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# Noise & Vibration Management Plan

**METRONET -Yanchep Rail Extension**

Reference: 17074053-02

**Prepared for:**  
**Public Transport Authority**



## Report: 17074053-02

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# 1 SUMMARY

This document presents the environmental management actions to manage the potential impacts of the proposal on amenity (noise and vibration).

The required extent, location and height of noise mitigation measures will be progressively reassessed by a suitably qualified person as detailed design for levels and layout for the railway and future surrounding developments become available. *Table 1-1* summarises the general content of this Noise and Vibration Management Plan (NVMP).

**Table 1-1 Noise and Vibration Management Plan Summary**

Item	Details
Title of Proposal	Yanchep Rail Extension
Proponent Name	Public Transport Authority
Key Environmental Factors and Objective	Noise and vibrations - EPA's objective for Social Surroundings is to protect social surroundings from significant harm.
NVMP Objectives	To minimise noise and vibration emissions from the operation of the proposal to as low as reasonably practicable.
Noise Management Targets	<ul style="list-style-type: none"> <li>• State Planning Policy 5.4 target <math>L_{Aeq (Day)}</math> 55 dB and <math>L_{Aeq (Night)}</math> 50 dB unless higher levels are permitted due to the incorporation of specified house facade protection.</li> </ul>
Vibration Management Targets	<ul style="list-style-type: none"> <li>• Criterion 1: vibration isolation measures will be provided where the predicted or actual vibration is Curve 2 or greater, as defined in AS 2670.2.</li> <li>• Criterion 2: the proposal will be designed to meet Curve 1.4 as defined in AS 2670.2.</li> <li>• Criterion 3: Vibration will be managed to be as low as reasonably practicable.</li> </ul>
NVMP Review	<ul style="list-style-type: none"> <li>• Changes to the operation of the proposal, such as increased train speeds, number of train movements, length of rail car sets or extended hours of operation.</li> <li>• Where significant complaints are received from sensitive receptors.</li> <li>• New or revised information becoming available.</li> <li>• Annually.</li> </ul>

## 2 CONTEXT, SCOPE AND RATIONALE

### 2.1 Description of the Proposal

The Public Transport Authority (PTA) is proposing to implement stage one of the Western Australian Government's METRONET vision, which includes the Yanchep Rail Extension (YRE) project (the proposal). The proposal is a 14.5 kilometre (km) extension of the Joondalup railway line from Butler to Yanchep, which includes the construction of three new stations at Alkimos, Eglinton and Yanchep.

The new railway line will be constructed in a cutting that is approximately 5m below existing and/or future surrounding ground levels. The railway corridor is surrounded by existing and future urban developments as shown in *Figure 5-1*.



**Figure 2-1 Rail Project Extent**

The scope of the NVMP is to outline the management and mitigation of potential noise and vibration impacts during the operation of the proposal. The NVMP has been prepared in accordance with the Environmental Protection Authority (EPA) Instructions on how to prepare Environmental Protection Act 1986 Part IV Environmental Management Plans.

Management of construction related noise and vibration impacts will be addressed within separate project specific Construction Environmental Management Plans (CEMPs) and is not included in the NVMP scope. Two CEMPs will be prepared for the project, to align with the staged construction of the rail line over Parts 1 and 2. Part 1 of the proposal is the construction of the alignment from Butler Station to Eglinton Station and construction environmental impacts will be managed in accordance with the Part 1 CEMP (Eco Logical, 2018). Part 2 of the proposal is the construction of the alignment from Eglinton Station to Yanchep Station and construction environmental impacts will be managed in accordance with the Part 2 CEMP.

## 2.2 Key Environmental Factors

Amenity (noise and vibration), classified under the Social Surroundings environmental factor is the key environmental factor applicable to this NVMP. Further information is provided in *Table 2-1*.

*Table 2-1 Environmental Factors of the Proposal for Amenity (Noise and Vibration)*

<b>Environmental Factor of the Proposal</b>	<b>Activity</b>	<b>Sensitive Receptors</b>	<b>Potential Impact</b>
Train Noise	Train movements during the operation of the proposal	Existing and future residential premises adjacent to the proposal.	Noise disturbance leading to annoyance. Sleep disturbance due to high noise level when trains passing.
Train Vibration	Train movements during the operation of the proposal	Other sensitive premises such as schools.	Felt vibration or regenerated noise leading to annoyance. Vibration levels resulting in damage to building structures
Station Noise	Operation of the Station		Noise from Station operations such as the public address system, mechanical plant and cleaning requirements

## 2.3 Requirements of the Request for Additional Information

Following referral of the proposal to the EPA under Section 38 of the *Environmental Protection Act 1986*, the EPA issued a notice (EPA, 2018) requesting PTA provide additional information for referral assessment. This included the preparation of a:

- Noise and vibration management plan (NVMP) to detail proposed noise and vibration management measures.
- Construction environmental management plan (CEMP) to detail proposed management and mitigation actions for each of the Preliminary Key Environmental Factors.

The CEMP is a separate document and includes the management and mitigation of noise and vibrations generated by the proposal construction works.

This NVMP is submitted in accordance with the following criteria:

- Railway operation (noise) - *State Planning Policy 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (the policy).
- Railway operation (vibration) - *Ministerial Statement 629*, which related to the railway south of Butler Station (*Ministerial Statement 629*).
- Railway station operation - The *Environmental Protection (Noise) Regulations 1997* (the regulations).

## 2.4 Rationale and Approach in Meeting the Environmental Objective

### 2.4.1 Noise and Vibration Modelling and Assessment

The results of the noise modelling and assessment inform the management approach for meeting the NVMP requirements stated in *Section 2.3*. The identified management actions, management targets and proposed review and revision of management actions are aligned with the overall proposed management approach.

A noise and vibration assessment was undertaken, in accordance with the policy, by Lloyd George Acoustics (January 2018), to assess the likely transportation noise and vibration levels, resulting from the proposal, on sensitive receptors.

While the policy states that “transport infrastructure providers should design mitigation measures to achieve the noise limit” (60 dB  $L_{Aeq(Day)}$ ) at ground floor level, based on the predicted future (15 to 20 years) scenarios, the noise assessment designed mitigation to achieve the policy target of 55 dB  $L_{Aeq(Day)}$  wherever practicable using noise barriers up to a height of 4 metres, unless the sensitive receptor incorporates specific noise mitigation within the construction of the building facade.

Noise modelling for the operation of the proposal was undertaken using the computer programme *SoundPLAN 8.0* and incorporating the Nordic Rail Prediction Method (Kilde Rep. 130) algorithm. The algorithm had been modified to reflect local conditions and trains using the METRONET rail network. The 3-dimensional computer modelling included existing topography integrated with the proposed



design of the railway, which has been designed to be in a cutting, between 4-7m below ground level, for the majority of the alignment. Variables included expected train lengths and speeds, expected number of train movements, existing noise sensitive premises, future residential developments and existing noise barriers.

The train configuration used in the modelling assumed all trains were 6-car sets, having a length of 150 metres. It was assumed that 75 train movements occurred in each direction during the day period (6:00 a.m. to 10:00 p.m.) and 22 train movements occurred in each direction during the night period (10:00 p.m. to 6:00 a.m.)

The train speeds used in the modelling was based on simulation plots undertaken by Australis Rail Consulting. The speeds ranged from 55 km/h coming into stations to 130 km/h on straight sections.

For the purposes of modelling, all buildings were assumed to be single storey and have a height of 4.0 metres. Considering the type of buildings constructed in the area and the fact that the assessment is undertaken at ground floor level, this approach was considered to be reasonable.

Existing noise walls were considered in the model; however, noise mitigation that has been incorporated into a subdivision design as part of the Development Application process, which may include noise barriers, specified facade protection on certain lots, or a combination of both were not included in this assessment.

Calibration of the noise model was undertaken assuming a passing noise level from a train travelling at 130 km/h of 87 dB  $L_{Amax}$ . This measurement data was obtained during the commissioning of new trains operating on the Joondalup line.

The key assumptions and uncertainties associated with the noise modelling include:

- Number of train movement is correct.
- Train speeds are as modelled.
- Daytime noise levels will be more than 5 dB above the night time levels.
- Ground levels at existing and proposed sensitive receivers are as surveyed or designed.
- Noise control measures assigned to existing residential development along the alignment are constructed as specified.
- Noise walls for future residential developments are constructed as specified.

The assessment of noise from the railway stations will be undertaken during the detailed design stage of the stations.

The vibration assessment was based on measured vibration levels adjacent to the Northern Suburbs Railway undertaken by Herring Storer Acoustics. The assessment considered the profile of the track (straight, bend, etc) and distance from the track to the sensitive receptor.

The attenuation of vibration levels occurs with distance from the source and the damping properties of the ground material. Based on the measured vibration levels, the distances required to achieve

the criterion of Curve 1.4 in Australian Standard 2670.2-1990 “*Evaluation of human exposure to whole-body vibration; Part 2: Continuous and shock-induced vibration in buildings (1 to 80 Hz)* are :

- Near Station - 50 metres
- Inside bend - 55 metres
- Outside bend - 40 metres
- Straight Track - 40 metres

These distances assume the train will be travelling at high speeds.

The key assumptions and uncertainties associated with the vibration predictions include:

- Vibration measurement results from the existing railway translate to the proposed railway design and ground conditions.

## **2.4.2 Noise and Vibration Modelling and Assessment Results**

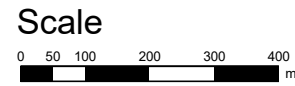
The results of the noise modelling showed that the Policy noise *target* was exceeded at a number of receiver locations and as such, noise mitigation is required to be incorporated into the design of the railway to achieve this criterion, where practicable.

For the PTA, the only practicable noise mitigation measure available is to install noise barriers along the rail reserve boundary, where practicable, at all identified noise sensitive premises. For reasons of practicability, noise walls have been limited to a height of 4 metres above ground level.

The recommended noise walls are presented in *Figures 2-2 to 2-7*. While these noise walls have been designed to achieve the Policy noise *target*, wherever practicable, they do not take into consideration other mitigation measures, such as house facade protection, which are permitted under the Policy. For example, where urban development includes the requirement for facade protection on certain lots, higher external noise levels are permitted and therefore a reduction in the height of the noise wall, or the elimination of the wall, would be considered acceptable.

The results of the vibration assessment show the criterion of 103 dB<sub>v</sub> is predicted to be marginally exceeded at a number of locations along the railway alignment. While vibration criteria for above ground railways are generally set to address annoyance (i.e. Curve 1.4 AS2670.2-1990), the ground conditions south of Butler Station resulted in a number of properties experiencing structure-borne regenerated noise issues (rumbling) as trains passed by. As a result of this, PTA have committed to installing ballast matting adjacent to all existing and approved future residential developments. A reduction of between 10 to 15 dB<sub>v</sub> can be expected which would significantly reduce vibration levels to well below the vibration criterion.

# METRONET - Yanchep Rail Extension Proposed Noise Barriers



## Figure 2-2



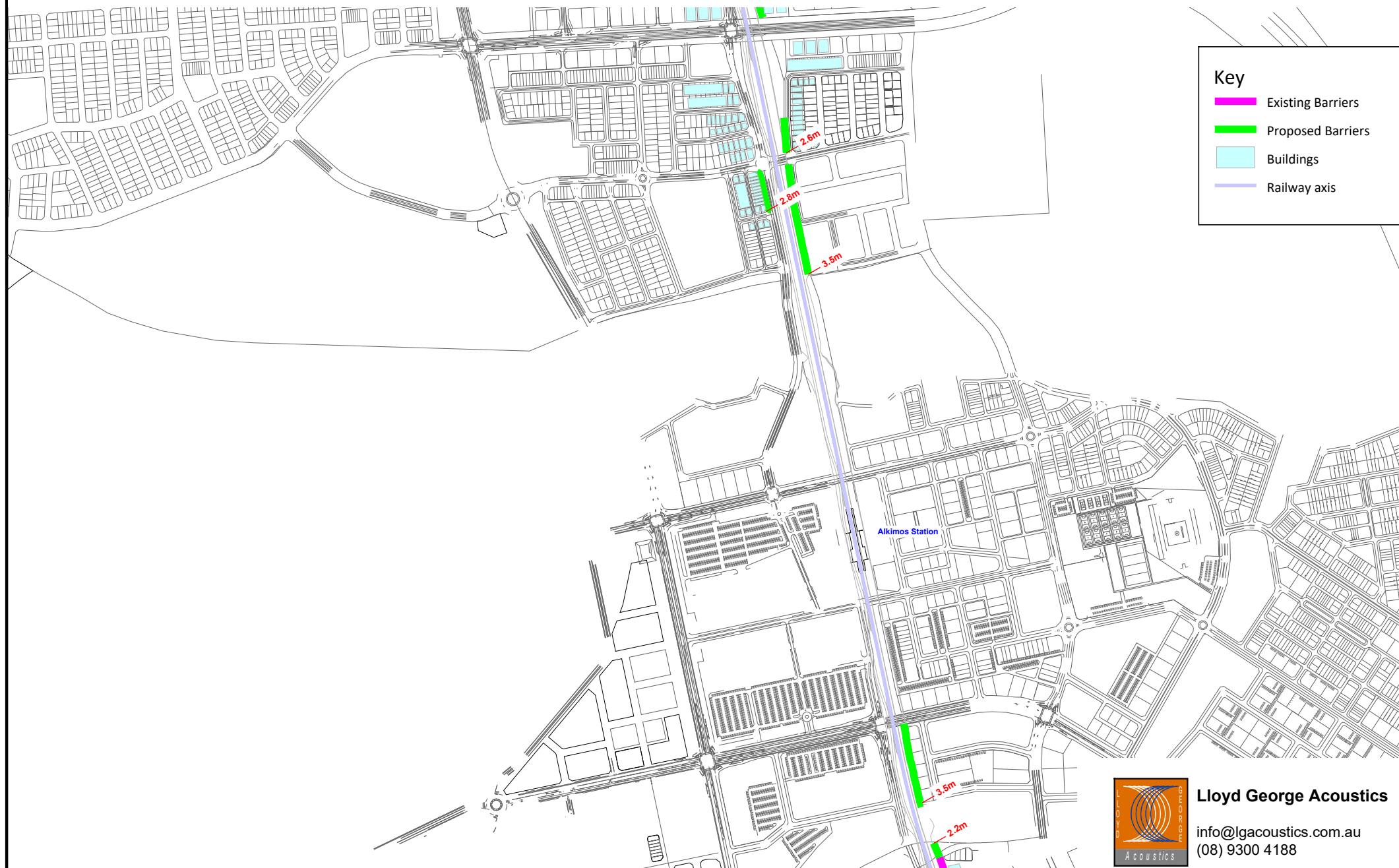
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# METRONET - Yanchep Rail Extension Proposed Noise Barriers



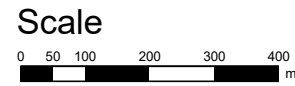
## Figure 2-3



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# METRONET - Yanchep Rail Extension Proposed Noise Barriers



## Figure 2-4



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# METRONET - Yanchep Rail Extension Proposed Noise Barriers

Scale



## Figure 2-5



### Key

- Existing Barriers
- Proposed Barriers
- Buildings
- Railway axis

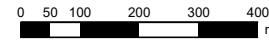


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# METRONET - Yanchep Rail Extension Proposed Noise Barriers

Scale



## Figure 2-6

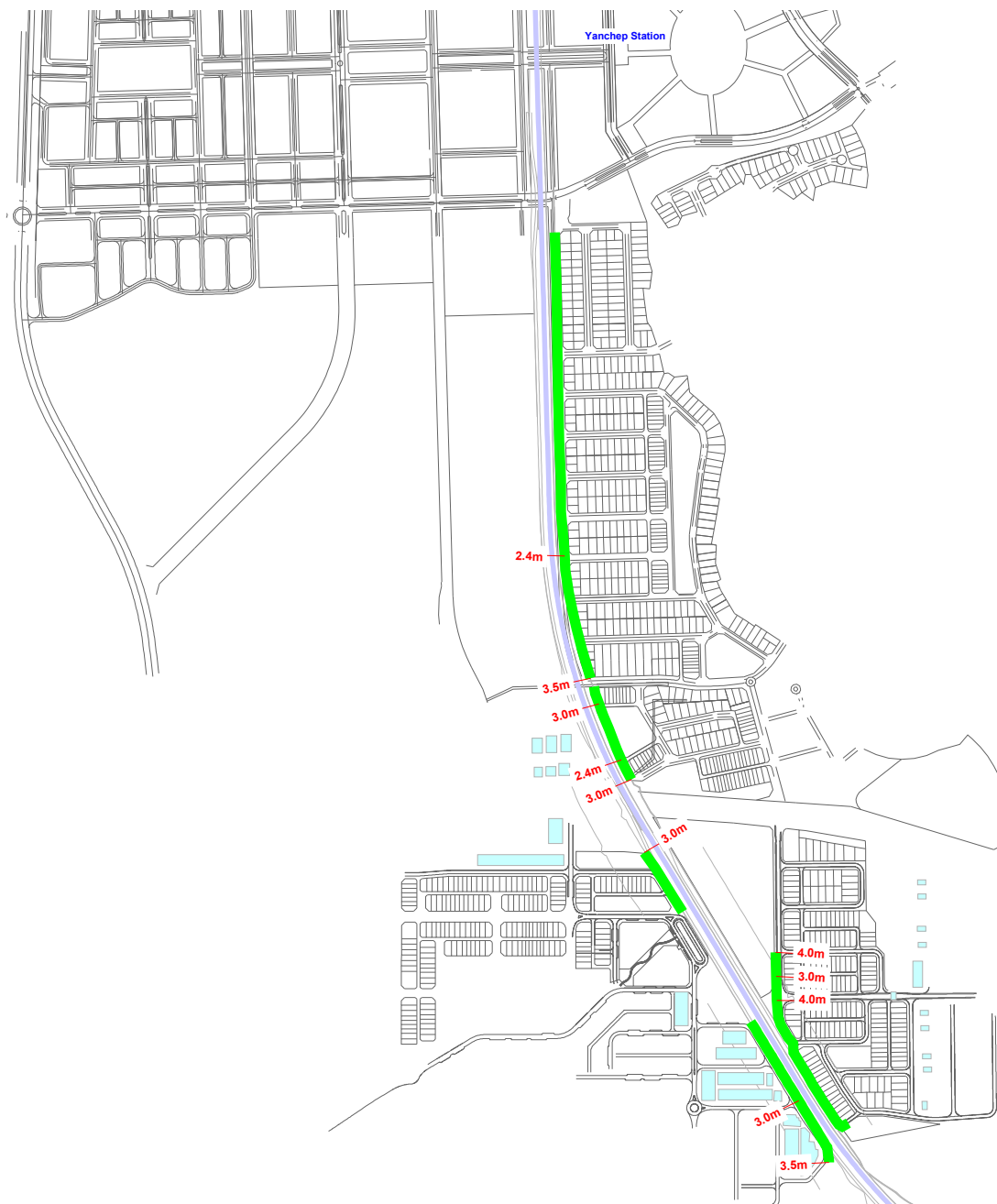


# METRONET - Yanchep Rail Extension Proposed Noise Barriers

Scale

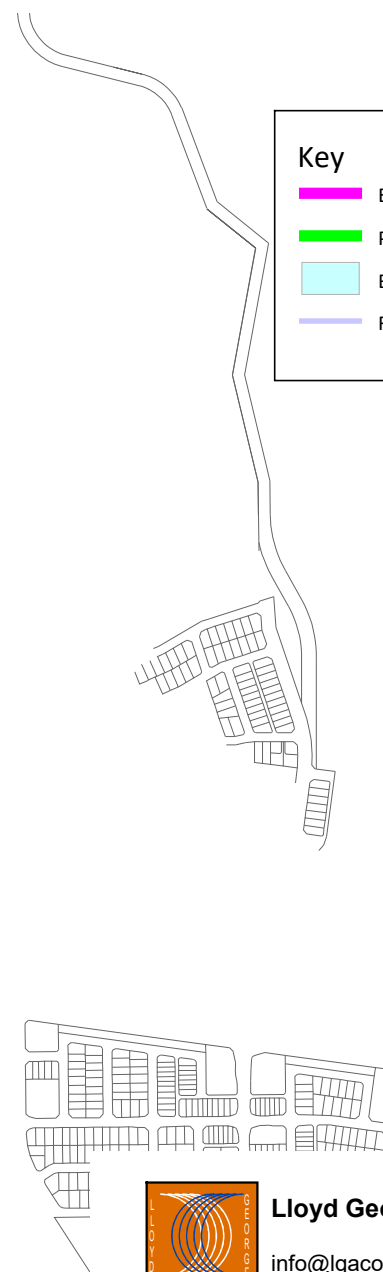


## Figure 2-7



### Key

- Existing Barriers
- Proposed Barriers
- Buildings
- Railway axis



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### 2.4.3 Management Approach

The management approach for noise has been informed by the policy and industry best practice.

For vibration the approach is identical to Ministerial Statement 629 (relating to the railway south of Butler Station), which references *Australian Standard AS 2670.2-1990: Evaluation of human exposure to whole body vibration - Part 2: Continuous and shock induced vibration in buildings (1 to 80 Hz)*. This Standard characterises sources (of vibration) which operate intermittently, but which would produce continuous vibration if operated continuously, such as railway trains.

### 2.4.4 Rationale for Choice of Management Targets

The rationale for the choice of management targets to achieve the environmental objectives for amenity is detailed below:

- The management target for outdoor noise has been developed by the Western Australian Planning Commission in the policy based on emissions of road or rail transport noise as received at a noise-sensitive land use, namely:
  - for new road or rail infrastructure proposals, at 1 m from the most exposed, habitable façade of the building receiving the noise, at ground floor level only; and
  - for new noise-sensitive development proposals, at 1 m from the most exposed, habitable façade of the proposed building, at each floor level, and within at least one outdoor living area on each residential lot.
- In the application of these outdoor noise criteria to new major transport projects, the objectives of the Policy is that the new infrastructure be designed and constructed so that noise emissions are at a level that -
  - Provides an acceptable level of acoustic amenity for existing noise-sensitive land uses and for the planning of noise-sensitive developments;
  - Is consistent with other planning policies and community expectations; and
  - Is practicably achievable.
- The management targets for ground-borne vibration resulting from the train pass-bys was given in the Ministerial Statement 629 for the existing railway south of Butler Station. The Ministerial Conditions required that the proponent meet specific vibration criteria with reference to the Australian Standard AS 2670.2-1990: Evaluation of human exposure to whole body vibration - Part 2: Continuous and shock induced vibration in buildings (1 to 80 Hz). This Standard characterises sources (of vibration) which operate intermittently, but which would produce continuous vibration if operated continuously, such as railway trains. The preferred method of assessing the influence of continuous vibrations is to assess the root mean square (RMS) value of the weighted particle acceleration. In terms of vibrational energy, both particle acceleration and velocity are identical.
- The management target for noise resulting from operation of the railway stations is based on the requirements and assigned levels contained within the *Environmental Protection (Noise) Regulations 1997*.

## 3 NVMP PROVISIONS

### 3.1 Environmental Objectives

The environmental objective of this NVMP is to minimise noise and vibration emissions from the operation of the proposal to as low as reasonably practicable. This aligns with EPA's objective for Social Surroundings which is to protect social surroundings from significant harm.

### 3.2 Management Actions and Targets

Risk-based management actions have been identified and prioritised to achieve the environmental objective. These management actions focus the greatest management effort on reducing the noise and vibration levels at sensitive receptors along the alignment.

*Table 3-1 Management Actions & Targets to be Implemented to Achieve Objectives*

Risk and Key Impact	Management Targets	Management Actions
Noise disruption to existing and future sensitive receptors along the alignment and reduction in amenity values due to rail operations.	<b>Operational Noise Management Target</b>  The target for outdoor noise is to maintain operational noise to below $L_{Aeq(Day)}$ 55 dB (6.00 a.m. to 10.00 p.m.) and below $L_{Aeq(Night)}$ 50 dB (10.00 p.m. to 6.00 a.m.) (WAPC, 2009)	Design of the railway to be in cut as far as practicable.
		Noise attenuation barriers (noise walls) will be designed and constructed during the construction phase of the Project, as detailed in Section 3.3.
		A noise monitoring program will be implemented within three months of the opening of the proposal, and again at 18 months, to assess the effectiveness of noise mitigation. Specifically the program will: <ul style="list-style-type: none"> <li>• Confirm the as-built and operating railway achieves the Policy target <math>L_{Aeq(Day)}</math> 55 dB and <math>L_{Aeq(Night)}</math> 50 dB unless higher levels are permitted due to the incorporation of specified house facade protection.</li> <li>• Assess the accuracy of the pre-construction noise modelling predictions that were used to determine noise reduction treatments.</li> </ul> Further details are provided in Section 3.4.
		The PTA will undertake rail maintenance to reasonably maintain the operational performance of the relevant railway infrastructure and reduce wear to trains. This will involve regular inspection of the rail condition and rail rectification / grinding to remove excessive roughness or corrugation which may develop over time.

Risk and Key Impact	Management Targets	Management Actions
Station noise	<p><b>Station Noise Management Targets</b></p> <p>The target for noise resulting from operation of the railway stations is to ensure noise levels comply with the assigned levels under the Environmental Protection (Noise) Regulations 1997.</p>	Design and construct rail stations to meet station noise management targets.
Vibration disruption to existing and future sensitive receptors along the alignment and reduction in amenity values due to rail operations.	<p><b>Operational Vibration Management Target</b></p> <p>The target for ground-borne vibration, from Ministerial Statement 629 is detailed below:</p> <ul style="list-style-type: none"> <li>• <b>Criterion 1:</b> vibration isolation measures will be provided where the predicted or actual vibration is Curve 2 or greater, as defined in AS 2670.2.</li> <li>• <b>Criterion 2:</b> the proposal will be designed to meet Curve 1.4 as defined in AS 2670.2.</li> <li>• <b>Criterion 3:</b> Vibration will be managed to be as low as reasonably practicable.</li> </ul>	Vibration mitigation in the form of ballast matting will be installed adjacent to all existing and future residential developments during the construction phase of the project.
Complaints regarding levels of noise and vibration	No complaints regarding noise and/or vibrations during operation of the railway.	Noise and vibration complaints during operation will be managed by PTA through a specific procedure as detailed in Section 3.5.

### 3.3 Design and Construction of Noise Mitigation Measures

The required extent, location and height of noise walls will be progressively reassessed by a suitably qualified person/consultant/engineer as the following detail becomes available:

- Detailed design levels of the railway;
- Detailed design levels and layout of the surrounding future developments; and
- Confirmation of noise wall and building facade noise control packages implemented by surrounding developments where required as part of the subdivision approval conditions.

Under the policy, building facade noise control packages allow higher noise levels external to the building by maintaining acceptable internal noise levels. While custom facade packages can be

designed by an acoustical consultant, the policy guidelines have three “deemed to comply” facade packages, being Package A, B and C. Package A is required for external noise levels between 55 and 60 dB LAeq(Day), Package B is required for external noise levels up to 63 dB LAeq(Day) and Package C is required for external noise levels up to 65 dB LAeq(Day). The use of facade protection can result in lower noise walls where considered appropriate.

The responsibility for construction of noise walls will also need to be determined in accordance with Policy recommendations. Where a new rail infrastructure project is to be constructed in the vicinity of a future noise-sensitive land use, the infrastructure provider and developer are both responsible for ensuring that the objectives of the policy are achieved, and a mutually-beneficial noise management plan, including individual responsibilities, should be negotiated between the parties.

Noise walls will be designed to the following specifications and constructed during the construction phase of the Project:

- Height will vary based on location to a maximum height of 4 m; and
- Constructed of a material with a surface density exceeding 15 kg/m<sup>2</sup>.

### **3.4 Monitoring**

The purpose of monitoring is to inform, through the management targets, if the environmental noise and vibration criteria are being achieved and when management actions need to be reviewed and revised.

A noise and vibration monitoring program aimed at measuring the noise and vibration levels at existing sensitive premises will be developed. The monitoring results will provide information to assess how effective the management actions have been in achieving the management targets.

Noise and vibration monitoring will be undertaken by a suitably qualified person/consultant/engineer within three months of the opening of the proposal, over a period of seven (7) days at sensitive premises within the locality as presented in *Table 3-2* and illustrated in *Figure 3-1*. Additional monitoring locations will be added where residential areas are developed adjacent to the proposal prior to the commencement of operations.

The monitoring will be undertaken in accordance with the policy guidelines using un-manned statistical noise or vibration monitors placed one metre from the facade of the sensitive premises. All equipment used will have been NATA laboratory certified within the previous two years.

The results of the monitoring will be used to assess the effectiveness of noise and vibration mitigation measures by comparing the results against the management targets.

This suite of measurements will be repeated at the same locations 18 months after commencement of the normal train service to establish that compliance with the management targets is being maintained.

Monitoring may also be conducted at sensitive receptors where complaints have been received.

Table 3-2 Noise and Vibration Recommended Monitoring Locations

Measurement ID	Locality of measurement
Receiver Point 1	Charlbury Drive, Alkimos
Receiver Point 2	Chesham Rise, Alkimos
Receiver Point 3	Duerden Street, Alkimos
Receiver Point 4	Maroon Avenue, Alkimos
Receiver Point 5	Bulburin Parade, Yanchep

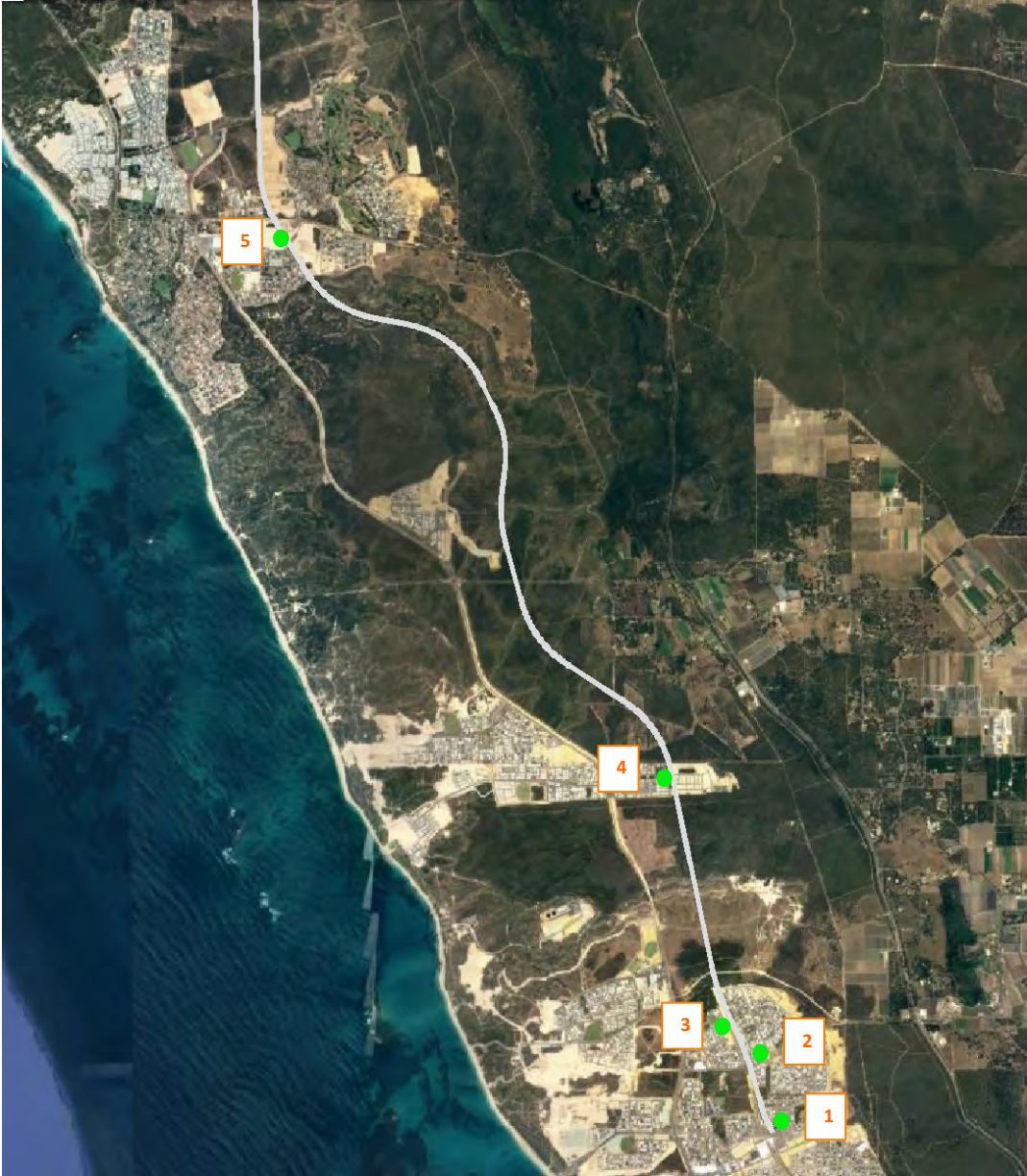


Figure 3-1 Recommended Monitoring Locations

### 3.5 Noise and Vibration Complaint Procedure

Noise and vibration complaints during operation will be managed by PTA through a specific procedure that includes:

- Directing complaints to contact the PTA via their Infoline 13 62 13 or via the comments section on the PTA's website [www.pta.wa.gov.au/about-us/complaints-and-comments](http://www.pta.wa.gov.au/about-us/complaints-and-comments)
- All calls and emails will be logged and responded to within five days of receipt.
- The PTA will investigate all noise and/or vibration complaints received by:
  - Investigating the operations at the time of the complaint
  - Substantiated or widespread complaints will be investigated as follows:
    - An appropriate number of short-term measures/measurements will be undertaken to assess the cause of substantiated complaint/incidents and to assess how to rectify the situation.
    - Unattended (logged) noise levels relevant to the complaint or incident will be reviewed.
    - Where appropriate, immediate measures that could be implemented to address the nature of the complaint will also be reviewed/assessed.
  - Filing an incident report.
  - Where appropriate, provide a written response within 10 working days from receipt of the complaint.

### 3.6 Review and Revision of Management Actions

Where the management target is not met or where a management action is not implemented, PTA will investigate the reasons for the management target not being met or the management action not being implemented, review and revise the management actions as required, and develop additional management actions where necessary.

As a minimum, management actions will be reviewed and revised annually.

Additional management/remedial actions likely to be considered include:

- Investigate the cause of the action not being met.
- Undertake additional/more detailed monitoring to identify the cause.
- Investigate additional mitigation measures/management actions.
- Review of noise and vibration complaint procedure including the response times and approach to investigations.

## **3.7 Reporting**

### **3.7.1 Monitoring Reports**

Two monitoring reports will be prepared following completion of the two specified monitoring events (i.e. within three months of the opening of the proposal and within 18 months of the opening of the proposal). The monitoring reports will:

- Include and summarise monitoring results
- Compare monitoring results to management targets

Assess operational compliance with and success of the management actions detailed in Table 3-1 in relation to monitoring results

- Where management targets have not been achieved during the reporting period, include a description of revised and/or additional management actions to be implemented to achieve the targets.

## 4 ADAPTIVE MANAGEMENT AND REVIEW OF THE NVMP

### 4.1 Adaptive Management

The PTA will implement adaptive management to respond to issues identified in the implementation of management actions, monitoring and evaluation against the management targets, to more effectively meet the environmental objective.

Potential adaptive management actions may include:

- Where modelling indicates that noise sensitive premises will be in excess of the management targets, assess additional noise mitigation measures (provided this does not include noise walls in excess of 4 m).
- Where monitoring suggests certain locations exceed the vibration management target, undertake investigations to assess the cause of the exceedance.
- Where complaints are received resulting from operation of the proposal, undertake measurements at the complainants premises to compare against the management targets.
- Where management targets are exceeded at complainant's premises, investigate cause and assess additional mitigation as required.

### 4.2 Review of Plan

This plan will be reviewed annually to assess if management actions require revision. Potential reasons or triggers for revising management actions include:

- Changes to the operation of the proposal, such as increased train speeds, number of train movements, length of rail car sets or extended hours of operation.
- Where significant complaints are received from sensitive receptors.
- New or revised information becoming available.

The implementation of this plan will be audited by PTA.



## 5 STAKEHOLDER CONSULTATION

### 5.1 Consultation and Community Engagement

The PTA has consulted extensively with key stakeholders including the proponents/developers responsible for the urban development projects in proximity to the rail alignment to:

- Inform preliminary planning for the proposal.
- Understand the urban development location, extent and progress to date.
- Understand the existing noise and vibration management and mitigation measures.

Table 5-1 identifies the key government and community stakeholders consulted for the YRE project in relation to noise and vibration impacts and/or management measures at the time this NVMP was prepared.

The PTA has also initiated an extensive community engagement program, including the provision of information on the project via the METRONET website [www.metronet.wa.gov.au](http://www.metronet.wa.gov.au).

As required, information will be routinely updated to inform the community as the project commences construction and as the railway is commissioned.

**Table 5-1 Stakeholder Consultation**

Timeframe	Key stakeholder	Summary of consultation
September 2017 to present. Consultation is ongoing.	EPA and DWER EPA services unit.	Environmental advice under the EP Act (as required).
Jan 2018 to present. Consultation is ongoing.	Department of Water and Environmental Regulation (DWER)	Environmental advice (as required). Provision of draft Noise and Vibration Assessment report to DWER Noise Branch for technical expert review and comment. DWER Noise Branch provided report feedback and advice and guidance to be implemented in Project planning and design.
As required, ongoing.	Department of Planning, Lands and Heritage (DPLH)/ Western Australian Planning Commission	Obtaining and verifying planning approvals for urban developments.
Feb 2018 to present. Consultation is ongoing.	Property developers for the adjacent urban development projects illustrated in <i>Figure 5-1</i> .	Noise and vibration impacts and management conditions (existing and proposed). Project definition and delivery.

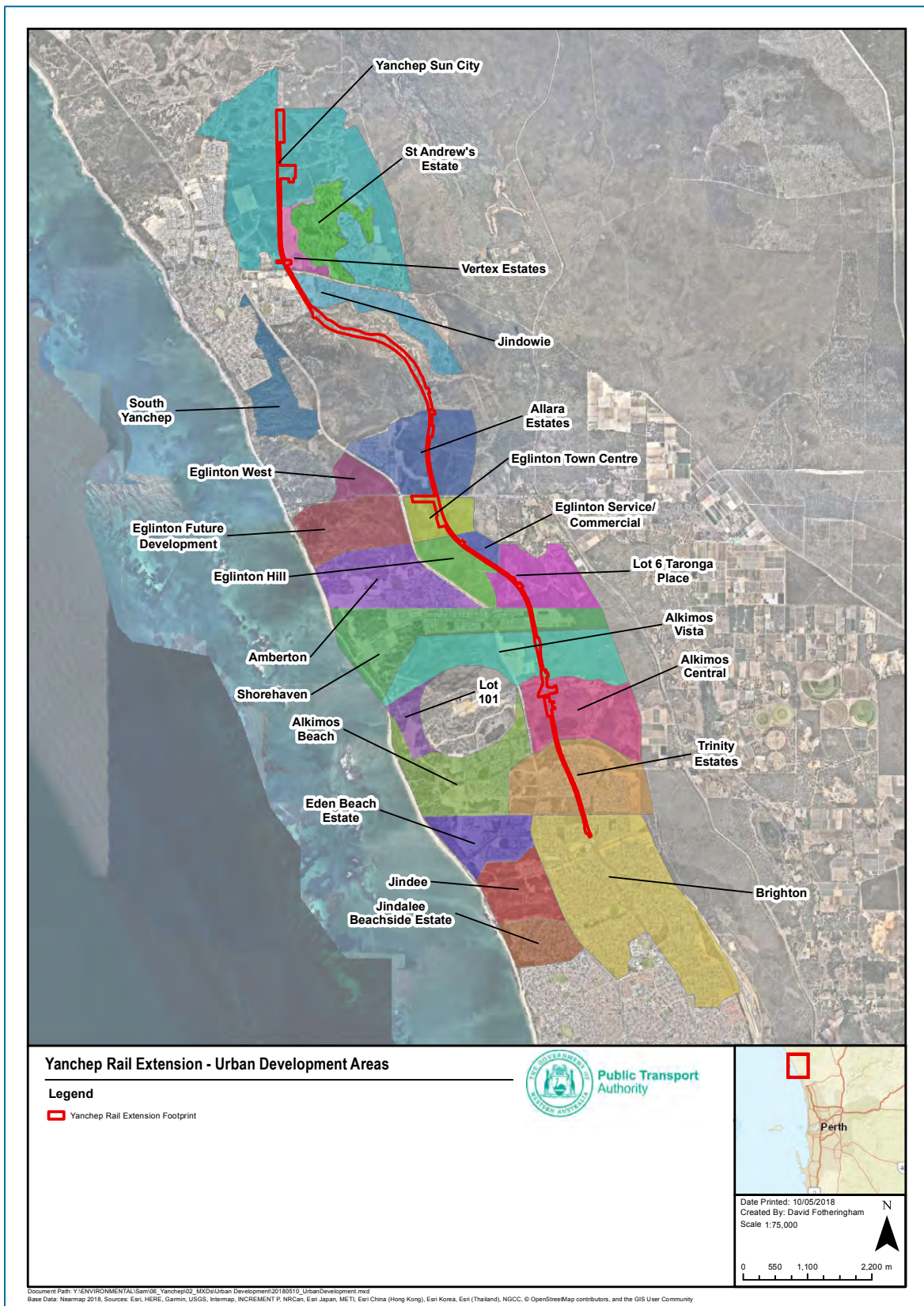


Figure 5-1 Urban Development Locations

## 6 GLOSSARY

Table 6-1 Glossary of Terms

Abbreviation	Definition
PTA	Public Transport Authority
YRE	Yanchep Rail Extension
NVMP	Noise and Vibration Management Plan
EPA	Environmental Protection Authority
CEMP	Construction Environmental Management Plans
NATA	National Association of Testing Authorities, Australia
dB	Decibel
dB(A)	A-weighted decibel level
$L_{Aeq}$	Average A-weighted noise energy during a measurement period
$L_{Aeq (Day)}$	Logarithmic average of the hourly $L_{Aeq}$ levels from 6.00 am to 10.00 pm on the same day.
$L_{Aeq (Night)}$	Logarithmic average of the hourly $L_{Aeq}$ levels from 10.00 p.m. to 6.00 a.m. the same day.
Hz	Hertz
$Kg/m^2$	Kilograms per metre squared
CAR	Compliance Assessment Report
CEO	Chief Executive Officer
EMP	Environmental Management Plan
OEPA	Office of the Environmental Protection Authority

## 7 REFERENCES

Lloyd George Acoustics. 2018. Ref:17074053-01. Transportation Noise & Vibration Assessment: METRONET -Yanchep Rail Extension

Herring Storer Acoustics. 2012. Ref: 15438-1-12160. Northern Rail Extension: Romeo Road to Yanchep - Ground Vibration Assessment

Australian Standard AS 2670.2-1990: Evaluation of human exposure to whole body vibration - Part 2: Continuous and shock induced vibration in buildings (1 to 80 Hz)

State Planning Policy 5.4: Road and Rail Transport Noise and Freight Considerations in Land Use Planning

Environmental Protection (Noise) Regulations 1997.