# Document Control

<table>
<thead>
<tr>
<th>Revision Number</th>
<th>Revision Date</th>
<th>Author</th>
<th>Approver</th>
<th>Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4 Dec 2018</td>
<td>Paul West</td>
<td>Martine Scheltema</td>
<td>[Signature]</td>
</tr>
<tr>
<td>0</td>
<td>12 Dec 2018</td>
<td>Paul West</td>
<td>Martine Scheltema</td>
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Invitation to make a submission

The Environmental Protection Authority (EPA) invites people to make a submission on the environmental review for this proposal.

The Commissioner of Main Roads Western Australia is proposing to upgrade High Street within the City of Fremantle. The Environmental Review Document (ERD) has been prepared in accordance with the EPA’s Procedures Manual (Part IV Divisions 1 and 2). The ERD is the report by the proponent on their environmental review which describes this proposal and its likely effects on the environment.

The ERD is available for a public review period of 4 weeks from 17 December 2018, closing on 18 January 2019.

Information on the proposal from the public may assist the EPA to prepare an assessment report in which it will make recommendations on the proposal to the Minister for Environment.

Why write a submission?
The EPA seeks information that will inform the EPA’s consideration of the likely effect of the proposal, if implemented, on the environment. This may include relevant new information that is not in the ERD, such as alternative courses of action or approaches.

In preparing its assessment report for the Minister for Environment, the EPA will consider the information in submissions, the proponent’s responses and other relevant information.

Submissions will be treated as public documents unless provided and received in confidence, subject to the requirements of the Freedom of Information Act 1992.

Why not join a group?
It may be worthwhile joining a group or other groups interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission
You may agree or disagree with, or comment on information in the ERD.

When making comments on specific elements in the ERD:
- Clearly state your point of view and give reasons for your conclusions.
- Reference the source of your information, where applicable.
- Suggest alternatives to improve the outcomes on the environment.

What to include in your submission
Include the following in your submission to make it easier for the EPA to consider your submission:
- Your contact details – name and address.
- Date of your submission
- Whether you want your contact details to be confidential.
- Summary of your submission, if your submission is long.
- List points so that issues raised are clear, preferably by environmental factor.
- Refer each point to the page, section and if possible, paragraph of the ERD.
- Attach any reference material, if applicable. Make sure your information is accurate.
The closing date for public submissions is:


The EPA prefers submissions to be made electronically via the EPA’s Consultation Hub at https://consultation.epa.wa.gov.au.

Alternatively submissions can be:
- posted to: Chairman, Environmental Protection Authority, Locked Bag 33, Cloisters Square WA 6850, or
- delivered to: the Environmental Protection Authority, Level 4, The Atrium, 168 St Georges Terrace, Perth 6000.

If you have any questions on how to make a submission, please contact the EPA Services at the Department of Water and Environmental Regulation on 6364 7000.
### SCOPING CHECKLIST

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<tr>
<th>Task No.</th>
<th>Required work</th>
<th>Section</th>
</tr>
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<tbody>
<tr>
<td><strong>Terrestrial Fauna</strong></td>
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</tr>
<tr>
<td>1</td>
<td>Undertake surveys for terrestrial fauna and fauna habitat within the impact area and surrounds in accordance with relevant policy/guidelines. The surveys to be undertaken by suitably qualified and experienced environmental practitioners.</td>
<td>S 4.2.3.2</td>
</tr>
<tr>
<td>2</td>
<td>Describe by text and mapping the terrestrial fauna values recorded by the surveys within the impact area and surrounds.</td>
<td>S 4.2.3.2, S 4.2.3.3, Figure 7, Figure 8</td>
</tr>
<tr>
<td>3</td>
<td>Describe by text and mapping the expected environmental effects of the Proposal to terrestrial fauna values at a local and regional scale, including direct and indirect and cumulative effects, with particular emphasis on the fauna taxa and fauna habitats listed above, and including identification of large mature trees to be removed/retained.</td>
<td>S 4.2.3.2, S 4.2.4, Figure 7, Figure 8</td>
</tr>
<tr>
<td>4</td>
<td>Provide an assessment of the significance of the potential environmental effects to terrestrial fauna values. Consideration will be given to the EPA’s objective for terrestrial fauna in relation to the representation, diversity, viability and ecological function of the identified environmental values at a local and regional scale.</td>
<td>S 4.2.3.2, S 4.2.5, S 4.2.7</td>
</tr>
<tr>
<td>5</td>
<td>Demonstrate the anticipated impacts (actual footprint of the Proposal), particularly which large mature tuart trees and habitat trees for Black Cockatoos will be cleared, within the development envelope. It will also be demonstrated which mature trees will be retained.</td>
<td>S 4.2.4, S 4.2.7, Figure 7, Figure 8</td>
</tr>
<tr>
<td>6</td>
<td>Outline how the ‘Mitigation Hierarchy’ (avoid, minimise, rehabilitate) has been applied to the Proposal for the potential effects to terrestrial fauna values</td>
<td>S 4.2.6</td>
</tr>
<tr>
<td>7</td>
<td>Describe the management, mitigation and monitoring in relation to potential environmental effects and that the application of environmental offsets</td>
<td>S 4.2.6, S 6</td>
</tr>
<tr>
<td>8</td>
<td>Describe the proposed management and/or monitoring proposed in relation to the potential environmental effects</td>
<td>S 4.2.6</td>
</tr>
<tr>
<td>9</td>
<td>Consider the application of environmental offsets for any significant environmental effects to terrestrial fauna values (after applying the Mitigation Hierarchy), having regard to relevant policy/guidance on the application of environmental offsets, and if appropriate, provide an outline of any proposed environmental offsets to be applied.</td>
<td>S 6</td>
</tr>
<tr>
<td>10</td>
<td>Include copies of reports and spatial data relevant to the Proposal and the surveys.</td>
<td>Appendix 3 and to be provided</td>
</tr>
<tr>
<td><strong>Air Quality</strong></td>
<td></td>
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<tr>
<td>11</td>
<td>Identify the appropriate air quality criteria and guidelines applicable to this assessment.</td>
<td>S 4.3.2.3</td>
</tr>
<tr>
<td>12</td>
<td>Investigate the existing environment including topography, meteorology, background air quality and sensitive receptors.</td>
<td>S 4.3.3.1</td>
</tr>
<tr>
<td>13</td>
<td>Outline how the ‘Mitigation Hierarchy’ (avoid, minimise, rehabilitate) has been applied to the Proposal for the potential effects to air quality.</td>
<td>S 4.3.6</td>
</tr>
<tr>
<td>14</td>
<td>Outline and justifying the emission sources from the project, including traffic volume projections and associated road network and vehicle emission rates.</td>
<td>S 4.3.5.1</td>
</tr>
<tr>
<td>15</td>
<td>Describe dispersion modelling undertaken for the assessment of predicted pollution.</td>
<td>S 4.3.5.2</td>
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</tbody>
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local air quality impacts from the project during operation.

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<tbody>
<tr>
<td>16</td>
<td>Describe the expected environmental effects. This will include written text and/or tables, as appropriate.</td>
</tr>
<tr>
<td>17</td>
<td>Expand/update the GHD High Street Fremantle Upgrade Project Air Assessment to include previous measurements of air quality pollutants by the Department of Water and Environmental Regulation on the corner of Canning and Stirling Highways in 2007/2008.</td>
</tr>
<tr>
<td>18</td>
<td>Expand/update the GHD High Street Fremantle Upgrade Project Air Assessment to clarify the assumptions on the NO₂/NOₓ ratio and the use of meteorological data from a different site than South Lake.</td>
</tr>
<tr>
<td>19</td>
<td>Assess the significance of the potential environmental effects to air quality. Consideration will be given to the EPA’s objective for air quality.</td>
</tr>
<tr>
<td>20</td>
<td>Describe the proposed management and/or monitoring proposed in relation to the potential environmental effects. Provide management and/or monitoring plans, if appropriate (to be included as an Appendix).</td>
</tr>
<tr>
<td>21</td>
<td>Provide information in the Air Quality study on the raw data.</td>
</tr>
<tr>
<td>22</td>
<td>Within the Air Quality study, discuss and explain suitability of the model assumptions.</td>
</tr>
<tr>
<td>23</td>
<td>Provide meteorological and model output files.</td>
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</table>

### Social Surroundings

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<tbody>
<tr>
<td>24</td>
<td>Describe the road traffic noise model, which was based on existing and future predicted traffic flows, that was developed to predict noise levels for a number of scenarios.</td>
</tr>
<tr>
<td>25</td>
<td>Document the noise monitoring along the proposed alignment to determine ambient noise levels in areas of noise sensitive receptors.</td>
</tr>
<tr>
<td>26</td>
<td>Assessing of noise monitoring data against relevant criteria.</td>
</tr>
<tr>
<td>27</td>
<td>Outline how the ‘Mitigation Hierarchy’ (avoid, minimise, rehabilitate) has been applied to the Proposal for potential noise impacts.</td>
</tr>
<tr>
<td>28</td>
<td>Identify management and mitigation measures for noise during construction and operational phases of the proposal.</td>
</tr>
<tr>
<td>29</td>
<td>Demonstrating the potential noise impacts along the routes and the location and dimensions of the proposed noise walls to mitigate impacts.</td>
</tr>
<tr>
<td>30</td>
<td>Show the visual implications of the proposed noise walls from various points along the Proposal</td>
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<thead>
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<tbody>
<tr>
<td>S 4.3.5.2</td>
<td>Table 14</td>
</tr>
<tr>
<td>S 4.3.3.3</td>
<td>Appendix 4</td>
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<tr>
<td>Appendix 4</td>
<td>S 4.3.5.1</td>
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<td>Appendix 4</td>
<td>S 4.3.5</td>
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<td>Appendix 4</td>
<td>S 4.3.6</td>
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<td>Appendix 4</td>
<td>S 4.3.5</td>
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<tr>
<td>Appendix 4 and to be provided</td>
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<tr>
<td>S 4.4.3</td>
<td>S 4.4.5.1</td>
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<td>S 4.4.2.1</td>
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<td>S 4.4.5.2</td>
<td>S 4.4.5.3</td>
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<td>S 4.4.6</td>
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<td>S 4.4.3.1</td>
<td>S 4.4.5.3</td>
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<td>Figure 9</td>
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<td>S 2.3</td>
<td>Figure 4</td>
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<td>Figure 4</td>
<td>Figure 6</td>
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</table>
EXECUTIVE SUMMARY

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to upgrade High Street (the Proposal) within the City of Fremantle. The Proposal involves:

- Upgrade of High Street and Stirling Highway intersection with a 60m diameter dual lane roundabout with bypass and slip lanes to improve traffic operations.
- Grade separated pedestrian crossing of High Street at Montreal Street, and Stirling Highway at Forest Street.
- Wide median west of Wilkinson Street to retain mature trees along High St verge
- 1.5 km of new carriageway.
- A 1 km service road for existing properties.
- Retaining walls, noise mitigation and landscaping.

The purpose of this Environmental Review Document (ERD) is to present an environmental impact assessment of the Proposal for public review and assessment by the Environmental Protection Authority (EPA). The ERD includes a detailed impact assessment and description of proposed mitigation and management measures for the environmental factors identified in the Environmental Scoping Document.

This document has been prepared in accordance with the Environmental Impact Assessment Administrative Procedures (EPA, 2016a) and the Instructions on How to Prepare an Environmental Review Document (EPA, 2016b).

Key Components

Tables ES1 and ES2 provide a summary of the proposal and the key characteristics of the Proposal.

Table ES1: Summary of the Proposal

<table>
<thead>
<tr>
<th>Proposal title</th>
<th>High Street Upgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proponent name</td>
<td>Commissioner of Main Roads Western Australia</td>
</tr>
<tr>
<td>Short description</td>
<td>The proposal is the construction of the High Street upgrade between Stirling Highway and Carrington Street in Fremantle. The proposal consists of the construction of a roundabout at the Stirling Highway and High Street Intersection, a new westbound carriageway of High Street between Stirling Highway and Carrington Street, realignment of approaches to Stirling Highway and High Street, pedestrian crossing points, a new service road for residents north of High Street and local road realignments. The proposal also includes the installation of noise walls, drainage, lighting, electricals, utilities and associated road infrastructure.</td>
</tr>
</tbody>
</table>

Table ES2: Proposed extent of Physical Elements

<table>
<thead>
<tr>
<th>Element</th>
<th>Location</th>
<th>Proposed extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical elements</td>
<td></td>
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</tr>
<tr>
<td>Clearing and disturbance for road and intersection upgrades, drainage basins, pedestrian crossing points, noise walls and associated road infrastructure.</td>
<td>High Street between Carrington Street and Stirling Highway intersection and Stirling Highway from High Street to Marmion Street in the City of Fremantle.</td>
<td>Clearing up to 0.63 hectares of native vegetation within a 20.1 ha development envelope.</td>
</tr>
<tr>
<td>Construction of noise walls.</td>
<td>Sections of High Street between Carrington Street and Stirling Highway intersection and Stirling Highway from High Street to Marmion Street in the City of Fremantle.</td>
<td>Height of noise walls to be no more than 5 metres.</td>
</tr>
</tbody>
</table>
Project Justification

The primary purpose of this project is to improve road safety along High Street between Carrington Street and Stirling Highway and improve the intersection of Stirling Highway and High Street in order to cater for expected traffic growth to 2041.

The current layout of High Street from Carrington Street to the Stirling Highway intersection provides direct access to several local roads and driveways that creates stop-start conditions and heightened safety risks. This results in congestion and unpredictable journey times to and from Fremantle and the Fremantle Port.

The stop start conditions also result in a high number of crashes being recorded on High Street between Carrington Street and Stirling Highway. Over a five year period between 2013-2017, approximately 450 crashes occurred within the project area with 74 per cent being rear end crashes and 11 per cent right angle or right turn crashes.

The upgrade of High Street will improve road user safety and the general flow of traffic for all road users travelling into and out of Fremantle.

Impact Assessment

In its assessment of the referral, the EPA identified the following key environmental factors being relevant to the proposal:

- Terrestrial fauna.
- Air quality.
- Social surroundings.

Main Roads prepared an environmental scoping document (ESD) in accordance with EPA guidelines. A program of studies and information collection was outlined for inclusion in this ERD.

Table ES3 provides a summary of the potential impacts, the proposed mitigation measures that the predicted outcomes for the environmental factors considered in this ERD.

### Table ES3: Summary of potential impacts, proposed mitigation and outcomes

<table>
<thead>
<tr>
<th>Key Environmental Factor – Terrestrial Fauna</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>EPA objective</strong></td>
</tr>
<tr>
<td><strong>Potential impacts</strong></td>
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<tr>
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</table>
**Mitigation**

**Avoid:**
The Proposal has avoided 28 potential future breeding trees through the inclusion of a wide median to the west of Wilkinson Street.

**Minimise:**
- Steepening batter slopes to minimise footprint.
- Scope reduction from previous (2014) concept design.
- Installation of a retaining wall to minimise the clearing of native vegetation in the north eastern extent of the golf course.
- Existing disturbed areas will be utilised for storage and access. No clearing for temporary works will be permitted.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Residual Impact:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Loss of the following habitat for Carnaby's Cockatoo and Forest Red - tailed Black Cockatoo:</td>
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<tr>
<td></td>
<td>• 0.67 ha of foraging habitat, including 0.63 ha of native vegetation.</td>
</tr>
<tr>
<td></td>
<td>• 16 potential future breeding trees of a species known to support black cockatoo breeding and DBH &gt;500mm.</td>
</tr>
<tr>
<td></td>
<td>• No impact on known roosting habitat, potential suitable breeding hollows or known breeding hollows.</td>
</tr>
</tbody>
</table>

**Offset:**
None proposed.

### Key Environmental Factor – Air Quality

**EPA objective**
To maintain air quality and minimise emissions so that environmental values are protected.

**Policy and guidance**

**EPA Policy and guidance**

**Other policies and guidance**
- National Environment Protection (Ambient Air Quality) Measure.

**Potential impacts**
Potential to increase level of air pollutants at nearby sensitive receivers.

**Mitigation**

**Avoid:**
- Unable to avoid impacts from Proposal.

**Minimise:**
- Creating separation between the road traffic and sensitive receivers.
- Improving traffic flow/ reducing stop/start traffic.
- Installation of noise walls as a barrier to the dispersion of some air pollutants.

**Outcomes**

**Residual Impact:**
Ambient air quality concentrations will comfortably comply with air quality criteria.

**Offset:**
None proposed.
### Key Environmental Factor – Social Surroundings

<table>
<thead>
<tr>
<th>EPA objective</th>
<th>To protect social surroundings from significant harm.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy and guidance</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Government of Western Australia (2009). <em>State Planning Policy 5.4 – Road and rail transport noise and freight considerations in land use planning</em>.</td>
</tr>
<tr>
<td></td>
<td>• Government of Western Australia (2014). <em>Implementation guidelines for state planning policy 5.4</em>.</td>
</tr>
<tr>
<td></td>
<td>• <em>Environmental Protection (Noise) Regulations 1997</em>.</td>
</tr>
<tr>
<td>Potential impacts</td>
<td>The Proposal has the potential to adversely affect amenity through a potential increase in road traffic noise in the project area.</td>
</tr>
<tr>
<td>Mitigation</td>
<td>Avoid: Unable to avoid impacts from Proposal.</td>
</tr>
<tr>
<td></td>
<td>Minimise:</td>
</tr>
<tr>
<td></td>
<td>• Construction noise will comply with Regulation 13 of the Noise Regulations.</td>
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<tr>
<td></td>
<td>• Installation of noise walls to reduce traffic noise impacts at noise sensitive receivers.</td>
</tr>
<tr>
<td></td>
<td>• Separation of road traffic from noise sensitive receptors by moving main carriageways of High Street away from existing residential properties north of High Street.</td>
</tr>
<tr>
<td>Outcomes</td>
<td>Residual Impact:</td>
</tr>
<tr>
<td></td>
<td>• Meet the noise limit at 75% of noise sensitive receivers adjacent to the Proposal in 2041 (up from 4% for the “No Build” 2041 scenario).</td>
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<td>• Improve the traffic noise situation at all assessed sensitive receivers from the “No Build” scenario.</td>
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<td></td>
<td>Offset: None proposed.</td>
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1 INTRODUCTION

The Commissioner of Main Roads Western Australia (Main Roads) is proposing to upgrade High Street (the Proposal) within the City of Fremantle, see Figure 1.

The current layout of High Street, from Carrington Street to the Stirling Highway intersection, provides direct access to several local roads and driveways that creates stop-start conditions and heightened safety risks. This results in congestion and unpredictable journey times to and from Fremantle and the Fremantle Port.

The key features of the Proposal include:
- Constructing a 60 m diameter roundabout at the intersection of High Street and Stirling Highway.
- Constructing a new 1.5 km westbound carriageway.
- Establishing a 1 km single lane service road for residents north of High Street.
- Realigning the approaches to Stirling Highway and High Street.
- Constructing new parking bays along the service road and formalising and increasing the parking on Wilkinson Street to ease parking pressures near the Frank Gibson Park Netball Courts.
- Establishing a wide median west of Wilkinson Street to separate traffic and preserve a number of mature trees.
- Constructing grade separated pedestrian crossings of High Street and Montreal Street, and Stirling Highway and Forest Street to improve connectivity for pedestrian and cyclists accessing local schools, parks, shopping and recreation facilities.
- Constructing and installing associated road infrastructure including drainage, signs, roadside furniture, noise walls, lighting and the relocation of utilities and services.

1.1 Purpose and Scope

The purpose of this Environmental Review Document (ERD) is to present an environmental impact assessment of the Proposal for public review and assessment by the Environmental Protection Authority (EPA). The ERD includes a detailed impact assessment and description of proposed mitigation and management measures for the environmental factors identified in the Environmental Scoping Document (ESD) (Appendix 1).

This document has been prepared in accordance with the Environmental Impact Assessment Administrative Procedures (EPA, 2016a) and the Instructions on How to Prepare an Environmental Review Document (EPA, 2016b).

1.2 Proponent

The proponent for the Proposal is the Commissioner of Main Roads and formal contact details are:

<table>
<thead>
<tr>
<th>Proponent</th>
<th>Commissioner of Main Roads</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Main Roads Western Australia PO Box 6202</td>
</tr>
<tr>
<td></td>
<td>East Perth WA 6002</td>
</tr>
<tr>
<td>ABN/ACN</td>
<td>50 860 676 021</td>
</tr>
<tr>
<td>Project Key Contact</td>
<td>Gary Manning</td>
</tr>
<tr>
<td></td>
<td>Manager Project Development Planning and Technical Services Directorate</td>
</tr>
<tr>
<td></td>
<td>Main Roads Western Australia</td>
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</tbody>
</table>
1.3 Environmental Impact Assessment Process

The Proposal will be assessed under Part IV of the *Environmental Protection Act 1986* (WA) (EP Act), which is the primary legislation governing environmental protection and impact assessment in Western Australia. Division 1 of Part IV of the EP Act provides for the referral and assessment of significant and strategic proposals.

A proposed action that may have a significant impact on a matter of national environmental significance requires approval from the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The project was referred to the Department of the Environment and Energy (DotEE) under the EPBC Act on 7 October 2018. On 21 November 2018, Main Roads was advised that the Minister for the Environment determined that the proposed action is not a controlled action.

1.4 Other Approvals and Regulation

Following primary environmental approval of the Proposal under the EP Act (Part IV), no further environmental approvals will be required in order to develop and operate the Proposal.

1.4.1 Planning Approvals

The City of Fremantle (as the management body) of Reserves 6638 and 8860 has provided its consent to the excision from both reserves for the purpose of dedication, and widening of High Street.

The proposal to excise the road from Class A Reserve 6638 was advertised by the Department of Planning, Lands and Heritage (DPHL) in accordance with the requirements of the *Land Administration Act 1997* (WA) (LAA). The proposal is currently with the Minister for Lands to approve the tabling of the proposal in Parliament.

It is intended to amend Reserve 8860 at the same time as the amendment of the Class A reserve.

Tabling of the proposal to excise land form the A class reserve before both houses of Parliament is pursuant to S.42(4)(b) of the LAA. Approval of the Class A excision by Parliament allowing implementation of the proposal is pursuant to S.43(1) of the LAA. Amendments to reserves are implemented by Order under S.13 of the LAA. Dedication of the upgrade will be pursuant to S.28(1) of the LAA.

1.4.2 Decision Making Authorities

The authorities listed in Table 1 have been identified as decision-making authorities (DMAs) for the Proposal.

<table>
<thead>
<tr>
<th>Decision-making authority</th>
<th>Relevant legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minister for Lands</td>
<td><em>Land Administration Act 1997</em></td>
</tr>
<tr>
<td>Minister for Planning</td>
<td><em>Planning and Development Act 2005</em></td>
</tr>
<tr>
<td>Western Australian Planning Commission</td>
<td><em>Planning and Development Act 2005</em></td>
</tr>
<tr>
<td>Chief Executive Officer of the Department of Water and</td>
<td><em>Environmental Protection Act 1986</em></td>
</tr>
<tr>
<td>Environmental Regulation</td>
<td></td>
</tr>
<tr>
<td>City of Fremantle</td>
<td><em>Planning and Development Act 2005</em></td>
</tr>
<tr>
<td>Chief Executive Officer of the Department of Planning, Lands</td>
<td><em>Land Administration Act 1997</em></td>
</tr>
<tr>
<td>and Heritage</td>
<td></td>
</tr>
</tbody>
</table>
2 THE PROPOSAL

2.1 Background

The Proposal was referred to the EPA under section 38 of the EP Act on 8 October 2018. The EPA determined the Proposal required assessment under Part IV of the EP Act and set the level of assessment at Environmental Review Document on 6 November 2018.

No modifications have been made to the proposal since it was referred.

2.2 Justification

In 2002, the Metropolitan Freight Network Review considered options for managing freight demand, improving the sustainability of freight transport, reducing future problems and focusing government intervention to reduce the impact of freight in Western Australia. The Review produced a Six Point Plan which identified major, high priority actions to safe guard freight movement in Western Australia. The Plan included recommendations to upgrade High Street between Stirling Highway and Carrington Street in Fremantle.

In November 2007 the then Department for Planning and Infrastructure (DPI) commissioned a study to prepare a preliminary road design concept. As part of that study in 2008/2009 DPI undertook a comprehensive community consultation program to identify a preferred alignment option for the upgrade. Since taking ownership of the project in late 2011, Main Roads has collaborated with the City of Fremantle to further refine the concept design.

In 2014, a project was proposed to upgrade High Street from Carrington Street to Stirling Highway and Stirling Highway from High Street to Canning Highway. This project involved:

- The upgrade of High Street as a four lane dual carriageway.
- Realignment of the intersection of High Street and Stirling Highway, creating a continuous route between Leach Highway and Stirling Highway.
- Upgrade of the pedestrian and cyclist access along the route from Marmion Street-Stirling Highway intersection to the High Street - Carrington Street intersection, including at the major intersections.

In May 2017, the state and federal government committed funding for the High Street upgrade project.

In March 2018, a draft concept for the upgrade of High Street, between Stirling Highway and Carrington Street, was released for public comment. The adjacent residents, local community, road users and other key stakeholders were asked about their experiences travelling along High Street and their key concerns and priorities for the upgrade. Following this consultation, Main Roads prepared an updated concept to progress to the next phase of the project. The proposed upgrade has a smaller footprint than the 2014 proposal, has improved accessibility for pedestrians and cyclist and improved parking. The current design was released in a public newsletter in August 2018.

Over the five year period from 2013-2017, approximately 450 crashes occurred within the project area with 74 per cent being rear end crashes and 11 per cent right angle or right turn crashes.

The primary purpose of this project is to improve road safety along High Street between Carrington Street and Stirling Highway and improve the intersection of Stirling Highway and High Street in order to cater for expected traffic growth to 2041.

2.3 Proposal Description

The current layout of High Street from Carrington Street to the Stirling Highway intersection provides direct access to several local roads and driveways that creates stop-start conditions and heightened safety risks. This results in congestion and unpredictable journey times to and from...
Fremantle and the Fremantle Port. The upgrade of High Street will improve road user safety and the general flow of traffic for all road users travelling into and out of Fremantle.

The summary of the proposal and its key characteristics are shown in Table 2 and Table 3.

**Table 2: Summary of the proposal**

<table>
<thead>
<tr>
<th>Proposal title</th>
<th>High Street Upgrade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proponent name</td>
<td>Commissioner of Main Roads Western Australia</td>
</tr>
<tr>
<td>Short description</td>
<td>The proposal is the construction of the High Street upgrade between Stirling Highway and Carrington Street in Fremantle. The proposal consists of the construction of a roundabout at the Stirling Highway and High Street Intersection, a new westbound carriageway of High Street between Stirling Highway and Carrington Street, realignment of approaches to Stirling Highway and High Street, pedestrian crossing points, a new service road for residents north of High Street and local road realignments. The proposal also includes the installation of noise walls, drainage, lighting, electricals, utilities and associated road infrastructure.</td>
</tr>
</tbody>
</table>

**Table 3: Location and proposed extent of physical and operational elements**

<table>
<thead>
<tr>
<th>Element</th>
<th>Location</th>
<th>Proposed extent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical elements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clearing and disturbance for road and intersection upgrades, drainage basins, pedestrian crossing points, noise walls and associated road infrastructure.</td>
<td>High Street between Carrington Street and Stirling Highway intersection and Stirling Highway from High Street to Marmion Street in the City of Fremantle (Figure 2).</td>
<td>Clearing up to 0.63 hectares of native vegetation within a 20.1 ha development envelope.</td>
</tr>
<tr>
<td>Construction of noise walls.</td>
<td>Sections of High Street between Carrington Street and Stirling Highway intersection and Stirling Highway from High Street to Marmion Street in the City of Fremantle (Figure 2).</td>
<td>Height of noise walls to be no more than 5 metres.</td>
</tr>
</tbody>
</table>

The development envelope for the Proposal is shown in Figure 2 and the conceptual design is shown in Figure 3, with a number of trees within the development envelope to be retained.

Indicative cross sections that show the service road, noise wall, carriageways and medians at three locations along the proposal are provided in Figure 4.

A large roundabout approximately 60m in diameter will be constructed at the intersection of High Street and Stirling Highway. The roundabout will incorporate a feature treatment using both hard landscaping such as feature gravels or brick paving as well as planting to ensure it provides a strong way-finding marker on the journey to and from Fremantle Port, Fremantle and the surrounding area. A conceptual representation of the feature treatment of the roundabout is provided in Figure 5.

The proposal will incorporate noise walls. The noise walls perform the important function of buffering adjacent and neighbouring residential areas from noise and will be designed to contribute positively to the visual experience. While the detailed design of the noise walls is still to be completed, potential concepts have been developed (Figure 6). Where possible, planting will be undertaken to reduce the visual scale. Transparent perspex may be used on the top portion of the noise wall between the service road and High Street.
Proposed underpasses at Forrest Street and Montreal Street to improve pedestrian and cyclist connectivity.

Upgrade golf course access to two-way with left turn pocket

New bypass and slip lanes to improve traffic flow in the roundabout.

Wide 23 metre median to preserve as many mature trees as possible.

Existing golf course access to be closed.

New angled parking bays on service road and formalised parking adjacent to Wilkinson St.

LEGEND
- Land boundary owned by Main Roads
- New land boundary for High St Project
- Proposed roads
- Impacted tree
- Tree to be retained
- Underpasses

Main Roads
High Street Public Environmental Review
High Street Upgrade Proposal at Concept Design

FIGURE 3

Project No. 63-37248
Revision No. 0
Date 03/12/2018

Main Roads
High Street Public Environmental Review
High Street Upgrade Proposal at Concept Design
Indicative cross sections

West of Onslow Street

West of Wilkinson Street

West of Coode Street
Conceptual visualisation of landscaping of the roundabout
Potential noise wall design – indicative only
The project is located on High Street, 2 km east of Fremantle. The works will be conducted along High Street between Stirling Highway and Carrington Street, 0.03 Straight line kilometre (SLK) to 1.49 SLK, and the associated approaches to High Street and Stirling Highway, in the City of Fremantle (Figure 2).

The project is located in a historically disturbed urban environment. The majority of the project area is currently road reserve, surrounded by residential, recreation and commercial properties. The environment is highly modified and has undergone extensive land clearing. Past and current land uses in the surrounding region include:

- Road and road reserve.
- Residential.
- Service station.
- Golf course.
- Industrial.
- Quarry and landfill.

This section details the existing environment and impacts associated with the project.

2.3.1 Climate

The majority of the project is located in the City of Fremantle, a major port city in WA. Fremantle is characterised by a Mediterranean climate, cool wet winters and hot dry summers.

Climate data was sourced from the nearest Bureau of Meteorology station in Swanbourne, 11 km north of the project. The highest monthly average maximum temperature is 30.5°C (February), and the lowest monthly average minimum temperature is 9.7 °C (July). Swanbourne averages 730 mm of rainfall a year, with the highest rainfall in July (GHD, 2018a).

The project is 2.5 km from the coast and as such is not considered to be at significant risk of climate change events. Decreases in annual rainfall and increases in flood producing rainfall are expected (Main Roads, 2017).

2.3.2 Geology and soils

The project is located on the Swan Coastal Plain (SCP), characterised by dune ridges on limestone along the coast with an inner alluvial plain. Aeolian sand and alluvial sand are the predominant soil type, with Tamala limestone geology.

Soils within the project area are part of the Cottesloe suite and described as “low hilly landscape with shallow brown soils over limestone with much exposed limestone (Churchward and McArthur, 1980).

Acid Sulfate Soils (ASS) are naturally occurring soils containing iron sulphides. These soils are typically benign within an anaerobic environment, however they can become oxidised, resulting in acidic soil and groundwater. The resulting sulphuric acid can also break heavy metal bonds and result in groundwater contamination.

A desktop review of Landgate’s (2013) Shared Land Information Portal (SLIP) database identified the project area as having no known Acid Sulfate Soil (ASS) risk within 3 m of the natural soil surface. The Australian Soil Resource Information System (ASRIS, 2018) identified an Extremely Low Probability of Occurrence of ASS.

2.3.3 Flora and vegetation

2.3.3.1 Vegetation associations and complexes

The project is located in pre-European vegetation association 998, described as medium woodland; Tuart. A total of 18, 411.73 ha (36.2 per cent) of this vegetation association remains on the SCP (Table 4).
Table 4: Extent of vegetation association (2018)

<table>
<thead>
<tr>
<th>Pre-European Vegetation Association(s) in:</th>
<th>Pre–European Extent (ha)</th>
<th>Current Extent (ha)</th>
<th>% Remaining</th>
<th>% of Remaining in DBCA reserves</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBRA Region Swan Coastal Plain</td>
<td>1,501,221.93</td>
<td>578,997.37</td>
<td>38.57</td>
<td>38.47</td>
</tr>
<tr>
<td>Statewide Veg Assoc No. 998</td>
<td>50,867.50</td>
<td>18,411.73</td>
<td>36.20</td>
<td>48.58</td>
</tr>
<tr>
<td>IBRA region Veg Assoc No. 998 in the IBRA region</td>
<td>50,867.50</td>
<td>18,411.73</td>
<td>36.20</td>
<td>48.58</td>
</tr>
<tr>
<td>Local Government Authority City of Fremantle</td>
<td>1,891.32</td>
<td>34.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Vegetation complexes were mapped by Heddle, Loneragan and Havel (1980), which provides mapping at a finer scale than Beard (1979) based on the landforms and underlying geology. The Heddle et al (1980) mapping identified one vegetation complex within the project area, which is described as Spearwood Dunes: Cottesloe complex – central and south: Mosaic of woodland of *Eucalyptus gomphocephala* (Tuart) and open forest of *E. gomphocephala* – *E. marginata* (Jarrah) – *E. calophylla* (now *Corymbia calophylla*) (Marri); closed heath on the Limestone outcrops. The extent of the remaining vegetation complex is detailed in Table 5.

Table 5: Vegetation complexes (Heddle et al (1980) /Mattiske and Havel (2000)) within the project area

<table>
<thead>
<tr>
<th>Heddle/Mattiske Veg Complex</th>
<th>Pre–European Extent (ha)</th>
<th>2017 Vegetation Extent (ha)</th>
<th>% Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cottesloe Complex central and south</td>
<td>45,100</td>
<td>14571.31</td>
<td>32.31</td>
</tr>
</tbody>
</table>

**2.3.3.2 Vegetation type and condition**

The vegetation present in the project area is highly modified, consisting of planted trees, parkland, revegetation and scattered natives over introduced grasses and weeds. The native vegetation in the survey area has been extensively cleared to accommodate the activities associated with the golf course, road infrastructure and residential properties. The native vegetation that remains primarily occurs within the north eastern extent of the golf course, consisting of a combination of native and planted species over a predominately cleared understory.

The vegetation units identified in the development envelope included:

- Marri over Grass Trees; *Corymbia calophylla* and *Agonis flexuosa* open woodland over *Xanthorrhoea preissii* sparse shrubland over weedy grass/herbland.
- Marri and Eucalyptus spp.; *Corymbia calophylla*, *Eucalyptus marginata* and *E. gomphocephala* open woodland over weedy grass/herbland.
- Tuart; *Eucalyptus gomphocephala* open woodland over weedy grass/herbland.
- Planted; Predominately *Eucalyptus cladocalyx*, *E. robusta*, *E conferruminata* and *Corymbia citriodora* over weedy grass/herbland.

The condition of the native vegetation was rated as Degraded due to the deterioration of basic vegetation structure and weed dominance as a result of exotic plantings and clearing (GHD, 2014).
2.3.3.3 Conservation significant flora
No rare or priority flora were identified in the survey of the development envelope or considered likely to occur due to the degraded nature of the survey area and lack of suitable habitat (GHD, 2014).

2.3.3.4 Introduced flora
The project area is infested with weed species, mostly dominated by grass, daisy and pea species. A total of 64 introduced species have been recorded within and around the development envelope, including the Declared Pest Bridal Creeper (*Asparagus asparagoides*) (GHD, 2014). The limited native vegetation that remains is heavily infested with weeds. The road reserve contains a number of planted tree species that are non-native or not local to the SCP.

2.3.3.5 Dieback
Insufficient indicator species remain in the area to be able to provide an indication of Dieback status (GHD, 2014). Given the project is in an extensively disturbed area and adjacent to a golf course, the area is classified as Uninterpretable and Unprotectable from Dieback (GHD, 2014).

2.3.4 Surface water and drainage

2.3.4.1 Surface water and drainage
There are no water courses, drainage lines or wetlands are present within the project area.

The project area is situated approximately 1 km south of the Swan River, within the Swan Coastal catchment. The project is located within the Swan/Canning Estuary surface water allocation sub-areas. Stormwater runoff will be captured in drainage basins adjacent to the road and therefore will not flow offsite or towards the Swan River.

2.3.4.2 Wetlands
No geomorphic wetlands occur within the development envelope. However, the Swan River Estuary, classified as an Estuary-Waterbody, is situated approximately 1 km north of the project area.

Wetlands of International Significance are listed under the Ramsar Convention, an International treaty that covers the conservation of internationally important wetlands. The closest Ramsar wetlands are Thomsons Lake and Forrestdale Lake located approximately 11 km south southwest and 18 km southeast, respectively, from the proposed action (DotE, 2013a). The development envelope does not drain into the surface water catchment of either Ramsar wetland.

There is a man-made irrigation pond approximately 270 m from the project area (GHD, 2018a).

2.3.5 Groundwater
The project area is located in the Perth Groundwater Area, a Proclaimed groundwater area under the *Rights in Water and Irrigation Act 1914*. The project area crosses two groundwater sub-areas, the City of Fremantle South and City of Melville subareas.

The Department of Water and Environmental Regulation (DWER) (2018) Perth Groundwater Atlas database identified water depth between 21 and 57 m below ground level, and groundwater salinity ranging between 500 – 1000ppm total dissolved solids.

2.3.5.1 Public drinking water resource areas
There is no Public Drinking Water Source Areas (PDWSA) within the project area (DWER, 2018).

2.3.6 Landscaping and Public Amenity
The High Street landscape character is generally that of a straight, wide road corridor with significant mature trees and the Booyeembara Park and associated golf courses creating a 'green fringe' along its entire southern side. The northern side of the corridor is characterised by residential dwellings, broken-up mid-way along its length by Frank Gibson Park.
The High Street road corridor’s landscape character changes along its route, influenced and defined by adjoining land uses and landscape features within and outside of the study area.

The Proposal will retain as many trees as possible including:
- All fig trees along the south side of Frank Gibson Park.
- Maximising the retention of existing trees along the verge of the golf course through incorporation into a wide median where possible.

The large amenity trees to be retained and cleared within the development envelope are shown in Figure 7.

The landscaping for the proposal will incorporate species and strategies that are consistent with the City of Fremantle’s Verge Beautification Guideline, Greening Fremantle: Strategy 2020 and the Urban Forest Plan (2017). General design principles for the design of the planting are:
- Maximise vegetation retention along the corridor.
- Species selection will consider the local geology, hydrology, and habitat conditions, as well as the constraints based on the road design.
- All planting is to comply with edge setbacks, frangible zones, clear zones, and vehicle & pedestrian sightlines.
- Feature planting is to be utilised at the Stirling Highway and High Street intersection.
- Low planting at road edges, intersections, and crossings is to be implemented to accommodate the necessary sight lines and clear zones.
- Planting is to provide screening mitigation for residential properties from the visual impacts of the road and associated features within the corridor.
- Median planting is to consider maintenance access, visibility, and should be species that will not attract wildlife, in order to minimise wildlife road-kill and attracting scavenger birds.
- Sedges and other plants capable of withstanding periodic inundation from water are to be used in the bio-retention swales and associated storm-water basins.
- Where planting occurs on areas where existing road pavement or pathways has been removed, the ground and soil is to be prepared as for other planted areas.
- Use grindings from native trees removed from the site for mulch in landscaped areas.
- All bio-retention swales and drainage basins are to be planted with native riparian planting.

The landscape design concept combines the site and contextual analysis with the objectives of Main Roads WA and City of Fremantle to deliver the urban and landscape design objectives. Key features of the concept design are:
- Feature treatment at Stirling Highway/High Street intersection for including feature planting, paving and gravels to aid in way-finding and to provide a gateway treatment to Fremantle.
- Street trees and ground-cover planting is proposed along the verge of the service road between Montreal Street and Chudleigh Street.
- Underpasses at Montreal Street/High Street and Forrest Street/Stirling Highway to maintain walking and cycling connectivity for the local community.
- Maximise tree retention of locally native species and mature fig trees along Frank Gibson Park.
- Infill tree planting where appropriate within the retained trees in the median.
- Soften the road and infrastructure elements through planting of local native water-wise species where possible.
- Hard paving and treatments proposed in narrow medians and verges and hard to maintain areas.
- Incorporation of relief patterns and colours that reflect local character and theme on the noise walls.
- Implement Crime Prevention through Environmental Design concepts.

The finalisation of the landscaping design will be done in consultation with the City of Fremantle and other key stakeholders.
Main Roads
High Street Public Environmental Review

Large native and non-native trees to be retained and potentially removed
2.4 Local and Regional Context

High Street is located in Fremantle, WA approximately 14km south-east of the Perth CBD and less than 2km from the Fremantle Port.

High Street forms part of the Strategic National Road Network serving freight traffic between Fremantle Inner Harbour and the industrial areas to the south and east (including Kewdale inter-modal terminal, Kwinana and the Perth Airport). The road carries a significant level of port freight traffic mixing with the local, regional and tourist commuter traffic.

This section of road carries significant volumes of freight traffic bound for Fremantle Port, mixing with local traffic in a primarily residential area. As a result, there is congestion and increased safety risks to road users along High Street.

The intersection of High Street and Stirling Highway has had a high number of traffic accidents in the last 5 years. In May 2017, the Government of Western Australia announced funding for the upgrade of High Street between Carrington Street and Stirling Highway.

A concept for the High Street upgrade was developed in August 2018. This concept aimed to improve the capacity and efficiency of High Street and the Stirling Highway and High Street intersection. It proposed a dual carriageway with a wide median to maximise retention of the existing trees. The concept requires land from the Fremantle Public Golf Course and some residential lots around the intersection.

2.4.1 Regional Planning

2.4.1.1 Perth and Peel (Western Australian Planning Commission)

The Central Sub-regional Planning Framework aims to establish a long-term integrated planning framework for land use and infrastructure, with a focus on guiding future infill growth in the Central sub-region. The framework highlights the following:

- Area surrounding the project site is primarily urban with the Fremantle Public Golf Course and Fremantle Royal Golf Course listed as parks and reserves and the Fremantle Cemetery as Public Purpose.
- Fremantle Central City Area is highlighted as an activity centre which is a focal point for commercial and social activity and growth.
- High Street and Stirling Highways are designated as Primary Regional Roads.
- Marmion Street is proposed to be an Urban Corridor for higher-density residential development and high frequency public transport.
- Royal Fremantle Golf Club, Frank Gibson Park (Netball courts) and East Fremantle Oval form are highlighted as part of the green network (Greening Fremantle: Strategy 2020).

2.4.1.2 Westport: Port and Environ Strategy (Department of Transport)

The Westport: Port and Environ Strategy provides guidance to the Government on the planning, development and growth of the Port of Fremantle at the Inner and Outer Harbours, the required rail and road networks, and the potential for the Port of Bunbury to contribute to the handling of the growing trade task.

Initial documentation released to date highlights the following relevant information:

- High Street is a freight road as part of the existing regional freight network that services the ports. This road connects freight to the ports and also to local customers and businesses.
- Fremantle City Centre is an urban regeneration area with inner harbour and greater tourism opportunities. There is an opportunity for better city planning, better amenity, economic growth and increased supply and diversity of housing.
- There is an opportunity for the transport network between Kwinana and Fremantle to be a coordinated and integrated freight and integrated freight network. With the a vision for better infrastructure services, improved infrastructure quality, increase productivity, economic growth, and high productivity.
- The final Westport Strategy is due for release in late 2019.
2.4.2 Local Planning

2.4.2.1 Greening Fremantle: Strategy 2020, City of Fremantle
The objective of the Greening Fremantle plan is to increase the quality and distribution of green areas in the City, while improving the linkages, vegetation and quantity of flora and fauna. Relevant information for High Street upgrade is:
- Planning for future water security to identify opportunities for best available water sources for existing and new open space.
- Progressively increase tree planting across the city to achieve at least 20% canopy coverage.
- Booyeembara Park is a nature reserve under the management of the City.
- A proposed green linkage along Montreal Street for regional biodiversity, to increase habitats for native fauna, encourage their movements between green spaces and increase and improve biodiversity areas.

The Proposal’s Urban and Landscaping Design has been developed in consultation with the City of Fremantle and will incorporate species and strategies from the Greening Fremantle: Strategy 2020.

2.4.2.2 Urban Forest Plan, City of Fremantle 2017
The vision of the Urban Forest Plan is
To protect the existing green spaces and trees and progressively grow and diversify the City’s tree population for adaptive climate management and amenity; to collaborate effectively to plant, plan design and sustainably fund programs to create a resilient urban forest.

High Street is located in Area 3: East in the plan. Relevant information from the plan is as follows:
- Area 3 has the largest green area with Booyeembara Park, the Fremantle Public Golf Course and Royal Fremantle Golf Course. This green area has been classified as an area for priority conservation action.
- Within Area 3 there is currently 15% canopy coverage and the plan targets an increase in coverage to 21%.
- Green links are proposed along Marmion Street and Montreal Street. Currently these corridors only have a few trees and would require substantial tree planting. The Montreal Street link aligns with one of the project’s proposed underpasses.
- The plan proposes a 10 Year implementation plan with a total of 13,500 proposed trees across the City.
- Residential streets around High Street are scheduled for tree planting in 2026 and 2027.
- The plan has a species list for Area 3: East which will be used in the planting plan for the High Street upgrade project.

The Proposal’s Urban and Landscaping Design has been developed in consultation with the City of Fremantle and will incorporate species and strategies from the Urban Forest Plan.
3 STAKEHOLDER ENGAGEMENT

Stakeholder consultation has been a key component in the development of the Proposal. The overarching objectives of the stakeholder engagement program are:

- To inform stakeholders about the Proposal and its impacts to the environment and to describe the outcomes of consultation on project design.
- To establish relationships with key stakeholders that enable ongoing dialogue though implementation and regulation of the Proposal.

3.1 Key Stakeholders

Key stakeholders have been identified through Main Roads experience with road projects in the area. Key stakeholders identified to date are listed in Table 6.

Table 6: Key Stakeholders for the Proposal

<table>
<thead>
<tr>
<th>Government Agencies</th>
<th>Community, Adjacent Landowners and Industry Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department of the Environment and Energy (DotEE)</td>
<td>Royal Fremantle Golf Club</td>
</tr>
<tr>
<td>Department of Water and Environmental Regulation (EPA Services)</td>
<td>Fremantle Netball Association</td>
</tr>
<tr>
<td>Department of Planning, Lands and Heritage</td>
<td>Local community and adjacent residents</td>
</tr>
<tr>
<td>City of Fremantle</td>
<td>Fremantle Environmental Resource Network</td>
</tr>
<tr>
<td>Town of East Fremantle</td>
<td>East Fremantle Primary School</td>
</tr>
<tr>
<td>City of Melville</td>
<td>Community Focus Group</td>
</tr>
<tr>
<td>Metropolitan Cemeteries Board</td>
<td>Westport Taskforce</td>
</tr>
<tr>
<td>Fremantle Ports</td>
<td>WA Road Transport Association</td>
</tr>
<tr>
<td>LandCorp</td>
<td>WA Freight and Logistics Council</td>
</tr>
<tr>
<td>Public Transport Authority</td>
<td></td>
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<tr>
<td>Department of Transport</td>
<td></td>
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<tr>
<td>Department of Biodiversity, Conservation and Attractions</td>
<td></td>
</tr>
<tr>
<td>Western Australian Planning Commission</td>
<td></td>
</tr>
</tbody>
</table>

3.2 Stakeholder Consultation

Main Roads developed a Communication and Stakeholder Engagement Strategy to guide stakeholder consultation.

The project has been the subject of extensive community consultation, which is detailed in Table 7.

Table 7: Stakeholder consultation undertaken in relation to the High Street Upgrade proposal.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Date</th>
<th>Issues/topics raised</th>
<th>Proponent response/outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Impacts Committee</td>
<td>2002</td>
<td>It was recommended that works be undertaken to resolve traffic related problems and the high volumes of freight on High Street as a high priority, to</td>
<td>The Local Impacts Committee was set up by the Minister for Planning and Infrastructure.</td>
</tr>
<tr>
<td>Department of Planning</td>
<td>2008</td>
<td>Ensure local community was properly consulted on the proposal.</td>
<td>The Department of Planning commenced the community consultation process and engaged with the community and key stakeholders via letters, newspaper notices, information flyers, a website and community workshops. The first of two community workshops was held in May and the Department of Planning presented five upgrade options for discussion and feedback.</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------</td>
<td>----------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Department of Planning</td>
<td>2009</td>
<td>Ensure local community was properly consulted on options.</td>
<td>The Department of Planning held the second community workshop to discuss the shortlisted three preliminary road upgrading options (refined from five) for discussion and feedback.</td>
</tr>
<tr>
<td>Department of Planning</td>
<td>2009</td>
<td>Ensure local community was properly consulted on options.</td>
<td>A Consultation Report was prepared for the Department of Planning for the Project. The document provides a summary of the consultation undertaken between September 2007 and August 2009 to inform the development of the road design and upgrade along High Street, Fremantle.</td>
</tr>
<tr>
<td>Local Impacts Committee</td>
<td>2009</td>
<td>A range of issues were identified by many stakeholders, including retaining as many trees as possible.</td>
<td>Representatives from the City of Fremantle, Elected Members, the local community, and other key stakeholders worked through design constraints to develop a concept design that was most acceptable to all parties. Several design options were investigated at the time.</td>
</tr>
<tr>
<td>City of Fremantle</td>
<td>March to July 2012</td>
<td>Review of options</td>
<td>Three Project Alignment Workshops were held with City of Fremantle.</td>
</tr>
<tr>
<td>City of Fremantle</td>
<td>July 2012 to July 2013</td>
<td>Review of options</td>
<td>Regular updates to the City of Fremantle and Elected Members on design developments.</td>
</tr>
<tr>
<td>City of Fremantle</td>
<td>September 2013</td>
<td>Review of options</td>
<td>Presentation of concept to full Council (Elected Members and Officers). In principle support of a concept design ready for stakeholder and community consultation.</td>
</tr>
<tr>
<td>Stakeholder Advisory Group: WA Freight and Logistics Council, WA Road Transport Association, Metropolitan Cemeteries Board, City of Fremantle, City of Melville, Town of East Fremantle, Department of Lands, Planning and Heritage</td>
<td>2012 – 2014</td>
<td>Address transportation related issues</td>
<td>These key stakeholders provided representative input from their specific portfolios into relevant project matters, issues and design. Meetings also held with the Port Operations Taskforce.</td>
</tr>
<tr>
<td>Department of Transport, Public Transport Authority, Fremantle Ports, LandCorp and Main Roads.</td>
<td>Community Members and Simone McGurk, MLA for Fremantle and Greens MLC Lynn MacLaren</td>
<td>In addition, advertisements were placed in the local newspapers, and information was placed on the Main Roads website. Around 150 people attended the Session. Information on traffic safety, access and retention of trees was gathered from sessions and informed future project design.</td>
<td></td>
</tr>
<tr>
<td>Community Members and Simone McGurk, MLA for Fremantle and Greens MLC Lynn MacLaren</td>
<td>25 September 2013</td>
<td>Main Roads held a Community Information Session on 25 September 2013. Three weeks prior to the Session, letters were mailed to over 1,700 local residents, inviting them to participate in the session and nominate for the Community Focus Group. There was a high level of interest in the project from local residents and local Members of Parliament.</td>
<td></td>
</tr>
<tr>
<td>Community Focus Group</td>
<td>2013 to 2014</td>
<td>Discuss issues relating to noise wall location and retention of established trees. Main Roads established a Community Focus Group to ensure that surrounding communities had ongoing representative input into the project. The Group provided community input on specific design elements including pedestrian/cyclist access, noise mitigation and amenity walls, landscaping and public art components.</td>
<td></td>
</tr>
<tr>
<td>Office of the Environmental Protection Authority, Department of Environmental Regulation Air Quality Management Branch and Noise Branch</td>
<td>2013 to 2014</td>
<td>Met to discuss proposed noise modelling and results. Main Roads met with the then Office of the Environmental Protection Authority, Department of Environment Regulation Air Quality Management Branch and DER Noise Branch.</td>
<td></td>
</tr>
</tbody>
</table>
| City of Fremantle, Royal Fremantle Golf Club, Fremantle Public Golf Course, Fremantle Netball Association, Westport Taskforce and the Local community | 2018 | Main Roads revisited the previous planning and project development for the project in 2017 and in March 2018 released a new draft concept plan for the upgrade of High Street – Stirling Highway to Carrington Street. A targeted six week consultation program was implemented to: 
- Identify how the upgrade could meet the community’s needs as much as possible within the space, cost and operational constraints of the project. Feedback was invited from the local community, local community precinct committees for White Gum Valley and Gibson Park, businesses, road users and industry on the High Street Upgrade draft concept plan via: 
  - Surveys – Online and paper based. 
  - Community drop-in information sessions and displays inviting community to discuss the plan with the project team. 
  - Dedicated project email address. Dissemination of information occurred via a range of communication channels including: 
  - Formal State Government Media statement. |
<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Date</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Residents</td>
<td>March 2018</td>
<td>Air quality and noise pollution from the project, raised by stakeholders.</td>
</tr>
<tr>
<td>City of Fremantle - Elected Members</td>
<td>March 2018</td>
<td>Main Roads to maximise retention of trees on the existing southern verge of High Street in front of the public golf course, raised by stakeholders.</td>
</tr>
<tr>
<td>Main Roads - Sustainability</td>
<td>June 2018</td>
<td>Investigate ability to use crushed recycled concrete in construction.</td>
</tr>
<tr>
<td>Local resident</td>
<td>November 2018</td>
<td>Noise concerns raised by stakeholder.</td>
</tr>
<tr>
<td>Local residents</td>
<td>November 2018</td>
<td>Landscaping and amenity</td>
</tr>
</tbody>
</table>

The consultation program generated significant engagement and a number of key themes emerged which will be used to help refine the final concept and scope of works. Some of these included parking for netball facility, retaining large planted trees along current alignment, and inclusion of pedestrian underpasses.

Outcome of consultation provided in Appendix 2.

Appendix B details both the initial newsletter inviting community feedback, consultation summary and the updated concept plan newsletter. Community and stakeholder engagement will continue throughout the project lifecycle with the objectives to:

- Ensure a high level of stakeholder engagement and support for the project.
- Raise awareness of the project amongst a diverse range of stakeholders including the broader public.
- Develop and deliver the project in a socially sensitive manner.
- Collaborate with the City of Fremantle to ensure their needs/expectations are met.
- Encourage an innovative approach to the design and construction of the project.

A Construction Reference Group will be established in early 2019 and will continue to meet throughout construction.
4 ENVIRONMENTAL PRINCIPLES AND FACTORS

This section identifies the environmental factors relevant to the Proposal and outlines the overall assessment methodology presented in this document.

A detailed environmental impact assessment was undertaken for the following preliminary key environmental factors:
- Terrestrial fauna.
- Air quality.
- Social surroundings.

4.1 Principles

Main Roads’ consideration of the EP Act principles of environmental protection in relation to the Proposal is shown in Table 8.

Table 8: EP Act Principles

<table>
<thead>
<tr>
<th>Principle</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The precautionary principle</td>
<td></td>
</tr>
<tr>
<td>Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.</td>
<td></td>
</tr>
<tr>
<td>In application of this precautionary principle, decisions should be guided by:</td>
<td>A wide range of comprehensive desktop and field studies to assess the impact of the proposal. Studies included:</td>
</tr>
<tr>
<td>a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and</td>
<td>• Flora and vegetation.</td>
</tr>
<tr>
<td>b) an assessment of the risk-weighted consequences of various options.</td>
<td>• Terrestrial fauna.</td>
</tr>
<tr>
<td></td>
<td>• Hydrological processes</td>
</tr>
<tr>
<td></td>
<td>• Amenity (noise and vibration).</td>
</tr>
<tr>
<td></td>
<td>• Heritage (Aboriginal and European).</td>
</tr>
<tr>
<td></td>
<td>• Air quality.</td>
</tr>
<tr>
<td></td>
<td>Information gathered during these studies was used to inform the ERD and has reduced the uncertainty surrounding the prediction of impacts for the assessment.</td>
</tr>
<tr>
<td></td>
<td>Main Roads has ensured that the proposal’s design (where possible) avoids serious or irreversible damage to the environment.</td>
</tr>
<tr>
<td></td>
<td>Various studies have been undertaken since 2008.</td>
</tr>
<tr>
<td></td>
<td>As part of the alignment definition, potential physical and tenure constraints on the alignment were considered. These included topography, large trees, reserves, buildings and major infrastructure. The design for the proposal has been developed after taking into account engineering, environmental and social investigations and stakeholder consultation.</td>
</tr>
<tr>
<td></td>
<td>Impacts have been identified and described under each key environmental factor and mitigation and management measures have been proposed to ensure they are environmentally acceptable.</td>
</tr>
<tr>
<td>2. The principle of intergenerational equity</td>
<td>The proposal will ensure the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations.</td>
</tr>
<tr>
<td>3. Principles relating to improved valuation, pricing and incentive mechanisms</td>
<td>Main Roads acknowledges the need for improved valuation, pricing and incentive mechanisms and endeavours to pursue these principles when appropriate. For example, environmental factors have played a role in determining infrastructure</td>
</tr>
</tbody>
</table>
(2) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.

(3) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.

Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.

locations, with large trees to be retained as much as practicable.

The proposal design has given consideration to avoid the clearing of established trees within the urban environment.

Impacts on flora, vegetation and terrestrial fauna have been assessed and mitigation and management measures proposed.

The separation of local and commuter/commercial traffic, along with the introduction of a round-about in the upgraded road network is likely to reduce stop start traffic and associated emissions from heavy vehicles.

Main Roads accepts that the cost of the Proposal must include environmental impact mitigation, management and maintenance activities. These requirements will be incorporated into the overall Proposal costs.

4. The principle of the conservation of biological diversity and ecological integrity

Conservation of biological diversity and ecological integrity should be a fundamental consideration.

The proposal area has very limited biological diversity and ecological integrity. Main Roads has sought to preserve as much of the remnant biodiversity as possible by establishing a wide median to retain as many large trees as practicable.

5. The principle of waste minimisation

All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment.

The upgrade of High Street makes use of existing road formation.

Utilising cut and fill principles to minimise external fill requirements.

Consideration of otherwise waste materials such as crushed concrete in road construction.

The design for the Proposal includes drainage design to minimise the discharge of contaminated water into the environment.

Management strategies will be implemented to ensure that the generation of waste during the construction phase is minimised. All activities shall be carried out with the principles of cleaner production and waste minimisation.
4.2 Terrestrial Fauna

Terrestrial fauna was identified as an environmental factor relevant to the Proposal in the Environmental Scoping Document. The Proposal area and its surrounds contain a low diversity of native fauna taxa due to the limited fauna habitat, however the fauna recorded included taxa of listed conservation significance. Up to 0.63 ha of native vegetation that may provide habitat to native fauna taxa will require clearing to enable implementation of the Proposal.

The following sections provide an environmental impact assessment for this factor.

4.2.1 EPA Objective

The EPA's overarching Statement of Environmental Principles, Factors and Objectives (EPA, 2016c) lists the objective for terrestrial fauna as follows:

*To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.*

4.2.2 Policy and Guidance

The following EPA policy and guidance is relevant to this factor:


4.2.2.1 Conservation Significant Fauna

All terrestrial vertebrate native fauna in Western Australia is protected under the Biodiversity Conservation Act 2016. Specific fauna species may additionally be afforded special protection through a declaration as ‘Specially Protected Fauna’, with a similar special protection also available under the Environment Protection and Biodiversity Conservation Act 1999 (C’th) as a listed ‘Threatened Species’ of fauna.

4.2.3 Receiving Environment

4.2.3.1 Project Setting

The Proposal is located in a historically disturbed urban environment. The majority of the development envelope is currently road reserve, surrounded by residential, recreation and commercial properties. The environment is highly modified and has undergone extensive land clearing.

The vegetation present in the development envelope is highly modified, consisting of planted trees, parkland, revegetation and scattered natives over introduced grasses and weeds. The native vegetation in the survey area has been extensively cleared to accommodate the activities associated with the golf course, road infrastructure and residential properties. The native vegetation that remains primarily occurs within the north eastern extent of the golf course (Figure 7) consisting of a combination of native and planted species over a predominately cleared understory.

The development envelope has been extensively cleared and provides limited fauna habitat. Areas of native vegetation within the golf course, revegetation and street trees in the survey area would be utilised by species which tolerate urbanised environments. However, the lack of vegetation structure, diversity and micro-habitats (presence of logs, leaf litter etc.) would restrict fauna usage.
The project is located within a suburban environment in the City of Fremantle and is surrounded by residential and commercial development, and has little regional connectivity.

Locally the project is connected to the Royal Fremantle and Public Golf Course (approximately 68 ha and 16 ha, respectively). Surrounding links include Booyeembara Park (and its associated man-made water body, approximately 15 ha in total) and Fremantle Cemetery (approximately 40 ha of park lands), providing local connectivity. This creates a large parcel of park lands that the project area is a part of, suitable for numerous species (in particular birds) that have the ability to persist in such environments. Vegetation within the project area is narrow and linear and discontinuous. Clearing of this vegetation is unlikely to significantly impact local connectivity to the surrounding area.

For larger birds (e.g. Carnaby’s Cockatoo), the project will not increase the distance between patches of habitat for these species, as this patch will not be totally lost.

4.2.3.2 Studies and Survey Effort

The following project specific investigations were undertaken for the Proposal:


2013/14 Study

The fauna assessment was consistent with a level 1 assessment (reconnaissance survey) in accordance with the now superseded EPA Guidance Statement No. 56 (EPA 2004). Nomenclature follows that used by the Western Australian Museum and the DPaw NatureMap database, as it is deemed to contain the most up-to-date species information for Western Australia, with the exception of birds, which uses Christidis and Boles (2008).

The reconnaissance fauna survey of the 2013/14 Study area was conducted on foot by ecologists Glen Gaikhorst and Tony Kirkby on 10 September 2013. The survey included a fauna habitat assessment which assessed:

- Habitat structure (e.g. vegetation type, presence/absence of overstorey, midstorey, understorey, ground cover).
- Presence/absence of refuge including: fallen timber (coarse woody debris), hollow-bearing trees and stags and rocks/boulder piles, and the type and extent of each refuge.
- Presence/absence of waterways including type, extent and habitat quality within waterways.
- Land use or disturbance history.
- Location of habitat within the surrounding landscape and habitat connectivity.
- Identification of wildlife corridors within and immediately adjacent to the 2013/14 Study area.
- Evaluation of the likelihood of occurrence of listed fauna occurring within the habitat (based on presence of suitable habitat).

Opportunistic fauna searches were also conducted across the 2013/2014 study area. Opportunistic searches involved:

- Searching through microhabitats including turning over logs or rocks, turning over leaf litter and examining tree hollows and hollow logs.
- Visual and aural surveys. This accounted for many bird species potentially utilising the 2013/14 Study area.
- Searching the 2013/14 Study area for tracks, scats, bones, diggings and feeding areas for both native and feral fauna.
The 2014 survey included an assessment of Black Cockatoo habitat undertaken according to the EPBC Act Referral Guidelines for three threatened Black Cockatoo species: Carnaby’s Cockatoos (*Calyptorhynchus latirostris*), Baudin’s Black Cockatoo (*Calyptorhynchus baudinii*) and Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksii subsp. naso*) (DotE 2012). Information collected during the field survey included:

- Identification of foraging habitat: the location and extent of suitable Black Cockatoo foraging habitat was identified and mapped for the 2013/14 Study area, based on the vegetation associations and presence/absence of known foraging species. During the field surveys any direct or indirect evidence of foraging by cockatoos was recorded.

- Identification of potential breeding and roosting habitat: suitable breeding habitat for Black Cockatoos is defined by DotE (2012) as trees of species known to support breeding within the range of the species which either have a suitable nest hollow or are of a suitable diameter at breast height (DBH) to develop a nest hollow. For most tree species, suitable DBH is 500 mm (DotE 2012). Potential breeding trees are those that have hollow suitable at this time for breeding to occur. The location of all suitable trees (those with DBH>500 and potential breeding) was recorded in the 2013/14 Study area and is referred to as ‘Significant Trees’. Additionally, details of tree species and number of hollows observed, evidence of use and any other significant observations were recorded for each tree.

- Opportunistic observations (both visual and aural) for the presence of Black Cockatoos within the 2013/14 Study area and surrounding region were also noted during the 2014 survey.

- The above information was used to map and calculate the amount of foraging habitat, potential breeding habitat and roost sites within the 2013/14 Study area.

**2018 Study**

An assessment for Black Cockatoo habitat within the survey area was completed between 26 June and 2 July 2018 (Appendix 3). The assessments were undertaken by Glen Gaikhorst and Madi Roberts, with Tony Kirkby visiting the site on 28 June to assess any potential hollows identified as potentially suitable for Black Cockatoo use. The assessment involved visual and aural assessment of the survey area to identify breeding habitat (presence/absence of actual and potential breeding trees), foraging habitat, current activity, roosting area and any other signs of use by Black Cockatoos. The large hollows identified within the survey area were investigated further by Tony Kirkby on 9 July 2018 with the use of a pole camera.

For the purpose of this assessment, the DotE (2012) Black Cockatoo referral guidelines were used to define breeding, foraging and roosting habitat. Large medium and small hollows were defined as:

- **Large** = a hollow with an entrance of 12 cm or greater.
- **Medium** = a hollow with an entrance of approximately 8 to 12 cm.
- **Small** = a hollow up to 5 cm.

A combination of factors are used to determine if a hollow is potentially suitable for Black Cockatoo or utilised in the past. Some of these factors included chews on and around the hollow entrance, presence of other species, bees, angle and position of hollow and height from ground.

**Summary of Methodology**

As outlined within the fauna survey documents, the fauna surveys were undertaken by suitably qualified and experienced environmental practitioners, and in accordance with the policy/guidance identified in Section 4.2.2.

Specifically to note for the GHD (2018b) fauna survey, the survey was specifically targeted towards the identification of the avian fauna taxa *Calyptorhynchus latirostris* (Carnaby’s Cockatoo) and *Calyptorhynchus banksia subsp. naso* (Forest Red-tailed Black Cockatoo); both being taxa being declared as ‘Specially Protected Fauna’ under the *Wildlife Conservation Act 1950* (WA) (to be replaced by *Biodiversity Conservation Act 2016* (WA) on 1 January 2018).

the appropriate use of targeted surveys (in lieu of, or after, a broader comprehensive survey such as in GHD 2014) to identify the faunal assemblage and assess the potential environmental effects of a Proposal relevant to the complexity and the vegetation and habitats which exist.

4.2.3.3 Existing Environmental Value

The Proposal area and surrounds has been extensively cleared within the urban setting; such that it provides only limited fauna habitat. Whilst having a tree overstorey, limited mid-storey and understorey structure consisting predominantly of a mowed grass road verge and mowed grassed golf course has resulted in a general lack of vegetation structure, diversity and micro-habitats (presence of logs, leaf litter etc.) for use by native fauna.

The majority of the suburban verge trees consist of planted non-Western Australian taxa. The scattered native Tuart, Jarrah and Marri provide habitat for native fauna taxa, in particular, habitat for native avian fauna.

Nil to very limited fauna habitat exists in the mid-storey and understorey structure, which consists predominantly of a mowed grass road verge and mowed grassed golf course (i.e. degraded) within which the overstorey trees are situated, such that these areas do not provide suitable habitats for other fauna taxa of conservation significance.

Both native (to WA), Australian and introduced plant species were recorded within the development envelope. Native species recorded in the survey are primarily Tuarts, Jarrah and Marri of various ages and structure, some of which have hollows suitable for bird breeding. Galahs, Rainbow Lorikeets and Australian Ring-necks were recorded breeding in the 2013 survey and evidence of Galah breeding was identified in the 2018 survey.

An assessment of the fauna values of the Project area and surrounds by GHD (2014) identified a total of 29 fauna taxa, comprising 23 native fauna taxa and 6 introduced fauna taxa, see Table 9. The majority of the fauna taxa were avian fauna (27 taxa). Generally, the Project area and surrounds was identified as having a poor fauna diversity, being a reflection of the limited fauna habitat available.

Table 9: Fauna species recorded within the 2013/2014 Study area

<table>
<thead>
<tr>
<th>Family</th>
<th>Taxon</th>
<th>Common Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acanthizidae</td>
<td>Acanthiza chrysorrhoa</td>
<td>Yellow-rumped Thornbill</td>
</tr>
<tr>
<td>Acanthizidae</td>
<td>Smicrornis brevirostris occidentalis</td>
<td>Weebill</td>
</tr>
<tr>
<td>Accipitridae</td>
<td>Haliaenetus sphenurus</td>
<td>Whistling Kite</td>
</tr>
<tr>
<td>Anatidae</td>
<td>Anas superciliosa</td>
<td>Pacific Black Duck</td>
</tr>
<tr>
<td>Anatidae</td>
<td>Chenonetta jubata</td>
<td>Wood Duck</td>
</tr>
<tr>
<td>Cacatuidae</td>
<td>Eolophus roseicapilla</td>
<td>Galah</td>
</tr>
<tr>
<td>Cacatuidae</td>
<td>Cacatua sanguinea</td>
<td>Little Corella</td>
</tr>
<tr>
<td>Cacatuidae</td>
<td>Calyptorhynchus latirostris</td>
<td>Carnaby's Cockatoo</td>
</tr>
<tr>
<td>Campephagidae</td>
<td>Coracina novaehollandiae</td>
<td>Black-faced Cuckoo-shrike</td>
</tr>
<tr>
<td>Columbidae</td>
<td>Columba livia</td>
<td>Feral Pigeon</td>
</tr>
<tr>
<td>Columbidae</td>
<td>Streptopelia chinensis</td>
<td>Spotted Dove</td>
</tr>
<tr>
<td>Corvidae</td>
<td>Corvus coronoides perplexus</td>
<td>Australian Raven</td>
</tr>
<tr>
<td>Cracticidae</td>
<td>Cracticus tibicen dorsalis</td>
<td>Australian Magpie</td>
</tr>
<tr>
<td>Cracticidae</td>
<td>Cracticus torquatus</td>
<td>Grey Butcherbird</td>
</tr>
<tr>
<td>Dicruridae</td>
<td>Grallina cyanoleuca</td>
<td>Magpie-lark</td>
</tr>
<tr>
<td>Dicruridae</td>
<td>Rhipidura leucophrys leucophrys</td>
<td>Willie Wagtail</td>
</tr>
<tr>
<td>Halcyonidae</td>
<td>Dacelo novaeguineae</td>
<td>Laughing Kookaburra</td>
</tr>
<tr>
<td>Hirundinidae</td>
<td>Hirundo neoxena</td>
<td>Welcome Swallow</td>
</tr>
<tr>
<td>Meliphagidae</td>
<td>Phylidonyris novaehollandiae</td>
<td>New Holland Honeysater</td>
</tr>
<tr>
<td>Meliphagidae</td>
<td>Anthochaera carunculata</td>
<td>Red Wattlebird</td>
</tr>
<tr>
<td>Meliphagidae</td>
<td>Anthochaera lunulata</td>
<td>Little Wattlebird</td>
</tr>
<tr>
<td>Meliphagidae</td>
<td>Lichenostomus virescens virescens</td>
<td>Singing Honeyeater</td>
</tr>
<tr>
<td>Meliphagidae</td>
<td>Lichmera indistincta</td>
<td>Brown Honeyeater</td>
</tr>
<tr>
<td>Pardalotidae</td>
<td>Pardalotus striatus</td>
<td>Striated Pardelote</td>
</tr>
</tbody>
</table>
Psittacidae  |  Platycercus zonarius semitorquatus | Twenty-eight Parrot
Psittacidae  |  Trichoglossus haematodus | Rainbow Lorikeet
Threskiornithidae  |  Threskiornis molucca | Australian White Ibis

**Mammals**

<table>
<thead>
<tr>
<th>Order</th>
<th>Genus</th>
<th>Species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canidae</td>
<td>Vulpes vulpes</td>
<td>Red Fox</td>
</tr>
<tr>
<td>Canidae</td>
<td>Canis lupus</td>
<td>Domestic Dog</td>
</tr>
</tbody>
</table>

The proposal occurs within the range of *Calyptorhynchus latirostris* (Carnaby’s Cockatoo) and *Calyptorhynchus banksia ssp. naso* (Forest Red-tailed Black Cockatoo). Both taxa have been declared as ‘Specially Protected Fauna’ under the *Wildlife Conservation Act 1950* (WA).

Carnaby’s Cockatoos (Endangered) and Forest Red-tailed Black Cockatoos (Vulnerable) are also both listed under the *Environment Protection and Biodiversity Conservation Act 1999* (C’th) (EPBC Act).

**Carnaby’s Cockatoo (Calyptorhynchus latirostris)**

Carnaby’s Cockatoo is listed as Endangered under the EPBC Act and Schedule 1 under the WC Act. The species is endemic to the south-west of Western Australia. Its range and abundance has significantly reduced due to land clearing for agriculture, forestry and urban development. It faces continuing threats on the SCP as important feeding habitat is cleared.

Carnaby’s Cockatoos breed in eucalypt woodlands between the Stirling Range and Three Springs. The Study area is located just outside the known breeding range of the Carnaby’s Cockatoos (DotE, 2012). The species nests in hollows in live or dead trees of *E. salmonophloia* (Salmon Gum), *E. wandoo* (Wandoo), Tuart, Jarrah, *E. rudis* (Flooded Gum), *E. oxophleba subsp. oxophleba* (York Gum), *E. accedens* (Powderbark), *E. diversicolor* (Karri) and Marri. Of these species, Tuart, Jarrah, and Marri were all recorded from the Study area. A number of other introduced Eucalyptus species were also recorded that have the potential to bear hollows in the future and currently have a DBH >500 millimetres (mm). The closest known breeding site to the Proposal is located approximately 25 km east of the Study area in the Darling Range (Johnstone, Johnstone and Kirby, 2011). There has been a shift in the breeding range of this species further west and south since the middle of last century. A more rapid transgression in the past 10 to 30 years has shown their range to be moving into the Jarrah Marri forests of the Darling Scarp and the Tuart forests of the SCP (Johnstone and Kirkby, 2009).

Breeding success for Carnaby’s Cockatoo is largely dependent on suitable feeding habitat adjacent to the nest site, to provide the necessary food for the survival of the chick. Breeding individuals forage no more than approximately 20km from their nesting hollows, so having sufficient foraging resources close to breeding areas (particularly within a 12km radius) is critical to its breeding success. Non-breeding birds visit the SCP (including the Perth metropolitan region) from December to July. On the SCP, important foraging species consist of *Banksia attenuata*, *B. grandis*, *B. ilicifolia*, *B. sessilis*, *B. prionotes*, Marri, Jarrah and non-native *Pinus* species (Valentine and Stock, 2008; Higgins, 1999).

**Forest Red-tailed Black Cockatoo (Calyptorhynchus banksii naso)**

The Forest Red-tailed Black Cockatoo is listed as Vulnerable under the EPBC Act. This subspecies is endemic to the south-west of Western Australia. It displays erratic breeding activity in the summer and winter seasons (Kirkby 2010). These birds primarily nest in large hollows of Marri, Jarrah, Wandoo, Bullich (*Eucalyptus megacarpa*), Tuart and Karri (Johnstone and Kirkby 2009). The diet of the Forest Red-tailed Black Cockatoo primarily consists of seeds of Marri, Jarrah, Blackbutt, Karri, Sheoak (*Allocasuarina fraseriana*), Snottygobble (*Persoonia longifolia*) and, in recent times, the seeds of Cape Lilac (Johnstone and Kirkby 2009).

**Black Cockatoo Habitat**

**Breeding Habitat**

In total, 58 native Eucalyptus trees (Tuart, Marri, Jarrah and Flooded Gum) were recorded in the development envelope, having a DBH > 500 mm (future potential breeding tree) (Figure 8a). An additional four non-native (to WA) Eucalypt (Sugar Gum) trees with hollows were recorded. Small, medium and large hollows were inspected via ground assessment.
From ground inspection there were four hollows that appeared large enough for use by Black Cockatoo, and had evidence of being previously worked (i.e. chews present). Pole camera inspections of the four large hollows found only one hollow potentially suitable for Black Cockatoo use. The tree identified is outside the project area and will not be impacted.

The development envelop is not within the modelled breeding distribution for Carnaby’s Cockatoo (DotEE 2017).

Forest Red-tailed Black Cockatoos are known to breed in this locality. Forest Red-tailed Black Cockatoos have been recently recorded breeding in Murdoch University land in artificial hollows. Forest Red-tailed Black Cockatoos breed in all months (mainly spring and autumn) and were breeding at the time of the 2018 survey.

**Foraging Habitat**

Foraging or feeding is identified by remnants of husks, cones or nuts on the ground. In total, 9 GPS foraging points were recorded in the development envelope. All foraging habitat in the development envelope is mapped and presented in Figure 8b.

Feeding evidence was recorded across the development envelope predominantly where Marri and Jarrah were present. Marri and Jarrah feeding appeared mainly by Forest Red-tailed Black Cockatoo, however some Marri appeared to be utilised by Carnaby’s Cockatoo.

During the 2014 survey, a total of 0.98 ha of foraging habitat was recorded in the development envelope (consisting of native and non-native species). Forest Red-tailed Black Cockatoos were recorded on several occasions flying over the development envelope in flocks of 2 to 6 birds. This species was also recorded feeding on Marri nuts along Stirling Highway and near the golf course. Forest Red-tailed Black Cockatoo were also recorded loafing in Swamp Mahogany near Stirling Highway.

The Royal Fremantle and Public Golf Course provide appropriate habitat and are 68 ha and 16 ha in size, respectively. Surrounding links also include Booyeembara Park and its associated man-made water body, approximately 15 ha in size, and Fremantle Cemetery (approximately 40 ha of park lands).

The preparatory work for the Perth and Peel Green Growth Plan for 3.5 million - Green Growth Plan (GGP) identified Black Cockatoo habitat remaining on the SCP based on spatial datasets. Based on this work, there is 249 ha of Carnaby’s Cockatoo and 238.3 ha of Forest Red-tailed Black Cockatoos habitat present within a 5 km buffer of the development envelope. This is presented in Figures 8c and 8d.

At a regional scale there is approximately 474,000 ha of suitable Carnaby's Cockatoo habitat on the SCP (Johnston, 2013), whereas the GGP estimates this area to be 529,893 ha. The GGP estimates the Forest Red-tailed Black Cockatoos habitat on the SCP to be 205,647 ha. Figures 8e and 8f present a more regional context (i.e. approximately 20 km) of the remaining Black Cockatoo habitat in relation to the development envelope.

**Roosting Sites**

A number of trees recorded within the Study area would be considered suitable as roosting habitat. Suitable roosting habitat is identified based on the presence of suitable tall trees, close proximity to water and presence of suitable foraging habitat. The closest known roosting site is located approximately 3 km east of the Study area (Johnstone, Johnstone and Kirby 2011). No roosting sites were recorded during the field survey.
FIGURE 8

**FUTURE POTENTIAL BLACK COCKATOO BREEDING TREES**
TO BE RETAINED OR POTENTIALLY CLEARED

**FIG 8(a)**

**POTENTIAL BLACK COCKATOO FORAGING HABITAT**
TO BE CLEARED AND TO BE RETAINED

**FIG 8(b)**

**Main Roads**
High Street Public Environmental Review
Black Cockatoo potentially cleared habitats
LEGEND

- Major Road
- Development Envelope
- Project Footprint
- Forest Red-tailed Black Cockatoo habitat (GGP)

Data source: Landgate: Imagery, Roads - 20181210; GHD: Project Footprint - 20130909; Mainroads: Carnaby's cockatoo habitat (GGP), Forest Red-tailed Black Cockatoo habitat (GGP), High street study area - 20181210. Created by: bjones2

G:\61\37248\GIS\Maps\Working\PR Figures\6137248_008f_ForestRed-tailedBlackCockatooHabitatGGP_Rev0.mxd

Print date: 10 Dec 2018 - 15:22
4.2.3.4 Other Fauna Taxa

Fauna surveys undertaken in the Proposal area and surrounds (GHD 2014, 2018a) recorded 29 fauna taxa. The majority of the native fauna taxa recorded were avian fauna, largely due to the faunal habitats consisting of large trees with nil to minimal understorey/mid-storey native vegetation remaining. Accordingly, the Proposal may have the potential to affect other fauna taxa in addition to Black Cockatoos.

Such other fauna taxa are not of conservation significance due to their population sizes and broad regional distributions. In this context, the environmental effect of the Proposal to other fauna taxa is not expected to be environmentally significant, and the EPA’s objectives for the key environmental factor of ‘Terrestrial Fauna’ and can therefore met with the Proposal not expected to result in a significant detrimental effect to the representation, diversity, viability or ecological function of the other fauna taxa. Accordingly, impacts on other fauna taxa are not considered further.

4.2.4 Potential Impacts

The proposal has the potential to impact a number of fauna habitats and conservation significant fauna during the construction phase. Habitat loss due to vegetation clearing is anticipated during the construction phase.

The Proposal will be implemented within an area of 20.1 ha, comprising approximately 0.63 ha of native vegetation. Non-native vegetation will also be cleared. This vegetation provides habitat for limited native fauna taxa, including a number of fauna taxa of listed conservation significance.

Of the limited recorded terrestrial fauna values within the development envelope, the Proposal is likely to affect two conservation listed fauna, Carnaby’s Cockatoo and Red-tailed Black Cockatoo.

Due to the localised impact of vegetation clearing and the cumulative impact of the urbanisation of the Swan Coastal Plan, the habitat loss associated with the construction of the upgrade was assessed. The impact of habitat loss on conservation significant fauna at a local and regional scale is provided in Table 10.

The clearing of 0.67 ha of Black Cockatoo foraging habitat (0.63 ha of native vegetation and 0.04 ha of non-native vegetation) by the proposal represents 0.0000014 per cent of the available habitat in a bioregional context. The insignificance of this impact at a regional scale will not materially change from cumulative impacts from other proposal on the SCP.

Table 10: Local and regional context of habitat loss for conservation significant fauna

<table>
<thead>
<tr>
<th>Species</th>
<th>Habitat loss due to the proposal</th>
<th>Proportion of habitat loss at a local scale1</th>
<th>Proportion of habitat loss at a regional scale2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carnaby’s Cockatoo</td>
<td>0.67 ha foraging habitat</td>
<td>0.28%</td>
<td>0.000001%</td>
</tr>
<tr>
<td></td>
<td>0 ha Roosting habitat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16 Potential Future Breeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trees (DBH &gt;500mm.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 Potential Suitable Breeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hollows</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 Known Breeding Hollows</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest Red-tailed Black</td>
<td>0.67 ha foraging habitat</td>
<td>0.29%</td>
<td>0.000005%</td>
</tr>
<tr>
<td>Cockatoo</td>
<td>0 ha Roosting habitat</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>16 Potential Future Breeding</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trees (DBH &gt;500mm.)</td>
<td></td>
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</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hollows</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0 Known Breeding Hollows</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Local Scale represents the amount of Black Cockatoo habitat within 5 km – 239 ha (Carnaby’s Cockatoo) and 228.3 ha (Red-tailed Black Cockatoo) – Green Growth Plan 2015 (included known cumulative loss of 9.9ha within 5 km since GGP publication)

Bioregional scale represents the amount of Black Cockatoo habitat on the Swan Coastal Plain
At a local scale (i.e. within 5 km of the development envelope), there does not currently appear to be any other proposal being considered under Part IV of the EP Act by the EPA. Similarly, DWER is not assessing any native vegetation clearing permit applications within 5 km of the development envelope.

The DWER Clearing Permit Map Viewer1 identifies four amended or expired clearing permits within 5 km of the development envelope totalling 2.23 ha (1.24 ha included within the amended clearing permit).

In addition, part of clearing undertaken under Ministerial Statement 1008 (MS 1008) falls within the 5 km buffer of the Proposal. This amounts to approximately 7 ha of clearing of Black Cockatoo habitat.

A conservative approach has been applied to the cumulative assessment at a local scale by assuming the previously approved native vegetation clearing permits within 5 km of the development envelope have impacted Black Cockatoo habitat, but not been accounted for or removed from the GGP spatial dataset. The cumulative habitat loss at a local scale increases to 3.97% and 4.15% for Carnaby’s Cockatoo and Red-tailed Black Cockatoo, respectively. This is based on known cumulative loss of 9.9 ha (MS 1008 and DWER NVCP system) within 5km since GGP data was published in 2015.

4.2.5 Assessment of Impacts

The criteria used to assess significant impact for conservation significant species often refer to ‘populations’ and/or ‘important populations’ (e.g. The Commonwealth Significant impact guidelines 1.1 (DotE, 2013b)). However, these terms have not been defined for Black Cockatoos, due to the mobile and widely-distributed nature of these species, and the variation in flock compositions (e.g. between breeding and non-breeding seasons). For Black Cockatoos, it is more appropriate to consider significance in terms of impacts on habitat rather than a resident population (DotE, 2012 and DotEE, 2017).

Species recovery, as defined by the Carnaby’s Cockatoo Recovery Plan (Department of Parks and Wildlife, 2013), is dependent upon stopping the further decline in the distribution and abundance of Carnaby’s cockatoo by protecting the birds throughout their life stages and enhancing habitat critical for survival throughout their breeding and non-breeding range, ensuring that the reproductive capacity of the species remains stable or increases. Habitat critical to the survival of Carnaby’s Black Cockatoo is defined as (Department of Parks and Wildlife, 2013):

- Known breeding and nearby feeding habitat.
- Former breeding habitat that has hollows intact.
- Vegetation that provides habitat for feeding, watering and regular night roosting.

Critical habitat for Red-tailed Black Cockatoo included Marri, Karri (Eucalyptus diversicolor) and Jarrah forests, woodlands and remnants in the South-west of Western Australia receiving more than 600 mm of annual average rainfall (Department of Environment and Conservation (DEC), 2008a).

The Proposal will result in the clearing of up to 0.67 ha of foraging habitat for Black Cockatoos. Up to sixteen future potential Black Cockatoo breeding trees (DBH >500 mm) will be cleared for the project. No hollows of suitable size for Black Cockatoos will be impacted by the Proposal. No known Black Cockatoo roosting trees will be impacted by the Proposal. There are no water sources within the development envelope, and there is suitable Black Cockatoo habitat in close proximity to water bodies in the local and regional area, which would more likely be considered potential critical habitat. Habitat critical to the survival of Carnaby’s Black Cockatoo will not be directly or indirectly impacted by this Proposal. The Proposal is unlikely to impact breeding or the recovery of Carnaby's Black Cockatoo. Furthermore the habitat associated with this Proposal does not represent critical habitat for Red-tailed Black Cockatoo.

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1 https://cps.dwer.wa.gov.au/main.html%5B%7B%22xclass%22%3A%22app.map.Main%22%7D%2C%7B%22xclass%22%3A%22app.Content%22%7D%5D
The clearing associated with this Proposal equates to a negligible loss of Black Cockatoo foraging habitat at both a local and bioregional context. Even with cumulative impacts considered at the local scale, proposed clearing of native vegetation is estimated to remove approximately 1% of the mapped Cockatoo Habitat, with the Proposal having a minor contribution.

The clearing of up to 0.67 ha of foraging habitat, which will include up to sixteen future potential Black Cockatoo breeding trees will cause negligible impacts to Black Cockatoos or Black Cockatoo habitat beyond the immediate development envelope.

The Proposal will not result in fragmentation of existing habitat, with only selected trees being removed along the alignment. The surveys completed to inform this Proposal show there are 42 future potential breeding trees in the development envelope, in additional to four non-native Eucalypt trees with hollows that will be retained. The Royal Fremantle and Public Golf Course provide appropriate habitat and are 68 ha and 16 ha in size, respectively. Surrounding links also include Booyeembara Park and its associated man-made water body, approximately 15 ha in size, and Fremantle Cemetery (approximately 40 ha of park lands). Given these land uses have modified the vegetation, most of the suitable habitat associated with these areas are in addition to the remaining Black Cockatoo habitat identified by the GGP.

The influence of invasive species are sometimes important to consider when assessing the impact of a project. This Proposal involves the upgrade of an existing road primarily for road safety reasons. The vegetation within and adjacent to the project area is degraded in condition, with a predominantly cleared understory associated with weeds. The proposed action is not anticipated to contribute or cause additional invasive species to be introduced. European bees compete for hollows but are already established in the area, with bee infestations managed by the golf course as required.

The Proposal’s impacts to Black Cockatoos was assessed to determine if referral is required to DotEE under the Environment Protection and Biodiversity Conservation Act 1999. Although the assessment indicated that referral was not warranted, Main Roads referred the project to DotEE on 7 October 2018. On 21 November 2018, Main Roads was advised that the Minister for the Environment decided that the proposed action is not a controlled action.

4.2.5.1 Fauna habitat connectivity

Regional
The project is located within a suburban environment in the City of Fremantle and is surrounded by residential and commercial development, thus having little regional connectivity.

Local
Locally the project is connected to the Royal Fremantle and Public Golf Course (approximately 68 ha and 16 ha, respectively). Surrounding links include Booyeembara Park (and its associated man-made water body, approximately 15 ha in total) and Fremantle Cemetery (approximately 40 ha of park lands), providing local connectivity.

Given the scale and nature of the clearing, the Proposal will not increase the distance between patches of habitat for Black Cockatoos, as this patch will not be totally lost.

Vegetation within the project area is disturbed, narrow, linear and immediately adjacent to an existing highway. Accordingly, clearing of this vegetation will not significantly impact local connectivity to the surrounding area.

4.2.6 Mitigation

The reduction of impacts and key threatening processes in the clearing footprint has been achieved through the consideration of alternative project design options and developing management and mitigation strategies. During the project development phase, considerable attention has been given to avoid, minimise and reduce impacts on fauna and its habitat. In addition to these measures, management and mitigation has been proposed to further minimise
identified impacts on fauna from the proposed project.

Main Roads has implemented a number of measures to avoid and further reduce the impact from the proposed road upgrade to Black Cockatoos.

4.2.6.1 Avoid
A tree by tree assessment was undertaken in a workshop with the design team utilising the data obtained by the Black Cockatoo survey (GHD 2018b) and Arborist Assessment (ArborCentre 2018). Through further refinement of the design, 28 future potential breeding trees (DBH > 500mm) were avoided, reducing the number of potential breeding trees impacted from 44 trees to 16 trees. Figure 8 shows the future potential breeding trees that are to be retained and the future potential breeding trees that may be cleared by the Proposal.

4.2.6.2 Minimise
Minimisation measures include:
- Batter slopes were steepened to 1 in 6 from 1 in 12. The original design was to have a gradual slope to the natural surface, however this was steepened to retain more trees.
- The project has been simplified from the original 2014 design and will have a smaller footprint as well as a reduced clearing area.
- Incorporating a very large median to retain as many trees as possible, currently on the south side of the existing road and west of Wilkinson Street. This has resulted the majority of the large trees (within the central to western end of the project area) on the south side of the existing road being retained in the new median.
- Installation of a retaining wall to minimise the clearing of native vegetation in the north eastern extent of the golf course.
- Existing disturbed areas will be utilised for storage and access. No clearing for temporary works will be permitted.

4.2.6.3 Offset
With regard to the key environmental factor of ‘Terrestrial Fauna’, as outlined by the assessment of the environmental effect of the Proposal on terrestrial fauna, Main Roads does not consider there are any significant residual environmental effects of the Proposal to fauna values for which a consideration of environmental offsets would be necessary.

4.2.6.4 Key Management Actions
Key management actions associated with Terrestrial Fauna include:
- Mature trees identified as significant to the local streetscape will be retained where possible, particularly trees in the median.
- Trees to be retained will be clearly marked on site.
- Within 7 days before the felling of any potential Black Cockatoo breeding tree, the trees will be inspected by suitably qualified ecologist for evidence of Black Cockatoo breeding.
- If a tree is found to be supporting breeding by Black Cockatoos, the tree will be retained until a suitably qualified ecologist determines that the tree is no longer being utilised by Black Cockatoos.
- Inductions will be undertaken to ensure all contractors understand their obligations under the *Wildlife Conservation Act 1950 / Biodiversity Conservation Act 2016*.
- Any animals disturbed by the works will be allowed to leave the site before further work occurs.
- Removal of any fauna from the project area will only be undertaken by a designated and trained person.
- No native fauna (including venomous snakes) are to be impaired or killed by construction personal. If any fauna are killed as a result of works, it will be reported as an incident.
4.2.7 Predicted Outcome

The residual impacts after the implementation of the Proposal and the application of the mitigation measures outlined in Section 4.6.2 are shown in Table 11.

Table 11: Predicted environmental outcome

<table>
<thead>
<tr>
<th>Impact</th>
<th>Residual Impact after Management</th>
<th>Local/Regional Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loss of significant fauna habitat</td>
<td>Loss of 0.67 ha of Black Cockatoo foraging habitat and 16 future potential breeding trees (DBH &gt; 500mm).</td>
<td>Given the clearing of 0.67 ha of Black Cockatoo foraging habitat within a historically disturbed, highly modified urban environment, the Proposal is not expected to have a significant impact on Black Cockatoos at a local nor regional scale.</td>
</tr>
<tr>
<td></td>
<td>No hollows suitable for breeding will be impacted.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No roosting nor breeding habitat will be impacted.</td>
<td></td>
</tr>
</tbody>
</table>

Given the relatively small amount (ie less than 1 ha) of degraded vegetation to be impacted, the clearing of terrestrial fauna habitat for the Proposal, which includes 0.67ha of Black Cockatoo foraging habitat, will not significantly impact the representation, diversity, viability and ecological function of any fauna taxa.

Through the mitigation measures proposed to minimise its potential environmental impacts, the Proposal meets the EPA’s objective for the factor Terrestrial Fauna to “protect terrestrial fauna so that biological diversity and ecological integrity are maintained".
4.3 Air Quality

Air quality refers to the state of the air around us. An air pollutant is a contaminant in the air that can harm humans and/or the environment. Air pollution can adversely impact human health, particularly that of people with pre-existing respiratory conditions (such as asthma) and cardiovascular diseases, young children and the elderly. Impacts range from mild airway irritations to major organ damage and can be short or long term.

The National Environmental Protection Measure (NEPM) for ambient air quality (DotE, 2016) identifies six criteria air pollutants of concern in Australia including: particulates (as PM\textsubscript{10} and PM\textsubscript{2.5}), ozone (O\textsubscript{3}), carbon monoxide (CO), nitrogen dioxide (NO\textsubscript{2}), sulfur dioxide (SO\textsubscript{2}) and lead. The Ambient Air Quality NEPM sets air quality standards for each of these criteria pollutants.

Air quality in Perth is generally of a high standard compared with other Australian and international cities (EPA, 2015). Levels of some air pollutants in Perth have decreased significantly over the past decade. Levels of CO, NO\textsubscript{2}, SO\textsubscript{2} and lead have all declined to levels below national air quality standards, due largely to the progressive tightening of national vehicle emission and fuel standards over the past 20 years and the management of industrial, commercial and domestic sources of air pollution.

Particulates are produced by a wide range of human activities as well as natural sources. Human generated sources of particulates include motor vehicles (especially diesel-fuelled vehicles) and dust from industrial activities. Natural sources include windblown dust, pollen from plants, sea salt and bushfires.

Motor vehicles are a major source of air pollution in urban areas. Vehicle emissions are influenced by the volume of traffic in an area, vehicle speeds, the age of the vehicle fleet and traffic congestion. Increasing vehicle numbers, vehicle use and congestion all increase vehicle emissions.

The relationship between emissions and air quality is complex. How emissions are dispersed, transported and transformed depends on:

- Local climatic conditions (wind speed and direction [high wind speeds tend to dilute emissions while wind direction influences where they are transported], temperature, sunlight and rainfall).
- Topography (a flat landscape such as in Perth allows pollutants to disperse).
- Atmospheric reactions and the source of the emissions (i.e. from a point source or a diffuse source such as vehicle emissions over an urban road network).

Strategies that reduce congestion and improve network efficiency will result in a significant improvement in air pollution caused by vehicle emissions. Main Roads has undertaken a number of initiatives that contribute to reducing emissions from vehicles:

- Optimising traffic management on the Perth metropolitan road network, which will minimise emissions.
- Encouraging the use of alternative transport through a network of principal shared paths links for pedestrians and cyclists and actively supporting multi-mode transport solutions.
- Implementing a $40 million Congestion Management Program to improve travel through key congestion hot spots in Perth.
- Working closely with the Department of Transport and Public Transport Authority on the Perth Transport Plan for 3.5 million People and Beyond, which examines options for an integrated transport system of roads, river crossings, mass transit, cycling and future technologies that will promote good air quality outcomes.
- Reducing the impact of air pollution from the construction fleet on its projects by ensuring Bulk Haulage Plans consider and manage impacts on communities and encouraging contractors to use low emission plant and equipment.
4.3.1 EPA objective
The EPA's objective relating to air quality (EPA, 2016) is:
To maintain air quality and minimise emissions so that environmental values are protected.

4.3.2 Policy and Guidance
The following policy and guidance is relevant to this factor.

4.3.2.1 EPA Policy and guidance
- Environmental Protection Authority (2016g). Environmental Factor Guideline – Air Quality. Dec 2016

4.3.2.2 Other policies and guidance
- National Environment Protection (Ambient Air Quality) Measure.

4.3.2.3 Air quality criteria and guidelines
Air quality impacts are assessed by comparing monitoring results or model predictions with appropriate ambient air criteria. The criteria considered for this assessment included air related National Environment Protection Measures (NEPM) and WHO criteria.

The National Environment Protection (Ambient Air Quality) Measure (Air NEPM) was developed to provide benchmark standards for ambient air quality to allow for the adequate protection of human health and well-being. Air NEPM standards have been developed for carbon monoxide (CO), nitrogen dioxide (NO₂), photochemical oxidants (as ozone), sulphur dioxide (SO₂), lead and particulates (as PM₁₀ and PM₂.₅).

The National Environment Protection (Air Toxics) Measure (Air Toxics NEPM) provides a framework for monitoring, assessing and reporting on ambient levels of five air toxics; benzene, formaldehyde, toluene, xylenes and polycyclic aromatic hydrocarbons (PAHs), in order to facilitate the collection of information for the future development of air quality standards for these pollutants.

WHO guidelines were considered where NEPM standards were not available.

The worst case predicted concentration of each pollutant modelled is compared to the appropriate criteria at sensitive receptors.

4.3.3 Receiving environment

4.3.3.1 Project Setting
The Proposal is located in a historically disturbed urban environment. The majority of the development envelope is currently road reserve, surrounded by residential, recreation and commercial properties. The environment is highly modified and has undergone extensive land clearing.

When predicting the impact of a project, in this case a road upgrade, it is important to give consideration to the existing environment as part of the assessment. When assessing air quality impacts, important aspects include topography, meteorology, background air quality and sensitive receptors. These have all been considered and accounted for in the modelling air assessment.

Topography
The project is located in Fremantle, which lies on a series of limestone hills with the project area situated on gently undulating land. The project area includes the existing road, which is surrounded by residential properties, limited commercial buildings and recreational open spaces. There are planted vegetation for landscaping purposes located throughout the project area, with small patches of remanent native vegetation. Two golf courses are situated to the south of the project.
area (Fremantle Public Golf Course and the Royal Fremantle Golf Course) consisting of a small manmade lake, large lawn fairways and large trees.

**Meteorology**
The area is subject to a Mediterranean climate, with hot dry summers and mild wet winters, with the majority of rain falling in winter. The closest Bureau of Meteorology (BoM) weather station to the project is the Swanbourne automatic weather station (AWS; approximately 8 km north). This station records temperature, rainfall, relative humidity, wind speed and direction and has data available dating back to 1993). Meteorological data for this assessment was based on measurements taken at the BoM Swanbourne AWS. Data from 1 January 2010 to 31 December 2010 was used to produce a meteorological data file for input into AUSROADS and included:

- Hourly average air temperature, wind speed and wind direction with missing data interpolated from surrounding values.
- Wind speeds less than 0.5 m/s were allocated a nominal wind speed of 0.5 m/s.
- Stability classes were developed following the Turner method, using Perth Airport cloud cover data.

**Background Air Quality**
In order to determine the significance of potential air quality impacts from the project, baseline ambient air quality was considered. It is common practice where background monitoring is not available to use the 75th percentile from a representative location to estimate the background concentrations. DWER provides 75th percentile concentrations for all monitoring stations in the Perth air quality monitoring network. Ambient air quality is monitored at Swanbourne (approximately 8 km north of the project area) and South Lake (approximately 20 km south-west of the project area). While the only relevant parameter monitored at the Swanbourne site is NO₂, the South Lake site monitors CO, NO₂ and PM₁₀.

South Lake was considered sufficiently representative of the project area, and therefore 75th percentile concentrations from the site were adopted as background levels for CO, NO₂ and PM₁₀ for this assessment. For all other constituents a background concentration of zero was assumed.

**4.3.3.2 Studies and Survey Effort**
An air quality assessment was undertaken for the Leach Highway Fremantle Upgrade Project in 2013 (GHD, 2013), with another air quality assessment undertaken for the current Proposal undertaken in 2018 (GHD, 2018c) (Appendix 4).

The purpose of this assessment was to predict the impacts likely to occur as a result of the upgrade. The scope of the air quality assessment included:

- Constructing an air quality model with current and upgraded road design and three traffic year scenarios (out to 2041).
- Running the air quality model to estimate emissions associated with the three separate scenarios.
- A technical report that includes a discussion on potential impacts and contribution of heavy diesel vehicles.

The approach adopted for the air assessment is summarised in the following points.

- Outline of emission sources from the project, including traffic volume projections and associated road network and vehicle emission rates.
- Identification of the appropriate air quality criteria and guidelines applicable.
- Investigation of the existing environment including topography, meteorology, background air quality and sensitive receptors.
- Dispersion modelling for the assessment of predicted local air quality impacts from the Proposal. Modelling was conducted for the Proposal (including background conditions) and compared to the base scenario, which simulates the existing road design.
- The building scenarios for:
  - Existing road design (no build scenario) – year 2020
  - Upgraded road network day of opening – year 2020
- Upgraded road network 21 years after opening – year 2041.

4.3.3.2.1 Data
A range of data was used to model the projected air quality. These include (section within Air Quality Assessment (GHD (2018c) (Appendix 4)):

- Vehicle emission rates (Section 2.3 and Appendix C of GHD, 2018c).
- Vehicle traffic counts (Section 2.2 of GHD, 2018c).
- Vehicle traffic counts used to predict future traffic flow (Section 2.2 of GHD, 2018c).
- Meteorological data used for modelling (Section 4.2 of GHD, 2018c).
- Ambient monitoring data used to estimate background air quality for modelling (Section 4.3 of GHD, 2018c).
- All data related to sensitive receptors including name, location and type of sensitive receptors (Section 4.4 of GHD, 2018c).
- Fleet configuration and assumptions (Section 2.3, 5.1.3 and Appendix C of GHD, 2018c).

4.3.3.3 Other Relevant Studies
The DEC completed a study in 2007 and 2008 to gather data on selected air pollutant concentrations attributed to traffic exhaust emissions. Of particular interest to this assessment was the sampling of polycyclic aromatic hydrocarbons (PAHs) at a site located near the junction of Canning Highway and Stirling Highway, to the north of the proposed road upgrade assessed by this modelling report. Given the focus of the Perth traffic corridor study in 2007-2008, only one air pollutant is common to both assessments this being benzo(a)pyrene (BaP), a marker for PAHs.

For further information regarding the 2007 and 2008 DEC study, see Section 5.3.3 of the air quality assessment (GHD, 2018c).

4.3.4 Potential Impacts
Major vehicle pollutants include products of combustion, such as carbon monoxide (CO), particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}), oxides of nitrogen (NOx), and volatile organic compounds (VOCs). The human health effects of these air pollutants range from mild airway irritations to major organ damage. Many of the emissions from motor vehicles react together and with pollutants from other sources to form secondary pollutants, such as photochemical oxidants (ozone; O3), which can also have significant effects. The properties and effects of the six major air pollutants related to road traffic is shown in Table 12.
<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Properties</th>
<th>Vehicle Contribution</th>
<th>Effects</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>Colourless, odourless gas produced by the incomplete combustion of any carbon-based fuel</td>
<td>Motor vehicles are the principal source of CO in urban areas.</td>
<td>Exposure to high levels may result in vision impairment, reduced motor skills, poor learning ability and low birth weights.</td>
<td>Concentrations have decreased in the last decade due to tighter emission controls for light vehicles</td>
</tr>
<tr>
<td>Ozone (O₃)</td>
<td>Colourless, highly reactive gas with a distinct odour.</td>
<td>Formed by nitric oxide from combustion and volatile organic compounds from vehicles.</td>
<td>May cause irritation of the airways and minor lung function changes. Exposure associated with increased mortality and hospital admissions.</td>
<td>Concentrations have increased slightly in Perth due to higher temperatures and more sunlight during summer.</td>
</tr>
<tr>
<td>Oxides of Nitrogen (NOₓ)</td>
<td>A light brown gas and a precursor of photochemical smog.</td>
<td>Motor vehicle emissions are a major source of NO₂ in urban areas.</td>
<td>Exposure may lower immunity to respiratory infections and can cause severe lung injury.</td>
<td>Increased levels due to the number of vehicles and the age of the vehicle fleet (11 years in Perth).</td>
</tr>
<tr>
<td>Hydrocarbons (HC)</td>
<td>Hydrocarbons include all organic compounds emitted</td>
<td></td>
<td>May be toxic or carcinogenic (e.g. benzene). Important precursors of photochemical smog, may indirectly contribute to the greenhouse effect.</td>
<td></td>
</tr>
<tr>
<td>Particulate Matter</td>
<td>Airborne particles (solids and liquids) are classified by their size.</td>
<td>Human activity include combustion processes in motor vehicles.</td>
<td>Tend to settle out on surfaces, resulting in soiling and discolouration. Inhalable particles are associated with increases in respiratory illnesses.</td>
<td>Between 1992 and 1999 particulate matter has decreased in Perth.</td>
</tr>
<tr>
<td>Carbon dioxide (CO₂)</td>
<td>Carbon dioxide a major product of the combustion of all carbon containing materials.</td>
<td></td>
<td>It is considered the least harmful of the major greenhouse gases for a given volume, but is also the largest contributor to total greenhouse gases in the atmosphere.</td>
<td></td>
</tr>
</tbody>
</table>

The air assessment for the project estimates pollution generated by vehicles using projected traffic volumes and vehicle emission rates as inputs to an air dispersion model. This section outlines the new road alignment and surrounding road network projected traffic volumes and vehicle emission rates used for modelling.

During construction of the proposed project, potential emissions to air include products of fuel combustion from vehicles and equipment used in construction and transportation activities and dust and odour emissions from the construction activities. Dust is expected to be generated during construction, however this will be limited as the road will be constructed with live traffic diverted away from the lane under construction. Dust will be controlled using standard mitigation measures, such as watering trucks.
4.3.5 Assessment of Impacts

4.3.5.1 Model Input and Assumptions

NO2/NOx Ratio Assumptions
A 15 per cent NOx as NO$_2$ ratio has been used for the air quality assessment, which is considered a conservative estimate of NO$_x$ to NO$_2$ for typical vehicle fleets in Australia.

Whilst it is acknowledged that dieselisation of the fleet leads to a higher NOx as NO$_2$ ratio, as newer technology (Euro 5 and 6) diesel vehicles emit a higher proportion of NOx as NO$_2$, the conservative assumption that the vehicle fleet does not improve in emissions performance between 2020 and 2041 allows for the likely increase in the NOx to NO$_2$ ratio over time and provides for a conservative assessment of predicted ground level concentrations (glc) of NO$_2$.

Meteorological Data
Meteorological data for this assessment was primarily based on measurements taken at the BoM Swanbourne AWS. The choice of Swanbourne meteorological data was made due to the coastal location of Swanbourne being similar to the road upgrade area considered in this assessment, with Swanbourne being within 10 km of the project area. Data from 1 January 2010 to 31 December 2010 was used to produce a meteorological data file for input into AUSROADS. This model year was chosen after review of ten years of meteorological data from Swanbourne to determine a representative ‘average’ year.

This data was used for the previous study completed in 2013 as part of the Leach Highway Fremantle Upgrade Project, which was proposing a much more significant road upgrade at the time. An assessment by GHD determined the 2010 year was still representative and suitable for use for this assessment.

For further information regarding the meteorological data used, see Sections 4.2 and 5.1 of the air quality assessment (GHD, 2018c).

Vehicle emission rates
The amount of pollutant emitted from a vehicle depends on the type of vehicle (passenger, light or heavy vehicle), fuel type (petrol, diesel or LPG) and driving conditions (grade of slope, congestion and road conditions). Emissions profiles will also vary over time as new vehicle emission standards become effective. The vehicle emission rates adopted for the model have been based on various data sources, see Table 13.

Table 13: Emission rates used in the assessment

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>World Road Association (PIARC) Australian emission tables</td>
</tr>
<tr>
<td>NO</td>
<td>PIARC Australian emission tables</td>
</tr>
<tr>
<td>PM$_{10}$</td>
<td>Back calculation from PIARC Australia opacity tables</td>
</tr>
<tr>
<td>Total VOC</td>
<td>Taken as a ratio of CO. Ratio is derived from National Pollutant Inventory (NPI) VOC:CO ratios for various vehicle and fuel types</td>
</tr>
<tr>
<td>VOC constituents</td>
<td>Taken as a ratio of total VOC. Ratios are based on MOVES ratios for various vehicle and fuel types. Where a ratio is not available from MOVES, ratios are based on NPI</td>
</tr>
</tbody>
</table>

The percentage of diesel versus petrol passenger vehicles on the road was taken from the ABS Motor Vehicle Census 2017 as 22 per cent. Heavy vehicles were estimated to account for 16.4 per cent of the total vehicle traffic, with all of these assumed to be diesel. Vehicle purchases over recent years indicate that a greater percentage of diesel passenger cars are being purchased over time. However, as the ratio of diesel to petrol vehicles depend on a number of factors, this ratio is assumed to be constant across the 2020 and 2041 model scenarios. This assumption will not significantly impact the modelling result, particularly given there has been no allowance for improvements in the motor vehicle fleet over time as more stringent and newer, cleaner vehicles replace older vehicles in the fleet or addition of alternative technologies such as hybrid or electric vehicles.
Details regarding how the emission rates were derived are provided in Section 2.3 and Appendix C of the air quality assessment (GHD, 2018c).

**Fleet Configuration**

As it is difficult to predict how the fleet age may change over time, a conservative approach has been taken, where the predicted emission rates for 2020 have been used for the year 2041.

Further details on the fleet configuration and assumptions used in the model, including future road vehicle emission rates, are provided in Appendix C of the air quality assessment (GHD, 2018c).

**Sulphur Dioxide Concentrations Significance**

Sulphur dioxide is not included as a pollutant of consideration in emission estimation tables provided by PIARC. SO$_2$ vehicle emissions are primarily associated with the presence and concentration of sulphur in petrol and diesel. Sulphur levels in Australian fuels have significantly reduced since the early 2000s and are now mandated to 50 ppm and as such SO$_2$ emissions are not considered an emission of interest for this assessment as the contribution will be minimal.

**Traffic volumes**

Vehicle traffic volume projections were developed to estimate future traffic volumes.

Existing traffic volumes were taken from the Main Roads Trafficmap website.

The traffic counts come from a mix of short term samples and continuous collections from fixed infrastructure. Traffic is counted on state roads, significant local roads and cycle paths. Counts are adjusted to remove the influence of seasonal variation. All counts provide the number of vehicles travelling past a location, with some able to determine the type and speed of vehicles.

Traffic count data, including vehicle type, speed, hour of day and weekday/weekend day variations were accessed to establish the existing traffic volume and fleet characteristics from the following three sites:

- High Street west of Carrington Street.
- High Street west of Stirling Highway.
- Stirling Highway north of High Street.

Predicted traffic volumes for year 2041 were estimated based on an annual growth rate of 2.8 per cent. This is considered to be a conservative estimation, as a growth rate of 2.1 per cent per annum was observed for both 2016 and 2017 based on ABS motor vehicle census data. In order to obtain the desired day of opening (2020) and future (2041) traffic volume projection, GHD used the same growth rate of 2.8 per cent and applied this to the 2018 data.

The rationale for estimation of traffic volumes is further detailed in Section 2.2 of the air quality assessment (GHD, 2018c).

**Ambient monitoring data**

In order to determine the significance of potential air quality impacts from the project, baseline ambient air quality was used. It is common practice where background monitoring is not available to use the 75th percentile from a representative location to estimate the background concentrations.

The DWER provides 75th percentile concentrations for all monitoring stations in the Perth air quality monitoring network. The South Lake site monitors CO, NO$_2$ and PM$_{10}$.

Further details on the ambient air monitoring data and assumptions used in the model are provided in Section 4.3 of the air quality assessment (GHD, 2018c).
Sensitive Receivers

Sensitive receptors are any place where people are likely reside in a non-occupational setting. As there are a significant number of residences alongside the proposed upgrade, every second house was marked as a discrete receptor.

The AUSROADS automatic receptor generation function was also used to identify 368 automatic receptors for the no build scenario and 464 automatic receptors for the upgrade scenarios along the entire proposed road alignment at 10 m, 25 m and 50 m offsets from the road links. It is intended these will adequately represent sensitive receptors along the entirety of the road network.

Further details on the sensitive receivers, including name, location and type, used in the model are provided in Section 4.4 and Appendix B of the air quality assessment (GHD, 2018d).

4.3.5.2 Results

Vehicle emission dispersion was modelled for this air assessment using the AUSROADS dispersion model. AUSROADS is a simple line source Gaussian plume dispersion model that estimates the near road impact of vehicle emissions in relatively uncomplicated terrain. The methodology is based on the US CALINE model and is widely accepted across Australian jurisdictions.

The methodology takes one year of representative hourly meteorological data and estimates the dispersion of vehicle emissions for each hour of that year. Representative hourly meteorological data is chosen based on measurements in the area. The input data includes:

- Meteorological data
- Land use categories
- Background air quality
- Fleet characteristics, including traffic volumes and vehicle emission rates
- Sensitive receptor locations

AUSROADS was used for dispersion modelling of the predicted emissions from the project for the following scenarios:

- Scenario 1: Existing road network (no build), year 2020.
- Scenario 2: Upgraded road network day of opening, year 2020.
- Scenario 3: Upgraded road network, projected year 2041.

Each scenario was modelled for four pollutants – NO₂, CO, PM₁₀ (including PM₂.₅) and VOCs.

Although it is assumed that emission standards become more stringent and newer and cleaner vehicles replace older vehicles in the fleet, the emission factors for year 2020 were used for all three modelling scenarios. This conservative approach was adopted for the modelling to simulate the worst case scenario and compared against assessment criteria. Therefore, for the 2041 model scenario, an increase in vehicle volume rates was used and coupled with the higher 2020 emission factors.

The predicted maximum concentrations for each scenario is shown in Table 14.
Table 14: Predicted maximum concentration of air pollutants within the proposal envelope for scenarios= 1 (2020 no build), scenario 2 (2020 build) and scenario 3 (2041 build).

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Background Conc. (μg/m³)</th>
<th>Predicted Max Conc. (μg/m³)</th>
<th>Assessment criterion (μg/m³)</th>
<th>Avg. period</th>
<th>Max % of Discrete criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Discrete criterion receptor</td>
<td>Auto receptor</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Scenario 1: Existing road network 2020</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>625.2</td>
<td>654</td>
<td>769</td>
<td>11,254</td>
<td>8 hrs</td>
</tr>
<tr>
<td>NO2</td>
<td>43.1</td>
<td>48</td>
<td>70</td>
<td>247</td>
<td>1 hr</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>18.9</td>
<td>19.0</td>
<td>19.9</td>
<td>50</td>
<td>24 hrs</td>
</tr>
<tr>
<td>PM₂.₅</td>
<td>11.3</td>
<td>11.4</td>
<td>11.7</td>
<td>25</td>
<td>24 hrs</td>
</tr>
</tbody>
</table>

**Volatile Organic Compounds**

- Benzene: 0.01, 0.14, 10.5, Annual, 1.3%
- Toluene: 0.06, 0.42, 4114, 24 hrs, 0.01%
- Xylene: 0.05, 0.35, 1183, 24 hrs, 0.03%
- Formaldehyde: 0.05, 0.35, 53.6, 24 hrs, 0.65%
- Acetaldehyde: 0.11, 0.59, 2300, 24 hrs, 0.03%
- Benzo(a)pyrene: 0.000002, 0.00006, 0.0003, Annual, 20%

**Scenario 2: Upgraded road network day of opening, 2020**

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Background Conc. (μg/m³)</th>
<th>Predicted Max Conc. (μg/m³)</th>
<th>Assessment criterion (μg/m³)</th>
<th>Avg. period</th>
<th>Max % of Discrete criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Discrete criterion receptor</td>
<td>Auto receptor</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Scenario 2: Upgraded road network day of opening, 2020</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO</td>
<td>625.2</td>
<td>689</td>
<td>921</td>
<td>11,254</td>
<td>8 hrs</td>
</tr>
<tr>
<td>NO2</td>
<td>43.1</td>
<td>54</td>
<td>81</td>
<td>247</td>
<td>1 hr</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>18.9</td>
<td>19.2</td>
<td>21.2</td>
<td>50</td>
<td>24 hrs</td>
</tr>
<tr>
<td>PM₂.₅</td>
<td>11.3</td>
<td>11.4</td>
<td>12.1</td>
<td>25</td>
<td>24 hrs</td>
</tr>
</tbody>
</table>

**Volatile Organic Compounds**

- Benzene: 0.01, 0.24, 10.5, Annual, 2%
- Toluene: 0.12, 0.90, 4114, 24 hrs, 0.02%
- Xylene: 0.10, 0.75, 1183, 24 hrs, 0.06%
- Formaldehyde: 0.10, 0.75, 53.6, 24 hrs, 1%
- Acetaldehyde: 0.26, 1, 2300, 24 hrs, 0.05%
- Benzo(a)pyrene: 0.000003, 0.00009, 0.0003, Annual, 31%

**Scenario 3: 2041 predicted traffic data, upgraded road**

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Background Conc. (μg/m³)</th>
<th>Predicted Max Conc. (μg/m³)</th>
<th>Assessment criterion (μg/m³)</th>
<th>Avg. period</th>
<th>Max % of Discrete criterion</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>625.2</td>
<td>732</td>
<td>1130</td>
<td>11,254</td>
<td>8 hrs</td>
</tr>
<tr>
<td>NO2</td>
<td>43.1</td>
<td>62</td>
<td>107</td>
<td>247</td>
<td>1 hr</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>18.9</td>
<td>19.4</td>
<td>22.8</td>
<td>50</td>
<td>24 hrs</td>
</tr>
<tr>
<td>PM₂.₅</td>
<td>11.3</td>
<td>11.6</td>
<td>13.7</td>
<td>25</td>
<td>24 hrs</td>
</tr>
</tbody>
</table>

**Volatile Organic Compounds**

- Benzene: 0.02, 0.42, 10.5, Annual, 4%
- Toluene: 0.20, 2, 4114, 24 hrs, 0.04%
- Xylene: 0.16, 1, 1183, 24 hrs, 0.11%
Concentrations predicted at sensitive receptors in the model are considered to be conservative, based on previous modelling studies. This is a result of AUSROADS being a conservative model, with consideration given to the distance of sensitive receptors from the road edge.

Predicted concentrations for all pollutants for the three scenarios comply with the criteria set by NEPM and WHO.

Scenario 1 (no build, 2020) has the lowest predicted concentrations for all modelled pollutants. This is due to the shorter road length in the modelled existing road network, i.e. no roundabout, which adds approximately 240 m of road links to the upgraded road network. The existing road network also does not include the extra slip lane on Stirling Highway, which essentially adds another 180 m of road links. These extra road links (34 for the build scenarios compared to 13 for the no build scenario) account for the slight increases in concentrations in Scenario 2 (upgraded road network, 2020) compared to Scenario 1.

Scenario 3 (21 years after opening, 2041) has the highest concentrations for all pollutants. This is due to the extra road links for the upgraded road network as well as the increase in traffic volume rates.

The proposed road upgrade is not predicted to result in a material change to air quality. The ambient concentrations for all pollutants modelled comply with the NEPM and WHO standards by a significant margin.

The predicted increase in air quality concentrations over time are associated with the predicted increase in traffic volumes, which are independent to the proposed upgrade progressing. The slight increase in predicted ambient air pollutant concentrations for the 2020 build scenario when compared to the 2020 no build scenario is considered an artefact of the model associated with extra road links included in the upgraded road network. A total of 13 links were modelled for the no build scenario and 34 links were modelled for the build scenario.

The modelling approach provides confidence the predicted concentrations are conservative, as:

- There has been no improvement in fleet emissions applied over time.
- Using the auto generation approach assumes sensitive receptors are located closer to the road than will be the case in reality.

The modelled air pollutant concentrations including background sources and conservative nature of the assessment approach, combine to provide confidence air quality will be maintained and where possible emissions minimised so that environmental values are protected.

Comparison of predicted concentrations to roadside measurements for Benzo(a)pyrene
The Perth Traffic Corridor Study 2007-2008, Report AQM 03 (Department of Environment and Conservation) presents results for benzo(a)pyrene (BaP) as an annual average of 0.08 ng/m³.

The air assessment completed for High Street Fremantle Upgrade Project predicts concentrations of BaP at the closest auto receptor (located 10 m from the roadside) for each scenario as follows:

- Scenario 1: Existing 2020 – 0.06 ng/m³.
- Scenario 2: High St Upgrade 2020 – 0.09 ng/m³.
- Scenario 3: High St Upgrade 2041 – 0.1 ng/m³.

The above shows the annual average model predicted BaP concentrations for scenarios 1 and 2, with day of opening traffic volumes, are comparable to and supported by actual roadside measurements.
The measured concentrations would be expected to be slightly higher for Stirling Highway/Canning Highway (outside the scope of the Proposal) due to the proximity to the road (likely closer than 10 m from the road) and presence of higher proportion of diesel trucks (the primary contributor to BaP emissions).

It is also important to note that the High St Upgrade 2041 scenario has assumed that the emissions performance of the vehicle fleet does not improve, with the same emission rates being used for both 2041 and 2020.

4.3.6 Mitigation
The modelling results show that for all three scenarios, predicted concentrations for all pollutants comfortably comply with the relevant air quality criteria.

4.3.6.1 Avoid
Given the scale and nature of the Proposal and that the air quality assessment predicts that the upgrade will not have an adverse impact on local air quality, no additional avoidance measures are proposed.

4.3.6.2 Minimise
The minimisation measures for this project regarding air quality during operation are:

- Creating separation between the road traffic and sensitive receivers.
- Improving traffic flow/reducing stop/start traffic.

Moving the alignment of High Street southwards will increase the separation distance between traffic on this road and residential homes to the north. Vehicle traffic remaining on the existing road in front of these homes should be limited to local use, with limited numbers. This will result in a minor reduction in air pollutant concentrations from vehicles travelling on the upgraded road network for these residence. The inclusion of a round-about in the upgraded road network is also expected to reduce stop start traffic and associated emissions from all vehicles including heavy vehicles.

Noise walls are commonly used to reduce noise from a source, and in particular, vehicle noise along a roadside. However, several studies have shown that noise walls can also be effective at reducing vehicle concentrations downwind from the road source.

Mitigation improvements associated with the inclusion of noise walls and maintenance of as many large trees as practical that will create additional vegetative barriers have not been considered in the model, but have been shown to found to be effective in reducing air pollutant concentrations downwind of vehicle emissions.

One particular study by Wesseling (2009) examined vehicle concentrations downwind of a road with a 4 m noise wall and compared this to equivalent data collected with no noise wall. Concentrations were measured at 5 m, 10 m and 28 m distances from the noise wall. Results showed that NO\textsubscript{2} concentrations were reduced by an average of 20 per cent at distance of 10 m from the noise wall. Similarly, a 30 per cent reduction was noted for PM\textsubscript{10} at a distance of 10 m from the wall.

Hooghwerff et al (2009) carried out an assessment of NOx and PM\textsubscript{10} concentrations in open terrain, with a 4 m reference noise wall and several other barriers. The 4 m noise wall showed a 14 per cent reduction in NO\textsubscript{2} and 24 per cent reduction in PM\textsubscript{10} concentrations. The study highlighted that height is an important factor in the effectiveness of a noise wall in reducing vehicle concentrations downwind.

Golder (2013) carried out dispersion modelling to analyse the effect of noise walls on vehicle air pollutant concentrations using two models. The modelling scenarios simulated 0 m, 4 m and 6 m walls. Both models predicted a reduction in downwind pollutant concentration by more than 30 per cent, varying with noise wall and model configuration.
Other studies show that vegetative barriers can also be effective in reducing vehicle concentrations downwind. A United States Environmental Protection Agency publication (2015) describes vegetative barriers and noise walls as best practice measures for reducing exhaust pollutant exposure at schools. It has also been suggested that the combined use of noise walls and vegetative barriers is highly effective, reducing vehicle concentrations downwind of road source by up to 60 per cent.

The above literature suggests with noise walls implemented in the High Street upgrade, vehicle concentrations are likely to be reduced downwind from the road source. As the air quality model has not accounted for the inclusion of noise walls, additional conservatism is applied to the predicted results for build scenarios in the modelling assessment.

No management and/or monitoring is proposed for the operation of the road once the upgrade is completed and opened.

The minimisation measures for this project regarding air quality during construction are:

- Develop and implement effective dust controls.
- Workforce inductions to include education in relation to minimising dust generation.
- No burning of vegetation or other materials will be permitted on site.
- Dust generating activities shall not be undertaken during unfavourable weather conditions, e.g. high wind speeds, unfavourable wind directions relative to sensitive premises and environments.
- All vehicles carrying dusty loads will be covered, if travelling outside of the project area.
- Water tankers will be available at all times to wet down exposed surfaces within the project area.
- Progressive rehabilitation of disturbed areas shall be undertaken to reduce the total exposed area.
- Inform nearby sensitive receptors including adjoining residents of activities that may cause excessive dust and respond quickly to any complaints made.

4.3.6.3 Rehabilitate

Given the scale and nature of the Proposal and that the air quality assessment predicts that the upgrade will not have an adverse impact on local air quality, no rehabilitation measures are proposed.

4.3.6.4 Offset

Given the scale and nature of the Proposal and that the air quality assessment predicts that the upgrade will not have an adverse impact on local air quality, Main Roads does not consider there are any significant residual environmental effects of the Proposal to air quality values for which a consideration of environmental offsets would be necessary.

4.3.7 Predicted Outcome

The EPA's objective for the factor air quality is to maintain air quality and minimise emissions so that environmental values are protected.

Predicted air quality concentrations for the pollutants modelled comfortably comply with the relevant air quality criteria, under all scenarios. The technical air assessment report includes tables and figures showing the outcome of the air modelling.

Overall, the modelling indicates the road upgrade will not have a significant cumulative impact on local air quality above existing impacts. The no build scenario at 2020 identified all pollutants below 47 per cent of criterion, whereas the upgraded road network at 2020 predicts all air concentrations are below 50 per cent of the ambient criteria. While the difference in predicted concentrations between the 2020 scenarios is slight, the upgraded road network resulted in higher concentrations than the existing road network. The predicted increase in concentrations for the build scenario is likely to be associated with extra road links (roundabout and Stirling Highway slip lane) included in the upgraded road network, rather than an expected actual increase. The 2041 scenario identified all pollutants below 53 per cent of the ambient criterion, with this increase in air quality impacts.
being associated with increases in traffic volumes over time, which is independent to the project proceeding.

Appropriate measures will be implemented to ensure the short term construction related air quality impacts are effectively managed.

Although not accounted for in the modelling, the proposed inclusion of noise walls are expected to reduce air emissions approaching nearby houses based on findings of various studies.

Accordingly, the EPA’s objective for air quality will be met.
4.4 Social Surroundings (Noise)

4.4.1 EPA Objective

The EPA’s objective relating to social surrounds (EPA, 2016) is:

To protect social surroundings from significant harm.

The objective recognises the importance of ensuring that social surroundings are not significantly affected as a result of implementation of a proposal or scheme.

4.4.2 Policy and Guidance

The following guidelines were utilised in the assessment for social surroundings (noise):

- Government of Western Australia (2009). State Planning Policy 5.4 – Road and rail transport noise and freight considerations in land use planning.

The Environmental Factor Guideline – Social Surroundings was utilised to ensure all relevant factors are addressed.

The noise modelling assessment undertaken to quantify potential impacts was completed in accordance with State Planning Policy 5.4 (SPP 5.4).

4.4.2.1 State Planning Policy 5.4

Under Section 5.4 of the SPP5.4, a modification to an existing road does not specifically require compliance with noise limit criteria. As stated in DWER’s advice to EPA regarding the Proposal:

“It can be read from the proposal that the proposed upgrade is to improve road safety and the general flow of traffic for all road users travelling into and out of Fremantle. It does involve changes in alignment, particularly around the intersection of High Street and Stirling Highway, but does not involve the increase of traffic-carrying capacity. It does not involve the increase of the road traffic noise levels at most of the existing residences either. Therefore, the application of the SPP5.4 noise standards to this proposed upgrade may be arguable.

However ENB does not disagree that MRWA uses SPP5.4 standards to assess and manage the traffic noise impact, as a conservative approach. This will result in the significant reduction of the traffic noise impact levels on the existing residences along the upgraded section of High Street.”

Although SPP 5.4 noise criteria may not be applicable to this proposal, Main Roads objective is for the Proposal to be compliant with SPP 5.4 noise criteria as far as is it reasonable and practicable to do so.

4.4.3 Receiving Environment

4.4.3.1 Project Setting

The proposal is located in a residential area with housing on the north side and the golf courses on the south side of High Street. High Street is used for general traffic as well as freight to and from Fremantle Port.

Noise sensitive premises occur adjacent to the proposal throughout the development envelope. They abut the existing High Street on the northern side of the road, to the south of High Street west of Montreal Street and on both sides of Stirling Highway. Currently there is no form of noise mitigation in place for these residential properties.
The existing environment has an extremely high level of traffic noise impacting noise sensitive receivers currently. Traffic noise has been measured in this location in excess of 70 dBA (LAeq), which is more than 10 dB higher than the outdoor noise criteria in State Planning Policy 5.4.

Studies and Survey Effort
A noise assessment was undertaken for the current Proposal in 2018 by GHD (GHD, 2018d).

The 2018 noise assessment was undertaken to monitor existing noise levels and model future impacts based on the Proposal. The scope of works for the traffic noise assessment included:

- Identification of sensitive receptors and selection of four representative locations for attended and unattended monitoring.
- Attended and unattended noise monitoring, undertaken for a seven day continuous period at each site to determine the existing noise environment.
- Assessment of noise monitoring data against relevant criteria.
- The development of a road traffic noise model based on existing and future predicted traffic flows to predict noise levels for a number of scenarios (out to 2041).
- Comparison of predicted noise levels against relevant road traffic noise criteria.
- Development of in-principle noise mitigation (noise barriers) to prevent adverse noise impacts for build 2041 traffic noise levels.

Noise Monitoring
Noise monitoring was undertaken to measure existing noise levels experienced by receptors located within the project area. Unattended and attended noise monitoring was undertaken at four locations adjacent to the upgraded section of road network:

- 78 Holland Street, Fremantle (Site A).
- 302 High Street, Fremantle (Site B).
- 332 High Street, Fremantle (Site C).
- 368 High Street, Fremantle (Site D).

The monitoring locations were chosen to provide good representation of the noise environment prior to construction of the High Street Upgrade. The monitoring locations were also identified as being safe and secure for unattended equipment, minimising the risk of theft or vandalism. Three of the noise loggers (Sites B – D) were located in the front yards of residence facing the existing eastbound side of High Street, to record representative noise levels experienced from passing traffic on High Street. The fourth noise logger (Site A) was situated in the front yard of a residence facing the southbound side of Stirling Highway to sample noise levels experienced from passing traffic on Stirling Highway approaching the High Street intersection.

All noise sampling activities were undertaken with consideration to the specifications outlined in AS2702-1984 Acoustics – Methods for the Measurement of Road Traffic Noise. Noise logging was conducted using a Larson Davis 831 environmental noise logger. Prior to deployment and at monitoring completion, the loggers were calibrated with a sound pressure level of 94 dBA at 1 kHz using a Larson Davis CAL200 sound level calibrator.

The Table 15 details the LA10, 18-hr, LAeq, 16-hr and LAeq, 8-hr unattended traffic noise levels at the monitoring locations and provides the rating background level (RBL) for monitoring site. The RBL provides the overall single figure background level representing each assessment period (day/ night) over the whole monitoring period. It is defined as the median value of:

- All the day assessment traffic noise levels over the monitoring period for the day (6:00 am to 10:00 pm).
- All the night assessment background levels over the monitoring period for the night (10:00 pm to 6:00 am).
Table 15: Unattended traffic noise levels at the monitoring locations

<table>
<thead>
<tr>
<th>Site</th>
<th>L_{A10}, 18-hr (6:00 am to 12:00 am)</th>
<th>L_{Aeq}, 24-hr (12:00 am to 12:00 am)</th>
<th>L_{Aeq}, 16-hr (day) (6:00 am to 10:00 pm)</th>
<th>L_{Aeq}, 8-hr (night) (10:00 pm to 6:00 am)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site A RBL</td>
<td>58</td>
<td>55</td>
<td>57</td>
<td>48</td>
</tr>
<tr>
<td>Site B RBL</td>
<td>74</td>
<td>70</td>
<td>71</td>
<td>64</td>
</tr>
<tr>
<td>Site C RBL</td>
<td>74</td>
<td>71</td>
<td>72</td>
<td>64</td>
</tr>
<tr>
<td>Site D RBL</td>
<td>77</td>
<td>74</td>
<td>72</td>
<td>67</td>
</tr>
</tbody>
</table>

The attended noise logging and field observations indicate the ambient noise environment at each monitoring location is typically associated with high noise levels, with the main noise contribution coming from High Street, including heavy vehicles movements.

### 4.4.4 Potential Impacts

During the construction and operation phases of the proposal, potential impacts from excessive noise include:

- Sleep disturbance.
- Hearing impairment.
- Community annoyance.
- Reduced amenity.
- Reduced learning capacity.
- Changed behaviour in the use of public areas.
- Hearing protection requirement.

### 4.4.5 Assessment of Impacts

GHD was commissioned by Main Roads WA in 2018 to complete a noise assessment to assess predicted noise impacts from the proposed High Street upgrade on nearby sensitive receptors (GHD, 2018d, Appendix 5).

#### 4.4.5.1 Noise assessment approach

The traffic noise assessment involves the use of noise monitoring to develop the numerical modelling of the anticipated noise levels applicable to the existing and constructed roads. Unattended and attended noise monitoring was completed to inform the assessment and validate the model.

Predicted traffic noise impacts on receptors were modelled using CadnaA, which considers local topography, reflection, ground absorption, relevant building structures, site sources and the locations of the receptor areas to predict received noise levels. To predict road traffic noise levels based on existing and predicted future road traffic flows, four scenarios were developed:

- Current noise impacts with existing road alignment, 2018 (Existing 2018).
- Future noise impacts with existing road alignment, 2041 (No Build 2041).
- Future noise impacts with upgraded design, 2041 (Build 2041).
- Future noise impacts with upgraded design and design noise mitigation, 2041 (Build 2041 with Mitigation).

#### 4.4.5.2 Noise Criteria

SPP 5.4 outlines the most relevant criteria for transportation noise. SPP 5.4 has been adopted by the Western Australian Planning Commission as a whole of Government approach to managing noise from transportation sources.

Table 16 outlines ambient noise criteria applying to proposals for new noise sensitive developments or new major roads and railways assessed under SPP 5.4.
Table 16: Outdoor noise criteria, dBA Noise target Noise limit

<table>
<thead>
<tr>
<th>Time of day</th>
<th>Noise target</th>
<th>Noise limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day (6:00 am to 10:00 pm)</td>
<td>LAeq (Day) = 55</td>
<td>LAeq (Day) = 60</td>
</tr>
<tr>
<td>Night (10:00 pm to 6:00 am)</td>
<td>LAeq (Night) = 50</td>
<td>LAeq (Night) = 55</td>
</tr>
</tbody>
</table>

As the Proposal involves upgrades to existing roads, the following SPP 5.4 policy measures apply:

- Practicable noise management and mitigation measures should be considered in accordance with Sections 5.6 and 5.8 of the policy, having regard to:
  - The existing transport noise levels
  - The likely changes in noise emissions resulting from the proposal
  - The nature and scale of works and the potential for noise emissions
- The proponent should prepare a noise management plan for the redevelopment works in accordance with the guidelines and in consultation with the state environmental agency and local government.

Section 5.6 of the SPP 5.4 policy refers to possible noise management and mitigation measures such as using separation distances, noise attenuation barriers and building design.

Section 5.8 of the SPP 5.4 policy refers to reasonable and practicable measures, recognising that it may sometimes not be reasonable and practical to meet noise target criteria. Measures are expected to be implemented to balance reasonable and practical considerations including noise benefit, cost, feasibility, community preferences, amenity impacts, safety, security and conflict with other planning and transport policies.

Main Roads has adopted the Noise Limit criteria in SPP 5.4 policy as a guide to the effectiveness of noise mitigation measures for this Proposal. Where the limit is achieved, no further assessment or mitigation has been considered at that location. In cases where the Limit can not be achieved, traffic noise must be shown to be as low as is reasonably practicable in the circumstances.

4.4.5.3 Results

The results of the unattended noise monitoring indicate sensitive receptors adjacent to High Street currently exceed the ambient noise criteria of SPP 5.4. Observations during the attended noise measurement identified dominant sources to include vehicle traffic, heavy vehicles (including buses and trucks) and exhaust breaks. The noise model constructed for the project predicts more than 85 per cent of the specified sensitive receptors are exposed to noise levels above the SPP 5.4 noise limit criteria.

The noise model predicts all residential properties identified as a receptor will be exposed to noise levels above the noise limit criteria by 2041 with the proposed upgrade occurring (Build 2041 scenario), and all but three residential properties without the propose upgrade occurring (No Build 2041 scenario). However, with the inclusion of noise walls, it is expected there would be a positive (that is, reduced) noise impact to many sensitive receptors, see Table 17.

Table 17: Summary of number of noise sensitive receivers in the Existing and 2041 No Build/Build Scenarios that will be above or below the noise limit.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Existing 2018</th>
<th>No Build 2041</th>
<th>Build 2041</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below target &lt;= 55 dBA</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Above target below limit &gt; 55 dBA and &lt;= 60 dBA</td>
<td>15</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Over limit &gt; 60 dBA and &lt;= 62 dBA</td>
<td>2</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Over limit &gt; 62 dBA</td>
<td>59</td>
<td>65</td>
<td>75</td>
</tr>
</tbody>
</table>
The Build 2041 with Mitigation scenario, which incorporates noise walls, is expected to result in a positive noise impact (that is, reduced noise impact) to many sensitive receptors. The noise model predicted 58 receptors (more than 80%) would comply with the limit noise criterion, with three of these complying with the more stringent noise target. Of the 18 receptors predicted to exceed the noise limit with noise walls incorporated into the design, five are deemed marginal. Furthermore, 17 of the 18 receptors that exceed the noise limit for the Build 2041 with Mitigation scenario are predicted to be exposed to noise levels equal to or less than the No Build 2041 scenario, showing an improvement in almost all cases.

The concept plan showing the location of the Proposal’s noise wall is shown in Figure 9.

Visual concepts of the noise wall are shown in Figure 6.

4.4.6 Mitigation

The following noise mitigation measures are proposed to reduce the road traffic noise to as low as reasonably practicable to noise sensitive receivers adjacent to the Proposal:

- Installation of noise walls (as shown in Figure 9) up to a maximum height of 5m.
- Separation of road traffic from noise sensitive receivers along High Street east of Stirling Highway, by moving the main thoroughfare carriageways further away from residential properties.

4.4.5.4 Avoid

Given the nature of the proposal and the close proximity of sensitive receivers, construction and operational noise associated with the Proposal can not be avoided.

4.4.5.5 Minimise

4.4.5.5.1 Construction Noise

Construction noise will comply with Regulation 13 of the Noise Regulations.

Construction works will be carried out in accordance with AS 2436:2010 - Guide to Noise and Vibration control on Construction, Demolition and Maintenance sites, and will include the following mitigation/management measures:

- Using equipment with low noise levels and maintaining noise control devices on equipment.
- Using broadband reversing alarms on construction equipment.
- Maintaining a complaints register.
- Obtaining necessary approval to work outside of normal working hours, if required.
- Providing public notification where receptors may be impacted by construction noise and/or vibration, particularly when works will occur outside normal working hours.
- Minimising the amount of night-time traffic and construction adjacent to residential areas.
- Potentially affected locations to alert operators of exceedances of noise and vibration limits.

4.4.5.6 Rehabilitate

Given the minimisation measures proposed, no rehabilitation is proposed to be undertaken to further mitigate the Proposal’s impacts on social surroundings.

4.4.5.7 Offset

Given the Proposal involves the upgrade of an existing road and that the noise assessment predicts that the upgrade will not have an adverse impact on any sensitive receivers, Main Roads does not consider there are any significant residual environmental effects of the Proposal to social surroundings values for which a consideration of environmental offsets would be necessary.
4.4.7 Predicted Outcome

The EPA’s objective for the factor Social Surroundings is “To protect social surroundings from significant harm”. The noise model constructed for the project predicts more than 95 per cent of specified sensitive receptors will be exposed to noise levels above the noise limit criteria by 2041 with or without the propose upgrade occurring. However, with the inclusion of noise walls, it is expected there would be a positive noise impact to almost all sensitive receptors. The noise model predicted more than 75 per cent (up from 4 per cent for the No Build 2041 scenario) of sensitive receivers would comply with the limit noise criterion and an additional 6.5 per cent would marginally exceed the limit with noise walls incorporated into the design. Less than 25 per cent of sensitive receivers would be expected to be above the noise limit criteria, compared to more than 96 per cent for the No Build 2041 scenario.

The proposal to upgrade High Street will have an overall positive impact (that is, a reduced noise impact) on the noise levels with adjacent residential properties, compared to a no build option.

Accordingly, the EPA’s objective for social surroundings will be met.
Legend

- Noise wall

Main Roads
High Street Public Environmental Review

Location and extent of proposed noise walls
5 OTHER ENVIRONMENTAL FACTORS OR MATTERS

The EPA did not identify any other environmental factors or matters relevant to the proposal that needed to be addressed.

During the submission period (19 to 25 October 2018) for the referral document for the Proposal, 17 submissions (both for and against the proposal) were received by the EPA. In addition to the Key Environmental Factors already discussed with Section 4, these submissions also raised other concerns, see Table 18.

Table 18: Responses to other concerns raised during public submissions period

<table>
<thead>
<tr>
<th>Concern</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perception that Proposal is linked to Roe Highway Extension Project</td>
<td>This project is not linked to the previous Government’s Roe Highway Extension Project. This upgrade is addressing the congestion and safety issues along High Street. Regarding the ultimate planning for High St, the State Government is developing the Westport Strategy. (see <a href="http://www.transport.wa.gov.au/westport">www.transport.wa.gov.au/westport</a>).</td>
</tr>
<tr>
<td>High Street should be preserved and road users should adapt</td>
<td>The objective of the Proposal is to improve safety and the general flow of traffic for all road users travelling into and out of Fremantle. Around 32,000 vehicles per day travel on High Street, of which 15 per cent are heavy vehicles. During 2013-2017, approximately 450 crashes occurred within the project area, of which 74 per cent were rear end crashes and 11 per cent were right angle or right turn crashes. Regarding efficiency, road users wanting to turn right to head north are currently experiencing queuing on High St from the Stirling Highway traffic signals that extends about 1km in the peak periods. This project does not have a significant impact on High Street, compared to the previous concept released in 2013.</td>
</tr>
<tr>
<td>Trucks transporting containers to the port – should be railed</td>
<td>The State Government is working on the Westport Strategy, which will outline a vision to guide the planning, development and growth of both the Inner Harbour at Fremantle and the Outer Harbour at Kwinana. This Strategy will set out how the port and its associated landside transport linkages are expected to develop. This work will ensure the freight, trade and logistics requirements of Perth and the surrounding regions are met for the next 50 years and beyond Consultation is being undertaken as part of this process (see <a href="http://www.transport.wa.gov.au/westport">www.transport.wa.gov.au/westport</a>). The objective of the High Street Upgrade project is to improve safety and the general flow of traffic for all road users travelling into and out of Fremantle, not just heavy vehicles.</td>
</tr>
<tr>
<td>Loss of trees and tree canopy in urban environment</td>
<td>The project has been developed in consultation with the City of Fremantle and the community with the objective of retaining as many mature trees as possible. A tree survey was undertaken to identify the number and location of trees along High Street. This informed the design which now features a 23m wide median between Montreal Street and Wilkinson Street to retain most of the mature trees south of High Street. This wider median will have some impact on the existing public golf course fairway, but the new roadway will preserve a number of mature trees identified during our community and stakeholder consultation as highly significant to the community. Additionally, as part of the project, an urban design and landscaping strategy is being developed in conjunction with the City of Fremantle to ensure the amenity of the area is retained.</td>
</tr>
<tr>
<td>Change of land use and loss of</td>
<td>The majority of the project is being constructed within the existing Primary Regional Road reservation. However, reserves 6638 and 8860, which are</td>
</tr>
</tbody>
</table>
| **a Class A Reserve and recreation space.** | Both owned by the crown and vested in the City of Fremantle, are also impacted. These impacts primarily resulted from the local community’s and the City of Fremantle’s desire to minimise the impact on mature trees in the existing road reservation. To enable this to occur a wide median has been provided that impacts on both reserves but mainly the public golf courses. This golf course will be redesigned as part of the project to keep the existing 9 hole course.

It is to be noted that this land is not public open space but utilised as a public and private golf course. The Class A reserve impacted by the project is not reserved for conservation, it is reserved for recreation. The public golf course will retain its 9 holes following reconfiguration and there will be no overall loss of recreation function. |
| **Pedestrian and cyclist safety** | Proposed underpasses at Forrest Street and Montreal Street will greatly improve pedestrian and cyclist connectivity. Both underpasses will provide connections to the City of Fremantle’s existing cycling network. Key features will include adequate vertical clearance to increase natural light and visibility, landscaping, stairs and ramps to promote a sense of openness, safety, visibility and access for all users. |
| **Unnecessary impacts to road users and adjacent residents during construction** | Main Roads understands the concerns regarding the impacts of these works on the local community and will work with affected stakeholders in the area prior to and during construction to address these concerns. All construction activity will be governed by a series of management plans to ensure noise, dust and vibration is constrained to acceptable levels. All out of hours works will be communicated to residents in advance and approved by the Local Government Authority. Main Roads is committed to keeping the community informed of any construction impacts through various channels. |
| **Encourage higher utilisation of local roads** | The current layout of High Street – from Carrington Street to the Stirling Highway intersection, provides direct access to several local roads and driveways which results in stop-start conditions and heightened safety risks.

A new one-way service road will be constructed between Montreal Street and Chudleigh Street on the northern side of High Street to provide safer access for properties that currently have direct driveway access on High Street. This, along with the new median on High Street, will prevent right turn movements into and out of High Street.

To assess the impact Main Roads undertook traffic surveys in May 2018 which showed very low numbers of vehicles undertaking these right turn movements. These findings were discussed with the City of Fremantle and it was agreed that there would be a minimal impact on local streets as a result of these changes.

Additionally, traffic from Marmion Street may have been using local streets to access High Street previously. Limiting access to High Street may reduce drivers taking alternate routes through local roads as a more efficient, free-flowing solution will be available. However as with all projects the design and development process will include further traffic modelling. |
| **Impacts on adjacent sporting facilities, including loss of car parking opportunities** | Netball patrons are currently parking in the road reserve, which is not a formal designated parking area. However, to assist the Fremantle Netball Association, Main Roads will construct new bays along the service road in front of the large fig trees that will be retained. Main Roads will also formalise and increase the parking on Wilkinson Street to ease the pressures. |
6  OFFSETS

The EPA identified the following environmental factors as matters relevant to the proposal which required a thorough assessment in this ERD:

- Terrestrial Fauna.
- Air Quality.
- Social Surroundings (Noise).

The above factors were assessed in Section 4 of this report and the information presented confirmed that the project complies with relevant regulations, policies (Government of WA, 2014a) and criteria to the extent that the EPA objectives will not be compromised for these factors.

Given the management and mitigation measures as outlined in this ERD, Main Roads does not anticipate any residual environmental impacts which would require the application of an environmental offset. Therefore, no environmental offsets are proposed for the Proposal.
7 HOLISTIC IMPACT ASSESSMENT

The EIA process needs to consider the connections and interactions between parts of the environment to inform a holistic view of impacts to the whole environment. This requires consideration of the impacts of the Proposal in a regional context as well as at the local scale.

Consistent with the guidelines for preparing an Environmental Review Document, this section considers the holistic impact of the Proposal.

The primary purpose of the Proposal is to improve road safety along High Street between Carrington Street and Stirling Highway and improve the intersection of Stirling Highway and High Street in order to cater for expected traffic growth to 2041.

The Proposal is designed to provide a solution to the crashes, including truck rollovers, and the peak hour congestion in the area.

The High Street upgrade is one of several initiatives planned to improve efficiencies for the freight industry travelling to and from Fremantle Port. Other initiatives include the recent increase to the freight on rail subsidy and the creation of the Westport Taskforce which will guide the planning, development and growth of the Port of Fremantle and the associated road and rail links to support the new port facilities.

The environmental and social impact studies undertaken for this Proposal have considered and assessed potential impacts at both at a local and regional scale. The results of these studies have informed the Proposal impact assessment and development of mitigation measures.

The Proposal’s predicted outcomes have been considered in relation to the environmental principles (see Section 4.1) and the EPA’s environmental objectives for each Key Environmental Factor.

7.1 Terrestrial Fauna (Black Cockatoos)

The reduction of impacts and key threatening processes in the clearing footprint has been achieved through the consideration of alternative project design options and developing management and mitigation strategies. During the project development phase, considerable attention has been given to avoid, minimise and reduce impacts on fauna and its habitat.

All future potential nesting hollows have been avoided by the Proposal, with no known roosting trees to be impacted.

The Proposal’s clearing of 0.67 ha of Black Cockatoo foraging habitat (0.63 ha native vegetation and 0.04 ha non-native) within a historically disturbed, highly modified urban environment is not expected to have a significant impact on Black Cockatoos at a local nor regional scale.

Main Roads considers that significant measures undertaken to reduce the Proposal’s clearing footprint has substantially reduced the potential impacts to terrestrial fauna, with the environmental objective to protect terrestrial fauna so that biological diversity and ecological integrity are maintained will be met.

7.2 Air Quality

Overall, the modelling indicates the road upgrade will not have a significant cumulative impact on local air quality above existing impacts. The no build scenario at 2020 identified all pollutants below 47 per cent of criterion, whereas the upgraded road network at 2020 predicts all air concentrations are below 50 per cent of the ambient criteria. While the difference in predicted concentrations between the 2020 scenarios is slight, the upgraded road network resulted in higher concentrations than the existing road network. The predicted increase in concentrations for the build scenario is likely to be associated with extra road links (roundabout and Stirling Highway slip lane) included in the upgraded road network, rather than an expected actual increase. The 2041 scenario identified
all pollutants below 53 per cent of the ambient criterion, with this increase in air quality impacts being associated with increases in traffic volumes over time, which is independent to the project proceeding.

Although not accounted for in the modelling, the proposed inclusion of noise walls are expected to reduce air emissions approaching nearby houses based on findings of various studies.

The EPA’s objective for the factor Air Quality is to maintain air quality and minimise emissions so that environmental values are protected. Given the predicted air quality concentrations for the pollutants modelled comfortably comply with the relevant air quality criteria, under all scenarios, the EPA’s objective for air quality will be met.

7.3 Social Surroundings (Noise)

The noise model constructed for the Proposal predicts all residential properties identified as a receptor will be exposed to noise levels above the noise limit criteria by 2041 with the proposed upgrade occurring (Build 2041 scenario). All but three residential properties will be exposed to noise levels above the noise limit criteria without the proposed upgrade occurring (No Build 2041 scenario).

Furthermore, the Build 2041 with Mitigation scenario, which incorporates noise walls, is expected to result in a positive noise impact (that is, a reduced noise impact) to many sensitive receptors. Only 18 sensitive receivers will be exposed to noise levels above the noise limit criteria, compared to 61 sensitive receivers currently (Existing 2018) and 73 sensitive receivers for the No Build 2041 Scenario.

The EPA’s objective for the factor Social Surroundings is “To protect social surroundings from significant harm”. Given the scale and nature of the upgrade and the mitigation measures proposed, the proposal to upgrade High Street will have an overall positive impact on the noise levels with adjacent residential properties, compared to a no build option. Accordingly, the EPA’s objective for social surroundings will be met.
8 REFERENCES AND RELATED DOCUMENTS


Environmental Protection Authority (2015). *Perth and Peel @ 3.5 Million. Environmental Impacts, Risks and Remedies*. Interim strategic advice of the EPA to the Minister for Environment under Section 16(e) of the EP Act


Environmental Protection Authority (2016g). *Environmental Factor Guideline – Air Quality*. December 2016


Government of Western Australia (2014b). *Implementation Guidelines for State Planning Policy 5.4*
Government of Western Australia (2011). *Western Australian Offsets Policy*. September 2011

Government of Western Australia (2009). *State Planning Policy 5.4 – Road and Rail Transport Noise and Freight Considerations in Land use Planning*


Johnston (2013). *Food resource availability for Carnaby’s cockatoo Calyptorhynchus latirostris on the Swan Coastal Plain*. School of Natural Sciences, Edith Cowan University.


9 APPENDICES

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<th>Appendix</th>
<th>Title</th>
</tr>
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<td>Environmental Scoping Document</td>
</tr>
<tr>
<td>Appendix 2</td>
<td>Community Consultation</td>
</tr>
<tr>
<td>Appendix 3</td>
<td>Black Cockatoo Assessment (GHD, 2018b)</td>
</tr>
<tr>
<td>Appendix 4</td>
<td>Air Quality Assessment (GHD, 2018c)</td>
</tr>
<tr>
<td>Appendix 5</td>
<td>Noise Assessment (GHD, 2018d)</td>
</tr>
</tbody>
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