# Appendix D. Operation: Airborne Noise from Fixed Infrastructure

## D.1 Introduction

Tunnel design for the Melbourne Metro Rail Project (Melbourne Metro) has taken into consideration the requirements of the operating train system, providing not only for the trains but also for a variety of mechanical, electrical, communications and safety systems.

Fixed infrastructure associated with the Melbourne Metro has been identified as presented in Table D.1.

**Table D.1: Fixed Infrastructure associated with the Melbourne Metro**

| Precinct | Type of Fixed Infrastructure | Comments |
|---|---|---|
| **Precinct 1: Tunnels** | Stair pressurization fan(s) to be located near the existing tennis courts off Toorak Road.<br>Stair pressurization fan to be located as part of the emergency access shaft located near the corner of Linlithgow Avenue and St Kilda Road. | The area for the intake grille for the stair pressurization fans has been identified. Fan selections and duct layouts have yet to be developed. Emergency operation and testing only. |
| **Precinct 2: Western Portal** | No fixed plant in this area. | Provision should be allowed for potential stair pressurization fan.<br>Provision should be allowed for a substation. |
| **Precinct 3: Arden Station** | • Tunnel Ventilation System<br>• Over Track Extract fans<br>• Over Platform Extract fans<br>• Over Concourse Extract fans<br>• Back of House) ventilation systems<br>• Chiller plant (location of this plant is still to be determined) | The area or zone for the intake and discharge fans has been identified. Fan selections and duct layouts have yet to be developed.<br>The location for chiller plant is yet to be determined. |
| **Precinct 4: Parkville Station** | • Tunnel Ventilation System<br>• Over Track Extract fans<br>• Over Platform Extract fans<br>• Over Concourse Extract fans<br>• Back of House) ventilation systems | Mechanical and electrical plant located at the eastern end of the station with ducting and cabling.<br>There are a number of vent shafts located on Grattan Street between Barry and Leicester Streets. Each approx. 4 m high |
| **Precinct 5: CBD North** | • Tunnel Ventilation System<br>• Over Track Extract fans Over Platform Extract fans<br>• Over Concourse Extract fans<br>• Back of House) ventilation systems | A ventilation shaft passes under the City Baths to connect from the end of the station cavern north of Franklin Street to the entry space under Franklin Street.<br>Vents approximately 3 m high on Franklin Street (adjacent to City Baths) |
| **Precinct 6: CBD South** | • Tunnel Ventilation System<br>• Over Track Extract fans<br>• Over Platform Extract fans<br>• Over Concourse Extract fans<br>• Back of House ventilation systems | Ventilation is provided in the southern entrance footprint with vents form the north running through the cavern to the south and vents from the sound running under Flinders Street (in a small cavern) and connection in to the entry box at its far western end |
| **Precinct 7: Domain Station** | • Tunnel Ventilation System<br>• Over Track Extract fans<br>• Over Platform Extract fans<br>• Over Concourse Extract fans<br>• Back of House) ventilation systems | An underground substation.<br>Generator / chiller approx. 4 m high (Albert Road) |
| **Precinct 8: Eastern Portal** | • Tunnel Ventilation System - discharge fan<br>• Stair pressurization fan<br>• Substation ventilation system | Ventilation openings above an underground structure located between Osborne St and the existing rail lines. |
| **Precinct 9 Western turnback** | No fixed plant has been identified in this area. | |

## D.2 Criteria

### D.2.1 SEPP N-1

Operational noise from fixed infrastructure associated with the Melbourne Metro including fixed plant and equipment, ventilation systems, maintenance, stabling facilities etc., would need to meet the requirements of State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No, N-1 (SEPP N-1).

The purpose of SEPP N-1 is to protect people from commercial, industrial or trade noise that may affect a Noise Sensitive Area (NSA), while taking into consideration the existing land use around the NSA in the Metropolitan region. NSAs are defined in SEPP N-1 and include dwellings, residential buildings and similar types of accommodation.

The following noise categories are not assessed by SEPP N-1:

- Music, voices, crowds
- Construction / demolition
- Intruder /emergency / safety alarms
- Fire pump used in an emergency
- Noise from non-commercial vehicles (except for maintenance activities).

Furthermore, the 'commercial, industrial or trade premises' to which SEPP N-1 applies does not include an operational railway line, although it can include a siding, marshalling the yard or maintenance depot.

The SEPP N-1 assessment includes the following:

- Determination of the Effective Noise Level based upon the noise level measured in the NSA with adjustments for noise character, duration and measurement position
- Determination of the Noise Limit, based on the measured background noise level and land use zoning of the area around the NSA. The NSA is defined in SEPP N-1 as the part of the land within the apparent boundaries of any piece of land which is within a distance of 10 m outside the external walls of the sensitive building (e.g. residences, hotels, hospitals)
- A comparison between the Effective Noise Level and the Noise Limit. For compliance the *Effective Noise Level* is not to exceed the Noise Limit.

The Noise Limits are determined following the methodology in Schedule B of SEPP N-1. This involves:

- Determination (by measurement) of the existing background noise level,
- Determination of the Influencing Factor (based on the zoning type in a circle of 140 m and 400 m in diameter, centred on the NSA),
- Calculation of the Zoning Level, based on the Influencing Factor (for each Time Period)
- Determination of the *Noise Limit* based on the *Zoning Level* and background noise level.

In addition, the Noise Limits are dependent on the time period and SEPP N-1 defines specific time periods to be used in the assessment. The time periods as defined in SEPP N-1 are shown in Table D.2

**Table D.2: SEPP N-1 time periods**

| Time Period | Time |
|---|---|
| **Day** | 7am - 6pm Monday to Friday<br>7am - 1pm Saturday |
| **Evening** | 6pm - 10pm Monday to Friday<br>1pm - 10pm Saturday<br>7am - 10pm Sunday and Public Holidays |
| **Night** | 10pm - 7am All Days |

The Noise Limits determined using this methodology shall not be less than the Base Noise Limits which are provided in Table D.3. If the *Noise Limit* determined is lower than the Base Noise Limit then the Base Noise Limit becomes the Noise Limit.

**Table D.3: SEPP N-1 Base *Noise Limits***

| Time Period | Base *Noise Limit, dB(A)* |
|---|---|
| **Day Period** | 45 |
| **Evening Period** | 40 |
| **Night Period** | 35 |

The Noise Limits are applicable to the combined level of noise associated with all commerce industry and trade associated with the Melbourne Metro and other facilities). Therefore the noise from each facility may need to be less than the given Noise Limit.

*Influencing Factor (IF)*

The *Influencing Factor* takes into account the types of planning zone around the NSA. The Victoria EPA has designated all planning zones as either Type 1, Type 2 or Type 3 (*Designation of Types of Zones and Reservations in the Metropolitan Region Planning Schemes for the Purposes of the SEPP N-1*, February 2000, EPA State Government of Victoria).

Two circles, centred on the NSA, are drawn, one with a diameter of 140 metres and one with a diameter of 400 metres. The Influencing Factor is calculated from the following formula (SEPP N-1, Schedule B2);

$$IF = \frac{1}{2}\left[\frac{area\ Type\ 3 + {}^{1}/_{2}\,(area\ of\ Type\ 2)}{total\ area\ of\ 140\ m\ diameter\ circle}\right] 140\ m\ circle + \frac{1}{2}\left[\frac{area\ Type\ 3 + {}^{1}/_{2}\,(area\ of\ Type\ 2)}{total\ area\ of\ 400\ m\ diameter\ circle}\right] 400\ m\ circle$$

*Zoning Level*

The *Zoning Level* is calculated based on the *Influencing Factor* for each time period as follows;

**Day Period** Zoning Level = (18 x IF) + 50

**Evening Period** Zoning Level = (17 x IF) + 44

**Night Period** Zoning Level = (17 x IF) + 39

*Noise Limit*

The *Noise Limit* is calculated based on the Zoning Level and the measured background noise level for each time period, depending on whether the background noise level is Neutral, High or Low.

The background noise level is High if:

**Day Period** Background Noise Level + 6 > Zoning Level

**Evening or Night Period** Background Noise Level + 3 > Zoning Level

The background noise level is Neutral if:

**Day Period** Background Noise Level is between 6 dB(A) and 12 dB(A) below the Zoning Level

**Evening or Night Period** Background Noise Level is between 3 dB(A) and 9 dB(A) below the Zoning Level

The background noise level is Low if:

**Day Period** Background Noise Level + 13 < Zoning Level

**Evening or Night Period** Background Noise Level + 10 < Zoning Level

The *Noise Limit* is then determined, based on the type of background noise level (High, Neutral or Low), the background noise level, and the Zoning Level, as shown in Table D.4.

**Table D.4: SEPP N-1 *Noise Limits***

| Background Noise Level | Period | *Noise Limit, dB* $L_{Aeq}$ |
|---|---|---|
| **High** | Day | Background Noise Level + 6 |
| | Evening or Night | Background Noise Level + 3 |
| **Neutral** | Day | Zoning Level |
| | Evening or Night | Zoning Level |
| **Low** | Day | ½(Zoning Level + Background Noise Level) + 4.5 |
| | Evening or Night | ½(Zoning Level + Background Noise Level) + 3 |

*Noise Limits and Emergency Equipment*

SEPP N-1 states that the Policy does not apply to noise from fire pumps in an emergency but states that the *Noise Limit* for standby generators, standby boilers and fire pumps during testing is increased by 10 dB for the Day period and 5 dB for all other periods. It is assumed that this applies to the testing of these plant items only and not to their use in emergency conditions.

It is expected that this approach also applies to the noise associated with other emergency equipment, including stair pressurization fans, smoke extract fans and similar items of equipment.

Where items of plant have been identified as being for use under emergency conditions only (and not used during normal operation) a correction of +10 dB has been applied to the calculated Noise Limits for the Day period and a correction of +5 dB has been applied to the calculated Noise Limits for the Evening and Night periods.

## D.3 Applicable Noise Limits

Based on the noise monitoring that has been undertaken, representative background noise levels have been determined and the relevant SEPP N-1 Noise Limits have been calculated for the nearest noise sensitive areas located near fixed plant and equipment.

### 3.1 Precinct 1: Tunnels Precinct

Fixed plant in Precinct 1 is expected to consist of emergency stair pressurization fans which are proposed to be located in Fawkner Park. The fans would be enclosed and/or located underground; however, the intake air louvre would effectively be a noise source to the surrounding environment.

Apart from regular testing, these fans would only operate during emergency conditions. SEPP N-1 states that the policy does not apply to noise from fire pumps in an emergency and implies that the *Noise Limit* for standby generators, standby boilers and fire pumps during testing is increased by 10 dB for the Day period and 5 dB for all other periods. This approach would also apply to the emergency stair pressurization fans.

The proposed location of the intake louvre for the pressurization fans is shown in Figure D.1.

The nearest Noise Sensitive Areas with respect to the Fawkner Park fans are in the residential areas to the north on Toorak Road. Noise measurements have been conducted at 68 Toorak Road which are considered to be representative of the background noise levels in this area. The SEPP N-1 Noise Limits for1 Millswyn Street, South Yarra (the nearest residence) are provided in Table D.5.

For the Linlithgow Avenue Emergency Shaft, the nearest Noise Sensitive Areas is the residential areas to the south. Noise measurements have been conducted at The Melburnian, 250 St Kilda Road. The SEPP N-1 Noise Limits for these residences are also provided in Table D.5


**Figure D.1: Approximate location of stair pressurization fan intake louvre.**

**Table D.5: SEPP N-1 *Noise Limit*s for Precinct 1**

| Location | Period | *Noise Limit, dBL$_{Aeq,30\ minutes}$* |
|---|---|---|
| **1 Millswyn Street, South Yarra** | Day | 71 |
| | Evening | 59 |
| | Night | 52 |
| **The Melburnian, 250 St Kilda Rd, Melbourne** | Day | 69 |
| | Evening | 62 |
| | Night | 51 |

Stair pressurization fans are also proposed for the Linlithgow Avenue emergency access shaft. The approximate location of this shaft and intake grille of the stair pressurization fan is shown in Figure D.2.


**Figure D.2: Approximate location of stair pressurization fan intake louvre.**

## 3.2 Precinct 2: Western Portal

There are no items of fixed plant in Precinct 2, however, there is potential for a stair pressurization fan (and possibly a substation) to be located in this precinct.

The potential location of a future intake a stair pressurization fan is shown in Figure D.3.


**Figure D.3: Approximate location of stair pressurization fan intake louvre.**

The nearest Noise Sensitive Areas to the potential fans are in the residential areas to the east on Ormond and Childers Streets, Kensington. Noise measurements have been conducted at 3 Childers Street which is representative of the background noise level in this area. The SEPP N-1 Noise Limits are provided in Table D.6. The *Noise Limits* apply to all industrial, commercial and retail noise sources, so that the effective Noise Limit for any individual source may be less than the Noise Limit.

**Table D.6: SEPP N-1 *Noise Limit*s for Precinct 2 (for emergency equipment)**

| Location | Period | *Noise Limit*, dBL$_{Aeq,30\ minutes}$ |
|---|---|---|
| **135 Ormond Street, Kensington** | Day | 67 |
| | Evening | 54 |
| | Night | 54 |

## 3.3 Precinct 3: Arden Station

Ventilation and other fixed plant are proposed for Precinct 3 and may operate 24-hours and must meet the relevant SEPP N-1 Noise Limits at the nearest Noise Sensitive Area. Design of the fixed plant and ventilation to comply with the SEPP N-1 Noise Limit for the Night Period also implies compliance with the Day and Evening Periods as the background noise levels and therefore Noise Limits are lower at night.

The fixed plant noise in Precinct 3 is expected to include:

- Tunnel Ventilation System
- Over Track Extract fans
- Over Platform Extract fans
- Over Concourse Extract fans
- Back of House ventilation systems
- Chiller plant (location of this plant is still to be determined).

The fans would be enclosed and/or located underground and the louvre/grilles would effectively be a noise source to the surrounding environment. The proposed location/zone of the louvres/grilles fan is shown in Figure D.4.

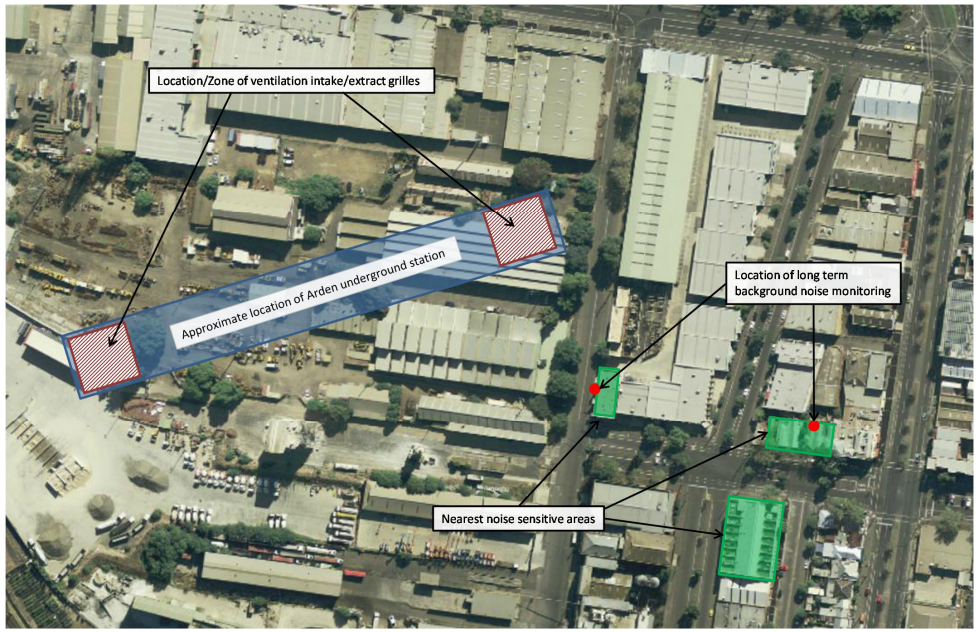


**Figure D.4: Location of fixed noise sources, measurements of background noise levels and Noise Sensitive Areas for Precinct 3**

The nearest NSAs are in the residential areas to the east and south east of Arden Station on Laurens Street, Queensbury Street and on the corner of Queensberry Street and Munster Terrace.

Noise measurements have been conducted at 141 Laurens Street and in the rear garden at 724 Queensberry Street in North Melbourne. These are representative of the background noise levels in this area.

The SEPP N-1 *Noise Limits* are provided in Table D.7. The *Noise Limit* at the Noise Sensitive Areas applies to noise from all industrial sources at this location so that the *Noise Limit* from any individual item of plant may be lower than the *Noise Limit*.

**Table D.7: SEPP N-1 *Noise Limits* for Precinct 3**

| Location | Period | *Noise Limit, dBL$_{Aeq,30\ minutes}$* |
|---|---|---|
| **141 Laurens Street, North Melbourne** | Day | 59 |
| | Evening | 53 |
| | Night | 51 |
| **724 Queensbury Street, North Melbourne** | Day | 57 |
| | Evening | 51 |
| | Night | 48 |

## 3.4 Precinct 4: Parkville Station

Ventilation and other fixed plant noise must meet the relevant SEPP N-1 *Noise Limits* at the nearest Noise Sensitive Area. As the ventilation needs to be able to operate 24-hours, compliance with the night *Noise Limit* (the most onerous *Noise Limit*) implies compliance with the Day and Evening Period limits

The fixed plant noise in Precinct 4 is associated with the:

- Tunnel Ventilation System
- Over Track Extract fans
- Over Platform Extract Fans
- Over Concourse Extract fans
- Back of House ventilation systems
- Chiller plant.

The fans would be enclosed and/or located underground and the louvre/grilles would effectively be a noise source to the surrounding environment. The proposed location of the intake louvre of the pressurization fan is shown in Figure D.5.

The nearest Noise Sensitive Areas are the ward areas of the Royal Melbourne Hospital (corner of Grattan Street and Royal Parade) and the residential areas to the south of Parkville Station on Berkeley Street, Barry Street and Leicester Street.

Noise measurements have been conducted at a number of locations. Those most representative of the background noise levels of the nearest Noise Sensitive Areas are shown as red dots in Figure D.5.

The SEPP N-1 Noise Limits are provided in Table D.8. The Noise Limits apply to all industrial, commercial and retail noise sources, so that the effective Noise Limit for any individual source may be less than the *Noise Limit*.

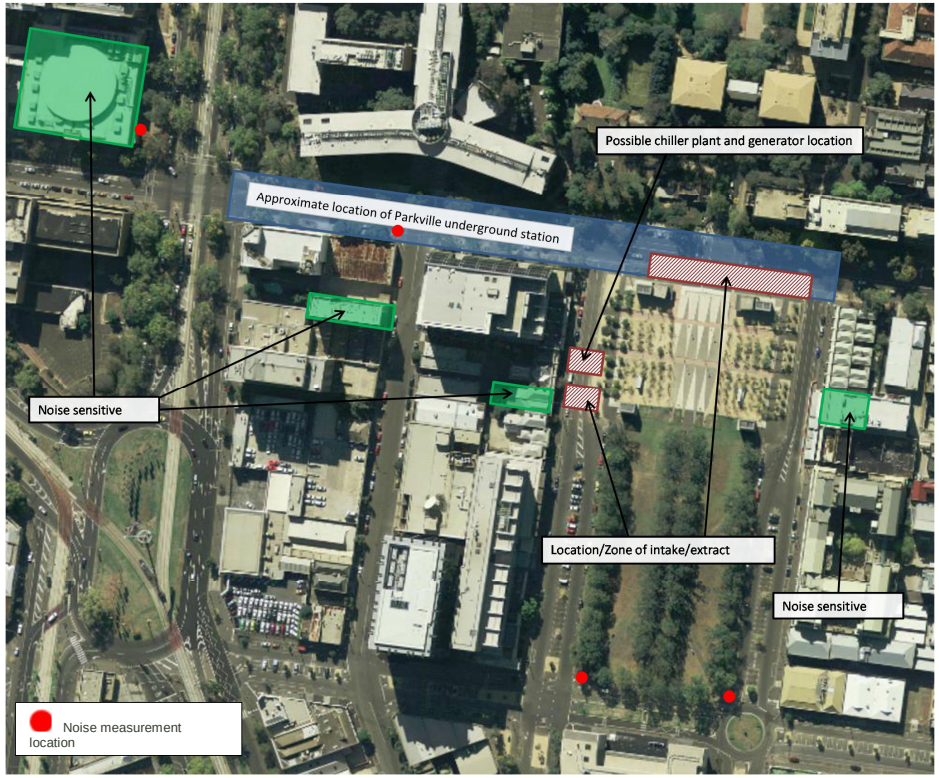


**Figure D.5: Location of fixed noise sources, measurements of attended background noise levels (red dots) and Noise Sensitive Areas for Precinct 4**

**Table D.8: SEPP N-1 *Noise Limit*s for Precinct 4**

| Location | Period | *Noise Limit*, dBL$_{Aeq,30\ minutes}$ |
|---|---|---|
| **139 Barry Street, Carlton** | Day | 60 |
| | Evening | 52 |
| | Night | 47 |
| **223 Berkeley Street, Parkville** | Day | 64 |
| | Evening | 59 |
| | Night | 50 |
| **224 Leicester Street, Carlton** | Day | 60 |
| | Evening | 53 |
| | Night | 45 |
| **Royal Melbourne Hospital** | Day | 67 |
| | Evening | 62 |
| | Night | 58 |

## 3.5 Precinct 5: CBD North Station

Ventilation and other fixed plant must comply with the relevant SEPP N-1 Noise Limits at the nearest Noise Sensitive Areas. As the ventilation needs to be able to operate 24-hours, compliance with the night period Noise Limit (the most onerous) would imply compliance during the other periods.

Fixed plant is proposed to be:

- Tunnel Ventilation System
- Over Track Extract fans
- Over Platform Extract Fans
- Over Concourse Extract fans
- Back of House ventilation systems.

Fans would be enclosed and/or located underground and the louvre/grilles would effectively be a noise source to the surrounding environment. The nearest Noise Sensitive Areas are the residential buildings located at 483 Swanston Street, 87 Franklin St, 31 A'Beckett Street, 30 Little Latrobe Street and 200 Latrobe Street, Melbourne. The nearest Noise Sensitive Areas and plant are shown on Figure D.6.

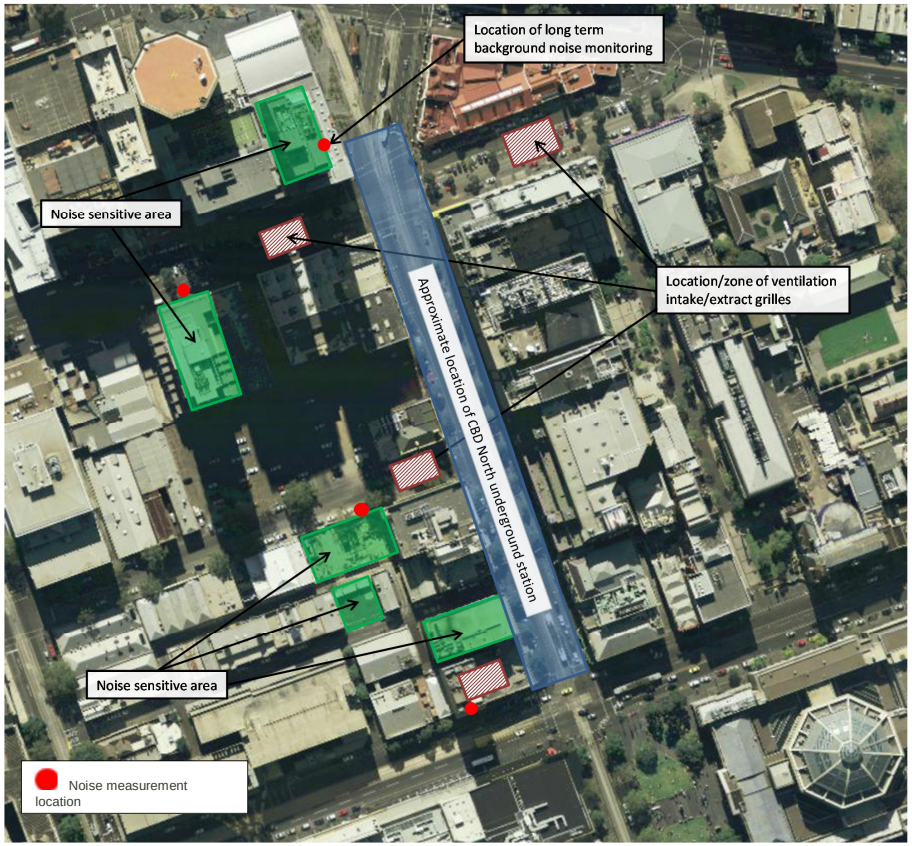


**Figure D.6: Location of fixed noise sources, measurements of attended background noise levels (red dots) and Noise Sensitive Areas for Precinct 5**

The SEPP N-1 Noise Limits are provided in Table D.9. The Noise Limits apply to all industrial, commercial and retail noise sources, so that the effective Noise Limit for any individual source may be less than the Noise Limit.

**Table D.9: SEPP N-1 *Noise Limit*s for Precinct 5**

| Location | Period | *Noise Limit*, $dBL_{Aeq,30\ minutes}$ |
|---|---|---|
| **31 A'Beckett Street, Melbourne** | Day | 69 |
| | Evening | 63 |
| | Night | 53 |
| **81 Franklin Street, Melbourne** | Day | 70 |
| | Evening | 62 |
| | Night | 57 |
| **200 La Trobe Street, Melbourne** | Day | 69 |
| | Evening | 66 |
| | Night | 61 |
| **483 Swanston Street, Melbourne** | Day | 65 |
| | Evening | 60 |
| | Night | 56 |

## 3.6 Precinct 6: CBD South Station

Ventilation and other fixed plant noise must meet the relevant SEPP N-1 Noise Limits at the nearest Noise Sensitive Areas. As the ventilation needs to be able to operate continuously, design of the fixed plant and ventilation systems is to achieve the SEPP N-1 Noise Limit for the Night Period (the most onerous limits) which implies compliance with the other periods.

The fixed plant noise in Precinct 6 is associated with the:

- Tunnel Ventilation System
- Over Track Extract fans
- Over Platform Extract Fans
- Over Concourse Extract fans
- Back of House ventilation systems.

The fans would be enclosed and/or located underground and the louvre/grilles would effectively be a noise source to the surrounding environment. Cooling towers are also expected to be located on the roof near the corner of Swanston Street and Flinders Street. The proposed location of plant is shown in Figure D.7 along with the NSA. The nearest NSAs are the Westin Hotel and residential area at 205 Collins Street and the residential areas at 228 Flinders Lane and 228 Flinders Street, Melbourne.

The SEPP N-1 Noise Limits are shown in Table D.10. It is noted the Noise Limits apply to all industrial, commercial and retail noise sources, so that the effective Noise Limit for any individual source may be less than the Noise Limit.

**Table D.10: SEPP N-1 *Noise Limit*s for Precinct 6**

| Location | Period | *Noise Limit*, $dBL_{Aeq,30\ minutes}$ |
|---|---|---|
| **Westin Hotel 205 Collins Street, Melbourne** | Day | 67 |
| | Evening | 63 |
| | Night | 59 |
| **228 Flinders Street, Melbourne** | Day | 70 |
| | Evening | 63 |
| | Night | 58 |

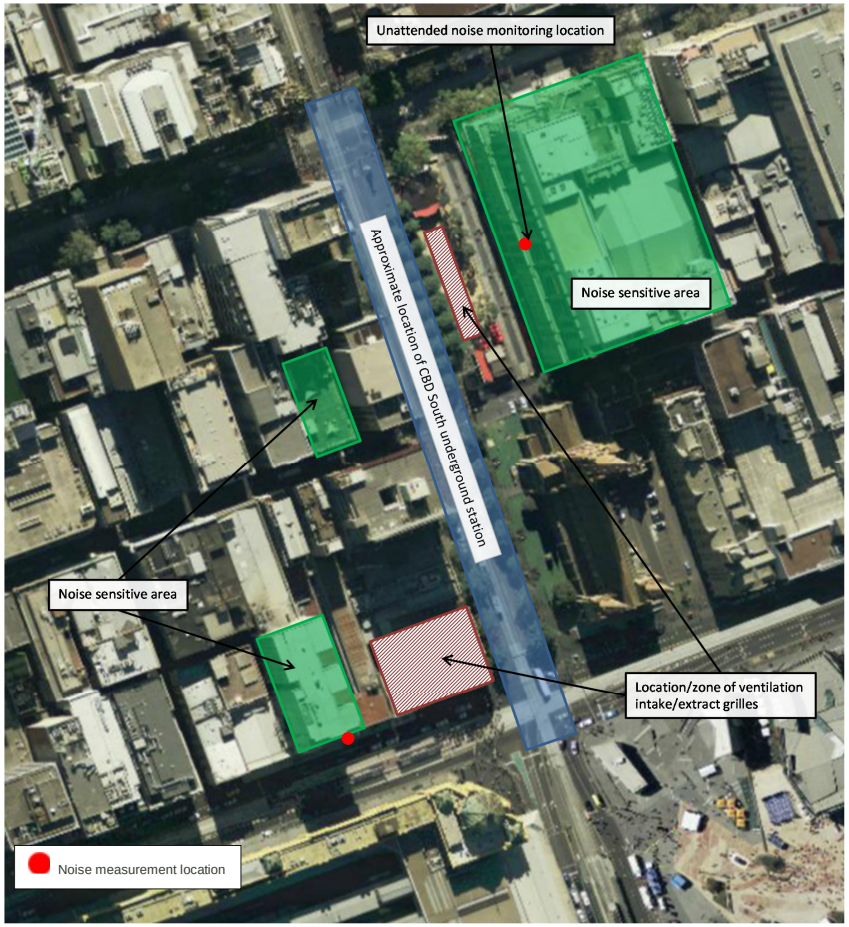


**Figure D.7: Location of fixed noise sources, measurements of attended background noise levels (red dots) and Noise Sensitive Areas for Precinct 6**

## 3.7 Precinct 7: Domain Station

Noise from ventilation and other fixed plant must meet the relevant SEPP N-1 Noise Limits at the nearest Noise Sensitive Areas. Ventilation needs to be able to operate 24-hour and design of the fixed plant and ventilation systems to achieve the SEPP N-1 night period Noise Limit (the most onerous Noise Limit) which implies compliance for the other periods.

The fixed plant noise in Precinct 6 is associated with the:

- Tunnel Ventilation System
- Over Track Extract fans
- Over Platform Extract fans
- Over Concourse Extract fans
- Back of House ventilation systems.

The fans would be enclosed and/or located underground and the louvre/grilles would effectively be a noise source to the surrounding environment. The proposed locations/zones of the intake/extract louvres are shown in Figure D.8 along with the locations of the baseline measurements.

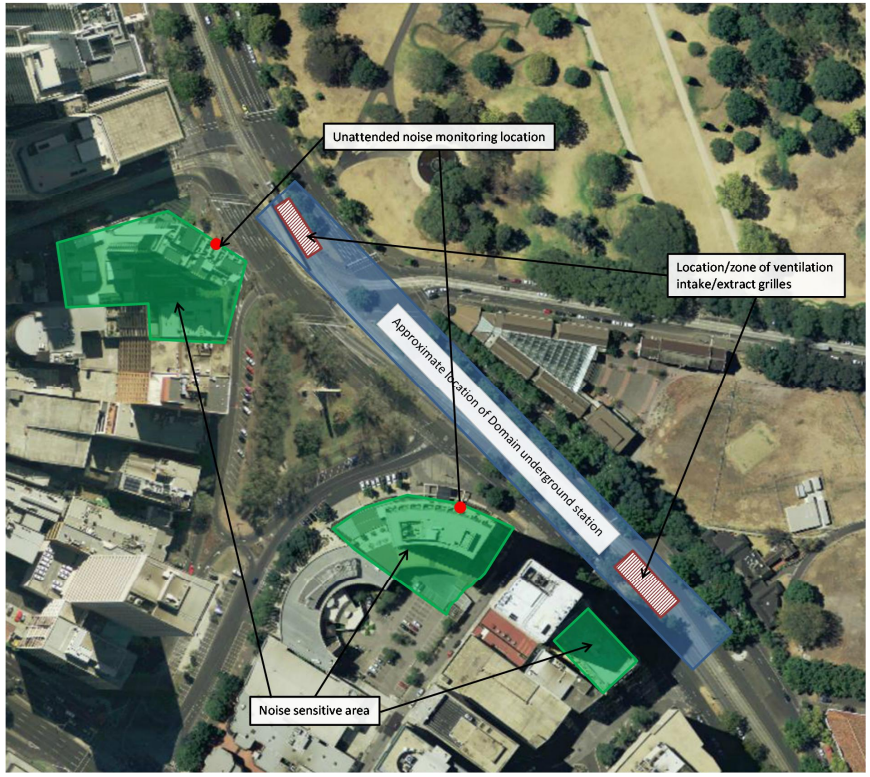


**Figure D.8: Location of fixed noise sources, measurements of attended background noise levels (red dots) and Noise Sensitive Areas**

The nearest Noise Sensitive Areas are residential areas at 2-14 Albert Road, 29 Albert Road and 402 St Kilda Road, Melbourne.

The SEPP N-1 Noise Limits are provided in Table D.11. It is noted the Noise Limits apply to all industrial, commercial and retail noise sources, so that the effective Noise Limit for any individual source may be less than the Noise Limit.

**Table D.11: SEPP N-1 Noise Limits for Precinct 7**

| Location | Period | Noise Limit, $dBL_{Aeq,30\ minutes}$ |
|---|---|---|
| **29 Albert Road, Melbourne** | Day Period | 62 |
| | Evening Period | 56 |
| | Night Period | 50 |
| **2-14 Albert Road, Melbourne** | Day Period | 62 |
| | Evening Period | 56 |
| | Night Period | 48 |
| **402 St Kilda Road, Melbourne** | Day Period | 62 |
| | Evening Period | 56 |
| | Night Period | 48 |

## 3.8 Precinct 8: Eastern Portal

There are a number of items of plant proposed for the Precinct 8 including;

- Tunnel Ventilation System - discharge fan
- Stair pressurization fan
- Substation Ventilation fans.

The fans are proposed to be located at the top of a mostly underground structure located between Osborne Street and the existing rail lines in South Yarra.

Noise from ventilation and other fixed plant must meet the relevant SEPP N-1 Noise Limits at the nearest Noise Sensitive Areas (NSAs). Ventilation needs to be able to operate 24-hour and design of the fixed plant and ventilation systems to achieve the SEPP N-1 night period Noise Limit (the most onerous Noise Limit) which implies compliance for the other periods.

The proposed location of the ventilation fans in Precinct 8 are shown in Figure D.9.

The nearest noise sensitive areas are along Osborne Street to the west of the proposed plant and there are also noise sensitive areas to the east, at the rear of William Street.

Table D.12 shows the calculated SEPP N-1 Noise Limits in the vicinity of the eastern portal. It is noted the Noise Limits apply to all industrial, commercial and retail noise sources, so that the effective Noise Limit for any individual source may be less than the Noise Limit.

**Table D.12: SEPP N-1 *Noise Limits* for Precinct 8**

| Location | Period | *Noise Limit*, $dBL_{Aeq,30\ minutes}$ |
|---|---|---|
| **139 Osborne Street, South Yarra** | Day | 55 |
| | Evening | 49 |
| | Night | 47 |
| **19 William Street, South Yarra** | Day | 52 |
| | Evening | 46 |
| | Night | 41 |


**Figure D.9: Location of fixed noise sources, measurements of attended background noise levels (red dots) and NSAs**

## 3.9 Precinct 9:

There is no fixed plant is proposed in Precinct 9.

## 3.10 Summary

A summary of the SEPP N-1 *Noise Limits* for each time period, including the measured background noise level, *Influencing Factor* and *Zoning Level*, is shown in Table D.13

**Table D.13: Noise Limits**

| Location | Time Period | Background Noise Level $L_{A90}$, dB | Influencing Factor (IF) | Zoning Level | *Noise Limit* $L_{Aeq,30\ min}$, dB |
|---|---|---|---|---|---|
| **Precinct 1** | | | | | |
| **1 Millswyn Street, South Yarra** | Day | 55 | 0.05 | 51 | 71 * |
| | Evening | 51 | 0.05 | 45 | 59 * |
| | Night | 44 | 0.05 | 40 | 52 * |
| **The Melburnian, 250 St Kilda Road, Melbourne** | Day | 53 | 0.35 | 56 | 69* |
| | Evening | 54 | 0.35 | 50 | 62* |
| | Night | 43 | 0.35 | 45 | 51* |
| **Precinct 2** | | | | | |
| **135 Ormond Road, Kensington,** | Day | 51 | 0.275 | 51 | 67 * |
| | Evening | 46 | 0.275 | 45 | 54 * |
| | Night | 46 | 0.275 | 40 | 54 * |
| **Precinct 3** | | | | | |
| **141 Laurens Street, North Melbourne** | Day | 53 | 0.5 | 59 | 59 |
| | Evening | 50 | 0.5 | 53 | 53 |
| | Night | 48 | 0.5 | 48 | 51 |
| **724 Queensberry Street, North Melbourne** | Day | 45 | 0.5 | 59 | 57 |
| | Evening | 42 | 0.5 | 53 | 51 |
| | Night | 43 | 0.5 | 48 | 48 |
| **Precinct 4** | | | | | |
| **139 Barry Street, Carlton** | Day | 54 | 0.375 | 59 | 60 |
| | Evening | 49 | 0.375 | 50 | 52 |
| | Night | 44 | 0.375 | 45 | 47 |
| **223 Berkeley Street, Parkville** | Day | 58 | 0.4375 | 58 | 64 |
| | Evening | 56 | 0.4375 | 51 | 59 |
| | Night | 47 | 0.4375 | 43 | 50 |
| **224 Leicester Street, Carlton** | Day | 54 | 0.3375 | 56 | 60 |
| | Evening | 50 | 0.3375 | 50 | 53 |
| | Night | 42 | 0.3375 | 45 | 45 |
| **Royal Melbourne Hospital, Corner Grattan Street and Royal Parade, Parkville** | Day | 61 | 0.45 | 58 | 67 |
| | Evening | 59 | 0.45 | 52 | 62 |
| | Night | 55 | 0.45 | 47 | 58 |
| **Precinct 5** | | | | | |
| **31 A'Beckett Street, Melbourne** | Day | 63 | 0.45 | 58 | 69 |
| | Evening | 60 | 0.45 | 52 | 63 |
| | Night | 50 | 0.45 | 47 | 53 |
| **81 Franklin Street, Melbourne** | Day | 64 | 0.4875 | 59 | 70 |
| | Evening | 59 | 0.4875 | 52 | 62 |
| | Night | 54 | 0.4875 | 47 | 57 |

| Location | Time Period | Background Noise Level $L_{A90}$, dB | Influencing Factor (IF) | Zoning Level | *Noise Limit* $L_{Aeq,30\ min}$, dB |
|---|---|---|---|---|---|
| **Latrobe House, 200 Latrobe Street, Melbourne** | Day | 63 | 0.45 | 58 | 69 |
| | Evening | 63 | 0.45 | 52 | 66 |
| | Night | 58 | 0.45 | 47 | 60 |
| **483 Swanston Street, Melbourne** | Day | 59 | 0.475 | 59 | 65 |
| | Evening | 57 | 0.475 | 52 | 60 |
| | Night | 53 | 0.475 | 47 | 56 |
| **Precinct 6** | | | | | |
| **Westin Hotel, 210 Collins Street, Melbourne** | Day | 61 | 0.4625 | 58 | 67 |
| | Evening | 60 | 0.4625 | 52 | 63 |
| | Night | 56 | 0.4625 | 47 | 59 |
| **228 Flinders Street, Melbourne** | Day | 64 | 0.4875 | 59 | 70 |
| | Evening | 60 | 0.4875 | 52 | 63 |
| | Night | 55 | 0.4875 | 47 | 58 |
| **Precinct 7** | | | | | |
| **29 Albert Road, Melbourne** | Day | 56 | 0.275 | 55 | 62 |
| | Evening | 53 | 0.275 | 49 | 56 |
| | Night | 47 | 0.275 | 44 | 50 |
| **214 Albert Road, Melbourne** | Day | 56 | 0.4125 | 57 | 62 |
| | Evening | 53 | 0.4125 | 51 | 56 |
| | Night | 45 | 0.4125 | 46 | 48 |
| **402 St Kilda Road, Melbourne** | Day | 56 | 0.4375 | 58 | 62 |
| | Evening | 53 | 0.4375 | 51 | 56 |
| | Night | 45 | 0.4375 | 46 | 48 |
| **Precinct 8** | | | | | |
| **139 Osborne Street, South Yarra** | Day | 48 | 0.25 | 55 | 55 |
| | Evening | 46 | 0.25 | 48 | 49 |
| | Night | 44 | 0.25 | 43 | 47 |
| **19 William Street, South Yarra** | Day | 40 | 0.2625 | 55 | 52 |
| | Evening | 38 | 0.2625 | 48 | 46 |
| | Night | 33 | 0.2625 | 43 | 41 |

* These *Noise Limits* have been adjusted by +10 dB for the Day period and +5 dB for the Evening and Night periods in accordance with the SEPP-N1 requirements for the testing of emergency equipment.

## 3.11 Discussion

As items of plant have not been selected it is not possible to fully assess the impact of noise from fixed infrastructure. Noise associated with fixed infrastructure must comply with the SEPP N-1 Noise Limits. Plant noise is expected to be able to be mitigated to comply with the noise limits using one or more of the following mitigation measures:

- Selection of quiet plant and equipment (low noise options)
- Incorporation of acoustic attenuator on equipment
- Use of acoustically lined ducts and /or plenums
- Acoustic barriers or screens

The above listed items are routinely and successfully used on industrial projects for mitigating operational noise from fixed infrastructure.

## 3.12 Conclusion

The SEPP N-1 *Noise Limits* for each time period have been determined for the nearest noise sensitive areas at each of the proposed fixed infrastructure and ventilation sites along the Melbourne Metro alignment. The proponent shall design the plant to comply with these limits. This can be achieved by selecting quiet equipment and/or applying acoustic mitigation measures as discussed in this Appendix.


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