discussed at section 4.3.

- Section 40 – Discharges

  The EPA is satisfied that the discharges to the atmosphere resulting from the operation of the ventilation system supporting the road tunnels, complies with the relevant SEPP's and polices subject to the works approval conditions (section 7.3).

- Section 46 – Emission of Noise

  The EPA is satisfied that the emissions of noise resulting from the operation of the ventilation system supporting the road tunnels, complies with the relevant SEPP N-1 subject to works approval conditions (section 8.3).

- Section 49 – Resource efficiency

  The EPA is satisfied the energy efficiency resulting from the operation of the ventilation system supporting the road should comply with The Protocol for Environmental Management: GHG Emissions and Energy (Greenhouse PEM) subject to works approval conditions (section 6.3).

5.2. Relevant legislation, policy and guidance assessment overview

The WAA is required to comply with EP Act, relevant subordinate legislation and instruments under the EP Act and the *Climate Change Act 2017*.

The EPA considers that the following SEPPs and PEMs are of relevance for this proposal:

- SEPP (AQM)
- Greenhouse PEM
- SEPP N-1.

The assessment against the Climate Change, SEPPs and PEM is detailed in sections 6 to 9. It also includes other publications relevant for the assessment.

5.3. Environmental performance track record

The applicant, NELP, is a division of the Major Transport Infrastructure Authority (MTIA), which is an administrative office of the Department of Transport. It is responsible for managing NEL on behalf of the State.

For the purposed of the EP Act, the applicant is considered to be a fit and proper person.

With regard to the track record of the existing road tunnels in Melbourne, there are currently two road tunnels (CityLink and EastLink) incorporating ventilation systems licensed by the EPA.

The review of the ventilation stacks for the EastLink and CityLink tunnels showed that local air quality in the vicinity to the stacks was not adversely affected post operation of the tunnel ventilation systems.

6. CLIMATE CHANGE, ENERGY USE AND GHG EMISSIONS

6.1. Relevant documents

Climate Change Act 2017:

- Section 17 (2) requires the EPA to have regard to the potential impacts of climate change relevant to the decision or action and the potential contribution to the state's GHG emissions of the decision or action.
- Section 17 (3) sets out the relevant considerations for the EPA. These are the potential biophysical impacts, the potential long- and short-term economic, environmental, health and social impacts, the potential beneficial and detrimental impacts, the potential direct and indirect impacts, and the potential cumulative impacts.
- Section 17 (4) sets out the relevant considerations for the EPA when assessing a works approval. These are the potential short-term and long-term, direct and indirect, increases and decreases and cumulative impacts of GHG emissions.

SEPP (AQM):

- Clause 33 manages GHG in accordance with clause 18 and 19.

Greenhouse PEM:

- Section 2.1: Where the anticipated level of energy use associated with the application is 500 gigajoules per annum or more (or greater than 100 tonnes of energy-related CO2 – equivalent emissions per annum), identify and implement best practice with respect to the activities that are the subject of the application.

The final EPRs approved by the Minister:

- Implement a Sustainability Management Plan
- SCC2 – Minimise GHG emissions in design of major infrastructure projects
- SCC3 – Apply best practice measures for energy usage for tunnel ventilation and lighting systems.

6.2. Application

6.2.1. Climate change

The WAA considers potential climate risks relating to tunnel ventilation in section 8.2. It provides analysis of potential climate risk relating to tunnel ventilation. The risk includes potential power failure, damage to ventilation systems, unforeseen disbursement of emissions affecting sensitive receivers and failure of the ventilation system.

Section 8.3 of the WAA provides adaptation measures to address those risks. It is considered that the most significant climate risks with potential to impact on the tunnel ventilation system would be power failure and damage to the ventilation system by extreme wind and rainfall (flooding). Adaptation measures have been considered in the design.

6.2.2. Energy use and GHG emission

Energy use and GHG emissions are addressed in Section 9 of the WAA.

The report has relied upon the classification used in the *National Greenhouse Reporting Act 2007* and *National Greenhouse and Energy Reporting Regulation 2018*, as follows:

- scope 1 – direct GHG emissions
- scope 2 – indirect GHG emissions from purchased energy
- scope 3 – other indirect release of GHG emissions.

The operation of the tunnel ventilation system does not result in direct GHG emissions. GHG emission impacts are likely from electricity used to operate and undertake maintenance on the ventilation system and fuel used during maintenance.

The total GHG emissions per annum from NEL operations (including maintenance) are estimated to be approximately 84 kt CO_2-e, of which, 81kt CO_2-e (96.4%) GHG emissions would be associated with operating the tunnels[11].

Details of electricity and energy consumption, as well as the breakdown of scope 2 and 3 emissions, are shown in Table 3:

Table 3 GHG use from electricity use[12]

Operation	Electricity consumption (MWh/year)	Energy consumption (GJ/year)	Scope 2 (kt CO_2-e/year)	Scope 3 (kt CO_2-e/year)
Tunnel ventilation system (including pumps, signs and tunnel lighting)	69,500	250,100	74	7

Note: the above calculation was based 24 on hours per day, seven days a week and 52 weeks a year operation.

An assessment utilising criterion in section 17(4) of the Climate Change Act 2017 regarding the potential contribution to the Victorian GHG emissions is provided in section 9.2.1 of the WAA. It is estimated that the operation of the tunnel would represent 0.07 per cent of emissions from all Victorian sectors in 2016.

The WAA considers that the ventilation system has been designed with the following GHG reduction measures:

- variable speed drives (VSD) for main ventilation fan control, tailoring ventilation levels to traffic flows
- the use of light emitting diodes (LED) where required.

6.3. Assessment

6.3.1. Climate change assessment

The assessment considers that the WAA:

- has considered the potential impact of climate change on the tunnel ventilation system and identified adaptation measures (section 8 of the WAA)
- has provided analysis of GHG emissions (section 9 of the WAA).

[11] Chapter 16 GHG of EES documents.

[12] Table 9-1 of the WAA.

6.3.2. GHG emission assessment

The application is supported by a GHG Assessment. The assessment methodology is acceptable.

It is considered that using VSD tunnel extraction fans and LED lights represents best practice, meeting the requirement of PEM in this regard. However, it is further considered that GHG is strongly related to the power or energy needed to run the ventilation during operation. The overall system design is responsible for the energy efficiency of a ventilation system.

Comparison of GHG emissions with other Australian road tunnels has been made and presented in Table 4. The results indicate that the tunnel operation of NEL would consume a much higher amount of energy per km, except when compared with the M5 East Tunnel.

Table 4 Electricity consumption of Australian road tunnels

Project	Electricity consumption (MWh/annum	Total (2 way) tunnel length (km)	Traffic (vehicles per day)	MWh/km per annum
Lane Cove Tunnel[13]	15,400	7.2	70,000	2,139
M5 East Tunnel[14]	49,245	8	100,000	6,156
City Link (Melbourne)[14]	21,500	5	100,000	4,300
Proposed West Gate Tunnel (Melbourne)[14]	16,700	6.8	100,000	2,459
NEL	69,500	12	125,000	5,792

Considering the requirements of the Greenhouse PEM and EPR SCC2,[15] the EPA has sought advice from an international industrial expert, regarding potential ways to minimise energy consumption, resulting in a reduction of GHG emissions.

The expert comments that:

The topic of greenhouse gas emissions (GHG) is strongly related to the topic of ventilation power, or rather, to energy needed to run the ventilation during operation. The overall system design is responsible for the energy efficiency of a ventilation system.

In the case of the NEL tunnel project the policy of zero portal emissions is the driving factor behind energy consumption. Even with very low polluting vehicles, it is to be expected that for free-flowing traffic on all three lanes, a very high air volume flow will have to be extracted due to the piston effect. In situations with lower vehicle speeds (due to congestions) the NO_2 criterion drives the

[13] NSW Advisory Committee on Tunnel Air Quality, Technical Paper TP05: Road Tunnel Stack Emissions, November 2018. The M5 East stack approximately 1 km away from the tunnel.

[14] West Gate Tunnel Works Approval Application.

[15] SCC2 - Minimise GHG emissions: Integrate sustainable design practices which are best practice for major infrastructure projects into the design process and implement these to minimise, to the extent practicable, GHG emissions arising from construction, operation and maintenance of North East Link.

required fresh air (= extraction air) amount. This means, that most of the time some 800 to 1000 m³/s of air has to be extracted. The unfavourable design of the smoke duct as well as the fan positions in the cut & cover sections unnecessarily adds to the already high energy demand. As ventilation power is related to volume flow to the power of 3 (cubic) – for the same cross section – a very high electricity consumption is to be expected.

- In traffic situations where the NO_2 criterion is responsible for a high fresh air volume, intermediate air exchange stations (e.g. extraction via a ventilation station and intake air from the ramp portals at Manningham Road area) would considerably reduce the required ventilation power.
- In cases where the traffic-induced air flow (piston effect due to high vehicle speeds and amounts) dominates the air volume flow, the zero portal-emission strategy dominates ventilation power.

It is stated in the documents[16] (e.g.) that various options including intermediate vent stations were considered. It is also stated that CAPEX and OPEX calculations were performed. However, detailed information concerning important ventilation parameters is missing (e.g. ventilation requirements for various options, e.g. relating to different traffic scenarios and pricing of GHG) [17]. While it is possible that the current solution is the best of the options investigated, it is also possible other options or improvements in the current design are available which result in less ventilation power and less energy demand.

In summary, it is to be expected that a different layout of the system could reduce the energy consumption – especially for situations with heavy traffic combined with lower driving speeds. However, on the basis of the referenced documentation it is not possible to trace how or why the solution finally chosen should be the best at meeting the overall requirements.

In view of the above, WA_W1 1) requires an alternative engineering design of smoke extraction system as detailed above in section 3.3.3.

It should be noted that the assessment considers potential allowance for portal emissions. It concludes that further environmental and human health risk assessment will be required before considering this option, as detailed below in section 7.3.3.

[16] For example, section 3.2.1 of the *Response to EPA Victoria S22 Notice, 5 September 2019.*

[17] NELP provided at a late stage a Technical Memorandum qualitatively explaining why in this case option E was rejected, however, the information provided in this one page is rather limited.

6.4. Conclusion

The conclusions of the assessment of climate change impact and GHG emissions are:

- The WAA has met the requirements of the Climate Change Act.
- The WAA can meet PEM and SEPP (AQM), subject to the conditions.
- Works approval conditions include the following:

  Prior to construction (WA_W1 1))

  - Provide alternative engineering solutions for the smoke extraction system.

  Prior to commissioning (WA_R1):

  - Provide a Sustainability Management Plan to comply with EPR SCC1 which must include target and measures to the targets.

7. AIR EMISSION

7.1. Relevant documents

SEPP (AQM): clause 9, 18, 19, Schedule A (Note 8) and Schedule C.

- Clause 9 – protecting human health and local amenity.
- Clauses 18 and 19 – applying best practice for a new emission source to the management of emissions.
- Schedule C – methodology required for modelling emissions to air for new or modified sources.

Demonstrating Best Practice (EPA publication 1517).

EPR as recommended by the IAC and Minister:

- AQ2 Design tunnel ventilation system to meet EPA requirements for air quality
- AQ3 In-tunnel air quality performance standards
- AQ5 – Monitor ambient air quality
- AQ6 Monitor compliance of in-tunnel air quality and ventilation structure emissions.

7.2. Application

7.2.1. Ventilation stack emission impact assessment

7.2.1.1. Input data

Potential air quality impacts associated with the operation of the tunnel relate to vehicle exhaust emissions discharged from the road tunnel ventilation system. An air quality assessment for the tunnel ventilation system was conducted using the approved regulatory model (AERMOD—the latest version18081) for normal operation (traffic speed 80km/hr) model input data.

- The following pollutants were modelled and predicated:
  - $PM_{2.5}$
  - PM_{10}
  - NO_2
  - CO
  - Air toxics: benzene; toluene; ethylbenzene; xylene isomers (BTEX); 1,3 butadiene; formaldehyde; and polycyclic aromatic hydrocarbons (PAHs).
- Background concentrations of ambient air quality for CO, NO_2, PM_{10} and $PM_{2.5}$) from the EPA's Alphington air quality monitoring station (AAQMS) and the concentrations of air toxics were provided by the EPA.
- Traffic emission input factors (CO, NO_2, PM_{10} and $PM_{2.5}$) developed with the COPERT Australia road transport air pollutant emission inventory model and adjusted by PIARC (PIARC, 2012) factors.
- Five-year meteorological data for 2013 and 2017 developed using data collected at AAQMS and at three selected stations of the Bureau of Meteorology.

- Scenarios analysis using traffic data 2026 and 2036 for the following scenarios:
  - Scenarios A
    - A1 - 2026; 2020 emissions factors
    - A2 – 2026; 2025 emission factors
  - Scenarios B
    - B1 - 2036; 2020 emissions factors
    - B2 – 2036; 2025 emission factors.
- Worst case sensitivity analysis conducted, including:
  - maximum lane capacity, 24 hours per day, 365 days per year, with a traffic speed of 40km/hr
  - emissions at in-tunnel air quality limits.

7.2.1.2. Stack emission and sensitivity test

Emission during normal operation

Based on the modelling, the air quality impact of the emissions from the proposed ventilation stacks is considered to meet the requirements of SEPP (AQM) for all pollutants without background.

The design criteria for PM_{10} and $PM_{2.5}$ are not met on a number of occasions if considering the existing background levels. However, the contribution from the tunnel ventilation emissions is negligible, less than 1 per cent. Section 10.2 of the WAA provides a summary of dispersion model results. The following tables provide a summary of modelling results.

Table 5 Air quality modelling results – scenario A (2026), project and background

	Units	SEPP (AQM) design criterion	Maximum predicted GLC			Project contribution relative to design criterion (%)
			Total	Project	Background	
PM_{10}	**µg/m³**	**80**	**200**	**0.17**	**200**	**0.22**
$PM_{2.5}$	**µg/m³**	**50**	**74**	**0.063**	**74**	**0.13**
CO	mg/m³	29	2.5	0.032	2.5	0.11
NO_2	µg/m³	190	130	11	120	5.6
Benzene	µg/m³	53	14	5.6	8.0	11
Toluene	µg/m³	650	59	11	47	1.7
Ethylbenzene	µg/m³	14,500	9.4	4.2	5.2	0.029
Xylene isomers	µg/m³	350	33	11	22	3.1
1,2-Butadiene	µg/m³	73	1.7	1.2	0.48	1.6
Formaldehyde	µg/m³	40	8.7	2.3	6.4	5.8
PAHs	µg/m³	0.73	0.0011	0.00056	0.00055	0.077

Note: **Bold text** indicates exceedances of the design criterion when background values included.

Table 6 Air quality modelling result - scenario B (2036), project and background

	Units	SEPP (AQM) design criterion	Maximum predicted GLC			Project contribution relative to design criterion (%)
			Total	Project	Background	
PM_{10}	**µg/m³**	**80**	**200**	**0.21**	**200**	**0.27**
$PM_{2.5}$	**µg/m³**	**50**	**74**	**0.083**	**74**	**0.17**
CO	mg/m³	29	2.5	0.037	2.5	0.13
NO_2	µg/m³	190	130	11	120	5.7
Benzene	µg/m³	53	14	5.6	8.0	11
Toluene	µg/m³	650	59	11	47	1.7
Ethylbenzene	µg/m³	14,500	9.4	4.2	5.2	0.029
Xylene isomers	µg/m³	350	33	11	22	3.1
1,2-Butadiene	µg/m³	73	1.7	1.2	0.48	1.6
Formaldehyde	µg/m³	40	8.8	2.3	6.4	5.8
PAHs	µg/m³	0.73	0.0011	0.00058	0.00055	0.079

Note: **Bold text** indicates exceedances of the design criterion when background values included.

Sensitivity test – maximum lane capacity

With the assumption of maximum lane capacity, 24 hours per day, 7 days per week, all modelled pollutants, except PM_{10} and $PM_{2.5}$ are compliant with the SEPP (AQM). However, without accounting the background concentrations, the maximum predicted project contribution to PM_{10} and $PM_{2.5}$ is 12 per cent and 17 per cent of the design criterion respectively.

Emissions at in-tunnel air quality limits

With the assumption of emissions at in-tunnel air quality limits, modelling results (including background) indicated compliance with both CO and NO_2 design criteria.

7.2.2. In-tunnel air quality performance

The ventilation system, as summarised in section 3.2, has been designed to achieve the in-tunnel air quality detailed in section 3.2.1 above.

7.2.3. Monitoring

An air quality monitoring plan is provided in Appendix B of the WAA.

The proposed monitoring program includes:

- A continuous emission monitoring system (CEMS) at each ventilation structure to monitor the emissions of the following pollutants, together with exhaust gas velocity, temperature and relative humidity:
  - $PM_{2.5}$
  - PM_{10}
  - NOx
  - CO.
- In-tunnel air quality:
  - Monitoring equipment will be installed at specific locations within each tunnel to monitor air speed and direction, visibility, CO and NO_2.
  - CO, NO_2 and visibility data shall be used to control the tunnel ventilation system VSD fan operation.

Air toxics emission monitoring will be conducted on each ventilation structure to determine the concentrations and mass rates of emission for the following pollutants:

- benzene, toluene, xylene isomers and 1,3-butadiene
- PAHs
- formaldehyde.

A number of emission testing methods include: SUMMA passivated canister sampling and GC analysis; multicomponent sampling train; and adsorbent cartridge and HPLC analysis.

7.3. Assessment

7.3.1. Ventilation stack emission impact assessment

Clauses 18 and 19 of SEPP (AQM) require the adoption of best practice for new emission source.

The use of stacks to disperse pollutants is considered as best practice. This is supported by the NSW Advisory Committee on Tunnel Air Quality's documents18, which states that:

- *'In most cases, the stack provides an additional outlet, so that emissions from the portals of a longer or busier tunnel are reduced to levels comparable to a shorter or less busy tunnel.*

[18]NSW Advisory Committee on Tunnel Air Quality, Technical Paper TP05: Road Tunnel Stack Emissions, November 2018. https://www.chiefscientist.nsw.gov.au/__data/assets/pdf_file/0004/196645/TP05_Road-Tunnel-Stack-Emissions.pdf

- *Stacks improve dispersion and lower ground level concentrations of vehicle emissions compared to releases at ground level.'*

Emission sources and types were adequately identified.

Independent model verification has been undertaken to verify that the predicted impacts from emissions to air of NO_2 from the ventilation stacks are sound, and that they will comply with SEPP (AQM).

The outcomes of air quality impact verification have confirmed that:

- The choice of indicators and Design Criteria are appropriate as per Schedule A of SEPP (AQM), albeit that only NO2 has been examined specifically in this project.
- Sensitivity tests – verification of two sensitivity test cases confirms compliance with SEPP (AQM).
- The choice of model, the model configuration, and the key model inputs represent 'best practice'.
- In general, the modelling process and the associated impact assessment meet the requirements and intent of Schedule C – Modelling Emissions to Air' of SEPP (AQM).

Any issues or differences in interpretation identified during the verification process are considered minor. While they may alter some of the quantitative numbers and percentages when comparing the relative contributions from the emission sources and background, as well as the quantitative comparison with the design criteria, these changes would be small and would not alter the general conclusions.

It should be noted:

- It seems that the background concentrations for $PM_{2.5}$ and PM_{10} can potentially influence greatly the tunnel ventilation emissions, based on the EPA's historical monitoring data at Alphington.
- It seems that background concentrations for NO_2 should not contribute to such a great extent to the ground level concentrations with a ratio of 120:11 (background vs the project as shown in Table 7). The one-hour NO_2 levels were mostly below 0.04 ppm[19] based on the EPA's monitoring data at Alphington, whereas the estimated worst tunnel traffic emission for 2036 (northbound) was 1.0 ppm.[20]
- Traffic emissions were calculated on the basis of COPERT Australia emission factor. Traffic emission should be re-calculated using PIARC 2019 data to have a safety margin for calculating CO and particulates emissions, as explained below in section 7.3.2.1.

In view of the above, the condition (WA_W1 2)) requires that prior to the construction, an air quality assessment is provided to show compliance with the SEPP (AQM) (or any later equivalent) and EPR AQ2. The report must include the air emission limits (in g/s) for the southern and northern ventilation stacks. Emission limits need to be set as per the discharge levels modelled for the air quality assessment with the updated emission factors calculated using PIARC 2019. This provides

[19] Mostly below 0.05ppm (one-hour average), as shown in Figure 13 of Appendix A of the WAA.

[20] Calculated using the design flow rate of 1300m^3/s for the northern portal and 1.3 g/s as shown in Table 7 of Appendix A of the WAA.

the understanding of the impacts and evidence that the ground level concentrations estimated have been adequately assessed.

7.3.2. In-tunnel air quality compliance assessment

It is considered that the criteria adopted for the tunnel ventilation system design is a stringent approach compared to the international practice. For example, in the international context, a prohibition of portal air in urban areas is very rare. PIARC recommended in-tunnel NO_2 is 1 ppm rather than 0.5 ppm which is this design case.

7.3.2.1. Traffic emission calculation

Traffic emissions were calculated on basis of COPERT Australia emission factor. PIARC has updated the emission data base for the fresh air demand calculation in 2019. These emission data tend to overestimate emissions of CO and particles in order to have a solid calculation bases for the fresh air requirement. The ventilation system would also be able to cope with short events of higher emissions (occurrence of high polluting vehicles). This is consistent with most of the tunnel projects in Australia. It is recommended to update the emission and in-tunnel air quality data in the detailed design phase using PIARC 2019 data (WA_W1 2)).

7.3.2.2. Compliance with in-tunnel air quality design criteria

The NO_2 design criterion is a quite stringent one and dominates the required fresh air volume flow. The design comes up with high air volume flows at the portal air extraction stations and hence high fresh (supply) air via the entrance portals and on and off ramps at Manningham Road and Lower Plenty Road.

The NO_2 criterion can be kept as soon as the average driving speed is above 20 km/h. However, it is not clear whether the NO_2 criterion was correctly interpreted in the project. As aforementioned the “rolling average over 15 minutes” is defined as a time related average at a certain fixed location (i.e. monitoring site) and has nothing to do with a travel time.[21,22] Taking the NO_2 criterion literally, the parts between the ramps at Manningham road (or between Lower Plenty Road northbound) to the exit portals would not meet the NO_2 criterion, as the route average is above 0.5 ppm. However, it is not logical that shorter rides within the tunnel would not fulfil the criterion while the whole tunnel does. This is due to the fact, that the criterion only looks at the route average and not on the exposure (dose).

Due to the high air volume flow rates, the following design criteria can be met for:

- CO in-tunnel design criteria
- Visibility – the PIARC in-tunnel air quality recommendation
- Speed – the resulting air speeds are quite high. This results in very high ventilation power and maximum air speed, which is close to a critical range, but stays below the threshold value of 10m/s.

[21] The NO_2 criterion is solely dependent on the tunnel (route) average as defined in NSW: In-Tunnel Air Quality (Nitrogen Dioxide) Policy, Advisory Committee Tunnel Air Quality, February 2017. It has no dose (i.e. exposure time) relationship.

[22] Statements concerning travel times in relation to the NO_2 criterion made in section 11.1 of Responses to EPA Victorian s22 Notice, 5 September 2019, are misleading.

For most of the traffic situations net airflow out of the mainline tunnel portals can be avoided. The situation at the off and on ramps might be different, as documented in the design reports. However, in order to achieve the requirement of zero portal emissions, high ventilation power even at times with little traffic is required.

7.3.2.3. Portal emission

EPA's expert also commented that in an international context (outside of Australia), a prohibition of portal air in urban areas is very rare. In cases with portal air management via stacks, the operating time of the systems is restricted to a few hours, depending on traffic and external air quality conditions. Operation times are predefined on the basis of an environmental impact analysis and the effective operation finally implemented in connection with local air quality monitoring.

In Melbourne, City Link and East Link have been allowed portal emissions during off-peak periods after commencing operation with risk assessment supported by monitoring data.

The WAA states that:

> '*To prevent portal emissions from the main tunnels and ramp portals for the North East Link tunnel dictates that the main fans and a significant number of jet fans always be operated….This results in energy being used in an inefficient manner.*'[23]

The assessment considers that while it is necessary to consider portal emissions to reduce energy consumption and the requirement of EPR SCC2 to achieve net zero emissions in the operation and maintenance of the project, the priority must be given to optimise the tunnel ventilation system design to improve energy efficiency, hence reducing GHG emissions. This is consistent with the 1I Principle of wastes hierarchy, which requires that wastes should be managed in accordance with the order of preference: firstly, avoidance and lastly disposal. It is also consistent with the best practice of PEM.

Nevertheless, the assessment assesses analytical data of the WAA regarding the portal emissions. The estimated concentrations of some pollutants for all hours of days (NO_2 and $PM_{2.5}$) in both tunnel portals are much higher than the SEPP (AQM) criteria listed below. It can pose risk if portal emissions are allowed without further risk assessment.

The Schedule A of SEPP (AQM) for those pollutants are:

- CO—29,000µg/m^3, 1-hour average
- NO_2—190 µg/m^3, 1-hour average
- PM_{10}—80 µg/m^3, 1-hour average
- $PM_{2.5}$—50 µg/m^3, 1-hour average.

Concentrations of those pollutants could be below the SEPP (AQM) at Manningham Interchange off ramp (Northbound tunnel) during off-peak periods (10pm – 4am) and Greensborough Highway Interchange off-ramps (Southbound tunnel) during most hours of the day. Nevertheless, it is considered that potential allowance for portal emissions should be subject to further risk assessment with supporting real air quality monitoring data after the commissioning of the project.

[23] Section 7.4.1 of the WAA and section 2 of Appendix of Response to EPA Victoria S22 Notice, 5 September 2019.

7.3.2.4. Underdeck ventilation from maintenance tunnel

It is proposed a combined volume of 36 m^3/s air collected from both underdeck tunnels would be discharged via the northern tunnel ventilation structure. However, no information has been provided about its quality. Air emissions of this source should be included in the updated air quality assessment during the detailed design (WA_W1 2)).

7.3.3. Monitoring

Monitoring for ventilation structure emissions and in-tunnel air quality has been proposed. However, details of the monitoring program are yet to be finalised.

Considering the requirement of EPR AQ5, the following works approval conditions related to the monitoring are required:

- Monitoring compliance of in-tunnel air quality and ventilation structure emissions to meet the EPR AQ5 (WA_W1 3)):
  - in-tunnel air quality monitoring:
    - detailed in-tunnel air monitoring program, including parameters, instrument, locations of instrument installation
    - tunnel ventilation control system linked to in-tunnel air monitoring, including related performance parameters and indicative alarm set points
    - develop contingency measures to manage in-tunnel air quality in the event of incidents or emergencies.
  - A continuous monitoring program for the ventilation stack emissions, including parameters, assessment methodology and criteria which are linked to ambient monitoring data, as well as daily public reporting system
  - a monitoring program for ambient air quality, including periods before and after the commencement of tunnel operation using the existing five monitoring sites relied upon within the application, or sites as otherwise agreed with EPA Victoria, inclusive of the specifications and location of instruments (AQ4)
  - provision for daily reporting of ambient air quality monitoring program results, on a publicly available website related to the project, or through EPA Victoria's Air Watch website. The reporting shall be undertaken for at least five years after the commissioning of the project, or such lesser period, as agreed with the EPA.
- Implementation details of monitoring program to meet EPR AQ5 prior to the commissioning of the works (WA_R1):
  - a confirmed monitoring program for in-tunnel air quality and ventilation stack emissions and provision for publishing the data.

7.4. Conclusion

The conclusions of the assessment of potential effects on the air environment are that:

- The project can comply with the SEPP (AQM) for emissions from the ventilation stacks.
- In-tunnel air quality design criteria can be met.
- Permission of portal emissions must be subject to further environmental and public health impact assessment (HIA) based on monitoring data collected after operation.

- Works approval conditions include the following:

  Prior to construction (WA_W1)

  - A conceptual provision for retrofitting of future pollution control equipment installed at the tunnel ventilation structures (WA_W1 1).
  - An updated air quality assessment to demonstrate compliance with the State Environment Protection Policy (Air Quality Management) and EPR AQ2 (WA_W1 2). The report must include:
    - assessment of all emission points, including underdeck space, on/off ramps
    - updated emission factors using PIARC 2019 data
    - modelling of the proposed air emission licence limits (in g/s) for all ventilation stacks.
  - Monitoring compliance of in-tunnel air quality and ventilation structure emissions to meet the EPR AQ5 (WA_W1 3).
    - In-tunnel air quality monitoring:
      i. detailed in-tunnel air monitoring program, including parameters, instrument, locations of instrument installation
      ii. tunnel ventilation control system linked to in-tunnel air monitoring, including related performance parameters and indicative alarm set points
      iii. develop contingency measures to manage in-tunnel air quality in the event of incidents or emergencies.
    - A continuous ventilation structure emission monitoring programme, including parameters, assessment methodology and criteria which are linked to ambient monitoring data, as well as daily public reporting system.
  - A monitoring program for ambient air quality to meet EPR AQ4 (WA_W1 3).
    - Including periods before and after the commencement of tunnel operation using the existing five monitoring sites relied upon within the application inclusive of the specification and location of instruments.
    - Provision for daily reporting of ambient air quality monitoring program results, on a publicly available website related to the project, or through EPA Victoria's Air Watch website. The reporting shall be undertaken for at least five years post commissioning of the project, or such lessor period, as agreed with the EPA.

  Prior to commissioning (WA_R1):

  - Operation environmental management plan (OEMP), including a confirmed monitoring program for in-tunnel air quality and ventilation stack emissions to meet EPR AQ5 (WA_W1).

8. NOISE

8.1. Relevant documents

State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) N-1 (SEPP N-1).

Noise from Industry in Regional Victoria (NIRV) (EPA publication 1411).

EPR as recommended by IAC and approved by the Minister:

- NV6 Design permanent tunnel ventilation system and relevant fixed infrastructure to meet EPA requirements for noise.
- NV7 Monitor noise from tunnel ventilation system and relevant fixed infrastructure.

8.2. Application

A Noise Impact Assessment (NIA) for the operation of the tunnel ventilation system proposed in the Reference Project, has been undertaken and provided in the Appendix C of the WAA, against the noise limits set by SEPP N-1. Further information dated 19 November 2019, SLR's *Response to EPA Question Works Approval Application,* forms part of the application.

8.2.1. Noise emission sources

Noise sources considered for the operation of the ventilation system are from the following ventilation locations:

- the northern portal
- the southern portal
- Manningham Road Interchange – emergency smoke discharge
- Greensborough Road on and off ramps
- Manningham Road Interchange on and off ramps.

Equipment/fixed infrastructure considered in the reference design include:

- fresh-air supply and exhaust fans, generally jet fans located in ventilation buildings, with stacks of a height of 40m and outlets
- in-tunnel jet fans
- multiple substations, all of which except two would be below ground—the two above ground substations are located at the Northern Portal and Manningham Interchange, respectively and will be housed in new buildings with provisional space for ventilation and noise mitigation.

Section 2 of the NIA and additional information provides the locations, number of equipment, sound power levels of those equipment/fixed infrastructure for the assessment and considered acoustic treatment.

Noise limits were determined based on the measured background level as detailed in section 4 of the NIA. However, there was no baseline noise monitoring conducted to residences to the south of the Manningham Interchange site, west of Bulleen Road (i.e. around Ilma Crescent).

Since smoke exhaust fans (Manningham interchange) are only used in emergency situations, they are exempt from assessment. However, they were assessed for the daytime period, as relevant to the proposed schedule for routine maintenance testing.

8.2.2. Noise sensitive receivers and predicted noise levels

The assessment results (Table 7) indicate that the noise limits of SEPP N-1 would be achieved through proper selection of equipment and standard mitigation measures:

Table 7 Noise limits and compliance

(Source: Table 11-1 of the WAA)

		Background level, (dBA L_{90})	Zoning level (dBA)	Noise limit (dBA L_{eq})	Adjusted noise limit[1] (dBA L_{eq})	Predicted emissions, (dBA)	Compliance with SEPP N-1
Northern ventilation structure							
183 Greensborough Road, Watsonia	Daytime	59	53	53	-	33	Yes
	Evening	56	46	47	-	33	Yes
	Night-time	44	41	41	-	33	Yes
5 Hester Walk, Watsonia	Daytime	55	51	51	-	28	Yes
	Evening	52	45	47	-	28	Yes
	Night-time	40	40	40	-	28	Yes
Manningham Interchange (testing of emergency smoke exhaust fans only)							
218 Bulleen Road	Daytime	53	57	55	52	49	Yes
1A Elizabeth Street	Daytime	48	53	53	50	46	Yes
40-42 Bridge St	Daytime	48	53	53	50	48	Yes
Southern ventilation structure							
11 Ben Nevis Grove	Daytime	46	50	50	-	36	Yes
	Evening	48	44	48	-	36	Yes
	Night-time	43	39	43	-	36	Yes

[1] Daytime noise limits at Manningham Interchange adjusted by 3dBA to account for possible noise contributions of future development.

Noise emissions from the in-tunnel jet fans located at two interchanges' on and off ramps are predicted to comply with the noise limits of SEPP N-1 (Table 1) with the use of a 2D silencer on the intake and discharge side of the fan.

Table 8 Assessment of noise emissions from jet fans and the ventilation building

(Source: Table 5-1 of SLR's Response to EPA Questions WAA)

Location	Impacted by fans	SEPP N1 criteria (dBA)	Predicted emissions from two Jet Fans (dBA)	Predicted emissions from Ventilation station (VS) and sub-station (dBA) (1st floor level) Note 1	Margin Below criteria (dBA)	Statement of compliance
Northern portal						
Baptcare Strathallan Macleod	Fan 1 and Fan 2	51 (daytime)	37	<25 (VS + substation)	14	Complies with SEPP N-1
		47 (evening)	37	<25 (VS+ substation)	10	Complies with SEPP N-1
		40 (night-time)	37 Note 2	<25 (VS+ substation)	3	Complies with SEPP N-1
131 Greensborough Road	Fan 1 and Fan 2	51 (daytime)	34	<25 (VS + substation)	17	Complies with SEPP N-1
		47 (evening)	34	<25 (VS+ substation)	13	Complies with SEPP N-1
		40 (night-time)	34 Note 2	<25 (VS+ substation)	6	Complies with SEPP N-1
Manningham Interchange						
218 Bulleen Road	Fan 5 and Fan 6	52 (daytime)	27	49 (VS + substation)	3	Complies with SEPP N-1
		48 (evening)	27	19 (substation only)	21	Complies with SEPP N-1
		43 (night-time)	27	19 (substation only)	15	Complies with SEPP N-1
1A Elizabeth Street	Fan 5 and Fan 6	50 (daytime)	27	46 (VS + substation)	4	Complies with SEPP N-1
		43 (evening)	26	16 (substation only)	17	Complies with SEPP N-1
		38 (evening)	26	16 (substation only)	12	Complies with SEPP N-1
40 – 42 Bridge Street	Fan 5 and Fan 6	50 (daytime)	29	48 (VS + substation)	2	Complies with SEPP N-1
		43 (evening)	29	26 (substation only)	12	Complies with SEPP N-1
		38 (evening)	29	26 (substation only)	7	Complies with SEPP N-1
20 Ilma Street	Fan 3 and Fan 4	50 (daytime)	21	42 (VS + substation)	5	Complies with SEPP N-1
		43 (evening)	21	<10 (substation only)	20	Complies with SEPP N-1
		38 (evening)	21	<10 (substation only)	17	Complies with SEPP N-1

Note 1: this represents noise from other fixed plant and equipment, and has been extracted from the Surface Noise and Vibration report, prepared for the EES

Note 2: it is likely that only one fan will operate during the night, though two have been assessed

Note 3: All fans are assumed to have a 2D silencer (no pod) on the intake and discharge side of the fan

The noise assessment was based on the use of VSD fans to reduce noise during low traffic, the use of noise attenuators (silencers) on the intake and discharge of fans. The NIA for the reference design concluded that no other mitigation measures would be considered necessary to achieve the noise limits. Ongoing monitoring to confirm compliance has been proposed.

8.3. Assessment

8.3.1. Comments on the noise impact assessment

The EPA reviewed the NIA, having regard to the approach taken to determine the noise limits at strategic noise sensitive areas, the measurement of background levels, the relevance of the inputs to the noise model (such as location of equipment and their sound power level, acoustic performance of mitigation measures) and the assumptions made for the acoustic calculations and assessment.

Noise source locations and equipment/fixed infrastructure associated with the operation of the tunnel ventilation system are acceptable.

The selected sensitive receptors are residential type and consistent with the requirement of SEPP N-1. The effective noise levels from the tunnel ventilation structures, portals and interchange determined are plausible, and would meet the SEPP N-1 limit.

8.3.2. Recommendations for the works approval

During the EES, submitters recommended that noise should be assessed for other sensitive uses, which are not covered by SEPP N-1, especially around the Southern Portal. Those sensitive receptors could include the educational institutes located in close proximity. For other projects (e.g. Melbourne Metro), EPA accepted noise objectives based on levels from Australia and New Zealand Standard AS/NZS 2107 for locations for which N-1 does not set a limit (e.g. schools and libraries).

The IAC considers that the requirement to assess non-residential sensitive uses is acceptable. Thus, noise assessment for those receptors is required under EPR NV6, which specifies to 'design and implement the permanent tunnel ventilation system to comply with the internal Satisfactory Recommended Design Sound Levels as defined in AS/NZS 2107 for relevant affected spaces. Having regards to the most recent revision of AS/NZS 2107 (2016), the 'Satisfactory level' criteria would equate the lower value of the design sound level range provided for the considered type of occupancy and activity.

Furthermore, there are several uncertainties which are subject to the detailed design. For example, the layout of the tunnel ventilation system, the final number of equipment (jet fans and extraction fans), equipment type and locations of installations, design and construction of the ventilation buildings and stack(s). The NIA mentions refinements to be made during detailed design, such as:

- refinement of the noise limits
- confirmation of sound power levels and relevant adjustments (modifying factors) for the equipment eventually selected
- confirmation of operating conditions of the fans
- noise reduction provided by the noise mitigation measures eventually selected, considering the potential effects of airflow on silencers (influence on the acoustic attenuation, and potential flow-generated noise), the long-term degradation in acoustic performance; and, for in-tunnel fans, the reverberation of sound in the tunnel
- acoustic design of the ventilation and substation buildings.

The NIA also envisages that, as part of the detailed design, the design be justified with respect to best practice. This consideration is consistent with clause 19 of SEPP N-1.

It is noted that an alternative design for the Bulleen interchange was tabled at the IAC hearings. If an alternative design is selected for a detailed design, then the relocation or redesign of the ventilation structures or changes in equipment selection are expected. In any case, an acoustic assessment would be required, inclusive of a revision of the identification of the noise sensitive receptors at which noise emissions need to be assessed.

In view of the above, WA_W1 4) requires that an updated noise assessment be undertaken upon confirmation of the detailed design, which must meet the requirements in EPR NV6, to include, but not be limited to:

- Re-assessment of the background levels that may have varied due to different assessment locations, or due to potential change in background conditions.
- Noise impact assessment on non-residential sensitive uses (schools, libraries) using the lower value of the design sound level range of AS/NZS 2107 standards of those receptors.
- The necessary refinements to the noise assessment, including:
    - The fans and silencers ultimately selected for installation and consideration of the layout of the facility (including the noise path between the fan and the point of discharge). The assessment must consider:
        - silencer insertion-loss data based on dynamic testing of the product under similar operational conditions
        - the risk of flow-generated noise across the face of silencers
        - the acoustic performance throughout the life of silencers with explanation of how the potential for acoustic degradation in the performance equipment (such as silencers) through wear and dust build-up will be addressed.
    - Design of ventilation buildings and stack(s) and of substation buildings to prevent or otherwise minimise break-out noise.
    - The need for adjustments to the predicted levels, having consideration of the character of the noise (tonal, impulsive or low frequency).
- Implementation of best practice noise control, in accordance with clause 19 of SEPP N-1.

8.3.3. Monitoring

EPR NV7 requires the monitoring of noise from the tunnel ventilation system and relevant fixed infrastructure. In this regard, the following condition (WA_R1) is required prior to the commencement of operation:

- a monitoring program for noise, including periods before and after the commencement of the tunnel operation. This plan must include contingency measures to be implemented if noise level limits are not met.

8.4. Conclusion

Overall, the conclusion of the noise assessment is that:

- The project can comply with the SEPP N-1, subject to the works approval conditions.
- Works approval conditions include the following:

<u>Prior to construction (WA_W1 5)</u>

- To provide a detailed noise impact assessment which is reviewed by an independent acoustics specialist and meet the requirements of EPR NV6.
- CEMP, including noise management to demonstrate the compliance with the EPRs NV3 and NV4.

<u>Prior to commissioning (WA_R1)</u>

- An operation environmental management plan, including a monitoring program for noise impact, and including periods before and after the commencement of the tunnel

operation to comply with EPR NV7. This plan must include contingency measures to be implemented if noise level limits are not met.

9. HEALTH

9.1. Relevant documents

- SEPP (AQM), clause 9 to protect human health.
- EnHealth 2012a. Environmental Health Risk Assessment – Guidelines for Assessing Human Health Risks from Environmental Hazards (enHealth 2012a).
- EnHealth 2012b. Australian Exposure Factor Guidance – Guidelines for Assessing Human Health Risks from Environmental Hazards (enHealth 2012b).
- EnHealth Health Impact Assessment Guidelines (enHealth 2017).

9.2. Application

Technical Report – Health Impact Assessment (HIA) provides information on the evaluation of potential health risks for sensitive receptors associated with the project. The HIA used available evidence to evaluate the magnitude, likelihood and distribution of potential impacts on human health associated with the NEL, including tunnel ventilation.

The receptors identified in the HIA that are likely to be affected by the ventilation structure emissions include motorists and those near the following emission points:

- the northern ventilation structure—which corresponds to a surface road assessment receptor located on Watson Street in Macleod, approximately 450m north of the site
- the southern ventilation structure—which is located near the boundary of a residence approximately 280m south-east of the site
- other sensitive receivers within Precinct 2 (the tunnel portals and tunnel section)—which includes residential areas, community buildings (including child care centres and kindergartens), outdoor recreation and public open spaces and heritage buildings.

Based on the available data and the assessment of changes in air quality presented in the HIA report, it is concluded that:

- Volatile organic compounds (VOCs) such as benzene, toluene, xylene and ethylbenzene were evaluated using relevant health-based guidelines. Potential exposure to VOCs is below all relevant health based guidelines and hence health impacts are considered negligible.
- Carcinogenic pollutants such as benzene, benzene(a)pyrene and diesel particulate matter were evaluated for cancer risk. The potential for incremental cancer risk is considered to be low.
- CO—potential exposure to CO is below all relevant health-based guidelines and is considered negligible.
- NO_2—population health impact from tunnel ventilation facilities is considered to be low.
- Particulates ($PM_{2.5}$)—population health impact from tunnel ventilation facilities is considered to be low.

9.3. Assessment

The methodology was consistent with the methods used in previous similar projects considered by approval authorities in Victoria (the Westgate Tunnel) and New South Wales (North and West Connex) and consistent with a national approach as outlined in the guidelines for assessing human health risks from environmental hazards (enHealth 2012).

Overall, the HIA provides an outline of the potential for risks to sensitive receptors based on the available information. The health risk assessment has been conducted in general accordance with enHealth (2012a, 2012b and 2017) and good practice risk assessment.

The findings in the HIA supports the conclusion that risk associated with emissions from the tunnel ventilation systems for sensitive receptors (near the tunnel ventilation system) is likely to be low.

9.4. Conclusion

The conclusion of the health impact assessment is that the project:

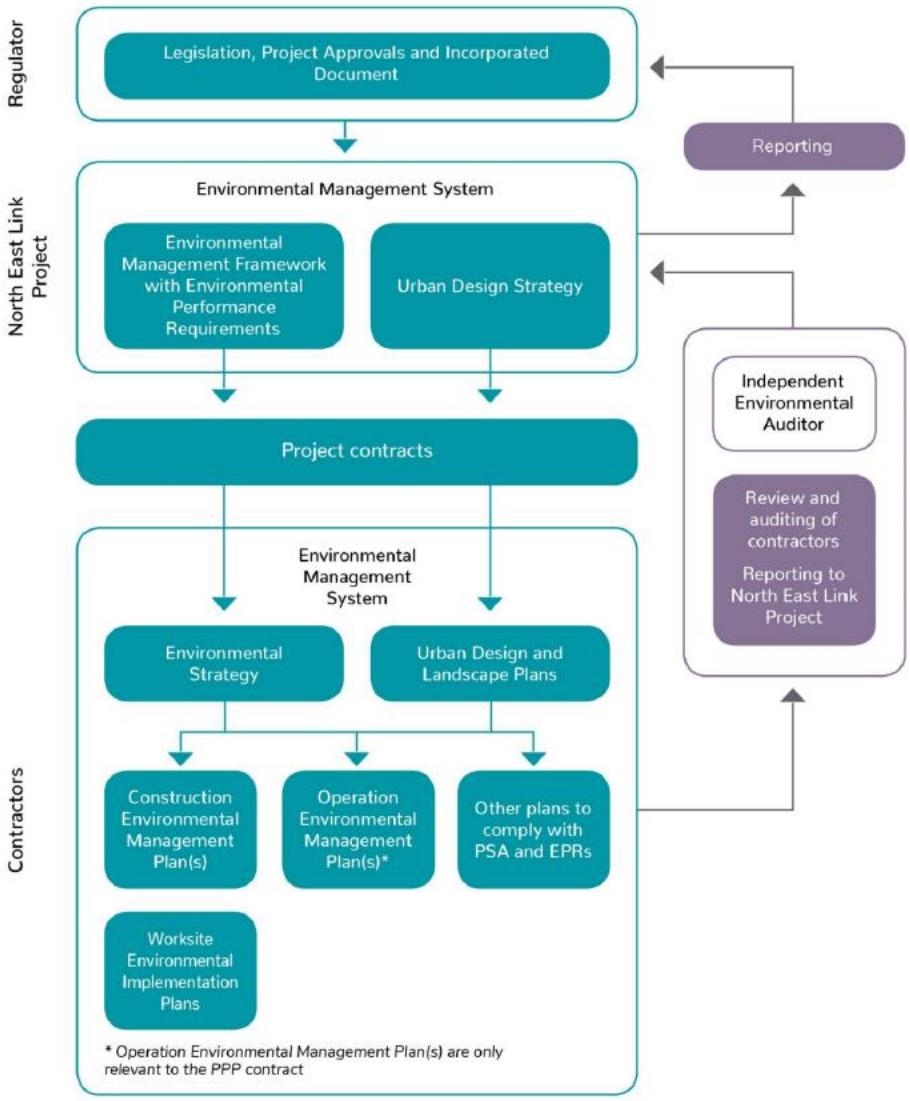
- complies with the requirements of SEPP (AQM)
- the risk to human health of sensitive receptors in the proximity to the proposed ventilation system is negligible.

10. CONSTRUCTION IMPACT

10.1. The application

Section 12.1 of the WAA outlines the environmental management framework for the project. Construction activities will be managed through an EMF and EPRs approved by the Minister. Under the EMF and EPRs, contractors will be required to develop and implement CEMPs and work sites environment implementation plans. Specific monitoring programs would be developed and implemented as part of CEMP. All the documents will be audited by an independent auditor. The framework is shown in Figure 9.

Figure 9 Key environmental management documentation



12.2 of the WAA has identified potential environmental impacts associated with the construction of two tunnel ventilation structures and the emergency smoke discharge structure. Issues identified include:

- dust and odour emissions
- noise and vibration emissions

- construction solid wastes (contaminated soils and materials and hazardous wastes, including asbestos)
- GHG emissions.

The construction would take approximately 81 months.

10.2. Construction EPRs and works approval requirement

Through the EES, IAC concludes that the EMF and EPRs provide a generally sound and robust framework for managing the environmental effects of the project. Its recommendation is to approve the EMF and EPRs, subject to changes and including the appointment of an independent environmental auditor (IEA).

The assessment considers the EPRs relevant to the construction activities under this WAA which have been recommended by IAC and approved by the Minister. They include the following:

- Environment management frameworks:
  - EMF1 – develop and implement an environmental management system.
  - EMF2 – develop and implement environmental strategy and management plans, CEMP and work site environmental management plans.
  - EMF3 – appoint an IEA to produce an audit report on environmental compliance on a six-monthly basis during construction.
  - EMF 4 – complaint management system.
- Construction compound management plan (CC1) – to develop and implement this plan which includes the requirements of meeting EP Act and SEPP Prevention and Management of Contaminated Land.
- Air quality (AQ1) – to develop and implement a Dust and Air Quality Management and Monitoring Plan to minimise air quality impact during construction. The Minister has recommended the provision of real-time monitoring of particulate matter to manage dust control.
- Contamination and soil (CL1) – to develop and implement a Spoil Management Plan, which includes the requirements of meeting EP Act and Environment Protection (Industrial Waste Resource) Regulation 2009.
- Noise and vibration:
  - NV3 – minimising construction noise impact, including construction noise management levels and targets for daytime, evening and night-time.
  - NV4 – develop and implement a Construction Noise and Vibration Management Plan.
  - NV5 – establish vibration guidelines to protect utility assets.

Considering the comprehensive construction management framework and EPRs, the EPA is satisfied that construction impacts can be managed. To ensure the compliance of the construction of the tunnel ventilation system, WA_W1 5) requires that:

- prior to commencing construction of the tunnel ventilation system, the EPA receives a copy of the CEMP detailing the proposed practice and procedures to be undertaken for:
  - noise management to demonstrate the compliance with the EPR NV3 and NV4

- dust management, including a real-time monitoring program to comply with the EPR AQ1
- actions to minimise GHG emissions to comply with EPR SCC2
- waste management plan to comply with EPR SCC4.

11. RECOMMENDATIONS

11.1. Considerations and recommendations

To obtain a works approval, the application needs to demonstrate that the proposal:

- is permitted by the land use planning scheme
- will not adversely affect the interests of any person
- will not adversely affect the quality of any segment of the environment
- complies with relevant SEPPs, regulations and guidelines, specifically those outlined in section 5 above.

The assessment concludes that the application can meet all the above requirements, subject to the following WA conditions. It is therefore recommended that the EPA should issue a works approval for the installation of the NEL Tunnel Ventilation System and associated equipment, pursuant to Section 19A of the *EP Act.*

11.2. Site-specific works approval conditions

WA_G1

Subject to the following conditions, this approval allows the construction of the following works and associated equipment—Tunnel ventilation systems associated with the construction and operation of twin tunnels supporting the North East Link Tunnel.

WA_G2

The works must be constructed in accordance with the application accepted on 6 March 2019 as augmented or amended by additional information dated 5 and 20 September, 1, 7, 14, 21 and 24 October, 15 and 18 November and 5 December 2019 (‘the application’), except that, in the event of any inconsistency arising between the application and the conditions of this approval, the conditions of this approval shall apply.

WA_G3

This approval will not take effect until any permit which is required under the *Planning and Environment Act 1987* has been served on the Authority by the applicant.

WA_G4

This approval expires:

1) on the issue or amendment of a licence relating to all works covered by this approval
2) when the EPA advises in writing that all works covered by this approval have been satisfactorily completed and no licence is required; or
3) five years from the date of issue of this approval, unless the works have been commenced by this date to the satisfaction of EPA.

WA_W1

Before commencing construction of the following components of the works, you must provide to EPA a report or reports outlining the plans and specifications of those components, including details of:

1) Final design of the tunnel ventilation system with the engineering approach based on 'typical' parameters and assumptions to demonstrate that the system can meet the required EPRs for air quality (AQ2 and AQ3) and GHG emissions (SCC2 and SCC3). The design must be reviewed by a consultant or engineer who has demonstrated qualification and experience in road tunnel ventilation design suitable for the project. This entity can be the appointed independent environmental auditor for the North East Link Project (IEA), if suitable, or another suitable entity, independent form the project, subcontracted by the IEA). It must include:
    A. Final design of the smoke extraction system. This should consider the alternative engineering solutions below to provide an equivalent safety standard for tunnel users:
        a) eliminating the smoke duct in the whole tunnel;
        b) eliminating the smoke duct in the cut and cover sections (at least south part of Manningham Interchange); or
        c) a different engineering design of the smoke duct allowing for more efficient usage of the jet fans in the cut and cover section.
    B. Report of final design of ventilation, consisting of:
        d) detailed ventilation design, including all relevant parameters for the design of the ventilation system (jet fans and axial fans), ventilation stations, as well as for the smoke duct which covers leakage rates from closed smoke dampers, casting joints, connections to other structures, etc), if semi-transverse ventilation is required;
        e) description of the final design of the ventilation control system for normal and incident operation, including its physical space requirements with consideration of the effect on positioning and number of jet fans;
        f) proposed leakage rates from closed smoke dampers, casting joints, connections to other structures, etc. in the smoke extraction system design, if semi-transverse ventilation is required.
    C. Conceptual provision for retrofitting of future particulates pollution control equipment to be installed at the tunnel ventilation structures.
    D. The content of the Fire Engineering Brief and Fire Engineering Report must be reviewed and agreed by the Emergency Services in accordance with the process outlined in AS4825. Fire and life safety systems and facilities must be designed and constructed in consultation with the Emergency Services.
2) An air quality assessment to demonstrate compliance with the SEPP (Air Quality Management) and EPR AQ2. The report must include:
    A. Assessment of all emission points, including underdeck space and on and off ramps
    B. updated emission factors using PIARC 2019 data
    C. modelling of the proposed air emission licence limits (in g/s) for all ventilation stacks.
3) Monitoring programs to demonstrate compliance of in-tunnel air quality and ventilation structure emissions with EPR AQ5 and ambient air quality with EPR AQ4 including:
    A. In-tunnel air quality monitoring:

a) detailed in-tunnel air monitoring program, including parameters, instrument, locations of instrument installation

b) tunnel ventilation control system linked to in-tunnel air monitoring, including related performance parameters and indicative alarm set points

c) contingency measures to manage in-tunnel air quality in the event of incidents or emergencies.

B. Continuous monitoring program for ventilation stack emissions, including parameters, assessment methodology and criteria which are linked to ambient monitoring data, as well as daily public reporting system.

C. Ambient air quality monitoring program:

a) including periods before and after the commencement of tunnel operation using the existing five monitoring sites relied upon within the application, inclusive of the specification and location of instruments

b) provision for daily reporting of ambient air quality monitoring program results, on a publicly available website related to the project, or through EPA Victoria's Air Watch website. The reporting shall be undertaken for at least five years after commissioning of the project, or such lessor period, as agreed with the EPA.

4) A detailed noise assessment must be reviewed by an acoustic consultant or engineer who has demonstrated qualifications and experience in acoustic design and noise management suitable for the project. This entity can be the IEA, if suitable, or another suitable entity, independent form the project, subcontracted by the IEA. The assessment must demonstrate that the requirements set out in EPR NV6 will be met, including, but not be limited to:

A. Re-assessment of the background levels that may have varied due to different assessment locations, or due to potential change in background conditions.

B. Noise impact assessment on non-residential sensitive uses (schools, libraries) using the lower value of the design sound level range of AS/NZS 2107 standards of those receptors.

C. The necessary refinements to the noise assessment, including:

a) the fans and silencers ultimately selected for installation, and consideration of the layout of the facility (including the noise path between the fan and the point of discharge). The assessment must consider:

i. silencer insertion-loss data based on dynamic testing of the product under similar operational conditions

ii. the risk of flow-generated noise across the face of silencers

iii. the acoustic performance throughout the life of silencers with explanation of how the potential for acoustic degradation in the performance equipment (such as silencers) through wear and dust build-up will be addressed

b) design of ventilation buildings and stack(s) and of substation buildings to prevent or otherwise minimise break-out noise

c) the need for adjustments to the predicted levels, having consideration of the character of the noise (tonal, impulsive or low frequency).

D. Implementation of best practice noise control in accordance with clause 19 of SEPP N-1.

5) Prior to commencing construction of the tunnel ventilation system, provide a CEMP for the tunnel ventilation system detailing the proposed:

A. Noise management to demonstrate the compliance with the EPRs NV3 and 4.

B. Dust management, including a real-time monitoring program to comply with the EPR AQ1.

C. Actions for minimising GHG emissions to comply with EPR SCC2.

D. Waste management to comply with EPR SCC4.

WA_W2

You must not commence construction of those parts of the works for which reports are required by condition WA_W1 until written EPA approval of those reports has been received.

WA_W3

Where any reports specified in condition WA_W1 and approved by the EPA differ from the application, the works must be constructed in accordance with those approved reports.

WA_W4

You must notify the EPA when the construction of the works covered by this approval has commenced.

WA_W5

You must notify the EPA when the construction of the works covered by this approval has been completed.

WA_W7

You must not commission or operate the works without the written approval of the EPA.

WA_W12.1

You must install all exhaust stacks so that provisions for sampling are included in accordance with EPA Publication 440.1 "A guide to the Sampling and Analysis of Air Emissions and Air Quality", or as approved by the EPA.

Reporting conditions

WA_ R1

At least three months before commencement of any commissioning, you must provide to the EPA reports that include:

A. An operation environmental management plan (OEMP), which must include the information of:

a) a confirmed monitoring program for in-tunnel air quality and ventilation stack emissions to meet EPR AQ6, as approved under WA_W1 3) A and B

b) a monitoring program for monitoring noise from the tunnel ventilation system and relevant fixed infrastructure to comply with EPR NV7. It should include contingency measures in the event of exceedances of noise limits.

B. A Sustainability Management Plan to comply with EPR SCC1 which must include target and measures to the targets.

WA_R5

You must not commence operation of the works until written EPA approval of the reports required by condition(s) WA_R1 has been received.

11.3. Works approval construction and completion inspection

Once the plant has been constructed, the EPA will perform a site visit (or series of site visits) to verify that the requirements of the works approval have been fulfilled. Details of the inspection lists should be finalised prior to the commissioning, with reference to the EPA's approvals of detailed designs, subject to the conditions in this WA. The following table presents a summary of a tentative checklist.

Table 9 Site inspection list

Location		Note
Ventilation structure	Tunnel ventilation stacks	The number of stacks and locations subject to the detailed design.
	Tunnel air extraction fans, jet fans, noise attenuators, dampers	The number of and locations of these equipment subject to the detailed design.
	Space for retrofitting	Northern and southern ventilation stack shafts, subject to the detailed design for its sizes.
	Smoke duct (if applicable)	Details subject to the detailed design.
Monitoring equipment	Ventilation stack air sampling points for the northern and southern ventilation stacks	Sample points installation in accordance with EPA publication 440 (as amended). Continuous monitoring parameters and instrument.
	In-tunnel air monitoring equipment (CO, NO_x), visibility and air speed and direction	Monitoring equipment, locations and control system, subject to the detailed design.

11.4. Commissioning approval requirements

The EMF requirements include the following:

- The OEMP must be developed in consultation with relevant stakeholders as listed in the EMF and as required by NELP or under any statutory approvals (EMF2).
- Appoint an IEA to review OEMP for compliance with the EMF and the EPRs (EMF3).

These requirements are covered in WA_R1 above.

Under the Act, a 30A commissioning approval shall be required prior to commissioning of the ventilation system. Standard conditions shall apply.

11.5. Licence issue

Provided the plant can demonstrate performance in accordance with the works approval, the next step would be to transition into an EPA licence.

Under the EP Act, a licence will be required to be issued prior to the operation of the proposed development.

The following draft licence conditions are recommended, noting that the licence conditions shall be subject to review prior to issue.

The applicant proposed licence limits which have been derived from emission rates calculated for the maximum lane capacity sensitivity analysis (2,000 vehicles per hour per lane) multiplied by a factor of 1.48. However, considering the potential changes in project design and tunnel traffic emission factor calculation, they will affect licence limits. For these reasons, the discharge limits should be determined during the detailed design based on the maximum emission rate subject to the condition (WA_W1 2)).

DRAFT LICENCE CONDITIONS

LI_G1

You must ensure that waste is not discharged, emitted or deposited beyond the boundaries of the premises except in accordance with this licence.

LI_G2

You must immediately notify the EPA of non-compliance with any condition of this licence.

LI_G3

By 30 September each year you must submit an annual performance statement to the EPA for the previous financial year in accordance with the Annual Performance Statement Guidelines (EPA Publication 1320).

LI_G4

Documents and monitoring records used for preparation of the annual performance statement must be retained at the premises for seven years from the date of each statement.

LI_G5

You must implement a monitoring program that enables you and the EPA to determine compliance with this licence.

LI_A4

Nuisance airborne particles must not be discharged beyond the boundaries of the premises.

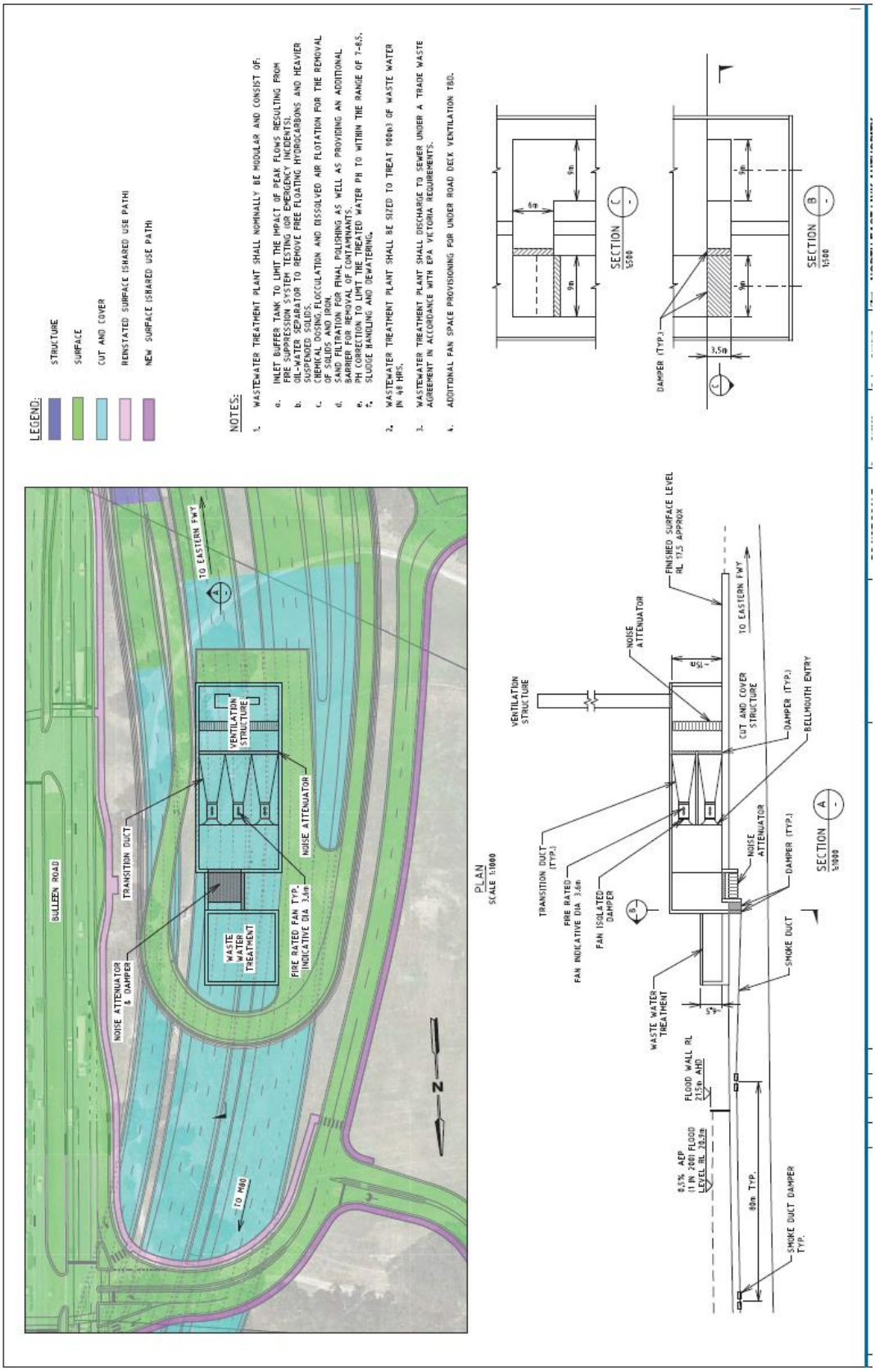
LI_DA1

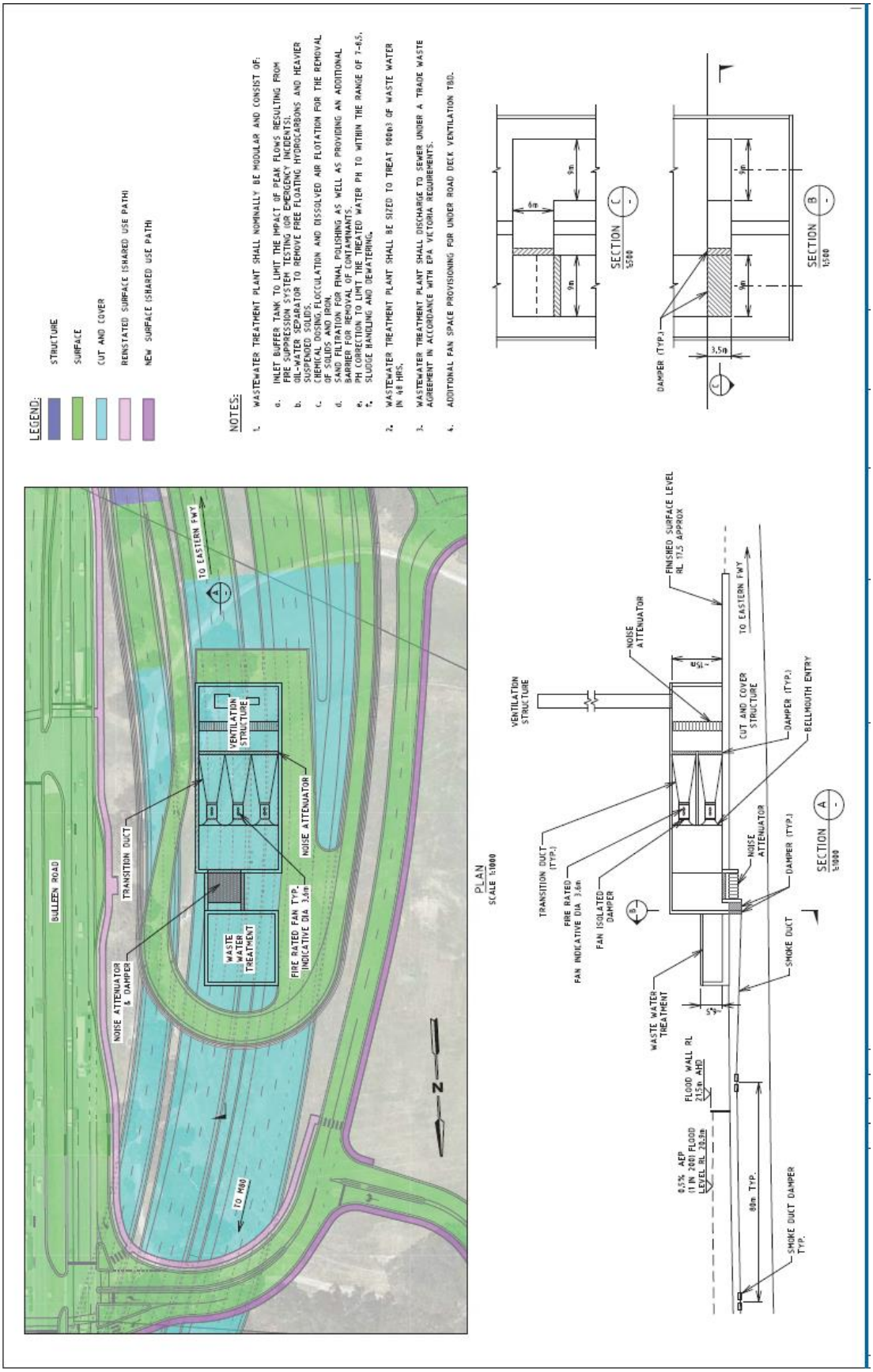
Discharge of waste to air must be in accordance with the 'Discharge to Air' Table (limits to be determined).

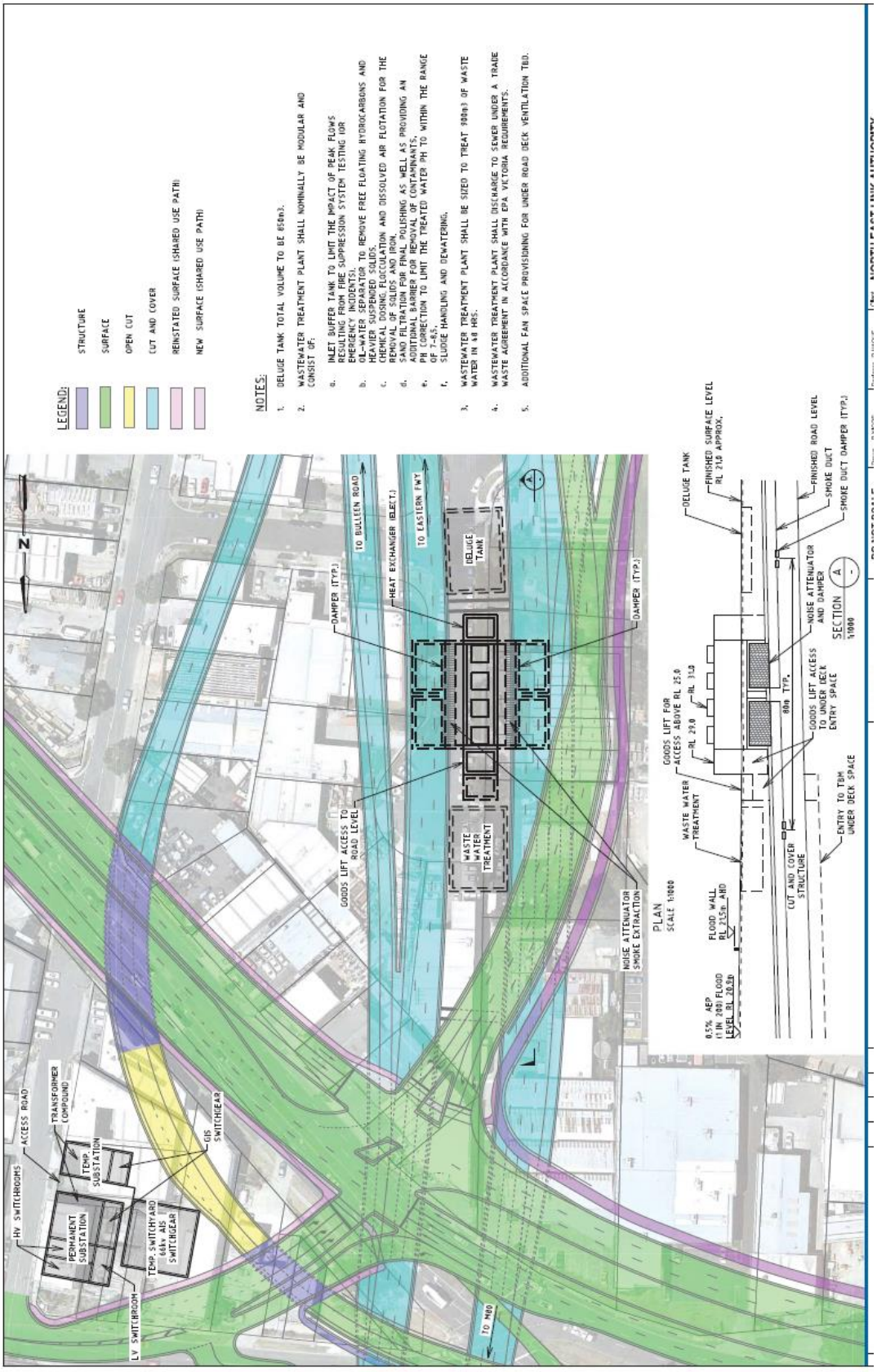
APPENDIX 1 LIST OF APPLICATION DOCUMENTS AND SUPPORTING INFORMATION

Document	EPA received date
Works approval application, dated 1 August 2018	7 March 2019
Responses to EPA Victoria S22 Notice	5 September 2019
EES submissions	Between 10 April and 7 June 2019
Emails information • Air quality modelling/licence limits • Tunnel ventilation design • Additional noise assessment • Ventilation system – option E analysis	 • 20 Sept & 1, 7 & 14 October, 15 Nov. 2019 • 21 & 24 October 2019 • 20 Nov.2019 • 5 December 2019
Tunnel Ventilation Design Report (31-35006-RD-TU-RPT-002), 12 September 2019	18 November 2019 (confidential)
Fire Safety Strategy (31-35006-RD-TU-RPT-003), 28 August 2019	18 November 2019 (confidential)
Relevant EES documentation • Chapter 6 Project development • Chapter 8 Project description • Chapter 26 GHG • Technical Report J – Health impact Assessment • Technical Report R – GHG	Access through the link: https://northeastlink.vic.gov.au/environment/environment-effects-statement-ees/environment-effects-statement-documentation
Other documents • IAC report for public release • Minister for Planning	 • October 2019 • 6 December 2019

APPENDIX 2 TUNNEL VENTILATION DESIGN DRAWINGS




LEGEND:
STRUCTURE
SURFACE
CUT AND COVER
REINSTATED SURFACE (SHARED USE PATH)
NEW SURFACE (SHARED USE PATH)
NOTES:
1. WASTEWATER TREATMENT PLANT SHALL NOMINALLY BE MODULAR AND CONSIST OF:
a. INLET BUFFER TANK TO LIMIT THE IMPACT OF PEAK FLOWS RESULTING FROM PIPE SURCHARGING AS A RESULT OF EMERGENCY INCIDENTS;
b. OIL-WATER SEPARATION TO REMOVE FREE FLOATING HYDROCARBONS AND HEAVIER SUSPENDED SOLIDS,
c. CHEMICAL DOSING, FLOCCULATION AND DISSOLVED AIR FLOTATION FOR THE REMOVAL OF SOLIDS AND IRON,
d. SAND FILTRATION FOR FINAL POLISHING AS WELL AS PROVIDING AN ADDITIONAL BARRIER FOR REMOVAL OF CONTAMINANTS;
e. PH CORRECTION TO LIMIT THE TREATED WATER PH TO WITHIN THE RANGE OF 7-8.5,
f. SLUDGE HANDLING AND DEWATERING.
2. WASTEWATER TREATMENT PLANT SHALL BE SIZED TO TREAT 900m3 OF WASTE WATER IN 48 HRS.
3. WASTEWATER TREATMENT PLANT SHALL DISCHARGE TO SEWER UNDER A TRADE WASTE AGREEMENT IN ACCORDANCE WITH EPA VICTORIA REQUIREMENTS.
4. ADDITIONAL FAN SPACE PROVISIONING FOR UNDER ROAD DECK VENTILATION TBD.
SECTION C
SECTION B
DAMPER (TYP.)
BULLEEN ROAD
TRANSITION DUCT
NOISE ATTENUATOR & DAMPER
WASTE WATER TREATMENT
FIRE RATED FAN TYP. INDICATIVE DIA 3.6m
VENTILATION STRUCTURE
NOISE ATTENUATOR
TO EASTERN FWY
TO M80
N
PLAN
SCALE 1:1000
FINISHED SURFACE LEVEL RL 17.5 APPROX
CUT AND COVER STRUCTURE
BELLMOUTH ENTRY
SMOKE DUCT
FLOOD WALL RL 21.5m AHD
0.5% AEP (1 IN 200) FLOOD LEVEL RL 20.2m
40m TYP.
SMOKE DUCT DAMPER TYP.
SECTION A


LEGEND:
STRUCTURE
SURFACE
OPEN CUT
CUT AND COVER
REINSTATED SURFACE (SHARED USE PATH)
NEW SURFACE (SHARED USE PATH)
NOTES:
1. DELUGE TANK TOTAL VOLUME TO BE 850m3.
2. WASTEWATER TREATMENT PLANT SHALL NOMINALLY BE MODULAR AND CONSIST OF:
a. INLET BUFFER TANK TO LIMIT THE IMPACT OF PEAK FLOWS RESULTING FROM FIRE SUPPRESSION SYSTEM TESTING FOR EMERGENCY ACCESS.
b. OIL-WATER SEPARATOR TO REMOVE FREE FLOATING HYDROCARBONS AND HEAVIER SUSPENDED SOLIDS.
c. CHEMICAL DOSING, FLOCCULATION AND DISSOLVED AIR FLOTATION FOR THE REMOVAL OF SOLIDS AND IRON.
d. SAND FILTRATION FOR FINAL POLISHING AS WELL AS PROVIDING AN ADDITIONAL BARRIER FOR REMOVAL OF CONTAMINANTS.
e. PH CORRECTION TO LIMIT THE TREATED WATER PH TO WITHIN THE RANGE OF 7-8.5.
f. SLUDGE HANDLING AND DEWATERING.
3. WASTEWATER TREATMENT PLANT SHALL BE SIZED TO TREAT 400m3 OF WASTE WATER IN 48 HRS.
4. WASTEWATER TREATMENT PLANT SHALL DISCHARGE TO SEWER UNDER A TRADE WASTE AGREEMENT IN ACCORDANCE WITH EPA VICTORIA REQUIREMENTS.
5. ADDITIONAL FAN SPACE PROVISIONING FOR UNDER ROAD DECK VENTILATION TBD.
N
HV SWITCHROOMS
ACCESS ROAD
TRANSFORMER COMPOUND
TEMP. SUBSTATION
PERMANENT SUBSTATION
GIS SWITCHGEAR
TEMP. SWITCHYARD 66kv AIS SWITCHGEAR
LV SWITCHROOM
TO NUD
TO BULLEEN ROAD
TO EASTERN FWY
DAMPER (TYP.)
HEAT EXCHANGER (ELECT.)
DELUGE TANK
WASTE WATER TREATMENT
GOODS LIFT ACCESS TO ROAD LEVEL
NOISE ATTENUATOR SMOKE EXTRACTION
PLAN
SCALE 1:1000
DELUGE TANK
FINISHED SURFACE LEVEL RL 21.0 APPROX.
GOODS LIFT FOR ACCESS ABOVE RL 25.0
RL 31.0
RL 29.0
WASTE WATER TREATMENT
FLOOD WALL RL 25.5m AHD
0.5% AEP (1 IN 200) FLOOD LEVEL RL 20.2m
CUT AND COVER STRUCTURE
80m TYP.
GOODS LIFT ACCESS TO UNDER DECK ENTRY SPACE
ENTRY TO TBM UNDER DECK SPACE
NOISE ATTENUATOR AND DAMPER
FINISHED ROAD LEVEL
SMOKE DUCT
SMOKE DUCT DAMPER (TYP.)
SECTION A-A
1:1000

APPENDIX 3 REFERRAL RESPONSE

MFB

Manningham City Council

Works Approval - North East Link Ventilation and Exhaust Structures

JG

Jeff Gower <Jeff.Gower@manningham.vic.gov.au>
To Rachel.Manassa@epa.vic.gov.au
Cc Frank Vassilacos

Reply | Reply All | Forward | ...
Tue 06/08/2019 10:59 AM

I refer to your letter (Reference: 1003465) dated 20th June 2019, regarding the works approval for the North East Link Southern Ventilation Portal and Manningham Interchange Emergency Exhaust Structure.

The North East Link Project is currently progressing through the public hearings associated with the North East Link Environment Effects Statement (EES). Ultimately, Council is expecting a suite of planning controls implemented into the Manningham Planning Scheme that will remove the need for planning permissions associated with implementing the construction of the project provided it accords with a set government direction. This will include ventilation and exhaust systems associated with any tunnelling.

As it currently stands, there is a broad exemption within the Mannigham Planning Scheme for roadworks. There appears to be a direct relationship between the proposed infrastructure requiring the works approval, and a proposed road. In this respects, no planning permissions are required for the works provided they occur in association with a road. If the relationship between the works and road is not recognised, planning permission is required for the works under several planning scheme overlays.

The exemption relating to roadworks does not extend to vegetation removal. There may be vegetation removal associated with the Southern Ventilation Portal that requires planning permission. It is expected that this permission will fall away once the suite of new controls that implement NEL construction of the project occurs.

There is nothing in the Planning Scheme that prohibits the works.

Council has no in-principal objection to EPA considering or issuing the works approval if appropriate.

Regards

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