Cross River Rail Environmental Impact Statement

Request for Project Change 11

Changes to the Project and changes to the imposed conditions

Volume 3 Technical Reports

Date: ***April 2021***

Author: ***Cross River Rail Delivery Authority***

CROSSRIVERRAIL

Queensland Government

Table of Contents

1. Introduction

These technical reports have been prepared for the Cross River Rail (CRR) Project to assess the environmental effects arising from the Proposed Changes in comparison to the Evaluated Project.

Volume 1 describes the Proposed Changes to the design and delivery of the Evaluated Project and Volume 2 provides a set of drawings for evaluation. In some cases, the Proposed Changes are generally in accordance with the evaluated plans and drawings set out in the Evaluated Project, within the level of assessed impacts and consistent with the CRR Project-wide Imposed Conditions.

These aspects have been identified and compared and, where they are generally in accordance with the Evaluated Project, no new detailed assessment has been undertaken.

Where there has been a material or significant change in the design, delivery, existing environmental values, assessment criteria, or the proposed change is inconsistent with the Coordinator-General's Imposed Conditions, further detailed technical assessments, modelling and surveys have been undertaken, and detailed in this report and supported by **Attachments A-G**.

2. Proposed Change

This RfPC requests that the Coordinator-General evaluate the following Proposed Changes:

- Changes to the Project Works at Clapham Yard as follows -
    - reconfigure the layout of the Project Works at Clapham Yard, including Moorooka Station, to improve the operational functionality of Clapham Yard.
    - replacement of the two existing rail bridges and construction of a new grade separated structure across Moolabin Creek and into Clapham Yard with track configurations.
    - raising of the stabling yard in Clapham Yard to achieve a 1% AEP flood immunity, with the import of approximately 240,000 m^3 of fill material.
- Proposed Change to Imposed Condition 1 (General Conditions) to include references to the project documentation incorporating the Proposed Changes, and removing redundant references to previous drawings. The drawings in Volume 2 for the Cross River Rail Project replaces the drawings set in full.
- Proposed Change to Imposed Condition 10 (Hours of Work) to remove the existing limitation of 80 hours of continuous work for the Clapham Yard worksite so that work hours for track possessions align with the period of track possessions approved by Queensland Rail (QR).
- Proposed Change to Imposed Condition 10 (Hours of Work) to allow for haulage of spoil and delivery of materials/equipment 24 hours a day, 7 days a week for the Clapham Yard worksite.

3. Technical Assessments

A requirement for technical assessments has been identified for the Proposed Change listed in Table 1.

The purpose of the technical assessments is to ascertain whether the proposed changes result in new impacts which have not previously evaluated or a change, specifically an increase in previously assessed potential impact. Where the proposed changes are deemed likely to result in new or additional impacts, the technical assessments have identified whether changes to the imposed conditions or changes to the Environmental Management Framework are required.

Table 1: Requirement for technical assessments

Proposed change	Potential impact	Technical assessment required
Changes to the Project Works at Clapham Yard	Traffic impacts associated with increased operational capacity of the Yard	Traffic impact assessment
	Noise and vibration impact from construction and operational noise impact associated with track geometry and elevation changes	Noise and vibration impact assessment
	Hydrology impact associated with rail bridges across Moolabin creek and filling of Clapham yard	Hydrology impact assessment
	Air quality impact from construction	Air quality impact assessment
	Contaminated land, Acid Sulphate Soils and erosion impact from construction	Soils and erosion impact assessment
	Vegetation impact associated with in-stream works at Moolabin creek	Nature conservation impact assessment
	Visual amenity impact associated with elevated structures and construction	Landscape and visual amenity impact assessment
Changes to Imposed Condition 10 – Table 1 (Hours of Work)	Traffic impact from additional Haulage over extended work hours	Traffic impact assessment
	Noise impact from construction, additional haulage and associated traffic	Noise and vibration impact assessment

Seven (7) technical reports have been prepared to assess the potential changes arising from the Proposed Change in comparison to the Evaluated Project (**Attachments A-G**).

These technical reports provide an assessment of whether the proposed changes contribute to a changed impact associated with the change to the potential sources / types of impact or whether the changes continue to result in the same impact with the Evaluated Project. How these reports relate to potential changed impacts and associated cross-references are detailed in Table 2.

Some of the technical assessments have relied on previous assessments presented as part of RfPC-4 and the 2011 EIS when the previous assessment have been deemed relevant and reliable for the purposed of the assessment. When previous technical assessments have been relied upon, these have been appended to the corresponding technical report and justification has been provided in the report as to the suitability for use of the previous assessment.

Some of the technical assessments are relying on new assessments either qualitative or quantitative in nature (e.g. additional predictive modelling undertaken). Typically, new assessments were undertaken when:

- Previous assessment methodologies have been subject to significant changes in industry standards;
- Data used in the assessment input can no longer be relied upon due to its age; and
- New knowledge or information has been obtained since the previous assessment was undertaken, which has a material impact on the assessment.

Table 2: Potential changed impacts and associated technical report cross-references

Proposed Changes to impacts / Technical Report	Change Aspects	Technical Report cross-reference
Traffic impact **Attachment A Technical Report: Traffic and Transport** This report covers detailed traffic assessment of additional construction related road traffic along approved routes for the Clapham Yard worksite.	Evaluated project	Section 2.1 Evaluated Project Context
	Effect of the proposed change	Section 2.2 Construction Impacts Section 2.3 Operational Impact Section 4 Conclusion
	Mitigations proposed	Section 3.2 Proposed Changes to the EMF
Construction and traffic noise impact **Attachment B Technical Report: Noise and Vibration** This report covers detailed assessment of noise impacts from traffic, construction works and operations associated with the Clapham Yard worksite.	Evaluated project	Section 2.1 Evaluated Project Context
	Effect of the proposed change	Section 2.2 Construction Impacts Section 2.3 Operational Impact Section 2.4 Summary of Impacts Section 4 Conclusion
	Mitigations proposed	Section 3.2 Proposed Changes to the EMF
Hydrology impact **Attachment C Technical Report: Hydrology** This report covers detailed hydrology assessment associated with the construction of rail bridges across Moolabin Creek, and importing and filling activities at Clapham Yard.	Evaluated project	Section 2.1 Evaluated Project Context
	Effect of the proposed change	Section 2.2 Construction Impacts Section 2.3 Operational Impact Section 4 Conclusion
	Mitigations proposed	Section 3.2 Proposed Changes to the EMF
Air quality impact **Attachment D Technical Report: Air quality** This report covers detailed assessment of air quality impacts from construction works at the Clapham Yard worksite.	Evaluated project	Section 2.1 Evaluated Project Context
	Effect of the proposed change	Section 2.2 Construction Impacts Section 2.3 Operational Impact Section 4 Conclusion
	Mitigations proposed	Section 3.2 Proposed Changes to the EMF
Impacts from soil disturbance **Attachment E Technical Report: Soils** This report covers detailed assessment of impacts associated with potentially contaminated land, acid sulfate soils and erosion from construction works at the Clapham Yard worksite.	Evaluated project	Section 2.1 Evaluated Project Context
	Effect of the proposed change	Section 2.3 Construction Impacts Section 2.4 Operational Impact Section 4 Conclusion
	Mitigations proposed	Section 3.2 Proposed Changes to the EMF
Impact on nature conservation **Attachment F Technical Report: Nature Conservation** This report covers detailed assessment of impacts on surrounding flora and fauna from construction works at the Clapham Yard worksite, particularly from bridge works over Moolabin Creek.	Evaluated project	Section 2.1 Evaluated Project Context
	Effect of the proposed change	Section 2.4 Construction Impacts Section 2.5 Operational Impact Section 4 Conclusion
	Mitigations proposed	Section 3.2 Proposed Changes to the EMF
Landscape and visual amenity impact	Evaluated project	Section 2.1 Evaluated Project Context

Proposed Changes to impacts / Technical Report	Change Aspects	Technical Report cross-reference
Attachment G Technical Report: Landscape and Visual Amenity This report covers detailed assessment of landscape and visual impacts from structural design elements associated with the Clapham Yard.	Effect of the proposed change	Section 2.2 Construction Impacts Section 2.3 Operational Impact Section 4 Conclusion
	Mitigations proposed	Section 3.2 Proposed Changes to the EMF

Cross River Rail Environmental Impact Statement

Request for Project Change 11

Changes to the Project and changes to the imposed conditions

Volume 3 Technical Reports

Attachment A Traffic and Transport

Date: ***April 2021***

Author: ***Cross River Rail Delivery Authority***

CROSSRIVERRAIL

Queensland Government

Table of Contents

1. Assessment Methodology

To ensure a comprehensive and consistent analysis is undertaken, the following transport modes and facilities have been considered in the assessment process:

- Vehicle traffic
- Pedestrians
- Cyclists
- Public Transport
- Park 'n' Ride / Kiss 'n' Ride
- Car parking
- Site/Property access
- Emergency services, and
- Special events.

Where the Proposed Changes are expected to be consistent with the Evaluated Project or would not result in a changed traffic or transport impact, the transport mode or facility has not been included in the assessment. The potential impacts are described further in the following sections.

1.1 Construction Phase Assessment Methodology

The methodology used for this analysis includes:

- Reviewing the approved project scope as described in the Evaluated Project;
- Identifying the implications of changing the original scope and assess the potential traffic and transport impacts that may arise from the Proposed Changes;
- Reviewing the changes to predicted traffic volumes associated with heavy vehicle movements during the bulk earthworks phase;
- Review the impacts associated with extended approved rail possessions;
- Review the current approved RIS Alliance Haulage Management Plan (HMP) and Construction Traffic Management Plan (CTMP) developed to comply with Imposed Condition 14; and
- Identifying new or changed mitigation measures or updates to the Plans that would be required to mitigate the identified impacts of the Proposed Changes.

1.2 Operational Phase Assessment Methodology

The Proposed Changes assessed pertains to the construction phase only. There is no requirement to undertake an operational phase assessment.

2. Changes to Potential Impacts

This RfPC requests that the Coordinator-General evaluate the following Proposed Changes:

- Reconfiguration of the layout of the Project Works at Clapham Yard, including Moorooka Station, to improve the operational functionality of Clapham Yard. These changes are generally consistent with the Evaluated Project.

- Raising of the stabling yard in Clapham Yard to achieve a 1% AEP flood immunity, with the import of approximately 240 000m^3 of fill material.

- Proposed Change to Imposed Condition 10 (Hours of Work) to allow for haulage of spoil and delivery of materials/equipment 24 hours a day, 7 days a week for the Clapham Yard worksite.

2.1 Evaluated Project Context

2.1.1 Imposed Conditions - Heavy Vehicle

The current Imposed Conditions for Spoil Haulage and Materials / Equipment Delivery (excluding concrete deliveries) for works at Clapham Yard are consistently Monday to Saturday, 6.30 AM to 6.30 PM with heavy vehicle restrictions between 7:30-09:00 AM and 2:30-4:30 PM, Monday to Friday.

Table 1 provides a visual representation of the Imposed Condition.

Table 1 Heavy Vehicle Movements Imposed Conditions – Clapham Yard

<table>
<tr><th>Time</th><th>Monday</th><th>Tuesday</th><th>Wednesday</th><th>Thursday</th><th>Friday</th><th>Saturday</th><th>Sunday</th></tr>
<tr><td>12:00AM to 6.30 AM</td><td colspan="6">No Spoil Haulage and Materials / Equipment Delivery Allowed</td><td rowspan="7">No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>6.30 AM to 7.30 AM</td><td colspan="5">Spoil Haulage and Materials / Equipment Delivery Allowed</td><td rowspan="5">Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>7.30AM to 9.00 AM</td><td colspan="5">No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>9.00 AM to 2.30 PM</td><td colspan="5">Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>2.30 PM to 4.30 PM</td><td colspan="5">No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>4.30 PM to 6.30 PM</td><td colspan="5">Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>6.30 PM to 12.00 AM</td><td colspan="6">No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
</table>

2.1.2 Requirement for Changes

The Clapham Yard Worksite has limited laydown and storage space resulting in substantial reliance on daily transport (throughout the shift) of equipment and materials from staging areas or subcontractor yards or suppliers.

As Clapham Yard is augmented, space restrictions increase as greenfield corridor land becomes unavailable.

At the same time, the delivery of permanent materials such as embankment / formation fill, gravel and concrete must be delivered on an as-needs basis to support the daily construction program (for example, concrete pours are typically booked in the mornings and can run for several hours). The presence of two delivery embargo windows mid-shift effectively reduces the main window of haulage to the period between 9:00am to 2:30pm (3.5 hours)

The current program of bulk earthworks coincides with the tunnel spoil from the TSD sites becoming available. There is an opportunity to reduce reliance on external quarries extracting virgin fill material by redirecting spoil from the tunnelling operations away from spoil disposal sites to Clapham Yard.

The Southern Portal worksite can haul spoil from the tunnel 24hours, 7days under the current Imposed Conditions, so does the Woolloongabba worksite (except Monday to Friday, 7:00am to 9:00am and 4:30pm to 6:30pm).

However, under the current Imposed Conditions Clapham Yard:

- cannot receive fill / spoil and continuously Monday to Friday during time and at night time and
- cannot receive fill / spoil 24hours, 7days any other day

Therefore, the removal of the day-time haulage restrictions would support the efficient delivery of the Clapham Yard bulk earthworks, whilst the allowance to haul fill material during night would support the beneficial reuse of spoil materials from other Cross River Rail worksites, and enable a reasonable spread of peak heavy vehicles across a 24 hour period, thus reducing daytime peaks, supporting improved road safety and managing any potential traffic congestion impacts on Fairfield Road.

2.2 Construction Impacts

2.2.1 Vehicle Traffic

2.2.1.1 Vehicle Types

Heavy vehicles used during construction include spoil removal, materials and equipment deliveries, concrete (including precast) delivery and steel and quarry material delivery. The vehicles used will be:

- 12.5m rigid trucks – materials, concrete, quarry and other miscellaneous deliveries
- 19m semi-trailers – materials including steel, concrete, quarry and other miscellaneous deliveries
- Light vehicles – support.

A 70/30 split can be assumed between the use of Heavy Vehicles and Light Vehicles.

2.2.1.2 Traffic movement

Consistent with the Evaluated Project, the primary access routes will remain from Ipswich Road and Fairfield Road, with the primary access point via the existing Queensland Rail gate at Chale Street.

Most of the construction traffic and all spoil haulage will approach from the north via Ipswich Road (primary freight route), Muriel Ave (arterial road) to Fairfield Road south of Tennyson Memorial Avenue (primary freight access).

Construction delivery and material traffic will approach from:

- the south utilising the Ipswich Motorway (primary freight route);
- the north via Fairfield Road north of Tennyson Memorial Avenue (arterial);
- the west via Sherwood Road (primary freight access); or
- the east via Evans Road / Muriel Avenue (primary freight access / arterial).

This access approach adopted for Clapham Yard seeks to prioritise the use of the highest road classification in the area and is consistent with existing traffic movements of commercial businesses in the area and on Fairfield Road.

Beaudesert Road (arterial) will not be used as an access route, thereby removing the potential interaction with traffic and pedestrians associated with the nearby schools.

Construction traffic from all approaches will utilise the stretch of Fairfield Road between Tennyson Memorial Avenue and Sherwood Road / Muriel Avenue. 70% will approach from the south (Sherwood Road / Muriel Avenue) and 30% will approach from the north (Fairfield Road).

2.2.1.3 Traffic volume

The Clapham Yard Works will be delivered in stages, including the staged construction of a zoned embankment to accommodate the rail formation, which includes embankment fill, a subgrade level, a capping layer, a formation layer, ballast rock, outer verge material and the final rail level. The primary heavy vehicle movement generating activity at Clapham Yard will be bulk import of the following materials or the complete upgrade of Clapham Yard:

- Rail formation construction which will require:
    - 240,000m^3 of fill to construct the rail embankment to subgrade level, which will be sourced from multiple sources pending supply and demand including:
        - Surplus geotechnically suitable spoil from cut activities in other part of the corridor;
        - Tunnelling activities;
        - External quarries.
    - 60,000m^3 of rail formation capping material from a limited number of external quarries (as it must meet QR technical specifications)

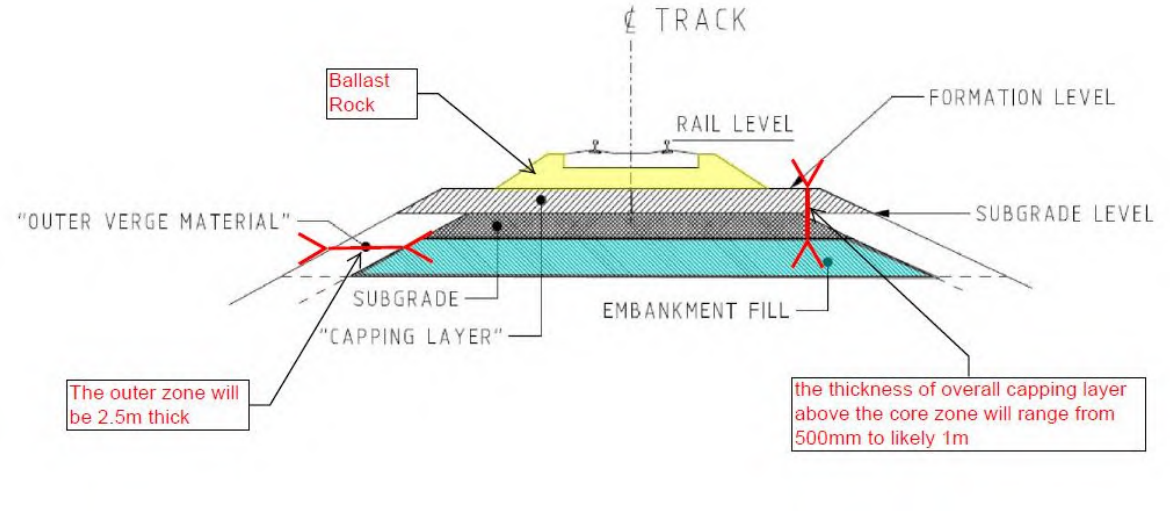
- 17,000m³ of ballast rock from a limited number of external (as it must meet QR technical specifications).

- 20,000m³ of specialised fill for the construction of RSS walls

The rail formation is a zoned embankment which is built in stages and is predicted to occur over two key periods:

- September 2021 to June 2022 (average 14,000 m³ / month), and
- December 2022 to March 2023 (average 19,000 m³ / month).

Out of the estimated 317,000m³ of imported material required to upgrade Clapham Yard the most intensive activity will be the construction of the embankment fill.



Peak Import is predicted to occur over two key periods:

- September 2021 to June 2022 (average 14,000 m³ / month), and
- December 2022 to March 2023 (average 19,000 m³ / month).

In order to confirm whether a detailed traffic analysis is required, a construction life cycle analysis has been undertaken for the bulk import of the embankment fill volume of 240,000m³. This analysis included peak traffic movements (light vehicles and heavy vehicles combined) during standard working hours (Monday to Saturday, 6.30am to 6.30pm). This analysis resulted in peak traffic movements that were comparable with the Evaluated Project. A further detailed traffic analysis is therefore not required.

A summary of the peak traffic movement requirements is provided in Figure 1.

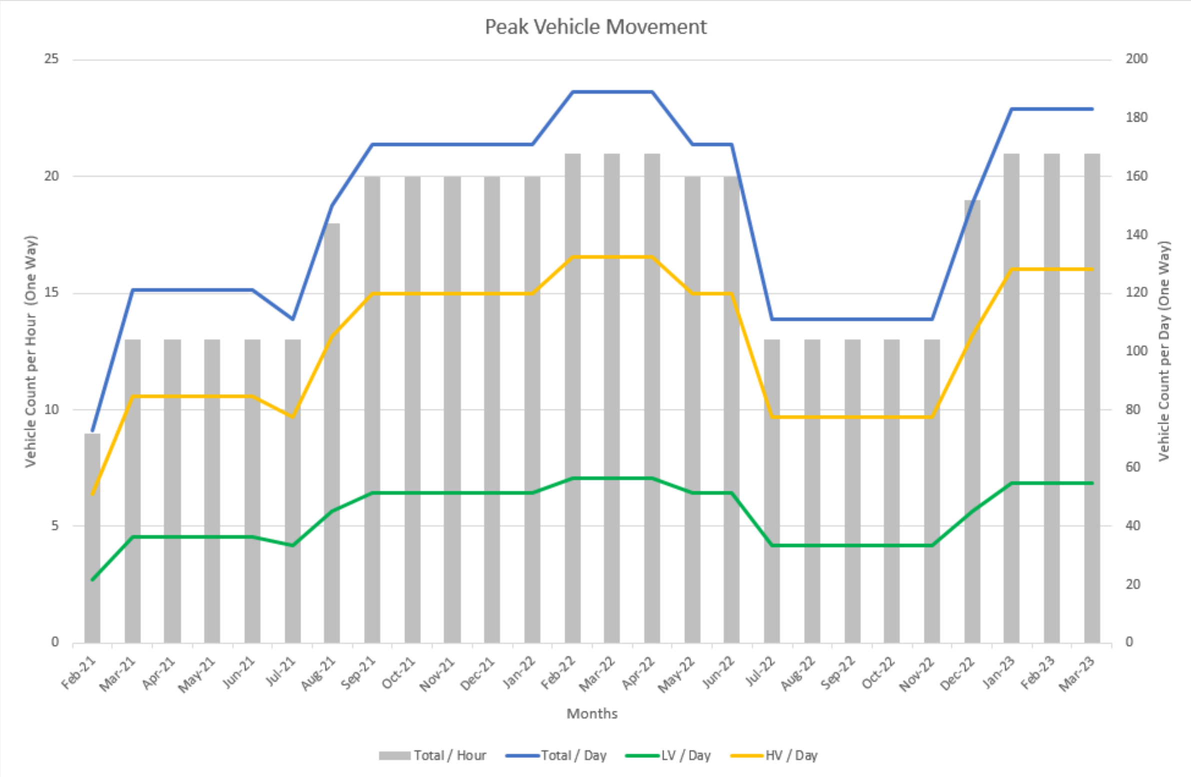


Figure 1 Peak Vehicle Movements (peak vehicle movement is for daytime off peak period 9.30-14.30)

The Proposed Change to heavy vehicle restrictions, detailed in section 2.1.1, seeks to allow for 24/7 spoil haulage to Clapham Yard. A conservative traffic assessment has previously been undertaken that considers 6.30am-6.30pm (day time hours), when traffic loading on the network are greater as compared to 6.30pm-6.30am (night time hours).

For this assessment, it has been extrapolated that if haulage activities occur 24 hours per day, 7 days a week to Clapham Yard, the actual peak hourly traffic numbers will be lower than what is presented in this assessment. This is because logistics of project delivery require the same volume of spoil and material/equipment delivery across increased haulage hours, meaning that deliveries can be spread across an increased amount of time. Any identified traffic impacts are therefore reduced.

Any potential noise and air quality impacts associated with night time haulage are detailed in Noise and Vibration technical report and the Air Quality Report respectively.

Table 2 outlines the estimated heavy vehicle movements over a standard working day at the Clapham Yard work site. The peak traffic movement load per hour is estimated to average at 21 (one way).

These movements and consequent increase in impacts are measured based on typical AM / PM traffic peaks rather than the current heavy vehicle movement restrictions documented in the CRR Project Imposed Conditions from the Coordinator General. This is consistent with the overarching Construction Traffic Management approach for the Project as well as similar major infrastructure projects in urban environments. This approach does provide for an overlap in peak hour traffic movements and the current approved movement hours for the Evaluated Project and an assessment of the “worst case scenario” for traffic movement.

Table 2 Construction Traffic (LVs and HVs) - Day Time Traffic Volumes

Worksite	AM Peak (3 hrs) (6:30am-9:30am)		Daytime off-peak (5hrs) (09:30am–2:30pm)		PM Peak (4 hrs) (2:30pm–6:30pm)		Program Duration
	Peak Hour	Total for Period	Peak Hour	Total for Period	Peak Hour	Total for Period	
Clapham Yard (peak vehicle duration)	12	36	21	105	12	48	September 2021 to June 2022
Clapham Yard (peak vehicle duration)	10	30	21	105	12	48	December 2022 to March 2023

As presented in section 2.2.1.6, where possible, access routes have been established to avoid traffic signals at the Fairfield Road / Palomar Road intersection to maximise the opportunity for free flow turnaround whilst minimising back of queue impacts. For example, primary work site egress will be via Chale Street northbound turning left onto Fairfield Road southbound, which will avoid adding traffic to the back of queue at the signalised intersection with Palomar Road.

The primary and secondary access points and associated access routes are depicted in section 2.2.1.6.

Access schemes have been incorporated in the Construction Traffic Management Sub-Plan for the Clapham Yard area, which has been provided to and endorsed by BCC. This Sub-Plan has been prepared by a Nominated Traffic Officer who holds a current Traffic Management Design qualification and applies reasonable engineering principles to achieve the requirements of:

- The Manual of Uniform Traffic Control Devices - Part 3 “Works on Roads”
- Transport and Main Roads Technical Specification MRTS02 “Provision for Traffic”
- Traffic and Road Use Management Manual – Volume 7 “Road Works” (TRUM Vol.7) with Interim and Working Draft Notes

Each primary route will be via non-signalised seagull intersections with dedicated turning lanes into Chale Street, which are located in the median of Fairfield Road.

Where avoiding traffic signals is not possible, the Fairfield Road / Palomar Road intersection will be utilised to provide access.

The signalised intersections of Muriel Avenue with Fairfield Road and Ipswich Road are not anticipated to be significantly impacted by the Proposed Changes due to these intersections being part of a major freight corridor access point (higher class road classification). As the Proposed Changes are anticipated to result in one Heavy Vehicle every 3.8 minutes at this intersection, it is expected that the CRR Project’s construction heavy vehicle transport through these intersections is within the range of typical fluctuations around this north-south / east-west interchange.

A comparison of the estimated peak traffic movements per hour is provided in Table 3. Compared with the average 21 (one way) movements for the Proposed Changes, RfPC4 identified 17 movements per hour.

Consistent with the Evaluated Project, the Proposed Changes result in a less than 5% increase in demand on the impacted intersections. Therefore, it has been assessed that the impacts as previously described for the Evaluated Project are unchanged as a result of the Proposed Changes.

Table 3 Comparison of Peak Traffic Volumes - Proposed Changes and Evaluated Project

Evaluated Project	Site Access/Egress	Peak HV Movement Loads/day (one way)	Peak Traffic Movement Load/hour (one way)	Intersection Impact	Change assessment
RfPC 4 Inputs	Fairfield Road	166	17	<5%	No Change
RfPC 11 Inputs	Fairfield Road	159	21	<5%	Consistent with 2011 EIS and RfPC 4 inputs

There is some marginal variation in the Peak Traffic Movement load per hour between the Proposed Changes, and RfPC4, despite the increase of heavy vehicle movements associated with the net import of fill material. This is because:

- Additional construction planning activities occurred since RfPC4 which more accurately predicted heavy vehicle movements associated with concurrent activities across Clapham Yard activities. Activities requiring heavy vehicle support include:
  - Construction of structural elements including bridges, requiring deliveries of concrete, steel and other prefabricated elements
  - Earthworks activities related to the import of engineering material including capping material
  - Drainage construction activities requiring delivery of prefabricated concrete pipes
  - Dual gauge track works requiring deliveries of sleepers and ballast.
- Staging of work was revised between RfPC4 and the Proposed Changes including:
  - Approximately an additional year for activities requiring peak heavy vehicle support
  - Overall development timeframe extending by approximately one year.

The extended program and adjusted delivery staging therefore allows the peak traffic movement to only be marginally increased compared to the numbers presented in RfPC4.

The intent of the Proposed Change to Imposed Condition 10 is to ultimately enable 24/7 haulage, which will decrease peak heavy vehicles traffic and allow vehicle movements to be more evenly spread across the day, therefore further reducing residual impacts on effected intersections.

Consistent with the Evaluated Project, the Chale Street / Fairfield Road Intersection along the haul route to Clapham Yard remains a seagull intersection type treatment with Fairfield Road, with a dedicated right turn bay to provide access from Fairfield Road and therefore is not a critical lane.

Section 6.4 of the DTMR Guide to Traffic Impact Assessment (December 2018) provides triggers on the nature and extent of traffic impact assessment that must when development traffic may affect road users and existing infrastructure. Typically, when development traffic exceeds 5% of the base traffic, a detailed impact assessment is required to assess impact on elements such as, but not limited to intersection delays. As the construction traffic associated with the Changes does not exceed 5% of the base traffic, SiDRA analyses have not been undertaken.

The Chale Street/Fairfield Road intersection currently provides for a high percentage of heavy vehicle turning movements due to the industrial nature of the surrounding land use. This pattern of utilisation would continue through the Project.

2.2.1.4 Pedestrians and Cyclists

As per the Evaluated Project, impacts to pedestrians and cyclists as a result of the Proposed Changes are not anticipated.

2.2.1.5 Car Parking

As per the Evaluated Project, construction workforce car parking will be provided within the Clapham Yard worksite.

2.2.1.6 Site/Property Access

As per the Evaluated Project, access to the work site will be primarily via the existing Queensland Rail gate located on Chale Street (Gate 3). Construction traffic will enter the work site utilising the existing right turn pocket on Fairfield Road northbound at the T-intersection with Chale Street and exit the work site via Chale Street northbound turning left onto Fairfield Road southbound (refer Figure 4). To disperse traffic accessing the worksite, two secondary access point (Gate 1 and 2) will be located along Fairfield Road at the southern end of the work site via an industrial driveway and an existing Queensland Rail Access (refer Figure 2 and Figure 3).

Gate 1 – Fairfield Road

Gate One (1) is considered a secondary access point as there is minimal queue length prior to the gate.

The nominated location on Fairfield Rd utilises the current kerb cross-over location that Queensland Rail use to access the Southern end of Clapham Yard.

There is an existing dedicated median turn lane that services the proposed location.

The gate will operate with left and right turn, access will be permitted with right turning traffic utilising the existing median turn lane. Egress will be left out only.

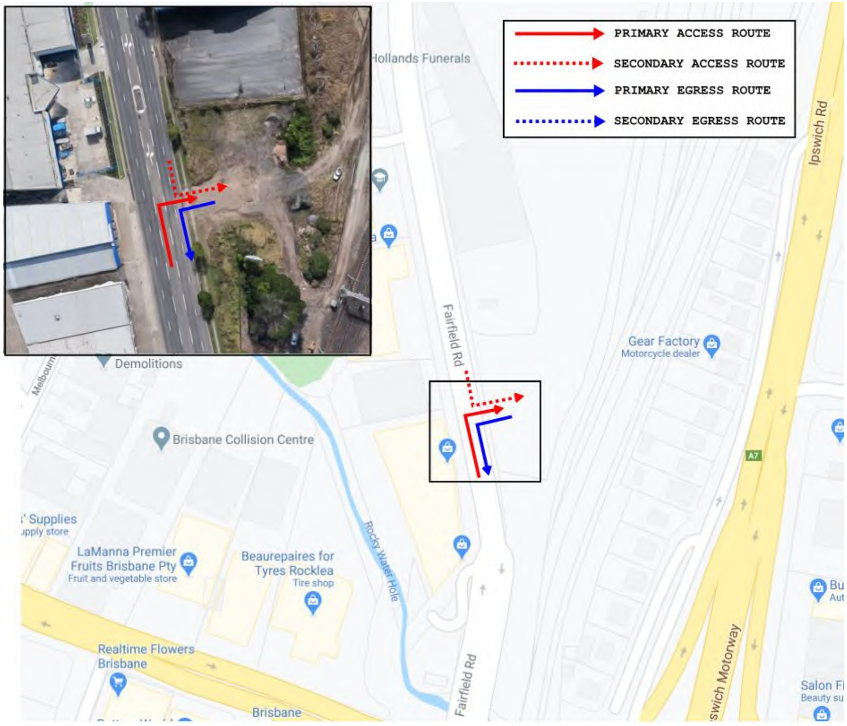


Figure 2: Clapham Gate 1 - Primary and Secondary access routes

Gate 2 – Fairfield Road

Gate Two (2) is considered a secondary access point as there is minimal queue length prior to the gate.

The nominated location on Fairfield Rd will utilise an existing industrial driveway of a building for Clapham Yard construction.

There is an existing dedicated median turn lane that services the proposed location.

The gate will operate with left and right turn access will be permitted with right turning traffic utilising the existing median turn lane. Egress will be left out only.

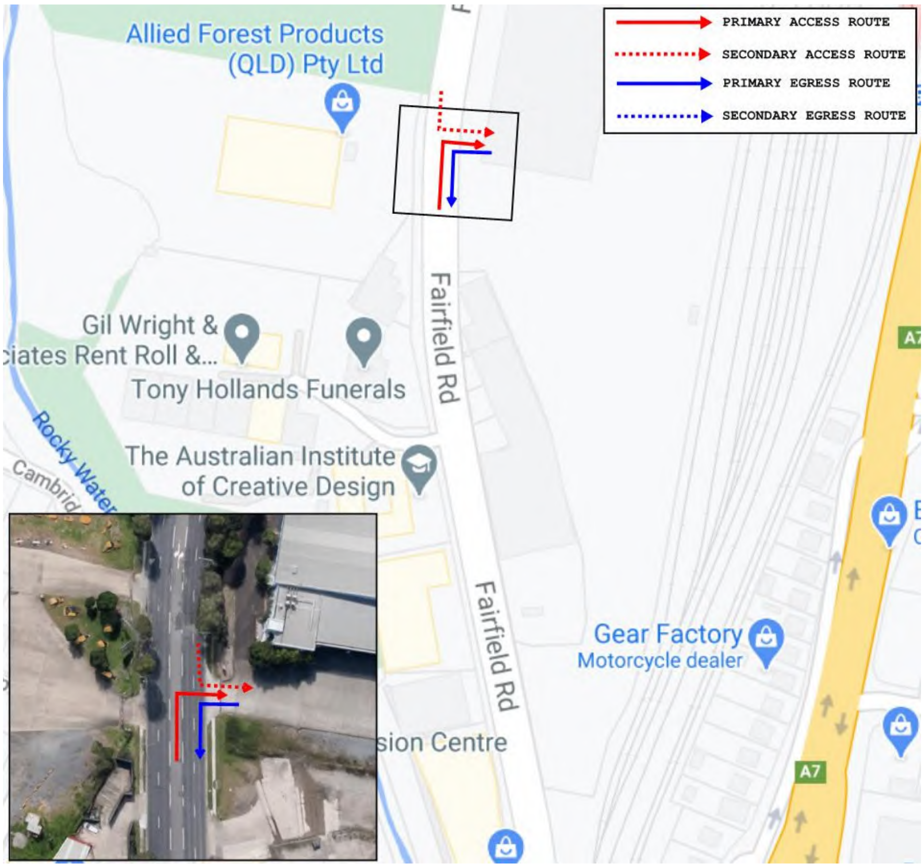


Figure 3: Clapham Gate 2 - Primary and Secondary access routes

Gate 3 – Chale Street

Gate Three (3) is considered the primary access point for Clapham Yard works.

The nominated location for Gate Three (3) on Chale Street utilises the current Clapham Yard access point utilised by Queensland Rail.

Access to the work site will be via the existing Queensland Rail gate located on Chale Street with construction traffic utilising the existing median turning lane on Fairfield Road northbound at the T-intersection with Chale Street as the primary access.

Primary egress will be via Chale Street northbound turning left onto Fairfield Road southbound. This arrangement avoids adding traffic to the back of queue at the signalised intersection with Palomar Road.

A secondary access route will be via the nearby traffic signals traveling south on Chale Street with egress via left turn onto Chale Street and onto Fairfield Road.

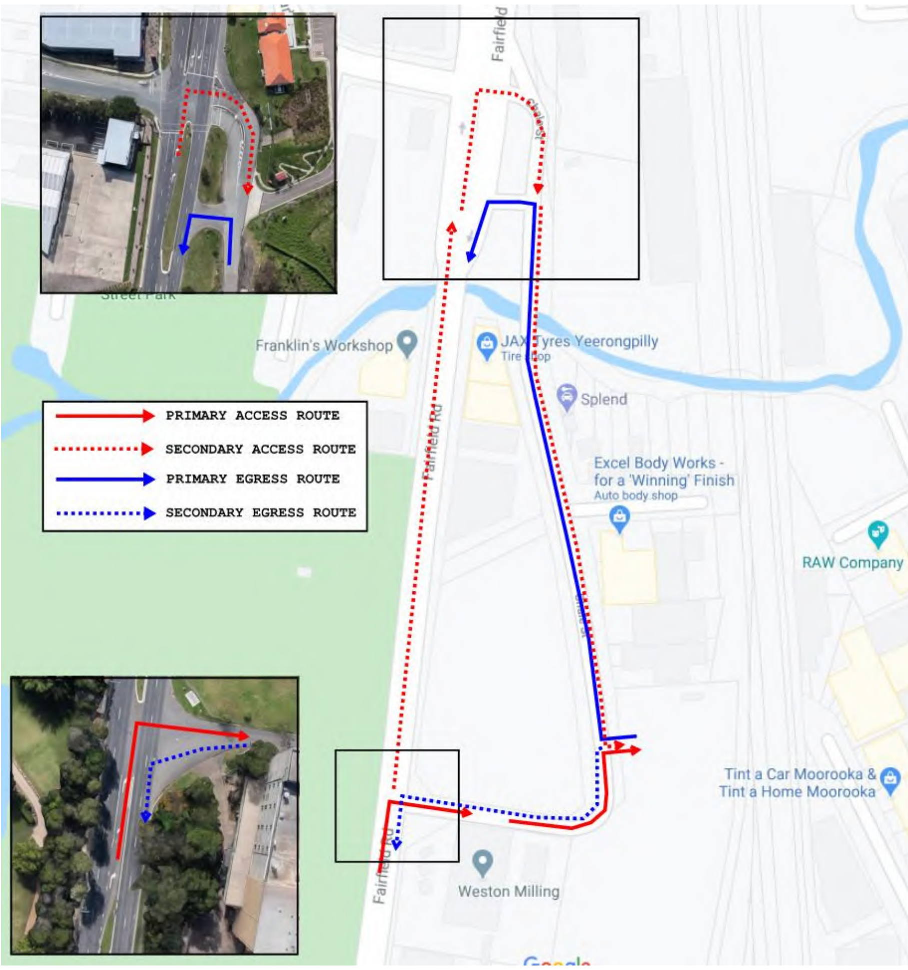


Figure 4:Clapham Gate 3 – Primary and Secondary access routes

2.2.1.7 Schools

Access to site will be directly from Ipswich Road or from Fairfield Road for works west of the station. Traffic from Fairfield Road will travel either via Chale Street. The area west of the rail alignment is industrial.

The closest school in the vicinity of the worksite is St Brendan's Primary School approximately 500m east of Ipswich Road. It is expected that the estimated heavy vehicle construction traffic will have nil measurable impact on school operations during or outside of peak hours.

Moorooka State School located east of Beaudesert Road is considered well outside any zone influenced directly by construction activities.

Figure 5 Clapham Yard and HV access routes

2.2.1.8 Emergency

Access for emergency services vehicles to project worksites and adjoining properties will be maintained throughout the construction phase. Where necessary, alternative access arrangements are provided in consultation with rail operators.

2.3 Operation

Following construction and based on the Clapham Yard Concept Design, impacts at Clapham Yard to traffic and transport as a result of the Proposed Changes are generally consistent with the Evaluated Project, with the exemption of a slight decrease to car park provisions.

The Concept Design proposes 127 car parks and 10 motorcycle parking bays, compared to 130 car parks presented in the Evaluated Project.

Consistent with the Evaluated Project, vehicle access to Clapham Yard will be via the existing signalised intersection of Chale Street onto Fairfield Road. Staff facilities are provided outside the main lines to limit the number of vehicles needing to cross the dual gauge lines.

Upgrades to the yard will provide improved parking capacity and integrated pathways for independent access from the carpark to the boarding platforms (at Moorooka Station). While an increase of vehicular traffic is expected on Fairfield Road due to the provision of additional parking bays at the yard, impacts to the existing road network can be mitigated with modifications to signals personalities and minor geometric changes to cater for operational traffic access and leaving Clapham Yard at shift changes.

3. Changes to Mitigation Measures

3.1 Environmental Management Framework (EMF)

Recommended mitigation measures for the changed traffic and transport impacts arising from the Proposed Changes are generally consistent with the Evaluated Project requirements as documented in the Project OEMP. They also are consistent with the currently endorsed Construction Management Plan and the Construction Environmental Management Plan. A summary of the key relevant mitigation measures in the existing EMF is discussed below.

3.1.1 Haulage Management Plan (HMP)

The Project is required to comply with the Haulage Management Plan (HMP) that has been developed in consultation with and approved by TMR and BCC.

The scope of the approved HMP already includes the Clapham Yard site, inclusive of the associated haulage road and access points.

An administrative amendment may be required to the HMP to adjust the description of the peak traffic movement numbers which currently reflect the RfPC-4 inputs.

There are however no requirements to amend the mitigations measures described in the HMP as they continue to be suitable to manage the predicted minor change in impacts during construction.

3.1.2 Construction Traffic Management Plan

3.1.2.1 Vehicle traffic

Each construction worksite would have a CTMP Sub-Plan prepared in accordance with the overarching CTMP to implement measures that avoid, minimise or mitigate, traffic problems arising during the construction phase.

The CTMP Sub-Plan is developed in consultation with TMR, BCC and Emergency Service Authorities. It is also supplemented by the Haulage Management Plan which haulage management measures for haulage routes.

Local communities and road users would be notified of proposed changes to local traffic access arising from Project works.

This includes, but is not limited to, the provision of clear signage identifying changed traffic conditions, and public advertisements (local and regional newspapers, Project website) describing the proposed changes, the duration of the changes, and possible alternative routes to avoid the impacts of the proposed changes.

3.1.2.2 Pedestrians and cyclists

Safe and functional access for pedestrians and cyclists would be maintained near Project works for the elderly, children and people with mobility difficulties (including vision and hearing impairments). Access will also consider relevant Crime Prevention through Environmental Design (CPTED) principles.

3.1.2.3 Public transport

Traffic management measures would be implemented near to Project works to minimise disruption and delays to bus services.

Bus replacement services would be provided should passenger rail operations be interrupted, such as during rail network shutdown periods or temporary closures.

3.1.2.4 Car parking

During construction, workforce car parking will be provided and managed to avoid workforce parking on local streets.

3.1.2.5 Site/Property access

Access to properties adjoining or near to Project works would be maintained. Where changes to property access are required, alternative access arrangements would be identified in consultation with property owners and occupants.

To the extent reasonable and practicable, existing access to the rail corridor for maintenance and emergency service vehicles would be maintained. Where necessary, alternative access arrangements would be provided in consultation with QR and other rail operators.

3.1.2.6 Emergency services

Access for emergency services vehicles to project worksites and adjoining properties will be maintained throughout the construction phase. Where necessary, alternative access arrangements are provided in consultation with rail operators.

3.1.2.7 Special events

Disruption to rail passenger services is to be avoided to the extent reasonable and practicable during major events such as the Ekka or events at Suncorp Station or the Gabba. Where disruptions are unavoidable, bus shuttle services are provided between appropriate stations to the major event venues, or to bypass the disrupted section in the network.

3.2 Proposed Changes to the EMF

Recommended mitigation measures for changed traffic impacts are consistent with the Evaluated Project requirements as documented in the Project OEMP. As such, the OEMP and C-EMP are not required to be updated.

Beyond the Proposed Change to Imposed Condition 10, no further modifications to the CRR Project Imposed Conditions have been identified with respect to the traffic impacts.

4. Conclusion

The Proposed Changes affecting transport and traffic as a result of the Clapham Yard Concept design refinements are minimal and generally consistent with the level of impacts assessed for the Evaluated Project.

Although the Clapham Yard Master Plan includes configuration of the stabling capacity, additional facilities and changed internal road alignment, traffic impacts are expected to slightly increase during construction though remain like the Evaluated Project during operation.

Overall, in comparison to the Evaluated Project, the Proposed Changes to transport and traffic are minor during construction, and beneficial throughout operation.

The predicted impacts do not warrant an amendment of the O-EMP, C-EMP and Imposed Conditions.

Cross River Rail Environmental Impact Statement

Request for Project Change 11

Changes to the Project and changes to the imposed conditions

Volume 3 Technical Reports

Attachment B Noise and Vibration

Date: ***April 2021***

Author: ***Cross River Rail Delivery Authority***

Table of Contents

1. Assessment Methodology

This technical report presents the findings of the assessment of the effect of the Proposed Change on potential noise and vibration impacts from the CRR Project.

The Proposed Changes to the Project with the potential to effect noise and vibration impacts that have been considered for this assessment are:

- the proposed reconfiguration of Clapham Yard;
- impacts from additional heavy vehicles associated with the import of approximately 240,000m^3 of fill, proposed to be undertaken 24 hours a day, 7 days a week;
- noise impacts associated with the removal of the 80 hours continuous work limit for rail possessions, to be replaced by the duration of the possession.

1.1 Construction Phase Assessment Methodology

1.1.1 Airborne Noise

Construction noise has been assessed against the noise goals in the Imposed Conditions, which specify an $L_{A,10\ (15min)}$ noise goal for intermittent noise sources. All construction equipment identified in the current construction methodology would be classified as intermittent sources. Additional equipment that may be classified as continuous such as generators would require the implementation of mitigation measures which typically are consistent with the ones included in this assessment for managing the effects of intermittent noise sources.

The noise impacts of construction activities have been assessed for the "worst case scenario". The loudest source noise level at the shortest distance to each Sensitive Place has been modelled operating over the entire 15 minute assessment period, to represent the likely impact when measured using the L_{A10} descriptor. The CONCAWE industrial prediction model was used to determine the magnitude of the noise impact at the nearest Sensitive Place.

A conservative reduction of 7 dB(A) for partially closed windows for a typical Queenslander type residential Sensitive Place has been assumed as per *Guideline Planning for Noise Control, Ecoaccess, DES, January 2016* (GPfNC). A higher level of reduction has only been applied at specific industrial and commercial Sensitive Places on a case by case basis depending on the building type and construction, up to a maximum reduction of 20 dB(A) for single glazed, closed windows in accordance with GPfNC.

As per the Imposed Condition, a more stringent noise goal is applicable during Non-Standard Hours (Monday – Saturday 6:30pm – 6:30am, Sundays and public holidays) compared to Standard Hours (Monday to Saturday 6:30am – 6:30pm).

1.1.2 Groundborne Vibration

The vibration impacts due to construction works have been assessed based on formulae from BS 5228-2:2009 *Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 2 Vibration*. Conservative parameters were selected for the formulae to estimate the 'worst-case' vibration impacts.

Vibration impacts have been assessed at all Sensitive Places in proximity to the proposed areas of work against the CG Conditions for cosmetic damage and human comfort. Sensitive Places which are classified as heritage structures have been assessed against the more stringent heritage criteria.

1.1.3 Traffic Noise

The noise impacts of construction traffic were assessed with the UK Department of Transport *Calculation of Road Traffic Noise* (CoRTN) algorithms in the Evaluated Project.

The construction traffic volumes associated with the Proposed Changes have been compared against:

- Those described in the Evaluated Project, and

- Traffic data from Brisbane City Council for Fairfield road near Chale Street.

The construction traffic volumes have been sourced from the Traffic and Transport Report and have been redistributed to support a comparative analysis with the Evaluated Project.

1.2 Operational Phase Assessment Methodology

1.2.1 Airborne Noise

Operational modelling has been undertaken at Clapham Yard based on the Proposed Change, inclusive of the noise emissions from through rail movements and idling trains within the yard. The assessment includes all Sensitive Places as defined by the Imposed Conditions.

The operational noise produced at Clapham Yard was assessed in accordance with the *Queensland Rail MD Series (including documents MD-15-315 to MD-15-318)*. A digital 3D noise model was generated in SoundPLAN (version 8.0), which implemented the CONCAWE prediction algorithm to predict noise emissions from idling train equipment, and the Kilde 130 algorithms to predict rail movement noise for through rail movements and movements within the stabling yard. The Kilde 130 algorithms are widely used to predict rail movement noise impacts from QR projects and are specified by MD-15-316.

The noise model inputs included terrain contours, buildings, existing noise barriers, number of stabled trains, number of through train movements and train noise emission levels.

Corrections were included in the model to account for specific track features such as turnouts, bridges and curves, as specified by MD-15-316.

Sound power levels for trains were sourced from Queensland Rail's rollingstock noise documentation. Based on the Queensland Rail noise levels, the train noise emission parameters applied in the SoundPLAN model have been updated compared to the parameters used in the EIS model. Passenger trains were modelled as EMU trains with a length of 144m. It has been assumed that EMUs are the loudest passenger trains which will operate within the project area and are therefore representative of the worst-case impacts from passenger trains. The Evaluated Project has assessed the noise emissions from IMU/SMU passenger trains only. Freight trains were modelled as double-headed, current-generation diesel-electric locomotives operating at Notch 8 with a length of 36m and general freight consists were modelled with a length of 1500m. A speed of 60km/h was assumed for passenger and freight trains travelling on dual gauge track, and for all passenger trains travelling on the Up Suburban track. A speed of 90km/h was assumed for all passenger trains travelling on the Down Suburban track. These speeds are specific to the through track movements adjacent the Clapham Yard area.

Workshop noise sources were excluded from the SoundPLAN model, as they are not expected to have a significant impact on the overall noise levels. If required, workshop noise may be mitigated by closing workshop openings, limiting simultaneous equipment usage, treatment of individual equipment through proprietary mitigation (such as using manufacturer enclosures for compressors) and localised screening of equipment.

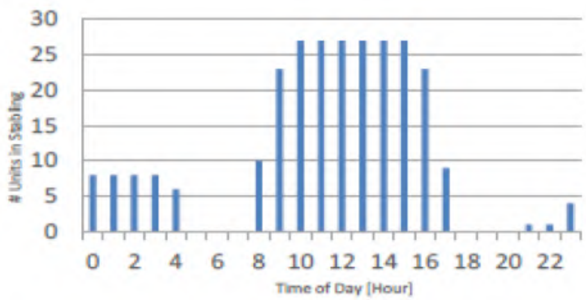
The modelled noise levels include contributions from through rail movement and idling trains in the stabling yard. A +3.0 dB(A) façade correction has been applied to all predicted noise levels to account for reflections as the criteria is assessed 1 metre from the façade of the Sensitive Place. The façade correction allows for the noise both coming from the source and reflecting off the building behind the measurement location.

The through rail movements modelled are summarised in Table 1, including both freight and passenger trains. The number of trains idling in the stabling yard is presented in Table 2.

Table 1 Through Train Movements at Clapham Yard by Train Type

Train Type	Maximum Daily Train Movements (2036)
Passenger Trains (Single Gauge)	348
Passenger Trains (Dual Gauge)	64
Freight Trains (Dual Gauge)	20

Table 2 Stabled Passenger Trains at Clapham Yard

Time	Train Count
Overnight Stabled	8
Interpeak Stabled	27
Capacity[1]	29
Daily Histogram	

[1] Based on 29 New Generation Rollingstock trains, with proposed configurations of 24x 6-car trains and 5x 9-car trains, or 13x 9-car trains and 7x 6-car trains.

1.2.2 Groundborne Noise and Vibration

No operational groundborne noise or vibration impacts have been assessed, as there are no segments of underground track within the area subject to the Proposed Changes. For surface level track, the airborne noise emissions are dominant over the groundborne noise emissions, and therefore the groundborne noise impacts are not predicted to affect nearby Sensitive Places.

2. Changes to Potential Impacts

2.1 Evaluated Project Context

This RfPC requests that the Coordinator-General evaluate the following Proposed Changes, relevant to noise impacts:

- reconfigure the layout of the Project Works at Clapham Yard, including Moorooka Station, to improve the operational functionality of Clapham Yard;
- replacement of the two existing rail bridges and construction of a new grade separated structure across Moolabin Creek and into Clapham Yard with track configurations as follows:
    - one replaced bridge to be a three track bridge for the dual gauge mainline, neck and Aurizon shunt neck;
    - one replaced bridge to be a two track bridge for up and down suburban lines;
    - a new grade separated structure approximately 430m in length, including a bridge crossing of Moolabin Creek.
- raising of the stabling yard in Clapham Yard to achieve a 1% AEP flood immunity, with the import of approximately 240,000m^3 of fill material.

- proposed Change to Imposed Condition 10 (Hours of Work) to remove the existing limitation of 80 hours of continuous work for the Clapham Yard worksite so that work hours for track possessions align with the period of track possessions approved by Queensland Rail (QR);
- proposed Change to Imposed Condition 10 (Hours of Work) to allow for haulage of spoil and delivery of materials/equipment 24 hours a day, 7 days a week for the Clapham Yard worksite.

The capacity of the stabling yard and the number of train movements in and out of the yard remains unchanged compared to the design assessed in RfPC4.

2.2 Construction Noise and Vibration Impacts

Not all of the major components of the Change Request are a change from the Evaluated Project, however for the purposes of the construction noise and vibration assessment, the impacts from the Clapham Yard activities, including elements that are already part of the Evaluated Project, have been included to take account of changed programming, staging and construction methodology.

The below table summarises the scenarios that have been assessed and the purpose of the predictive modelling:

Table 3 Acoustic assessment scenarios and purpose

Construction Scenarios	Dominant Noise Source	Purpose of Assessment	Detailed description of predicted Impact
Scenario 1 – Building Demolition Standard and Non-Standard Hours	30t excavator with a hammer SWL of 118dB(A)	Review of scale, duration and intensity of the proposed activities inclusive of their geographical location in relation to Sensitive Places to ascertain whether changes to the EMF are required	Section 2.2.1
Scenario 2 – Earthworks – Clear and Grade Operations Standard and Non-Standard Hours	Grader SWL of 114dB(A)	Review of scale, duration and Intensity of the proposed activities inclusive of their geographical location in relation to Sensitive Places to ascertain whether changes to the EMF are required	Section 2.2.2
Scenario 2A – Earthworks – Embankment Fill Construction using same equipment as daytime Non-Standard Hours	Grader SWL of 114dB(A)	Support the change request to authorise haulage over 24hr/7days	Section 2.2.2
Scenario 2B Earthworks – Embankment Fill Construction using same equipment as daytime Non-Standard Hours	Dozer SWL of 109dB(A)	Support the change request to authorise haulage over 24hr/7days	Section 2.2.2

Construction Scenarios	Dominant Noise Source	Purpose of Assessment	Detailed description of predicted Impact
Scenario 2C Earthworks – Embankment Fill Construction - Import of Fill Only Non-Standard Hours	Truck and Dogs SWL of 106dB(A)	Support the change request to authorise haulage over 24hr/7days	Section 2.2.2
Scenario 3 – Moolabin Creek bridges Construction	Bored piling rig SWL of 111dB(A)	Review of scale, duration and Intensity of the proposed activities inclusive of their geographical location in relation to Sensitive Places to ascertain whether changes to the EMF are required	Section 2.2.3
Scenario 4 Works within the rail corridor - overhead line and signal upgrade work Standard and Non-Standard Hours	Concrete saw / Rail saw SWL of 118dB(A)	Support the change request to remove the 80hrs restriction on approved rail possessions at Clapham Yard	Section 2.2.8
Scenario 5 Works within the rail corridor - construction Standard and Non-Standard Hours	Concrete saw / Rail saw, Tamping equipment and Regulator SWL of 118dB(A)	Support the change request to remove the 80hrs restriction on approved rail possessions at Clapham Yard	Section 2.2.8
Construction Traffic Standard and Non-Standard Hours	Truck and Dogs SWL of 106dB(A)	Support the change request to authorise haulage over 24hr/7days	Section 2.2.9

The predictive modelling outputs vary depending on the following key inputs:

- Footprint of the proposed Project Works in relation to the assessed Sensitive Places
- Proposed equipment to be used for the proposed Project Works assessed.

In order to contextualise the assessment scenarios described in Table 3 the following figure provides a pictorial description of the relevant areas where each scenario is proposed to occur within the broader Clapham Yard footprint.

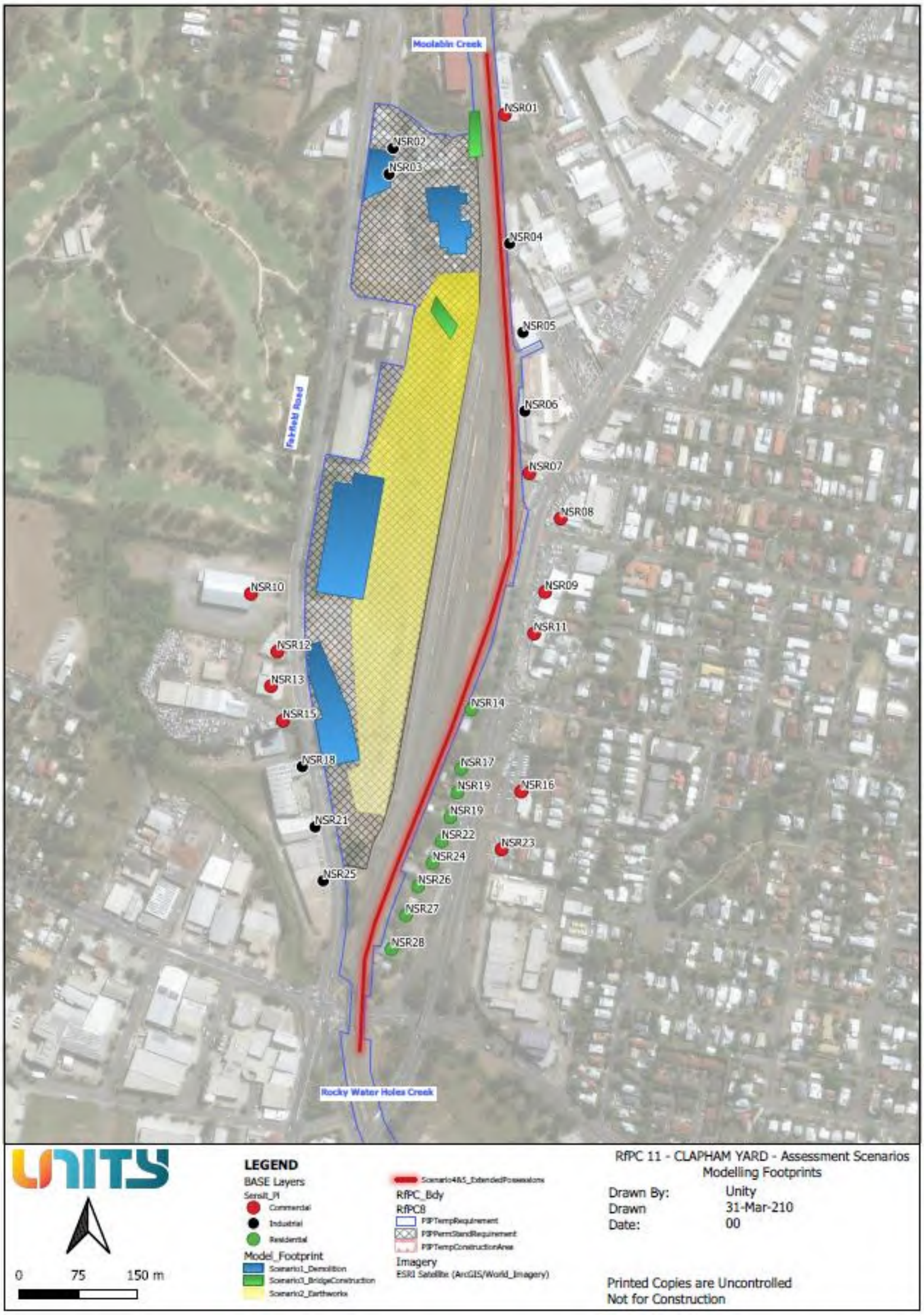


Figure 1:Modelling Scenarios Footprints

For the purpose of the noise assessment the following noise goals are relevant to identify DAPs and ensuing mitigation measures.

Table 4: Relevant Noise Goals

Land Use	Working Hours	Noise Goal[1] (LA10adj) dB(A) AS2107 Maximum design level + 10dB(A)	Noise Goal + 20dB(A) dB(A)
Commercial	Standard – Monday to Saturday 6.30 am to 6.30 pm	**55 dB(A)** (AS2107 Maximum design level for general office areas = 45 dB(A))	75 d(BA)
	Out of Hours – Monday to Saturday 6.30pm to 6.30 am, Sundays and Public Holidays	42 dB(A)	62 dB(A)
Industrial	Standard – Monday to Saturday 6.30 am to 6.30 pm	**60 dB(A)** (AS2107 Maximum design level for Lunchrooms and foremen's offices = 50 dB(A))	80 d(BA)
	Out of Hours – Monday to Saturday 6.30pm to 6.30 am, Sundays and Public Holidays	42 dB(A)	62 dB(A)
Residential	Standard – Monday to Saturday 6.30 am to 6.30 pm	**55 dB(A)** (AS2107 Maximum design level for Living Areas for house and apartments near major roads = 45 dB(A))	75 d(BA)
	Out of Hours – Monday to Saturday 6.30pm to 6.30 am, Sundays and Public Holidays	42 dB(A)	62 dB(A)

The major components of the Clapham Yard construction works are the demolition of existing buildings (scenario 1), general earthworks (scenario 2) and construction of the Moolabin Creek bridges (scenario 3). Based on the proposed construction methodology for Clapham Yard these activities are likely to generate the highest level of noise impacts to nearby Sensitive Places across all phases of construction.

All construction scenarios described in this report will be generating intermittent noise types (i.e. noise that gives fluctuations of 4dB or greater). The noise goal descriptors for intermittent noise are expressed as LA_{10adj}. Therefore, predicted exceedances in each scenario assessed in this technical report are associated with the plant / equipment with the loudest sound power level being used as part of the activity for 90 seconds or more.

As a result, when there are predicted exceedances it is important to understand that this is a representation of the worst-case scenario during the activity but is not reflective of the noise levels that will be generated during the entire duration of the activity.

Additionally, were two scenarios to occur concurrently within the same general area, for example building demolition and earthworks, there will not be a cumulative noise impact resulting in higher predicted noise levels when assessing potential exceedance against the intermittent noise goals. The

[1] All construction scenarios described in this report will be generating Intermittent noise types (i.e. noise that gives fluctuations of 4dB or greater)

loudest equipment would be the driver for identifying the DAPs. In this instance a 30t excavator with a hammer used during demolition (SWL of 118 dB(A)) would be the dominant noise source of a grader used for earthworks (SWL of 114 dB(A)).

Therefore, the below scenarios are presented the worst-case impacts associated with the most noise intensive activities to be carried out during construction, whether or not they are occurring concurrently.

Other construction activities to be undertaken which are predicted to have less significant noise and vibration impacts include track works and building construction. The track works, some of which will be undertaken during approved rail possession were already modelled as part of RfPC8. A review of the scenario modelled, particularly the plant and equipment types confirmed that the track works associated with the Clapham Yard and Moorooka Station works will use similar equipment of equivalent SWL. Therefore, no additional modelling has been undertaken. However, the RfPC8 modelling outputs from the relevant scenarios have been used to inform the assessment of potential impacts to DAPs associated with extended approved rail possessions which is presented in section 2.2.8.

In comparison to the construction activities assessed at Clapham Yard in RfPC4, more substantial earthworks are required which will have greater noise and vibration impacts at nearby Sensitive Places.

The most noise intensive equipment required for general earthworks (inclusive of earthworks, pavements and service installation) is a grader, which has been modelled with a representative sound power of 114 dB(A). These works will also require the use of a smooth drum roller, which produces a PPV vibration level of 8mm/s at a setback distance of 10m.

The most noise intensive equipment required for the demolition of existing buildings is a 30t excavator (with hammer), which has been modelled with a representative sound power of 118 dB(A). The hydraulic hammer was identified as the most vibration-intensive equipment required for this activity.

The most noise intensive equipment required for the construction of the Moolabin Creek bridges is anticipated to be a bored piling rig, which has been modelled with a representative sound power of 111 dB(A). No vibration intensive equipment is anticipated to be required for this activity.

As part of the Proposed Change, some general earthworks activities are proposed to be conducted during Non-Standard Working Hours. Accordingly, all construction activities associated with the Proposed Change have been assessed during both Standard and Non-Standard Hours.

Following the modelling methodology outlined in Section 1.2, noise Sensitive Places located close to the area of works have been assessed to identify potential worst case impacts. Twenty eight representative Sensitive Places within the assessment area are identified in Figure 2, and the noise levels predicted at each of these Sensitive Places are presented in Table 5.

Figure 2 Representative Sensitive Places for Construction Noise Impacts

Table 5 Clapham Yard Construction Predicted Noise Impacts at Representative Sensitive Places

Receptor ID	Land Use	Address	Predicted L_{A10} (dB(A)) Noise Level (Internal[1])		
			Scenario 1 (Building Demolition)	Scenario 2 (Earthworks)	Scenario 3 (Bridge Construction)
NSR1	Commercial	60 Evesham Street, Yeerongpilly	51	43	53
NSR2	Industrial	760 Chale Street Yeerongpilly	63	44	46
NSR3	Industrial	770 Fairfield Road, Yeerongpilly	78	44	46
NSR4	Industrial	41 Unwin Street, Yeerongpilly	58	55	47
NSR5	Industrial	30 Unwin Street, Yeerongpilly	54	55	47
NSR6	Industrial	1117 Ipswich Road, Moorooka	51	52	47
NSR7	Commercial	1145 Ipswich Road, Yeerongpilly	49	49	40
NSR8	Commercial	1130 Ipswich Road, Moorooka	48	49	40
NSR9	Commercial	1166 Ipswich Road, Moorooka	47	48	37
NSR10	Commercial	931 Fairfield Road, Yeerongpilly	63	50	35
NSR11	Commercial	1160 Ipswich Road, Moorooka	47	48	35
NSR12	Commercial	945 Fairfield Road, Yeerongpilly	58	47	35
NSR13	Commercial	969 Fairfield Road, Yeerongpilly	61	50	44
NSR14	Residential	1213 Ipswich Road, Moorooka	61	62	45
NSR15	Commercial	973 Fairfield Road, Yeerongpilly	57	50	35
NSR16	Commercial	12 Kenway Street, Moorooka	46	46	32
NSR17	Residential	1219 Ipswich Road, Moorooka	63	62	44
NSR18	Industrial	985 Fairfield Road, Yeerongpilly	62	55	31
NSR19	Residential	1223 Ipswich Road, Moorooka	63	64	43
NSR20	Residential	1227 Ipswich Road, Moorooka	65	65	45
NSR21	Industrial	993 Fairfield Road, Yeerongpilly	62	55	31
NSR22	Residential	1231 Ipswich Road, Moorooka	62	63	43
NSR23	Commercial	1220 Ipswich Road, Moorooka	47	46	32
NSR24	Residential	1235 Ipswich Road, Moorooka	62	62	42
NSR25	Industrial	999 Fairfield Road, Yeerongpilly	51	50	29
NSR26	Residential	1241 Ipswich Road, Moorooka	63	62	44
NSR27	Residential	1249 Ipswich Road, Moorooka	60	59	41
NSR28	Residential	1257 Ipswich Road, Moorooka	59	57	37

[1] A 7dBA façade attenuation has been assumed to enable direct comparison with predicted noise impacts described in RfPC-4.

Table 6 provides a summary of the maximum predicted noise impacts for residential, commercial and industrial places. Industrial places have been included in the assessment as a conservative measure, however it is unlikely that those places are a "Sensitive Place" in accordance with the Imposed Conditions. The status of industrial places will be confirmed during consultation with directly affected persons.

Table 6 Predicted Construction Noise Levels at Nearby Sensitive Places

Sensitive Place Classification	Predicted L_{A10} (dB(A)) Noise Level at Nearest Sensitive Place (Internal[1])			
	Building Demolition	General Earthworks	Bridge Construction	Comments
Residential	65	65	55	**Noise goals** Exceedances predicted during Standard and Non-Standard Hours for all scenarios Additional discussion around management measures presented below
Noise Goal +20 (dBA)	Standard Hours –75 (55+20) Non-Standard Hours – 62 (42+20)			**Noise goals + 20 dB(A)** No exceedances predicted during Standard Hours of Works. Exceedance predicted during Non-Standard Hours for works associated with building demolition and General Earthworks. Whilst Building demolition is not proposed to be undertaken during Non-Standard Work Hours, General Earthworks are proposed to be undertaken during Non-Standard Hours. Additional discussion is provided below
Commercial	63	50	44	**Noise goals** Exceedances predicted during Standard Hours for building demolition only. General earthworks and bridge construction are deemed managed during Standard Hours Exceedances predicted during Non-Standard Hours for all scenarios Additional discussion around management measures presented below
Noise Goal + 20 (dBA)	Standard Hours –75 (55+20) Non-Standard Hours – 62 (42+20)			**Noise goals + 20 dB(A)** No exceedances predicted during Standard Hours for all scenarios. Exceedance predicted during Non-Standard Hours associated with building demolition works. Building demolition is not proposed to be undertaken during Non-Standard Hours.

[1] A 7dBA façade attenuation has been assumed to enable direct comparison with predicted noise impacts described in RfPC-4

Sensitive Place Classification	Predicted L_{A10} (dB(A)) Noise Level at Nearest Sensitive Place (Internal[1])			
	Building Demolition	**General Earthworks**	**Bridge Construction**	**Comments**
Industrial	78	65	54	**Noise goals** Exceedances precited during Standard and Non-Standard Hours for all scenarios Additional discussion around management measures presented below
Noise Goal +20 (dBA)	Standard Hours – 80 (60+20) Non-Standard Hours – 62 (42+20)			**Noise goals + 20 dB(A)** No exceedances predicted during Standard Hours. Exceedance predicted during Non-Standard Hours associated with building demolition and general earthwork. Whilst Building demolition is not proposed to be undertaken during Non-Standard Work Hours, General Earthworks are proposed to be undertaken during Non-Standard Hours. Additional discussion is provided below

The worst-case construction activity modelled in the Evaluated Project was predicted to result in noise impacts of up to 65 dB(A) at residential receivers. The noise impacts at residential receivers is predicted to increase by up to 3 dB(A) compared to the Evaluated Project. An increase of 3 dB(A) can be avoided as per the current Imposed Conditions and management measures detailed in the Noise and Vibration Sub-Plan.

Where noise impacts from the Project Works are predicted to be above the noise goals + 20 dB(A), the Project Works may proceed subject to compliance with Imposed Condition 11(c), including through increased engagement with Directly Affected Persons and appropriate mitigation measures. The DAP engagement process is detailed in Appendix 1.

Table 7 provides a summary of predicted impacts from vibration intensive construction activities[1] at Sensitive Places.

Table 7 Predicted Exceedances of Construction Vibration Criteria

Scenario / Impact type	Receptor Type	Vibration Goal in mm/s (Imposed Condition 11e, Table 3)	Required Setback Distance to meet the goal	Number of receptors where vibration is exceeded	Vibration Goal in mm/s (Imposed Condition 11g)[2]	Required Setback Distance to meet the goal	Number of receptors where vibration is exceeded
Scenario 1 – demolition (hydraulic hammer)							
	Residential	15.0	11	0	15.0	11	0

[1] Scenario 3 does not have vibration intensive equipment more details are presented in section 2.2.6

[2] The has been based on the transient vibration respite limit as per condition 11(g) of the CGCR.

Scenario / Impact type	Receptor Type	Vibration Goal in mm/s (Imposed Condition 11e, Table 3)	Required Setback Distance to meet the goal	Number of receptors where vibration is exceeded	Vibration Goal in mm/s (Imposed Condition 11g)[2]	Required Setback Distance to meet the goal	Number of receptors where vibration is exceeded
Cosmetic Damage	Commercial and Industrial	50.0	4	0	50.0	4	0
	Heritage	2.0	77	0	2.0	77	0
Human Comfort (day)	Residential[3]	1.0	153	15	10.0	16	0
	Commercial and Industrial[4]	2.0	77	17	10.0	16	2
Human Comfort (night)	Residential[3]	0.5	306	89	10.0	16	0
Scenario 2 – earthworks (vibratory roller)							
Cosmetic Damage	Residential	15.0	6	0	15.0	6	0
	Commercial and Industrial	50.0	2	0	50.0	2	0
	Heritage	2.0	28	0	2.0	28	0
Human Comfort (day)	Residential[1]	1.0	45	0	10.0	8	0
	Commercial and Industrial[2]	2.0	28	1	10.0	8	0
Human Comfort (night)	Residential[3]	0.5	73	2	10.0	8	0

2.2.1 Scenario 1 Noise Impacts

Building demolition activities are currently proposed to occur during Standard Working Hours. No exceedances of the noise goal + 20 dB(A) are predicted as a result of these activities at nearby Sensitive Places.

However, 11 exceedances of the Standard Hours noise goal of up to 10 dB(A) are predicted at residential and commercial Sensitive Places. Four (4) exceedances of the Standard Hours noise goal of up to 18dB(A) are predicted at industrial places. For the latter predicted exceedances it is highly likely that a façade reduction greater than the 7dBA used as part of the reductive modelling will actually apply and therefore the predicted exceedances are likely to be demonstrated to be less

[1] This number is related to the total number of buildings. Buildings such as residential apartment blocks may include multiple receptors

[2] As Table 3 in the CGCR references a standard that does not include PPV human comfort criteria, the lower limit has been based on DIN 4150-3 Structural Vibration Part 3 – Effects of vibration on structures.

during further detailed modelling to be undertaken as part of the existing Environmental Management Framework (EMF) processes.

These impacts will be managed through the mitigation measures detailed in section 3.1.

It should also be noted that exceedances of the Non-Standard Hours noise goal + 20 dB(A), of up to 16 dB(A) are predicted for Sensitive Places (Industrial) located on Fairfield Road, Chale Street, Gus Street and Varley Street, should these works be undertaken during Non-Standard Hours.

2.2.2 Scenario 2 Noise Impacts

General earthworks activities are proposed to occur during both Standard and Non-Standard Hours. No exceedances of the Standard Hours noise goals + 20 dB(A) are predicted for these construction activities.

Multiple exceedances of the Standard Hours noise goal are predicted at residential, commercial and industrial places in close proximity to the proposed area of works, located on Chale Street, Ipswich Road, Blackburn Street, Chaucer Street and Hamilton Road.

The noise goal + 20 dB(A) for Non-Standard Hours is predicted to be exceeded at one industrial place on Chale Street and four residential Sensitive Places on Ipswich Road by 3 dBA.

It is likely that the industrial place will not be occupied during Non-Standard Hours; this will be confirmed during community consultation to identify the number of DAPs impacted as part of the works.

The predicted exceedances of the Non-Standard Hours noise goals would at this stage prevent earthworks from being undertaken during Non-Standard Hours. For these activities to be allowed to proceed during Non-Standard Hours (i.e. 24hours/7days), it is required that they are not predicted to exceed 42dBA at occupied Sensitive Places (Indoors) to be deemed Managed Works.

It is noted that the noise model assessed earthworks activities undertaken across the majority of the Clapham Yard area. Consistent with Imposed Condition 4c(ii), further predictive studies and assessment will be undertaken. The following will be further validated to refine the predictive model inputs to ascertain under which construction strategy these works would meet the definition of Managed Works:

- Verify the sound power level of the grader (which is the primary noise contributor associated with earthworks)
- Ascertain the actual footprint where earthworks would occur
- Verify the façade attenuation of the residential buildings predicted to be impacted
- Verify the attenuation the existing noise walls located at the south eastern boundary of the yard provide to the residential properties located along Ipswich
- Verify the occupancy of said properties
- Identified whether additional controls may be able to be reasonable and practically implemented at source or at receiver through consultation with the identified DAPs

There is an opportunity for tunnel spoil from the Woolloongabba and Southern Portal sites to be beneficially re-used as fill material for the Clapham Yard earthworks. This approach is consistent with the approach described in the 2011 EIS and would minimise the Project need to source virgin fill material from off-site quarries, resulting in a more sustainable outcome for the Project.

It is therefore recommended this option be further assessed once a better understanding of the actual delivery, stockpiling and placement works needs compared to fill supply from the TSD worksites using the existing mechanisms mandated by the Imposed Conditions.

However, to ascertain whether this proposal is highly likely to be viable the following scenarios have been modelled based on the information available to date.

Table 8: Potential Managed Works Scenarios

Scenario	Plant Type	Indicative Number*	SWL (dB(A))
Scenario A - Deliver, Stockpile and Place using same equipment as during daytime	Grader 25t	1	114
	Smooth Drum Roller	1	108
	Truck & Dogs	21 (worst case peak)	106
	Water Cart	1	98
	Light Vehicles	5	88
Scenario B - Deliver, Stockpile and Place using alternative equipment	825 Compactor	1	109
	Truck & Dogs	21 (worst case peak)	106
	Water Cart	1	88
	Light Vehicles	5	88
Scenario C - Deliver and Stockpile Only	Truck & Dogs	21 (worst case peak)	106
	Light Vehicles*	5	88*

The predicted modelling has assumed that the Commercial and Industrial Sensitive Places detailed in Figure 2 will not be occupied during Public Holidays, on Sundays and at Night Time. The Modelling has therefore focussed on the residential receivers for which the façade attenuation is assumed to be lowest despite being located behind an existing noise wall) and who would be the most likely DAPs by out of hours operations.

The below table details the outcomes of the model. In summary:

- Scenario 2A can proceed as managed Works as long as the proposed earthworks are marginally reduced to provide a minimum offset of 111m from the residential receivers. This offset would only marginally reduce the placement area and therefore out of hours earthworks are viable
- Scenario 2B can proceed as managed Works as long as the proposed earthworks are marginally reduced to provide a minimum offset of 59m from NSR26.
- Scenario 2C can proceed without further management measures as works are predicted to be managed works.

Table 9: Predictive Modelling Outputs

Receptor ID	Closest distance from baseline stockpiling and placement area (m)	Scenario A - Deliver, Stockpile and Place using same equipment as during daytime		Scenario B - Deliver, Stockpile and Place using alternative equipment		Scenario C - Deliver and Stockpile Only	
		Predicted LA10 (dB(A)) Noise Level (internal [1])	Actual offset distance (m) from Project Works to be Managed Works	Predicted LA10 (dB(A)) Noise Level (internal [1])	Actual offset distance (m) from Project Works to be Managed Works	Predicted LA10 (dB(A)) Noise Level (internal [1])	Actual offset distance (m) from Project Works to be Managed Works
NSR14	79	**45**	111	39	N/A - Managed Works at current distance	38	N/A - Managed Works at current distance
NSR17	75	**46**	111	40	N/A - Managed Works at current distance	39	N/A - Managed Works at current distance
NSR19	79	**45**	111	39	N/A - Managed Works at current distance	38	N/A - Managed Works at current distance
NSR20	70	**47**	111	40	N/A - Managed Works at current distance	39	N/A - Managed Works at current distance
NSR22	70	**47**	111	40	N/A - Managed Works at current distance	39	N/A - Managed Works at current distance
NSR24	63	**47**	111	41	N/A - Managed Works at current distance	40	N/A - Managed Works at current distance
NSR26	52	**50**	111	**44**	57	42	N/A - Managed Works at current distance
NSR27	67	**47**	111	41	N/A - Managed Works at current distance	40	N/A - Managed Works at current distance
NSR28	103	**44**	111	37	N/A - Managed Works at current distance	37	N/A - Managed Works at current distance

[1] A 7dBA façade attenuation has been assumed to enable direct comparison with predicted noise impacts described in RfPC-4.

2.2.3 Scenario 3 Noise Impacts

No exceedances of the Standard Hours or Non-Standard Hours noise goal +20dBA are predicted at nearby Sensitive Places as a result of the Scenario 3 bridge construction activities. Bridge construction activities are proposed to occur during standard working hours only. As demonstrated in Table 6, the maximum predicted noise impact as a result of these works is 55 dB(A) at a residential Sensitive Place, which does not exceed the Noise Goals. It is noted that the construction footprints for the bridge construction activities are located further from Sensitive Places, compared to the Scenario 1 and Scenario 2 works.

2.2.4 Scenario 1 Vibration Impacts

The proposed equipment for the building demolition activities includes a hydraulic hammer, which has the potential to produce measurable vibration impacts.

The operation of the hydraulic hammer within the demolition construction footprint is not predicted to result in exceedances of the cosmetic damage criteria for Sensitive Places.

Two industrial places are predicted to exceed the vibration goal for the Human Comfort (10mm/s), located on Fairfield Road and Chale Street respectively.

These two places are however located within the land required for the Clapham Yard Upgrade and therefore are likely to be vacated prior to demolition works commencing.

The Chale Street property has been confirmed as a vacant block of land and therefore there are no limitations placed on the demolition activity despite the predicted exceedance of the 10mm/s transient vibration goals.

The DAP engagement process will confirm the actual occupancy of the sensitive place located on Fairfield Road (which is located 15m away from the demolition works) to confirm whether the requirements of Imposed Condition 11(g) are applicable to the demolition activities.

Following the modelling methodology described in Section 1.1.2, the predicted vibration level at this Sensitive Place is 11mm/s.

2.2.5 Scenario 2 Vibration Impacts

The proposed equipment for general earthworks includes a smooth drum roller, which has the potential to produce measurable vibration impacts. The nearest Sensitive Place is located 15m from the proposed earthworks construction footprint on Chale Street and is used for industrial purposes (Weston Milling).

Following the modelling methodology described in Section 1.1.2, the predicted vibration level at this place is 4.5mm/s. This complies with the cosmetic damage goal for Sensitive Places of 50.0mm/s, however, it exceeds the human comfort lower goal of 2mm/s.

These impacts will be managed through general mitigation measures, as outlined below, as the predicted vibration levels do not exceed the vibration goals for Human comfort of 10 mm/s (transient vibration) nominated under Imposed Condition 11(g).

No other exceedances of the cosmetic damage or human comfort vibration goals are predicted at nearby Sensitive Places for daytime activities.

Exceedances of the of night-time human comfort vibration goal are predicted at two residential properties along Ipswich Road, located 70m from the edge of the works. The predicted vibration level at these Sensitive Place is 0.6 mm/s. If earthworks were to occur at night, further review of the activities and associated plant and equipment to be used will be undertaken as per the current processes under the EMF. If the vibratory roller is not to be used during night-time activities, there would be no exceedance of the 0.5mm/s vibration goal.

2.2.6 Scenario 3 Vibration Impacts

The proposed equipment for structure construction activities does not include any equipment that is classified as vibration intensive. As such no vibration modelling has been completed for this activity as the potential vibration impacts would be unlikely to exceed the imposed conditions related to construction activities at any nearby Sensitive Places.

2.2.7 Summary

The noise and vibration impacts produced by these works generally align with the magnitude of the construction noise and vibration impacts assessed within the Evaluated Project for residential Sensitive Places.

Mitigation measures will be applied to manage the impacts of the Proposed Change, which include:

- Conducting consultation with identified DAPs to provide information on the duration of works and level of noise impacts. Further details on how DAP engagement is triggered and carried out is presented in Appendix 1.
- Monitoring of noise levels during high noise emission works to confirm noise impacts and the accuracy of the predicted noise levels to nearby Sensitive Places.
- Noise and/or vibration monitoring in response to complaints.
- Positioning construction equipment further from Sensitive Places, where feasible,
- Reviewing construction methodologies to assess if alternative equipment can be used (e.g. substituting a 13T excavator for a 6T excavator would theoretically achieve a 4dB(A) reduction for the same Project works within the same footprint),
- Where there is no alternative to undertaking construction works during Non-Standard Hours, noise intensive works should be scheduled during less disruptive periods of the Non-Standard Working Hours shift, such as in the early evening.

Further detail regarding the mitigation measures for the Proposed Changes is provided in Section 3.1.

2.2.8 Extended Possessions

Extended rail possession will be required to undertake overhead line and signal upgrade works and track works within the rail corridor.

These extended possessions will typically be over times providing the least disruption to customers, such as Easter and Christmas and will be agreed in consultation with Queensland Rail. These extended windows are essential to enabling the delivery of significant portions of work that require extended periods with no trains.

Works during these extended periods are maximised to ensure the utmost efficiency and magnitude of works can be undertaken, reducing the number of overall rail possessions that are required for the Project.

As part of RfPC8, the following scenarios related to works within the rail corridor were modelled.

Table 10: Rail corridor scenarios - Nominated Plant and Equipment List (extracted from RfPC8 - Volume 3)

Scenario	Plant and equipment list	Plant and equipmentnumber	Noise powerlevel – SWL LA_{eq} (dBA)
Scenario 4 - Works within the rail corridor - overhead line and signal upgrade work	Excavator (45t)	1	112
	Truck (<20t)	3	90
	Mobile crane (20t)	1	113
	Concrete saw	1	118
	Vac Truck	2	109
	Light vehicle	4	103
	Generator	1	103

Scenario	Plant and equipment list	Plant and equipmentnumber	Noise powerlevel – SWL LA_{eq} (dBA)
Scenario 5 -Works within the rail corridor - construction	Excavator (45t) Truck (<20t) Mobile crane (20t) Concrete saw [1] Vac Truck Light vehicle Generator Bored piling rig	1 3 1 1 2 4 1 1	112 90 113 118 109 103 103 114

The outcome of the predictive modelling for the Moorooka Station area are reproduced in the below Table.

Table 11: Moorooka Station Noise Assessment and Predicted Impacts (extracted from RfPC8 - Volume 3)

Sensitive receptor type[2]	Distance from nearest construction source (m)	Activity scenario	Project noise goal (LA10 dBA) (internal & external)			Predicted noise level (dBA) - worst case	
			Residential day	Residential evening	Residential Night	External	Internal
Commercial Residential - House (2 Storey)	150m - BlackburnStreet	Scenario 1	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	66	56.5
Commercial Residential - House (2 Storey)	150m - BlackburnStreet	Scenario 2	50 (int) 57 (ext)	50 (int) 57 (ext)	42 (int) 49 (ext)	66	56.5

A worst-case scenario for track works during ‘extended works’ as part of rail possession would result in noise impacts 14.5 dB(A) above the Non-Standard Hours Noise Goal.

This noise impact would still remain within the noise goal + 20 dBA whereby not triggering Imposed Condition 11(c) and the additional management with the Directly Affected Persons (DAPs). However, to further mitigate this impact, additional detailed noise assessment and planning will be completed prior to these works commencing as per the current EMF processes.

It also is noted that this noise impact relates to the use of tools and equipment with the highest SWL of 118dB(A), which typically are rail / concrete saw and specialised track equipment for the tamping and regulation of ballast.

Rail / concrete saws are typically used at the start of a rail possession when existing tracks requires to be cut in discrete areas along the existing rail network. When rail-saws must be used to cut track, this activity is of very short duration (typically 10-15 minutes per cut).

Similarly, the use of tamping and regulation equipment occurs during discrete periods of the rail possessions. Tamping and regulation equipment are mobile equipment that travel along the newly laid tracks therefore not remaining located in one location for extended period of times.

[1] The SWL of concrete saw is the same as of Track equipment (tamping machine and regulator), therefore if ballast tamping and regulation is required to occur the predicted noise levels would be the same as scenario 2 predictions.

[2] Assumed façade reduction 7 dBA, plus 2.5 dBA facade reflection for Residential (House)

The transient and discrete nature of these sub-activities associated with track works during rail possessions means that the worst case noise impact presented in Table 11 is not representative of the noise level the closest sensitive Places will experience for the duration of the extended Rail Possessions.

2.2.9 Construction Traffic Impacts

The construction methodology for Clapham Yard requires the movement of haulage vehicles and other heavy vehicle construction traffic.

The below table summarises the key description of key Traffic Movements that may result in increased Traffic Noise levels and provides a summary comparison with the Proposed Change.

Table 12: Heavy Vehicles – Traffic Volumes

Evaluated Project – RfPC-4	Proposed Change
Noise impacts associated with construction traffic not assessed However, a maximum of 166 one-way truck movements per day were considered as part of the traffic and transport assessment broken down as follows: 41 one-way heavy vehicle movement for spoil movement and 125 one-way heavy vehicle movements for deliveries	**First peak haulage period (September 2021 to June 2022)** Maximum of 159 one way-way truck movement. Worst case scenario assuming the following activities will occur concurrently 137 one-way truck movement for bulk fill import (up to 14,000m^3/month) per day 10 one-way truck movements for off-site haulage of unsuitable spoils per day 12 one-way heavy vehicle movement for other miscellaneous delivery activities comprised of equipment and concrete deliveries **Second peak haulage period (December 2022 to March 2023)** Maximum of 153 one way-way truck movement. Worst case scenario assuming the following activities will occur concurrently 133 one-way truck movement for bulk fill import (up to 14,000m^3/month) per day 10 one-way truck movements for off-site haulage of unsuitable spoils per day 10 one-way heavy vehicle movement for other miscellaneous delivery activities comprised of equipment and concrete deliveries

It is noted there are no specific Imposed Conditions related to construction traffic noise. Imposed Condition 14(e) states:

Heavy construction vehicles use only designated routes for spoil haulage and deliveries of major plant, equipment and materials, in accordance with the Construction Environmental Management Plan. The designated haulage routes for each worksite must follow major or arterial roads to the extent practicable and be developed in consultation with the Department of Transport and Main Roads and the Brisbane City Council in preparation of the Construction Environmental Management Plan.

An aerial photograph of the site and the surrounding roads is shown below in Figure 3.

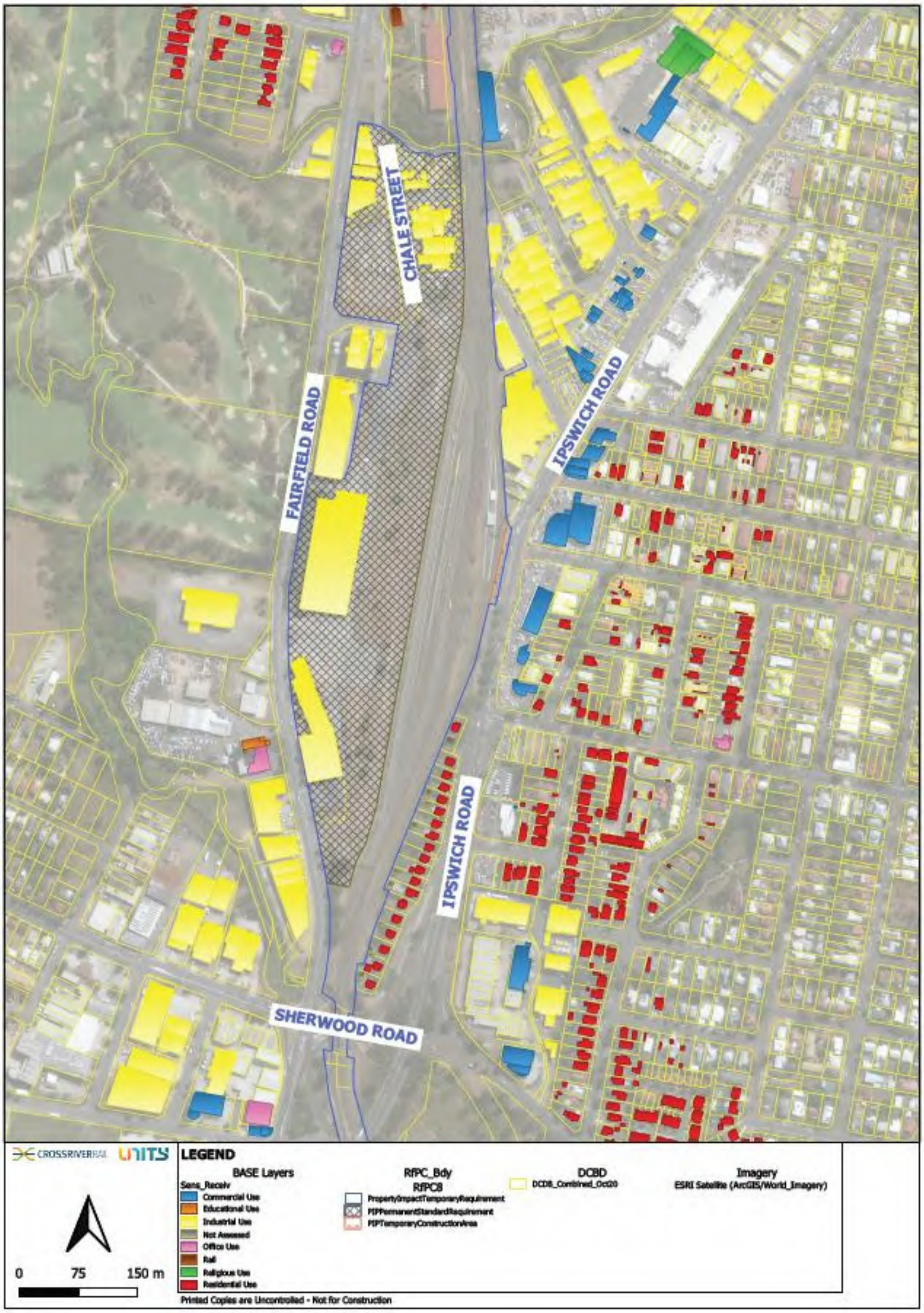


Figure 3: Locality Map

The proposed construction traffic routes are further detailed in the Traffic and Transport Technical Report.

Section 2.2.6 Construction Road Traffic Noise of the EIS states:

Where the construction phase of CRR is adding heavy vehicles to the existing road network, it is appropriate to consider the incremental change in noise levels due to the changes in traffic volume.

A change of up to 3 dBA in the level of a dynamic noise, such as passing vehicles is difficult for most people to detect, whilst a 3 dBA to 5 dBA change corresponds to a small but noticeable change in loudness. A 10 dBA change corresponds to an approximate doubling or halving in loudness.

It is acknowledged that people are likely to notice increased traffic based on visual clues and perception of vehicle pass-by frequency before they will objectively notice an increase in the average noise level.

For assessment purposes it is common to set the threshold of significance in relation to changes in the noise emission level from roads at 2 to 3 dBA.

Other relevant literature to the assessment of construction traffic noise impact has been reviewed, inclusive of the DTMR Code of Practice Volume 2 (CoP2)- Construction Noise and Vibration (2016).

Section 3.2.1.2 of the CoP2 state the following with regards to construction traffic:

Haulage/transportation associated with construction activities on public roads within the project area or beyond has the potential to create traffic noise issues for existing sensitive receptors. The following criteria shall be used to limit traffic noise caused by construction traffic:

- Construction traffic should not increase the pre-construction traffic noise level $L_{A10,1\ hour}$ by more than 3 dB(A).

The increase due to construction traffic should be considered against the median minimum $L_{A10,1\ hour}$ noise levels for each of the relevant hours within each work period. If measurements are unavailable, the increase should be considered against the predicted pre-construction $LA_{10,1\ hour}$ noise level.

For the impact assessment of construction traffic noise the noise goal in Table 13 *has been used.*

Table 13: Noise Goal - Construction Traffic Impact assessment

Type of Roads	Goal
Existing Roads	3dBA change in existing $LA10_{(1\ hour)1}$ 2dBA change in existing $LA10_{(12hour)2}$, and $L10_{(18hour)3}$

1 $L_{A10(1hour)}$ for the peak number of heavy vehicle movements during any hour between 12 midnight and 6am as stated in Section 9.4.2 of the EIS.
2 $L_{A10(12hour)}$ is the average L_{A10} traffic noise level between the hours of 6:30am and 6:30pm as stated in Section 9.4.2 of the EIS.
3 $L_{A10(18hour}$ is the average L_{A10} traffic noise level between the hours of 6 am and 12 midnight.

Recent traffic volume data for Fairfield Road in the vicinity of Chale Street was reviewed to ascertain the effect of construction related vehicle traffic on noise emissions.

The effect of construction related traffic noise as part of the Proposed Change has been assessed using the CoRTN prediction algorithm. This assessment methodology has been adopted to assess the difference in noise emissions from roads with the changed construction traffic for Clapham Yard. The following periods have been assessed to cover the potential for 24 hour working hours at the worksite of Clapham Yard.

- LA10(12hour) for the hours between 6:30am and 6:30pm
- LA10(18hour) for the hours of 6:00am and 12:00am midnight
- LA10(1hour) for the vehicle movements during any hour between 12:00am midnight and 6:00am.

On a given roadway, the essential modelling inputs that the additional construction traffic will alter are the percentage of heavy vehicles and total vehicle numbers utilising that roadway. For the assessment of typical construction truck volumes, 70% of the peak daily frequencies have been adopted as being representative of total truck movements, with the remainder being light vehicle traffic (consistent with the Traffic and Transport Report).

For existing road traffic data, it has been assumed that light vehicles represent 80% of the traffic volumes and heavy vehicles represent 20% of the traffic volumes.

As a conservative assessment approach, the day-time hourly peak movements for the day production rates were assumed to occur during all hours. These movements were combined with the quietest hour of traffic movements between the hours of 12:00am to 6:00am to be representative of the highest increase in noise impacts for the LA10(1hour) prediction. The increase in noise levels for each period is presented in Table 14.

Table 14 Predicted increase in noise levels due to construction traffic

Worksite	Change in Road Traffic Noise level due to the Project, dB(A)		
	LA10(18hour)	LA10(12hour)	LA10(1hour)
Noise Goal (Table 13)	<2dBA	<2dBA	<3dBA
Clapham Yard	+0.1[1]	+0.2[1]	+2.6[1,2,3]

Notes

1. The CoRTN assessment has used the worst case hourly vehicle movements (one way)
2. The LA10(1hours) covers an 18 hours window. The data from the quietest window of existing traffic movement was used to assess the predicted change therefore the data presented are a worst case increase scenario
3. Road adjacent to industrial/commercial receivers only

As shown in Table 7, the maximum increase in traffic noise is +2.6dBA LA10(1hour). This is below the goal of 3dBA and therefore, the proposed change is seen to not have an increased impact compared to the Evaluated Project.

2.3 Operational Noise and Vibration Impacts

The Proposed Changes include a new alignment for the Clapham Yard stabling roads and an increase in the terrain height within Clapham Yard. Furthermore, the sound power source levels for idling trains and through train movements have been revised compared to the Evaluated Project, based on updated data from Queensland Rail. The capacity of the stabling yard and the number of idling trains remains unchanged compared to the Evaluated Project.

The Imposed Conditions provide noise criteria for operational noise at Sensitive Places of 65 dB(A) $L_{A,eq}$ and a Single Event Maximum (SEM) of 87 dB(A).

The predicted impacts at twenty eight representative Sensitive Places located closest to the boundary of Clapham Yard are presented in Table 15, a map of Sensitive Places relating to each receptor ID is presented in Figure 2. This table provides the highest predicted operational noise impacts related to the revised design of Clapham Yard.

Table 15 Clapham Yard Operational Noise Impacts at Representative Sensitive Places

Receptor ID	Land Use	Address	Noise Goals (EDR3(a))		Predicted Operational Noise Impacts	
			Single Event Maximum (dB(A))	$L_{A,eq\ (24h)}$ (dB(A))	Single Event Maximum (dB(A))	$L_{A,eq\ (24h)}$ (dB(A))
NSR1	Commercial	60 Evesham Street, Yeerongpilly	87	65	95	78
NSR2	Industrial	760 Chale Street Yeerongpilly	87	65	83	68
NSR3	Industrial	770 Fairfield Road, Yeerongpilly	87	65	84	68
NSR4	Industrial	41 Unwin Street, Yeerongpilly	87	65	96	78

Receptor ID	Land Use	Address	Noise Goals (EDR3(a))		Predicted Operational Noise Impacts	
			Single Event Maximum (dB(A))	$L_{A,eq\ (24h)}$ (dB(A))	Single Event Maximum (dB(A))	$L_{A,eq\ (24h)}$ (dB(A))
NSR5	Industrial	30 Unwin Street, Yeerongpilly	87	65	93	75
NSR6	Industrial	1117 Ipswich Road, Moorooka	87	65	94	76
NSR7	Commercial	1145 Ipswich Road, Yeerongpilly	87	65	88	72
NSR8	Commercial	1130 Ipswich Road, Moorooka	87	65	82	67
NSR9	Commercial	1166 Ipswich Road, Moorooka	87	65	87	70
NSR10	Commercial	931 Fairfield Road, Yeerongpilly	87	65	83	69
NSR11	Commercial	1160 Ipswich Road, Moorooka	87	65	88	70
NSR12	Commercial	945 Fairfield Road, Yeerongpilly	87	65	82	68
NSR13	Commercial	969 Fairfield Road, Yeerongpilly	87	65	74	63
NSR14	Residential	1213 Ipswich Road, Moorooka	87	65	85	69
NSR15	Commercial	973 Fairfield Road, Yeerongpilly	87	65	79	64
NSR16	Commercial	12 Kenway Street, Moorooka	87	65	78	65
NSR17	Residential	1219 Ipswich Road, Moorooka	87	65	81	68
NSR18	Industrial	985 Fairfield Road, Yeerongpilly	87	65	84	69
NSR19	Residential	1223 Ipswich Road, Moorooka	87	65	79	68
NSR20	Residential	1227 Ipswich Road, Moorooka	87	65	80	68
NSR21	Industrial	993 Fairfield Road, Yeerongpilly	87	65	85	70
NSR22	Residential	1231 Ipswich Road, Moorooka	87	65	81	68
NSR23	Commercial	1220 Ipswich Road, Moorooka	87	65	75	64
NSR24	Residential	1235 Ipswich Road, Moorooka	87	65	81	67
NSR25	Industrial	999 Fairfield Road, Yeerongpilly	87	65	86	72
NSR26	Residential	1241 Ipswich Road, Moorooka	87	65	84	69
NSR27	Residential	1249 Ipswich Road, Moorooka	87	65	87	71

Receptor ID	Land Use	Address	Noise Goals (EDR3(a))		Predicted Operational Noise Impacts	
			Single Event Maximum (dB(A))	$L_{A,eq\ (24h)}$ (dB(A))	Single Event Maximum (dB(A))	$L_{A,eq\ (24h)}$ (dB(A))
NSR28	Residential	1257 Ipswich Road, Moorooka	87	65	89	72

The noise modelling includes an assessment of Sensitive Places within 100m of the boundary of Clapham Yard to identify the total number of exceedances against the Imposed Conditions. A summary of the total number of exceedances is presented in Table 16.

Table 16 Predicted Operational Noise Impacts at Nearby Sensitive Places

Sensitive Place Classification	Number of Exceedances of $L_{A,eq\ (24h)}$ Criterion	Maximum Predicted $L_{A,eq\ (24h)}$ (dB(A))	Number of Exceedances of SEM Criterion	Maximum Predicted SEM (dB(A))
Residential	21	72	3	89
Commercial	19	78	7	95
Industrial	38	78	13	96

The noise level at nearby Sensitive Places is dominated by the noise emissions of the through rail traffic. The noise produced by the trains idling in the stabling yard does not have a significant effect on the overall noise levels.

As shown in Table 16, the predicted noise levels are in exceedance of the noise criteria at multiple residential, commercial and industrial Sensitive Places in close proximity to Clapham Yard. However, the magnitude of the operational noise impacts aligns with the impacts assessed within the Evaluated Project. Mitigation measures for a number of these Sensitive Places will be required and will be implemented in accordance with the EMF.

Multiple residential Sensitive Places located on Ipswich Road behind an existing noise barrier at the south-eastern boundary of Clapham Yard are predicted to experience exceedances of the noise goal. Potential mitigation measures within the footprint of the existing project boundaries for these residential Sensitive Places may include, where practicable, modifications to the existing noise barriers which were constructed in 2006/2007. To ascertain whether modifications are required and practicable the following will be clarified during the detailed design phase of the Operational Noise Modelling:

- Track geometry and elevation
- As-Built level of the top of the existing barrier
- Building levels, and window levels of the Residential Sensitive Places
- Other relevant modelling inputs (such as but not limited to New Generation Rollingstock [NGR] idling noise levels)

Two residential Sensitive Places located on Blackburn Street are predicted to experience exceedances of the noise goal by up to 2 dB(A). A barrier may not be practical to mitigate the noise impacts at these Sensitive Places as they are located approximately 50m from the boundary of Clapham Yard and are shielded by existing buildings.

Industrial use buildings in proximity to the construction area are used for the purposes of milling, car repairs and mechanical works. The majority of these industrial places are double-storey buildings, limiting the efficacy of noise barriers as a potential mitigation measure. Commercial use buildings in proximity to the construction area are used for the purposes of automotive sales. The industrial and commercial buildings in proximity to the construction works are constructed along an existing rail corridor, and likely incorporate mitigation within the façade design to address noise intrusion.

Accordingly, mitigation measures for these Sensitive Places are not proposed at this stage. Consultation with DAPs will be conducted at a later stage of the project to determine if mitigation measures are required and feasible.

2.4 Summary of Impacts

The change in construction impacts is due to the revised construction methodology, which includes building demolition works and additional bridge works and, and more substantial earthworks. As a result of these changes, the noise impacts at nearby residential Sensitive Places may increase by up to 3 dB(A), which can be avoided.

When construction works occurring during Standard Hours exceed the relevant noise goal, they do not exceed the relevant noise goal + 20dBA. Four residential Sensitive Places located on Ipswich Road and one industrial Sensitive Place located on Chale Street are predicted to exceed the relevant noise goal + 20dBA for construction works occurring during Non-Standard Hours were the bulk earthworks proposed to occur across the full footprint of Clapham Yard during Non-Standard Hours.

Further investigations will be undertaken, consistent with the Imposed Conditions and the processes detailed in the endorsed C-EMP and its subplans, to refine the proposed earthworks methodology to ascertain whether these works could be Managed Works. Based on predictive assessment undertaken using currently available information it is highly likely these proposed earthworks are or could be deemed Managed Works. Alternatively, through the DAP engagement process, works may be authorised to proceed despite the predicted exceedances.

One exceedance of the human comfort vibration criteria is also predicted for an industrial place located on Chale Street. Community consultation will be undertaken with the identified DAP. Noise and vibration monitoring will be conducted to confirm the noise impacts at nearby Sensitive Places. Where possible, construction equipment will be located away from Sensitive Places to reduce the noise and vibration impacts.

The noise contour maps for the construction scenarios subject to further modelling are presented in Appendix 2.

The proposed changes to Condition 10 will not result in any changes to the nature of the works to be undertaken for the CRR Project but will result in certain works being undertaken during extended work hours, with an extended duration to those hours. An assessment of the effects of those changes concludes that the environmental effects of the changes can be managed in accordance with the existing environmental management framework, in particular for management of noise during extended rail possessions and noise traffic impacts, and that the environmental outcomes and process requirements of the environmental management framework remain appropriate for those works

The operational noise impacts have been predicted for the revised design of Clapham Yard and the impacts compared to the Evaluated Project have changed.

The assessment of predicted noise impacts indicates impacts above the noise goals, which may require mitigation measures for those properties.

The noise contour maps for the operational subject to further modelling are presented in Appendix 3.

3. Changes to Mitigation Measures

3.1 Environmental Management Framework (EMF)

The CRR Project currently operates under the C-EMP that is progressively endorsed by the Environmental Monitor for the Relevant Project Works.

The C-EMP endorsement is subject to necessary predictive assessments to satisfy Imposed Condition 4c(ii) having been completed prior to the Project Works commencing. The extent of predictive assessment for noise and vibration and the nominated mitigation measures are subject to the requirements of the NVMP.

Mitigation measures for changed noise and vibration impacts are consistent with the Evaluated Project requirements as documented in the Project OEMP. As such, the OEMP and C-EMP are not required to be updated because of the change in noise and vibration impacts.

Furthermore, no required changes to the CRR Project Imposed Conditions have been identified with respect to the noise and vibration impacts identified for the Proposed Changes.

The mechanisms in place under the C-EMP and its subplans ensure that impacts to human comfort and the risk of property damage associated with noise and vibration intensive activities are appropriately managed during construction.

- C-EMP - Construction Environmental Monitoring Program requires:
  - That prior to works commencing, predictive assessment of noise and vibration levels generated by specific construction activities with a high risk of generating noise or vibration be undertaken to support:
    - refining construction methods and
    - developing adequate mitigation measures to minimise impacts to sensitive places
  - That all works proposed to be undertaken outside of standard working hours be further assessed to ensure they are only authorised to proceed under an Out of Hours permit process.
    - The Out of Hours permitting process requires justification and approval for out of hours works from the Stakeholder and Community Relations Manager, the Environment Manager and the Area Manager or their delegates prior to the works being approved to proceed.
    - When seeking permission to undertake works during non-standard hours, the Out of Hours Permit requires confirmation the requirement to implement and/or vibration mitigation and / or monitoring has been considered.
  - That quantities monitoring of impacts at sensitive places be undertaken based on the outcomes of the predictive assessments
- The Noise and Vibration Management Sub-Plan:
  - Sets out the minimum expectation with regards to standard mitigation measures to be implemented to minimise impacts to human comfort at occupied sensitive places. For Noise the standard mitigation measures are as follows:
    - Swearing or unnecessary shouting or loud stereos/radios on site should not be tolerated
    - Vehicle radios and engines should be turned off wherever possible
    - Appropriately sized equipment should be selected for the task, such as vibratory compactors and rock excavation equipment.
    - Avoid the use of horns within the construction area, except in the case of emergency
    - Set site entry and egress points as far from sensitive receptors as practically possible
    - Utilise main roads for site vehicle access, wherever possible
    - Avoid using plant and equipment simultaneously adjacent to sensitive receptors where reasonably practical. The combined noise/vibration levels could be significantly less when sources operate separately
    - Use mufflers and engine cover/screens, where reasonable and practicable
    - Restrict the number of nights per week that works are undertaken, or schedule in respite measures, unless it can be adequately demonstrated that

the sequencing of works to a shorter timeframe will result in reduced exposure duration to high noise levels.

        - Where possible, the duration of simultaneous operation of noise or vibration-intensive plant should be minimised. Plant and equipment used intermittently or no longer in use should be throttled or shut down.
        - Where feasible, the location for site access points and roads, gathering points, shift changes, parking, etc will be sited away from sensitive receptors.
        - Construction plant, vehicles, equipment and machinery should be maintained and operated in accordance with manufacturer’s instructions to minimise noise and vibration emissions.
        - Non-tonal reversing beepers (or an equivalent mechanism) should be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Without compromising site safety, unnecessary reversing should be avoided and turning circles used instead.
        - The drop height of materials will be minimised, for example, while loading and unloading vehicles or in storage areas.
        - The speed of construction traffic should be minimised near noise sensitive receptors, including acceleration.
    - Sets out the incremental increase of consultation and impact management requirements based on the risk profiles of the Relevant Project Works.
    - Sets out the noise complaints management protocols for Out of Hours Works.
- Then Property Damage Mitigation Sub-Plan:
    - Sets out the minimum expectation with regards to standard mitigation measures to be implemented to minimise impacts to properties.
    - Sets out the incremental increase of consultation and impact management requirements based on the outcomes of the predictive assessment.
    - Sets out the monitoring response procedure, when trigger alarms are being exceeded. This ensures when vibration generated by the Relevant Project Works has the potential to adversely affect buildings, works are stopped and re-assessed.
- The Community Engagement Plan:
    - Sets out the guiding principles to community engagement and consultation to ensure effective engagement of project stakeholders.
    - Sets out the minimum consultation and notification requirements associated with relevant Project based on the outcomes of the predictive noise and vibration impacts.

More details on the DAP engagement process are presented in Appendix 1.

In the event the validation monitoring or the feedback from the community engagement process identifies that management and mitigation measures require adjustment to better minimise impact to sensitive places, the plans will be updated to incorporate improvements in management measures.

3.2 Proposed Changes to the EMF

Based on the outcomes of the predictive assessments presented for the scenarios described in this report, the C-EMP and its subplans continue to contain adequate management measures for the proposed scope changes. As such no additional management measures are proposed.

4. Conclusion

The Proposed Changes to the stabling facilities at Clapham Yard are predicted to result in changes to the construction and operational impacts, as summarised in Section 2.4.

Changes to the construction impacts resulting from changes to Clapham Yard have been investigated using a digital 3D noise model and desktop vibration calculations. The changed impacts do not require changes of the EMF; the current OEMP, CEMP which currently include mitigation and management measures that sufficiently manage these works.

The operational impacts of Clapham Yard are predicted to result in exceedances of the noise criteria for a number of residential, commercial and industrial Sensitive Places. However, the overall noise and vibration impacts at Clapham Yard are similar to the impacts assessed within the Evaluated Project.

Multiple residential Sensitive Places on Ipswich Road, located behind an existing barrier, are predicted to exceed the noise criteria. The requirement for mitigation measures will be confirmed during the detailed design phase for these Sensitive Places in consultation with Queensland Rail.

Two residential Sensitive Places located on Blackburn Street are predicted to exceed the noise criteria. A noise barrier is not feasible at this location.

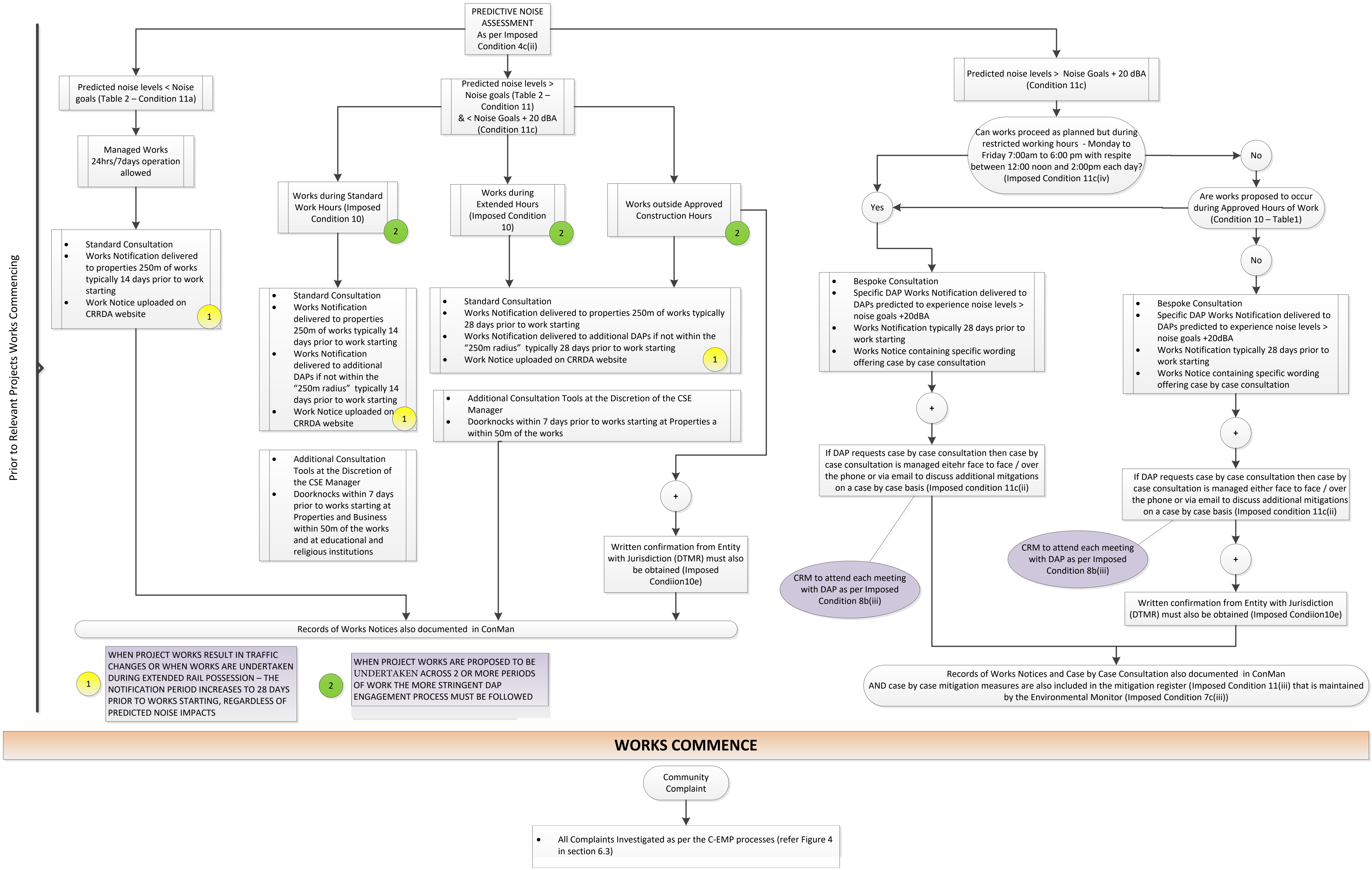
Exceedances of the noise criteria have also been identified at commercial and industrial Sensitive Places. It is expected that these buildings constructed at the boundary of a rail corridor will have existing mitigation within the façade design to address noise intrusion.

Community consultation with identified DAPs will be conducted to determine if mitigation measures are required and feasible.

The change in construction and operational impacts due to the Proposed Changes do not require changes to the Project Imposed Conditions, CEMP, OEMP and the relevant sub-plans.

Appendix 1 – DAP Engagement Process

UNITY ALLIANCE – COMMUNITY, STAKEHOLDERS AND DIRECTLY AFFECTED PERSONS CONSULTATION AND ENGAGEMENT PROCESS – (RfPC 8 Conditions)

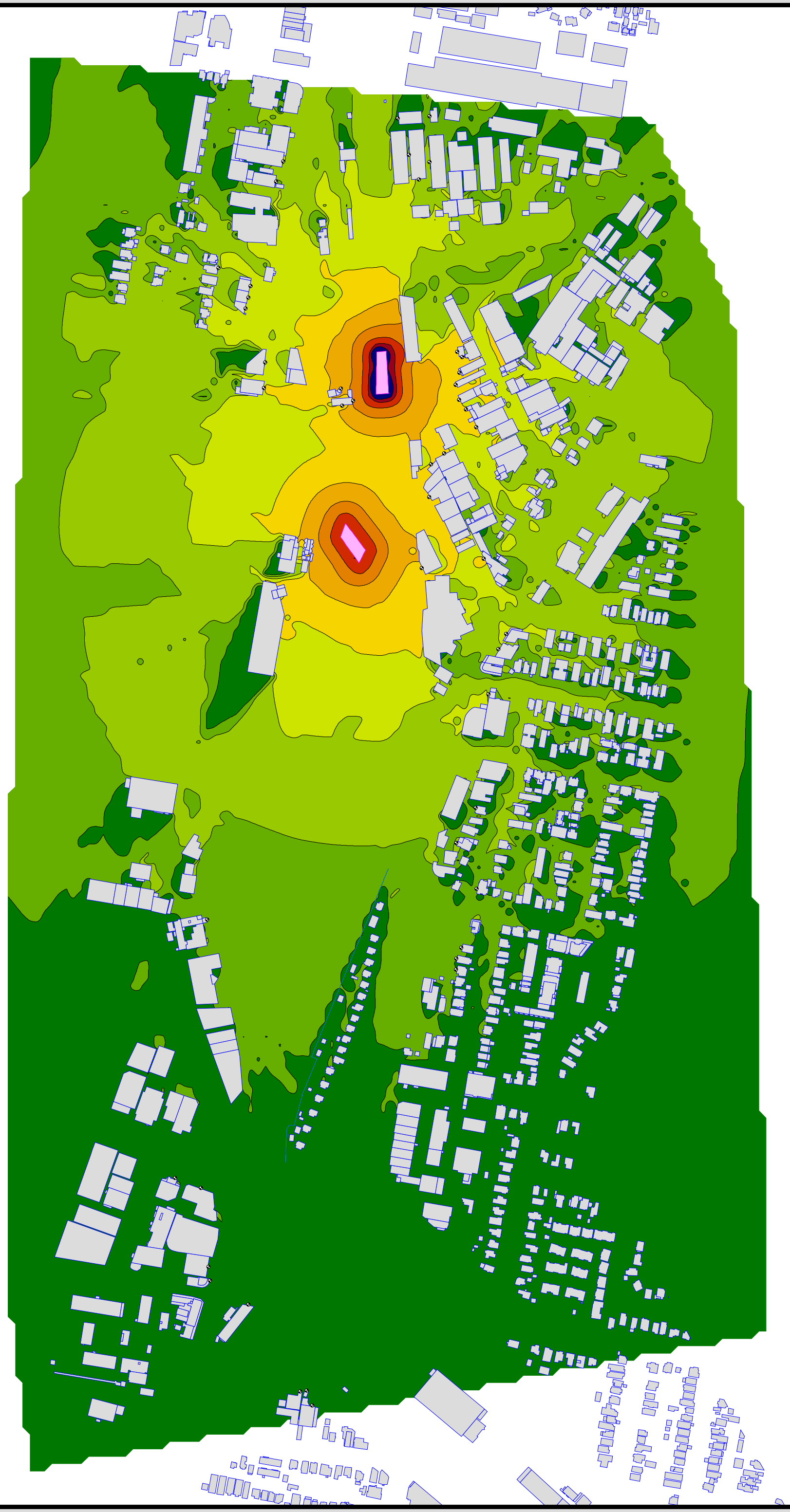


Appendix 2 - Noise Contour Maps and Predictive Assessments – Construction Phase

Clapham Yard - Construction

Bridge Construction

Noise contours do not apply to outdoor areas.
The internal levels for residential locations are produced by applying a 7dB(A) reduction from outdoor to indoor.
Additional reductions apply to specific Sensitive Places up to a maximum of 20dB(A).



Signs and symbols

- Line
- Main building
- Wall
- Base line
- Wall
- Receiver
- Area source

Internal Noise Level
LA10 (15 min)
in dB(A)

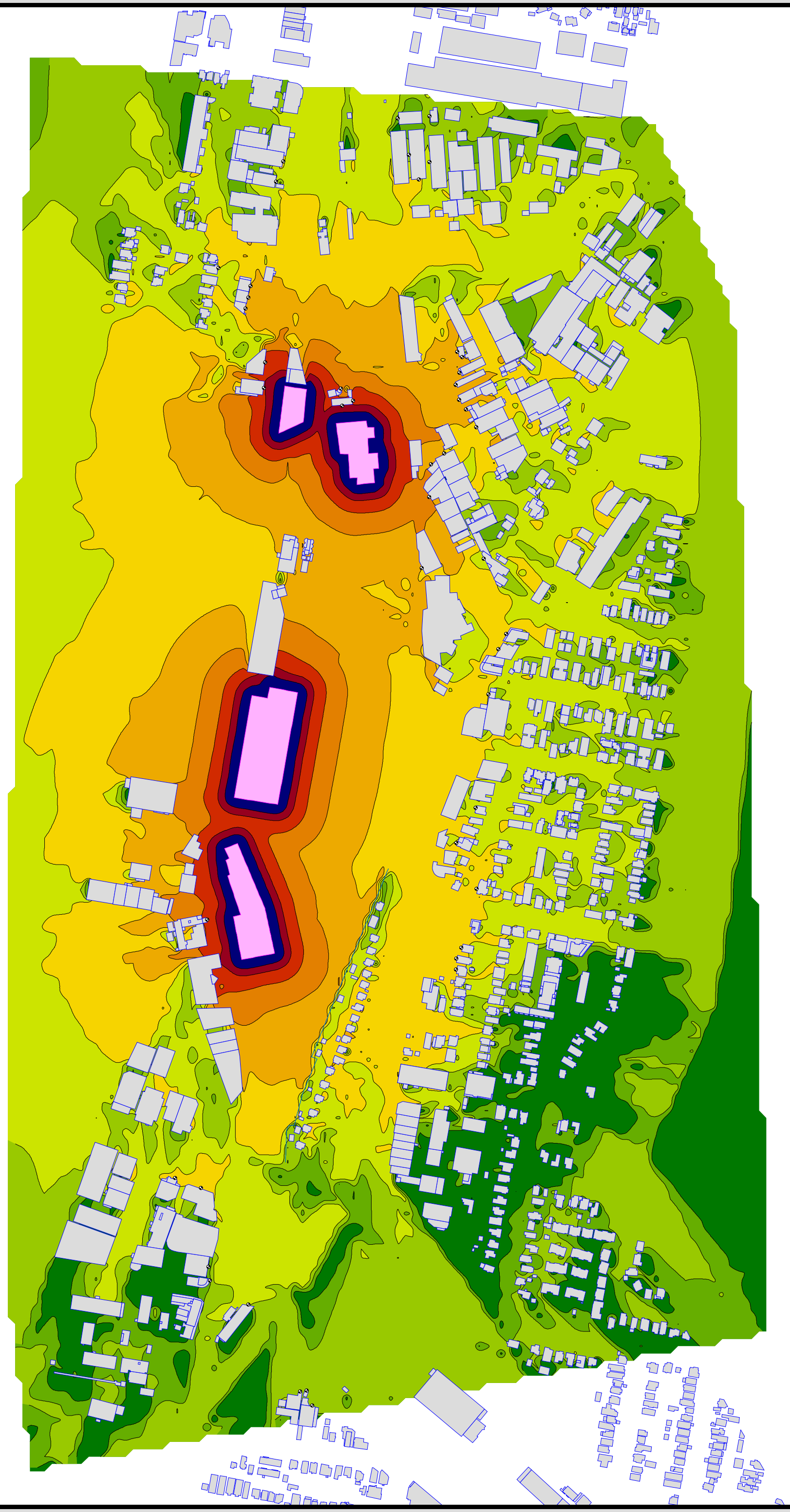
	<=	42
42 <	<=	47
47 <	<=	52
52 <	<=	57
57 <	<=	62
62 <	<=	67
67 <	<=	72
72 <	<=	77
77 <	<=	82
82 <		

Scale 1:10000

0 50 100 200 300 400 m

Clapham Yard - Construction
Building Demolition

Noise contours do not apply to outdoor areas.
The internal levels for residential locations are produced by applying a 7dB(A) reduction from outdoor to indoor.
Additional reductions apply to specific Sensitive Places up to a maximum of 20dB(A).



Signs and symbols

- Line
- Main building
- Wall
- Base line
- Wall
- Receiver
- Area source

Internal Noise Level
LA10 (15 min)
in dB(A)

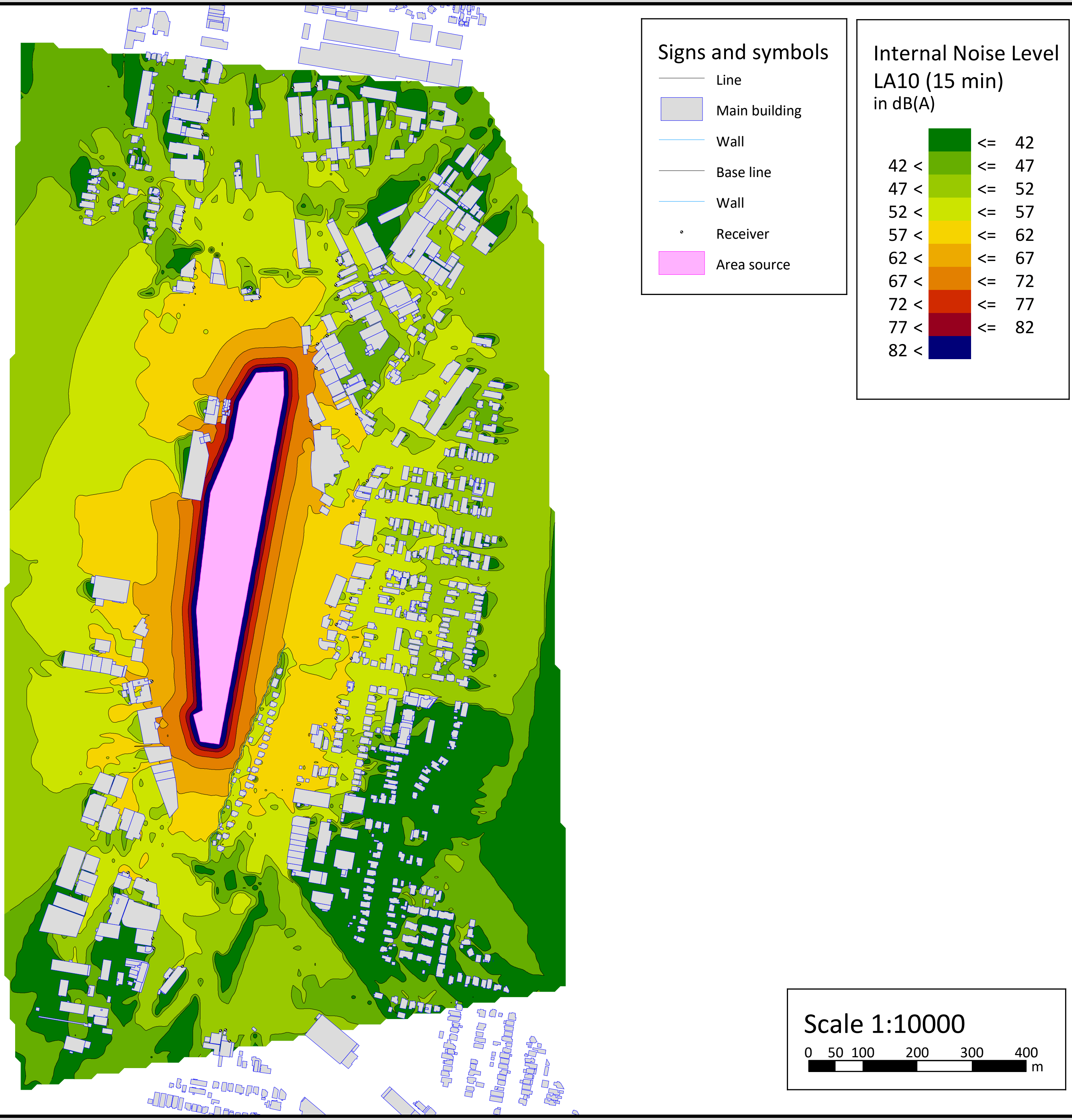
	<=	42
42 <	<=	47
47 <	<=	52
52 <	<=	57
57 <	<=	62
62 <	<=	67
67 <	<=	72
72 <	<=	77
77 <	<=	82
82 <		

Scale 1:10000

0 50 100 200 300 400 m

Clapham Yard - Construction
Earthworks

Noise contours do not apply to outdoor areas.
The internal levels for residential locations are produced by applying a 7dB(A) reduction from outdoor to indoor.
Additional reductions apply to specific Sensitive Places up to a maximum of 20dB(A).



Construction Noise Assessment

Cross River Rail – Rail, Integration and Systems Alliance

Rev	Date	Prepared By	Reviewed By	Approved By	Remarks
0	30/03/21	Kristelle Gentil	0	0	RfPC 11 Managed Work Scenario - Scenario 2B
Signature:					

Introduction

The UNITY alliance has been commissioned to undertake the Rail Integration and Systems (RIS) component of the Cross River Rail (CRR) project. This report contains a construction noise assessment carried out against the Coordinator-General conditions for the project for Clapham Yard - Night Works - Embankment Fill - Deliver and Place - same equipment as Day Shift. The results of this assessment are to be incorporated into the Relevant Site Environmental Plan and Workpack to supplement the C-EMP and Noise and Vibration Management Plan.

Project Requirements

The Intermittent (LA10,adj) (15min) is the relevant Coordinator-General noise goal for all works associated with these construction works. The exact requirements are included within Condition 11(a) of the CGCR. The noise goals for Standard Hours (6:30am - 6:30pm Monday-Saturday) are based on the room usage within buildings and the maximum design level from AS2107 + 10 dB(A). During Non-Standard Hours (6:30pm - 6:30am Monday-Saturday, Sundays and Public Holidays) the Lower Limit intermittent noise goal is 42dB(A) and the Upper Limit is 62dB(A).

The CG conditions for construction noise relate to continuous and intermittent noise sources. The noise descriptor for continuous sources is the LAeq where the descriptor for intermittent noise source is LA10. The CRRDA has advised that future requests for project changes will consider modifying the intermittent descriptor from LA10 to LAeq. This is on the basis that the LAeq is a more appropriate descriptor to capture the noise impacts from intermittent construction sources. This assessment has assessed against the current LA10 descriptor, however it is expected that if the descriptor was changed to LAeq that this assessment would be conservative i.e. the predicted LAeq levels from these construction activities would be slightly lower than the predicted LA10 levels.

Methodology

Noise levels due to the construction activities were predicted at nearby Sensitive Places using a desktop implementation of the CONCAWE noise propagation model. Corrections were applied for geometric spreading, atmospheric absorption, ground absorption, meteorological conditions, source and receiver height and barrier attenuation. It was assumed that the plant with the highest sound power level will dominate the L10 noise descriptor. The calculations represent expected worst periods of construction work impact to compare against the noise goals - nearby Sensitive Places will experience periods of lower construction noise impacts across the duration of the works.

Source noise levels have been taken from various sources. Equipment locations have been based on UNITY's proposed work pack and discussions.

Proposed Activities

Activities proposed to be carried out as part of Clapham Yard - Night Works - Embankment Fill - Deliver and Place - same equipment as Day Shift are outlined in Table 1. The activities are proposed to be completed during standard and non-standard hours. Only the plant with the highest sound power (Dozer (towing roller - rolling and compaction) 142 kW, 20 t) was modelled, as it is assumed this will be the dominant source for LA10 noise levels.

Table 1. Construction Plant

Plant Type	Overall Sound Power Level Leq (dB(A))
Dozer (towing roller - rolling and compaction) 142 kW, 20 t	109
Tipper Lorry	106
Body Truck	88

Assessed Sensitive Places

The sensitive places assessed are outlined in Table 2.

Table 2. Details of Sensitive Places

ID	Description	Category	Distance to Source (m)	Barrier	Ground Surface
1	NSR14	Residential	79	Full shielding (barrier close to receiver)	Grass field with trees
2	NSR17	Residential	75	Full shielding (barrier close to receiver)	Grass field with trees
3	NSR19	Residential	79	Full shielding (barrier close to receiver)	Grass field with trees
4	NSR20	Residential	70	Full shielding (barrier close to receiver)	Grass field with trees
5	NSR22	Residential	70	Full shielding (barrier close to receiver)	Grass field with trees
6	NSR24	Residential	63	Full shielding (barrier close to receiver)	Grass field with trees
7	NSR26	Residential	52	Full shielding (barrier close to receiver)	Grass field with trees
8	NSR27	Residential	67	Full shielding (barrier close to receiver)	Grass field with trees
9	NSR28	Residential	103	Full shielding (barrier close to receiver)	Grass field with trees

Predicted Impacts

Based on the inputs detailed above, the following noise impacts have been predicted for the works associated with Stage 1. The noise impacts have been assessed against the construction noise goals included in CGCR Condition 11.

Table 3. Predicted Impacts at Sensitive Places

Receptor ID	Standard Work Hours Lower Limit	Standard Work Hours Upper Limit	Out of Hours Lower Limit	Out of Hours Upper Limit	Highest Predicted LA10 (15min) Internal Impact (dB(A))
1	55	75	42	62	39
2	55	75	42	62	40
3	55	75	42	62	39
4	55	75	42	62	40
5	55	75	42	62	40
6	55	75	42	62	41
7	55	75	42	62	44
8	55	75	42	62	41
9	55	75	42	62	37

The noise impacts presented in Table 3 demonstrate that the unmitigated noise impacts will not result in levels above the internal noise goals +20 dBA limit for standard hours or out of hours limit at Clapham Yard.

Standard Mitigation Measures

The following mitigation measures will be used by UNITY as best practice:

- Project Notifications will be provided to areas regardless of whether residents / business are predicted to be affected with sufficient information to enable them to understand the likely nature, extent and duration of noise and vibration impacts during various construction activities.
- Unnecessary sources of noise should be avoided. Swearing or unnecessary shouting or loud stereos/radios on site should not be tolerated. Materials should not be dropped from height; metal items should not be thrown and doors should not be slammed.
- Appropriately sized equipment should be selected for the task.
- The duration of simultaneous operation of noise or vibration-intensive plant should be minimised. Plant and equipment used intermittently or no longer in use should be throttled or shut down.
- The location for site access points and roads, gathering points, shift changes, parking etc will be sited away from sensitive receptors.
- Equipment should be operated in the correct manner and correctly maintained including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components and repair of leakages in compressed air lines. Construction plant, vehicles and machinery should be maintained and operated in accordance with manufacturer’s instructions to minimise noise and vibration emissions. Each of these items will need to be checked and included on a plant/equipment checklist.
- Fit engine covers to all plant.
- Fit effective residential class silencers to all engine exhausts.
- Non-tonal reversing beepers (or an equivalent mechanism) should be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Without compromising site safety, unnecessary reversing should be avoided and turning circles used instead.
- The drop height of materials will be minimised, for example, while loading and unloading vehicles or in storage areas.
- The speed of construction traffic should be minimized near noise sensitive receptors, including acceleration.

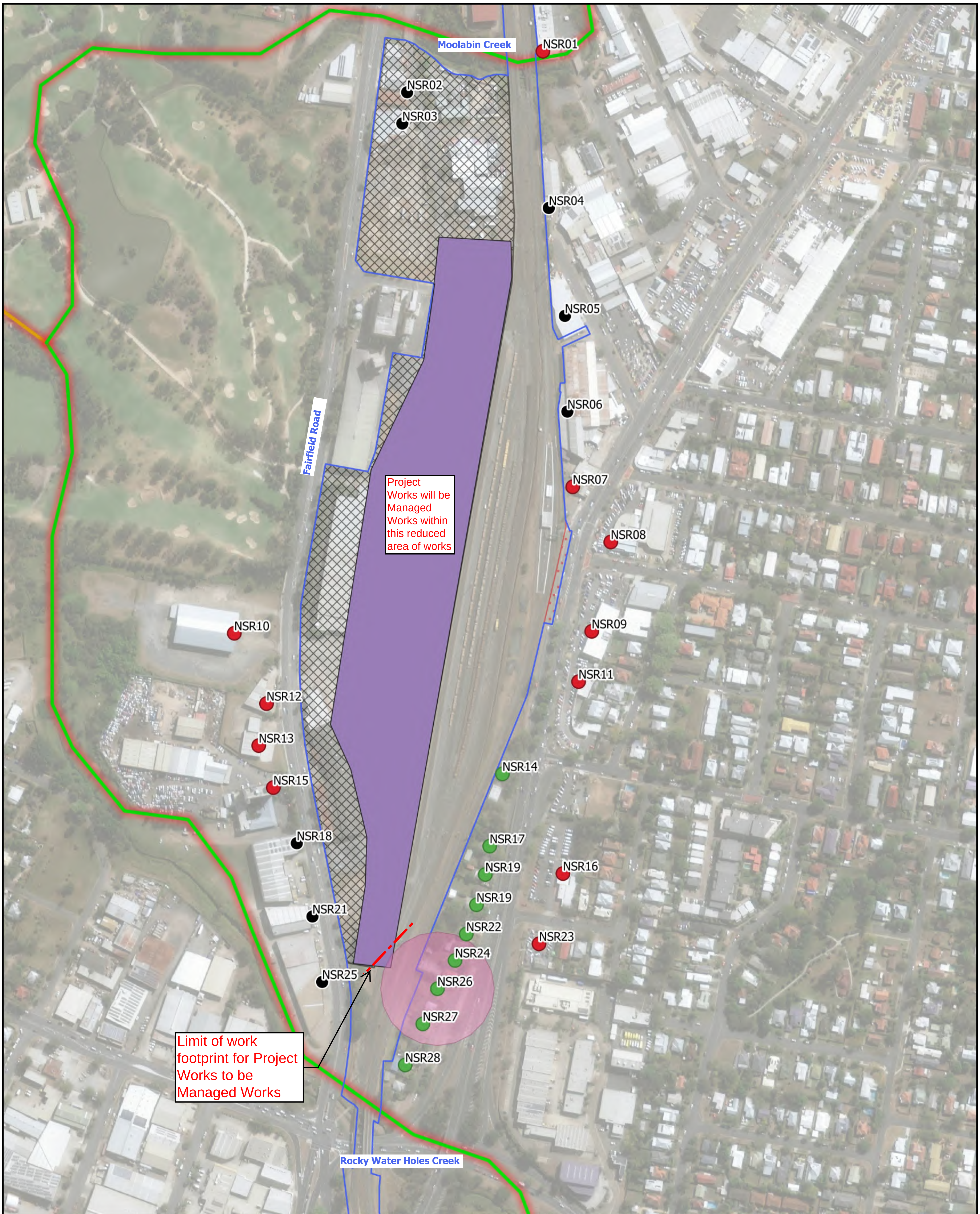
Works Specific Mitigation Measures

There are no predicted exceedances of the Noise Goals +20dBA. Specific mitigation measures above and beyond the mitgations measures detailed in the CEMP's Noise and Vibration Management Sub-Plan are therefore not proposed.

Conclusion

This report provides an assessment of construction noise impacts to nearby Sensitive Places from the Clapham Yard - Night Works - Embankment Fill - Deliver and Place - same equipment as Day Shift. occuring during Stage 1.

Construction noise impacts are forecast to comply with the noise goals +20dB(A) at all assessed Sensitive Places but are not deemed Managed Works for works occurring outside Standard Surface Hours at one Sensitive Place (NSR26) located 52m away from the footprint . For these works to be deemed managed works at all residential receivers, the proposed activities would have to be offset a minimum of 59 m away from NSR26 .



UNITY

0 75 150 m

LEGEND

BASE Layers

Sensit_Pl

- Commercial
- Industrial
- Residential

ScenarioB_59mOffset

CY_ewks

RfPC_Bdy

RfPC8

PIPTempRequirement

PIPPermStandRequirement

PIPTempConstructionArea

Legal

Queensland_waterways_for_waterway_barrier_works

- 1
- 2

Imagery

ESRI Satellite (ArcGIS/World_Imagery)

RfPC 11 - CLAPHAM YARD - Managed Works Earthworks Scenario 2B

Drawn By:	Unity
Drawn	30-Mar-210
Date:	00

Printed Copies are Uncontrolled

Not for Construction

Construction Noise Assessment

Cross River Rail – Rail, Integration and Systems Alliance

Rev	Date	Prepared By	Reviewed By	Approved By	Remarks
0	30/03/21	Kristelle Gentil	0	0	RfPC 11 Managed Work Scenario - Scenario 2C
Signature:					

Introduction

The UNITY alliance has been commissioned to undertake the Rail Integration and Systems (RIS) component of the Cross River Rail (CRR) project. This report contains a construction noise assessment carried out against the Coordinator-General conditions for the project for Clapham Yard - Night Works - Embankment Fill - Deliver and Place - same equipment as Day Shift. The results of this assessment are to be incorporated into the Relevant Site Environmental Plan and Workpack to supplement the C-EMP and Noise and Vibration Management Plan.

Project Requirements

The Intermittent (LA10,adj) (15min) is the relevant Coordinator-General noise goal for all works associated with these construction works. The exact requirements are included within Condition 11(a) of the CGCR. The noise goals for Standard Hours (6:30am - 6:30pm Monday-Saturday) are based on the room usage within buildings and the maximum design level from AS2107 + 10 dB(A). During Non-Standard Hours (6:30pm - 6:30am Monday-Saturday, Sundays and Public Holidays) the Lower Limit intermittent noise goal is 42dB(A) and the Upper Limit is 62dB(A).

The CG conditions for construction noise relate to continuous and intermittent noise sources. The noise descriptor for continuous sources is the LAeq where the descriptor for intermittent noise source is LA10. The CRRDA has advised that future requests for project changes will consider modifying the intermittent descriptor from LA10 to LAeq. This is on the basis that the LAeq is a more appropriate descriptor to capture the noise impacts from intermittent construction sources. This assessment has assessed against the current LA10 descriptor, however it is expected that if the descriptor was changed to LAeq that this assessment would be conservative i.e. the predicted LAeq levels from these construction activities would be slightly lower than the predicted LA10 levels.

Methodology

Noise levels due to the construction activities were predicted at nearby Sensitive Places using a desktop implementation of the CONCAWE noise propagation model. Corrections were applied for geometric spreading, atmospheric absorption, ground absorption, meteorological conditions, source and receiver height and barrier attenuation. It was assumed that the plant with the highest sound power level will dominate the L10 noise descriptor. The calculations represent expected worst periods of construction work impact to compare against the noise goals - nearby Sensitive Places will experience periods of lower construction noise impacts across the duration of the works.

Source noise levels have been taken from various sources. Equipment locations have been based on UNITY's proposed work pack and discussions.

Proposed Activities

Activities proposed to be carried out as part of Clapham Yard - Night Works - Embankment Fill - Deliver and Place - same equipment as Day Shift are outlined in Table 1. The activities are proposed to be completed during standard and non-standard hours. Only the plant with the highest sound power (Tipper Lorry) was modelled, as it is assumed this will be the dominant source for LA10 noise levels.

Table 1. Construction Plant

Plant Type	Overall Sound Power Level Leq (dB(A))
Tipper Lorry	106

Assessed Sensitive Places

The sensitive places assessed are outlined in Table 2.

Table 2. Details of Sensitive Places

ID	Description	Category	Distance to Source (m)	Barrier	Ground Surface
1	NSR14	Residential	79	Full shielding (barrier close to receiver)	Grass field with trees
2	NSR17	Residential	75	Full shielding (barrier close to receiver)	Grass field with trees
3	NSR19	Residential	79	Full shielding (barrier close to receiver)	Grass field with trees
4	NSR20	Residential	70	Full shielding (barrier close to receiver)	Grass field with trees
5	NSR22	Residential	70	Full shielding (barrier close to receiver)	Grass field with trees
6	NSR24	Residential	63	Full shielding (barrier close to receiver)	Grass field with trees
7	NSR26	Residential	52	Full shielding (barrier close to receiver)	Grass field with trees
8	NSR27	Residential	67	Full shielding (barrier close to receiver)	Grass field with trees
9	NSR28	Residential	103	Full shielding (barrier close to receiver)	Grass field with trees

Predicted Impacts

Based on the inputs detailed above, the following noise impacts have been predicted for the works associated with Stage 1. The noise impacts have been assessed against the construction noise goals included in CGCR Condition 11.

Table 3. Predicted Impacts at Sensitive Places

Receptor ID	Standard Work Hours Lower Limit	Standard Work Hours Upper Limit	Out of Hours Lower Limit	Out of Hours Upper Limit	Highest Predicted LA10 (15min) Internal Impact (dB(A))
1	55	75	42	62	38
2	55	75	42	62	39
3	55	75	42	62	38
4	55	75	42	62	39
5	55	75	42	62	39
6	55	75	42	62	40
7	55	75	42	62	42
8	55	75	42	62	40
9	55	75	42	62	37

The noise impacts presented in Table 3 demonstrate that the unmitigated noise impacts will not result in levels above the internal noise goals +20 dBA limit for standard hours or out of hours limit at Clapham Yard.

Standard Mitigation Measures

The following mitigation measures will be used by UNITY as best practice:

- Project Notifications will be provided to areas regardless of whether residents / business are predicted to be affected with sufficient information to enable them to understand the likely nature, extent and duration of noise and vibration impacts during various construction activities.
- Unnecessary sources of noise should be avoided. Swearing or unnecessary shouting or loud stereos/radios on site should not be tolerated. Materials should not be dropped from height; metal items should not be thrown and doors should not be slammed.
- Appropriately sized equipment should be selected for the task.
- The duration of simultaneous operation of noise or vibration-intensive plant should be minimised. Plant and equipment used intermittently or no longer in use should be throttled or shut down.
- The location for site access points and roads, gathering points, shift changes, parking etc will be sited away from sensitive receptors.
- Equipment should be operated in the correct manner and correctly maintained including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components and repair of leakages in compressed air lines. Construction plant, vehicles and machinery should be maintained and operated in accordance with manufacturer's instructions to minimise noise and vibration emissions. Each of these items will need to be checked and included on a plant/equipment checklist.
- Fit engine covers to all plant.
- Fit effective residential class silencers to all engine exhausts.
- Non-tonal reversing beepers (or an equivalent mechanism) should be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Without compromising site safety, unnecessary reversing should be avoided and turning circles used instead.
- The drop height of materials will be minimised, for example, while loading and unloading vehicles or in storage areas.
- The speed of construction traffic should be minimized near noise sensitive receptors, including acceleration.

Works Specific Mitigation Measures

There are no predicted exceedances of the Noise Goals +20dBA. Specific mitigation measures above and beyond the mitgations measures detailed in the CEMP's Noise and Vibration Management Sub-Plan are therefore not proposed.

Conclusion

This report provides an assessment of construction noise impacts to nearby Sensitive Places from the Clapham Yard - Night Works - Embankment Fill - Deliver and Place - same equipment as Day Shift. occuring during Stage 1.

Construction noise impacts are forecast to comply with the noise goals +20dB(A) at all assessed Sensitive Places and are deemed Managed Works for works occurring outside Standard Surface Hours at ALL Sensitive Places.

For the purpose of the assessment only Reesidential Senstive Places have been as Industrial and Commercial Senstive Places have been assumed unoccupied during out of hours operations.

Construction Noise Assessment

Cross River Rail – Rail, Integration and Systems Alliance

Rev	Date	Prepared By	Reviewed By	Approved By	Remarks
0	30/03/21	Kristelle Gentil	0	0	RfPC 11 Managed Work Scenario - Scenario 2A
Signature:					

Introduction

The UNITY alliance has been commissioned to undertake the Rail Integration and Systems (RIS) component of the Cross River Rail (CRR) project. This report contains a construction noise assessment carried out against the Coordinator-General conditions for the project for Clapham Yard - Night Works - Embankment Fill - Deliver and Place - same equipment as Day Shift. The results of this assessment are to be incorporated into the Relevant Site Environmental Plan and Workpack to supplement the C-EMP and Noise and Vibration Management Plan.

Project Requirements

The Intermittent (LA10,adj) (15min) is the relevant Coordinator-General noise goal for all works associated with these construction works. The exact requirements are included within Condition 11(a) of the CGCR. The noise goals for Standard Hours (6:30am - 6:30pm Monday-Saturday) are based on the room usage within buildings and the maximum design level from AS2107 + 10 dB(A). During Non-Standard Hours (6:30pm - 6:30am Monday-Saturday, Sundays and Public Holidays) the Lower Limit intermittent noise goal is 42dB(A) and the Upper Limit is 62dB(A).

The CG conditions for construction noise relate to continuous and intermittent noise sources. The noise descriptor for continuous sources is the LAeq where the descriptor for intermittent noise source is LA10. The CRRDA has advised that future requests for project changes will consider modifying the intermittent descriptor from LA10 to LAeq. This is on the basis that the LAeq is a more appropriate descriptor to capture the noise impacts from intermittent construction sources. This assessment has assessed against the current LA10 descriptor, however it is expected that if the descriptor was changed to LAeq that this assessment would be conservative i.e. the predicted LAeq levels from these construction activities would be slightly lower than the predicted LA10 levels.

Methodology

Noise levels due to the construction activities were predicted at nearby Sensitive Places using a desktop implementation of the CONCAWE noise propagation model. Corrections were applied for geometric spreading, atmospheric absorption, ground absorption, meteorological conditions, source and receiver height and barrier attenuation. It was assumed that the plant with the highest sound power level will dominate the L10 noise descriptor. The calculations represent expected worst periods of construction work impact to compare against the noise goals - nearby Sensitive Places will experience periods of lower construction noise impacts across the duration of the works.

Source noise levels have been taken from various sources. Equipment locations have been based on UNITY's proposed work pack and discussions.

Proposed Activities

Activities proposed to be carried out as part of Clapham Yard - Night Works - Embankment Fill - Deliver and Place - same equipment as Day Shift are outlined in Table 1. The activities are proposed to be completed during standard and non-standard hours. Only the plant with the highest sound power (Grader (leveling haul road) 205 kW, 25 t)) was modelled, as it is assumed this will be the dominant source for LA10 noise levels.

Table 1. Construction Plant

Plant Type	Overall Sound Power Level Leq (dB(A))
Tipper Lorry	106
Body Truck	88
Grader (leveling haul road) 205 kW, 25 t)	114
Smooth Drum Roller	108

Assessed Sensitive Places

The sensitive places assessed are outlined in Table 2.

Table 2. Details of Sensitive Places

ID	Description	Category	Distance to Source (m)	Barrier	Ground Surface
1	NSR14	Residential	79	Full shielding (barrier close to receiver)	Grass field with trees
2	NSR17	Residential	75	Full shielding (barrier close to receiver)	Grass field with trees
3	NSR19	Residential	79	Full shielding (barrier close to receiver)	Grass field with trees
4	NSR20	Residential	70	Full shielding (barrier close to receiver)	Grass field with trees
5	NSR22	Residential	70	Full shielding (barrier close to receiver)	Grass field with trees
6	NSR24	Residential	63	Full shielding (barrier close to receiver)	Grass field with trees
7	NSR26	Residential	52	Full shielding (barrier close to receiver)	Grass field with trees
8	NSR27	Residential	67	Full shielding (barrier close to receiver)	Grass field with trees
9	NSR28	Residential	103	Full shielding (barrier close to receiver)	Grass field with trees

Predicted Impacts

Based on the inputs detailed above, the following noise impacts have been predicted for the works associated with Stage 1. The noise impacts have been assessed against the construction noise goals included in CGCR Condition 11.

Table 3. Predicted Impacts at Sensitive Places

Receptor ID	Standard Work Hours Lower Limit	Standard Work Hours Upper Limit	Out of Hours Lower Limit	Out of Hours Upper Limit	Highest Predicted LA10 (15min) Internal Impact (dB(A))
1	55	75	42	62	45
2	55	75	42	62	46
3	55	75	42	62	45
4	55	75	42	62	47
5	55	75	42	62	47
6	55	75	42	62	47
7	55	75	42	62	50
8	55	75	42	62	47
9	55	75	42	62	44

The noise impacts presented in Table 3 demonstrate that the unmitigated noise impacts will not result in levels above the internal noise goals +20 dBA limit for standard hours or out of hours limit at Clapham Yard.

Standard Mitigation Measures

The following mitigation measures will be used by UNITY as best practice:

- Project Notifications will be provided to areas regardless of whether residents / business are predicted to be affected with sufficient information to enable them to understand the likely nature, extent and duration of noise and vibration impacts during various construction activities.
- Unnecessary sources of noise should be avoided. Swearing or unnecessary shouting or loud stereos/radios on site should not be tolerated. Materials should not be dropped from height; metal items should not be thrown and doors should not be slammed.
- Appropriately sized equipment should be selected for the task.
- The duration of simultaneous operation of noise or vibration-intensive plant should be minimised. Plant and equipment used intermittently or no longer in use should be throttled or shut down.
- The location for site access points and roads, gathering points, shift changes, parking etc will be sited away from sensitive receptors.
- Equipment should be operated in the correct manner and correctly maintained including replacement of engine covers, repair of defective silencing equipment, tightening of rattling components and repair of leakages in compressed air lines. Construction plant, vehicles and machinery should be maintained and operated in accordance with manufacturer's instructions to minimise noise and vibration emissions. Each of these items will need to be checked and included on a plant/equipment checklist.
- Fit engine covers to all plant.
- Fit effective residential class silencers to all engine exhausts.
- Non-tonal reversing beepers (or an equivalent mechanism) should be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work. Without compromising site safety, unnecessary reversing should be avoided and turning circles used instead.
- The drop height of materials will be minimised, for example, while loading and unloading vehicles or in storage areas.
- The speed of construction traffic should be minimized near noise sensitive receptors, including acceleration.

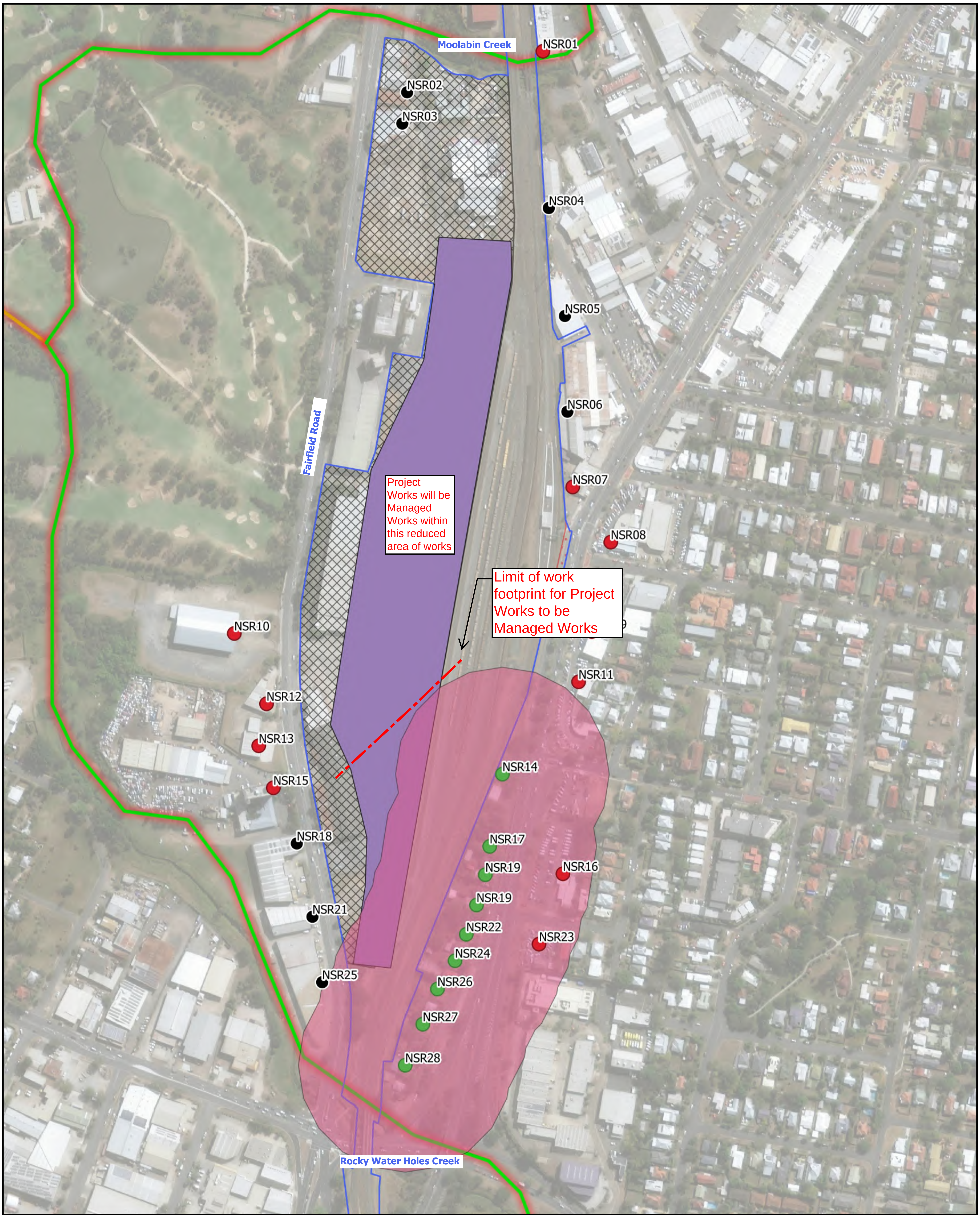
Works Specific Mitigation Measures

There are no predicted exceedances of the Noise Goals +20dBA. Specific mitigation measures above and beyond the mitgations measures detailed in the CEMP's Noise and Vibration Management Sub-Plan are therefore not proposed.

Conclusion

This report provides an assessment of construction noise impacts to nearby Sensitive Places from the Clapham Yard - Night Works - Embankment Fill - Deliver and Place - same equipment as Day Shift. occuring during Stage 1.

Construction noise impacts are forecast to comply with the noise goals +20dB(A) at all assessed Sensitive Places but are not deemed Managed Works for works occurring outside Standard Surface Hours. For these works to be deemed managed works, the proposed activities would have to be offset a minimum of 111m away from all the assessed Sensitive Places .



0 75 150 m

LEGEND

BASE Layers

Sensit_Pl

- Commercial
- Industrial
- Residential

ScenarioA_111mOffset

CY_ewks

RfPC_Bdy

RfPC8

PIPTempRequirement

PIPPermStandRequirement

PIPTempConstructionArea

Legal

Queensland_waterways_for_waterway_barrier_works

- 1
- 2

Imagery

ESRI Satellite (ArcGIS/World_Imagery)

RfPC 11 - CLAPHAM YARD - Managed Works Earthworks Scenario 2A

Drawn By:	Unity
Drawn	30-Mar-210
Date:	00

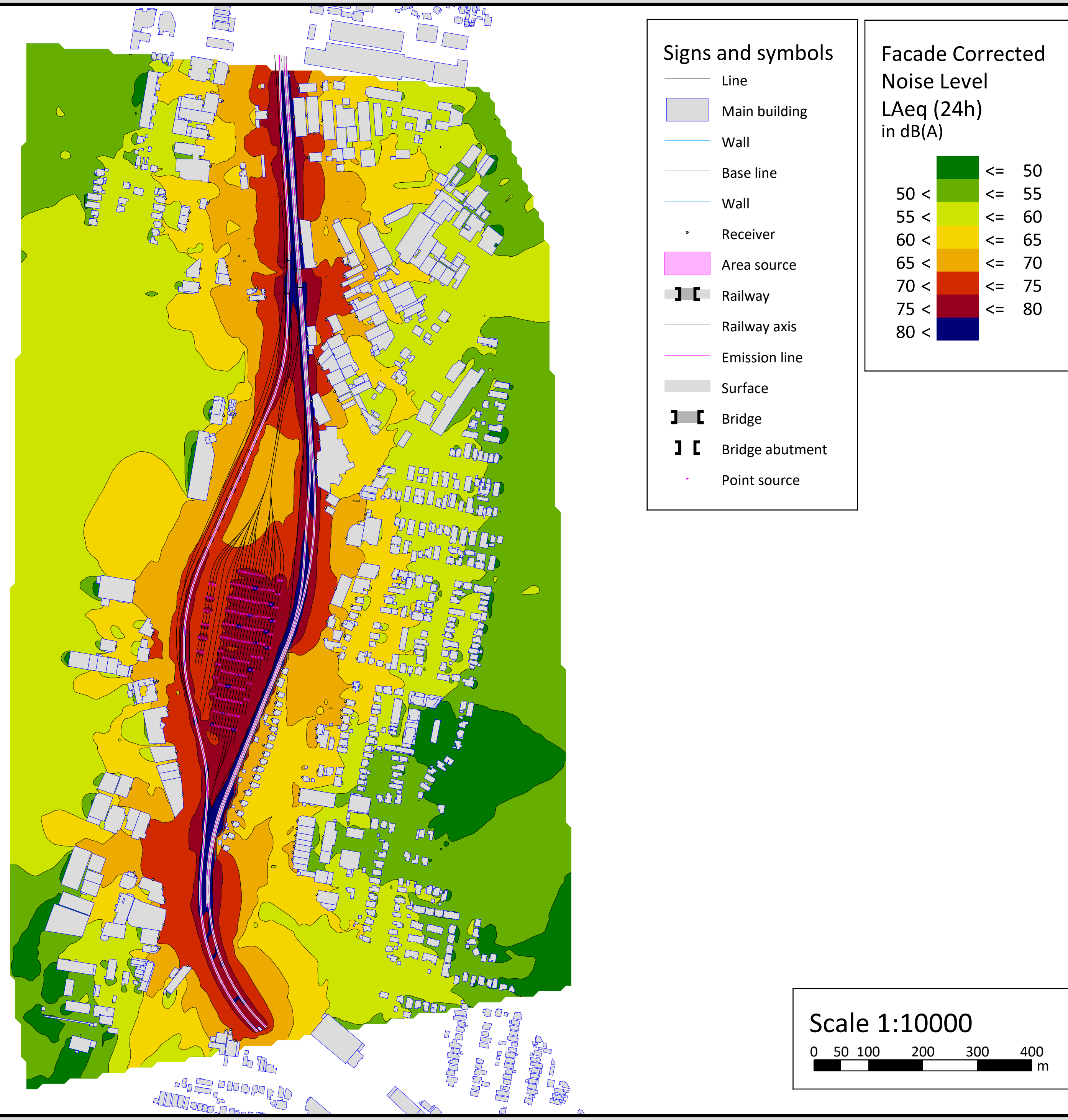
Printed Copies are Uncontrolled
Not for Construction

Appendix 3 – Noise Contour Maps – Operations

Clapham Yard - Operational

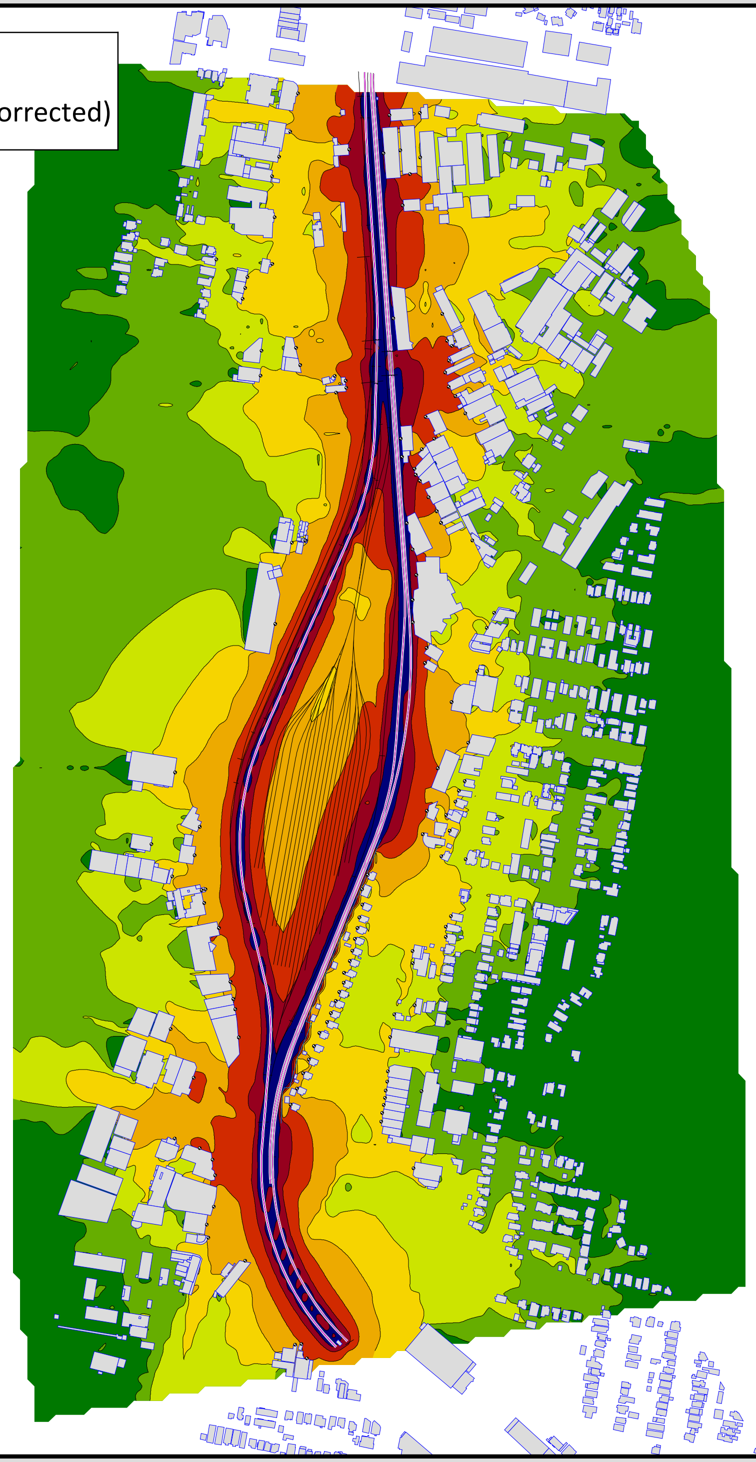
LAeq (24h) Noise Criteria (Facade Corrected)

Noise contours do not apply to free field external locations.
Facade corrected noise levels are produced by adding a 3dB(A) facade correction.
Noise levels are predicted at 1.8m above ground level.



Clapham Yard - Operational
Single Event Maximum Noise Criteria (Facade Corrected)

Noise contours do not apply to free field external locations.
Facade corrected noise levels are produced by adding a 3dB(A) facade correction.
Noise levels are predicted at 1.8m above ground level.



Signs and symbols

- Line
- Main building
- Wall
- Base line
- Wall
- Receiver
- Area source
- Railway
- Railway axis
- Emission line
- Surface
- Bridge
- Bridge abutment
- Point source

Facade Corrected Noise Level Single Event Maximum in dB(A)

	<=	67
67 <	<=	72
72 <	<=	77
77 <	<=	82
82 <	<=	87
87 <	<=	92
92 <	<=	97
97 <		

Scale 1:10000

0 50 100 200 300 400 m

Appendix 4 – Construction Road Traffic Noise Calculation Parameters

Recent traffic volume data for Fairfield Road in the vicinity of Chale Street were reviewed to ascertain the effect of construction related vehicle traffic on the noise emission. These traffic data is from February 2020 and was provided by BCC. The traffic volumes used for each calculation are presented in Table 17. Road traffic noise levels were predicted to a reference distance of 50 metres to enable the calculation in the difference of noise impacts.

Table 17 Traffic Parameters assumed for Road Traffic Noise Calculation

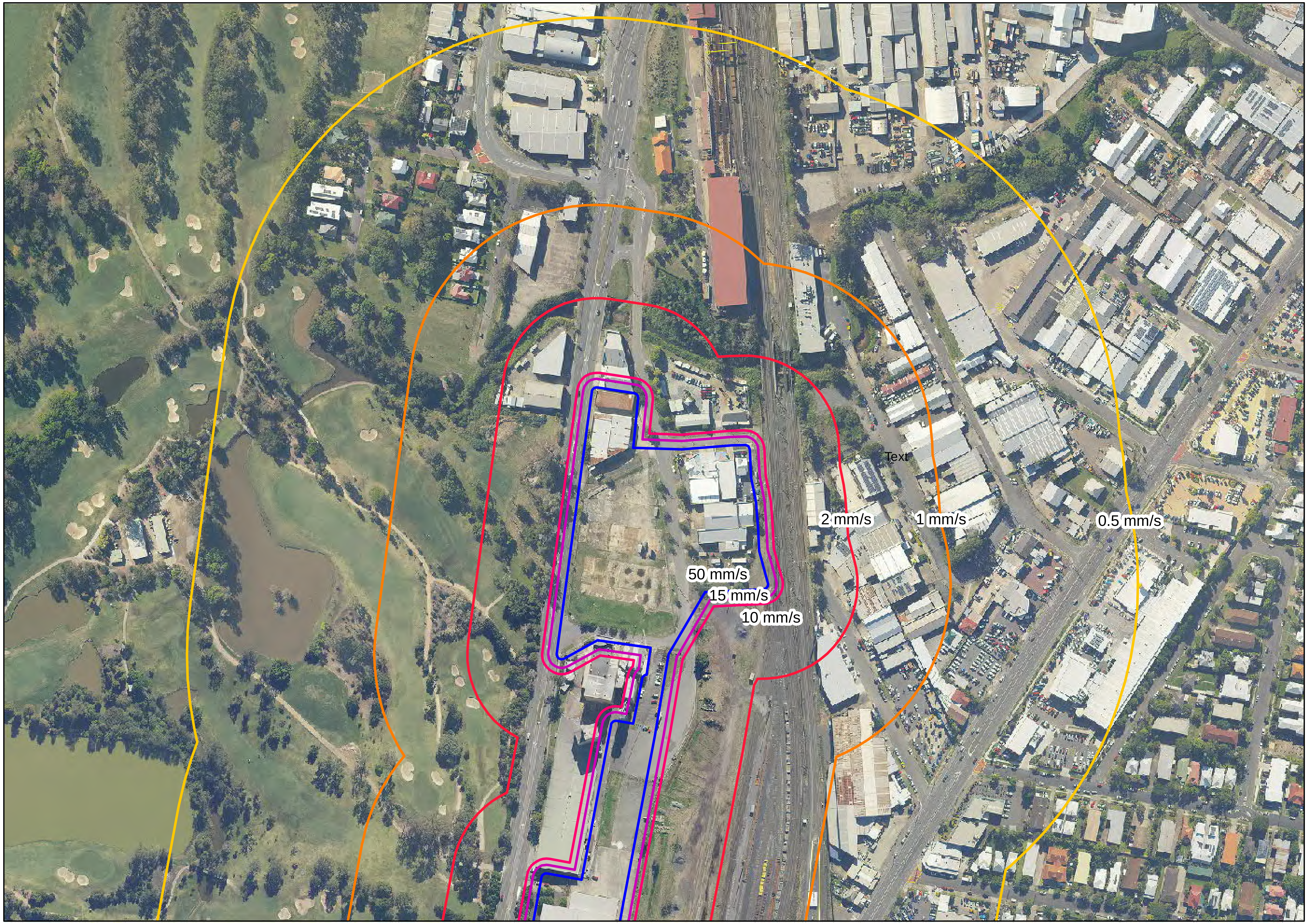
Traffic Scenario	Total number of vehicles	Percentage of Heavy Vehicles (HV),	Predicted noise level at reference distance, dB(A)[1]	Difference with Project, dB(A)
LA10(12hour), No Project	21532[1]	20%	69.1	-
LA10(12hour), With Project	21760	21%	69.2	+ 0.1
LA10(18hour), No Project	24954[1]	20%	69.7	-
LA10(18hour), With Project	25296	21%	69.9	+ 0.2
LA10(1hour), No Project	59[2]	20%	56.5	-
LA10(1hour), With Project	78	32%	59.1	+ 2.6

Table Notes:

1. Vehicle movement numbers based on 7-day average from BCC traffic flow data.

2. Number of movements based on the quietest hour of traffic between 12:00am midnight to 6:00am from BCC traffic flow data.

Appendix 5 – Vibration Contour Maps - Construction



Legend

Vibration Buffer - PPV

- 0.5 mm/s
- 1 mm/s
- 2 mm/s
- 10 mm/s
- 15 mm/s
- 50 mm/s

Rev	Description	Date	Approved
0	Clapham Yard - Vibration Buffers - Scenario 1	16/03/2021	B Robbie

Scale 1:3,000

0 15 30 60 90 120 150 m

Imagery Source: EagleView - Date of Capture 30/6/2019

UNITY Assured Integration for a New Era

Status

FOR INFOMRATION

Original Size	A3	Drawn	GIS
Coordinate System	GDA 1994 BCSG02	Designed	
Height Datum	AHD	Date Printed	16/03/2021
Filename:	Clapham Yard - Demolition Hammer - p1.mxd		

RfPC11 - Clapham Yard
Noise and Vibration Technical Report

Scenario 1 - Vibration buffers

Demolition - Hydraulic Hammer

Legend

Vibration Buffer - PPV

- 0.5 mm/s
- 1 mm/s
- 2 mm/s
- 10 mm/s
- 15 mm/s
- 50 mm/s

Rev	Description	Date	Approved
0	Clapham Yard - Vibration buffers - Scenario 1	16/03/2021	B Robbie

Scale 1:3,000

0 15 30 60 90 120 150 m

Imagery Source: EagleView - Date of Capture 30/6/2019

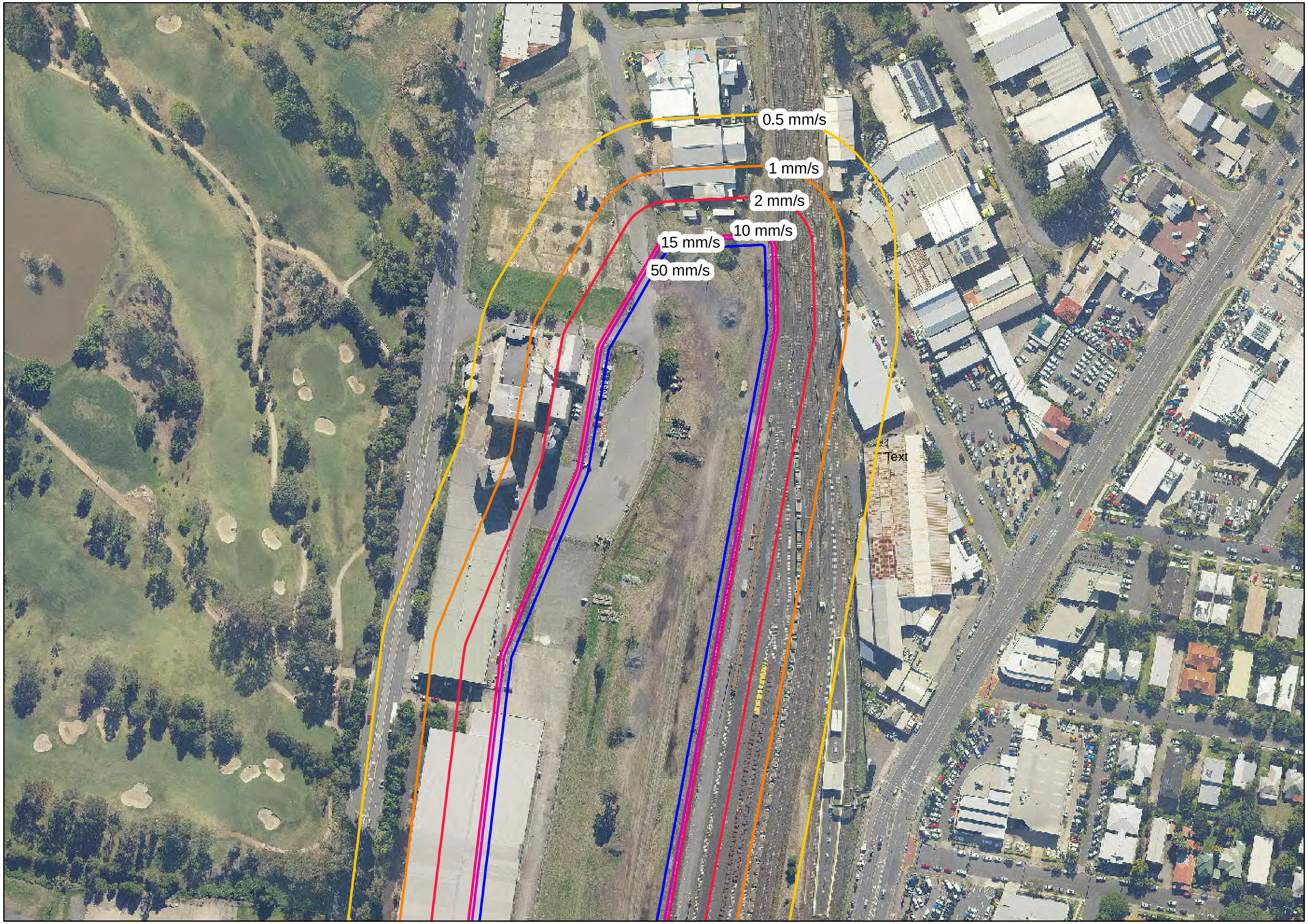
Assured Integration for a New Era

Status	FOR INFOMRATION		
Original Size	A3	Drawn	GIS
Coordinate System	GDA 1994 BCSG02	Designed	
Height Datum	AHD	Date Printed	16/03/2021
Filename:	Clapham Yard - Demolition Hammer - p2.mxd		

RfPC11 - Clapham Yard
Noise and Vibration Technical Report

Scenario 1 - Vibration buffers

Demolition - Hydraulic Hammer



Legend

Vibration Buffer - PPV

- 0.5 mm/s
- 1 mm/s
- 2 mm/s
- 10 mm/s
- 15 mm/s
- 50 mm/s

Rev	Description	Date	Approved
0	Clapham Yard - Vibration Buffers - Scenario 2	16/03/2021	B Robbie

Scale 1:2,000

0 10 20 40 60 80 100 m

Imagery Source: EagleView - Date of Capture 30/6/2019

UNITS Assured Integration for a New Era

Status

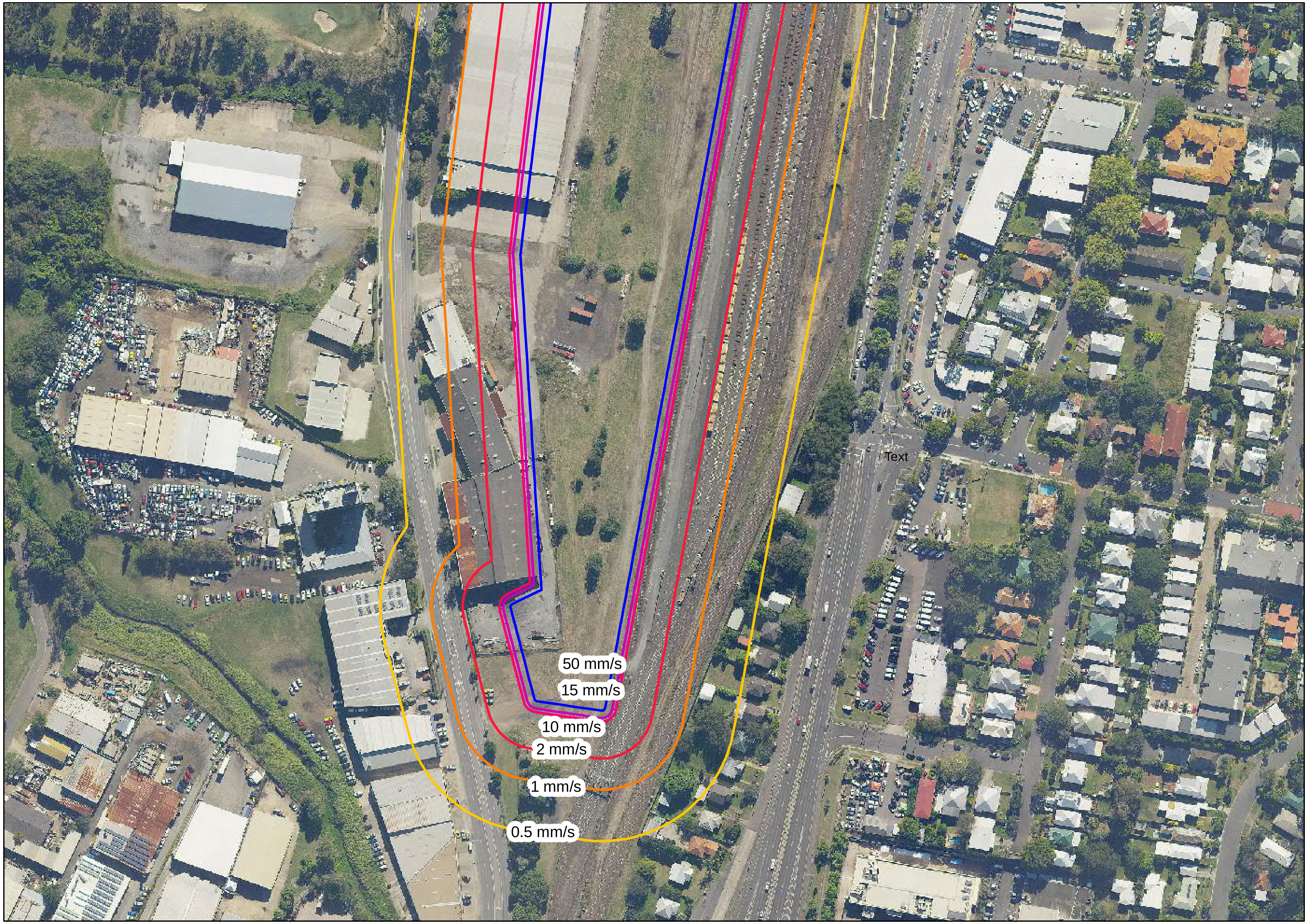
FOR INFOMRATION

Original Size	A3	Drawn	GIS
Coordinate System	GDA 1994 BCSG02	Designed	
Height Datum	AHD	Date Printed	16/03/2021
Filename:	Clapham Yard - Earthworks Roller p1.mxd		

RfPC11 - Clapham Yard Noise and Vibration Technical Report

Scenario 2 - Vibration buffers

Earthworks - Vibratory Roller



Legend

Vibration Buffer - PPV

- 0.5 mm/s
- 1 mm/s
- 2 mm/s
- 10 mm/s
- 15 mm/s
- 50 mm/s

Rev	Description	Date	Approved
0	Clapham Yard - Vibration Buffers - Scenario 2	16/03/2021	B Robbie

Scale 1:2,000

0 10 20 40 60 80 100 m

Imagery Source: EagleView - Date of Capture 30/6/2019

UNITY Assured Integration for a New Era

Status: FOR INFOMRATION

Original Size	A3	Drawn	GIS
Coordinate System	GDA 1994 BCSG02	Designed	
Height Datum	AHD	Date Printed	16/03/2021
Filename:	Clapham Yard - Earthworks Roller p2.mxd		

RfPC11 - Clapham Yard
Noise and Vibration Technical Report

Scenario 2 - Vibration buffers

Earthworks - Vibratory Roller

Cross River Rail Environmental Impact Statement

Request for Project Change 11

Changes to the Project and changes to the imposed conditions

Volume 3 Technical Reports

Attachment C Hydrology

Date: ***April 2021***

Author: ***Cross River Rail Delivery Authority***

Table of Contents

1. Assessment Methodology

Preliminary flood modelling has been undertaken for both the proposed developed conditions and temporary conditions during construction. This assessment has been undertaken based on existing available TUFLOW models, reports and refined design information compared to RfPC4. This preliminary flood modelling has been used to assess local flood risk, estimate flood levels for required design immunity and assess potential flood impacts during construction and operation.

The original EIS assessment of construction flood impacts was based on the potential flood impacts of the proposed protection bund for the worksite adjacent to Moolabin Creek, as the element most likely to cause impacts. The Proposed Changes include the replacement of two existing rail bridges and construction of a new grade separated structure across Moolabin Creek. The in-stream construction methodologies for these structures is different to that proposed for the EIS and RfPC-4. This report presents a detailed assessment of construction flood impacts based on the refined design and construction planning, and explicitly representing the potential in-stream activities required to construct the Moolabin Creek bridges.

Assessments will continue to be refined as further construction planning and detailed design progresses to verify that design and construction is performing as expected and consistent with:

- Environmental Design Requirement 5(l), and
- Recommendation 13
- Condition 17(b)

A flood management plan has been prepared for construction in accordance with Imposed Condition 17 for in stream works in Moolabin Creek.

A high level assessment of the resilience of the project to flooding under future climate conditions has been undertaken in accordance with Environmental Design Requirement 7 (b). Further hydrology and hydraulic assessments are also proposed in the detailed design phase to confirm this assessment.

Flood events in this report are expressed in Annual Exceedance Probability (AEP) which is the probability of a flood event of a certain size or greater occurring in any given year.

The following reference documents have been used in the preparation of the technical report input:

- Cross River Rail Environmental Impact Statement: Technical Report No. 6 – Flood Study (July, 2011)
- Cross River Rail project: Coordinator-General’s report on the environmental impact statement (December, 2012)
- Cross River Rail project: Coordinator-General’s change report – whole of project refinements 2019 (June, 2019)
- Cross River Rail project: Coordinator-General’s change report – no.8 – November 2020 (as amended December 2020)
    - Imposed Conditions 17b (Construction)
    - Environmental Design Requirement 5l (Design)
- Imposed Condition 7b (Design)Australian Rainfall and Runoff: A guide to flood estimation (ARR), 2019
- Queensland Rail Specification MD-12-708 Stabling Yards and Facilities in Network SEQ Design Guide
- Technical Guideline - Hydrologic and Hydraulic Modelling (October 2019), Queensland Government (DTMR 2019)
- Technical Summary Report - Comprehensive Hydrologic and Hydraulic Assessments - Brisbane River Catchment Flood Study (BMT-WBM, February 2017)
- Moolabin Creek and Rocky Waterholes Creek Flood Study (BCC, 2015)

- Stable Swamp Creek Flood Study (BCC, 2014)

2. Changes to Potential Impacts

2.1 Evaluated Project Context

Works within Clapham Yard and the associated Moolabin Creek bridges are located within the Brisbane River and Moolabin Creek floodplains.

Net-filling of Clapham Yard and an associated bridge over Moolabin Creek was assessed and approved as part of the Original 2011 EIS. Clapham Yard, and the associated Moolabin Creek bridge, was completely removed from the RfPC-1 project scope and subsequently re-introduced in RfPC-4.

Within RfPC-4 (Evaluated Project), the Clapham Yard works sought to achieve a cut/fill balance without net-import of fill to the Brisbane River floodplain. This approach was adopted with the aim of minimising any potential flood impacts of the project but acknowledged the reduced flood immunity and resilience of the Yard that would result from this approach.

QR requirements and the general operational utility of Clapham Yard have required a refinement to the design to include filling of Clapham Yard so that the stabling facilities achieve a 1% AEP flood immunity.

The changed configuration of Clapham Yard, including the improved flood immunity, have also necessitated changes to the associated Moolabin Creek bridges.

Assessment of the Project Changes on flood impacts have been undertaken as part of this RfPC and will continue through the design process.

Table 1 Moolabin Creek Scope of Works

Items	RFPC4 Evaluated Project	RFPC11 Changed Project
Permanent Scope Items relevant to flooding analyses	***Clapham yard rail formation*** No Net Filling ***Moolabin Creek*** Construction of a new single-track bridge over the creek between the existing rail bridges	***Clapham yard rail formation*** Re-introduction of Net Filling ***Moolabin Creek*** Construction of three bridges two of which are replacement bridges of existing
Bridge Construction method	• **Moolabin Creek** Temporary platform over the creek or from a stone fill working platform within the creek	• **Moolabin Creek** Low-level culvert crossings and/or stone fill working platforms within the creek
Relevant Imposed Condition – Construction requirements	• **Imposed Condition 17(b)** *Project works must be designed and implemented to avoid afflux or cause the redirection of uncontrolled surface water flows, including stormwater flows, outside of worksites.*	• **Imposed Condition 17(d), formerly Imposed Condition 17(b)** Note: RfPC8 identified the introduction of instream works in Breakfast Creek and Moolabin Creek. Accordingly, imposed condition 17(a) was modified, new conditions were added as 17(b) and 17(c) to require a flood management plan for in-stream construction works, and imposed condition 17b became 17(d).

2.1.1 Legislative requirements

In addition to the Imposed Conditions, the following secondary approvals or requirements may be triggered for the Moolabin Creek Bridges:

- *Operational Work (constructing or raising waterway barrier works)* under the *Planning Act 2016* (Planning Act), and
- *Riverine protection permit* for destroying vegetation, excavating or placing fill within a watercourse (Water Act)

As the detailed design progresses, the permanent technical solution and the construction methods will be reviewed to ascertain the secondary approvals requirements.

2.1.2 Operational Considerations – Clapham Yard Upgrade

QR specifications require that the stabling yard and facilities achieve a 1% AEP flood immunity, which has required a change to the proposed filling requirements for Clapham Yard.

Parts of the existing rail network surrounding Clapham Yard do not currently achieve 1% AEP immunity with 300mm freeboard. Tie-in to the existing network will limit the flood immunity of some portions of the design. However, the proposed flood immunity criteria for the majority of the design are outlined below. Elevation of buildings and rail systems assets to achieve flood immunity requirements will be via poles or localised pads.

Table 2: QR flood immunity criteria

Infrastructure type	Immunity requirement
Stabling Yard Access Roads	• 2% AEP
Track (top of formation)	• 1% AEP and • 300mm freeboard at hinge point of formation
Rail System Assets	• 0.5% AEP
Crew Change facilities	• 1% AEP level + 1 m

To achieve a cut/fill balance across Clapham Yard (excluding earthworks associated with the mainlines and the access road) would require an average elevation of ~RL8.5 across the site. This would mean that the stabling yard would not achieve 1% AEP flood immunity resulting in an unacceptable operational risk to the safe operation of the Network following commissioning. An increased risk of flooding to stabled rollingstock would exist, and trains that would normally be stabled in Clapham Yard would need to be evacuated to alternative locations on the network in times of flood.

To optimise the operational capability of Clapham Yard and to comply with the QR requirements, the Evaluated Project is proposed to be changed to introduce net fill import, which is consistent with the original design approach described in the 2011 EIS.

Increasing the fill level within Clapham Yard requires changes to the tie-in of the Yard to the existing rail network. This has necessitated changes to the proposed bridge solution over Moolabin Creek including replacement and realignment of the existing dual gauge bridge, upgrade of the existing suburban line bridge (demolition and reconstruction) and construction of a new grade separated structure to facilitate access into the yard.

2.1.3 Options Analyses

Two designs were initially developed. The first option was an at-grade solution which required ~150 m separation of the new third platform to the western side of the yard to access the third track (the new Dual Gauge Line). Separation of the platform was considered undesirable by stakeholders from a commuter safety, security, convenience and broader perception.

The alternative track layout (which is now proposed) utilised a grade separation of the Yard Arrival Road over a new third track, allowing the proposed new platform to be co-located with Moorooka Station.

2.1.4 Flood Modelling

Flooding relevant to Clapham Yard is dominated by backwater effects from regional flooding in the Brisbane River and local tributaries – Moolabin and Rocky Waterholes Creeks.

Moolabin Creek crosses the rail corridor to the north of Clapham Yard between Yeerongpilly and Moorooka Stations joining Oxley Creek just upstream of the confluence with the Brisbane River.

Rocky Waterholes Creek crosses the rail corridor between Moorooka and Rocklea Stations at the Sherwood and Fairfield Road intersection, joining Moolabin Creek within the Brisbane Golf Club downstream. The combined catchment of the two creeks is approximately 11.8 km^2.

2.1.4.1 Available Studies

BCC completed the Moolabin Creek and Rocky Waterholes Creek Flood Study in 2015. This study included development of a calibrated XP-RAFTS hydrologic model and 1D-2D linked TUFLOW hydrodynamic model.

The Brisbane River Catchment Flood Study (BRCFS) was completed in February 2017 on behalf of the State of Queensland. The focus of the BRCFS was to quantify riverine flooding in the Brisbane River, but not localised flooding caused by concentrated rainfall in a tributary. However, backwater effects into local tributaries were modelled including the lower reaches of Moolabin, Rocky Waterholes and Stable Swamp Creeks.

2.1.4.2 Dominant Flood Mechanism

A comparison of reported peak flood levels from the Brisbane River Catchment Flood Study, Moolabin and Rocky Waterholes Creek Flood Study and Stable Swamp Creek Flood Study was undertaken to determine the dominant flood mechanisms relevant to this area.

Table 3 demonstrates that the peak flood levels for regional flooding within the Brisbane River are 1.5 – 3m higher than local tributary flood levels for events with the same exceedance probability. Based on this comparison, Brisbane River flood levels are dominant in this area and define flood immunity requirements for the project.

It is noted that local tributary flood mechanisms often produce steeper hydraulic gradients and greater velocities. It is therefore important that both local tributary and regional backwater flood be considered when designing waterway crossings.

Table 3: Comparison of Brisbane River and Local Tributary Flood Levels

Creek Name	Location	Local creek Flood Level (mAHD)		Brisbane River Flood Level (mAHD)	
		1% AEP	0.05% AEP	1% AEP	0.05% AEP
Moolabin Creek	Rail Bridge	7.4	9.3	9.62	15.82
Rocky Water Holes Creek	Rail Bridge	6.1	6.9	9.65	15.82

2.1.4.3 Modelling of Brisbane River

The models, reports and results from the BRCFS were obtained from the Department of Environment and Science (DES) in November 2019 and included the BRCFS Model Amendment Pack (803.tcf).

A high level review of the study was undertaken to determine the appropriateness for adoption of the study outcomes for the F2S area which includes Clapham Yard and Moolabin Creek. The study represents the "most comprehensive, up-to-date and accurate analysis of Brisbane River riverine flooding" (BMT WBM, 2017). The BRCFS is documented in a series of reports, accessible here: https://www.publications.qld.gov.au/dataset/brisbane-river-catchment-flood-study.

The methodology is broadly consistent with the guidance provided within Australian Rainfall and Runoff (Ball et al., 2019). As part of the BRCFS, significant effort was undertaken on the review and update of rating curves throughout the catchment, calibration of hydrologic and hydraulic models, and validation of flood estimates to flood frequency analysis.

A calibrated TUFLOW model was developed as part of the BRCFS with a grid resolution of 30m. Given the F2S areas which includes Clapham Yard are volume-dominated backwater areas, there is limited variation in flood levels or velocities through the area of interest. The model resolution was considered sufficient for the purposes of this assessment.

Based on the reporting provided within the BRCFS models, it was possible to identify the critical durations and temporal patterns for each AEP within the area of interest. These critical events were then adopted for any further simulations required.

Review of the approach to climate change within the BRCFS identified the following key assumptions:

- Climate Change modelled for the 1% AEP
- A rainfall increase of 20%
- An increase of 0.8 m in Mean Sea Level

This approach is broadly consistent with the Imposed Conditions with the exception of the increase in Mean Sea Level of 1m detailed within the Environmental Design Requirements.

The BRCFS 1% AEP climate change model was re-run with a 0.2m increase in the downstream boundary to represent the increased Mean Sea Level rise which is consistent with the Imposed Condition. This resulted in a 30mm increase in flood levels through the area of interest corridor compared with a 0.8m increase in sea level. Levels within the Corridor are not sensitive to the adopted Mean Sea Level increase.

The BRCFS model was used to assess:

- The flood immunity and required filling within Clapham Yard
- The potential flood impacts of the permanent solution
- The resilience of the project to climate change

Figure 1 outlines the regional Brisbane River flood extents and size of the floodplain.

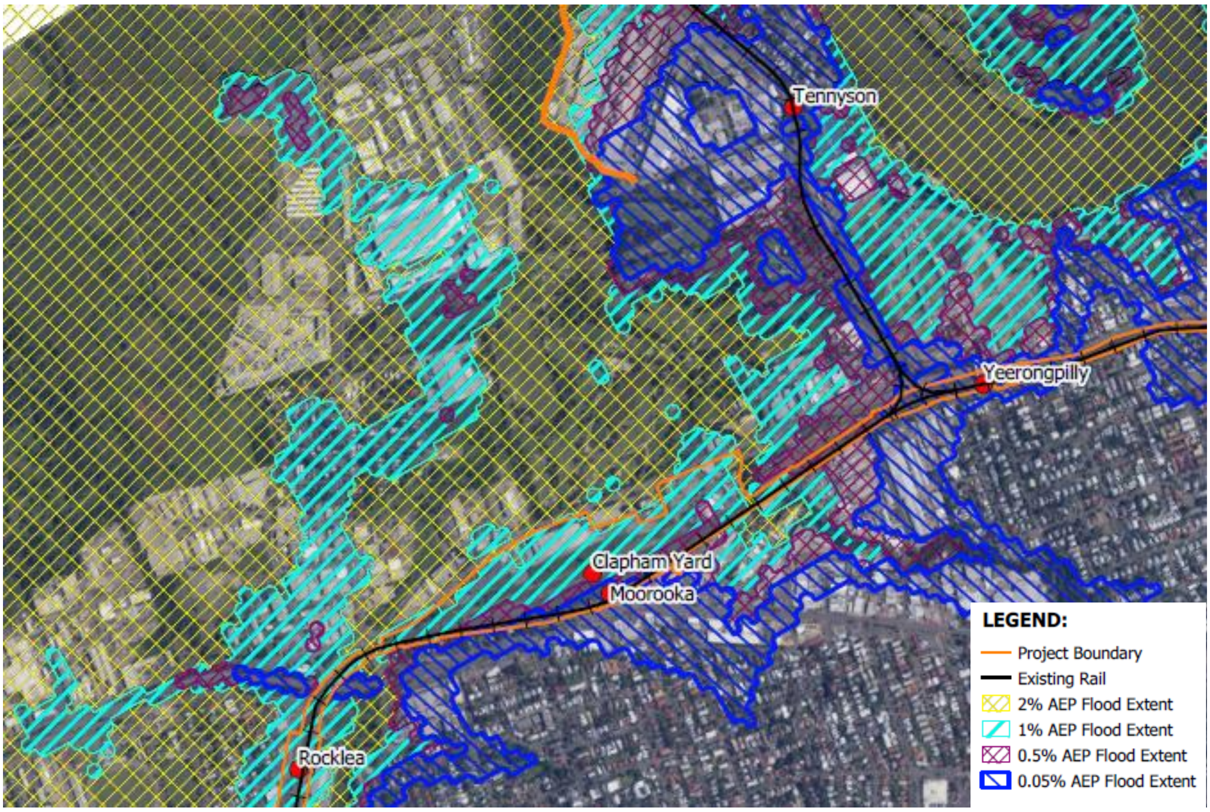


Figure 1 Brisbane River floodplain

Figure 2 illustrates a cross-section through Clapham Yard with the Existing and Developed 1% AEP flood surfaces plotted.

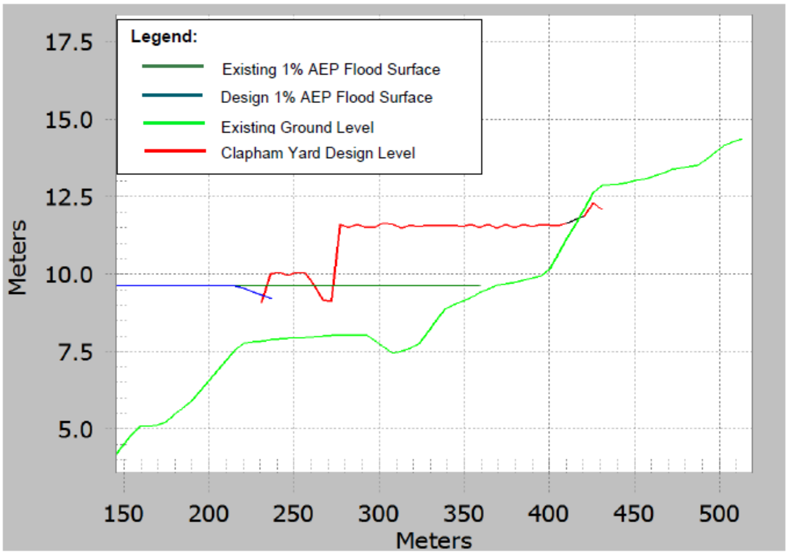


Figure 2: Cross-section through Clapham Yard with existing & developed 1% AEP Brisbane River Flood Levels

Figure 3 outlines the location of the proposed Clapham Yard fill platform in the context of the regional Brisbane River flood extent. The red area denotes the fill area. The yellow area is the 2% AEP flood extent and the blue area is the 1% AEP flood extent.

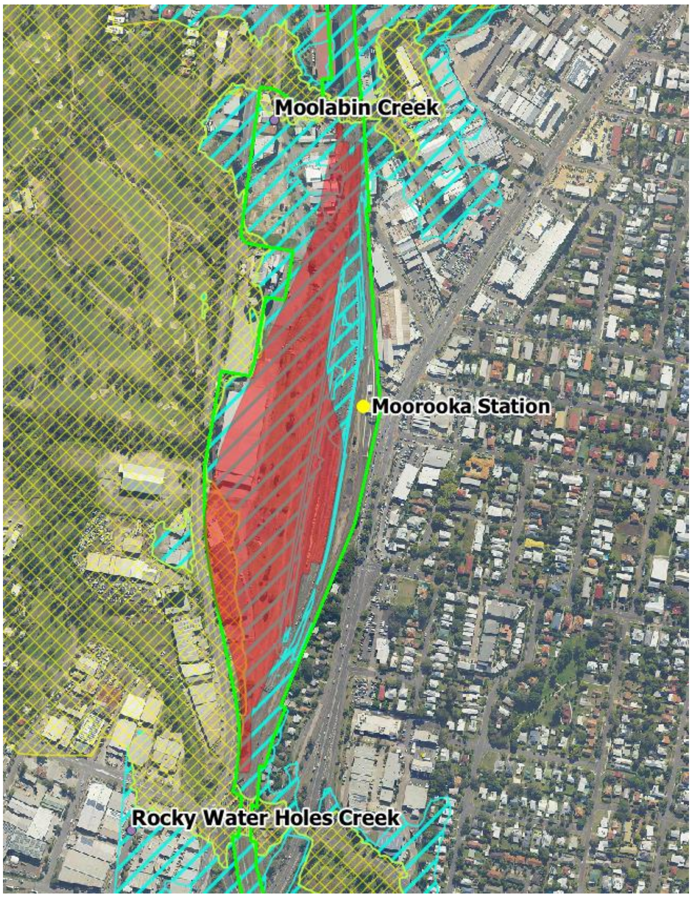


Figure 3 Clapham Fill platform overlain on existing flood extents

The model results identify that:

- Filling of the Yard to 9.95 mAHD will be required to provide 1% AEP + 300mm freeboard to the hinge-point of the formation.
- Permanent flood impacts will be less than 10mm.
- Under a 2100 climate scenario, 1% AEP flood levels at Clapham Yard increase by over 3m. To provide 1% AEP immunity under this future climate scenario, filling of the Yard by at least 3m would be required, as well as a 3-6m raising of many kilometres of the existing network.

This demonstrates compliance with imposed condition 5 (l). While it is not feasible within this project, to design to provide flood immunity under 2100 climate conditions, adopting a net-fill solution to provide 1% AEP immunity under existing climate conditions improves the ability of the project to adapt to climate change conditions in accordance with Environmental Design Requirement 7(b).

Brisbane River flooding within this area is storage driven with consistent flood levels across a large area (low/no hydraulic grade). This means that floodwaters tend to be slow moving and flood impacts are caused due to loss of storage rather than blockage of flow conveyance.

Construction within Clapham Yard will be within the permanent fill platform and will therefore have flood impacts less than the permanent solution (filling up to 9.95mAHD) described in Section 2.3. Temporary fill platforms, low level crossings or temporary jetties within Moolabin Creek would be equivalent to less than 1 % of Yard filling and will similarly not impact Brisbane River flood levels during construction. This demonstrates compliance of the proposed solution with imposed condition 17(d).

2.1.4.4 Modelling of Moolabin Creek

The models, reports and results from BCC's Moolabin Creek Flood Study were obtained from BCC. A high level review of the study was undertaken to determine the appropriateness for assessment of potential flood impacts.

This review identified that the flood study was undertaken in accordance with industry standards at the time it was undertaken. The study was undertaken prior to the release of the revised Australian Rainfall and Runoff (2019) and uses a 1D simulation approach through the area of the proposed Moolabin Creek bridges. It will therefore need to be updated for use in detailed design but was considered appropriate to provide indicative estimates of flood impacts within Moolabin Creek for the purposes of this RfPC-11.

Flood levels within Moolabin Creek in a 1% AEP do not interact with the proposed fill extent within the Yard. Potential flood impacts in Moolabin Creek will therefore be restricted to the re-configuration of Moolabin Creek bridges.

Concept level hydraulic modelling of the changes to the bridge structures across Moolabin Creek was undertaken. The modelling predicts the new bridge structures across Moolabin Creek do not cause any significant change in flood behaviour in the 1% AEP event.

The Moolabin Creek bridges will be designed to minimise the potential for flood impacts through the following:

- Minimising the number of piers within the creek
- Aligning the piers with existing piers and to minimise flow blockage
- Localised regrading of bed and banks

Through these activities the detailed design will achieve compliance with Environmental Design Requirement 5 (l).

While the final construction methodology for the bridges will be refined during detailed design, a typical construction method has been modelled within this model to assess the potential magnitude of temporary impacts during construction. Based on the analysis of this construction concept, a model is presented here which is representative of the potential flood impacts and is suitable for the purposes of this RfPC11.

Figure 4 presents an indicative section for this scenario with temporary fill pads on both sides of the creek to allow pier piling. The final temporary profile will be dependent on the final pier spacing for the bridge, the support requirements of equipment and access requirements. Access to Moolabin Creek from the north is severely restricted and a low-level crossing may be required during some periods of construction to allow access to the north bank during construction.

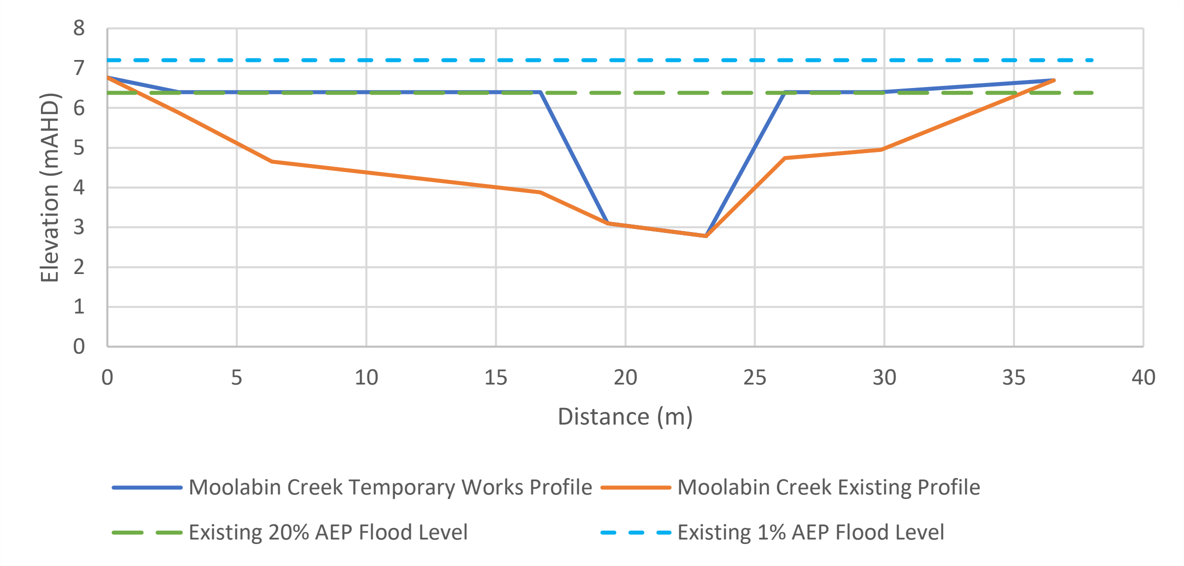


Figure 4: Indicative Construction Section

Potential impacts were assessed for the 20% and 1% AEP events. Figure 5 and Figure 6 present the modelled temporary flood impacts for this scenario. Flood impacts are limited to the reach of Moolabin Creek 300m upstream of the rail corridor.

The model predicts potential impacts of up to 32mm in the 20% AEP event and 27mm in the 1% AEP event, affecting 5 commercial properties upstream of the rail corridor. These commercial properties have a very low existing flood immunity and are flooded under existing conditions in a 20% AEP event with flood waters breaking out from the creek at Baldock Street before then flowing directly through and or around the buildings.

The location of the predicted impacts and area affected is different from that presented in the original EIS and RfPC-4 as the impacts are related to the bridge construction rather than the long worksite bund including within the original EIS flood assessment. The magnitude of impacts and number of affected properties is generally consistent with those previously reported as part of the evaluated project.

Development of the bridge design and construction methodology will seek to minimise these impacts where possible in accordance with imposed condition 17 (b). However, there will likely be some temporary flood impacts during construction should a 20% or 1% AEP event be experienced.

Figure 5: Modelled Temporary Impacts – 20% AEP

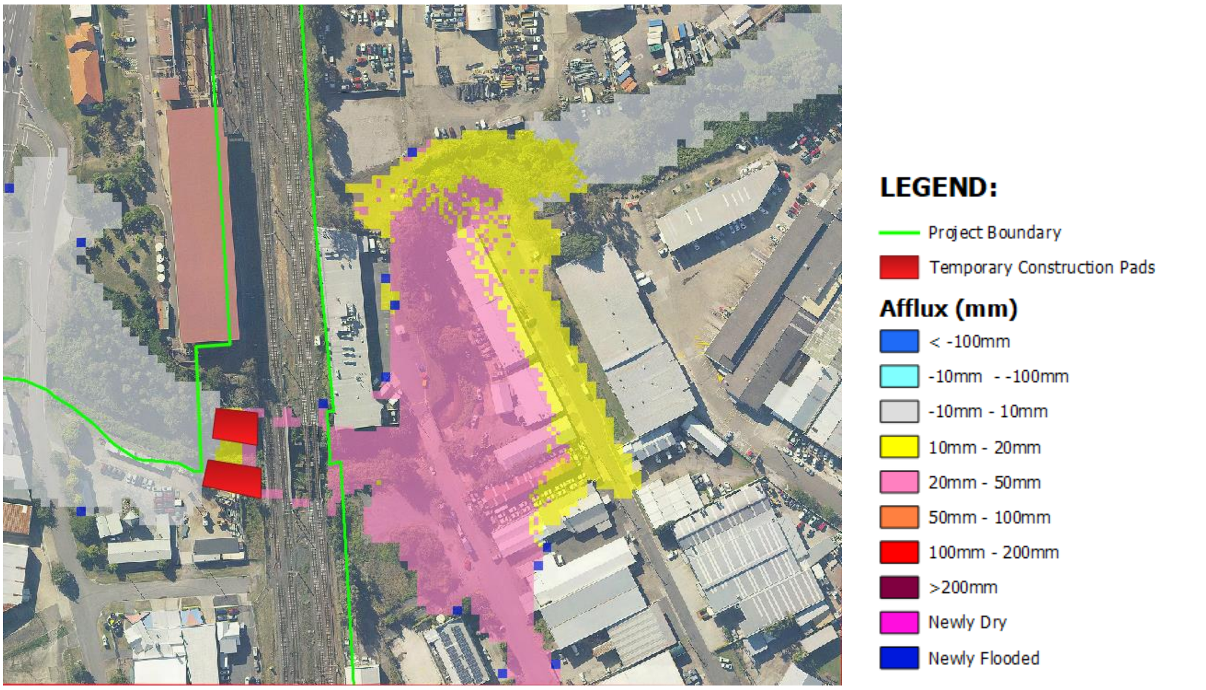


Figure 6: Modelled Temporary Impacts – 1% AEP

It is important to note when considering these reported impacts that Brisbane River flooding is responsible for the peak flood levels for all properties downstream of the rail corridor for events greater than the 10% AEP event. As the construction works do not affect the Brisbane River flood levels, there is no change to the flood risk profile of these properties even with the potential temporary changes to Moolabin Creek flooding.

For properties upstream of the rail corridor, Brisbane River flood levels are dominant for events greater than 2% AEP. However, local creek flooding is dominant for these properties for more frequent events.

2.2 Construction Impact

Required access for the construction of the three new bridges is very limited from the north side of Moolabin Creek. Piling pads are required to be set to a level where minor runoff events do not compromise the work site and construction of the new bridge piles/piers. Temporary crossings from the south bank may also be necessary for some periods of construction to facilitate heavy vehicle access for the piling rig and other large equipment or plant.

The current modelled impacts for the 20% AEP event predict only a minor increase in inundation on private property with the majority of increases located on Evesham Street. Detailed surveying of the affected areas/properties will be required to establish ground levels of structures currently experiencing flood impacts to determine any material impact. Given the instream nature of the works, effects of the temporary works in the creek is less sensitive to floods of a large magnitude (1% AEP).

During the detailed design process further refinement of the construction methodology will be developed in conjunction with flood modelling and the bridge designers. The final design of the three new bridges will play a key role in the determining the construction methodology and required works in the creek. Iterative flood modelling will be conducted to reduce the potential to cause flood impacts of the temporary arrangement.

The mitigation approaches currently in place are still appropriate and form part of the endorsed CEMP. The flood management plan may require amendments through the detail design phase to identify risks that are currently unable to be quantified or are not known at present. This may however include consultation with affected stakeholders if construction impacts are not able to be fully mitigated after design flood modelling iterations or through different construction methodologies.

Construction activities within the Clapham Yard fill platform will not be in excess of the permanent fill for the Yard. Therefore, similar to the permanent situation, there will not be Brisbane River flood impacts during construction. This represents no change to the Brisbane River flood impacts compared to the Evaluated Project.

The Evaluated Project identified there may be a need to construct a temporary bridge for the piling works due to the restricted work area as the new bridge described as part of the Evaluated Project was to be located within existing Rail Bridge Structures.

Relevant to hydrology, the Project Changes are:

- the location of the new 3 track dual gauge bridge on the outer western side of existing rail bridge over Moolabin Creek; and
- the location of the new bridges for up and down suburban trains on the outer eastern side of the rail corridor to replace the existing up suburban rail bridge over Moolabin Creek.

The revised bridge works for the Changed Project will extend the period of construction within Moolabin Creek compared to the Evaluated Project. Approximately 12 months of instream works will be required for each of the three bridges, (dual gauge bridge construction/demolition, suburban line bridge construction/demolition and construction of the new grade-separated structure) with some of these activities happening concurrently. Figure 7 outlines an indicative location and schedule for the instream works.

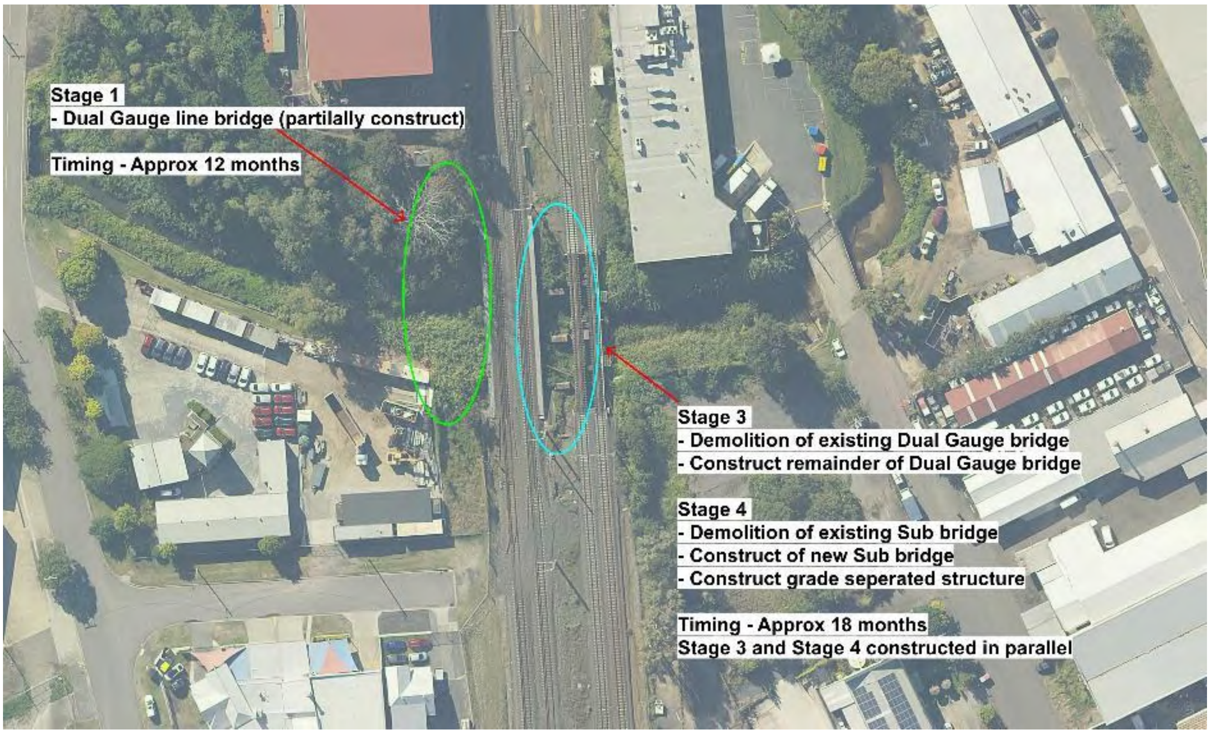


Figure 7: Staging and duration of In-stream works

The final construction methods will be refined through detailed design but will include some combination of typical construction methods such as temporary rockfill platforms and low-level crossings.

Notwithstanding the ongoing refinement of the construction methodology, the location and impacts of the potential temporary structures have been assessed as described in Section 2.1.4.4.

As demonstrated by the modelling undertaken for this RfPC-11, it is likely that there will be some level of temporary flood impacts during construction of the Moolabin Creek bridges.

This assessment represents a detailed assessment of the flood impacts of the instream works required to construct the Moolabin Creek bridges and explicitly considers instream activities required for the construction of the bridges and the current refined design requiring upgrade, realignment and construction of additional structures. All the existing bridges within Moolabin Creek are being decommissioned and replaced and there is the addition of a new grade separated structure crossing the creek. The duration of construction works within the creek has increased to facilitate the demolition and construction staging of the three new structures.

While this more detailed assessment has identified changes in the location of potential temporary flood impacts during construction, these impacts are considered similar in magnitude and extent to the Evaluated Project and impacts related to other projects of a similar nature.

2.3 Operational Impact

2.3.1 Brisbane River

In a Brisbane River flood event, the area of Clapham Yard acts as a large backwater storage area with significant depths of inundation but generally slow-moving water. This means that changes within the floodplain have only limited impacts on flood levels within a Brisbane River flood event.

The potential impacts of the proposed Clapham Yard have been assessed within the BRCFS TUFLOW model which demonstrates that the earthworks associated with the preferred design option produces off-site flood impacts of less than 10mm.

On this basis, the Impact described in the Evaluated Project has not changed.

2.3.2 Moolabin Creek

Local catchment flood events in Moolabin are associated with faster-moving flow within the creek and floodplain adjacent to the creeks. This means that changes within (i.e. bridges) or adjacent to the creeks may have significant impacts on flooding in a creek flood event.

Three new bridge structures are proposed across or in the vicinity of Moolabin Creek:

- Replacement of the current bridge for the dual gauge loop and Aurizon Rail Welding Facility shunt neck with a new bridge (downstream bridge) (3x track)
- Grade separated structure elevated above the floodplain
- Replacement of the current suburban line bridges for the Up and Down Suburban Lines (2x tracks).

Concept level hydraulic modelling of the changes to the bridge structures across Moolabin Creek was assessed using the provided BCC Moolabin Creek model. The track levels of the three new bridges are not predicted to be affected by local Moolabin Creek flooding in a 1% AEP event.

The modelling demonstrates that the new bridge structures across Moolabin Creek are not predicted to cause any significant change in flood behaviour in the 1% AEP event. It is noted that these flood models will be updated in accordance with Australian Rainfall and Runoff (2019) and reassessed through the design process. Minor channel works may be required as part of the Project Works to meet the Environmental Design Requirements and this will be determined during detailed design.

On this basis, the Impact described in the Evaluated Project has not changed.

3. Changes to Mitigation Measures

This assessment has not identified any change in the potential flood impacts under operations. Detailed flood modelling will be undertaken during detailed design to confirm that the permanent works do not cause adverse flood impacts for third parties, and consultation with BCC will be continued through design.

While this more detailed assessment has identified some changes to the potential temporary flood impacts during construction, the proposed mitigation measures already in place for temporary flood impacts remain appropriate, and no additional mitigation measures are proposed. The following outlines the mitigation measures already in place to manage the construction flood impacts.

Detailed hydrologic and hydraulic modelling will be undertaken during the detailed design to inform the design progression and construction planning. This modelling will be used to refine the design and construction planning to minimise any adverse flood impacts during construction.

The existing Moolabin Creek flood model will be updated from the existing one-dimensional model to a fully two dimensional and updated in line with current industry standards and technological advancements in modelling techniques. Recent LiDAR and detailed project survey will be incorporated into the model. The calibration of the model to historic events will be re-confirmed, and the design hydrology inputs (rainfall, losses, etc) will be updated consistent with ARR&R 2019.

In accordance with CG Recommendation 13, consultation with BCC in relation to the modelling will continue include review of the hydraulic models.

Consistent with the 2011 EIS and RfPC4, the selection of construction methods will be as such to minimise the extent of afflux (flood impacts) during construction. The philosophy of the detailed design will be to avoid temporary flood impacts that are not comparable with those detailed here.

A construction flood management plan has been developed for the management of instream works during construction. Ongoing update of this plan will be undertaken based on the results of the detailed flood modelling for the Moolabin Creek bridges.

3.1 Environmental Management Framework (EMF) Review

The following previously proposed mitigation measures will be undertaken:

- Detailed flood modelling of Clapham Yard and the Moolabin Creek bridges will be undertaken throughout all design phases to confirm that the design will not cause property damage from flood impacts to third parties for events up to and including the 1 in 100 AEP flood event.
- Flood resilience under climate change will be assessed (noting the constraints of the brownfield site in improving flood resilience).
- Consultation with BCC in relation to flooding will continue through all design phases.
- Implementation of the endorsed Flood Management Plan, including update where required as construction planning progresses

3.2 Proposed Changes to the EMF

No requirement for additional mitigation measures has been identified and therefore there are no proposed changes to the EMF in relation to hydrology.

3.3 Changes to Imposed Conditions

No changes to the imposed conditions are requested in relation to this change in project description.

4. Conclusion

Net-filling of Clapham Yard is required to improve the flood resilience of Clapham Yard. The proposed net-filling of the Yard will not cause flood impacts on third parties and will comply with imposed condition Clause 5(l).

The proposed bridge configurations at Moolabin Creek have evolved between the original 2011 EIS, RfPC-4 and this RfPC. Further design evolution will occur through the preliminary and detailed design phases to synthesise the range of design constraints including available space, rail geometry, geotechnical, structural, constructability and flooding constraints. Notwithstanding this design evolution, the proposed (and final) bridge configurations will not cause flood damage for third parties and will comply with imposed condition Clause 5(l).

In-stream works to facilitate the construction of the Moolabin Creek bridges may result in temporary impacts on third parties. Development of the bridge design and construction methodology will seek to minimise these impacts. A flood management plan has been developed to manage the instream works.

Detailed flood modelling for Clapham Yard and the Moolabin Creek bridges will continue through the design process to confirm compliance. Consultation with BCC will be ongoing through this process in accordance with the CG's Recommendation 13.

The technical assessment carried out has determined that the modified project described here does not result in a change in hydrology impacts that require any modification of the imposed conditions or existing mitigation measures under the OEMP, C-EMP and FMP.

Cross River Rail Environmental Impact Statement

Request for Project Change 11

Changes to the Project and changes to the imposed conditions

Volume 3 Technical Reports

Attachment D Air Quality

Date: ***April 2021***

Author: ***Cross River Rail Delivery Authority***

CROSSRIVERRAIL

Queensland Government

Table of Contents

1. Assessment Methodology

The methodology used for the assessment of air quality impacts includes

- Reviewing the project scope as described in the Evaluated Project.
- Identifying the potential air quality impacts of the Proposed Changes.
- Undertaking quantitative assessment in the form of dispersion modelling where relevant
- Review the current endorsed Construction Environmental Management Plan (C-EMP) and associated Air Quality Management Plan (AQMP) developed to comply with Imposed Condition 13
- Identifying any new or changed mitigation measures or updates to the Plans that would be required to mitigate the identified impacts of the Proposed Changes.

The proposed layout of Clapham Yard has been revised from the design presented and assessed for the Evaluated Project. Delivery of the new proposed layout requires import of additional fill material and a significant variation to the construction works and program.

Sensitive places are located near Clapham Yard, including residential dwellings along the south-eastern boundary of Clapham Yard on Ipswich Road, Moorooka. Additional details on sensitive places near Clapham Yard is provided in Section 1.2.3**Error! Reference source not found.**.

Due to the variations required to construction works to deliver the revised Clapham Yard layout and the presence of sensitive places, Clapham Yard has been assessed in detail via dispersion modelling to investigate changes to potential impacts and required changes to mitigation measures.

The air quality impacts forecast by the EIS for the Evaluated Project for Clapham Yard have been considered in this assessment of the Proposed Changes.

1.1 Air Quality Goals and Existing Air Quality

1.1.1 Air quality goals - Construction phase

The air quality goals which are included as Imposed Conditions for the CRR Project as required by the Coordinator General have been adopted for the assessment. The air quality goals are presented in Table 1.

There are no additional air quality goals for other pollutant species which need to be considered in the assessment as a result of changes to legislation or the Proposed Changes.

Table 1 Air quality criteria and goals

Criterion	Air quality indicator	Goal	Averaging period
Human health	TSP	90 µg/m^3	1 year
	PM_{10}	50 µg/m^3	24 hours
		25 µg/m^3	1 year
Nuisance	TSP	80 µg/m^3	24 hours
	Deposited dust	120 mg/m^2/day	30 days[1]

Table Note:
1. Daily deposition average (120 mg/m^2/day), calculated using the deposition level predicted or measured at a location over an averaging period of 30 days.

For the purpose of the assessment and this report, the air quality goals and criteria presented in Table 1 are referred to as the air quality goals hereafter.

1.1.2 Air quality goals - Operational phase

The purpose of this assessment is to identify if there are any potential operational air quality impacts for the Changed Project at Clapham Yard that require design consideration to achieve the air quality

Environmental Design Requirements (EDRs) listed in Schedule 1 of Cross River Rail Project Coordinator-General's change report – no.8 (November 2020)

EDR 2 requires that, relevantly:

b) The Project is designed so that it does not cause the air quality objectives specified in Table 5 (reproduced below in Table 2) to be exceeded.

Table 2 Ambient Air Quality Outcomes

Pollutant	Air Quality Objective	Averaging period
Total suspended particulates (TSP)	90 µg/m^3	Annual
Particulate matter (PM_{10})	50 µg/m^3	24 hours
	25 µg/m^3	Annual

Clapham Yard and Moorooka Station does not include tunnel and station ventilation systems, therefore EDR's 2a) and 2c) are not a design consideration for this proposed change.

To identify any potential operational air quality impacts that should be considered for the Changed Project at Clapham Yard a qualitative review of the previous air quality assessments undertaken as part of the approvals process for the Project has been completed.

The applicability of the previous air quality assessments to the proposed changes, and the outcomes of these assessments with respect to air quality impacts have been considered.

No additional modelling or predictive assessment has been undertaken for the operational assessment as the previous air quality assessments are appropriate for this purpose.

1.1.3 Existing air quality

The assessment of background air quality for the EIS for the Evaluated Project was undertaken based on monitoring data obtained from three monitoring stations (Rocklea, South Brisbane and Brisbane CBD) operated by the Department of Environment and Science (DES) and a station located at Bowen Hills for the Airport Link project.

Since the assessment of the Evaluated Project, the Proponent commissioned baseline monitoring which was undertaken by Suitably Qualified Professionals.

Baseline monitoring was undertaken from September 2018 to September 2019, which covers a period of one year. Background air quality monitoring was undertaken at six locations in the southern area of the CRR Project:

- Dutton Park State School (DPSS),
- Princess Alexandra Hospital - ground level (PAH-ground),
- Princess Alexandra Hospital - roof level (PAH-roof),
- Ecosciences Precinct,
- Dutton Street, and
- Leukaemia Foundation (LF).

Monitoring data from these locations has been compared with recent data collected from DES stations at South Brisbane and Rocklea (the nearest automatic DES stations to Clapham Yard for a more expansive representation of background air quality surrounding alignment.

Queensland Rail (QR) has also provided dust deposition monitoring results undertaken by DES at the Fairfield Station corridor western boundary. This data covers a period of 21 monthly monitoring cycles from January 2018 to October 2019.

The monitoring stations at DPSS, PAH-ground and LF measured deposited dust, TSP, and $PM_{10.}$ The PAH-roof monitoring station measured TSP and $PM_{10,}$ with the Ecosciences Precinct, Dutton Street and DES Fairfield monitoring stations measuring deposited dust only. The DES stations at Rocklea and South Brisbane monitor PM_{10} only. The locations of monitoring sites are shown in Figure 1.

No CRR Project early works activity was undertaken near the monitoring locations. It is noted that DES South Brisbane is located beside a heavily trafficked motorway and therefore provides a conservative estimate of background concentrations. Road works to Ipswich Road were also noted to have influenced monitoring undertaken at DPSS.

A summary of the monitoring results from the described monitoring stations for the southern area of the CRR Project (Fairfield to Salisbury) is presented in Table 3.

Table 3 Summary of monitoring results for the southern area of the CRR Project

Monitoring location	Dust deposition (mg/m²/day)	TSP (µg/m³)		PM_{10} (µg/m³)	
	Average of 30 day averages	Annual average	Max 24 hour average	Annual average	Max 24 hour average
Goal	120	90	80	25	50
DPSS[1]	60.0	31.9	**99.4**	18.2	48.1
PAH-ground[1]	29.0	31.6	64.6	18.0	38.9
PAH-roof[1]	n/m	30.4	63.4	18.9	**56.5**
Ecosciences Precinct[1]	20.0	n/m	n/m	n/m	n/m
Dutton Street[1]	29.0	n/m	n/m	n/m	n/m
LF[1]	26.0	22.7	31.9	13.3	29.2
DES South Brisbane[1]	n/m	n/m	n/m	19.3	**147.8**
DES Rocklea[1]	n/m	n/m	n/m	15.0	**137.2**
DES Fairfield[2]	37.9	n/m	n/m	n/m	n/m

Table Notes:
1. Monitoring results from monitoring undertaken between September 2018 to September 2019
2. Monitoring results from monitoring undertaken between January 2018 to October 2019
concentrations shown in **bold** exceed the air quality goal.
n/m = this pollutant species was not measured at this location.

No exceedances of the air quality goals for deposited dust, TSP, and PM_{10} were measured at the PAH-ground, Ecosciences Precinct, Dutton Street, LF or DES Fairfield monitoring stations. The DPSS monitoring station recorded exceedances of the 24 hour TSP goal (80 µg/m³) in June 2019 (99.4 µg/m³) and of the monthly deposited dust goal (120 mg/m²/day) in November 2018 (201 mg/m²/day). The PAH-roof monitoring station recorded one exceedance of the 24 hour PM_{10} goal (50 µg/m³) during December 2018 (56.5 µg/m³).

The air quality monitoring stations at South Brisbane and Rocklea operated by DES also measured six exceedances of the 24 hour PM_{10} goal at South Brisbane and Rocklea between September 2018 and August 2019. The DES Queensland Air Monitoring Report 2018 states that regional events were responsible for the measured exceedances in these months, specifically dust storms and bushfires. It is expected that these regional events were also responsible for the PM_{10} exceedances measured at the PAH-roof monitoring station.

In addition to presenting the monitoring data, a report (by SLR Consulting) was prepared, which was commissioned by the Proponent in 2018 to ascertain existing ambient air quality conditions prior the Project Commencing, also recommends 24 hour average background air quality concentrations for the southern area of the CRR Project (Fairfield to Salisbury) for dust deposition, TSP and PM_{10}. The recommended background concentrations are prescribed based on the measured 90th percentile 24 hour average concentrations from each of the monitoring locations which is considered appropriate for the purpose of this air quality assessment. The recommended 24 hour average background concentrations were 31.4 µg/m^3 for PM_{10} and 20.6 µg/m^3 for TSP.

Due to proximity to the construction area, and completeness of the dataset, the dust deposition results from DES Fairfield Station are considered more representative than the results obtained from the baseline monitoring undertaken by the Proponent and have been adopted for the assessment.

The SLR Report does not recommend annual average background concentrations for TSP or PM_{10}. Annual average background concentrations have been derived for this assessment by taking the average of the measured annual average concentrations from monitoring locations within the southern area.

The background air quality concentrations and dust deposition level which have been adopted for the assessment are presented in Table 4. These concentrations are comparable to the background concentrations adopted for the assessment of the Evaluated Project.

Table 4 Background air quality concentrations adopted for the assessment

Dust deposition (mg/m^2/day)	TSP (µg/m^3)		PM_{10} (µg/m^3)	
30 day average[3]	Annual average[2]	24 hour average[1]	Annual average[2]	24 hour average[1]
37.9	29.2	31.4	17.1	20.6

Table Notes:
1. Based on the measured 90th percentile 24 hour average concentrations from each of the monitoring locations.
2. Calculated as the average of the measured annual average concentrations.
3. Calculated as the average of the results of the 21 monthly monitoring cycles from data provided by QR.

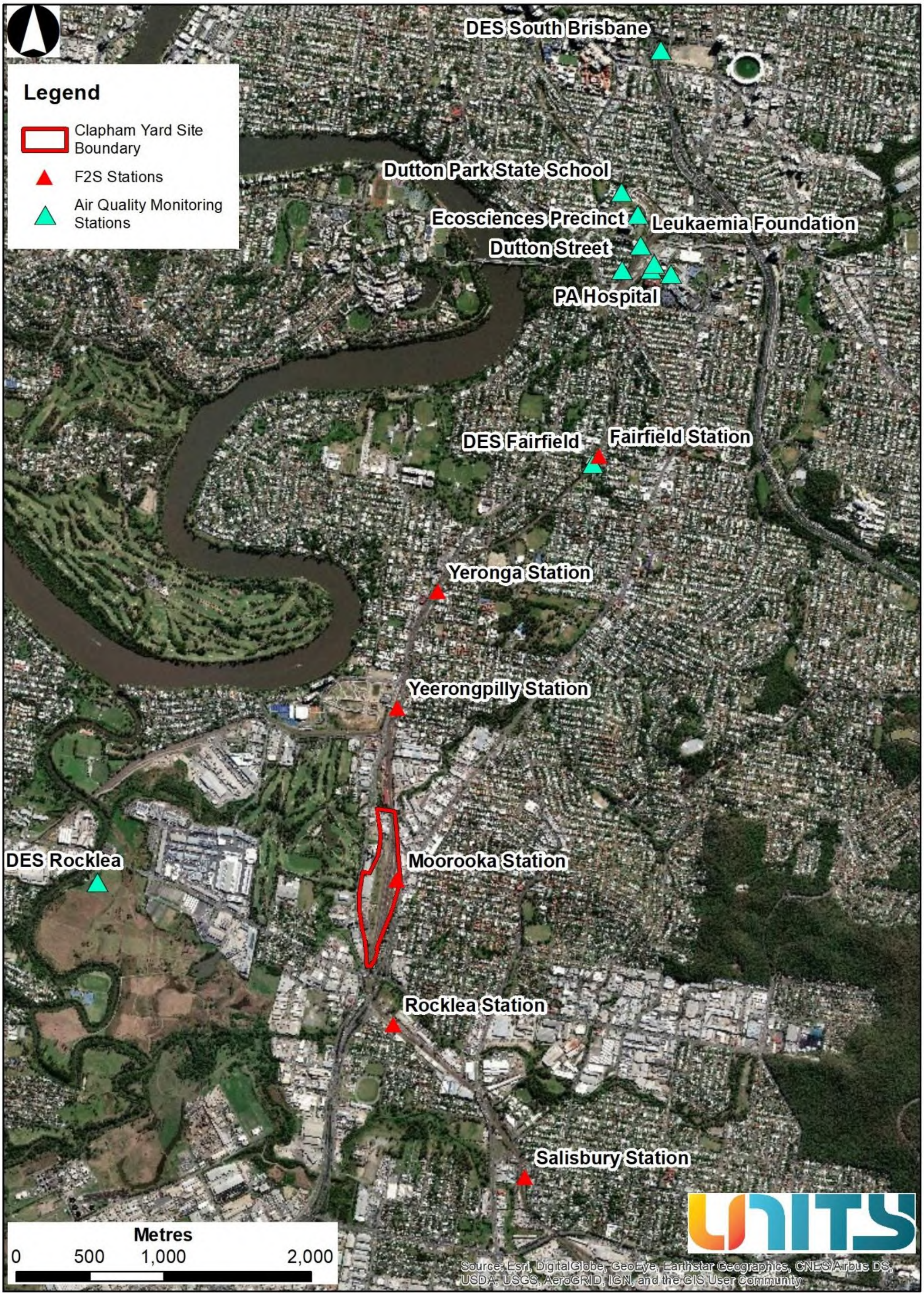


Figure 1 Location of Clapham Yard, Moorooka station and air quality monitoring locations

1.2 Air Dispersion Modelling

1.2.1 Overview

Dispersion modelling of air quality impacts previously carried out for the EIS focussed on fugitive dust emissions from construction activities and considered emissions of TSP, PM_{10} and $PM_{2.5}$. Modelling was undertaken to predict and assess airborne concentrations of TSP and PM_{10} and dust deposition rates.

Dispersion modelling for Clapham Yard considered emissions from bulldozer operation, wheel generated dust from vehicles and wind erosion. Modelling for Clapham Yard worksite was undertaken by developing an emissions inventory using emissions formula obtained from technical literature. In addition to emissions formula, mitigation measures and the effectiveness of these mitigation measures (percentage reduction to emissions) were also considered.

Dispersion modelling for Clapham Yard and the Moorooka Station Upgrade for the assessment of the Proposed Changes has been undertaken following the same approach as the EIS. However, emission sources and the emissions inventory have been modified based on the anticipated construction works for the proposed delivery of Clapham Yard and the Moorooka station upgrade.

The delivery of the Project at Clapham Yard and Moorooka station have been staged to occur consecutively. Construction activity over both areas is proposed to occur in five stages. Stage 1-3 of the RfPC-11 involves earthworks, rail-works and infrastructure works at Clapham Yard, whereas the station and track upgrade at nearby Moorooka station is not scheduled to occur until Stage 4 and 5 of the RfPC-11. Table 2 in Section 4.1 of the Introduction to *Changes to the Project and changes to the imposed conditions – Clapham Yard inclusive of Moorooka Station*-*Vol 3* presents a summary of the key stages required to deliver the Proposed Change to the project.

The construction activities which have the highest potential to generate emissions are earthworks and material handling (e.g. excavation and placement of capping material) due to the volume of material handled and the high potential for dust emissions from earthen material. In addition, vehicle movements to support earthworks, material handling and other construction activity are also considered a significant source.

The major activities with respect to air quality emissions within each stage are summarised as follows:

- Stage 1 (Clapham Yard):
  - Yard mobilisation, building demolition and site clearance
  - Earthworks; including remove and replace of earthen material.
  - Installation of main drainage trunk lines and construction of rail and road civil structures
- Stage 2 (Clapham Yard):
  - Reconfiguration and decommissioning of Dual Gauge tracks
- Stage 3 (Clapham Yard):
  - Demolition of structures
  - Earthworks; including drainage and inground services (following Dual gauge HR removal)
  - Construction of rail yard structures, lighting & comms, RMAR, Access Roads, Yard facilities including combined graffiti wash/maintenance road
- Stage 4 (Moorooka)
  - Reconfiguration and decommissioning of Dual Gauge tracks
- Stage 5 (Moorooka and Clapham Yard)
  - Construct of rail yard structures at Moorooka station and upgrade of existing structures

- Finalisation of construction at Clapham Yard

Based on the construction schedule, removal and replacement of earthen material occurs as part of the earthworks in Stage 1, which takes place within Clapham Yard. Stage 1 has the greatest potential to impact sensitive receptors and is considered to provide the greatest risk of exceedances of the air quality goals due to the quantity of material required to be removed and replaced during this stage. To assess the impact of construction activity in the Clapham Yard construction area, the air quality assessment has assessed Stage 1 construction activities for this area.

Reconfiguration and decommissioning of track works at Moorooka station during Stage 4 will have the greatest potential to impact sensitive receivers and provide greatest risk of exceedances of the air quality goals at sensitive receptors near Moorooka Station. To assess the impact of construction activity in the Moorooka construction area, the air quality assessment has also assessed Stage 4 construction activities for this area.

The Stages 1 and 4 are not expected to overlap in schedule therefore emissions from each stage have been considered in isolation from each other.

1.2.2 Meteorological Inputs

Consistent with the assessment for the Evaluated Project, dispersion modelling has been undertaken using the CALPUFF dispersion model. The meteorological data inputs generated and used for the assessment of the Evaluated Project (generated by CALMET, the meteorological pre-processor for CALPUFF) have been used in this assessment. The wind rose for Clapham Yard, is based on the meteorological predictions from CALMET is shown in Figure 2.

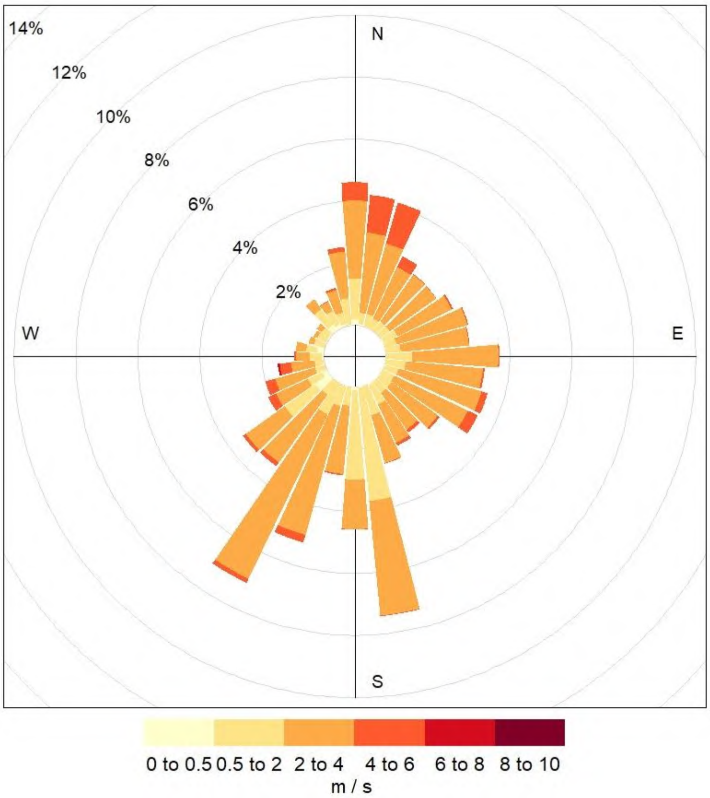


Figure 2 Wind rose for Clapham Yard based on meteorological predictions from CALMET

1.2.3 Sensitive places

Sensitive places are defined by the Imposed Conditions as follows:

- a dwelling (including residential allotment, mobile home or caravan park, residential marina or other residential premises, motel, hotel or hostel)
- a library, childcare centre, kindergarten, school, university or other educational institution
- a medical centre, surgery or hospital
- a protected area
- a public park or garden that is open to the public (whether or not on payment of money) for use other than for sport or organised entertainment, and
- a workplace used as an office or for business or commercial purposes, which is not part of the CRR Project activity(ies) and does not include employee's accommodation or public roads.

The definition of sensitive places is consistent with the definition for sensitive places presented in the DES Guideline *Application requirements for activities with impacts to air.*

It is noted that although the definition of a sensitive place includes educational institutions, public parks and workplaces, the shortest averaging period for the air quality goals for the CRR Project (see Section 1.1.1) is 24 hours. The exposure period to air quality impacts has been considered when assessing impacts from the construction areas on sensitive places.

The discrete receptor points which have been adopted for dispersion modelling for Clapham Yard and Moorooka Station are discussed in the following sections. In addition to discrete receptors, receptor grids have been used to allow for the presentation of concentration contour plots. Discrete and grid receptor points have been modelled at a height of 0m above ground.

1.2.3.1 Clapham Yard

The sensitive places which have been included in the dispersion modelling for Clapham Yard as discrete receptor points are shown in Figure 3. Description of the receptors is provided in Table 5.

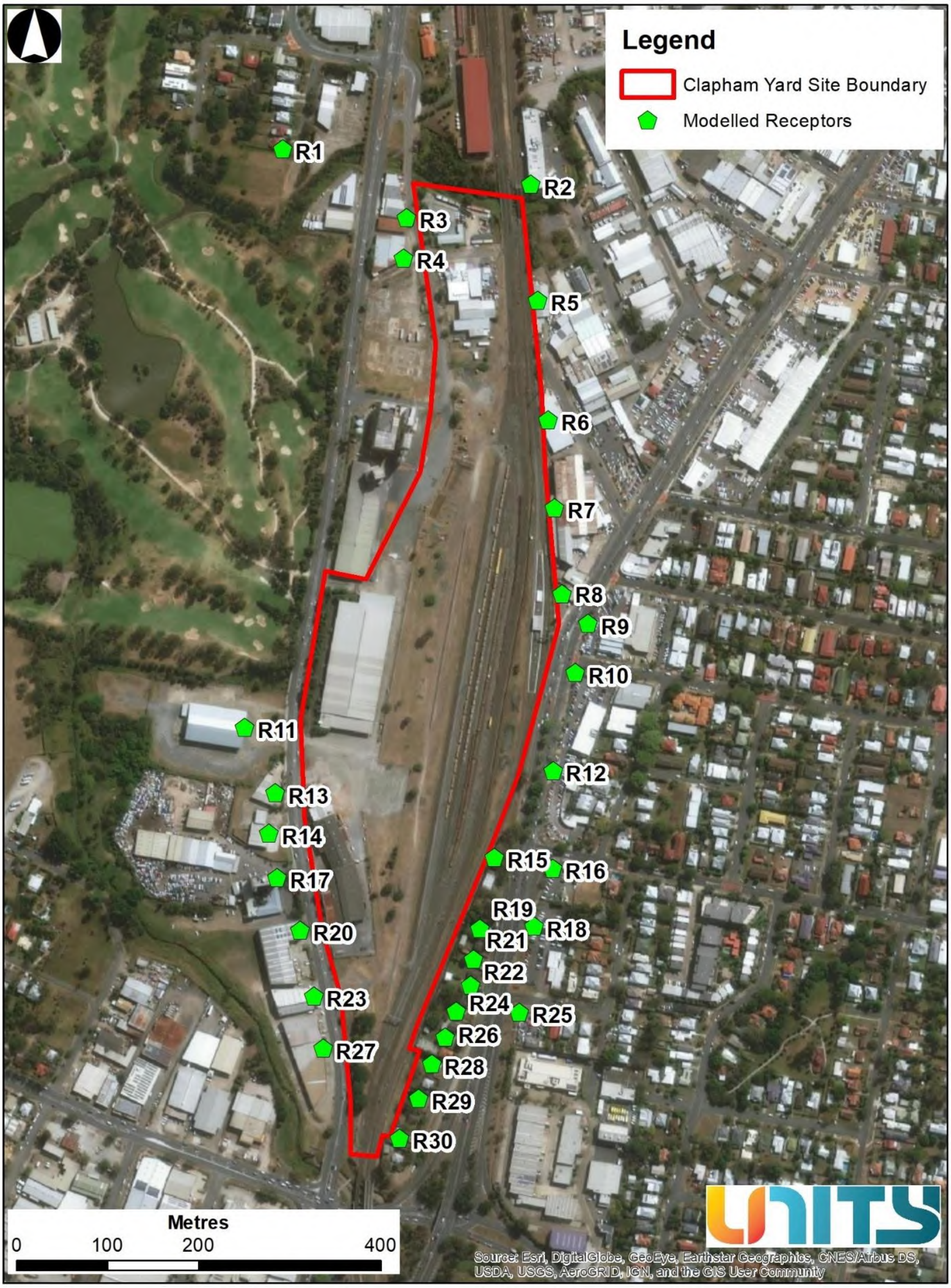


Figure 3 Sensitive places included in dispersion modelling for Clapham Yard

Table 5 Modelled sensitive places for Clapham Yard

Receptor ID	Land Use	Address	Easting (UTM MGA Zone 56)	Northing (UTM MGA Zone 56)
R1	Residential	15 Moolabin Crescent, Yeerongpilly	501,100	6,954,751
R2	Commercial	60 Evesham Street, Yeerongpilly	501,373	6,954,713
R3	Commercial/Industrial	760 Chale Street Yeerongpilly	501,236	6,954,676
R4	Commercial/Industrial	770 Fairfield Road, Yeerongpilly	501,233	6,954,632
R5	Industrial	41 Unwin Street, Yeerongpilly	501,380	6,954,585
R6	Industrial	30 Unwin Street, Yeerongpilly	501,392	6,954,454
R7	Industrial	20A Unwin Street, Yeerongpilly	501,398	6,954,357
R8	Commercial	1145 Ipswich Road, Yeerongpilly	501,406	6,954,263
R9	Commercial (Car Yard)	1130 Ipswich Road, Moorooka	501,436	6,954,230
R10	Commercial (Car Yard)	1166 Ipswich Road, Moorooka	501,421	6,954,176
R11	Industrial	931 Fairfield Road, Yeerongpilly	501,058	6,954,117
R12	Commercial (Car Yard)	1160 Ipswich Road, Moorooka	501,397	6,954,069
R13	Commercial	945 Fairfield Road, Yeerongpilly	501,092	6,954,044
R14	Commercial	969 Fairfield Road, Yeerongpilly	501,085	6,954,000
R15	Residential	1213 Ipswich Road, Moorooka	501,333	6,953,974
R16	Commercial (Car Yard)	1190 Ipswich Road, Moorooka	501,396	6,953,961
R17	Commercial	973 Fairfield Road, Yeerongpilly	501,094	6,953,952
R18	Commercial (Car Yard)	12 Kenway Street, Moorooka	501,376	6,953,897
R19	Residential	1219 Ipswich Road, Moorooka	501,317	6,953,895
R20	Industrial/Commercial	985 Fairfield Road, Yeerongpilly	501,119	6,953,894
R21	Residential	1223 Ipswich Road, Moorooka	501,310	6,953,862
R22	Residential	1227 Ipswich Road, Moorooka	501,306	6,953,833
R23	Industrial/Commercial	995 Fairfield Road, Yeerongpilly	501,134	6,953,821
R24	Residential	1231 Ipswich Road, Moorooka	501,291	6,953,805
R25	Commercial (Car Yard)	1220 Ipswich Road, Moorooka	501,360	6,953,804
R26	Residential	1235 Ipswich Road, Moorooka	501,279	6,953,776
R27	Industrial/Commercial	999 Fairfield Road, Yeerongpilly	501,144	6,953,764
R28	Residential	1241 Ipswich Road, Moorooka	501,264	6,953,747
R29	Residential	1249 Ipswich Road, Moorooka	501,249	6,953,708
R30	Residential	1257 Ipswich Road, Moorooka	501,229	6,953,665

Industrial places have been included in the assessment as a conservative measure, however it is unlikely that those places are a "Sensitive Place" in accordance with the Imposed Conditions. The status of industrial places will be confirmed during consultation with directly affected persons.

1.2.3.2 Moorooka Station

For assessment of the Moorooka station, sensitive places were chosen from within 100 m of the alignment, based on perceived risk of air quality impacts. A summary of the closest sensitive places to the station construction areas is shown below in Table 6. The sensitive place locations which have been modelled as discrete point receptors are presented in Table 7 and shown in Figure 4.

Table 6 Closest receptor to Moorooka station construction area

Station	Closest Receptor ID	Description	Address	Approximate distance from construction area (m)
Moorooka	5	Commercial	1145 Ipswich Road Moorooka	20

Table 7 Modelled sensitive place locations for Moorooka Station

Receptor ID	Land Use	Address	Easting (UTM MGA Zone 56)	Northing (UTM MGA Zone 56)
R1	Commercial	1117 Ipswich Road, Moorooka	501,437	6,954,378
R2	Commercial	1117 Ipswich Road, Moorooka	501,418	6,954,341
R3	Commercial	1133 Ipswich Road, Moorooka	501,422	6,954,279
R4	Commercial	1137 Ipswich Road, Moorooka	501,416	6,954,263
R5	Commercial	1145 Ipswich Road, Moorooka	501,405	6,954,243
R6	Commercial (Car Yard)	1130 Ipswich Road, Moorooka	501,485	6,954,224
R7	Commercial (Car Yard)	1099 Ipswich Road, Moorooka	501,479	6,954,397
R8	Commercial (Car Yard)	21 Unwin Street, Moorooka	501,440	6,954,454
R9	Commercial	25 Unwin Street, Moorooka	501,434	6,954,484
R10	Commercial	1/25 Unwin Street, Moorooka	501,422	6,954,486
R11	Commercial	29 Unwin Street, Moorooka	501,422	6,954,505
R12	Commercial	37 Unwin Street, Moorooka	501,406	6,954,539
R13	Commercial	41 Unwin Street, Moorooka	501,382	6,954,572
R14	Commercial	42 Evesham Street, Moorooka	501,420	6,954,599
R15	Commercial	40 Evesham Street, Moorooka	501,435	6,954,576
R16	Commercial	36 Evesham Street, Moorooka	501,442	6,954,556
R17	Commercial	34 Evesham Street, Moorooka	501,461	6,954,541
R18	Commercial (Car Yard)	1166 Ipswich Road, Moorooka	501,442	6,954,134

Receptor ID	Land Use	Address	Easting (UTM MGA Zone 56)	Northing (UTM MGA Zone 56)
R19	Commercial (Car Yard)	1178 Ipswich Road, Moorooka	501,415	6,954,015
R20	Commercial (Car Yard)	1166 Ipswich Road, Moorooka	501,416	6,954,061
R21	Commercial (Car Yard)	1190 Ipswich Road, Moorooka	501,404	6,953,947
R22	Residential	1213 Ipswich Road, Moorooka	501,338	6,953,947
R23	Residential	1215 Ipswich Road, Moorooka	501,327	6,953,926
R24	Residential	1217 Ipswich Road, Moorooka	501,323	6,953,907
R25	Residential	1219 Ipswich Road, Moorooka	501,317	6,953,894
R26	Residential	1221 Ipswich Road, Moorooka	501,312	6,953,878
R27	Residential	1223 Ipswich Road, Moorooka	501,313	6,953,861
R28	Residential	1225 Ipswich Road, Moorooka	501,314	6,953,847
R29	Residential	1227 Ipswich Road, Moorooka	501,305	6,953,831
R30	Residential	1229 Ipswich Road, Moorooka	501,299	6,953,814
R31	Commercial	78 Chale Street, Yeerongpilly	501,313	6,954,547
R32	Commercial	76 Chale Street, Yeerongpilly	501,308	6,954,560
R33	Commercial	74 Chale Street, Yeerongpilly	501,307	6,954,572
R34	Commercial	3 Gus Street, Yeerongpilly	501,303	6,954,605
R35	Commercial	8 Gus Street, Yeerongpilly	501,289	6,954,666

Figure 4 Sensitive places included in dispersion modelling for Moorooka

1.2.4 Emission Calculations

Emissions from construction activity for Clapham Yard and Moorooka Station have been calculated using construction schedule information provided by the CRR contractor.

Each of the five stages of the construction schedule, as described in Section 1.2.1, has been considered in its entirety, and a worst-case representative scenario was modelled based on intensity of high risk construction activity and potential to cause impacts to air quality at sensitive receptor locations.

For Clapham Yard, the construction stage with the highest potential to cause significant air quality impacts is Stage 1, which is the construction stage in which the majority of the bulk earthworks activity occurs and therefore the stage which has the highest potential to impact sensitive places.

For the assessment of the Moorooka Station, construction schedule information was provided, with this information used to calculate emissions to input into dispersion modelling.

Based on the construction information provided, the construction stage with the highest potential to cause significant air quality impacts was Stage 4, which is the stage where earthworks are required.

Emissions from construction activities have been estimated using the emission factors presented in the NPI Mining Manual and several chapters within the United States Environmental Protection Agency (US EPA) *AP-42: Compilation of Air Emissions Factors* (AP 42 Manual)*.* The use of these documents is consistent with the assessment methodology for the Evaluated Project.

The NPI Mining Manual also includes estimates for control factors (emission reduction efficiency) for various mitigation measures. The control factors prescribed in the NPI Mining Manual have been considered when investigating mitigation measures for construction activities. Due to changes to construction activities, the construction schedule and practical preferences for mitigation strategies, there are minor differences in the mitigation measures considered in this assessment as compared to those considered for the Evaluated Project for Clapham Yard.

Not all construction activities have been modelled for assessment, which is consistent with the approach adopted for the Evaluated Project. Construction activities which are anticipated to have the potential to generate exceedances of the air quality goals or cause nuisance to sensitive places have been assessed. For construction activities which are not anticipated to generate significant emissions or have a significant separation distance to receptors, these activities have not been assessed.

1.2.5 Modelling Scenarios

According to the staging schedule detailed in Table 2 of Section 4.1 of the Introduction to *Changes to the Project and changes to the imposed conditions – Clapham Yard inclusive of Moorooka Station-Vol 3,* works occurring in Clapham Yard and Moorooka are scheduled to occur separately.

To assess potential air quality impacts during high-risk dust emission construction activities such as earthworks activities for Clapham Yard, two modelling scenarios have been investigated based on Stage 1 of the Clapham Yard and Moorooka station works (Scenario 1 and 2).

For the assessment of the Moorooka station a single scenario has been modelled (Scenario 3) representing trackwork and Moorooka station upgrade designated to occur during State 4 of the Clapham Yard and Moorooka station works.

The modelling scenarios and the activities assessed for Clapham Yard and the Moorooka Station are described in Table 8.

Table 8 Modelling scenarios for construction activities

Scenario	Description	Emission sources assessed
Clapham Yard		

Scenario 1	**Surface excavation works**
	Surface excavation works involving the stripping, clearing and grubbing of existing surface material across the majority of the site, including the stabling yards.
	This construction work will be undertaken during standard construction hours between 6:30am to 6:30pm, Monday to Saturday, with dominant activity hours between 7:00am to 4:00pm on these days.
	Surface excavation works is anticipated to require approximately nine weeks to complete.
		• Surface excavation (average of 111 tonne/day)
		• Vehicle travel on haul roads, consisting of:
		  ◦ Haulage of excavated material, average of 60 truck and dog movements per day
		  ◦ General light vehicle traffic, average of 15 light vehicles per day
		  ◦ Total haul road length of approximately 1,060m
		• Wind erosion of exposed areas (approximately 54,000m^2 of exposed area)

Scenario 2	**Import and placement of fill material**
	Import and placement of fill material across the majority of the site, including the stabling yards. This activity requires import of off-site generated fill from tunnel excavation for the CRR Project. Import fill material will be stockpiled and subsequently placed and compacted. Fill material will be distributed across the site in layers to increase the finished ground level of Clapham Yard.
	As tunnel boring (and the generation of fill material) will occur during the day and night-time, spoil haulage is proposed to be undertaken over extended construction hours consisting of a day and a night shift.
	Import and placement of fill material is anticipated to require approximately 24 weeks to complete.
		• Unloading fill material from haul trucks (average of 3,666 tonne/day)
		• Vehicle travel on haul roads, consisting of:
		  ◦ Haulage of excavated material, average of 128 truck and dog movements per day
		  ◦ General light vehicle traffic, average of 16 light vehicles per day
		  ◦ Total haul road length of approximately 1,060 m
		• Dozer operation (distribution and compaction of fill) (two dozers, operating 9 hours per day and night shift)
		• Wind erosion of exposed areas (approximately 54,000 m^2 of exposed area)

Moorooka Station		

Scenario 3	**Bulk earthworks backfilling**
	Bulk earthworks required for the backfilling of unbound pavement underneath station platforms.
	This construction work will be undertaken during standard construction hours between 6:30am to 6:30pm, Monday to Saturday, with dominant activity hours between 7:00am to 4:00pm on these days.
	Stage 4 earthworks is anticipated to require approximately 2 weeks to complete per station.
		• Unloading material from haul trucks (average of 259 tonnes/day)
		• Vehicle haulage on un-sealed roads, consisting of:
		  ◦ Material haulage, average of 22 body trucks per day
		  ◦ Total haul road length of approximately 150 m per station
		• Wind erosion of exposed areas (approximately 1,700 m^2 of exposed area at each station)

Construction emissions for infrastructure projects are complex due to the distribution of activities across a large geographical area, and the transitory nature of many individual construction activities at particular locations. To accurately assess emissions from the construction area, different modelling scenarios have been developed to reflect emissions. For example, for assessment against the PM_{10} and TSP 24 hour goals, emission sources have been located within works areas that are representative of one day's activities. For assessment against the dust deposition goal (monthly averaged daily deposition rate) and the PM_{10} and TSP annual average goals, emissions have been spread across the relevant working areas.

For Scenario 1, assessment against 24 hour average goals was undertaken based on excavation occurring in the southern part of Clapham Yard. This area is closest to residential receptors, and requires the longest vehicle haul route.

For Scenario 2, assessment against 24 hour average goals was undertaken considering activity at the northern and southern extents of Clapham Yard. Additional modelling was undertaken for Scenario 2 (as compared to Scenario 1) based on the results of the modelling and as construction activity is proposed to occur during the day and night-time.

For both Scenario 1 and Scenario 2, assessment against the dust deposition (30 day average) and annual average PM_{10} and TSP goals was undertaken by distributing sources evenly throughout the working areas.

Due to the reduced size of the Moorooka Station (in comparison to Clapham Yard), a single set of source locations for each station was sufficient for assessment against all relevant air quality goals for Scenario 3.

For transport of material, truck and vehicle movements have been sourced from the Traffic and Transport Report but have been redistributed to account for the averaging periods across which the air quality goals are calculated, in an effort to maintain conservatism across the air quality assessment of the construction schedule.

1.2.6 Mitigation Measures

Mitigation measures for air quality relevant to Clapham Yard is contained within the endorsed CRR RIS Air Quality Management Plan sub-plan (AQMP-SP).

The mitigation measures which have been considered in the assessment for Clapham Yard are presented in Table 9.

An existing noise barrier is located adjacent to residential dwellings (R15 south towards R30, see Figure 3) on Ipswich Road adjacent to the south-eastern boundary of Clapham Yard. This existing noise barrier will mitigate the impact of near-field dust generation to these residential receptors due to the increased dispersion which will occur when wind transports the generated dust over the barrier. A control factor of 30% has been adopted for excavators, bulldozers and the unloading of fill material from haul trucks, consistent with the control factor adopted for the Evaluated Project.

Table 9 Mitigation measures and control factors for Clapham Yard and Moorooka station construction activities

Construction activity	Mitigation method	Control factor (%)
Scenario 1: Clapham yard - Surface excavation works		
Vehicle travel on haul roads	Road watering	50%
Excavators (loading to trucks)	Water sprays and pre-conditioning	50%
	Hoarding[1] (existing rail noise barrier)	30%[2]
Scenario 2: Clapham Yard - Import and placement of fill material		
Vehicle travel on haul roads	Polymer binding agent	90%[3]
Bulldozers on spoil	Hoarding[1] (existing rail noise barrier)	30%
Unloading fill material from haul trucks	Water sprays (material also has a required moisture content)	70%
	Hoarding[1] (existing rail noise barrier)	30%[2]
Scenario 3: Moorooka Station- Bulk earthworks backfilling		
Vehicle travel on haul roads	Road watering	50%
Unloading fill material from haul trucks	Water sprays	70%
Table Notes:		

Construction activity	Mitigation method	Control factor (%)
1. Only applied for predictions for receptors to the south-east of Clapham Yard, where the existing rail noise barrier is located. 2. 30% reduction applied to resulting emissions after correction for water sprays (70% reduction). 3. Assumed based on the anticipated travel on untreated (without polymer) sections (e.g. for unloading, manoeuvring, etc) being equal to 10%.		

1.2.7 Emissions Inventory

The emissions inventory for the construction activities modelled, including the influence of mitigation measures (see Table 9), is presented in Table 10.

Table 10 Emissions inventory for construction activities

Activity	Hours of operation	Emission rate (g/s)			Emission rate (kg/day)		
		TSP	PM_{10}	$PM_{2.5}$ [a]	TSP	PM_{10}	$PM_{2.5}$ [a]
Scenario 1: Clapham Yard - Surface excavation works							
Vehicle travel on haul roads	Standard construction hours (day-time only)	3.455	0.926	0.093	111.95	30.01	3.00
Excavators		0.251	0.119	0.005	8.15	3.85	0.15
Excavators (with hoarding)		0.176	0.083	0.003	5.70	2.70	0.11
Wind erosion		0.600	0.300	0.045	n/a	n/a	n/a
Total (without hoarding)		**4.306**	**1.345**	**0.142**	**120.09**	**33.87**	**3.16**
Scenario 2: Clapham Yard - Import and placement of fill material							
Vehicle travel on haul roads	Extended construction hours (day and night)	0.758	0.209	0.021	43.66	12.06	1.21
Bulldozers		1.068	0.140	n/e	61.54	8.05	0.00
Bulldozers (with hoarding)		0.748	0.098	n/e	43.08	5.63	0.00
Unloading fill material from haul trucks		0.229	0.082	0.004	13.20	4.73	0.25
Unloading fill material from haul trucks (with hoarding)		0.160	0.057	0.003	9.24	3.31	0.18
Wind erosion		0.600	0.300	0.045	n/a	n/a	n/a
Total (without hoarding)		**2.655**	**0.731**	**0.070**	**118.41**	**24.83**	**1.46**
Scenario 3: Moorooka Station - Bulk earthworks backfilling							
Vehicle travel on haul roads	Standard construction hours (day-time only)	0.131	0.094	0.037	4.24	3.03	1.21
Unloading fill material		0.003	0.002	0.001	0.09	0.06	0.03
Wind erosion		0.019	0.009	0.009	n/a	n/a	n/a
Total		**0.153**	**0.105**	**0.048**	**4.33**	**3.09**	**1.25**

Table note:

a. Predicted $PM_{2.5}$ concentrations at receptors have not been assessed. $PM_{2.5}$ has been speciated to account for the influence of the size of particulate matter on dust deposition.

n/a not able to be calculated in this manner as emissions vary based on wind speed.

n/e nil $PM_{2.5}$ emissions generated by bulldozers.

1.2.8 Limitations

The atmosphere is a complex, physical system, and the movement of air in a given location is dependent on several different variables, including temperature, topography and land use, as well as larger-scale synoptic processes. Dispersion modelling is a method of simulating the movement of air pollutants in the atmosphere using mathematical equations. The model equations necessarily involve some level of simplification of these very complex processes based on our understanding of the processes involved and their interactions, available input data, and processing time and data storage limitations.

These simplifications come at the expense of accuracy, which particularly affects model predictions during certain meteorological conditions and source emission types. For example, the prediction of pollutant dispersion under low wind speed conditions (typically defined as those wind speeds less than 1 m/s) or for low-level, non-buoyant sources, is problematic for most dispersion models. To accommodate these known deficiencies, the model outputs tend to provide conservative estimates of pollutant concentrations at particular locations.

While the models contain a large number of variables that can be modified to increase the accuracy of the predictions under any given circumstances, the constraints of model use in a commercial setting, as well as the lack of data against which to compare the results in most instances, typically precludes extensive testing of the impacts of modification of these variables. Model developers typically specify a range of default values for model variables that are applicable under most modelling circumstances. These default values are recommended for use unless there is sufficient evidence to support their modification.

As a result, the results of dispersion modelling provide an indication of the likely level of pollutants within the modelling domain. While the models, when used appropriately and with high quality input data, can provide very good indications of the scale of pollutant concentrations and the likely locations of the maximum concentrations occurring, their outputs should not be considered to be representative of exact pollutant concentrations at any given location or point in time. As stated above, however, the model predictions are typically conservative, and tend to over predict maximum pollutant concentrations at receiver locations.

2. Changes to Potential Impacts

Air quality impacts caused by the Proposed Changes are anticipated to be generally comparable with the impacts as described for the EIS. The following sections provides further details on the change in impacts to air quality for the Proposed Change.

2.1 Evaluated Project Context

2.1.1 Clapham Yard

Detailed dispersion modelling to assess the impact of construction works for Clapham Yard was undertaken in the EIS for the Evaluated Project. The proposed Clapham Yard upgrade described as part of RfPC-4 was considered to result in reduced air quality impacts due to a reduction in fill, earthworks timeframe and a reduced number of truck movements and therefore no dispersion modelling was undertaken. Based on review of the contour plots generated for the EIS (Figure 24, Figure 25, Figure B5 and Figure B10) the results of the dispersion modelling for Clapham Yard from the EIS are summarised as follows:

- PM_{10} 24 hour concentrations were predicted to exceed the air quality goal of 50 µg/m^3 outside the Clapham Yard boundary to the south-east (residential receptors, approximately R21, R22 and R24,), south-west (commercial and industrial receptors, approximately R11, R13, R14, R17, R20, R23 and R27,) and north-west (commercial and industrial receptors).
- TSP 24 hour concentrations were predicted to exceed the air quality goal of 80 µg/m^3 outside the Clapham Yard boundary to the south-east (residential receptors, approximately R19, R21, R22, R24 and R26,, south-west (commercial and industrial receptors, approximately R20 and R23,) and north-west (commercial and industrial receptors).
- Dust deposition rates were predicted to exceed the air quality goal of 120 mg/m^2/day outside the Clapham Yard boundary to the south-east (residential receptors, approximately R19, R21, R22 and R24) and along the western boundary of the site (commercial and industrial receptors and golf course, approximately R11, R13, R14, R17, R20 and R23).

- TSP annual average concentrations were predicted to be compliant with the air quality goal of 90 µg/m^3 within the Clapham Yard boundary.
- Annual average concentrations for PM_{10} were not considered in the EIS.

2.1.2 Moorooka Station Upgrade

The proposed Moorooka station upgrade described as part of RfPC-4 was not considered to be significant with regards to potential air quality impacts during construction given they are largely minor (e.g. demolition of station buildings, ramps, station furniture, new canopies, raised platforms, balustrades, signage, toilets etc.).

The station upgrade was deemed to have a low potential for construction phase air quality impacts and any impacts would be temporary and minor.

Although RfPC-4 confirmed no further air quality assessment was considered necessary for the proposed station upgrades, it was noted that the closest sensitive places located 130m to east would benefit from the mitigation measures detailed in the O-EMP.

2.2 Construction Impacts

2.2.1 Clapham Yard

2.2.1.1 Modelling Results

Predicted concentration and dust deposition levels at each of the modelled receptors for Scenarios 1 and 2 are presented in Table 11 and Table 12. The results presented are cumulative predictions and include the adopted background concentrations and deposition levels discussed in Section 1.1.3. The tabulated results can be compared directly against the air quality goals.

The air quality goals are required to be assessed against the maximum predicted result from dispersion modelling. However, as a full year of meteorological data has been used, results for other ranked predictions (e.g. second highest, third highest, etc) are also available from the modelling output. For 24 hour and monthly dust deposition predictions, results are presented for the four highest model predictions to provide an indication of the likelihood and magnitude of exceedances.

The modelling results with the inclusion of the targeted works specific mitigation measures are summarised as follows:

- PM_{10} 24 hour (health):
  - Scenario 1: No exceedances of the 24 hour goal of 50 µg/m^3 are predicted at any of the modelled receptors.
  - Scenario 2: Exceedance of the 24 hour goal of 50 µg/m^3 is predicted at receptors R7, R8, R14, R17, R20 and R23, which represent industrial and commercial receptors. No exceedances are predicted at residential receptors. Further discussion of these predicted exceedances is provided in Section 2.2.1.2.
- TSP 24 hour (nuisance):
  - Scenario 1: No exceedances of the 24 hour goal of 80 µg/m^3 are predicted at any of the modelled receptors.
  - Scenario 2: Exceedances of the 24 hour goal of 80 µg/m^3 are predicted at several modelled receptors, including at residential receptors. Further discussion of these predicted exceedances is provided in Section 2.2.1.2.
- Dust deposition (nuisance):
  - Scenario 1: Exceedance of the 120 mg/m^2/day goal is predicted at receptors R6 and R7, which represent industrial uses. Further discussion of these predicted exceedances is provided in Section 2.2.1.2.
  - Scenario 2: A single exceedance of the 120 mg/m^2/day goal is predicted at receptor R6, which represents an industrial receptor. The predicted deposition rate is 121 mg/m^2/day, which is 1 mg/m^2/day above the goal. Due to the margin of exceedance

and the land use of the receptor this result is not considered significant and is not considered further.

- PM_{10} annual average (health):
    - Scenarios 1 and 2: No exceedances of the annual average goal of 25 µg/m^3 are predicted at any of the modelled receptors.
- TSP annual average (health):
    - Scenarios 1 and 2: No exceedances of the annual average goal of 90 µg/m^3 are predicted at any of the modelled receptors.

In addition to the results presented in Table 11 and Table 12, contours for PM_{10} (24 hour), TSP (24 hour) and dust deposition for Scenario 1 and 2 are presented in Figure 5 to Figure 18. Due to the presence of the existing noise barrier adjacent to residential dwellings (R15 south towards R30, see Figure 3) to the south-east of Clapham Yard, and as modelling considered different source locations for Scenario 2, concentration and deposition contours are presented separately for different areas around Clapham Yard.

The concentration contours are cumulative and are predicted at ground level. The concentrations contours show that concentrations and deposition levels decrease significantly with distance from Clapham Yard.

Table 11 Predicted 24 hour PM_{10} and TSP cumulative concentration levels (µg/m³)

Receptor ID	PM10 24 hour (µg/m³)								TSP 24 hour (µg/m³)							
	Scenario 1 – Rank				Scenario 2 – Rank				Scenario 1 – Rank				Scenario 2 – Rank			
	Max	2nd Highest	3rd Highest	4th highest	Max	2nd Highest	3rd Highest	4th highest	Max	2nd Highest	3rd Highest	4th highest	Max	2nd Highest	3rd Highest	4th highest
Goal	50								80							
R1	22	22	22	22	25	25	24	24	35	35	34	34	47	47	42	42
R2	23	23	23	23	28	28	28	27	39	39	38	38	58	57	55	55
R3	23	23	23	23	30	28	27	27	39	38	38	38	61	60	57	57
R4	24	24	24	24	33	30	30	29	40	40	40	39	70	68	68	66
R5	26	26	26	26	36	36	35	35	47	47	47	46	**88**	**83**	**81**	80
R6	32	32	32	31	50	49	48	46	67	66	64	63	**145**	**134**	**131**	**127**
R7	32	31	31	30	**55**	**55**	48	47	65	63	62	60	**156**	**151**	**148**	**130**
R8	30	29	29	29	**54**	50	47	45	59	57	56	56	**147**	**128**	**121**	**117**
R9	28	27	27	27	42	40	39	39	52	49	49	49	**101**	**93**	**90**	**89**
R10	28	27	27	27	40	39	38	37	53	50	49	49	**88**	**86**	**84**	80
R11	25	25	25	25	43	36	33	33	44	43	43	43	**94**	73	72	65
R12	28	27	27	27	39	37	37	36	52	50	50	49	**91**	**90**	**83**	**82**
R13	27	27	26	26	47	46	45	42	48	48	48	48	**118**	**114**	**112**	**101**
R14	26	26	26	26	**51**	46	44	40	47	46	46	46	**121**	**120**	**116**	**109**
R15	30	30	29	29	42	40	40	40	58	58	56	55	**116**	**112**	**107**	**106**
R16	26	25	25	25	32	32	30	29	45	44	44	43	69	68	67	64
R17	27	26	26	26	**58**	46	45	42	47	47	46	46	**151**	**123**	**115**	**111**
R18	25	25	25	25	34	31	31	31	43	43	43	42	79	77	73	66
R19	28	28	28	27	44	43	41	38	52	52	50	49	**143**	**124**	**123**	**107**
R20	28	27	27	27	**66**	**55**	44	43	49	48	47	47	**201**	**155**	**131**	**125**

Receptor ID	PM_{10} 24 hour (µg/m^3)								TSP 24 hour (µg/m^3)							
	Scenario 1 – Rank				Scenario 2 – Rank				Scenario 1 – Rank				Scenario 2 – Rank			
	Max	2nd Highest	3rd Highest	4th highest	Max	2nd Highest	3rd Highest	4th highest	Max	2nd Highest	3rd Highest	4th highest	Max	2nd Highest	3rd Highest	4th highest
Goal	50								80							
R21	28	27	27	27	41	40	37	36	50	49	48	47	**123**	**116**	**108**	**97**
R22	27	27	27	27	37	34	34	34	48	48	46	46	**95**	**90**	**88**	**86**
R23	28	27	27	27	**57**	**52**	39	39	48	47	47	46	**179**	**154**	**113**	**108**
R24	28	28	27	27	34	34	34	33	49	48	47	46	**84**	**83**	79	77
R25	24	24	24	24	30	28	28	28	41	41	40	40	64	61	58	58
R26	27	27	27	27	34	0	32	31	47	46	45	44	**86**	75	71	71
R27	26	26	26	26	43	43	36	35	45	43	42	42	**119**	**115**	**90**	**86**
R28	26	26	26	26	34	31	31	30	45	43	43	43	**83**	67	65	65
R29	25	25	25	25	32	30	29	28	42	40	40	40	73	61	57	56
R30	24	24	24	24	30	28	27	27	39	38	38	38	65	56	51	50

Table note:
Results presented in **bold red** exceed the relevant air quality goal.

Table 12 Predicted cumulative dust deposition levels (mg/m²/day) and cumulative annual average PM_{10} and TSP concentration levels (µg/m³)

Receptor ID	Dust deposition (mg/m²/day)								PM_{10} annual average (µg/m³)		TSP annual average (µg/m³)	
	Scenario 1 – Rank				Scenario 2 – Rank							
	Max	2nd Highest	3rd Highest	4th highest	Max	2nd Highest	3rd Highest	4th highest	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Goal	120								25		90	
R1	43	43	43	43	43	43	42	42	17	18	30	31
R2	57	55	55	51	57	53	53	53	18	19	31	34
R3	51	50	49	48	52	52	50	50	18	18	31	34
R4	54	53	53	52	56	56	55	54	18	19	31	35
R5	89	86	84	76	80	74	72	71	19	20	34	38
R6	**157**	**149**	**145**	**143**	**121**	120	103	101	21	21	41	44
R7	**137**	**132**	**125**	117	109	106	104	93	21	22	39	44
R8	115	105	99	92	96	90	88	80	20	21	37	43
R9	89	79	75	70	76	70	69	65	19	20	34	38
R10	91	78	74	74	77	69	69	68	19	20	34	38
R11	82	77	70	67	79	72	67	66	18	20	33	38
R12	85	77	71	70	72	67	63	63	19	19	34	37
R13	97	91	83	80	92	84	77	76	19	21	34	41
R14	86	83	79	73	85	79	74	73	19	20	33	39
R15	103	95	86	85	81	80	80	68	19	20	35	38
R16	65	59	56	56	54	54	53	48	18	18	31	33
R17	81	78	76	71	80	78	76	73	18	20	33	39
R18	63	56	54	53	55	54	51	48	18	18	31	33
R19	83	75	69	66	76	72	68	63	18	19	32	36
R20	86	71	68	67	89	78	76	76	18	20	32	39

Receptor ID	Dust deposition ($mg/m^2/day$)								PM_{10} annual average ($\mu g/m^3$)		TSP annual average ($\mu g/m^3$)	
	Scenario 1 – Rank				Scenario 2 – Rank							
	Max	2nd Highest	3rd Highest	4th highest	Max	2nd Highest	3rd Highest	4th highest	Scenario 1	Scenario 2	Scenario 1	Scenario 2
Goal	**120**								**25**		**90**	
R21	75	69	64	62	72	67	61	61	18	19	32	35
R22	69	64	59	58	67	62	58	56	18	19	31	34
R23	75	63	60	56	85	68	64	62	18	19	31	36
R24	66	62	57	57	68	62	60	57	18	18	31	33
R25	56	51	50	48	52	51	47	47	18	18	30	32
R26	62	38	55	55	66	38	59	56	18	18	31	33
R27	65	56	56	52	74	61	59	58	18	19	31	34
R28	59	58	53	52	64	58	57	55	18	18	31	33
R29	55	55	51	50	59	56	54	52	18	18	30	32
R30	52	52	49	47	55	53	51	50	17	18	30	32

Table note:
Results presented in **bold red** exceed the relevant air quality goal.

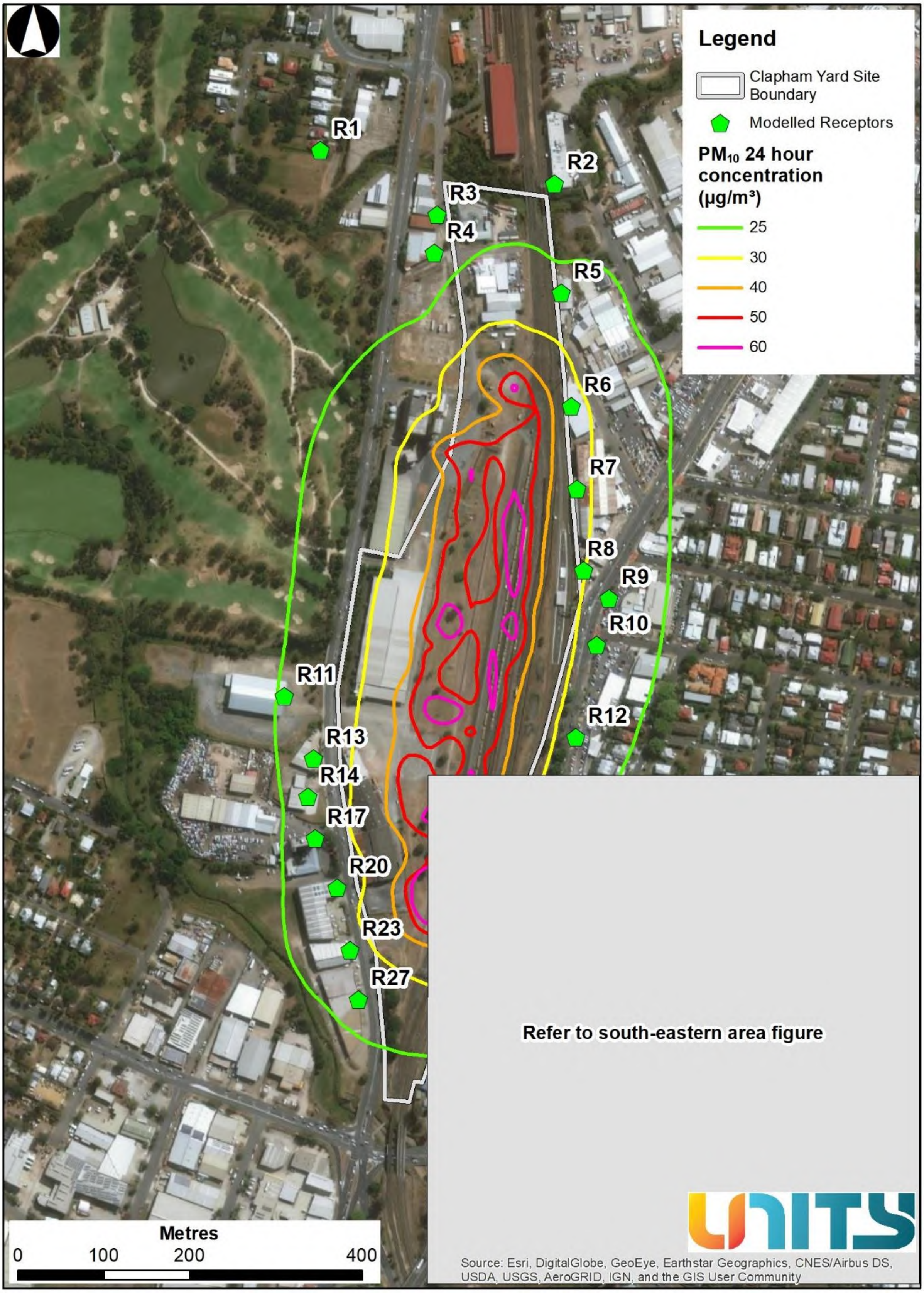


Figure 5 Predicted cumulative PM_{10} 24 hour concentration contours (µg/m³) for Scenario 1

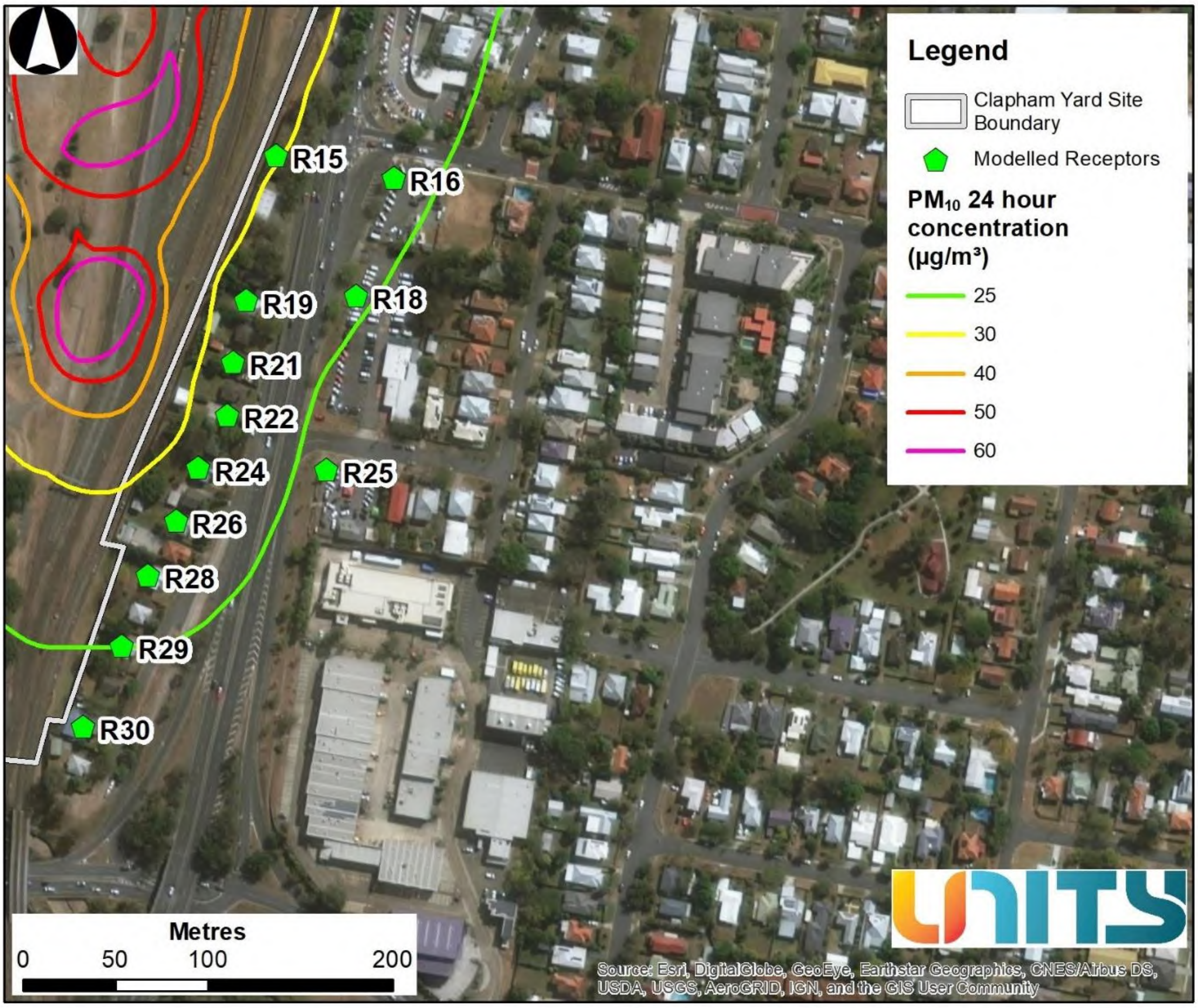


Figure 6 Predicted cumulative PM_{10} 24 hour concentration contours (µg/m3) for Scenario 1 (south-eastern area)

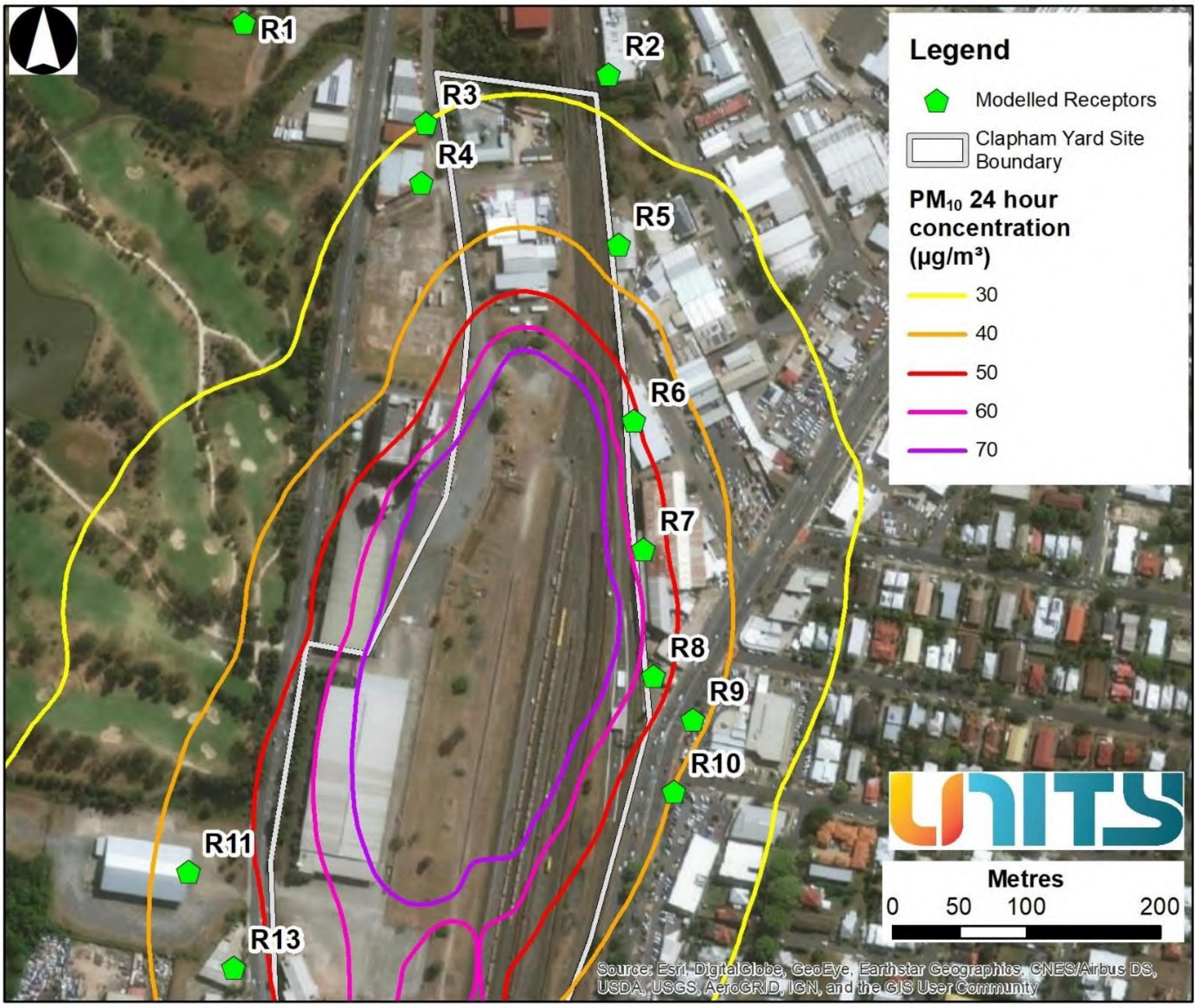


Figure 7 Predicted cumulative PM_{10} 24 hour concentration contours (µg/m3) for Scenario 2 (northern area)

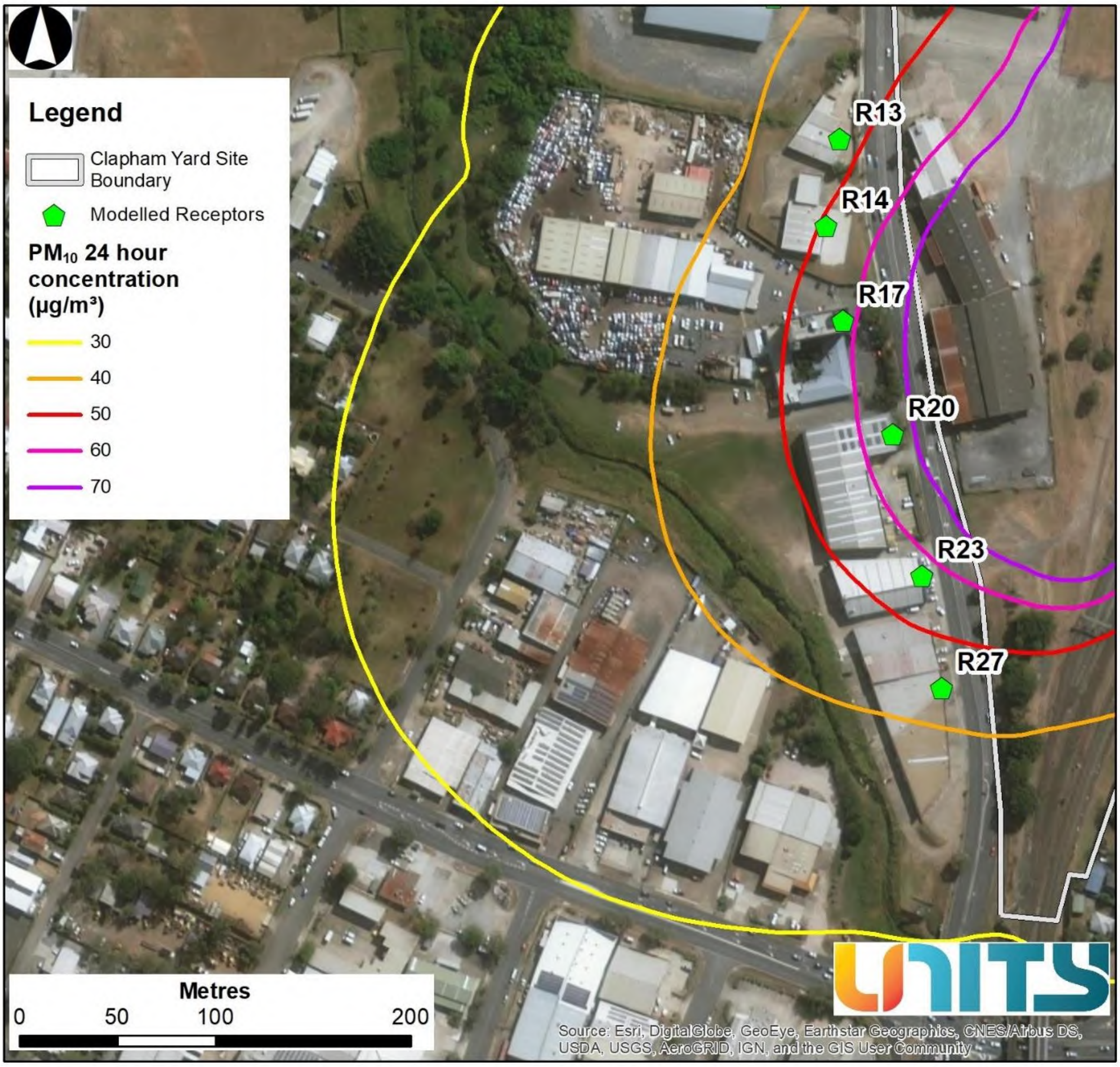


Figure 8 Predicted cumulative PM_{10} 24 hour concentration contours (µg/m3) for Scenario 2 (south-western area)

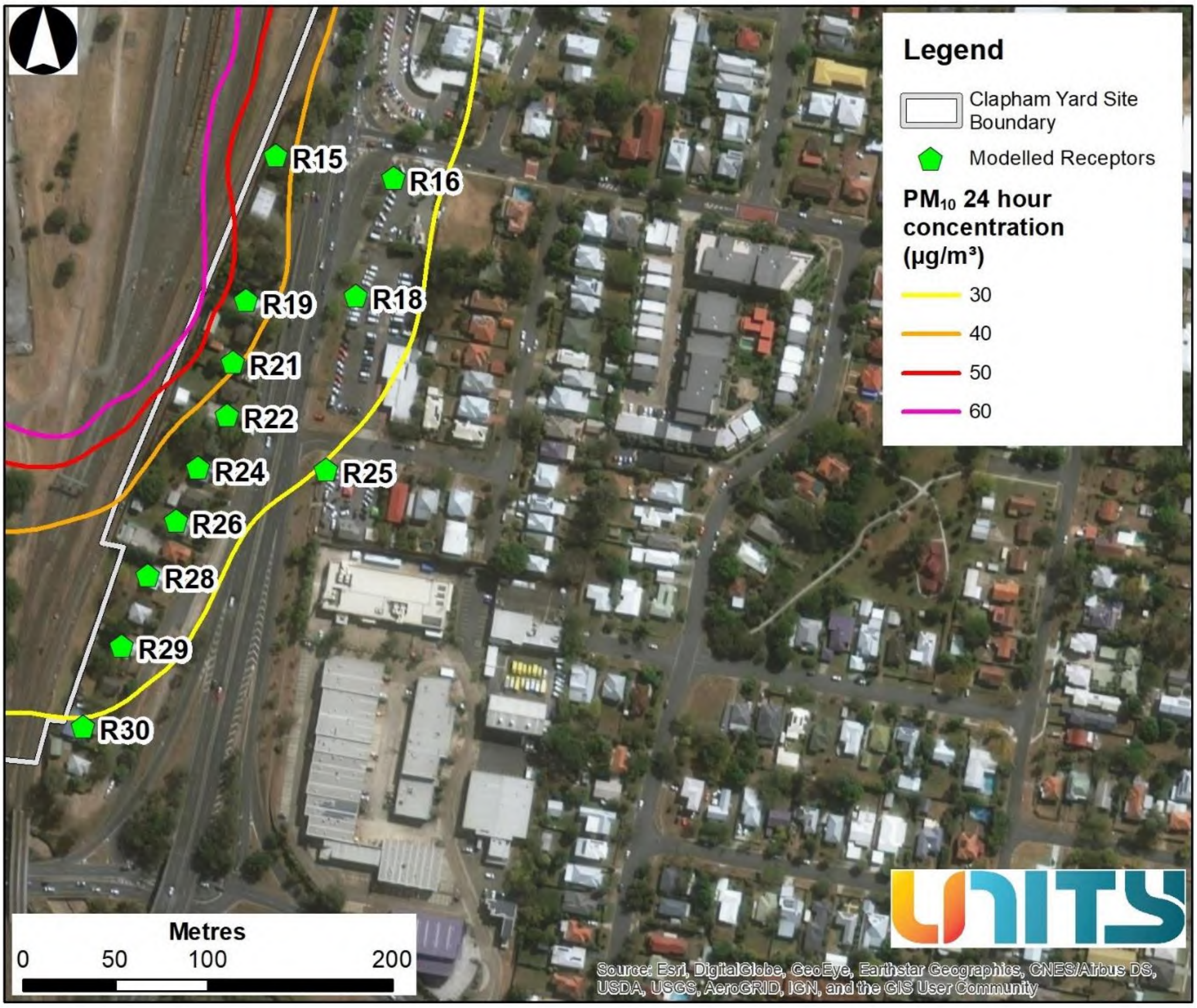


Figure 9 Predicted cumulative PM_{10} 24 hour concentration contours (µg/m³) for Scenario 2 (south-eastern area)

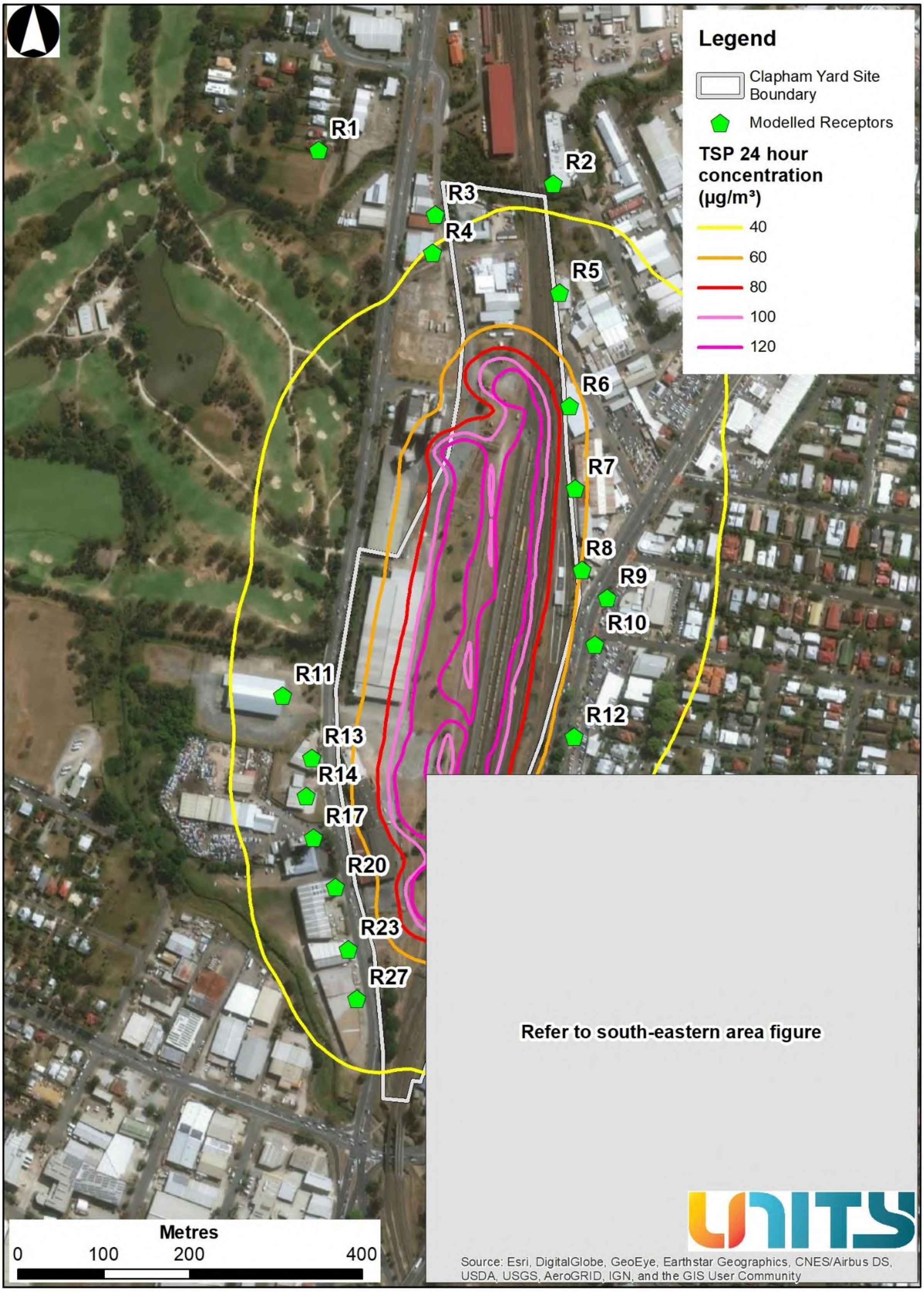


Figure 10 Predicted cumulative TSP 24 hour concentration contours (µg/m³) for Scenario 1

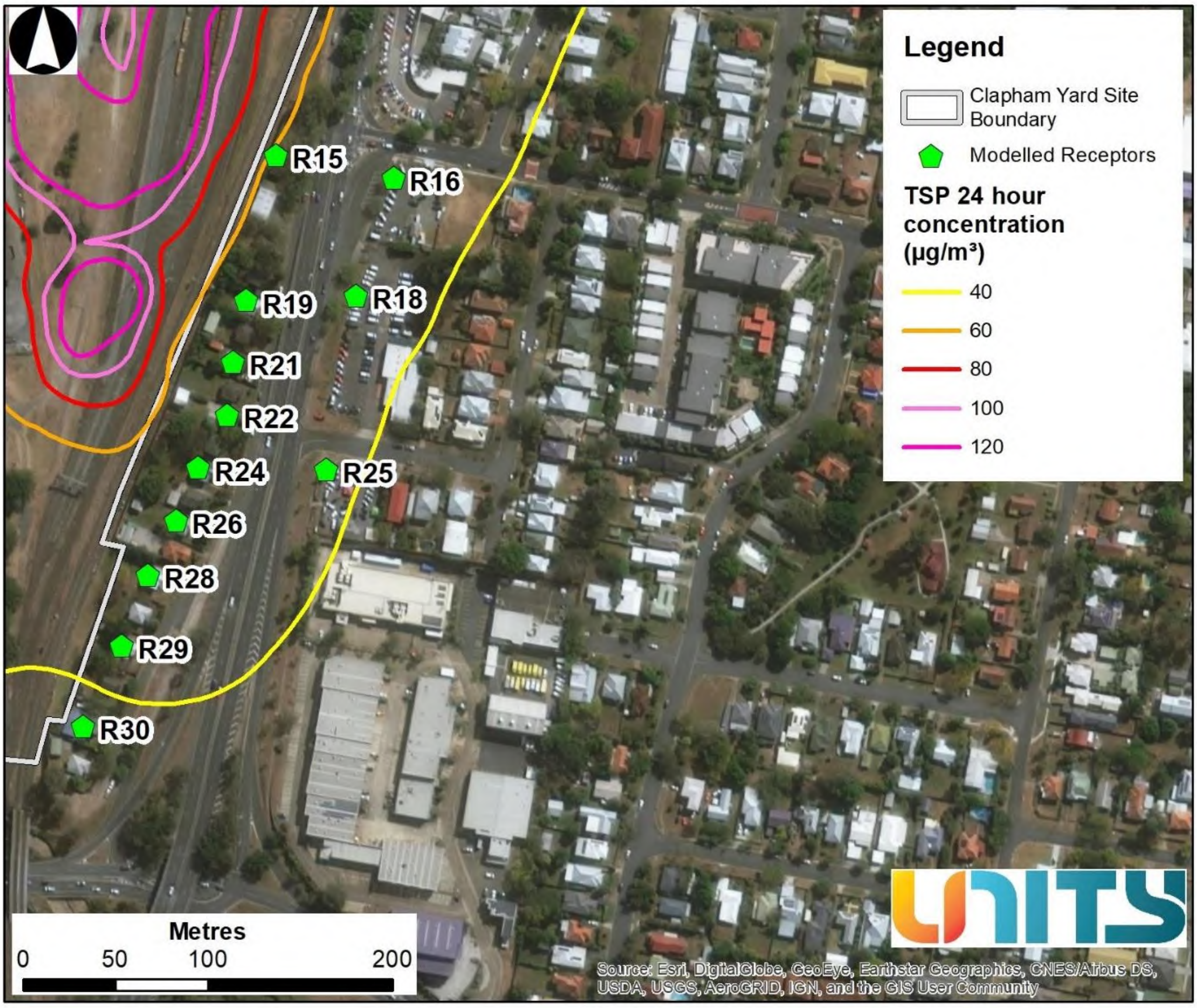


Figure 11 Predicted cumulative TSP 24 hour concentration contours (µg/m^3) for Scenario 1 (south-eastern area)

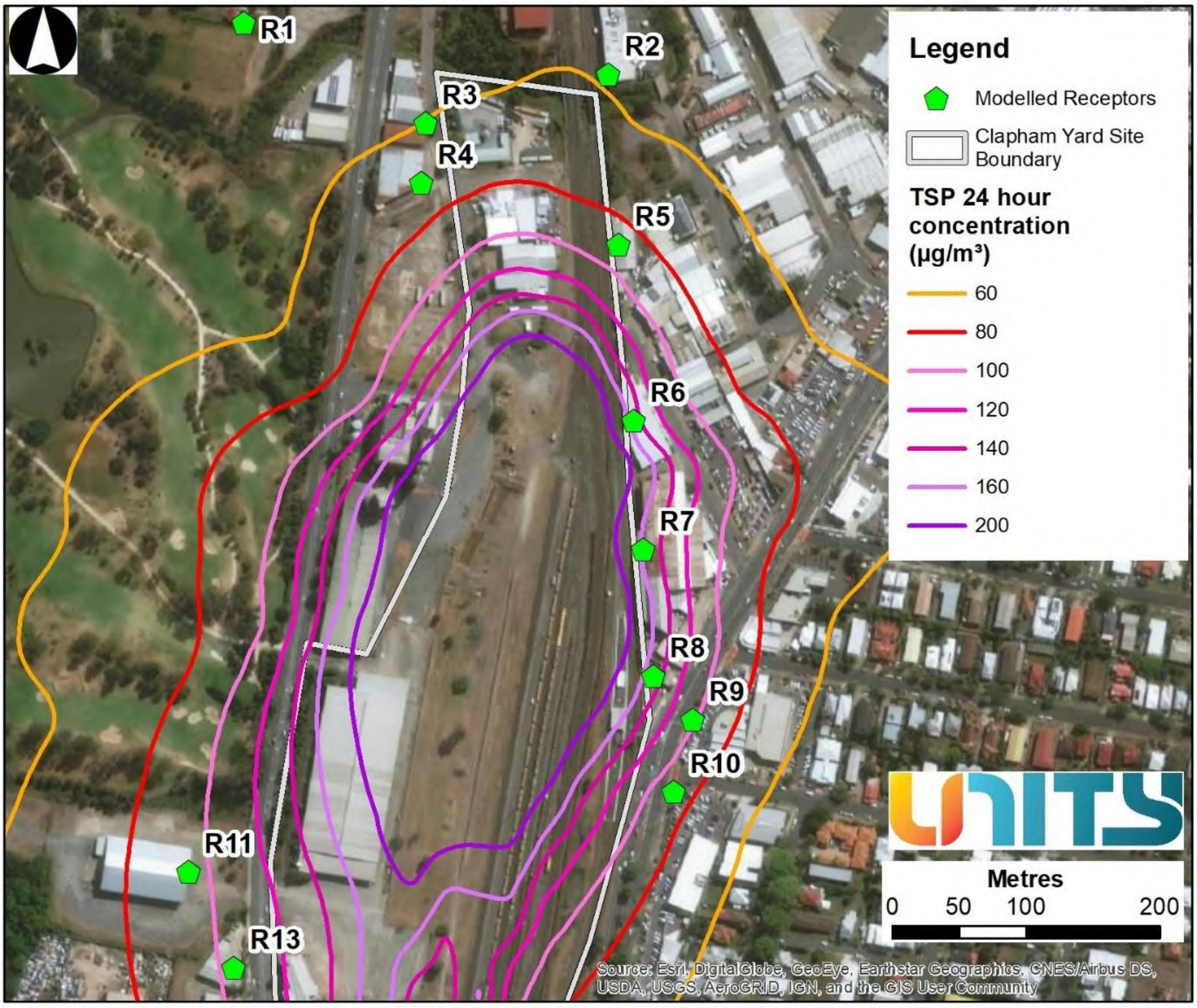


Figure 12 Predicted cumulative TSP 24 hour concentration contours (µg/m^3) for Scenario 2 (northern area)

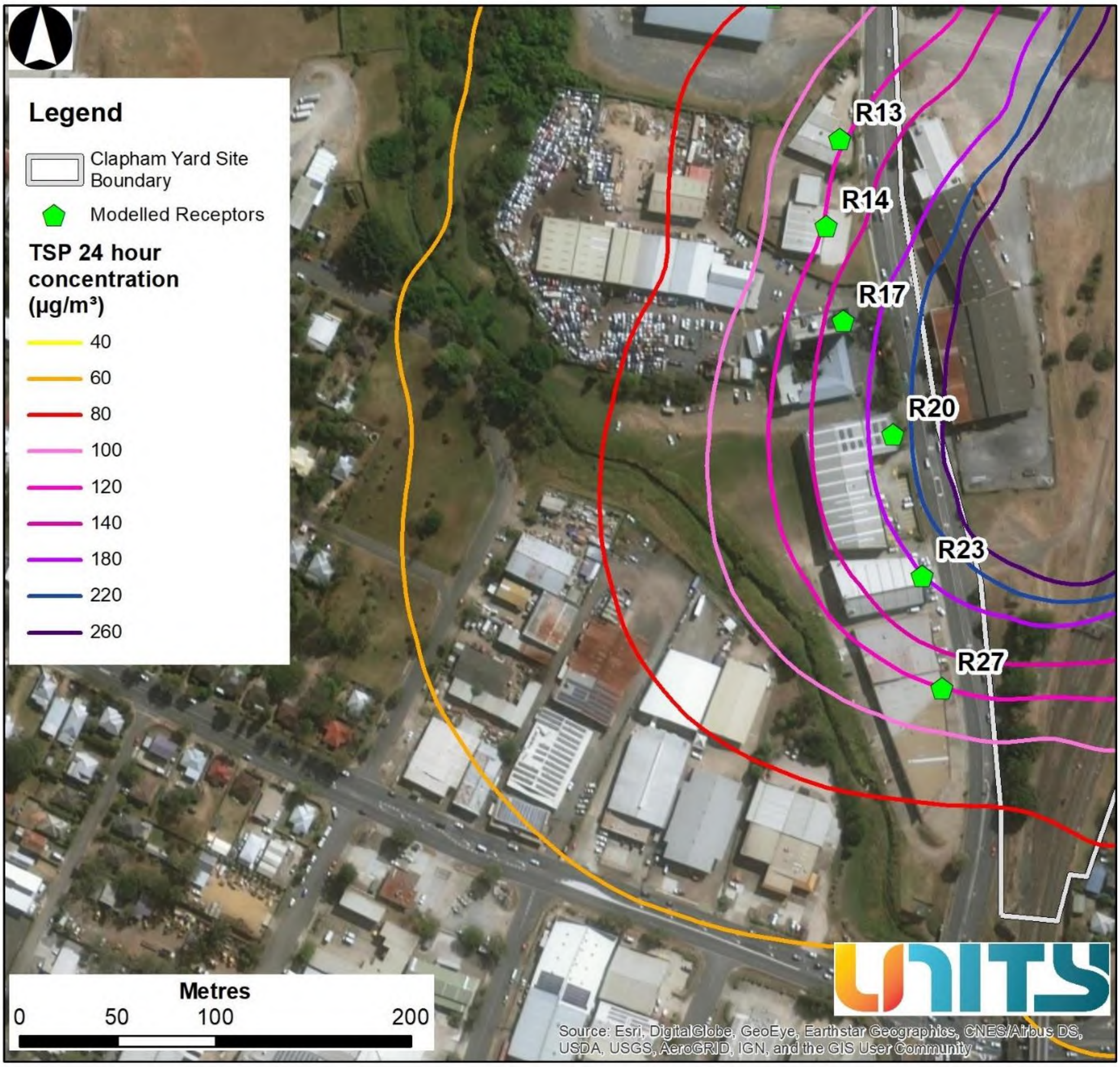


Figure 13 Predicted cumulative TSP 24 hour concentration contours (µg/m^3) for Scenario 2 (south-western area)

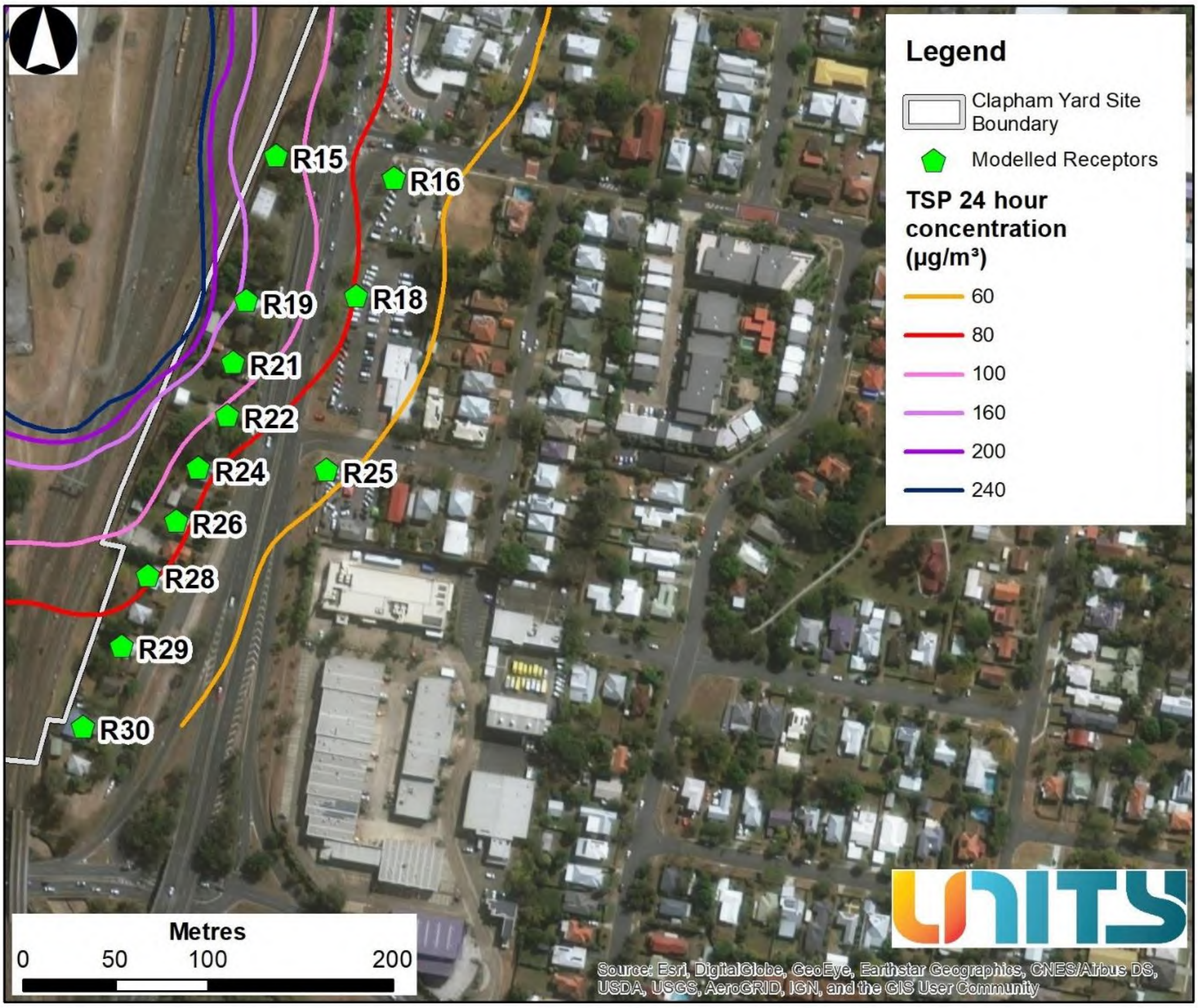


Figure 14 Predicted cumulative TSP 24 hour concentration contours (µg/m^3) for Scenario 2 (south-eastern area)

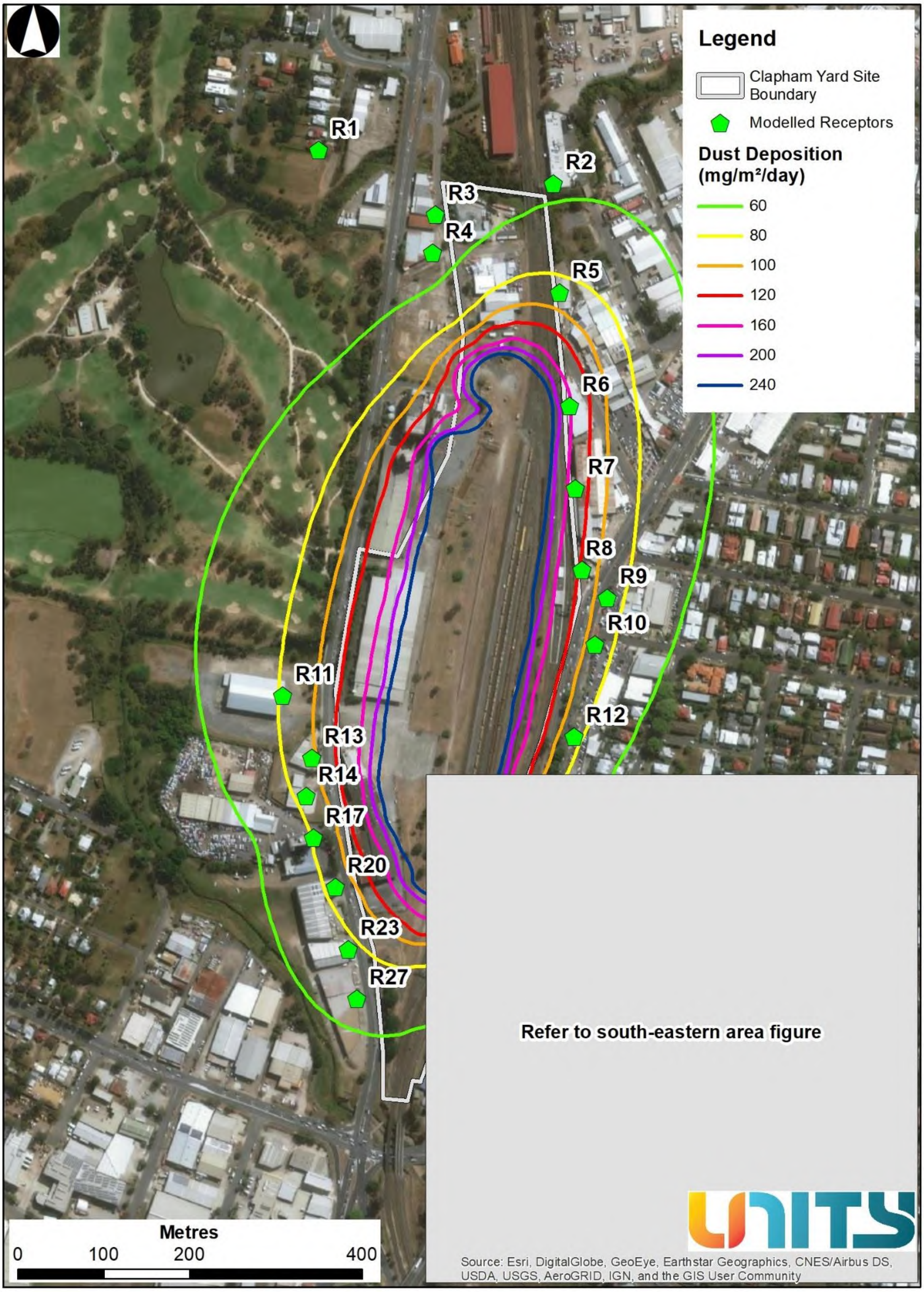


Figure 15 Predicted cumulative dust deposition contours (mg/m2/day) for Scenario 1

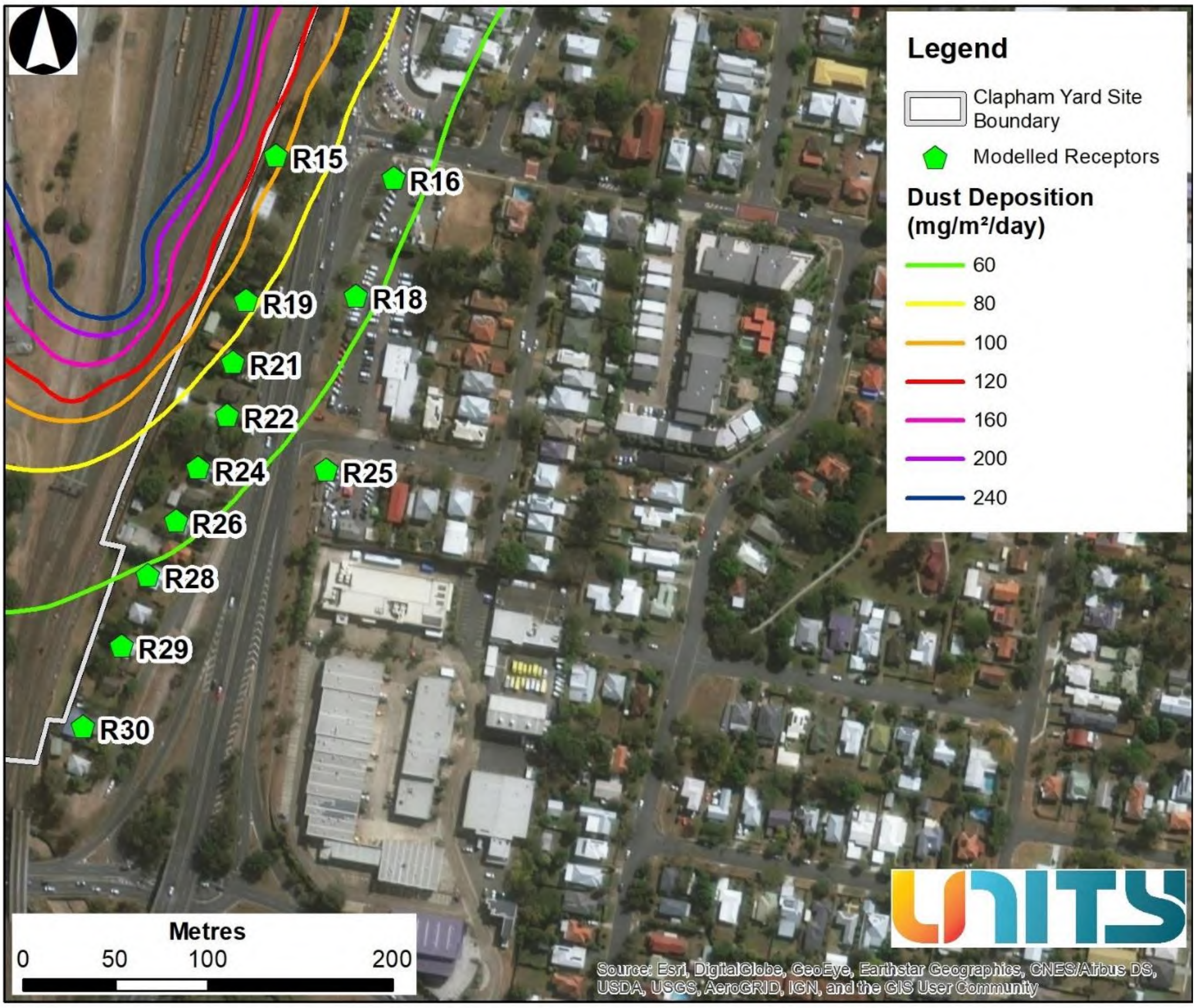


Figure 16 Predicted cumulative dust deposition contours (mg/m^2/day) for Scenario 1 (south-eastern area)

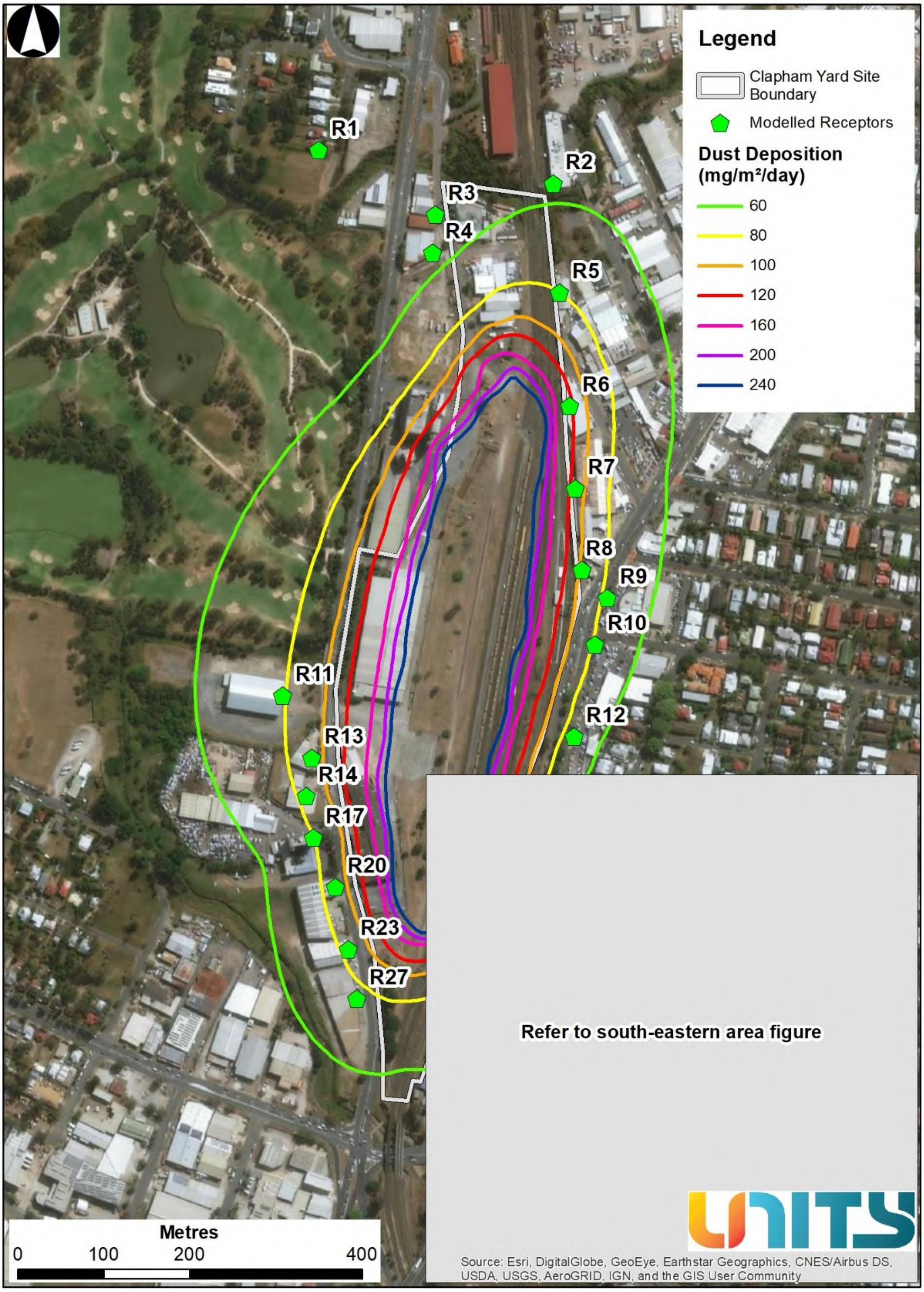


Figure 17 Predicted cumulative dust deposition contours (mg/m2/day) for Scenario 2

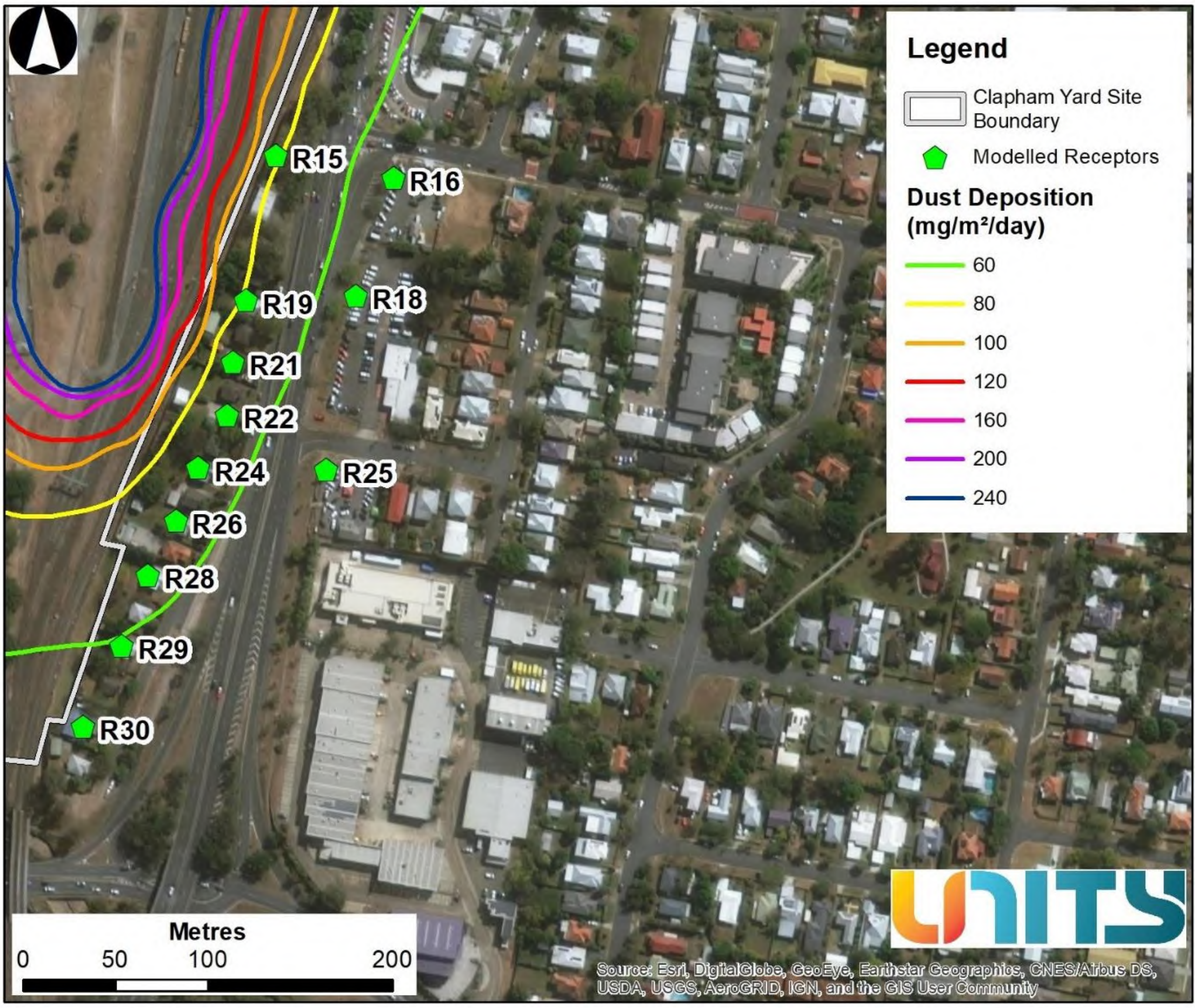


Figure 18 Predicted cumulative dust deposition contours (mg/m²/day) for Scenario 2 (south-eastern area)

2.2.1.2 Discussion of Air Quality Impacts

Health Impacts

The air quality goals which are set for the protection of human health (see Table 1) and are of primary concern are the PM_{10} 24 hour, PM_{10} annual average and TSP annual average goals. Exceedance of the PM_{10} 24 hour goal of 50 µg/m^3 is predicted for Scenario 2 at receptors R7, R8, R14, R17, R20 and R23, which represent industrial and commercial receptors. No exceedances are predicted at residential receptors.

As noted in Section 2.1, the dispersion modelling for the EIS predicted exceedances of the PM_{10} 24 hour goal of 50 µg/m^3 outside the Clapham Yard boundary.

As discussed in Section 1.2.3, it is noted that although the definition of a sensitive place includes workplaces (e.g. commercial and industrial uses), the shortest averaging period for the air quality goals is 24 hours.

None of the commercial or industrial uses represented by receptors R7, R8, R14, R17, R20 and R23 (where exceedances are predicted) are expected to include accommodation and therefore the exposure of occupants within these buildings is expected to be shorter than 24 hours. It is also noted that at the receptors where exceedances are predicted, a maximum of two exceedances (two days) were predicted over the entire year of meteorological data used in modelling. Import and placement of fill material (Scenario 2) is anticipated to require 24 weeks to complete, and therefore the likelihood of the predicted PM_{10} 24 hour exceedances occurring is further reduced.

For these reasons, the risk of significant air quality impacts to health to occupants of the commercial or industrial uses near Clapham Yard as a result of PM_{10} 24 hour concentrations is considered to be low and no further mitigation is required.

Predicted annual average PM_{10} and TSP concentrations at all sensitive places are compliant with the annual average air quality goals for both pollutant species (25 µg/m^3 for PM_{10} and 90 µg/m^3 for TSP) for both modelled scenarios.

Nuisance Impacts

The TSP 24 hour and dust deposition air quality goals are set to prevent nuisance rather than health impacts and are therefore considered to have less potential to generate significant impacts.

The dust deposition goal of 120 mg/m^2/day is predicted to be exceeded for Scenario 1 at receptors R6 and R7, which represent industrial receptors located on the eastern boundary of Clapham Yard.

As noted in Section 2.1, the dispersion modelling for the EIS predicted exceedances of the dust deposition goal of 120 mg/m^2/day outside the Clapham Yard boundary to the south-east (residential receptors, approximately R19, R21, R22 and R24, see Figure 8.3) and along the western boundary of the site (commercial and industrial receptors and golf course, approximately R11, R13, R14, R17, R20 and R23, see Figure 8.3). Although the location of the exceedances is different for the revised Clapham Yard layout, the predicted dust deposition impact is comparable with respect to impacts to non-residential uses.

Exceedances of the TSP 24 hour goal of 80 µg/m^3 are predicted at several receptors, including commercial and industrial uses in addition to residential dwellings located to the south-east of the Clapham Yard on Ipswich Road. Predicted TSP 24 hour concentrations are significantly above the air quality goal at modelled receptors, with the worst affected receptors being the commercial and industrial uses located on Fairfield Road (R20 and R23 for example), the industrial uses on Ipswich Road and Unwin Street (R7 and R8 for example) and the residential receptors on Ipswich Road.

Dispersion modelling for the Evaluated Project did predict exceedances of the TSP 24 hour goal outside the Clapham Yard boundary. However, the predicted margin of exceedance of the TSP 24 hour nuisance air quality goal for the revised Clapham Yard is significantly higher than in the EIS, and this represents a change to air quality impacts.

Earthworks of similar methodology and intensity have been occurring at Mayne Yard during 2020. Separation distances between Mayne Yard construction activities and sensitive places are similar to

Clapham Yard separation distances. At Mayne Yard the contractor has implemented all reasonable and practicable mitigation measures described in the AQMP to limit exceedances at these locations and the ambient air quality monitors recorded no project-attributed PM_{10}, TSP or deposited dust exceedances throughout the duration of the monitoring period (February 2020 to current). For the works at Clapham Yard and Moorooka station it is intended that all reasonable and practicable mitigation measures described in the AQMP will also be implemented to limit exceedances at sensitive places. A brief summary of the results of the monitoring undertaken at Mayne Yard during this monitoring period is provided below in Table 13, and reports of the monitoring data can be found online on the Cross River Rail website (https://crossriverrail.qld.gov.au/planning-environment/environment-approvals/environmental-reporting)

Table 13 Summary of Mayne Yard monitoring results- 2020

	PM_{10} (UNI324) Eastern Air Shed		TSP (UNI324) Eastern Air Shed		Dust Dep (AQ-04) E MAYNE		Dust Dep (AQ-05) W MAYNE	
Goal	**50 µg/m^3**		**80 µg/m^3**		**120 mg/m2/day**			
	Exceedances	Max	Exceedances	Max	Exceedances	Max	Exceedances	Max
January	Instruments not yet installed							
February								
March	Instruments not yet installed				0	40	0	Invalid
April					0	53	0	73
May	0	9	0	17.5	0	77	0	33
June	0	8	0	14	0	30	Instrument decommissioned	
July	0	7	0	13	0	13		
August	1	56	1	97	0	27		
September	0	13	0	21	0	33		
October	0	12	0	20.5	0	23		
November	0	35	0	70	0	103		
December	0	21	0	35	0	73		
	No further data from dataset							
Table Note: August saw an exceedance of the air quality goals; however, this was due to regional exceedance, and not attributed to project. More detail can be found https://crossriverrail.qld.gov.au/planning-environment/environment-approvals/environmental-reporting/								

Discussion and Recommendations

Based on the emission inventory developed for the assessment it is evident that the dominant source of TSP emissions for Scenario 2 are bulldozers. In addition to the uncertainty which is inherent in dispersion modelling (see Section 1.2.8), emission factors for bulldozer activity have enhanced uncertainty as emissions are directly related to the operation of the bulldozer, including the volume of material being moved and type of work being undertaken. The emission factor for bulldozer activity for the assessment has been adopted from the NPI Mining Manual for bulldozers on overburden.

During peak material movement periods, the emission factor for bulldozers working on overburden is expected to be accurate for Clapham Yard. However, over an entire construction shift the use of this emission factor is expected to over-estimate emissions from bulldozer activity, as the total volume of material moved at Clapham Yard over a bulldozer shift would be expected to be lower than the 100% utilisation assumption within the NPI Mining Manual. The NPI Mining Manual emission factor for bulldozer activity has been used in the absence of more appropriate emission estimation data. As the use of this emission factor is expected to over-estimate emissions, it is considered to provide a conservative assessment of potential air quality impacts.

It is noted that the predicted change to air quality impacts as a result of the revised Clapham Yard layout relates to nuisance dust rather than health impacts. The receptors which are considered to have the highest sensitivity to nuisance dust are the residential receptors to the south-west of Clapham Yard on Ipswich Road, and to a lesser extent, car yards also located on Ipswich Road.

Due to the uncertainty in the model predictions, and that the predicted change to air quality impacts relates to nuisance dust rather than health impacts, it is considered acceptable for construction of Clapham Yard to occur on the provision that construction work is supported by on-site air quality monitoring to assist in the mitigation of dust nuisance impacts.

To support the mitigation of construction dust emissions and to assist in reducing potential impacts to residential receptors, it is recommended that air quality monitoring targeting dust deposition and airborne concentrations of TSP and PM_{10} is undertaken at a location representative of the residential receptors on Ipswich Road.

Air quality monitoring of PM_{10} and TSP will allow for alerts to be sent to construction staff in the event that elevated concentrations are measured at the monitoring location and will allow for a trigger-action-response approach to dust emissions, which is considered to be the best available approach for monitoring and mitigating construction dust air quality impacts. Monitoring of PM_{10} and TSP using an optical particle counting device (e.g. light scattering method) is generally considered suitable for construction projects and is considered appropriate in this instance.

Where quantitative air quality monitoring (e.g. using optical device) indicates an exceedance of the air quality goals, the following additional mitigation measures may be implemented:

- visual inspections to confirm source of dust emission,
- increasing the frequency of watering, and
- targeted watering and/or application of chemical suppressants (e.g. polymer binding agent).

In addition to air quality monitoring, monitoring of forecast and current meteorological conditions is recommended to provide an early warning system for adverse conditions. With respect to impacts to the residential receptors to the south-east of Clapham Yard, north-westerly winds blowing from Clapham Yard towards the receptors will be the adverse weather condition of concern. Based on the wind rose for Clapham Yard presented in Figure 2, north-westerly winds are relatively infrequent.

It is noted that the exact location of the monitoring station will be subject to access restrictions. It is recommended that the air quality monitoring location is included in the Site Environment Plan (SEP) for Clapham Yard.

The Construction Environmental Monitoring Program (Attachment 4 of the C-EMP) allows for air quality monitoring to be conducted to demonstrate compliance with the CRR Project's air quality goals. The Construction Environmental Monitoring Program includes allowance for monitoring at high risk sites, including Clapham Yard.

2.2.2 Moorooka Station upgrade

2.2.2.1 Modelling Results

A summary of the modelling results Moorooka Station is presented in. Table 14 presents the predicted result at the worst affected receptor (maximum predicted concentration or deposition level), and the worst affected receptor for each pollutant species and averaging period. It also presents the air quality goals for each pollutant. The results presented are cumulative predictions and include the adopted background concentration and deposition levels.

Table 14 Summary of modelling results for Moorooka station

Station	Pollutant and averaging period	Air quality goal ($\mu g/m^3$ unless stated)	Result at worst affected receptor ($\mu g/m^3$ unless stated)	Worst affected receptor ID
Moorooka	PM_{10} 24 hour (health)	50	31	5
	TSP 24 hour (nuisance)	80	60	5
	Dust deposition (nuisance)	120 mg/m^2/day	107 mg/m^2/day	5
	PM_{10} annual (health)	25	21	5
	TSP annual (health)	90	39	5

Predicted concentration and dust deposition levels at each of the modelled receptors are presented in Table 15 to Table 16. The results presented are cumulative predictions and include the adopted background concentration and deposition levels. The model results can therefore be compared directly against the air quality goals.

The modelling results are summarised as follows:

- PM_{10} 24 hour (health): No exceedances of the 24 hour goal of 50 $\mu g/m^3$ are predicted at any of the modelled receptors.
- TSP 24 hour (nuisance): No exceedances of the 24 hour goal of 80 $\mu g/m^3$ are predicted at any of the modelled receptors.
- Dust deposition (nuisance): No exceedances of the 30 day average 120 mg/m^2/day goal are predicted at any of the modelled receptors.
- PM_{10} annual average (health): No exceedances of the annual average goal of 25 $\mu g/m^3$ are predicted at any of the modelled receptors.
- TSP annual average (health): No exceedances of the annual average goal of 25 $\mu g/m^3$ are predicted at any of the modelled receptors.

In addition to the tabulated results, concentration contours for PM_{10} (24 hour), TSP (24 hour) and dust deposition are presented in Figure 19 to Figure 21. The concentration contours are cumulative and are predicted at ground level. The concentrations contours show that concentrations and deposition levels decrease with distance from the construction works area.

Table 15 Predicted 24 hour PM_{10} and TSP cumulative concentration levels (µg/m^3) for Moorooka Station

Receptor ID	PM10 24 hour (µg/m^3)				TSP 24 hour (µg/m^3)			
	Max	2nd Highest	3rd Highest	4th Highest	Max	2nd Highest	3rd Highest	4th highest
Goal	50				80			
R1	24	24	24	23	38	38	38	37
R2	26	26	26	26	44	43	43	43
R3	28	27	27	26	49	46	46	46
R4	29	28	28	28	53	52	50	49
R5	31	31	30	30	60	58	57	57
R6	23	23	23	23	36	36	36	36
R7	22	22	22	22	35	35	35	35
R8	22	22	22	22	35	34	34	34
R9	22	22	22	22	35	34	34	34
R10	22	22	22	22	35	34	34	34
R11	22	22	22	22	35	34	34	33
R12	22	21	21	21	33	33	33	33
R13	21	21	21	21	33	32	32	32
R14	21	21	21	21	32	32	32	32
R15	21	21	21	21	33	33	33	33
R16	22	21	21	21	33	33	33	33
R17	21	21	21	21	33	33	33	33
R18	23	22	22	22	37	36	35	35
R19	22	22	21	21	34	34	33	33
R20	23	22	22	22	35	35	34	34
R21	22	22	21	21	33	33	32	32
R22	22	21	21	21	34	33	33	32
R23	22	21	21	21	33	32	32	32
R24	21	21	21	21	33	32	32	32
R25	21	21	21	21	33	32	32	32
R26	21	21	21	21	33	32	32	32
R27	21	21	21	21	33	32	32	32
R28	21	21	21	21	33	32	32	32
R29	21	21	21	21	33	32	32	32
R30	21	21	21	21	32	32	32	32
R31	21	21	21	21	32	32	32	32
R32	21	21	21	21	32	32	32	32
R33	21	21	21	21	32	32	32	32
R34	21	21	21	21	32	32	32	32
R35	21	21	21	21	32	32	32	32

Table 16 Predicted cumulative dust deposition levels (mg/m²/day) and cumulative annual average PM_{10} and TSP concentration levels (µg/m³) for Moorooka Station

Receptor ID	Dust deposition (mg/m²/day)				PM_{10} annual average (µg/m³)	TSP annual average (µg/m³)
	Max	2nd Highest	3rd Highest	4th Highest		
Goal	**120**				**25**	**90**
R1	51	50	50	46	18	31
R2	68	65	65	59	19	33
R3	77	76	75	71	19	34
R4	86	85	83	78	20	35
R5	107	106	103	96	21	39
R6	44	43	42	42	17	30
R7	44	44	44	43	18	30
R8	43	42	42	41	18	30
R9	41	41	41	40	17	30
R10	41	41	40	40	17	30
R11	41	40	40	40	17	30
R12	40	39	39	39	17	30
R13	39	39	39	39	17	29
R14	39	39	39	39	17	29
R15	39	39	39	39	17	29
R16	40	40	39	39	17	30
R17	40	40	40	39	17	30
R18	44	42	42	41	17	30
R19	40	40	40	39	17	29
R20	42	41	41	40	17	30
R21	39	39	39	39	17	29
R22	40	40	39	39	17	29
R23	40	39	39	39	17	29
R24	39	39	39	39	17	29
R25	39	39	39	39	17	29
R26	39	39	39	39	17	29
R27	39	39	39	39	17	29
R28	39	39	39	39	17	29
R29	39	39	39	38	17	29
R30	39	39	38	38	17	29
R31	39	39	38	38	17	29
R32	39	38	38	38	17	29
R33	39	38	38	38	17	29
R34	38	38	38	38	17	29
R35	38	38	38	38	17	29

Figure 19 Predicted cumulative PM_{10} 24 hour concentration contours (µg/m³) for Moorooka Station

Figure 20 Predicted cumulative TSP 24 hour concentration contours (µg/m^3) for Moorooka Station

Figure 21 Predicted cumulative dust deposition contours (mg/m^2/day) for Moorooka Station

2.2.2.2 Discussion of Air Quality Impacts for Moorooka Station

No exceedances of the air quality goals have been predicted at modelled receptors for the Moorooka Station upgrade.

Overall, no significant air quality impacts are anticipated due to the proposed construction schedule for Moorooka Station.

2.3 Operational Impacts

In their entirety, the EIS and the assessments undertaken for subsequent project changes considered operational air quality impacts from the following sources:

- Motor vehicles
- Freight and passenger trains
- Surface station upgrades
- Tunnel and station ventilation.

Based on the results of the operational air quality assessments undertaken for the Project to date which are applicable to Clapham Yard, the following operational air quality impacts are expected as a result of the Project:

- Minor beneficial residual effects on air quality over the medium term through reductions in motor vehicle use (in comparison to the Project not proceeding).
- The contribution of emissions from operational trains would be insignificant and unlikely to be measurable. Potential coal dust emissions from coal trains would be managed by the rail operator (the QRN now Aurizon) through their Coal Dust Management Plan.
- During operations in-tunnel air emissions and heat will be discharged to the atmosphere via station ventilation systems and through the northern and southern portals. To reduce the risk of emissions impacting on sensitive places at these locations, the environmental design requirements are required to be applied to the design of tunnel and station ventilation systems. The RIS component of the Project does not include tunnel and station ventilation systems, therefore this outcome is not a design consideration for the RIS component of the Project.

The EIS and the assessments undertaken for subsequent project changes identified that operational air quality impacts complied with the operational air quality objectives set out in air quality EDR 2b). As the proposed change will not increase the capacity of Clapham Yard, no further design considerations are required for the Project.

3. Changes to Mitigation Measures

3.1 Mitigation Measures

The air quality management measures described in the AQMP include all reasonable and practicable mitigation measures required to achieve the air quality goals are relevant and should be implemented across the CRR Project, including for the Proposed Changes.

The mitigation measures shown in Table 9 are proposed for Clapham Yard based on the current construction scale, duration and intensity.

Once further detailed planning has occurred, consistent with the processes nominated in the AQMP, a refined dispersion model will be completed to ascertain whether the additional mitigation measures recommended for Clapham Yard are still appropriate.

The mitigation measures in Table 9 for Moorooka Station (Scenario 3) are the standard mitigation measures from the AQMP and therefore no additional mitigation measures are required for Moorooka Station.

It is recommended that the relevant technical information for the early phase fill import be summarised in a separate technical report consistent with the processes detailed in the AQMP and provided to the Environmental Monitor to support the endorsement of updates to the C-EMP for the inclusion of additional relevant Project Works as per Imposed Condition 4(g)(i).

3.2 Proposed Changes to the EMF

The Project Works relevant to Clapham Yard operate under the endorsed CEMP.

The C-EMP endorsement is subject to necessary predictive assessments to satisfy Imposed Condition 4c(ii) having been completed prior to the Project Works commencing. For Air Quality, the extent of predictive assessments and associated nominated mitigation measures are subject to the requirements of the AQMP.

Recommended mitigation measures for changed impacts to air quality are generally similar to the Evaluated Project requirements as documented in the Project OEMP. As such, the OEMP and C-EMP are not required to be updated by cause of the change in impacts.

Furthermore, no required changes to the CRR Project Imposed Conditions have been identified with respect to the air quality impacts identified for the Proposed Changes.

4. Conclusion

There are no changed impacts which with respect to the operation of Clapham Yard and Moorooka Station and the upgrade of Moorooka Station.

Changes to construction impacts resulting from changes to Clapham Yard have been investigated via dispersion modelling of construction activity based on information provided by the CRR construction team. Dispersion modelling, considering the influence of mitigation measures, predicted exceedances of the CRR Project's air quality goals outside the Clapham Yard boundary at the location of sensitive places. These predicted exceedances were generally considered comparable with previous predicted impacts for Clapham Yard as determined for the EIS, with the exception of TSP 24-hour concentrations.

To support the mitigation of construction dust emissions and to assist in reducing potential impacts to residential receptors, air quality monitoring targeting dust deposition and airborne concentrations of TSP and PM_{10} is recommended at a location representative of the residential receptors on Ipswich Road, which are considered to be the receptors with the highest sensitivity to nuisance dust.

The predicted impacts do not warrant an amendment of the O-EMP, C-EMP and Imposed Conditions.

Cross River Rail Environmental Impact Statement

Request for Project Change 11

Changes to the Project and changes to the imposed conditions

Volume 3 Technical Reports

Attachment E Soils

Date: ***April 2021***

Author: ***Cross River Rail Delivery Authority***

CROSSRIVERRAIL

Queensland Government

Table of Contents

1. Assessment Methodology

The purpose of this technical assessment is to assess the effect of the Changed Project compared to Evaluated Project.

An increase in ground disturbance may lead to soil erosion, as well as uncovering Acid Sulfate Soils (ASS) (including both Potential Acid Sulfate Soils [PASS], Actual Acid Sulfate Soils [AASS]) or contaminated soils.

When this disturbance is not appropriately managed it may result in short to medium term impacts to the receiving environment during construction.

This assessment takes as its basis the current Evaluated Project and assessed the effect of impacts so soils and erosion that are different to those identified for the Evaluated Project.

1.1 Construction Phase Assessment Methodology

Assessment of changes that may lead to soil erosion, further disturbance (and potential incorrect management) of PASS/AASS and/or contaminated land impacts from the Proposed Changes was informed by searches and technical assessments completed as part of the delivery of the Project and included:

- Reviewing the:
    - Proposed Changes against the approved project scope as described in the 2011 Environmental Impact Statement (EIS) and the Evaluated Project as described in RfPC-4 with a specific focus on contaminated land, acid sulfate soils and erosion risk;
    - Existing environmental setting, specifically regarding contaminated land, acid sulfate soils, and erosion risk, based on available desktop information including:
        - *The 2011 EIS;*
        - *Previous contaminated land and acid sulfate soil (CLASS) assessments completed for the Evaluated Project; and*
        - *Environmental Management Register (EMR) and Contaminated Land Register (CLR).*
    - Additional groundtruthed data associated with contaminated land and acid sulfate soil (CLASS) investigation.
    - The current management processes as detailed in the Construction Environmental Management Plan, its subplans and subordinate management protocols developed to date
- Identifying the implications of the Proposed Changes against the Evaluated Project and assessing the potential impacts of:
    - Disturbance of contaminated land;
    - Disturbance of PASS or AASS; and
    - Increased soil erosion
- Identifying new or changed mitigation measures to address the identified impacts of the Proposed Changes.

1.2 Operational Phase Assessment Methodology

To assess potential operational phase impacts information reviewed as part of the construction phase assessment methodology has been supplemented by

- A review of the design technical requirements with regards to final landform stabilisation requirements; and
- A review of available geotechnical technical reports.

2. Changes to Potential Impacts

Changes to potential impacts with respect to soils, geology and contaminated land are anticipated for change elements where additional ground disturbance may be required. Generally, the changes are minor in nature and associated with the management of disturbance of contaminated and/or acid sulfate soils during construction. Further details are provided in the following sections.

2.1 Evaluated Project Context

In order to achieve appropriate flood mitigation for Clapham Yard, the Proposed Changes include the requirement for the bulk import of fill. With exception of the bridge works, intrusive maintenance or construction works associated with the features below are assumed to be limited to depths less of less than two metres below ground surface (mbgs).

Not all of the major components of the Change Request are a change from the Evaluated Project, however for the purposes of the soil assessment, the impacts from the Clapham Yard activities, including elements that are already part of the Evaluated Project, have been included to take account of changed programming, staging and construction methodology.

Soil disturbance associated with the Proposed Changes for Clapham Yard will comprise:

- Import of approximately 240,000 m^3 of fill material;
- Construction of a new Chale Street bridge and access road. Earthworks to comprise piling to depths of approximately 19 mbgs;
- Construction of the Moolabin Creek Bridges. Earthworks will comprise abutment construction and piling to a depth to be determined during detailed design.
- Construction of a new pedestrian foot bridge. Soil disturbance comprising piling to depths of approximately 19 mbgs;

Precise volumes of soil to be excavated/disturbed across the Clapham Yard will be confirmed through the development of detail design.

The Proposed Changes require additional land that extends beyond the current Evaluated Project boundary. The construction works at Clapham Yard will now have temporary and permanent impacts on six additional parcels of land, including:

- Lot 1 on RP37619;
- Lot 9 on SP119390;
- Lot 67 on RP37616; and
- Lot 68 on RP37616.
- Road Reserve of Chale Street / Moolabin Creek Unallocated State Land
- Road Reserve of Fairfield Road / Rocky Water Holes Creek Unallocated State Land

The layout of revised Clapham Yard, including additional land impacts, is provided in Volume 2.

Permanent structures proposed for these lots typically consist of underground Public Utility Plant, underground drainage and combined services routes. There will also be minor ground disturbance activities associated with supporting construction activities to deliver the aforementioned design elements as well as the Moolabin Bridges. The location of the four additional land parcels and two encroachments on Unallocated State Land (USL) are shown in Plate 1 and Plate 2.

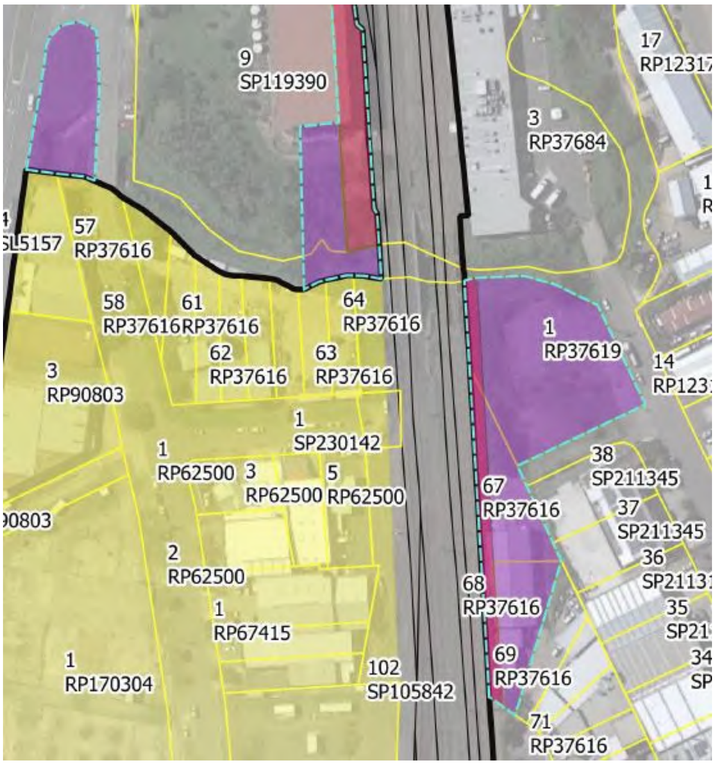


Plate 1 Lots 9SP119390, 1RP37619, 67to 69RP37616 and USL of Moolabin Creek

Plate 2: USL of Rocky Water Holes Creek

The internal reconfiguration of permanent design elements within the existing boundaries of Clapham Yard will result in a consistent disturbance footprint as the one covered by the Evaluated Project.

2.2 Known Environmental Settings

Clapham Yard is an existing non-electrified rail yard located within the Brisbane suburbs of Yeerongpilly and Moorooka, between 6.5 and 8.1 km south of the Brisbane CBD. Prior to the establishment of Clapham Yard in the early 1900s, the area comprised mostly farmland. Clapham Yard has been progressively developed since this time, with surrounding areas also subject to increases in both commercial and residential development. Moolabin Creek crosses the northern section of the Clapham Yard and Rocky Water Holes Creek forms the southern boundary. Both creeks merge 200 m west of Clapham Yard and subsequently discharge to Oxley Creek located 1.7 km to the west. There are also numerous surface water bodies associated with the Golf Course west of Clapham Yard (approximately 300 m west).

2.2.1 Contaminated Land

The additional land parcels outside of the Evaluated Project boundary have not been subject to intrusive investigation works targeting potential soil/groundwater contamination (if any) to date.

A desktop review comparing the Proposed Changes against the Evaluated Project was undertaken to identify additional potentially contaminated sites that may be directly or indirectly impacted by the Proposed Changes.

Due to the requirement for additional land associated with the Proposed Changes, review of the EMR/CLR status of each additional lot/plan was undertaken. Review of the EMR/CLR was undertaken to assess whether the land has been or is being used for a notifiable activity or has been contaminated by a hazardous contaminant.

A summary of the EMR/CLR search is provided in Table 1.

Table 1 Additional Land Parcels for Clapham Yard Development – EMR/CLR search

Land Parcel	Location	EMR/CLR	Notifiable Activity
Lot 1 on RP37619	Immediately east of rail corridor and immediately south of Moolabin Creek	Yes – EMR Only	PETROLEUM PRODUCT OR OIL STORAGE - storing petroleum products or oil
Lot 9 on SP119390	Immediately west of rail corridor and immediately north of Moolabin Creek	Yes – EMR Only	RAILWAY YARDS - operating a railway yard including goods-handling yards, workshops and maintenance areas
Lot 67 on RP37616	Immediately east of rail corridor and immediately south of Lot 1 on RP36719	None	Not Applicable
Lot 68 on RP37616		None	Not Applicable
Road Reserve of Chale Street / Moolabin Creek Unallocated State Land	Immediately west of rail corridor and within Moolabin Creek	None	Not Applicable
Road Reserve of Fairfield Road / Rocky Water Holes Creek Unallocated State Land	Immediately South of rail corridor and within Rocky Water Holes Creek	None	Not Applicable

Search of the EMR identified that Lot 67 and 68 on RP37616 were not on the EMR/CLR, however, both Lot 1 RP37619 and Lot 9 SP119390 are on the EMR for notifiable activity of *Petroleum Product or Oil Storage* and *Railway Yards*, respectively. Although not currently part of the existing rail yard, Lot 9 on SP119390 is on the EMR as it was subdivided from Lot 2 on RP37684. None of the additional lots are listed on the CLR.

A review of available information associated with the Evaluated Project (EIS, 2011) also identified several other land parcels surrounding Clapham Yard are on the EMR.

A preliminary CLASS investigation for Clapham Yard was undertaken between November 2019 to February 2020 as part of the CRR project. The objective of the Clapham Yard CLASS investigation was to collect sufficient data to inform design and constructability decisions/management for the Project with respect to contaminated soil and ASS. Based on the concentrations of CoPC in fill samples analysed, sections of fill material across Clapham Yard are considered contaminated soil under the EP Act.

Additional CLASS investigations are underway and preliminary results confirm the initial findings of the preliminary investigation.

Through these additional investigations the depth to groundwater has also been confirmed with shallow perched groundwater typically 5-6m below ground surface (m BGS).

2.2.2 Acid Sulfate Soils

Review of the Queensland Globe acid sulfate soils Tweed Heads to Teewah layer indicates only the southern extremity of the Clapham Yard (in the vicinity of Rocky Water Holes Creek) is mapped as land at or below 5m AHD with low probability of ASS. No other areas of the Clapham Yard Investigation Area are mapped as having a PASS risk within the Tweeds Head to Teewah layer.

This is in direct contradiction to the City Plan’s Potential and Actual Acid Sulfate Soils Overlay Map OM-016.1-20, and the results of the preliminary ASS investigation that reports the majority of the soils across the Clapham Yard Investigation Area are classified as AASS.

The results (including laboratory results and observations) from the recent investigation indicate that the majority of soils (including fill and natural soils) within the Clapham Yard Investigation Area are likely to be ASS (mainly classified as AASS). Approximately 66% of samples (both within ‘Fill’ and natural soils) exceeded the adopted ‘Action Criteria’ for ASS management.

The majority of the soil acidity within the Clapham Yard Investigation Area is present as ‘existing acidity’ and is potentially due to ASS processes such as the oxidation of sulfides during historic ‘cut’ and fill activities in the area or naturally acidic soils. For select samples in natural, higher concentrations of existing acidity were noted where negligible retained or potential acidity concentrations were reported, indicating sources of acidity other than sulfides. However, these samples reported pH KCl < 5.5 and as such may need management if disturbed (Dear et al, 2014). PASS was indicated in three samples (with net acidity exceeding the criteria) at distinct locations in north, central and southern portion of Clapham Yard at depths ranging between 1.5 m BGS, 0.1 m BGS and 3.0 m BGS respectively.

Based on the result of the preliminary investigations, there is no (or at the most negligible volumes of) PASS on the site and there is no AASS. The shallower soils are acidic soils and therefore are not PASS or AASS.

To reduce the potential impacts to environment surrounding the Clapham Yard Investigation Area, a supplementary ASSMP was developed, to manage the existing acidity and any associated waters (perched, seepage, stormwater etc) during construction.

Additional CLASS investigations are underway and preliminary results confirm the initial findings of the preliminary investigation, that is the fill material is not AASS / PASS. Additional data is being collected in the deeper natural clays to confirm whether the isolated finds of PASS are indeed isolated.

2.2.3 Soil Erosion

Topography along the Clapham Yard site is generally characterised by undulating terrain with gentle slopes towards the two waterways on either side of the Yard (Rocky Water Holes Creek to the south and Moolabin Creek to the north).

The Overarching ESC-P details the guiding principles for the selection of management measures based on predicted soil loss and resulting erosion risk. Overall, the disturbance in Clapham Yard, will exceed 1 hectare during the bulk of the earthworks. Whilst the erosion risk based on the soil loss will be low, since the disturbance duration is likely to exceed six months and since Clapham Yard is bounded by two waterways, management the erosion risk is automatically increased to a moderate risk.

Any in stream works will be deemed high risk for the purpose of determining the suitable erosion and sediment control measures during construction.

Upon completion of the construction, and particularly the earthworks, the overall erosion risk will be once again reduced to a low risk as the permanent design will provide the suitable level of cover by means of capping and ballasting of the upgraded rail infrastructure and paving of access roads.

A Site Specific ESC-P for Clapham Yard has been developed for the Changed Project, the management principles of the erosion risk during construction are consistent with those currently being implemented in Mayne Yard.

2.3 Construction Impacts

The CRR project has undertaken a significant in-situ soil characterisation effort as part of the ongoing design. This effort has subsequently led to the development of area specific management protocols consistent with the current legislative requirements under the *Environmental Protection Act 1994* and Imposed Condition 19. These protocols are designed to adapt to any increase of disturbance, and / or changes to volumes of soils to excavated as part of the project.

The increase of the footprint if unmitigated may result in additional impacts compared to the Evaluated Project.

Based on the current knowledge of the latent conditions and environmental settings throughout Clapham Yard and the management processes already being implemented the Changed Project is considered unlikely to adversely affect the receiving environment.

More details on the existing management measures and recommended actions are presented in section 3.

2.4 Operational Impact

The permanent landforms once the Clapham Yard is operational will be stabilised via the following means:

- Hardscaping via the means of asphalt pavement on internal access road and car parks and capping material and ballast rock on rail infrastructure
- Soft scaping (through revegetation either via seeding or landscaping) in the reminder of the areas.

Therefore, the erosion risk associated with operations is low.

Ballast rock and capping material are required to meet engineering specification and therefore are virgin quarry materials. The risk of new or additional contamination as a result of the Clapham Yard redevelopment via these media is therefore negligible.

The geotechnical assessment undertaken to date include settlement and stabiliser assessment. It also takes into consideration the groundwater conditions on site. The geotechnical assessment has conservatively adopted the assumption that the groundwater table is near surface. The long-term operational risk associated with settlement is that the rail formation formations and other ancillary permanent design elements become unstable resulting in an increases potential for groundwater table movement that would result in:

- inundation of AASS/PASS material ; or
- exposure of PASS material to oxidation process.

The purpose of the geotechnical assessment is to inform whether significant ground improvement regimes are required to mitigate post construction settlement.

The assessment indicates that the estimated post construction settlement and stability with net filling is within the Project technical requirements. Hence, any ground improvement regime is not essential. Consistent with the existing technical requirements for the Project, mitigation measures include the installation of settlement plates and pegs to monitor the consolidation settlement so that timely intervention can be taken to mitigate any unexpected ground behaviour.

On the basis of the above and based on the knowledge of PASS / AASS distribution across the site the risk of operational impact associated with PASS / AASS is concluded to be negligible.

3. Changes to Mitigation Measures

3.1 Environmental Management Framework (EMF) Review

3.1.1 C-EMP and Sub-Plans

The mechanisms in place under the existing C-EMP and its subplans ensure that risks associated with contaminated land, acid sulfate soils and erosion is appropriately managed

- The C-EMP requires-
    - That for all disturbance activities that have the potential to result in moderate to high risk to the receiving environment supplementary investigations and management plans be developed prior to the Project Works commencing.
    - That the implementation of the supplementary CLMPs and ASSMPs as well as the site specific ESC-Ps be monitored through routine site based assurance programs
    - That any additional sampling (soils to water) be undertaken in accordance with the management plans requirements to appropriately characterise the medium for the determination of best practice management.
- The Contaminated Land Management Sub-Plan:
    - Requires that supplementary CLMPs be developed upon the completion of site investigations that will include management criteria for soils, groundwater and surface waters where contaminated soils are present.
    - Requires Trapped waters proposed to be released to the receiving environment are managed in accordance with the WWMP and are:
        - *Tested prior to release*
        - *Released under an internal Permit to Dewater approved by the Environmental Team.*
- The Acid Sulphate Soils Management Sub-Plan:
    - Requires that supplementary ASSMPs be developed upon the completion of site investigations that will include management criteria for soils, groundwater and surface waters when AASS / PASS is identified.
- The Erosion and Sediment Control Management Sub-Plan
    - Requires that Erosion and Sediment Control Plans (ESC-P) are developed for all areas, including temporary worksites by a Suitably Qualified Person (SQP)
    - Requires that ESC-Ps are developed taking into consideration Best Practice Management Guidelines (BPMs) Principles as detailed in:
        - *IECA manuals*
        - *MRTS 52*
    - Requires that trapped waters proposed to be released to the receiving environment are:
        - *Tested prior to release*
        - *Released under an internal dewatering permit (Permit to Dewater) approved by the Environmental Team.*
- The Waterways and Water Quality Management Sub-Plan (WWQMP)
    - Requires that prior to any discharge of surface or groundwater being authorised from the site, the Environment Team will monitor the water using appropriately calibrated

water quality monitoring equipment and will authorise water releases from the site using the Permit to Dewater process.
- Only water that meets the Site Water Release Hierarchy as detailed in the WWQMP (as well as applicable requirements from the supplementary ASSMP or CLMP) will be authorised for release.

All the management plans that are intimately related to management of contaminated land, acid sulfate soils and erosion risk (on and offsite) are all consistent in their approach to managing adverse impacts associated with design refinements and associated changes. These plans cater for an iterative approach to consistent management of impacts. They require that as new information becomes available with regards to the extent of predicted disturbance (increase or decrease) the management requirements are reviewed and amended to ensure minimisation of impact to the receiving environment.

3.1.2 Contaminated Land

Consistent with the Contaminated Land Management Sub-Plan of the C-EMP, supplementary Contaminated Land Management Plans (CLMPs) have been developed for the Clapham Yard Areas by the Project’s Suitably Qualified Persons (SQPs).

These supplementary CLMPs provide soils management requirements to be followed for characterised soils to ensure compliance with legislative requirements are met and to mitigate the risk to ecological and human receivers. The supplementary CLMPs also extend to the management of waters that may be affected by the presence or disturbance of contaminated soils.

The supplementary CLMPs also identify that in the event that:

- Additional disturbance outside of the investigated areas occurs, or
- Excavation of soils is predicted to exceed the volume of fill characterised

Additional samples will be required to be collected at a rate of 1 sample per 250 m^3 (loose) for a list of predetermined CoPCs to adequately characterise the material and determine management requirements.

Soils with low level contamination may be reused within the project boundaries pending they are appropriately managed. Soils may be transferred intra-lot or inter lot (the latter under a Soil Disposal Permit issued by the Department of Environment and Science). When material cannot be beneficially re-used within the project boundaries, contaminated soils will be disposed of to an appropriately licensed landfill under a Soil Disposal Permit.

The supplementary CLMPs also identify that in the event that gross contamination is encountered during construction (with a focus on gross hydrocarbon contamination), additional sampling will be required to adequately characterise the material to determine management requirements.

On this basis, a management process has been implemented that enables the collection of additional soil sampling prior to disturbance commencing or undertaking additional soil sampling as construction progresses. This adaptive management approach provides for adequate management of contaminated land matters under clear guidance to ensure legislative requirements are met and the risk to the environment is managed.

Although there are increases in potential for disturbance of contaminated sites associated with the Proposed Changes, the mitigation measures are generally consistent with the Evaluated Project. To mitigate potential impacts associated with the disturbance of contaminated soils outside of the boundary of the Evaluated Project, additional soil characterisation will be undertaken consistent with the relevant supplementary CLMPs for the area. As a result of the additional sampling, the supplementary CLMPs will be updated.

3.1.3 Acid Sulfate Soils

Consistent with the Acid Sulfate Soils Management Sub-Plan of the C-EMP, supplementary Acid Sulfate Soil Management Plans (ASSMPs) have been developed for the Clapham Yard Areas by the Project’s SQPs.

This supplementary ASSMPs provides soil management requirements, in accordance with Imposed Condition 19 to be followed for:

- Known AASS and PASS and
- The discovery of suspected ASS that are not representative of the soil testing

The supplementary ASSMPs also extend to the management of waters that may be affected by the presence or disturbance of ASS.

Consistent with the ASSMPs in the event that additional discordance of soils that have not yet been characterised additional sampling and analysis must be undertaken to determined concentrations of reduced inorganic sulfur. This characterisation may occur either prior to construction commencing of during bulk excavation. An experienced ASS practitioner will attend site to provide additional guidance on suspected ASS on as required basis. Where suspected ASS is encountered a field test (pH f and pH fox) shall be conducted to provide an initial assessment of the materials. Field screening tests shall be conducted at a minimum rate of one per 250 m^3 of suspected ASS material encountered.

Confirmatory tests shall comprise sample analysis for the Chromium Suite of tests. Materials returning net acidity less than 0.03%S shall be removed from the stockpile area and used as fill without further acid sulfate management. Where net acidity greater than 0.03%S (with reduced inorganic sulfur >0.03%) is found, the materials shall be treated using Aglime.

Consistent with the *Queensland Acid Sulfate Soil Technical Manual (QASSIT), Soil Management Guidelines v4.0*, when disturbance of ASS is unavoidable the preferred management option for the areas is off-site removal of excess spoil (within Project boundary and rail corridor) and/or to licensed landfill due to geotechnical and/or contamination constraints. If the material is suitable for reuse, the excavated spoil shall be neutralised using a liming agent and verified as having been appropriately neutralised prior to reuse.

On this basis, a management process has been implemented that enables the collection of additional soil sampling prior to disturbance commencing or undertake additional soil sampling as construction progresses. This adaptative management approach provides for adequate management of acid sulfate soils matters under clear guidance to ensure legislative requirements are met and the risk to the environment is managed.

Although there are increases in potential for disturbance of potential or actual acid sulfate soils associated with the Proposed Changes, the mitigation measures are generally consistent with the Evaluated Project. To mitigate potential impacts associated with the disturbance of PASS / AASS outside of the boundary of the Evaluated Project, additional soil characterisation will be undertaken consistent with the relevant supplementary ASSMPs for the area. As a result of the additional sampling, the supplementary ASSMPs will be updated.

3.1.4 Erosion

Consistent with the Erosion and Sediment Control Management Sub-Plan of the C-EMP, supplementary Erosion and Sediment Control Plans (ESCPs) have been developed by the Project's SQPs (in this instance Certified Professional in Erosion and Sediment Control or CPESC) for the Clapham Yard Area. These site specific ESC-Ps are subsets of the Overarching Erosion and Sediment Control Plan (OESCP) which has been prepared in accordance with the following documents:

- Best Practice Erosion and Sediment Control (IECA, 2008)
- MRTS51 Environmental Management (DTMR, 2017)
- MRTS52 Erosion and Sediment Control (DTMR, 2017)
- Coordinator-General's Conditions of Approval – Appendix 1 – Part C:
    - Conditions 15, 17 and 18
- Outline-Environmental Management Plan (O-EMP)
    - Outline Erosion and Sediment Control Plan (Outline ESCP)

  - Construction Environmental Management Plan (CEMP)

- Brisbane City Council (BCC) City Plan 2014

The project works are covered by a multi-tiered level of planning to not only facilitate and present the overarching strategy but also assist in the implementation and staging of controls according to current works on site:

- The Overarching ESCP present the general approach to ESC, including the installation sequence and timing of controls, deviation to IECA 2008, response strategy for managing significant rain events, and the monitoring and maintenance requirements for the project site, erosion and sediment controls and receiving environment.
- The site specific ESC-Ps are Drawings prepared to indicate the location of controls for specific areas throughout all stages of construction, including clear and grub, earthworks, final levels and landscaping.
- The Progressive ESC-Ps are progressive updates and markups prepared internally to assist in implementation and progression of the site specific ESCPs, typically tracking minor amendments to reflect site characteristics

Although there are increases in potential for erosion associated with the Proposed Changes, the mitigation measures are generally consistent with the Evaluated Project. To mitigate potential impacts associated with the additional land disturbance outside of the boundary of the Evaluated Project, a review or development of site specific ESCPs will be undertaken consistent with the Overarching ESCP.

Since the site specific ESC-P already exists, it will be reviewed by the Project SQPs to incorporate any additional management requirements as necessary.

3.2 Proposed Changes to the EMF

It is recommended to update the supplementary ASSMP and CLMP upon completion of the additional CLASS investigations.

Otherwise no new or additional management measures are recommended to be incorporated in the EMF

There is no requirement to seek an amendment to the relevant Imposed Conditions.

4. Conclusion

The potential changes to impacts associated with the Proposed Changes are summarised below:

- Overall, there will be increased disturbance of potentially contaminated soils. This is based on preliminary contaminated land investigation findings and the close proximity of the Proposed Design changes to these areas. There will also be increased disturbance of soil from land parcels listed on the EMR that will be directly impacted by the Clapham Yard works. Disturbance of potentially contaminated soils will increase the volume of soil requiring management in relation to potential contamination however the predicted impacts are consistent with the ones from the Evaluated Project. Management of contaminated land will be completed in accordance with the C-EMP and subplans.
- Overall, there will be increases in the disturbance of PASS/AASS associated with the Proposed Changes. Disturbances of ASS will vary depending on the extent of soil disturbance and the finalised construction methodology for each of the Proposed Changes, however the predicted impacts are consistent with the impacts identified for the Evaluated Project. PASS/ASS will be managed in accordance with the C-EMP and subplans.
- Based on increased quantities of imported fill at Clapham Yard, the potential for changes to erosion impacts will be increased. However, these increases will be managed through the development or updates of site-specific Erosion and Sediment Control Plans of each element of the Proposed Changes in accordance with C-EMP and subplans

The predicted impacts do not warrant an amendment of the O-EMP, C-EMP and Imposed Conditions.

Cross River Rail Environmental Impact Statement

Request for Project Change 11

Changes to the Project and changes to the imposed conditions

Volume 3 Technical Reports

Attachment F Nature Conservation

Date: ***April 2021***

Author: ***Cross River Rail Delivery Authority***

Table of Contents

1. Assessment Methodology

A desktop assessment was conducted to identify any potential environmental / natural risks associated with the Proposed Change. The following is a list of desktop information used to inform this assessment:

- Commonwealth EPBC Protected Matters: Search Tool (PMST)
- Vegetation Management Support Mapping
    - Protected Plants Flora Survey Trigger Mapping
- Department of Environment and Science (DES) Wildlife Online Database
- State Planning Policy
- State Assessment and Referral Agency Mapping
- Brisbane City Council
    - Planning Scheme Overlays
    - Natural Assets Local Law
- Evaluated Project Technical Information
- Recent Field Assessment undertaken by CRRDA, including.
    - Southern Corridor (Fairfield to Salisbury, inclusive of Clapham Yard)

1.1. Field Assessment

An ecological field assessment was undertaken in 2019 as part of the broader Salisbury to Fairfield assessment which has been relied on for this technical assessment. No additional field assessment was undertaken for the Proposed Change.

2. Changes to Potential Impacts

2.1 Evaluated Project Context

The Project Changes most relevant to Nature Conservation are as follows:

- Reconstruction of two existing and the construction of one new rail bridge over Moolabin Creek to the west of the existing bridges.

The purpose of this technical assessment is to assess the effect of the increase disturbance to vegetation at Moolabin Creek compared to the Evaluated Project.

2.2 Desktop Assessment Results

Based on the desktop assessment described in Section 1.1, the following constraints were mapped over the Proposed Change. Detailed mapping is available in **Appendix 1**.

Table 1 Desktop Assessment Results

Commonwealth Government Legislation Constraints	
Environment Protection and Biodiversity Conservation Act 1999	
World Heritage Properties	None
National Heritage Places	None
Wetlands of International Importance	1
Great Barrier Reef Marine Park	None
Commonwealth Marine Land	None
Listed Threatened Ecological Communities	3
Listed Threatened Species	58

Listed Migratory Species	36
State Government Legislation Constraints	
Nature Conservation Act 1992	
Protected Plants	Nil
Vegetation Management Act 1999	
Regulated Vegetation	Category X
Regional Ecosystem	N/A
Watercourse	Watercourse order 1 – Moolabin Creek
Essential Habitat	N/A
Wetlands	N/A
Fisheries Act 1994	
Waterway for Waterway Barrier Works	WWBW 1 - Moolabin Creek
Water Act 2000	
Watercourse	Moolabin Creek
Local Government Constraints	
Brisbane City Plan 2014	
Overlays	Biodiversity Areas Overlay: • High Ecological significance strategic sub-category • MSES sub-category Waterway Corridors Overlay: • Citywide waterway corridor sub-category
Natural Assets Local Law	
Highly significant tree	Nil
Council vegetation	Nil
Significant urban vegetation	Nil
Significant native vegetation	Nil
Waterway and wetland vegetation	Yes

2.3 Field Assessment Results

The Moolabin Creek aquatic systems demonstrates conditions typical of a heavily urbanised waterway. Significant development has led to a generally degraded aquatic ecology, with reduced water quality conditions, impacted riparian vegetation (including weed disturbance) and a high incidence of introduced aquatic fauna. Despite these conditions, native species continue to find refugia within the waterway over its full length.

The proposed crossings at Moolabin Creek are situated in a heavily impacted reach displaying degraded water quality and a heavy infestation of introduced riparian and aquatic weed species. General litter accumulation and larger debris associated with periodic flood flows has also been recorded as shown in Figure 1 below.

Figure 1: View of Moolabin Creek form Chale Street towards rail corridor

2.3.1 Aquatic ecology

The survey findings provide considerations of aquatic ecological conditions within Moolabin Creek:

- The Moolabin Creek aquatic system demonstrates conditions typical of heavily urbanised waterways. Significant development has led to a generally degraded aquatic ecology, with reduced water quality conditions, impacted riparian vegetation (including weed disturbance) and a high incidence of introduced aquatic fauna.
- The aquatic systems within the waterway was considered moderately to heavily impacted.
- Moolabin Creek presents a long history of vegetation clearing and alteration to the riparian zone.
- The vegetation at Moolabin Creek is dominated by invasive weed species throughout.
- Moolabin Creek presents a significantly impacted riparian flora with dominance by the invasive Giant reed (*Arundo donax*), Chinese celtis and Singapore Daisy.

- No aquatic fauna species of conservation significance (*threta*) were recorded during the most recent surveys.
- The dusky moorhen is likely to breed in local waterways using shallow platform nests within reeds and associated riparian vegetation during the summer months. Moolabin Creek may present suitable nesting habitat for this species during the year.
- No active breeding places were recorded during field observations.
- Five (5) aquatic weed species identified as Category 3 Restricted weeds were identified during field observations, these included alligator weed, cabomba, common water hyacinth, salvinia and glush weed.

2.3.2 Terrestrial ecology

The following survey findings for terrestrial ecological values (flora, fauna and habitat) are broadly associated with the Fairfield to Salisbury corridor (inclusive of Clapham Yard):

- Vegetation within the corridor is dominated by weedy herbs, shrubs and grasses, though planted and naturally recruited natives are observed. Regular maintenance of existing vegetation is conducted adjacent to traction power supply lines and railway infrastructure as part of safety management and risk mitigation programs which limit the occurrence of tree and shrub vegetation generally.
- No protected flora has been observed within the disturbance footprint during field survey.
- No protected fauna species have been recorded within the disturbance footprint.
- 16 weed species identified as Category 3 Restricted weeds were identified during field observations.
- One restricted Category 2 weed was identified, and it was limited to a single species observed within the footprint, Mother of millions (Bryophyllum delagoense). This common garden escape was observed most commonly along the corridor cuttings adjacent to residential housing, where specimens have established along the boundary fencing.

2.3.3 Discussion of Findings

The Project footprint is fully developed, with a long history of railway infrastructure and ongoing disturbance. Vegetation within the corridor is dominated by weedy herbs, shrubs and grasses, though planted and naturally recruited natives are observed. Regular maintenance of existing vegetation is conducted adjacent to traction power supply lines and railway infrastructure as part of safety management and risk mitigation programs which limit the occurrence of tree and shrub vegetation generally.

The waterway crossings at Moolabin Creek presents the greatest associated habitat value. Although heavily disturbed themselves, these areas may provide increased values with respect to movement corridors and refugia. Water birds including the dusky moorhen, common moorhen, white faced heron and cormorants have been observed feeding at Moolabin Creek outside the Project footprint. eDNA analysis has further confirmed utilisation of the waterways by a broad range of terrestrial and aquatic species.

Overall, the proposed development footprint can be best described as being of low habitat value with increased corridor value being associated with creek crossings. Proposed activities should remain sensitive of the waterway habitats, minimising interactions and facilitating recovery/rehabilitation of areas which are disturbed during construction. The use of fauna spotters in these areas when initiating works is recommended, as is the consideration of potential disturbance during times of breeding.

Refer to **Appendix 2** for more details of the findings.

2.4 Construction Impacts

The Proposed Changes at Moolabin Creek relevant to Nature Conservation consists of the reconstruction of two existing rail bridges and the construction of one new grader separated rail bridge. The change will result in an increased disturbance area to the west of the exiting bridges of approximately 2,500m^2. As outlined in the field assessment notes, this area is of low ecological value and is unlikely to include any vegetation of value.

This impacted area will be cleared and rehabilitated in accordance with the provisions of the EMF and other required environmental approvals, as outlined in Section 2.6.

The required rehabilitation must rehabilitate the temporary riparian vegetation disturbance with trees, shrubs and grasses endemic to the area, sufficient to re-establish a riparian environment and protect bed and banks from erosion. Due to the current degraded nature of the disturbance area, the rehabilitation works will have net improvement on the existing environment.

Once all required rehabilitation has occurred, no additional impacts are anticipated to ecological values of Moolabin Creek compared to the Evaluated Project.

2.5 Operational Impacts

The Proposed Changes at Moolabin Creek consist of bridge and grade separated structures which will be designed to ensure fish passage is maintained. Whilst some permanent vegetation loss may occur associated with scour protection requirements at the bridges, the extent of the scour protection will be minimised to the minimum area necessary to achieve the technical requirements to protect the new infrastructure.

2.6 Legislative Requirements

2.6.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's main environmental legislation. It covers environmental assessment and approvals, protects significant biodiversity and integrates the management of important natural and cultural places. These are referred to as Matters of National Environmental Significance (MNES).

An EPBC Act Protected Matters Search was undertaken to determine if any known MNES are likely to occur within the Project area. Results of this search are shown in Table 1.

The Cross River Rail Project has previously been referred to the Commonwealth to determine if it meets the requirements of a controlled action. This referral resulted in the Project not being considered a Controlled Action. Ongoing monitoring, however, is recommended to ensure that no MNES become impacted by the Project. Based on the EPBC Protected Matters Search Tool results, no additional MNES were found in the vicinity of the Project Change compared to the Evaluated Project. As the Proposed Changes are unlikely to impact on MNES and will only increase the disturbance area by 1,200m^2, the Proposed Change is not required to be re-referred to the Commonwealth.

2.6.2 Nature Conservation Act 1992

The *Nature Conservation Act 1992* (NC Act) protects Queensland's ecological values, including protected areas and protected native wildlife and wildlife habitats. The NC Act and subordinate legislation are administered and enforced by the Department of Environment and Science (DES).

The Protected Plants Flora Survey Trigger Mapping shows that there are no protected plants within the Project Change area.

2.6.3 Vegetation Management Act 1999

The *Vegetation Management Act 1999* (VM Act), through the *Planning Act 2016* (Planning Act) regulates the clearing of native vegetation in Queensland in a way that conserves remnant vegetation i.e. regulated vegetation that is endangered, of concern or least concern regional ecosystem (RE). The VM Act conserves vegetation in declared areas, ensures that vegetation clearing does not cause land degradation and prevents loss of biodiversity and maintains ecological processes. The VM Act is administered and enforced by the Department of Resources (DoR).

The Vegetation management report shows the Project Change area as Category X vegetation. Moolabin Creek is mapped was drainage features 1 on the vegetation management watercourses and drainage feature map.

The Project meets the definition of Exempt Clearing work in accordance with Schedule 21, Part 1, section 1(14) of the *Planning Regulation 2017* (Planning Regulation) being infrastructure that is 'government supported transport infrastructure'. Therefore, required clearing can occur without a development approval under the Planning Act.

2.6.4 Fisheries Act, 1994

The purpose of the *Fisheries Act 1994* (Fisheries Act) is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats through the application of the principles of ecologically sustainable development. The Fisheries Act and the Fisheries (General) Regulation 2019 (Fisheries Regulation) (among other regulations) are administered by the Department of Agriculture and Fisheries (DAF) and provide for the management, use, development and protection of fisheries resources and fish habitats.

Moolabin Creek is mapped as waterways for waterway barrier works level 1. As such, all works within the waterway will be required to comply with 'Accepted development requirements for operational work that is construction or raising a waterway barrier work'. If these requirements cannot be complied with, the Project will be required to obtain an Operational Works (Construction or raising a waterway barrier work) permit from the State.

2.6.5 Water Act 2000

The *Water Act 2000* (Water Act) controls the allocation and sustainable management of water resources in Queensland. DES and the Department of Regional Development, Manufacturing and Water (DRDMW) administer the Water Act and control access to water through a system of water authorisations, including water licenses, water permits, water allocations and interim water allocations. These authorisations allow the holder to take or interfere with water. In addition, the Water Act regulates activities within a watercourse.

Moolabin Creek is mapped as a watercourse under the Water Act. This means that a riverine protection permits (RRP) will be required in relation to the works, unless an exemption applies.

2.6.6 Brisbane City Plan 2014

In accordance with Schedule 6, Part 5, Section 26 of the Planning Regulation, development for the construction of transport infrastructure and road transport infrastructure is prohibited from being stated as assessable development by the local development categorising instrument if the infrastructure is government supported transport infrastructure. Development that is for the upgrade of road transport infrastructure or transport infrastructure is also development that is prohibited from being stated as assessable development by the local development categorising instrument.

2.6.7 Natural Assets Local Law 2003

Brisbane City Council's *Natural Assets Local Law 2003* (NALL) helps to protect natural assets, including bushland areas, wetlands, waterway corridors and trees in urban areas. The NALL also allows better management of the impacts of weeds and hazardous vegetation.

Moolabin Creek is mapped as containing waterway and wetland vegetation.

The Cross River Rail Project is exempt from the NALL. However, CRRDA intends to comply with the intent of the NALL and will discuss the need for any vegetation offsets with Council prior to undertaking activities that may impact on matters protected under the NALL. As new areas of mapped NALL will be impacted by the Proposed Change, additional offsets may be required to be considered.

3. Changes to Mitigation Measures

3.1 Environmental Management Framework (EMF) Review

3.1.1 C-EMP and Sub-Plans

The mechanisms in place under the C-EMP and its sub-plans ensure that risks associated with impact to fauna and flora are appropriately managed.

A review of the C-EMP and sub-plans was conducted and the following sub-plans were considered relevant to Nature Conservation:

- Pests and Weed Species management will be undertaken in accordance with the Biosecurity Management Sub-Plan. This sub-plan requires:
    - Ecological survey be undertaken to identify matters of biosecurity concern
    - In the event that Category 1 or 2 restricted matters are identified, the matters be reported to Biosecurity Queensland within 24 hours of becoming aware of the findings
    - In the event that Categories 3, 4, 5, 6 and 7 restricted flora matters are identified, the management requirements under the Biosecurity Regulation 2016 be implemented
    - In the event that other pest fauna species are identified in the Project footprint, consultation with Brisbane City Council pest management team will be carried out occur (e.g. feral dog)
    - All machinery / equipment be inspected and declared weed seed and Fire Ant free prior to arriving on site, and a record of the declaration kept
    - Consultation with subcontractors and suppliers to ensure that the import of potential RIFA (i.e. red imported fire ants) carrier is managed in accordance with the *Biosecurity Act 2014* requirements, including where relevant that suppliers have a current Biosecurity Instrument Permit/s issued by DAF
- Native Fauna and Flora management will be undertaken in accordance with the Nature Conservation Management Sub-Plan. This sub-plan requires:
    - All the relevant flora clearing permits / approvals or exemptions are obtained prior to Project Works commencing
    - For Areas of Riparian Vegetation:
        - To minimise the extent of permanent and temporary disturbance to a reasonable and practical level
        - To obtain a RPP
        - To rehabilitate the temporary riparian vegetation disturbance with trees, shrub and grasses endemic to the area, sufficient to re-establish a riparian environment and protect bed and banks from erosion
    - A qualified fauna spotter/catcher is present prior to and during the removal of vegetation of habitat value or breeding places, to capture and relocate any disturbed native fauna in accordance with the requirements of the NC Act
    - the fauna spotter/catcher has necessary and current Rehabilitation or Damage Mitigation Permits
- The following C-EMP subplans will also be relevant for in stream works to ensure the aquatic values of the creeks are protected during the construction phase:
    - Acid Sulfate Soils management Sub-Plan
    - Contaminated Land Management Sub-Plan
    - Erosion and Sediment control Sub-Plan
    - Waterways and Water Quality management Sub-Plan

3.2 Proposed Changes to the EMF

There is no requirement to seek an amendment to the Imposed Conditions.

There are no new or additional management measures recommended to be incorporated in the EMF.

4. Conclusion

Due to the highly urbanised areas within the CRR Project alignment, the potential for changed impacts to nature conservation are confined to the Moolabin Creek waterway.

The potential impacts to Nature Conservation are due to the proposed bridge structures that require additional land within the stream and banks to enable construction works and permanent operations. These areas are considered to have limited ecological value and with the impacts to temporarily disturbed areas are anticipated to be suitably mitigated through the current mitigation measures.

The predicted impacts do not warrant an amendment of the O-EMP, C-EMP or Imposed Conditions.

Appendix 1 – Significant Vegetation Mapping

Australian Government

Department of the Environment and Energy

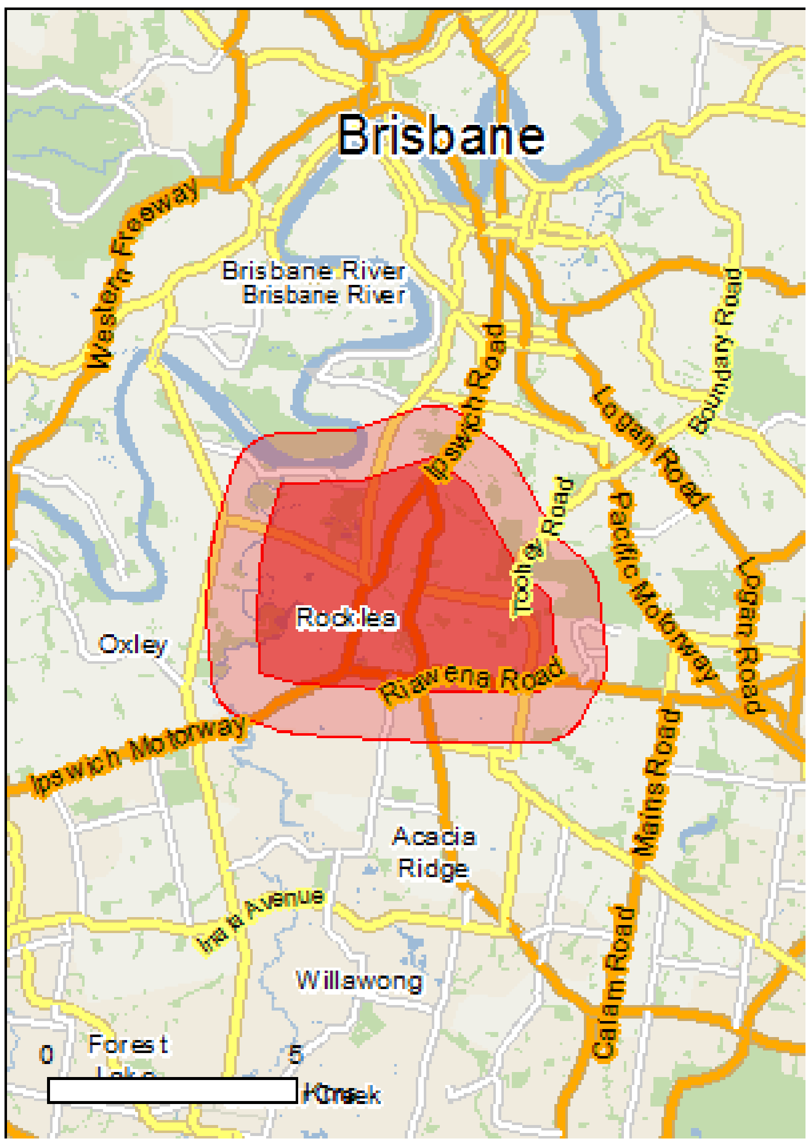
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

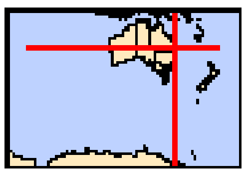
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 13/11/19 14:06:50



Coordinates

Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	58
Listed Migratory Species:	36

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	43
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	44
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Moreton bay	10 - 20km upstream

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area
Poplar Box Grassy Woodland on Alluvial Plains	Endangered	Community may occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Cyclopsitta diophthalma coxeni		
Coxen's Fig-Parrot [59714]	Endangered	Species or species habitat may occur within area
Dasyornis brachypterus		
Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within area
Diomedea antipodensis gibsoni		
Gibson's Albatross [82270]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Geophaps scripta scripta Squatter Pigeon (southern) [64440]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat may occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat may occur within area
Turnix melanogaster Black-breasted Button-quail [923]	Vulnerable	Species or species habitat likely to occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Frogs		
Mixophyes fleayi		
Fleay's Frog [25960]	Endangered	Species or species habitat may occur within area
Insects		
Argynnis hyperbius inconstans		
Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat may occur within area
Dasyurus hallucatus		
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat likely to occur within area
Petauroides volans		
Greater Glider [254]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus		
Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat may occur within area
Pteropus poliocephalus		
Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Arthraxon hispidus		
Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Bosistoa transversa		
Three-leaved Bosistoa, Yellow Satinheart [16091]	Vulnerable	Species or species habitat likely to occur within area
Cryptocarya foetida		
Stinking Cryptocarya, Stinking Laurel [11976]	Vulnerable	Species or species habitat may occur within area
Cupaniopsis shirleyana		
Wedge-leaf Tuckeroo [3205]	Vulnerable	Species or species habitat may occur within area
Dichanthium setosum		
bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area
Fontainea venosa		
[24040]	Vulnerable	Species or species habitat likely to occur within area
Gossia gonoclada		
Angle-stemmed Myrtle [78866]	Endangered	Species or species habitat known to occur within area
Macadamia integrifolia		
Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Macadamia tetraphylla		
Rough-shelled Bush Nut, Macadamia Nut, Rough-shelled Macadamia, Rough-leaved Queensland Nut [6581]	Vulnerable	Species or species habitat may occur within area
Notelaea ipsviciensis		
Cooneana Olive [81858]	Critically Endangered	Species or species habitat may occur within area
Phaius australis		
Lesser Swamp-orchid [5872]	Endangered	Species or species habitat likely to occur within area
Samadera bidwillii		
Quassia [29708]	Vulnerable	Species or species habitat likely to occur within area
Thesium australe		
Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Delma torquata		
Adorned Delma, Collared Delma [1656]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Furina dunmalli		
Dunmall's Snake [59254]	Vulnerable	Species or species habitat may occur within area
Lepidochelys olivacea		
Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Saiphos reticulatus		
Three-toed Snake-tooth Skink [88328]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna grisea		
Sooty Shearwater [82651]		Species or species habitat may occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis		
Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus		
Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca		
Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons		
Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Defence - MOOROOKA TRAINING DEPOT

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat may occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Indooroopilly Island	QLD
Toohey Forest	QLD

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides		
Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia		
Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus		
Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus africanus		
Climbing Asparagus, Climbing Asparagus Fern [66907]		Species or species habitat likely to occur within area
Asparagus plumosus		
Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana		
Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera		
Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. rotundata		
Bitou Bush [16332]		Species or species habitat likely to occur within area
Cryptostegia grandiflora		
Rubber Vine, Rubbervine, India Rubber Vine, India Rubbervine, Palay Rubbervine, Purple Allamanda [18913]		Species or species habitat likely to occur within area
Dolichandra unguis-cati		
Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes		
Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana		
Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Hymenachne amplexicaulis		
Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp.		
Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata		
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Parthenium hysterophorus Parthenium Weed, Bitter Weed, Carrot Grass, False Ragweed [19566]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Solanum elaeagnifolium Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-27.526071 152.995735,-27.525538 153.010155,-27.521657 153.023029,-27.5263 153.029638,-27.539695 153.038221,-27.54449 153.044058,-27.554306 153.04526,-27.559481 153.04217,-27.559328 153.023544,-27.558035 152.998482,-27.556209 152.991959,-27.545935 152.9911,-27.536422 152.992216,-27.526071 152.995735

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
GPO Box 787
Canberra ACT 2601 Australia
+61 2 6274 1111

Queensland Government

Department of Environment and Science

Environmental Reports

Biodiversity and Conservation Values

Biodiversity Planning Assessments and Aquatic Conservation Assessments

For the selected area of interest
Longitude: 153.01293 Latitude: -27.53561 with 2 kilometre radius

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or Area of Interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "Central co-ordinates" option, the resulting assessment area encompasses an area extending from 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: biodiversity.planning@des.qld.gov.au

Disclaimer

Table of Contents

Summary Information

Tables 1 to 8 provide an overview of the AOI with respect to selected topographic and environmental values.

Table 1: Area of interest details: Longitude: 153.01293 Latitude: -27.53561

Size (ha)	1,256.55
Local Government(s)	Brisbane City
Bioregion(s)	Southeast Queensland
Subregion(s)	Burringbar - Conondale Ranges, Moreton Basin
Catchment(s)	Brisbane

The following table identifies available Biodiversity Planning Assessments (BPAs) and Aquatic Conservation Assessments (ACAs) with respect to the AOI.

Table 2: Available Biodiversity Planning and Aquatic Conservation Assessments

Assessment Type	Assessment Area and Version
Biodiversity Planning Assessment(s)	Southeast Queensland v4.1
Aquatic Conservation Assessment(s) (riverine)	South East Queensland Catchments v1.1
Aquatic Conservation Assessment(s) (non-riverine)	South East Queensland Catchments v1.1

Table 3: Remnant regional ecosystems within the AOI as per the Qld Herbarium's 'biodiversity status'

Biodiversity Status	Area (Ha)	% of AOI
Endangered	3.88	0.31
Of concern	6.8	0.54
No concern at present	10.08	0.8

The following table identifies the extent and proportion of the user specified area of interest (AOI) which is mapped as being of "State", "Regional" or "Local" significance via application of the Queensland Department of Environment and Science's *Biodiversity Assessment and Mapping Methodology* (BAMM).

Table 4: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	4.87	0.39
State	6.69	0.53
Regional	0.0	0.0
Local or Other Values	0.0	0.0

Table 5: Non-riverine wetlands intersecting the AOI

Non-riverine wetland types intersecting the area of interest	#
Number of Palustrine wetlands	5
Number of Lacustrine wetlands	1
Total number of non-riverine wetlands	6

NB. The figures presented in the table above are derived from the relevant non-riverine Aquatic Conservation Assessment(s). Later releases of wetland mapping produced via the Queensland Wetland Mapping Program may provide more recent information in regards to wetland extent.

Table 6: Named waterways intersecting the AOI

Name	Permanency
BRISBANE RIVER	Perennial
OXLEY CREEK	Non-perennial

Refer to **Map 1** for general locality information.

The following two tables identify the extent and proportion of the user specified AOI which is mapped as being of "Very High", "High", "Medium", "Low", or "Very Low" aquatic conservation value for riverine and non-riverine wetlands via application of the Queensland Department of Environment and Science's *Aquatic Biodiversity Assessment and Mapping Method* (AquaBAMM).

Table 7: Summary table, aquatic conservation significance (riverine)

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	559.55	44.53
Medium	697.01	55.47
Low	0.0	0.0
Very Low	0.0	0.0

Table 8: Summary table, aquatic conservation significance (non-riverine)

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	7.39	0.59
Medium	3.91	0.31
Low	0.0	0.0
Very Low	0.0	0.0

Biodiversity Planning Assessments

Introduction

The Department of Environment and Science (DES) attributes biodiversity significance on a bioregional scale through a Biodiversity Planning Assessment (BPA). A BPA involves the integration of ecological criteria using the *Biodiversity assessment and Mapping Methodology* (BAMM) and is developed in two stages: 1) **diagnostic criteria**, and 2) **expert panel criteria**. The diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion, while the expert panel criteria allows for the refinement of the mapped information from the diagnostic output by incorporating local knowledge and expert opinion.

The BAMM methodology has application for identifying areas with various levels of significance solely for biodiversity reasons. These include threatened ecosystems or taxa, large tracts of habitat in good condition, ecosystem diversity, landscape context and connection, and buffers to wetlands or other types of habitat important for the maintenance of biodiversity or ecological processes. While natural resource values such as dryland salinity, soil erosion potential or land capability are not dealt with explicitly, they are included to some extent within the biodiversity status of regional ecosystems recognised by the DES.

Biodiversity Planning Assessments (BPAs) assign three levels of overall biodiversity significance.

- **State significance** - areas assessed as being significant for biodiversity at the bioregional or state scales. They also include areas assessed by other studies/processes as being significant at national or international scales. In addition, areas flagged as being of State significance due to the presence of endangered, vulnerable and/or near threatened taxa, are identified as "State Habitat for EVNT taxa".
- **Regional significance** - areas assessed as being significant for biodiversity at the subregional scale. These areas have lower significance for biodiversity than areas assessed as being of State significance.
- **Local significance and/or other values** - areas assessed as not being significant for biodiversity at state or regional scales. Local values are of significance at the local government scale.

For further information on released BPAs and a copy of the underlying methodology, go to:

http://www.qld.gov.au/environment/plants-animals/biodiversity/planning/

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

http://qspatial.information.qld.gov.au/geoportal/

The following table identifies the extent and proportion of the user specified AOI which is mapped as being of "State", "Regional" or "Local" significance via application of the BAMM.

Table 9: Summary table, biodiversity significance

Biodiversity significance	Area (Ha)	% of AOI
State Habitat for EVNT taxa	4.87	0.39
State	6.69	0.53
Regional	0.0	0.0
Local or Other Values	0.0	0.0

Refer to **Map 2** for further information.

Diagnostic Criteria

Diagnostic criteria are based on existing data which is reliable and uniformly available across a bioregion. These criteria are diagnostic in that they are used to filter the available data and provide a "first-cut" or initial determination of biodiversity significance. This initial assessment is then combined through a second group of other essential criteria.

A description of the individual diagnostic criteria is provided in the following sections.

Criteria A. Habitat for EVNT taxa: Classifies areas according to their significance based on the presence of endangered, vulnerable and/or rare (EVNT) taxa. EVNT taxa are those scheduled under the *Nature Conservation Act 1992* and/or the

Environment Protection and Biodiversity Conservation Act 1999. It excludes highly mobile fauna taxa which are instead considered in Criterion H and brings together information on EVNT taxa using buffering of recorded sites or habitat suitability models (HSM) where available.

Criteria B. Ecosystem value: Classifies on the basis of biodiversity status of regional ecosystems, their extent in protected areas (presence of poorly conserved regional ecosystems), the presence of significant wetlands; and areas of national importance such as the presence of Threatened Ecological Communities, World Heritage areas and Ramsar sites. Ecosystem value is applied at a bioregional (**B1**) and regional (**B2**) scale.

Criteria C. Tract size: Measures the relative size of tracts of vegetation in the landscape. The size of any tract is a major indicator of ecological significance, and is also strongly correlated with the long-term viability of biodiversity values. Larger tracts are less susceptible to ecological edge effects and are more likely to sustain viable populations of native flora and fauna than smaller tracts.

Criteria D. Relative size of regional ecosystems: Classifies the relative size of each regional ecosystem unit within its bioregion (**D1**) and its subregion (**D2**). Remnant units are compared with all other occurrences with the same regional ecosystem. Large examples of a regional ecosystem are more significant than smaller examples of the same regional ecosystem because they are more representative of the biodiversity values particular to the regional ecosystem, are more resilient to the effects of disturbance, and constitute a significant proportion of the total area of the regional ecosystem.

Criteria F. Ecosystem diversity: Is an indicator of the number of regional ecosystems occurring within an area. An area with high ecosystem diversity will have many regional ecosystems and ecotones relative to other areas within the bioregion.

Criteria G. Context and connection: Represents the extent to which a remnant unit incorporates, borders or buffers areas such as significant wetlands, endangered ecosystems; and the degree to which it is connected to other vegetation.

A summary of the biodiversity status based upon the diagnostic criteria is provided in the following table.

Table 10: Summary of biodiversity significance based upon diagnostic criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant contains at least 1 Endangered or 2 Vulnerable or Near Threatened species (A)	4.49	0.36
State	Remnant contains at least 1 Endangered or 2 Vulnerable or Near Threatened species (A) & Nat. Threatened Ecol. Community (B1)	0.38	0.03
State	Remnant contains at least 1 Endangered RE (B1) & Nat. Threatened Ecol. Community (B1)	1.45	0.12
Regional	Remnant contains at least 1 RE with <10 pc extent remaining or rare in subregion (B2)	5.24	0.42

Assessment of diagnostic criteria with respect to the AOI

The following table reflects an assessment of the individual diagnostic criteria noted above in regards to the AOI.

Table 11: Assessment of individual diagnostic criteria with respect to the AOI

Diagnostic Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
A: Habitat for EVNT Taxa	4.87	0.4	1.45	0.1	5.24	0.4		
B1: Ecosystem Value (Bioregion)	1.83	0.1	1.05	0.1			8.68	0.7
B2: Ecosystem Value (Subregion)	10.51	0.8	1.05	0.1				
C: Tract Size							11.56	0.9
D1: Relative RE Size (Bioregion)							11.56	0.9
D2: Relative RE Size (Subregion)	8.68	0.7					2.88	0.2
F: Ecosystem Diversity			1.83	0.1	8.68	0.7	1.05	0.1
G: Context and Connection	8.23	0.7			2.28	0.2	1.05	0.1

Other Essential Criteria

Other essential criteria (also known as expert panel criteria) are based on non-uniform information sources and which may rely more upon expert opinion than on quantitative data. These criteria are used to provide a "second-cut" determination of biodiversity significance, which is then combined with the diagnostic criteria for an overall assessment of relative biodiversity significance. A summary of the biodiversity status based upon the other essential criteria is provided in the following table.

Table 12: Summary of biodiversity significance based upon other essential criteria with respect to the AOI

Biodiversity significance	Description	Area (Ha)	% of AOI
State	Remnant contains Core Habitat for Priority Taxa (H)	1.05	0.08
State	Remnant contains Core Habitat for Priority Taxa (H) & Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I)	1.45	0.12
State	Remnant contains Core Habitat for Priority Taxa (H) & Remnant forms part of a bioregional corridor (J)	8.68	0.69
State	Remnant contains Special Biodiversity Values (view Expert Panel data for further information) (I) & Remnant forms part of a bioregional corridor (J)	0.38	0.03

A description of each of the other essential criteria and associated assessment in regards to the AOI is provided in the following sections.

Criteria H. Essential and general habitat for priority taxa: Priority taxa are those which are at risk or of management concern, taxa of scientific interest as relictual (ancient or primitive), endemic taxa or locally significant populations (such as a flying fox camp or heronry), highly specialised taxa whose habitat requirements are complex and distributions are not well correlated with any particular regional ecosystem, taxa important for maintaining genetic diversity (such as complex spatial patterns of genetic variation, geographic range limits, highly disjunct populations), taxa critical for management or monitoring of biodiversity (functionally important or ecological indicators), or economic and culturally important taxa.

Criteria I. Special biodiversity values: areas with special biodiversity values are important because they contain multiple taxa in a unique ecological and often highly biodiverse environment. Areas with special biodiversity values can include the following:

- Ia - centres of endemism - areas where concentrations of taxa are endemic to a bioregion or subregion are found.
- Ib - wildlife refugia (Morton *et al*. 1995), for example, islands, mound springs, caves, wetlands, gorges, mountain ranges and topographic isolates, ecological refuges, refuges from exotic animals, and refuges from clearing. The latter may include large areas that are not suitable for clearing because of land suitability/capability.
- Ic - areas with concentrations of disjunct populations.
- Id - areas with concentrations of taxa at the limits of their geographic ranges.
- Ie - areas with high species richness.
- If - areas with concentrations of relictual populations (ancient and primitive taxa).
- Ig - areas containing REs with distinct variation in species composition associated with geomorphology and other environmental variables.
- Ih - an artificial waterbody or managed/manipulated wetland considered by the panel/s to be of ecological significance.
- Ii - areas with a high density of hollow-bearing trees that provide habitat for animals.
- Ij - breeding or roosting sites used by a significant number of individuals.
- Ik - climate change refuge.

The following table identifies the value and extent area of the Other Essential Criteria H and I within the AOI.

Table 13: Relative importance of expert panel criteria (H and I) used to access overall biodiversity significance with respect to the AOI

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
H: Core Habitat Priority Taxa	11.18	0.9			0.38			
Ia: Centres of Endemism	1.83	0.1						
Ib: Wildlife Refugia	1.83	0.1						

Expert Panel	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
Ic: Disjunct Populations								
Id: Limits of Geographic Ranges								
Ie: High Species Richness								
If: Relictual Populations								
Ig: Variation in Species Composition								
Ih: Artificial Wetland								
Ii: Hollow Bearing Trees								
Ij: Breeding or Roosting Site								
Ik: Climate Refugia								

NB. Whilst biodiversity values associated with Criteria I may be present within the site (refer to tables 12 and 15), for the New England Tableland and Central Queensland Coast BPAs, area and % area figures associated with Criteria Ia through to Ij cannot be listed in the table above (due to slight variations in data formats between BPAs).

Criteria J. Corridors: areas identified under this criterion qualify either because they are existing vegetated corridors important for contiguity, or cleared areas that could serve this purpose if revegetated. Some examples of corridors include riparian habitats, transport corridors and "stepping stones".

Bioregional and subregional conservation corridors have been identified in the more developed bioregions of Queensland through the BPAs, using an intensive process involving expert panels. Map 3 displays the location of corridors as identified under the Statewide Corridor network. The Statewide Corridor network incorporates BPA derived corridors and for bioregions where no BPA has been assessed yet, corridors derived under other planning processes. *Note: as a result of updating and developing a statewide network, the alignment of corridors may differ slightly in some instances when compared to those used in individual BPAs.*

The functions of these corridors are:

- **Terrestrial** Bioregional corridors, in conjunction with large tracts of remnant vegetation, maintain ecological and evolutionary processes at a landscape scale, by:

  • Maintaining long term evolutionary/genetic processes that allow the natural change in distributions of species and connectivity between populations of species over long periods of time;

  • Maintaining landscape/ecosystems processes associated with geological, altitudinal and climatic gradients, to allow for ecological responses to climate change;

  • Maintaining large scale seasonal/migratory species processes and movement of fauna;

  • Maximising connectivity between large tracts/patches of remnant vegetation;

  • Identifying key areas for rehabilitation and offsets; and

- **Riparian** Bioregional Corridors also maintain and encourage connectivity of riparian and associated ecosystems.

The location of the corridors is determined by the following principles:

- Terrestrial

  • Complement riparian landscape corridors (i.e. minimise overlap and maximise connectivity);

  • Follow major watershed/catchment and/or coastal boundaries;

- Incorporate major altitudinal/geological/climatic gradients;
- Include and maximise connectivity between large tracts/patches of remnant vegetation;
- Include and maximise connectivity between remnant vegetation in good condition; and

- Riparian
  - Located on the major river or creek systems within the bioregion in question.

The total extent of remnant vegetation triggered as being of "State", "Regional" or "Local" significance due to the presence of an overlying BPA derived terrestrial or riparian corridor within the AOI, is provided in the following table. For further information on how remnant vegetation is triggered due to the presence of an overlying BPA derived corridor, refer to the relevant landscape BPA expert panel report(s).

Table 14: Extent of triggered remnant vegetation due to the presence of BPA derived corridors with respect to the AOI

Biodiversity Significance	Area (Ha)	% of AOI
State	9.06	0.72
Regional	0.0	0.0
Local	0.0	0.0

NB: area figures associated with the extent of corridor triggered remnant vegetation are only available for those bioregions where a BPA has been undertaken.

Refer to **Map 3** for further information.

Threatening process/condition (Criteria K) - areas identified by experts under this criterion may be used to amend (upgrade or downgrade) biodiversity significance arising from the "first-cut" analysis. The condition of remnant vegetation is affected by threatening processes such as weeds, ferals, grazing and burning regime, selective timber harvesting/removal, salinity, soil erosion, and climate change.

Assessment of Criteria K with respect to the AOI is not currently included in the "Biodiversity and Conservation Values" report, as it has not been applied to the majority of Queensland due to data/information limitations and availability.

Special Area Decisions

Expert panel derived "Special Area Decisions" are used to assign values to Other Essential Criteria. The specific decisions which relate to the AOI in question are listed in the table below.

Table 15: Expert panel decisions for assigning levels of biodiversity significance with respect to the AOI

Decision Number	Description	Panel Recommended Significance	Criteria Values
seq_fa_02	Lowland rainforest & wet sclerophyll forest	State	Ib (wildlife refugia): VERY HIGH
seqs_fl_84	Lowland riparian /gallery rainforest in the southern SEQ Bioregion	State	Ia (SEQ endemic taxa): VERY HIGH Ib (wildlife refugia): VERY HIGH
seqs_l_49	Riparian bioregional corridors	State	Criterion J

Expert panel decision descriptions:

seq_fa_02

Across the entire bioregion, all rainforest and wet sclerophyll forest with a rainforest understory at elevations of < 300m asl be designated as being of State significance. Based on importance for mesic fauna (e.g. Richmond birdwing Ornithoptera richmondia, giant barred-frog Mixophyes iteratus, Fleay's barred-frog Mixophyes fleayi, Coxen's fig-parrot Cyclopsitta diophthalma coxeni), and as drought/fire refugia.

seqs_fl_84

Localised linear patches of lowland riparian rainforest in fragmented landscapes in the southern part of the bioregion. They provide refugia for animal and plant species more commonly associated with the higher rainfall parts of SEQ.

SEQ endemic taxa (Criterion Ia):

Wildlife refugia (Criterion Ib):

Note: refer also to seqs_fl_02 and seqs_fl_19 for specific values associated with riparian rainforest communities within southern Gold Coast and Nambour areas respectively.

seqs_l_49

The riparian bioregional corridors provide connectivity through lowland areas of SEQ.

See Table 4 for list of waterways considered riparian corridors.

For further information, refer to sections 2.3.2 and 3.2 of this report.

Aquatic Conservation Assessments

Introduction

The Aquatic Biodiversity Assessment and Mapping Method or AquaBAMM (Clayton *et al.* 2006), was developed to assess conservation values of wetlands in queensland, and may also have application in broader geographical contexts. It is a comprehensive method that uses available data, including data resulting from expert opinion, to identify relative wetland conservation/ecological values within a specified study area (usually a catchment). The product of applying this method is an Aquatic Conservation Assessment (ACA) for the study area.

An ACA using AquaBAMM is non-social, non-economic and identifies the conservation/ecological values of wetlands at a user-defined scale. It provides a robust and objective conservation assessment using criteria, indicators and measures that are founded upon a large body of national and international literature. The criteria, each of which may have variable numbers of indicators and measures, are naturalness (aquatic), naturalness (catchment), diversity and richness, threatened species and ecosystems, priority species and ecosystems, special features, connectivity and representativeness. An ACA using AquaBAMM is a powerful decision support tool that is easily updated and simply interrogated through a geographic information system (GIS).

Where they have been conducted, ACAs can provide a source of baseline wetland conservation/ecological information to support natural resource management and planning processes. They are useful as an independent product or as an important foundation upon which a variety of additional environmental and socio-economic elements can be added and considered (i.e. an early input to broader 'triple-bottom-line' decision-making processes). An ACA can have application in:

- determining priorities for protection, regulation or rehabilitation of wetlands and other aquatic ecosystems
- on-ground investment in wetlands and other aquatic ecosystems
- contributing to impact assessment of large-scale development (e.g. dams)
- water resource and strategic regional planning prcesses

For a detailed explanation of the methodology please refer to the summary and expert panel reports relevant to the ACA utilised in this assessment. These reports can be accessed at Wetland *Info*:

http://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca

The GIS results can be downloaded from the Queensland Spatial Catalogue at:

http://qspatial.information.qld.gov.au/geoportal/

Explanation of Criteria

Under the AquaBAMM, eight criteria are assessed to derive an overall conservation value. Similar to the Biodiversity Assessment and Mapping Methodology, the criteria may be primarily diagnostic (quantitative) or primarily expert opinion (qualitative) in nature. The following sections provide a brief description of each of the 8 criteria.

Criteria 1. Naturalness - Aquatic: This attribute reflects the extent to which a wetland's (riverine, non-riverine, estuarine) aquatic state of naturalness is affected through relevant influencing indicators which include: presence of exotic flora and fauna; presence of aquatic communities; degree of habitat modification and degree of hydrological modification.

Criteria 2. Naturalness - Catchment: The naturalness of the terrestrial systems of a catchment can have an influence on many wetland characteristics including: natural ecological processes e.g. nutrient cycling, riparian vegetation, water chemistry, and flow. The indicators utilised to assess this criterion include: presence of exotic flora and/or fauna; riparian, catchment and flow modification.

Criteria 3. Naturalness - Diversity and Richness: This criterion is common to many ecological assessment methods and can include both physical and biological features. It includes such indicators as species richness, riparian ecosystem richness and geomorphological diversity.

Criteria 4. Threatened Species and Ecosystems: This criterion evaluates ecological rarity characteristics of a wetland. This includes both species rarity and rarity of communities / assemblages. The communities and assemblages are best represented by regional ecosystems. Species rarity is determined by NCA and EPBC status with Endangered, Vulnerable or Near-threatened species being included in the evaluation. Ecosystem rarity is determined by regional ecosystem biodiversity status i.e. Endangered, Of Concern, or Not of Concern.

Criteria 5. Priority Species and Ecosystems: Priority flora and fauna species lists are expert panel derived. These are aquatic, semi-aquatic and riparian species which exhibit at least 1 particular trait in order to be eligible for consideration. For flora species the traits included:

- It forms significant macrophyte beds (in shallow or deep water).
- It is an important food source.
- It is important/critical habitat.
- It is implicated in spawning or reproduction for other fauna and/or flora species.
- It is at its distributional limit or is a disjunct population.
- It provides stream bank or bed stabilisation or has soil binding properties.
- It is a small population and subject to threatening processes.

Fauna species are included if they meet at least one of the following traits:

- It is endemic to the study area (>75 per cent of its distribution is in the study area/catchment).
- It has experienced, or is suspected of experiencing, a serious population decline.
- It has experienced a significant reduction in its distribution and has a naturally restricted distribution in the study area/catchment.
- It is currently a small population and threatened by loss of habitat.
- It is a significant disjunct population.
- It is a migratory species (other than birds).
- A significant proportion of the breeding population (>one per cent for waterbirds, >75 per cent other species) occurs in the waterbody (see Ramsar criterion 6 for waterbirds).
- Limit of species range.

See the individual expert panel reports for the priority species traits specific to an ACA.

Criteria 6. Special Features: Special features are areas identified by flora, fauna and ecology expert panels which exhibit characteristics beyond those identified in other criteria and which the expert panels consider to be of the highest ecological importance. Special feature traits can relate to, but are not solely restricted to geomorphic features, unique ecological processes, presence of unique or distinct habitat, presence of unique or special hydrological regimes e.g. spring-fed streams. Special features are rated on a 1 - 4 scale (4 being the highest).

Criteria 7. Connectivity: This criterion is based on the concept that appropriately connected aquatic ecosystems are healthy and resilient, with maximum potential biodiversity and delivery of ecosystem services.

Criteria 8. Representativeness: This criterion applies primarily to non-riverine assessments, evaluates the rarity and uniqueness of a wetland type in relation to specific geographic areas. Rarity is determined by the degree of wetland protection within "protected Areas" estate or within an area subject to the *Fisheries Act 1994*, *Coastal Protection and Management Act 1995*, or *Marine Parks Act 2004*. Wetland uniqueness evaluates the relative abundance and size of a wetland or wetland management group within geographic areas such as catchment and subcatchment.

Riverine Wetlands

Riverine wetlands are all wetlands and deepwater habitats within a channel. The channels are naturally or artificially created, periodically or continuously contain moving water, or connecting two bodies of standing water. AquaBAMM, when applied to riverine wetlands uses a discrete spatial unit termed subsections. A subsection can be considered as an area which encompasses discrete homogeneous stream sections in terms of their natural attributes (i.e. physical, chemical, biological and utilitarian values) and natural resources. Thus in an ACA, an aquatic conservation significance score is calculated for each subsection and applies to all streams within a subsection, rather than individual streams as such.

Please note, the area figures provided in Tables 16 and 17, are derived using the extent of riverine subsections within the AOI. Refer to **Map 5** for further information. A summary of the conservation significance of riverine wetlands within the AOI is provided in the following table.

Table 16: Overall level/s of riverine aquatic conservation significance

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0

Aquatic conservation significance (riverine wetlands)	Area (Ha)	% of AOI
High	559.55	44.53
Medium	697.01	55.47
Low	0.0	0.0
Very Low	0.0	0.0

The individual aquatic conservation criteria ratings for riverine wetlands within the AOI are listed below.

Table 17: Level/s of riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic					1,256.56	100.0		
2. Naturalness catchment			356.62	28.4	899.94	71.6		
3. Diversity and richness	5.37	0.4	457.44	36.4	793.75	63.2		
4. Threatened species and ecosystems	351.25	28.0	905.31	72.0				
5. Priority species and ecosystems	214.31	17.1	351.25	28.0	691.0	55.0		
6. Special features			559.54	44.5				
7. Connectivity			23.58	1.9	1,232.98	98.1		
8. Representative-ness								

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to riverine wetlands within the AOI.

Table 18: Expert panel decisions for assigning overall levels of riverine aquatic conservation significance

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
bs_r_ec_04	High energy lotic systems	Brisbane Lower	6.1.1	3
bs_r_ec_07	Brisbane Deep pools for drought refuge	Brisbane Lower	6.3.1	3

4 is the highest rating/value

Expert panel decision descriptions:

bs_r_ec_04

Boulder to cobble bed stretches in stream beds providing pool and riffle environments. Provide diversity in substrate habitat and a highly oxygenated, self-cleaning system. Believed to be some examples downstream from Wivenhoe and Somerset dams and below other major infrastructure; regulated flow in these locations can result in enhanced biodiversity relative to natural state. Not all examples will have high ecological value due to other factors e.g. water quality. Activities that remove boulders and stones cause degradation.

bs_r_ec_07

Deep pools for drought refuge.

Non-riverine Wetlands

Non-riverine wetlands include both lacustrine and palustrine wetlands, however, do not currently incorporate estuarine, marine or subterranean wetland types. A summary of the conservation significance of non-riverine wetlands within the AOI is provided in the following table. Refer to **Map 6** for further information.

Table 19: Overall level/s of non-riverine aquatic conservation significance

Aquatic conservation significance (non-riverine wetlands)	Area (Ha)	% of AOI
Very High	0.0	0.0
High	7.39	0.59
Medium	3.91	0.31
Low	0.0	0.0
Very Low	0.0	0.0

The following table provides an assessment of non-riverine wetlands within the AOI and associated aquatic conservation criteria values.

Table 20: Level/s of non-riverine aquatic conservation significance based on selected criteria

Criteria	Very High Rating - Area (Ha)	Very High Rating - % of AOI	High Rating - Area (Ha)	High Rating - % of AOI	Medium Rating - Area (Ha)	Medium Rating - % of AOI	Low Rating - Area (Ha)	Low Rating - % of AOI
1. Naturalness aquatic			5.48	0.4			5.83	0.5
2. Naturalness catchment			0.03		11.28	0.9		
3. Diversity and richness	6.04	0.5	5.27	0.4				
4. Threatened species and ecosystems	1.91	0.2	2.04	0.2	7.36	0.6		
5. Priority species and ecosystems	6.04	0.5	5.27	0.4				
6. Special features					2.04	0.2		
7. Connectivity	9.27	0.7						
8. Representative-ness	3.79	0.3	5.48	0.4				

The table below lists and describes the relevant expert panel decisions used to assign conservation significance values to non-riverine wetlands within the AOI.

Table 21: Expert panel decisions for assigning overall levels of non-riverine aquatic conservation significance.

Decision number	Special feature	Catchment	Criteria/Indicator/Measure	Conservation rating (1-4)
bs_nr_ec_06	Ecologically Significant Wetlands	Brisbane Lower	6.3.3	2

4 is the highest rating/value

Expert panel decision descriptions:

bs_nr_ec_06

Freshwater Wetlands (OX/040), Wetlands (OX/060) ,Beryl Roberts Park , Stable Swamp Creek (SS/070) , Rocky Water Holes Wetland (R/010), Pallara Parklands (OX/050), Marshall Rd Wetland (SS/020), Archerfield Wetlands reep_bcc_9

Threatened and Priority Species

Introduction

This chapter contains a list of threatened and priority flora and/or fauna species that have been recorded on, or within 4km of the Assessment Area.

The information presented in this chapter with respect to species presence is derived from compiled databases developed primarily for the purpose of BPAs and ACAs. Data is collated from a number of sources and is updated periodically.

It is important to note that the list of species provided in this report, may differ when compared to other reports generated from other sources such as the State government's WildNet, Herbrecs or the federal government's EPBC database for a number of reasons.

Records for threatened and priority species are filtered and checked based on a number of rules including:

- Taxonomic nomenclature - current scientific names and status,
- Location - cross-check co-ordinates with location description,
- Taxon by location - requires good knowledge of the taxon and history of the record,
- Duplicate records - identify and remove,
- Expert panels - check records and provide new records,
- Flora cultivated records excluded,
- Use precise records less than or equal to 2000m,
- Use recent records greater than or equal to 1975 animals, greater than or equal to 1950 plants.

Threatened Species

Threatened species are those species classified as "Endangered" or "Vulnerable" under the *Environment Protection and Biodiversity Conservation Act 1999* or "Endangered", "Vulnerable" or "Near threatened" under the *Nature Conservation Act 1992*.

The following threatened species have been recorded on, or within approximately 4km of the AOI.

Table 22: Threatened species recorded on, or within 4km of the AOI

Species	Common name	NCA status	EPBC status	Back on Track rank	Migratory species*	Wetland species**	Identified flora/fauna
Adelotus brevis	tusked frog	V		Medium		Y	FA
Charadrius leschenaultii	greater sand plover	V	V	Low	Y	Y	FA
Charadrius mongolus	lesser sand plover	E	E	Low	Y	Y	FA
Eucalyptus curtisii	Plunkett mallee	NT		Low			FL
Gossia gonoclada		E	E	Medium			FL
Grevillea venusta	grevillea	V		High			FL
Lathamus discolor	swift parrot	E	CE	Medium			FA
Lilaeopsis brisbanica		E		High		Y	FL
Macadamia tetraphylla		V	V	Medium			FL
Ninox strenua	powerful owl	V		Medium			FA
Numenius madagascariensis	eastern curlew	E	CE	Low	Y	Y	FA
Ornithoptera richmondia	Richmond birdwing	V		Critical			FA

Species	Common name	NCA status	EPBC status	Back on Track rank	Migratory species*	Wetland species**	Identified flora/fauna
Petauroides volans	greater glider	V	V	Low			FA
Petauroides volans volans	southern greater glider	V	V				FA
Phascolarctos cinereus	koala	V	V	Low			FA
Phascolarctos cinereus	Koala	V	V	Low			FA
Pteropus poliocephalus	grey-headed flying-fox	C	V	Critical			FA
Symplocos harroldii	hairy hazelwood	NT		Low			FL

NB. Please note that the threatened species listed in this section are based upon the most recently compiled DES internal state-wide threatened species dataset. This dataset may contain additional records that were not originally available for inclusion in the relevant individual BPAs and ACAs.

**JAMBA - Japan-Australia Migratory Bird Agreement; CAMBA - China-Australia Migratory Bird Agreement; ROKAMBA - Republic of Korea-Australia Migratory Bird Agreement; CMS - Convention on the Conservation of Migratory Species*.

***Y - wetland indicator species*.

BPA Priority Species

A list of BPA priority species that have been recorded on, or within approximately 4km of the AOI is contained in the following table.

Table 23: Priority species recorded on, or within 4km of the AOI

Species	Common name	Back on Track rank	Identified flora/fauna
Cheramoeca leucosterna	White-backed Swallow	L	FA
Cherax dispar	Lobby	L	FA
Ctenotus arcanus	None	L	FA
Cyclorana brevipes	Superb Collared Frog	L	FA
Ephippiorhynchus asiaticus	Black-necked Stork	L	FA
Eroticoscincus graciloides	None	M	FA
Gossia hillii	None	None	FL
Griffithsina brisbanica	Brisbane Carnivorous Snail	None	FA
Hedleyella maconelli	Maconell's Panda-snail	None	FA
Ixobrychus dubius	Australian Little Bittern	DD	FA
Litoria dentata	Bleating Treefrog	L	FA
Litoria tyleri	Southern Laughing Treefrog	L	FA
Lophoictinia isura	Square-tailed Kite	L	FA
Macropus dorsalis	Black-striped Wallaby	L	FA
Melaleuca quinquenervia	swamp paperbark	None	FL
Melithreptus gularis	Black-chinned Honeyeater	L	FA
Mugil cephalus	Sea Mullet	L	FA
Nautiliropa omicron	Red-flamed Pinwheel Snail	None	FA
Onthophagus sp. nov. CQ8	dung beetle	None	FA

Species	Common name	Back on Track rank	Identified flora/fauna
Ophioscincus ophioscincus	None	L	FA
Ornithorhynchus anatinus	Platypus	L	FA
Pomatostomus temporalis	Grey-crowned Babbler	None	FA
Pteropus alecto	Black Flying-fox	L	FA
Pteropus scapulatus	Little Red Flying-fox	L	FA
Trachystoma petardi	Pinkeye Mullet	L	FA

NB. Please note that the list of priority species is based on those species identified in the BPAs, however records for these species may be more recent than the originals used. furthermore, the BPA priority species databases are updated from time to time. At each update, the taxonomic details for all species are amended as necessary to reflect current taxonomic name and/or status changes.

ACA Priority Species

A list of ACA priority species used in riverine and non-riverine ACAs that have been recorded on, or within approximately 4km of the AOI are contained in the following tables.

Table 24: Priority species recorded on, or within 4 km of the AOI - riverine

Species	Common name	Back on Track rank	Identified flora/fauna
Acrocephalus australis	Australian Reed-Warbler	Low	FA
Anguilla australis	Southern Shortfin Eel	Low	FA
Anguilla reinhardtii	Longfin Eel	Low	FA
Ardea alba modesta	Eastern Great Egret	Low	FA
Baumea articulata	jointed twigrush	None	FL
Bubulcus ibis	Cattle Egret	Low	FA
Castanospermum australe	black bean	None	FL
Casuarina glauca	swamp she-oak	None	FL
Eucalyptus tereticornis	None	None	FL
Ficus fraseri	white sandpaper fig	None	FL
Gallinago hardwickii	Latham's Snipe	Low	FA
Haliaeetus leucogaster	White-bellied Sea-Eagle	Low	FA
Hydroprogne caspia	Caspian Tern	Low	FA
Ixobrychus dubius	Australian Little Bittern	Data Deficient	FA
Melaleuca bracteata	None	None	FL
Melaleuca quinquenervia	swamp paperbark	None	FL
Mugil cephalus	Sea Mullet	Low	FA
Ornithorhynchus anatinus	Platypus	Low	FA
Pandion cristatus	Eastern Osprey	Low	FA
Trachystoma petardi	Pinkeye Mullet	Low	FA
Typha domingensis	None	None	FL
Typha orientalis	broad-leaved cumbungi	None	FL
Waterhousea floribunda	weeping lilly pilly	None	FL

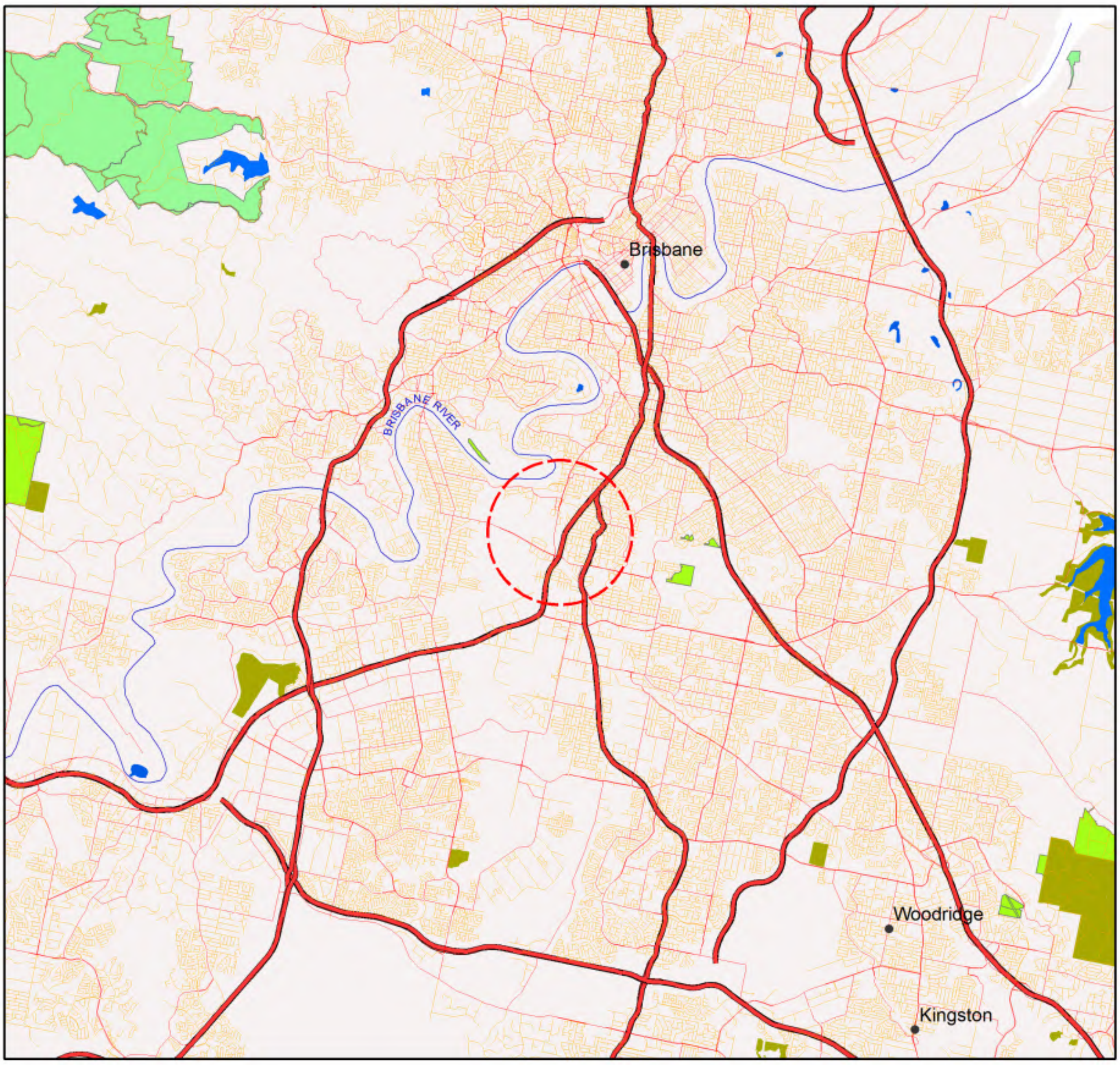
Table 25: Priority species recorded on, or within 4 km of the AOI - non-riverine

Species	Common name	Back on Track rank	Identified flora/fauna
Acrocephalus australis	Australian Reed-Warbler	Low	FA
Anguilla australis	Southern Shortfin Eel	Low	FA
Anguilla reinhardtii	Longfin Eel	Low	FA
Ardea alba modesta	Eastern Great Egret	Low	FA
Baumea articulata	jointed twigrush	None	FL
Bubulcus ibis	Cattle Egret	Low	FA
Calidris acuminata	Sharp-tailed Sandpiper	Low	FA
Cherax dispar	Lobby	Low	FA
Cyclorana brevipes	Superb Collared Frog	Low	FA
Eucalyptus tereticornis	None	None	FL
Gahnia clarkei	tall sawsedge	None	FL
Gallinago hardwickii	Latham's Snipe	Low	FA
Haliaeetus leucogaster	White-bellied Sea-Eagle	Low	FA
Hydroprogne caspia	Caspian Tern	Low	FA
Ixobrychus dubius	Australian Little Bittern	Data Deficient	FA
Melaleuca bracteata	None	None	FL
Melaleuca quinquenervia	swamp paperbark	None	FL
Ornithorhynchus anatinus	Platypus	Low	FA
Pandion cristatus	Eastern Osprey	Low	FA
Plegadis falcinellus	Glossy Ibis	Low	FA
Tringa glareola	Wood Sandpiper	Low	FA
Tringa stagnatilis	Marsh Sandpiper	Low	FA
Typha domingensis	None	None	FL
Typha orientalis	broad-leaved cumbungi	None	FL

NB. Please note that the priority species records used in the above two tables are comprised of those adopted for the released individual ACAs. The ACA riverine and non-riverine priority species databases are updated from time to time to reflect new release of ACAs. At each update, the taxonomic details for all ACAs records are amended as necessary to reflect current taxonomic name and/or status changes.

Maps

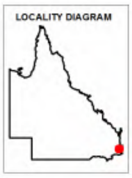
Map 1 - Locality Map



Locality Map

Legend

- 2 kilometre buffer
- Towns
- Highway
- Connector
- Street/Local Road
- Reservoirs
- Lakes
- National Park (Scientific)
- National Park
- National Park (CYPAL)
- Conservation Park
- Resources Reserve
- Forest Reserve
- State Forest
- Timber Reserve
- Nature Refuges
- Coordinated Conservation Areas
- Major rivers/creeks
- Queensland



N

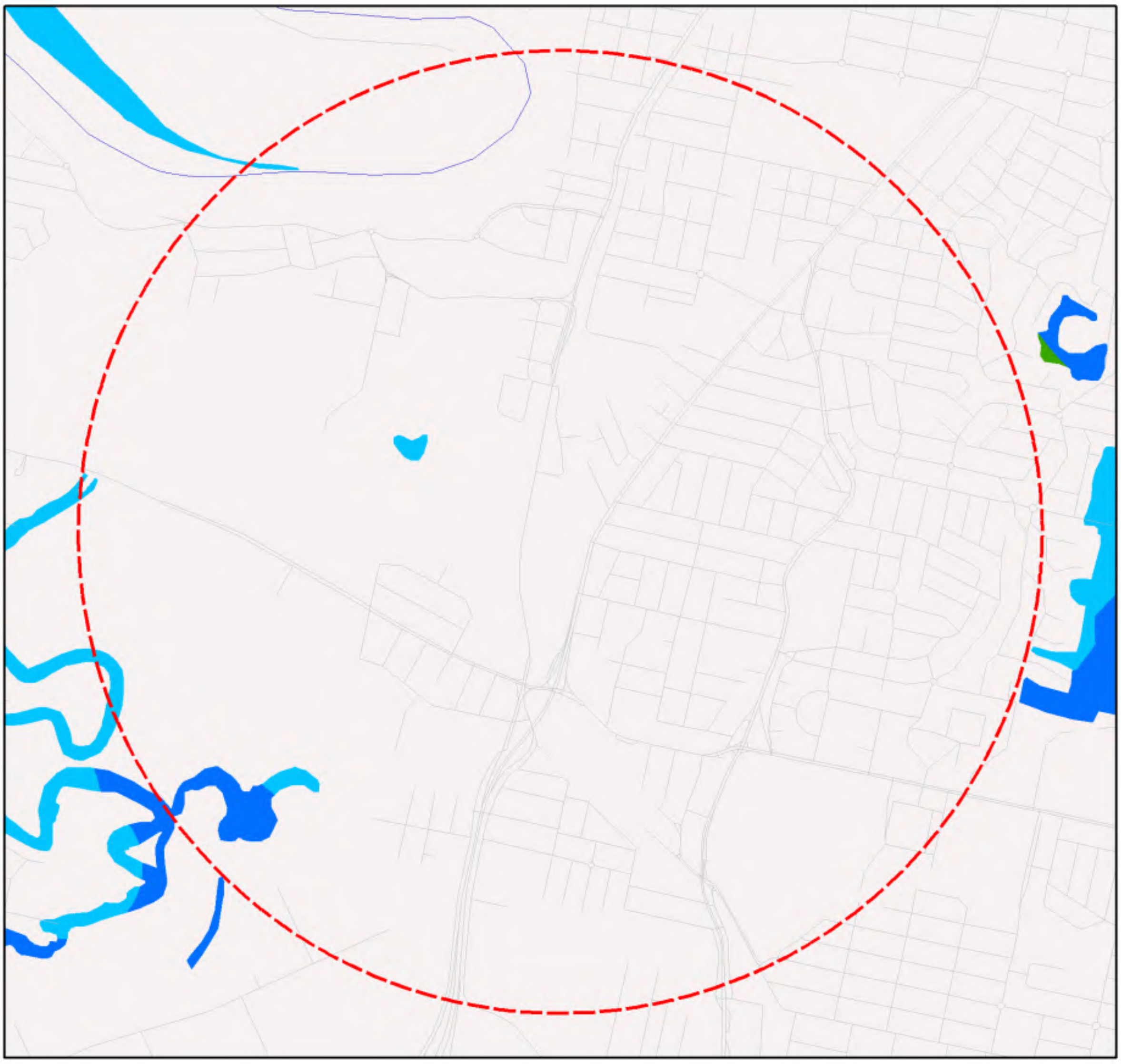
DISCLAIMER:
Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, the State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

The state of Queensland disclaims all responsibility for information contained in this product and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

0 1600 3200 4800 6400 8000 m

This product is projected into GDA 1994 Queensland Albers

Map 2 - Biodiversity Planning Assessment (BPA)



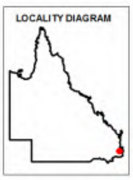
Biodiversity Planning Assessments

Legend

- 2 kilometre buffer
- Towns
- Roads
- Major rivers/creeks
- Queensland

Biodiversity Planning Assessment

- State Habitat for EVNT taxa
- State
- Regional
- Local or Other Values
- Non Bioregion Ecosystem



N

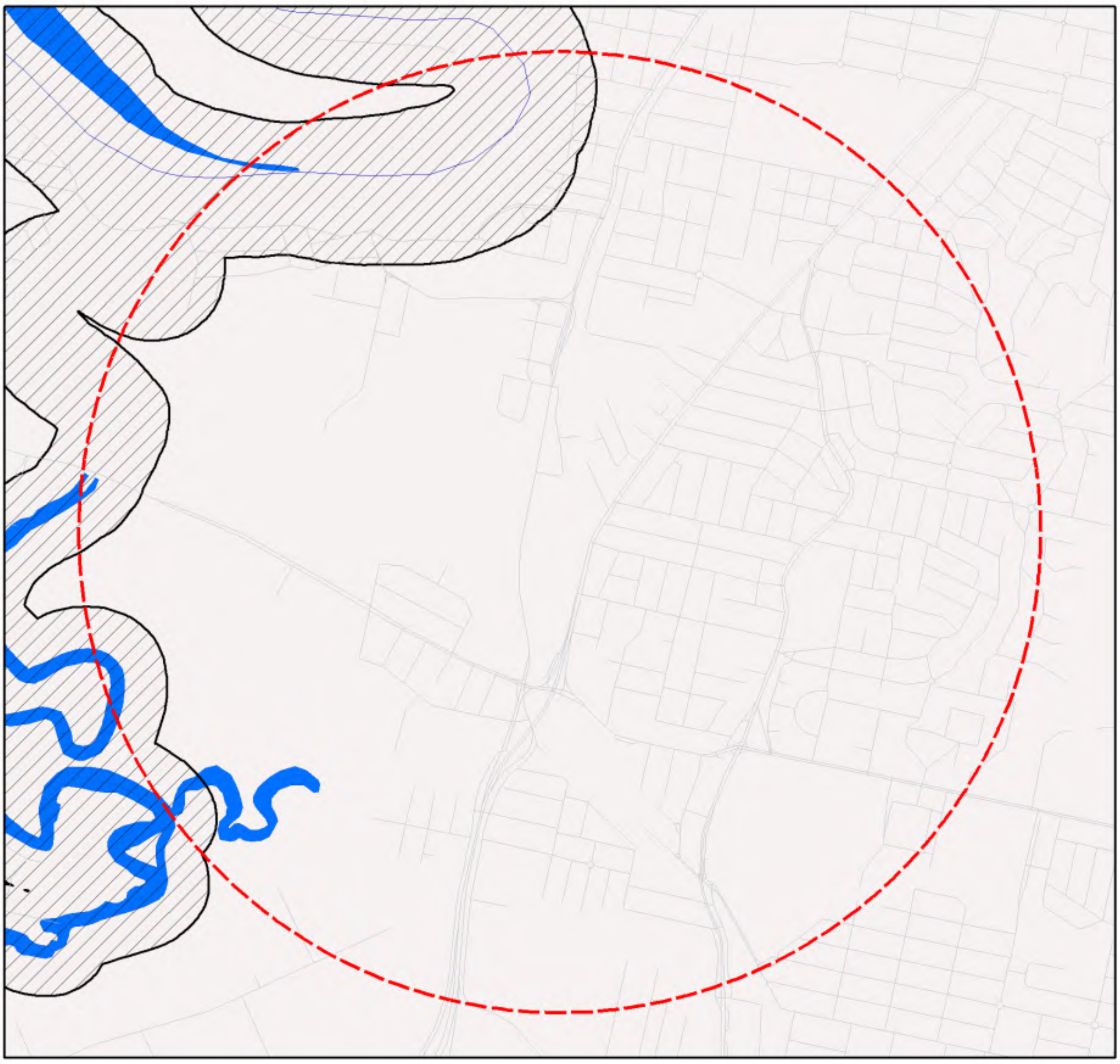
0 250 500 750 1000 1250 m

DISCLAIMER:
Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, the State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

The state of Queensland disclaims all responsibility for information contained in this product and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any wayfor any reason.

This product is projected into GDA 1994 Queensland Albers

Map 3 - Corridors



Corridors

Legend

2 kilometre buffer
Towns
Roads
Major rivers/creeks
Queensland

Corridors

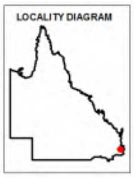
State
Regional

Corridor Triggered Vegetation

State
Regional
Local

Core Area Vegetation

Brigalow Belt only

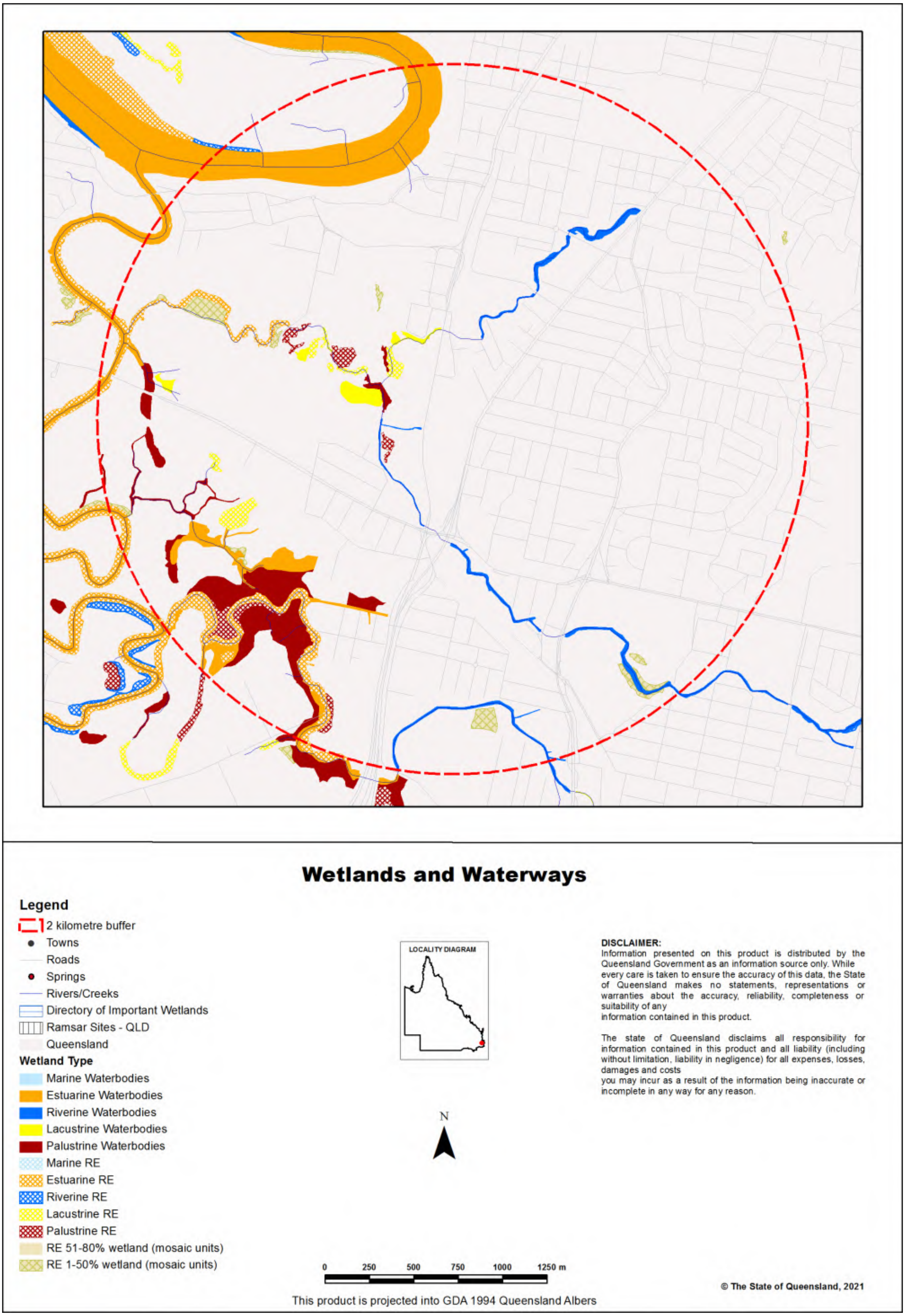


N

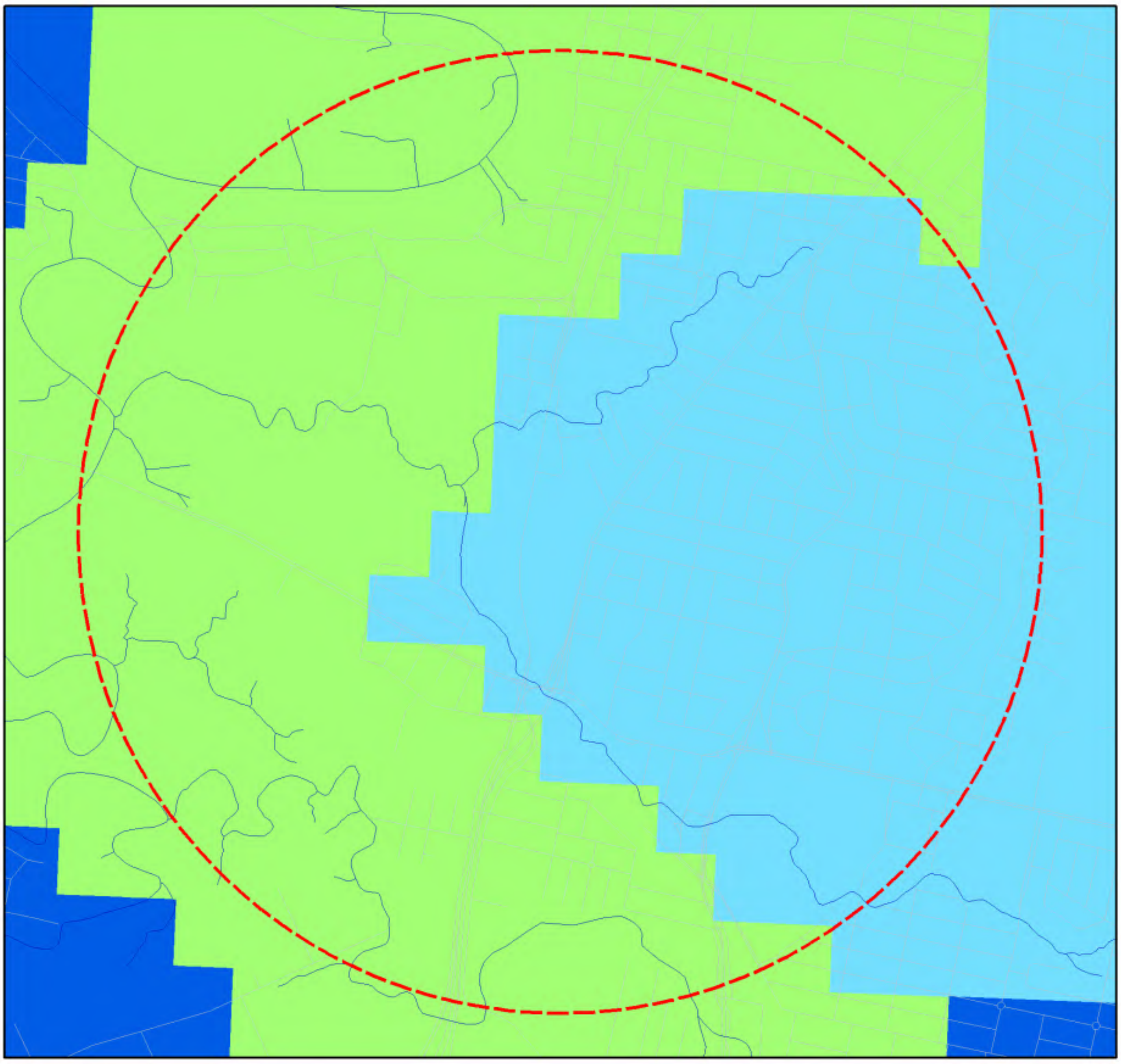
0 250 500 750 1000 1250 m

This product is projected into GDA 1994 Queensland Albers

Map 4 - Wetlands and waterways



Map 5 - Aquatic Conservation Assessment (ACA) - riverine



Aquatic Conservation Assessment (ACA) - riverine

Legend

- 2 kilometre buffer
- Towns
- Roads
- Rivers/Creeks
- Queensland

ACA Riverine - Subcatchment Significance

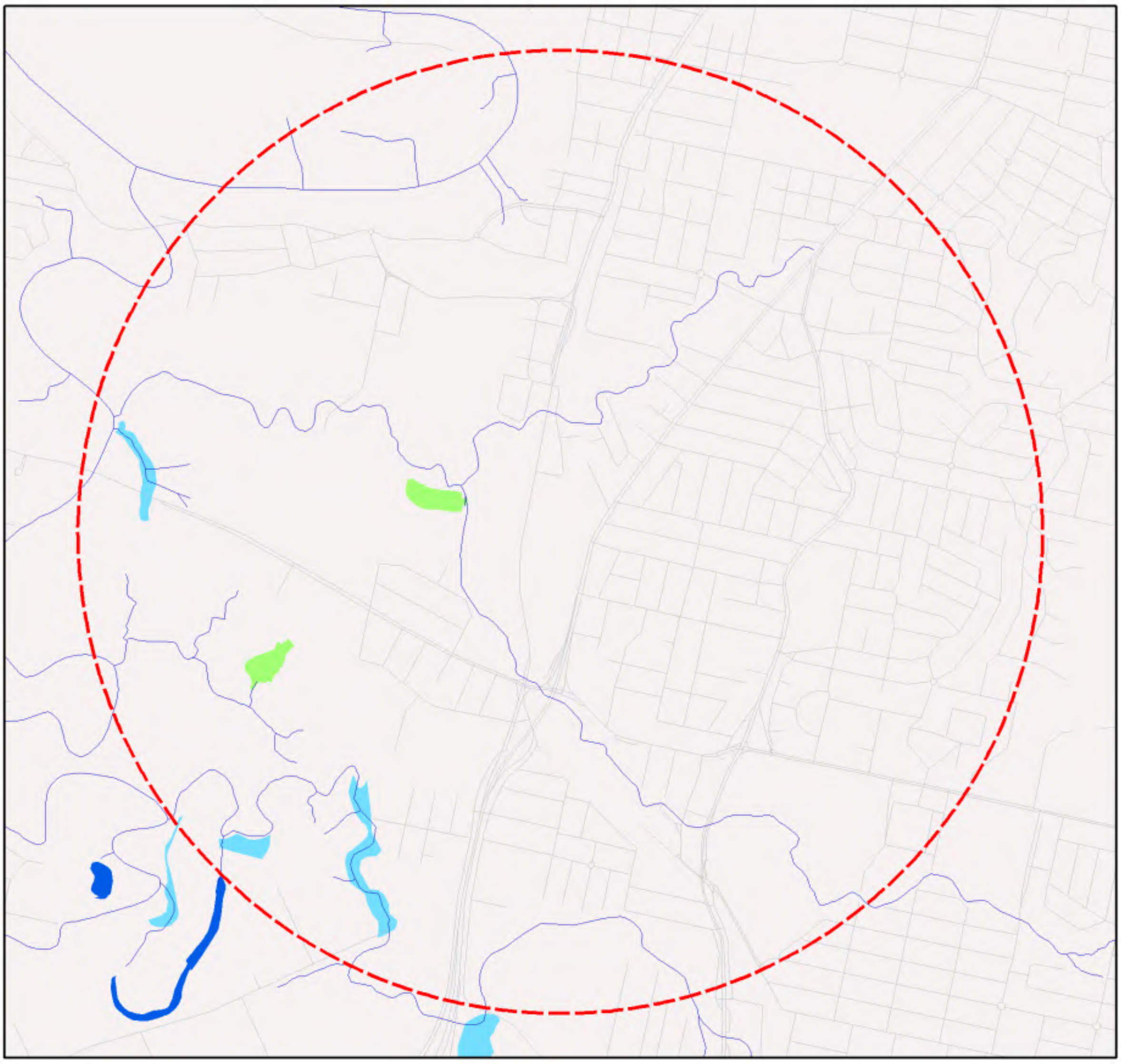
- Very High
- High
- Medium
- Low
- Very Low

DISCLAIMER:
Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, the State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

The state of Queensland disclaims all responsibility for information contained in this product and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

This product is projected into GDA 1994 Queensland Albers

Map 6 - Aquatic Conservation Assessment (ACA) - non-riverine



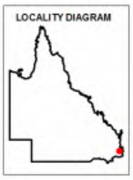
Aquatic Conservation Assessment (ACA) - nonriverine

Legend

- 2 kilometre buffer
- Towns
- Roads
- Rivers/Creeks
- Queensland

ACA Non-riverine

- Very High
- High
- Medium
- Low
- Very Low



N

DISCLAIMER:
Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, the State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

The state of Queensland disclaims all responsibility for information contained in this product and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

0 250 500 750 1000 1250 m

This product is projected into GDA 1994 Queensland Albers

References

Clayton, P.D., Fielder, D.F., Howell, S. and Hill, C.J. (2006) *Aquatic biodiversity assessment and mapping method (AquaBAMM): a conservation values assessment tool for wetlands with trial application in the Burnett River catchment.* Published by the Environmental Protection Agency, Brisbane. ISBN 1-90928-07-3. Available at

http://wetlandinfo.des.qld.gov.au/wetlands/assessment/assessment-methods/aca/

Environmental Protection Agency (2002) *Biodiversity Assessment and Mapping Methodology. Version 2.1, July 2002.* (Environmental Protection Agency, Brisbane).

Morton, S. R., Short, J. and Barker, R. D. with an Appendix by G.F. Griffin and G. Pearce (1995). *Refugia for Biological Diversity in Arid and Semi-arid Australia. Biodiversity Series* , Paper No. 4, Biodiversity Unit, Environment Australia.

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

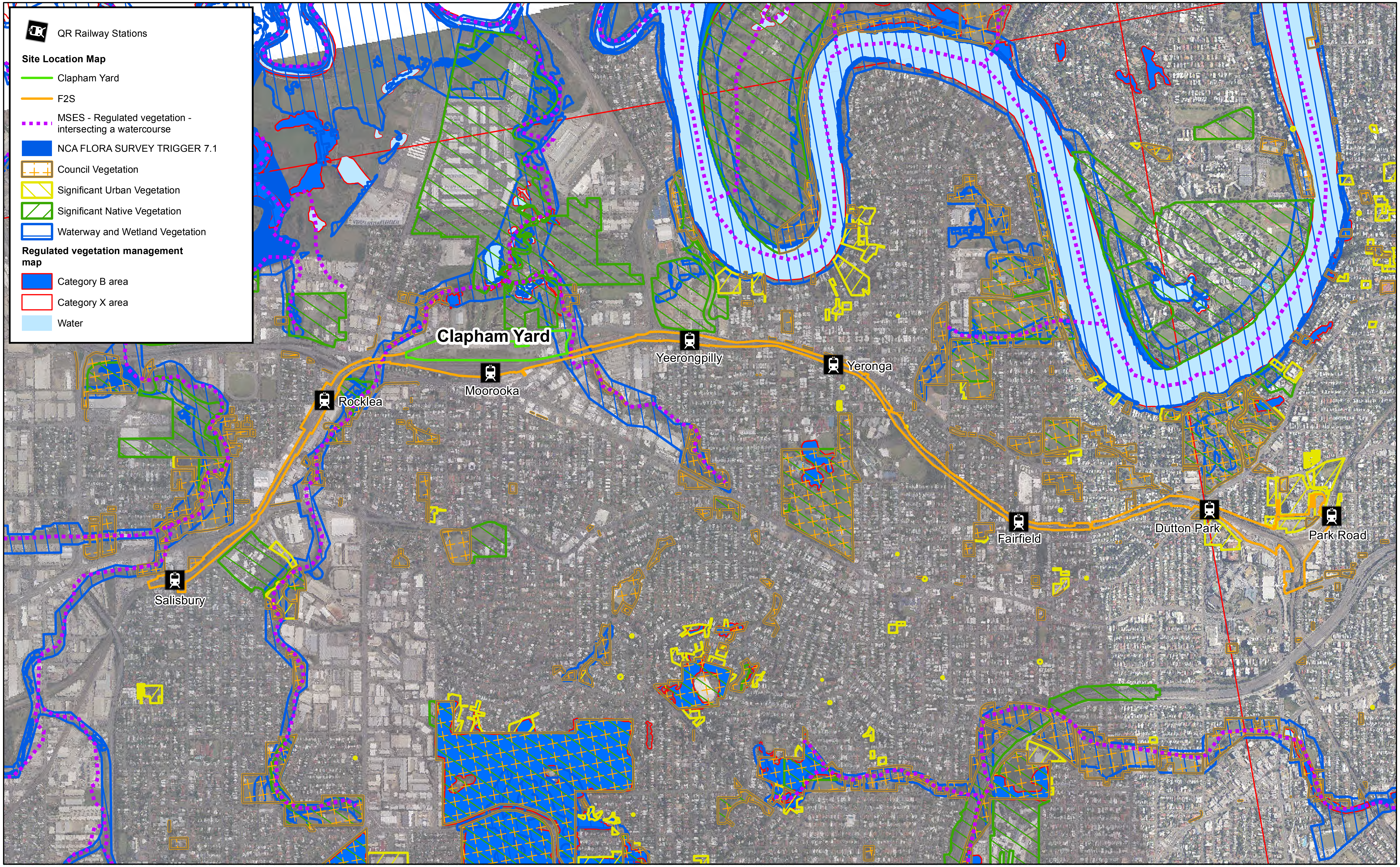
Theme	Datasets
Aquatic Conservation Assessments Non-riverine*	Combination of the following datasets: Cape York Peninsula Non-riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Non-riverine v1.3 Lake Eyre and Bulloo Basins v1.1 QMDB Non-riverine ACA v1.4 Southeast Queensland ACA v1.1 WBB Non-riverine ACA v1.1 Southern Gulf Catchments Non-riverine ACA v1.1
Aquatic Conservation Assessments Riverine*	Combination of the following datasets: Cape York Peninsula Riverine v1.1 Eastern Gulf of Carpentaria v1.1 Great Barrier Reef Catchment Riverine v1.1 Lake Eyre and Bulloo Basins v1.1 QMDB Riverine ACA v1.4 Southeast Queensland ACA v1.1 WBB Riverine ACA v1.1 Southern Gulf Catchments Riverine ACA v1.1
Biodiversity Planning Assessments*	Combination of the following datasets: Brigalow Belt BPA v2.1 Cape York Peninsula BPA v1.1 Central Queensland Coast BPA v1.3 Channel Country BPA v1.1 Desert Uplands BPA v1.3 Einasleigh Uplands BPA v1.1 Gulf Plains BPA v1.1 Mitchell Grass Downs BPA v1.1 Mulga Lands BPA v1.4 New England Tableland v2.3 Northwest Highlands v1.1 Southeast Queensland v4.1 Wet Tropics v1.1
Statewide BPA Corridors*	Statewide corridors v1.6
Threatened Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.
BPA Priority Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.
ACA Priority Species	An internal DES database compiled from Wildnet, Herbrecs, Corveg, the QLD Museum, as well as other incidental sources.

***These datasets are available at:**

http://dds.information.qld.gov.au/DDS

Appendix 2 - Acronyms and Abbreviations

AOI	- Area of Interest
ACA	- Aquatic Conservation Assessment
AQUABAMM	- Aquatic Biodiversity Assessment and Mapping Methodology
BAMM	- Biodiversity Assessment and Mapping Methodology
BoT	- Back on Track
BPA	- Biodiversity Planning Assessment
CAMBA	- China-Australia Migratory Bird Agreement
DES	- Department of Environment and Science
EPBC	- *Environment Protection and Biodiversity Conservation Act 1999*
EVNT	- Endangered, Vulnerable, Near Threatened
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
JAMBA	- Japan-Australia Migratory Bird Agreement
NCA	- *Nature Conservation Act 1992*
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
ROKAMBA	- Republic of Korea-Australia Migratory Bird Agreement



Rev	Description	Date	Approved
1	~~Overview Map~~		

Status: Issued for Information

Original Size	A3	Drawn	GIS
Coordinate System	GDA 1994 BCSG02	Designed	J Clothier
Height Datum	AHD	Date Printed	20/12/2019

Filename: Surface_Water_Southern_Area_Vegetation_Map.mxd

UNITY Assured Integration for a New Era

~~Terrestrial Ecology Report Southern~~

Figure 3-1: Regional Ecosystems, Waterways and Natural Assets Local Laws

Project Number	Discipline	Document	Document Number	Rev
	ENV	PL	002	1

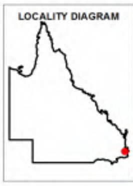
11/02/2021 15:34:11

Lot: 101 Plan: SP105842

Protected Plants Flora Survey Trigger Map

Legend

- Selected Lot and Plan
- High risk area
- Other land parcel boundaries
- Freeways / motorways / highways
- Secondary roads / streets



N

0 100 200 300 400 500 m

This product is projected into:
GDA 1994 Queensland Albers

This map shows areas where particular provisions of the Nature Conservation Act 1992 apply to the clearing of protected plants.

Land parcel boundaries are provided as locational aid only.

This map is produced at a scale relevant to the size of the area selected and should be printed as A4 size in portrait orientation.

For further information or assistance with interpretation of this product, please contact the Department of Environment and Science at palm@ehp.qld.gov.au

Disclaimer:
While every care is taken to ensure the accuracy of the data used to generate this product, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaim all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damages) and costs which might be incurred as a consequence of reliance on the data, or as a result of the data being inaccurate or incomplete in any way and for any reason.

Protected plants flora survey trigger map

The protected plants flora survey trigger map identifies 'high risk areas' where endangered, vulnerable or near threatened plants are known to exist or are likely to exist. Under the *Nature Conservation Act 1992* (the Act) it is an offence to clear protected plants that are 'in the wild' unless you are authorised or the clearing is exempt, for more information see section 89 of the Act.

Please see the Department of Environment and Science webpage on the clearing of protected plants for information on what exemptions may apply in your circumstances, whether you may need to undertake a flora survey, and whether you may need a protected plants clearing permit.

Updates to the data informing the flora survey trigger map

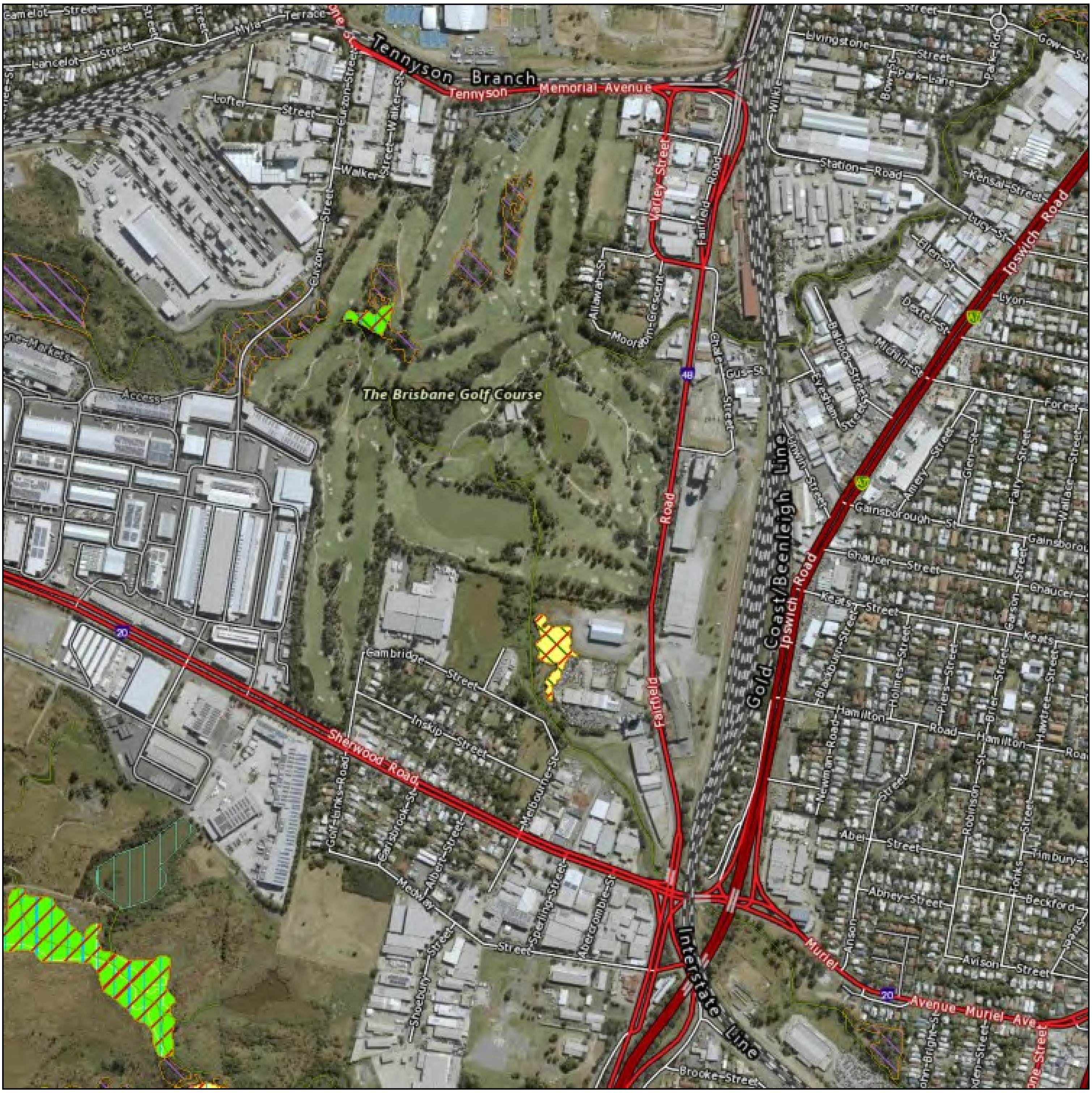
The flora survey trigger map will be reviewed, and updated if necessary, at least every 12 months to ensure the map reflects the most up-to-date and accurate data available.

Species information

Please note that flora survey trigger maps do not identify species associated with 'high risk areas'. While some species information may be publicly available, for example via the Queensland Spatial Catalogue, the Department of Environment and Science does not provide species information on request. Regardless of whether species information is available for a particular high risk area, clearing plants in a high risk area may require a flora survey and/or clearing permit. Please see the Department of Environment and Science webpage on the clearing of protected plants for more information.

27°31'31"S 152°59'53"E

27°31'31"S 153°1'13"E



27°32'42"S 152°59'53"E

27°32'42"S 153°1'13"E

A product of Queensland Globe

Legend located on next page

N

0 250 metres

Scale: 1:12382

Printed at: A4
Print date: 12/2/2021
Datum: Geocentric Datum of Australia 1994
Projection: Web Mercator EPSG 102100

For more information, visit https://qldglobe.information.qld.gov.au/help-info/Contact-us.html

Queensland Government
Department of Resources

Legend

MSES protected area [estates]

MSES protected area [nature refuges]

MSES marine park [highly protected]

MSES declared fish habitat area [A and B areas]

MSES legally secured offset area [offset register]

MSES legally secured offset area [vegetation offsets]

MSES regulated vegetation [defined watercourse]

MSES declared high ecological value waters [watercourse]

MSES declared high ecological value waters [wetland]

MSES strategic environmental area [designated precinct]

MSES regulated vegetation [category B - endangered or of concern]

MSES regulated vegetation [category C- endangered or of concern]

MSES regulated vegetation [category R- GBR riverine]

MSES regulated vegetation [essential habitat]

MSES regulated vegetation [100m from wetland]

MSES wildlife habitat [endangered or vulnerable]

MSES wildlife habitat [special least concern animal]

MSES wildlife habitat [SEQ koala habitat - core]

Attribution

Maxar

MSES high ecological significance wetlands

MSES wildlife habitat [SEQ koala habitat - locally refined]

Legend

MSES protected area [special wildlife reserves]

Road crossing

- Bridge
- Tunnel

Road

- Highway
- Main
- Local
- Private

Railway

Cities and Towns

LEGEND

- Project Boundary RFPC - Permanent
- Project Boundary RFPC- Temporary Construction
- Project Boundary RFPC - Volumentric
- MSES___Regulated_vegetation___intersecting_a_watercourse
- MSES___High_ecological_value_waters___watercourse
- MSES___Protected_area___nature_refuges
- MSES___Marine_park___highly_protected_zones
- MSES___Wildlife_habitat___threatened_and_special_least_concern_animal
- MSES___High_ecological_value_waters___wetlands
- MSES___High_ecological_significance_wetlands
- MSES___fish_habitat_area
- MSES___Legally_secured_offset_area___offset_register
- MSES___Legally_secured_offset_area___vegetation_offsets
- Brisbane Imagery (27/09/2020)

Scale 1: 4,000

0 101.6 203

Meters

FOR INFORMATION ONLY

This map is a user generated static output from the CIMIC Group Web GIS tool and is for reference only. Data layers that appear on this map may or may not be accurate, current or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Image Purchased from DNRM

Status	GIS OUTPUT NOT USED FOR CONSTRUCTION		
Original Size	A3	Drawn	
Coordinate System	GDA MGA 56	Approved	
Height Datum	AHD	Date Printed	11-Feb-2021

UNITY

Assured Integration for a New Era

Cross River Rail - RIS Alliance

Clapham Yard Significant Vegetation

MSES Mapping

Queensland Government

Department of Environment and Science

Environmental Reports

Matters of State Environmental Significance

For the selected area of interest
Longitude: 153.01293 Latitude: -27.53561 with 2 kilometre radius

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the point of interest.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no values have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Please direct queries about these reports to: Planning.Support@des.qld.gov.au

Disclaimer

Whilst every care is taken to ensure the accuracy of the information provided in this report, the Queensland Government makes no representations or warranties about its accuracy, reliability, completeness, or suitability, for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which the user may incur as a consequence of the information being inaccurate or incomplete in any way and for any reason.

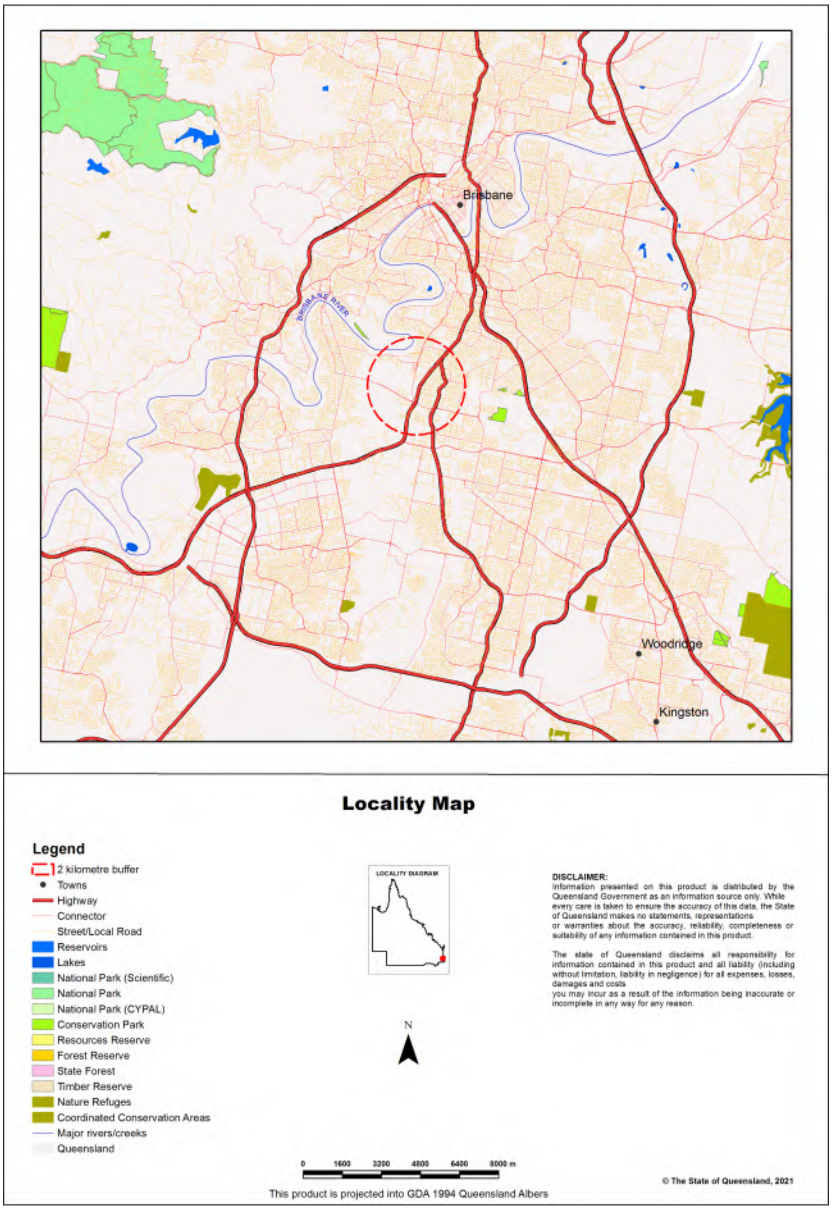
Table of Contents

Assessment Area Details

The following table provides an overview of the area of interest (AOI) with respect to selected topographic and environmental values.

Table 1: Summary table, details for AOI Longitude: 153.01293 Latitude: -27.53561

Size (ha)	1,256.55
Local Government(s)	Brisbane City
Bioregion(s)	Southeast Queensland
Subregion(s)	Burringbar - Conondale Ranges, Moreton Basin
Catchment(s)	Brisbane



Matters of State Environmental Significance (MSES)

MSES Categories

Queensland's State Planning Policy (SPP) includes a biodiversity State interest that states:

'The sustainable, long-term conservation of biodiversity is supported. Significant impacts on matters of national or state environmental significance are avoided, or where this cannot be reasonably achieved; impacts are minimised and residual impacts offset.'

The MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The SPP defines matters of state environmental significance as:

- Protected areas (including all classes of protected area except coordinated conservation areas) under the *Nature Conservation Act 1992* ;

- Marine parks and land within a 'marine national park', 'conservation park', 'scientific research', 'preservation' or 'buffer' zone under the *Marine Parks Act 2004* ;

- Areas within declared fish habitat areas that are management A areas or management B areas under the Fisheries Regulation 2008;

- Threatened wildlife under the *Nature Conservation Act 1992* and special least concern animals under the Nature Conservation (Wildlife) Regulation 2006;

- Regulated vegetation under the *Vegetation Management Act 1999* that is:

    • Category B areas on the regulated vegetation management map, that are 'endangered' or 'of concern' regional ecosystems;

    • Category C areas on the regulated vegetation management map that are 'endangered' or 'of concern' regional ecosystems;

    • Category R areas on the regulated vegetation management map;

    • Regional ecosystems that intersect with watercourses identified on the vegetation management watercourse and drainage feature map;

    • Regional ecosystems that intersect with wetlands identified on the vegetation management wetlands map;

- Strategic Environmental Areas under the *Regional Planning Interests Act 2014* ;

- Wetlands in a wetland protection area of wetlands of high ecological significance shown on the Map of Queensland Wetland Environmental Values under the Environment Protection Regulation 2019;

- Wetlands and watercourses in high ecological value waters defined in the Environmental Protection (Water) Policy 2009, schedule 2;

- Legally secured offset areas.

MSES Values Present

The MSES values that are present in the area of interest are summarised in the table below:

Table 2: Summary of MSES present within the AOI

1a Protected Areas- estates	0.0 ha	0.0 %
1b Protected Areas- nature refuges	0.0 ha	0.0 %
1c Protected Areas- special wildlife reserves	0.0 ha	0.0 %
2 State Marine Parks- highly protected zones	0.0 ha	0.0 %
3 Fish habitat areas (A and B areas)	0.0 ha	0.0 %
4 Strategic Environmental Areas (SEA)	0.0 ha	0.0 %
5 High Ecological Significance wetlands on the map of Referable Wetlands	3.53 ha	0.3%
6a High Ecological Value (HEV) wetlands	0.0 ha	0.0 %
6b High Ecological Value (HEV) waterways **	0.0 km	Not applicable
7a Threatened (endangered or vulnerable) wildlife	18.05 ha	1.4%
7b Special least concern animals	20.16 ha	1.6%
7c i Koala habitat area - core (SEQ)	5.13 ha	0.4%
7c ii Koala habitat area - locally refined (SEQ)	11.86 ha	0.9%
8a Regulated Vegetation - Endangered/Of concern in Category B (remnant)	10.89 ha	0.9%
8b Regulated Vegetation - Endangered/Of concern in Category C (regrowth)	0.0 ha	0.0 %
8c Regulated Vegetation - Category R (GBR riverine regrowth)	0.0 ha	0.0 %
8d Regulated Vegetation - Essential habitat	19.05 ha	1.5%
8e Regulated Vegetation - intersecting a watercourse **	33.3 km	Not applicable
8f Regulated Vegetation - within 100m of a Vegetation Management Wetland	10.61 ha	0.8%
9a Legally secured offset areas- offset register areas	0.0 ha	0.0 %
9b Legally secured offset areas- vegetation offsets through a Property Map of Assessable Vegetation	0.0 ha	0.0 %

Additional Information with Respect to MSES Values Present

MSES - State Conservation Areas

1a. Protected Areas - estates

(no results)

1b. Protected Areas - nature refuges

(no results)

1c. Protected Areas - special wildlife reserves

(no results)

2. State Marine Parks - highly protected zones

(no results)

3. Fish habitat areas (A and B areas)

(no results)

Refer to **Map 1 - MSES - State Conservation Areas** for an overview of the relevant MSES.

MSES - Wetlands and Waterways

4. Strategic Environmental Areas (SEA)

(no results)

5. High Ecological Significance wetlands on the Map of Queensland Wetland Environmental Values

Natural wetlands that are 'High Ecological Significance' (HES) on the Map of Queensland Wetland Environmental Values are present.

6a. Wetlands in High Ecological Value (HEV) waters

(no results)

6b. Waterways in High Ecological Value (HEV) waters

(no results)

Refer to **Map 2 - MSES - Wetlands and Waterways** for an overview of the relevant MSES.

MSES - Species

7a. Threatened (endangered or vulnerable) wildlife

Values are present

7b. Special least concern animals

Values are present

7c i. Koala habitat area - core (SEQ)

Values are present

7c ii. Koala habitat area - locally refined (SEQ)

Values are present

Threatened (endangered or vulnerable) wildlife habitat suitability models

Species	Common name	NCA status	Presence
Boronia keysii		V	None
Calyptorhynchus lathami	Glossy black cockatoo	V	None
Casuarius casuarius johnsonii	Sthn population cassowary	E	None
Crinia tinnula	Wallum froglet	V	Core
Denisonia maculata	Ornamental snake	V	None
Litoria freycineti	Wallum rocketfrog	V	None
Litoria olongburensis	Wallum sedgefrog	V	None
Melaleuca irbyana		E	None
Petaurus gracilis	Mahogany Glider	E	None
Petrogale persephone	Proserpine rock-wallaby	E	None
Phascolarctos cinereus	Koala - outside SEQ*	V	None
Pezoporus wallicus wallicus	Eastern ground parrot	V	None
Taudactylus pleione	Kroombit tinkerfrog	E	None
Xeromys myoides	Water Mouse	V	None

**For koala model, this includes areas outside SEQ. Check 7c SEQ koala habitat for presence/absence.*

Threatened (endangered or vulnerable) wildlife species records

Scientific name	Common name	NCA status	EPBC status	Migratory status
Ornithoptera richmondia	Richmond birdwing	V		
Gossia gonoclada		E	E	

Special least concern animal species records

Scientific name	Common name	Migratory status
Ornithorhynchus anatinus	platypus	
Tachyglossus aculeatus	short-beaked echidna	
Calidris acuminata	sharp-tailed sandpiper	M-C/J/R/B/E
Gallinago hardwickii	Latham's snipe	M-J/R/B/E
Tringa stagnatilis	marsh sandpiper	M-C/J/R/B/E

Scientific name	Common name	Migratory status
Tringa glareola	wood sandpiper	M-C/J/R/B/E
Pluvialis fulva	Pacific golden plover	M-C/J/R/B/E

**Nature Conservation Act 1992 (NCA) Status- Endangered (E), Vulnerable (V) or Special Least Concern Animal (SL). Environment Protection and Biodiversity Conservation Act 1999 (EPBC) status: Critically Endangered (CE) Endangered (E), Vulnerable (V)*

Migratory status (M) - China and Australia Migratory Bird Agreement (C), Japan and Australia Migratory Bird Agreement (J), Republic of Korea and Australia Migratory Bird Agreement (R), Bonn Migratory Convention (B), Eastern Flyway (E)

To request a species list for an area, or search for a species profile, access Wildlife Online at:
https://www.qld.gov.au/environment/plants-animals/species-list/

Refer to **Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals** and **Map 3b - MSES - Species - Koala habitat area (SEQ)** for an overview of the relevant MSES.

MSES - Regulated Vegetation

For further information relating to regional ecosystems in general, go to:
https://www.qld.gov.au/environment/plants-animals/plants/ecosystems/
For a more detailed description of a particular regional ecosystem, access the regional ecosystem search page at:
https://environment.ehp.qld.gov.au/regional-ecosystems/

8a. Regulated Vegetation - Endangered/Of concern in Category B (remnant)

Regional ecosystem	Vegetation management polygon	Vegetation management status
12.1.1	O-dom	rem_oc
12.3.20	E-dom	rem_end
12.3.11/12.3.5	O-dom	rem_oc
12.3.3d	E-dom	rem_end
12.3.11	O-dom	rem_oc
12.9-10.7a	O-dom	rem_oc
12.3.16	E-dom	rem_end

8b. Regulated Vegetation - Endangered/Of concern in Category C (regrowth)

Not applicable

8c. Regulated Vegetation - Category R (GBR riverine regrowth)

Not applicable

8d. Regulated Vegetation - Essential habitat

Values are present

8e. Regulated Vegetation - intersecting a watercourse**

A vegetation management watercourse is mapped as present

8f. Regulated Vegetation - within 100m of a Vegetation Management wetland

Regulated vegetation map category	Map number	RVM rule
B	9542	2
B	9442	2

Refer to **Map 4 - MSES - Regulated Vegetation** for an overview of the relevant MSES.

MSES - Offsets

9a. Legally secured offset areas - offset register areas

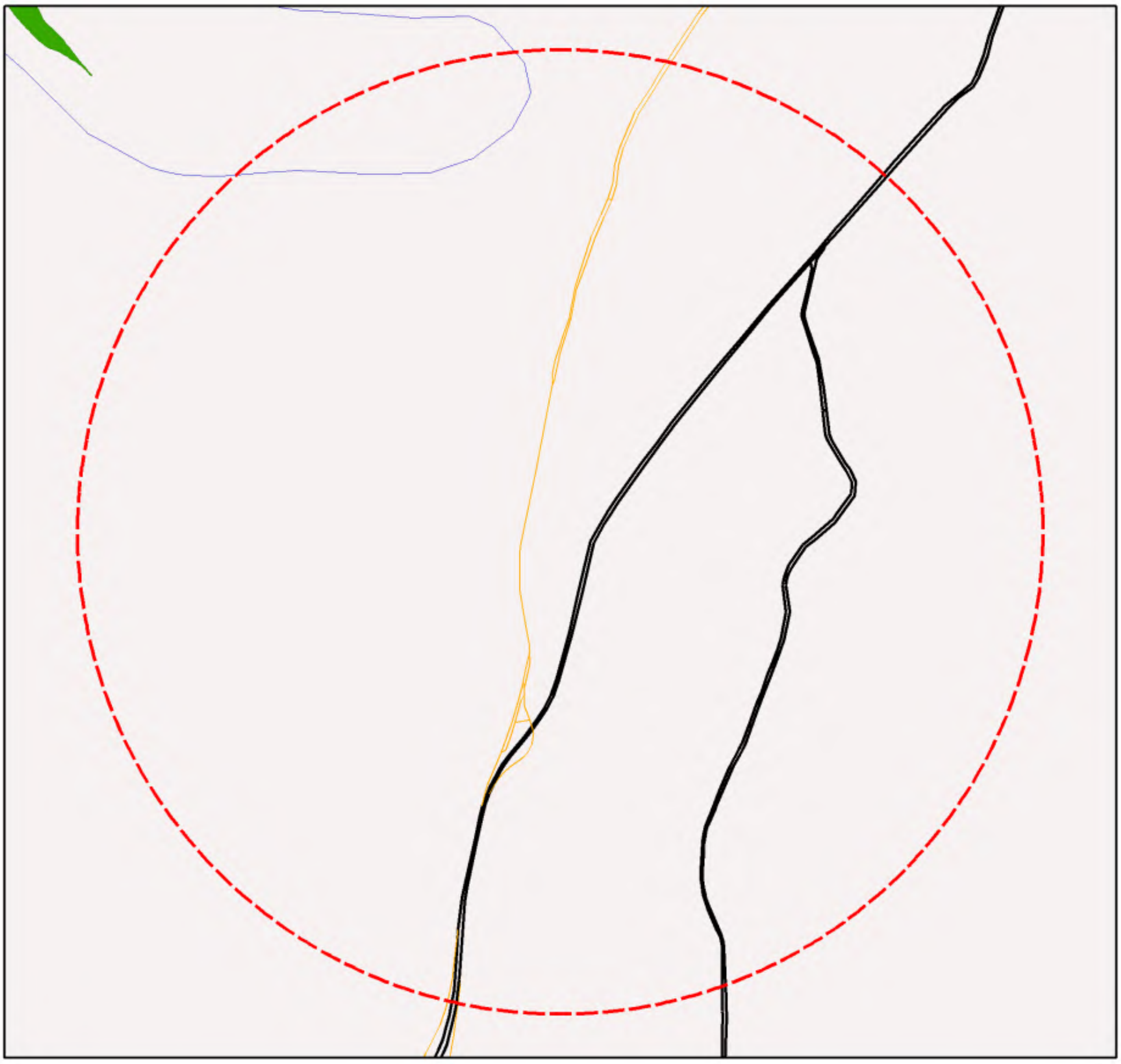
(no results)

9b. Legally secured offset areas - vegetation offsets through a Property Map of Assessable Vegetation

(no results)

Refer to **Map 5 - MSES - Offset Areas** for an overview of the relevant MSES.

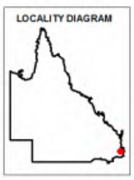
Map 1 - MSES - State Conservation Areas



MSES - State Conservation Areas

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Protected area (estates, nature refuges, special wildlife reserves)
- Declared fish habitat area (A and B areas)
- Marine park (highly protected)



N

0 250 500 750 1000 1250 m

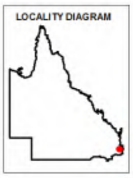
This product is projected into GDA 1994 Queensland Albers

Map 2 - MSES - Wetlands and Waterways

MSES - Wetlands and Waterways

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Declared high ecological value waters (watercourse)
- Strategic environmental area (designated precinct)
- Declared high ecological value waters (wetland)
- High ecological significance wetlands

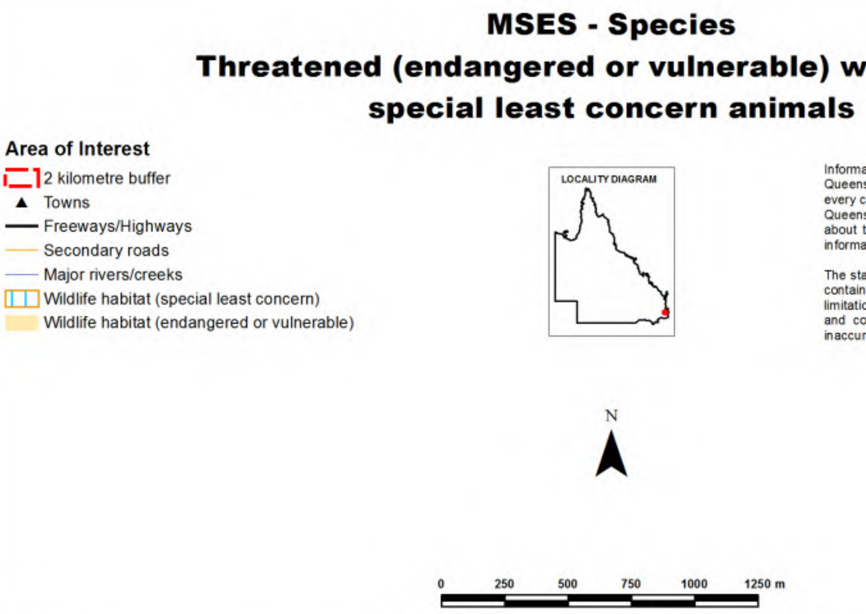


N

0 250 500 750 1000 1250 m

This product is projected into GDA 1994 Queensland Albers

Map 3a - MSES - Species - Threatened (endangered or vulnerable) wildlife and special least concern animals

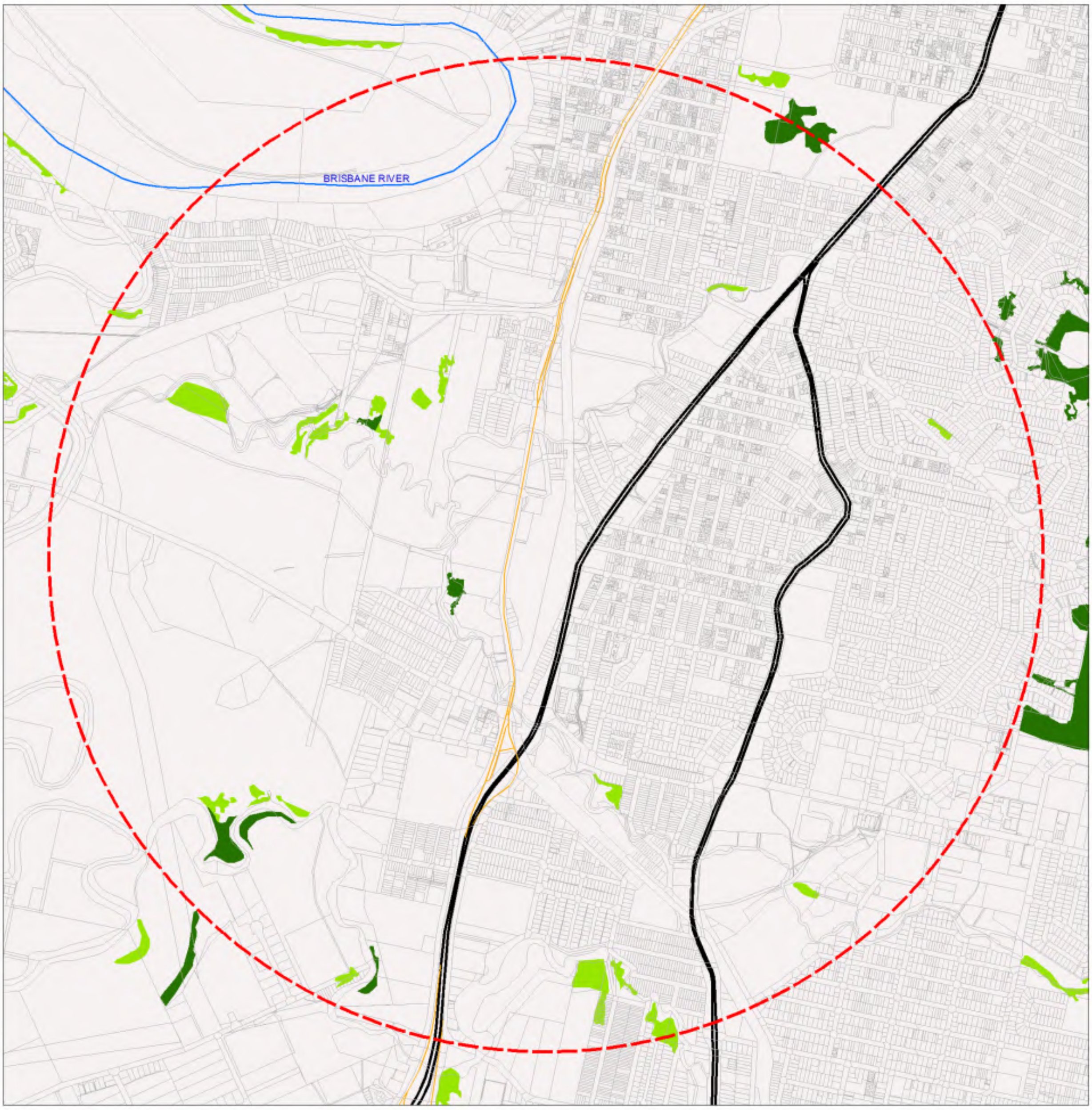


Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, the state of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

The state of Queensland disclaims all responsibility for information contained in this product and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

This product is projected into GDA 1994 Queensland Albers

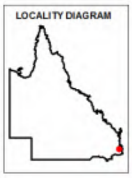
Map 3b - MSES - Species - Koala habitat area (SEQ)



MSES - Species
Koala habitat area (SEQ)

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Koala habitat area (core)
- Koala habitat area (locally refined)



While every care is taken to ensure the accuracy of this product, the Department of Environment and Science acting on behalf of the State of Queensland makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the data being inaccurate or incomplete in any way and for any reason. Due to varying sources of data, spatial locations may not coincide when overlaid.

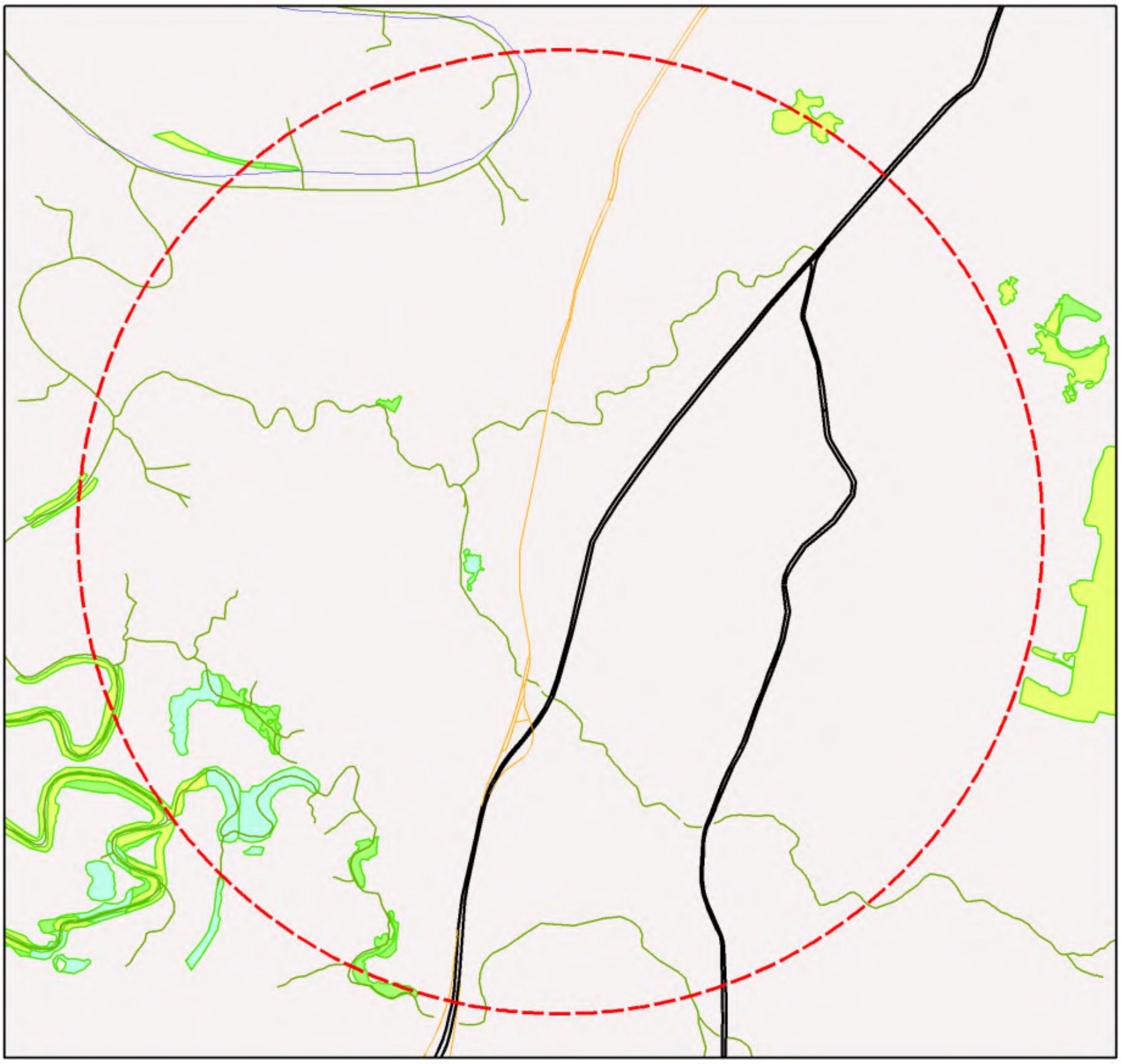
The represented layers for SEQ 'koala habitat area-core' and 'koala habitat area- locally refined' in MSES are sourced directly from the regulatory mapping under the Nature Conservation (Koala) Conservation Plan 2017. Whilst every effort is made to ensure the information remains current, there may be delays between updating versions. Please refer to the original mapping for the most recent version. See https://environment.des.qld.gov.au/wildlife/animals/living-with/koalas/mapping

The koala habitat mapping within South East Queensland uses regional ecosystem linework compiled at a scale varying from 1:25,000 to 1:100,000. Linework should be used as a guide only. The positional accuracy of regional ecosystem data mapped at a scale of 1:100,000 is +/- 100 metres.

0 225 450 675 900 1,125 m

This product is projected into GDA 1994 Queensland Albers

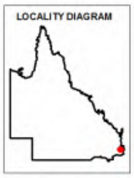
Map 4 - MSES - Regulated Vegetation



MSES - Regulated Vegetation

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Regulated vegetation (intersecting a watercourse)
- Regulated vegetation (100m from wetland)
- Regulated vegetation (category B - endangered or of concern)
- Regulated vegetation (category C - endangered or of concern)
- Regulated vegetation (category R - GBR riverine)
- Regulated vegetation (essential habitat)

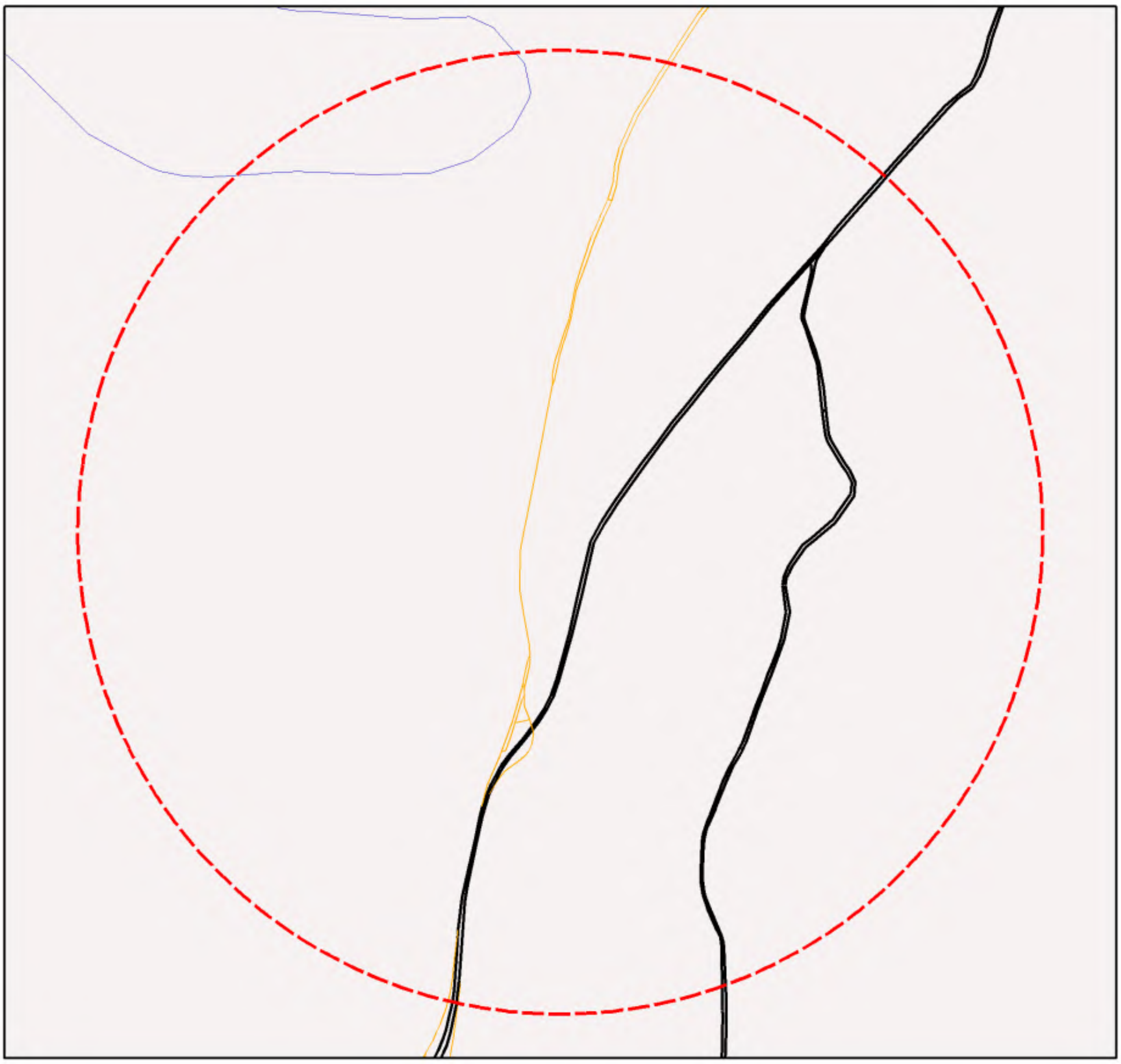


N

0 250 500 750 1000 1250 m

This product is projected into GDA 1994 Queensland Albers

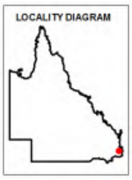
Map 5 - MSES - Offset Areas



MSES - Offsets

Area of Interest

- 2 kilometre buffer
- Towns
- Freeways/Highways
- Secondary roads
- Major rivers/creeks
- Legally secured offset area (offset register)
- Legally secured offset area (vegetation offsets)



N

Information presented on this product is distributed by the Queensland Government as an information source only. While every care is taken to ensure the accuracy of this data, the State of Queensland makes no statements, representations or warranties about the accuracy, reliability, completeness or suitability of any information contained in this product.

The state of Queensland disclaims all responsibility for information contained in this product and all liability (including without limitation, liability in negligence) for all expenses, losses, damages and costs you may incur as a result of the information being inaccurate or incomplete in any way for any reason.

0 250 500 750 1000 1250 m

This product is projected into GDA 1994 Queensland Albers

Appendices

Appendix 1 - Matters of State Environmental Significance (MSES) methodology

MSES mapping is a regional-scale representation of the definition for MSES under the State Planning Policy (SPP). The compiled MSES mapping product is a guide to assist planning and development assessment decision-making. Its primary purpose is to support implementation of the SPP biodiversity policy. While it supports the SPP, the mapping does not replace the regulatory mapping or environmental values specifically called up under other laws or regulations. Similarly, the SPP biodiversity policy does not override or replace specific requirements of other Acts or regulations.

The Queensland Government's "Method for mapping - matters of state environmental significance for use in land use planning and development assessment" can be downloaded from:

http://www.ehp.qld.gov.au/land/natural-resource/method-mapping-mses.html .

Appendix 2 - Source Data

The datasets listed below are available on request from:

http://qldspatial.information.qld.gov.au/catalogue/custom/index.page

- Matters of State environmental significance

Note: MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of underlying environment databases and geo-referenced information sources. MSES mapping is a versioned product that is updated generally on a twice-yearly basis to incorporate the changes to underlying data sources. Several components of MSES mapping made for the current version may differ from the current underlying data sources. To ensure accuracy, or proper representation of MSES values, it is strongly recommended that users refer to the underlying data sources and review the current definition of MSES in the State Planning Policy, before applying the MSES mapping.

Individual MSES layers can be attributed to the following source data available at QSpatial:

MSES layers	**current QSpatial data (http://qspatial.information.qld.gov.au)**
Protected Areas-Estates, Nature Refuges, Special Wildlife Reserves	- Protected areas of Queensland - Nature Refuges - Queensland - Special Wildlife Reserves- Queensland
Marine Park-Highly Protected Zones	Moreton Bay marine park zoning 2008
Fish Habitat Areas	Queensland fish habitat areas
Strategic Environmental Areas-designated	Regional Planning Interests Act - Strategic Environmental Areas
HES wetlands	Map of Queensland Wetland Environmental Values
Wetlands in HEV waters	HEV waters: - EPP Water intent for waters Source Wetlands: - Queensland Wetland Mapping (Current version 5) Source Watercourses: - Vegetation management watercourse and drainage feature map (1:100000 and 1:250000)
Wildlife habitat (threatened and special least concern)	-WildNet database species records - habitat suitability models (various) - SEQ koala habitat areas under the Koala Conservation Plan 2019
VMA regulated regional ecosystems	Vegetation management regional ecosystem and remnant map
VMA Essential Habitat	Vegetation management - essential habitat map
VMA Wetlands	Vegetation management wetlands map
Legally secured offsets	Vegetation Management Act property maps of assessable vegetation. For offset register data-contact DES
Regulated Vegetation Map	Vegetation management - regulated vegetation management map

Appendix 3 - Acronyms and Abbreviations

AOI	- Area of Interest
DES	- Department of Environment and Science
EP Act	- *Environmental Protection Act 1994*
EPP	- Environmental Protection Policy
GDA94	- Geocentric Datum of Australia 1994
GEM	- General Environmental Matters
GIS	- Geographic Information System
MSES	- Matters of State Environmental Significance
NCA	- *Nature Conservation Act 1992*
RE	- Regional Ecosystem
SPP	- State Planning Policy
VMA	- *Vegetation Management Act 1999*

LEGEND

- Project Boundary RFPC - Permanent
- Project Boundary RFPC - Temporary Construction
- Project Boundary RFPC - Volumentric
- Highly Significant Tree
- Council Vegetation
- Significant Urban Vegetation
- Significant Native Vegetation
- Waterway and Wetland Vegetation
- Park Boundary

Park Classification

- Community Use Park
- Corridor Link Park
- Informal Use Park
- Landscape Amenity Park
- Natural Area Park
- Other Park Land
- Sport Park

Brisbane Imagery (27/09/2020)

Scale 1: 4,000

0 101.6 203

Meters

FOR INFORMATION ONLY

This map is a user generated static output from the CIMIC Group Web GIS tool and is for reference only. Data layers that appear on this map may or may not be accurate, current or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Image Purchased from DNRM

Status	GIS OUTPUT NOT USED FOR CONSTRUCTION		
Original Size	A3	Drawn	
Coordinate System	GDA MGA 56	Approved	
Height Datum	AHD	Date Printed	11-Feb-2021

UNITS

Assured Integration for a New Era

Cross River Rail - RIS Alliance

Clapham Yard Significant Vegetation

NALL Mapping

Department of Environment and Science

Environmental Reports

Regional Ecosystems

Biodiversity Status

For the selected area of interest
Longitude: 153.01293 Latitude: -27.53561 with 2 kilometre radius

Environmental Reports - General Information

The Environmental Reports portal provides for the assessment of selected matters of interest relevant to a user specified location, or area of interest (AOI). All area and derivative figures are relevant to the extent of matters of interest contained within the AOI unless otherwise stated. Please note, if a user selects an AOI via the "central coordinates" option, the resulting assessment area encompasses an area extending for a 2km radius from the input coordinates.

All area and area derived figures included in this report have been calculated via reprojecting relevant spatial features to Albers equal-area conic projection (central meridian = 146, datum Geocentric Datum of Australia 1994). As a result, area figures may differ slightly if calculated for the same features using a different co-ordinate system.

Figures in tables may be affected by rounding.

The matters of interest reported on in this document are based upon available state mapped datasets. Where the report indicates that a matter of interest is not present within the AOI (e.g. where area related calculations are equal to zero, or no values are listed), this may be due either to the fact that state mapping has not been undertaken for the AOI, that state mapping is incomplete for the AOI, or that no matters of interest have been identified within the site.

The information presented in this report should be considered as a guide only and field survey may be required to validate values on the ground.

Important Note to User

Information presented in this report is based upon the Queensland Herbarium's Regional Ecosystem framework. The Biodiversity Status has been used to depict the extent of "Endangered", "Of Concern" and "No Concern at Present" regional ecosystems in all cases, rather than the classes used for the purposes of the *Vegetation Management Act 1999* (VMA). Mapping and figures presented in this document reflect the Queensland Herbarium's Remnant and Pre-clearing Regional Ecosystem Datasets, and not the certified mapping used for the purpose of the VMA.

For matters relevant to vegetation management under the VMA, please refer to the Department of Resources website https://www.dnrme.qld.gov.au/

Please direct queries about these reports to: Queensland.Herbarium@dsiti.qld.gov.au

Disclaimer

Table of Contents

Summary Information

The following table provides an overview of the AOI with respect to selected topographic and environmental themes. Refer to **Map 1** for locality information.

Table 1: Area of interest details: Longitude: 153.01293 Latitude: -27.53561 with 2 kilometre radius

Size (ha)	1,256.55
Local Government(s)	Brisbane City
Bioregion(s)	Southeast Queensland
Subregion(s)	Burringbar - Conondale Ranges, Moreton Basin
Catchment(s)	Brisbane

The table below summarizes the extent of remnant vegetation classed as "Endangered", "Of concern" and "No concern at present" regional ecosystems classified by Biodiversity Status within the area of interest (AOI).

Table 2: Summary table, biodiversity status of regional ecosystems within the AOI

Biodiversity Status	Area (Ha)	% of AOI
Endangered	3.88	0.31
Of concern	6.8	0.54
No concern at present	10.08	0.8
Total remnant vegetation	20.76	1.65

Refer to **Map 2** for further information.

Regional Ecosystems

1. Introduction

Regional ecosystems are vegetation communities in a bioregion that are consistently associated with particular combinations of geology, landform and soil (Sattler and Williams 1999). Descriptions of Queensland's Regional ecosystems are available online from the Regional Ecosystem Description Database (REDD). Descriptions are compiled from a broad range of information sources including vegetation, land system and geology survey and mapping and detailed vegetation site data. The regional ecosystem classification and descriptions are reviewed as new information becomes available. A number of vegetation communities may form a single regional ecosystem and are usually distinguished by differences in dominant species, frequently in the shrub or ground layers and are denoted by a letter following the regional ecosystem code (e.g. a, b, c). Vegetation communities and regional ecosystems are amalgamated into a higher level classification of broad vegetation groups (BVGs).

A published methodology for survey and mapping of regional ecosystems across Queensland (Neldner et al 2017) provides further details on regional ecosystem concepts and terminology.

This report provides information on the type, status, and extent of vegetation communities, regional ecosystems and broad vegetation groups present within a user specified area of interest. Please note, for the purpose of this report, the Biodiversity Status is used. This report has not been developed for application of the *Vegetation Management Act 1999* (VMA). Additionally, information generated in this report has been derived from the Queensland Herbarium's Regional Ecosystem Mapping, and not the regulated mapping certified for the purposes of the VMA. If your interest/matter relates to regional ecosystems and the VMA, users should refer to the Department of Resources website.

https://www.dnrme.qld.gov.au/

With respect to the Queensland Biodiversity Status,

"Endangered" regional ecosystems are described as those where:

- remnant vegetation is less than 10 per cent of its pre-clearing extent across the bioregion; or 10-30% of its pre-clearing extent remains and the remnant vegetation is less than 10,000 hectares, or
- less than 10 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss*, or
- 10-30 per cent of its pre-clearing extent remains unaffected by severe degradation and/or biodiversity loss and the remnant vegetation is less than 10,000 hectares; or
- it is a rare** regional ecosystem subject to a threatening process.***

"Of concern" regional ecosystems are described as those where:

- the degradation criteria listed above for 'Endangered' regional ecosystems are not met and,
- remnant vegetation is 10-30 per cent of its pre-clearing extent across the bioregion; or more than 20 per cent of its pre-clearing extent remains and the remnant extent is less than 10,000 hectares, or
- 10-30 percent of its pre-clearing extent remains unaffected by moderate degradation and/or biodiversity loss.****

and "No concern at present" regional ecosystems are described as those where:

- remnant vegetation is over 30 per cent of its pre-clearing extent across the bioregion, and the remnant area is greater than 10,000 hectares, and
- the degradation criteria listed above for 'Endangered' or 'Of concern' regional ecosystems are not met.

**Severe degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 50 years even with the removal of threatening processes; or soil surface is severely degraded, for example, by loss of A horizon, surface expression of salinity; surface compaction, loss of organic matter or sheet erosion.*

***Rare regional ecosystem: pre-clearing extent (1000 ha); or patch size (100 ha and of limited total extent across its range).*

****Threatening processes are those that are reducing or will reduce the biodiversity and ecological integrity of a regional ecosystem. For example, clearing, weed invasion, fragmentation, inappropriate fire regime or grazing pressure, or infrastructure development.*

*****Moderate degradation and/or biodiversity loss is defined as: floristic and/or faunal diversity is greatly reduced but unlikely to recover within the next 20 years even with the removal of threatening processes; or soil surface is moderately degraded.*

2. Remnant Regional Ecosystems

The following table identifies the remnant regional ecosystems and vegetation communities mapped within the AOI and provides their short descriptions, Biodiversity Status, and remnant extent within the selected AOI. Please note, where heterogeneous vegetated patches (mixed patches of remnant vegetation mapped as containing multiple regional ecosystems) occur within the AOI, they have been split and listed as individual regional ecosystems (or vegetation communities where present) for the purposes of the table below. In such instances, associated area figures have been generated based upon the estimated proportion of each regional ecosystem (or vegetation community) predicted to be present within the larger mixed patch.

Table 3: Remnant regional ecosystems, description and status within the AOI

Regional Ecosystem	Short Description	BD Status	Area (Ha)	% of AOI
12.1.1	Casuarina glauca woodland on margins of marine clay plains	Of concern	5.34	0.42
12.1.2	Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains	No concern at present	0.35	0.03
12.1.3	Mangrove shrubland to low closed forest on marine clay plains and estuaries	No concern at present	7.28	0.58
12.11.3a	Eucalyptus siderophloia, E. propinqua +/- E. microcorys, Lophostemon confertus, Corymbia intermedia, E. acmenoides open forest on metamorphics +/- interbedded volcanics	No concern at present	0.1	0.01
12.3.11	Eucalyptus tereticornis +/- Eucalyptus siderophloia, Corymbia intermedia open forest on alluvial plains usually near coast	Of concern	1.17	0.09
12.3.16	Complex notophyll to microphyll vine forest on alluvial plains	Endangered	0.39	0.03
12.3.20	Melaleuca quinquenervia, Casuarina glauca +/- Eucalyptus tereticornis, E. siderophloia open forest on low coastal alluvial plains	Endangered	2.6	0.21
12.3.3d	Eucalyptus tereticornis woodland on Quaternary alluvium	Endangered	0.89	0.07
12.3.5	Melaleuca quinquenervia open forest on coastal alluvium	No concern at present	0.81	0.06
12.9-10.17b	Eucalyptus acmenoides, E. major, E. siderophloia +/- Corymbia citriodora subsp. variegata open fores on sedimentary rocks	No concern at present	less than 0.01	less than 0.01
12.9-10.17c	Eucalyptus acmenoides, E. major, E. siderophloia +/- Corymbia citriodora subsp. variegata open fores on sedimentary rocks	No concern at present	1.52	0.12
12.9-10.7a	Eucalyptus crebra +/- E. tereticornis, Corymbia tessellaris, Angophora spp., E. melanophloia woodland on sedimentary rocks	Of concern	0.29	0.02
estuary	None	None	34.89	2.78
non-rem	None	None	1,191.01	94.78
water	None	None	9.89	0.79

Refer to **Map 2** for further information. **Map 3** also provides a visual estimate of the distribution of regional ecosystems present before clearing.

Table 4 provides further information in regards to the remnant regional ecosystems present within the AOI. Specifically, the extent of remnant vegetation remaining within the bioregion, the 1:1,000,000 broad vegetation group (BVG) classification, whether the regional ecosystem is identified as a wetland, and extent of representation in Queensland's Protected Area Estate. For a description of the vegetation communities within the AOI and classified according to the 1:1,000,000 BVG, refer to **Table 6**.

Table 4: Remnant regional ecosystems within the AOI, additional information

Regional Ecosystem	Remnant Extent	BVG (1 Million)	Wetland	Representation in protected estate
12.1.1	Pre-clearing 6000 ha; Remnant 2017 4000 ha	28a	Estuarine wetlands (e.g. mangroves).	High
12.1.2	Pre-clearing 32000 ha; Remnant 2017 27000 ha	35b	Estuarine wetlands (e.g. mangroves).	High
12.1.3	Pre-clearing 55000 ha; Remnant 2017 52000 ha	35a	Estuarine wetlands (e.g. mangroves).	High
12.11.3a	Pre-clearing 161000 ha; Remnant 2017 108000 ha	9a	None	High
12.3.11	Pre-clearing 173000 ha; Remnant 2017 42000 ha	16c	Contains palustrine wetland (e.g. in swales).	Low
12.3.16	Pre-clearing 14000 ha; Remnant 2017 3000 ha	4b	Riverine wetland or fringing riverine wetland.	Low
12.3.20	Pre-clearing 15000 ha; Remnant 2017 3000 ha	22a	Palustrine wetland (e.g. vegetated swamp).	Low
12.3.3d	Pre-clearing 438000 ha; Remnant 2017 40000 ha	13d	Floodplain (other than floodplain wetlands).	Low
12.3.5	Pre-clearing 45000 ha; Remnant 2017 20000 ha	22a	Palustrine wetland (e.g. vegetated swamp).	High
12.9-10.17b	Pre-clearing 65000 ha; Remnant 2017 31000 ha	10b	None	Medium
12.9-10.17c	Pre-clearing 65000 ha; Remnant 2017 31000 ha	9g	None	Medium
12.9-10.7a	Pre-clearing 248000 ha; Remnant 2017 41000 ha	12a	None	Low
estuary	None	None	None	None
non-rem	None	None	None	None
water	None	None	None	None

Representation in Protected Area Estate: High greater than 10% of pre-clearing extent is represented; Medium 4 - 10% is represented; Low less than 4% is represented, No representation.

The distribution of mapped wetland systems within the area of interest is displayed in **Map 6**.

The following table lists known special values associated with a regional ecosystem type.

Table 5: Remnant regional ecosystems within the AOI, special values

Regional Ecosystem	Special Values
12.1.1	Provides estuarine wetland habitat.

Regional Ecosystem	Special Values
12.1.2	Habitat for threatened fauna species including the false water-rat Xeromys myoides in the southern part of the bioregion particularly in areas immediately adjacent to mangroves, 12.1.3. (Van Dyck and Gynther, 1996, 2003).
12.1.3	Habitat for threatened fauna species including the false water-rat Xeromys myoides in the southern part of the bioregion particularly in areas immediately adjacent to saltpans, 12.1.2. (Van Dyck and Gynther, 1996, 2003). 12.1.3a: Habitat for threatened fauna species including the false water-rat Xeromys myoides in the southern part of the bioregion particularly in areas immediately adjacent to saltpans, 12.1.2. (Van Dyck and Gynther, 1996, 2003). 12.1.3b: Habitat for threatened fauna species including the false water-rat Xeromys myoides in the southern part of the bioregion particularly in areas immediately adjacent to saltpans, 12.1.2. (Van Dyck and Gynther, 1996, 2003). 12.1.3c: Habitat for threatened fauna species including the false water-rat Xeromys myoides in the southern part of the bioregion particularly in areas immediately adjacent to saltpans, 12.1.2. (Van Dyck and Gynther, 1996, 2003). 12.1.3d: Habitat for threatened fauna species including the false water-rat Xeromys myoides in the southern part of the bioregion particularly in areas immediately adjacent to saltpans, 12.1.2. (Van Dyck and Gynther, 1996, 2003). 12.1.3e: Habitat for threatened fauna species including the false water-rat Xeromys myoides in the southern part of the bioregion particularly in areas immediately adjacent to saltpans, 12.1.2. (Van Dyck and Gynther, 1996, 2003).
12.11.3a	Habitat for threatened plant species including Corchorus cunninghamii, Marsdenia coronata, Sophora fraseri. 12.11.3a: Habitat for threatened flora species including Corchorus cunninghamii, Marsdenia coronata, Sophora fraseri. 12.11.3b: Habitat for threatened plant species including Corchorus cunninghamii, Marsdenia coronata, Sophora fraseri.
12.3.11	Potential habitat for NCA listed species: Acronychia littoralis, Alectryon ramiflorus, Arthraxon hispidus, Cupaniopsis shirleyana, Eulophia bicallosa, Gossia gonoclada, Macrozamia lomandroides, Macrozamia pauli-guilielmi, Marsdenia coronata, Maundia trigl 12.3.11a: Habitat for threatened fauna species including the Black-breasted Button-quail Turnix melanogaster. (Aridis, Melzer and Hamley, 1998)
12.3.16	Habitat for threatened plant species including Xanthostemon oppositifolius, Fontainea rostrata and M. ternifolia. Habitat for threatened fauna species including Cyclopsitta diophthalma coxeni and Ornithoptera richmondia. Important for fruit-eating birds, many of which migrate seasonally from upland to lowland rainforest.
12.3.20	Potential habitat for NCA listed species: Acacia attenuata, Allocasuarina emuina, Lenwebbia sp. (Blackall Range P.R.Sharpe 5387), Maundia triglochinoides, Persicaria elatior, Phaius australis, Phaius bernaysii, Symplocos harroldii, Tecomanthe hillii
12.3.3d	Habitat for threatened plant species including Rhaponticum australe. 12.3.3a: Habitat for threatened plant species including occasional Rhaponticum australe. 12.3.3b: Habitat for threatened flora species including Melaleuca irbyana. 12.3.3c: Habitat for threatened flora species including Melaleuca irbyana and Marsdenia coronata. 12.3.3d: Habitat for threatened plant species including Rhaponticum australe.

Regional Ecosystem	Special Values
12.3.5	Habitat for threatened flora species including Phaius australis and P. bernaysii. Habitat for threatened fauna including the wallum froglet Crinia tinnula. 12.3.5a: Habitat for threatened flora species including Phaius australis, P. bernaysii and near threatened species including Schoenus scabripes.
12.9-10.17b	Potential habitat for NCA listed species: Acacia acrionastes, Arundinella grevillensis, Cupaniopsis tomentella, Gonocarpus hirtus, Grevillea linsmithii, Leionema obtusifolium, Macrozamia pauli-guilielmi, Marsdenia coronata, Marsdenia longiloba, Notelaea l
12.9-10.17c	Potential habitat for NCA listed species: Acacia acrionastes, Arundinella grevillensis, Cupaniopsis tomentella, Gonocarpus hirtus, Grevillea linsmithii, Leionema obtusifolium, Macrozamia pauli-guilielmi, Marsdenia coronata, Marsdenia longiloba, Notelaea l
12.9-10.7a	Potential habitat for NCA listed species: Callitris baileyi, Graptophyllum reticulatum, Melaleuca formosa, Melaleuca irbyana, Paspalidium grandispiculatum, Plectranthus habrophyllus, Polianthion minutiflorum, Zieria inexpectata
estuary	None
non-rem	None
water	None

3. Remnant Regional Ecosystems by Broad Vegetation Group

BVGs are a higher-level grouping of vegetation communities. Queensland encompasses a wide variety of landscapes across temperate, wet and dry tropics and semi-arid climatic zones. BVGs provide an overview of vegetation communities across the state or a bioregion and allow comparison with other states. There are three levels of BVGs which reflect the approximate scale at which they are designed to be used: the 1:5,000,000 (national), 1:2,000,000 (state) and 1:1,000,000 (regional) scales.

A comprehensive description of BVGs is available at:

https://publications.qld.gov.au/dataset/redd/resource/

The following table provides a description of the 1:1,000,000 BVGs present and their associated extent within the AOI.

Table 6: Broad vegetation groups (1 million) within the AOI

BVG (1 Million)	Description	Area (Ha)	% of AOI
None	None	1,235.79	98.35
10b	Moist open forests to woodlands dominated by Corymbia citriodora (spotted gum). (land zones 12, 11, 9, 5, 8) (SEQ, CQC, EIU, WET)	less than 0.01	less than 0.01
12a	Dry woodlands to open woodlands dominated by ironbarks such as Eucalyptus decorticans (gum-topped ironbark), E. fibrosa subsp. nubila (blue-leaved ironbark), or E. crebra (narrow-leaved red ironbark) and/or bloodwoods such as Corymbia trachyphloia (yellow bloodwood), C. leichhardtii (rustyjacket), C. watsoniana (Watson's yellow bloodwood), C. lamprophylla, C. peltata (yellowjacket). Occasionally E. thozetiana (mountain yapunyah), E. cloeziana (Gympie messmate) or E. mediocris are dominant. Mostly on sub-coastal/inland hills with shallow soils. (land zones 10, 7, 9) (BRB, DEU, SEQ, GUP)	0.29	0.02

BVG (1 Million)	Description	Area (Ha)	% of AOI
13d	Woodlands dominated by Eucalyptus moluccana (gum-topped box) (or E. microcarpa (inland grey box)) on a range of substrates. (land zone 5, 9, 3, 11, 12) (BRB, SEQ, EIU, CQC, [NET, WET])	0.89	0.07
16c	Woodlands and open woodlands dominated by Eucalyptus coolabah (coolabah) or E. microtheca (coolabah) or E. largiflorens (black box) or E. tereticornis (blue gum) or E. chlorophylla on floodplains. Does not include alluvial areas dominated by herb and grasslands or alluvial plains that are not flooded. (land zone 3) (All bioregions except WET, principally GUP, BRB, MUL).	1.17	0.09
22a	Open forests and woodlands dominated by Melaleuca quinquenervia (swamp paperbark) in seasonally inundated lowland coastal areas and swamps. (land zones 3, 2, 1, [11]) (SEQ, WET, CQC, CYP, [BRB])	3.42	0.27
28a	Complex of open shrubland to closed shrubland, grassland, low woodland and open forest, on strand and foredunes. Includes pure stands of Casuarina equisetifolia (coastal sheoak). (land zones 2, 1) (GUP, SEQ, [BRB, CYP, WET, CQC])	5.34	0.42
35a	Closed forests and low closed forests dominated by mangroves. (land zone 1) (CYP, GUP, BRB, SEQ, WET, CQC)	7.28	0.58
35b	Bare saltpans ± areas of Tecticornia spp. (samphire) sparse forbland and/or Xerochloa imberbis or Sporobolus virginicus (sand couch) tussock grassland. (land zone 1) (GUP, BRB, CYP, SEQ, [CQC, WET])	0.35	0.03
4b	Evergreen to semi-deciduous mesophyll to notophyll vine forest, frequently with Archontophoenix spp. (palms) fringing streams. (land zones 3, [10]) (CYP, SEQ, WET, CQC GUP) (Tracey 1982 1c)	0.39	0.03
9a	Moist to dry eucalypt open forests to woodlands, dominated by a variety of species including Eucalyptus acmenoides (narrow-leaved white stringybark), E. carnea (broad-leaved white mahogany), E. propinqua (small-fruited grey gum), E. siderophloia (red ironbark), E. tindaliae (Queensland white stringybark), E. racemosa, Corymbia intermedia (pink bloodwood), C. trachyphloia (yellow bloodwood), E. planchoniana (Planchon's stringybark), E. baileyana (Bailey's stringybark), E. moluccana (gum-topped box) and Angophora leiocarpa (rusty gum). (land zones 11, 9-10, 8, 12, 5, 3) (SEQ).	0.1	0.01
9g	Moist woodlands dominated by Eucalyptus tindaliae (Queensland white stringybark) or E. racemosa or E. tereticornis (blue gum) and Corymbia intermedia (pink bloodwood) on remnant Tertiary surfaces. (land zone 5) (SEQ)	1.52	0.12

Refer to **Map 4** for further information. **Map 5** also provides a representation of the distribution of vegetation communities as per the 1:5,000,000 BVG believed to be present prior to European settlement.

4. Technical and BioCondition Benchmark Descriptions

Technical descriptions provide a detailed description of the full range in structure and floristic composition of regional ecosystems (e.g. 11.3.1) and their component vegetation communities (e.g. 11.3.1a, 11.3.1b). See:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

The descriptions are compiled using site survey data from the Queensland Herbarium's CORVEG database. Distribution maps, representative images (if available) and the pre-clearing and remnant extent (hectares) of each vegetation community derived from the regional ecosystem mapping data are included. The technical descriptions should be used in conjunction with the fields from the regional ecosystem description database (REDD) for a full description of the regional ecosystem.

Technical descriptions include data on canopy height, canopy cover and native plant species composition of the predominant layer, which are attributes relevant to assessment of the remnant status of vegetation under the *Vegetation Management Act 1999*. However, as technical descriptions reflect the full range in structure and floristic composition across the climatic, natural disturbance and geographic range of the regional ecosystem, local reference sites should be used for remnant assessment where possible (Neldner et al. 2012 (PDF))* section 3.3.1 of:

https://publications.qld.gov.au/dataset/redd/resource/

The technical descriptions are subject to review and are updated as additional data becomes available.

When conducting a BioCondition assessment, these technical descriptions should be used in conjunction with BioCondition benchmarks for the specific regional ecosystem, or component vegetation community.

http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

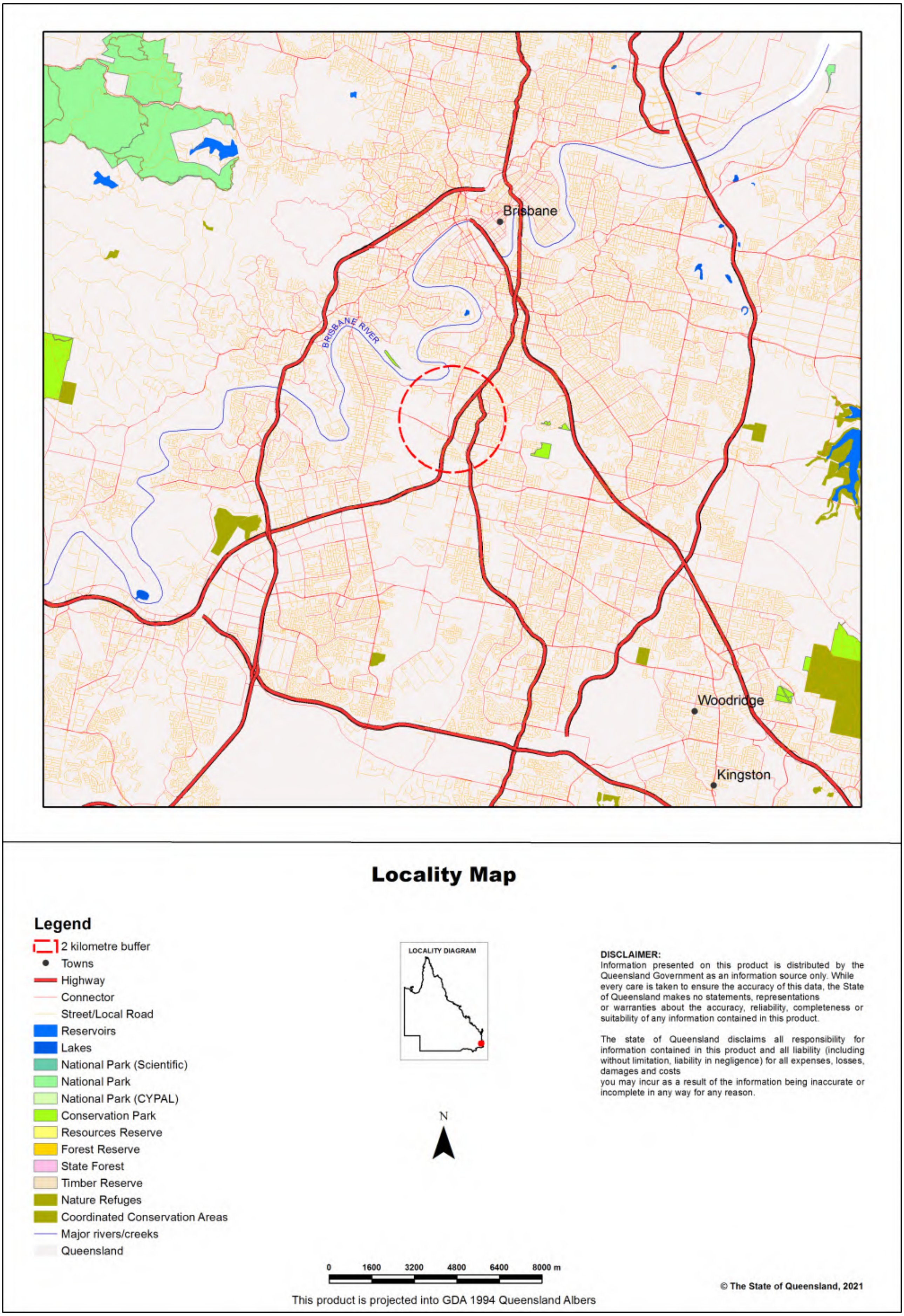
Benchmarks are based on a combination of quantitative and qualitative information and should be used as a guide only. Benchmarks are specific to one regional ecosystem vegetation community, however, the natural variability in structure and floristic composition under a range of climatic and natural disturbance regimes has been considered throughout the geographic extent of the regional ecosystem. Local reference sites should be used for this spatial and temporal (seasonal and annual) variability.

Table 7: List of remnant regional ecosystems within the AOI for which technical and biocondition benchmark descriptions are available

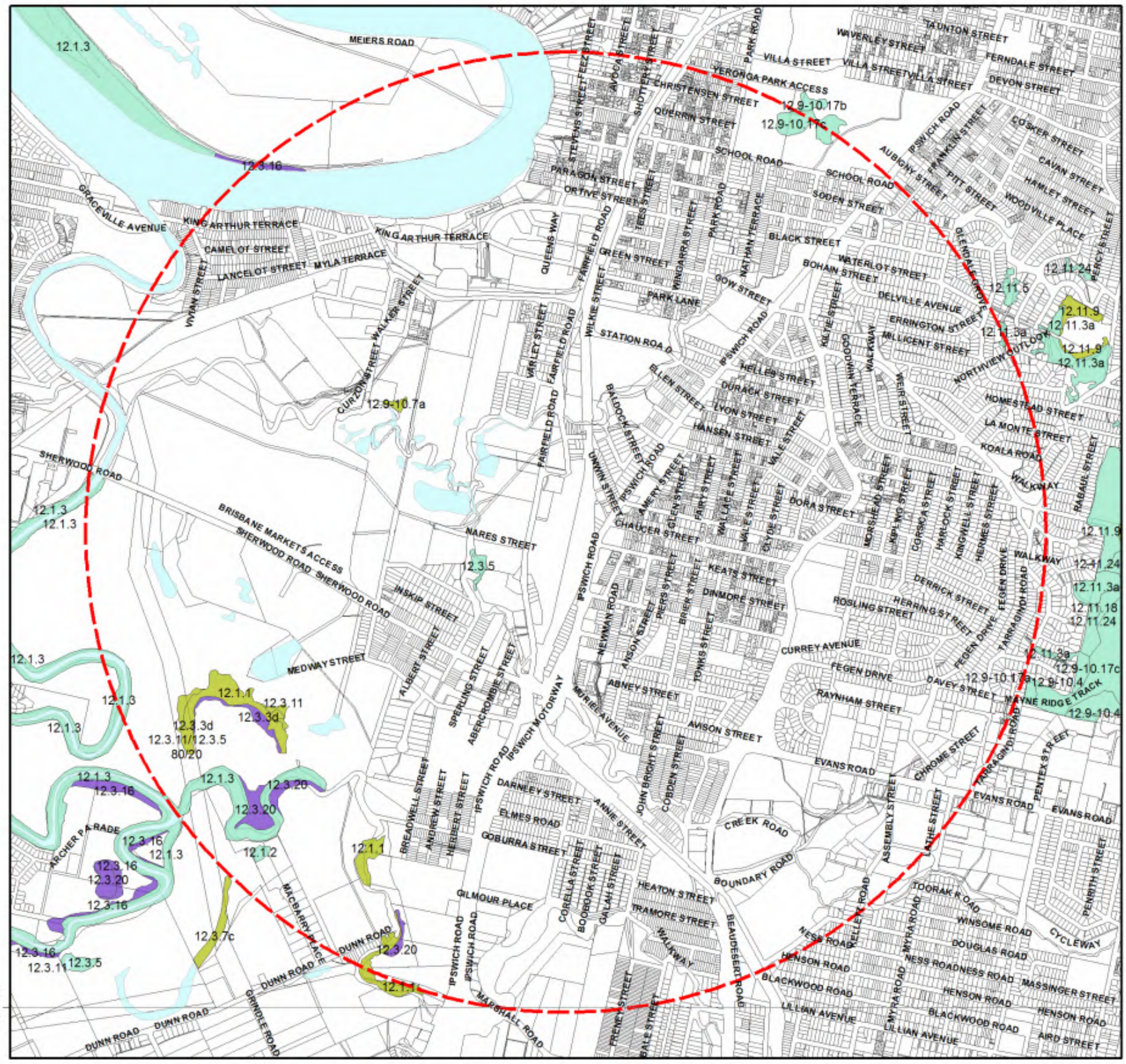
Regional ecosystems mapped as within the AOI	Technical Descriptions	Biocondition Benchmarks
12.1.1	Available	Not currently available
12.1.2	Not currently available	Not currently available
12.1.3	Not currently available	Not currently available
12.11.3a	Available	Available
12.3.11	Available	Not currently available
12.3.16	Not currently available	Not currently available
12.3.20	Not currently available	Not currently available
12.3.3d	Available	Not currently available
12.3.5	Available	Not currently available
12.9-10.17b	Available	Not currently available
12.9-10.17c	Not currently available	Not currently available
12.9-10.7a	Available	Not currently available
estuary	Not currently available	Not currently available
non-rem	Not currently available	Not currently available
water	Not currently available	Not currently available

Maps

Map 1 - Location



Map 2 - Remnant 2017 regional ecosystems



Remnant 2017 Regional Ecosystems

Biodiversity Status

- 2 kilometre buffer
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Non-remnant vegetation, cultivated or built environment
- Plantation
- Water
- Cadastral Boundaries

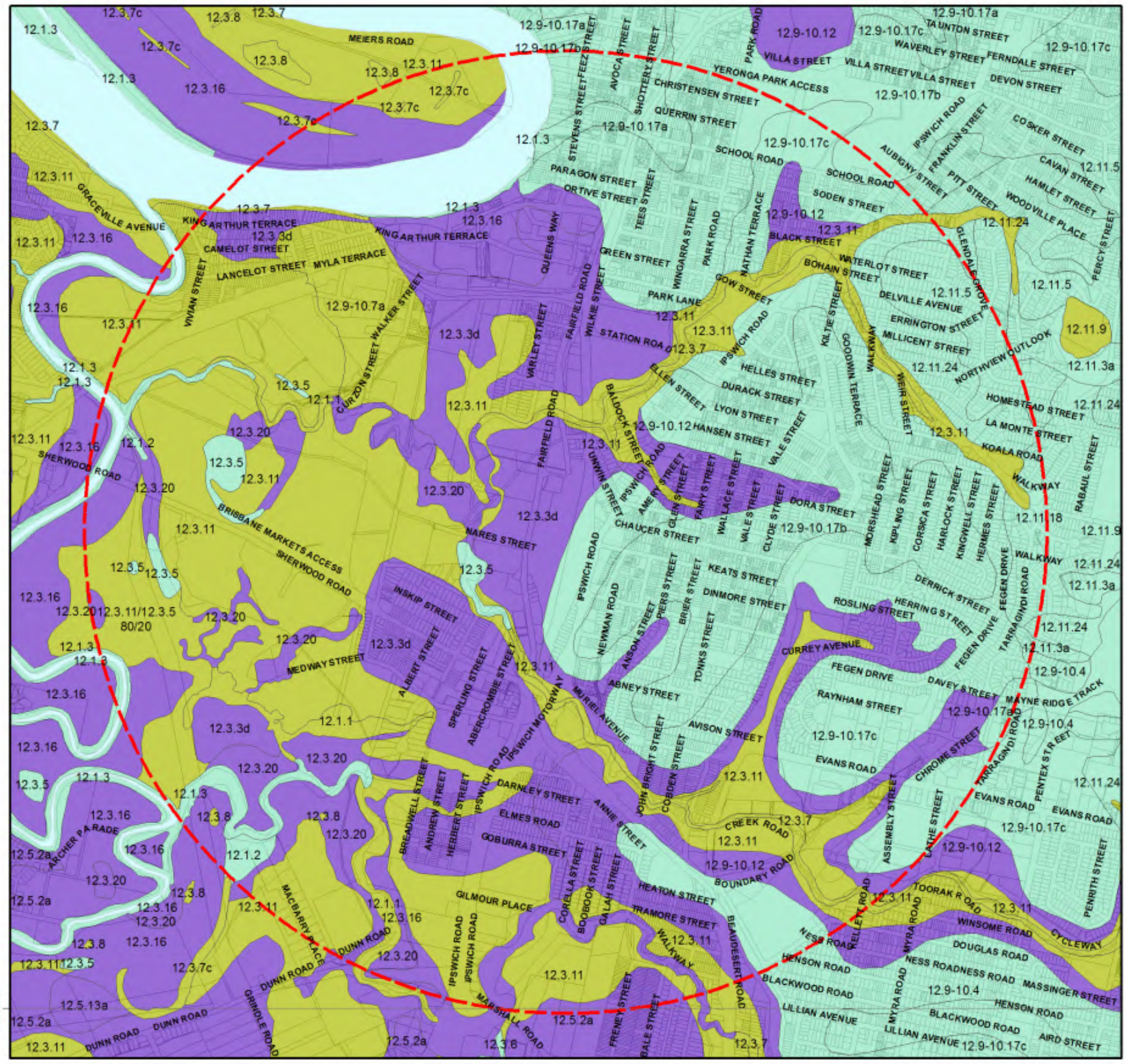
N

0 0.25 0.5 0.75 1 km

This product is projected into GDA 1994 Queensland Albers

Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.
Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.
Non-remnant vegetation includes regrowth and disturbed native vegetation.

Map 3 - Pre-clearing regional ecosystems



Pre-clearing Regional Ecosystems

Biodiversity Status

- 2 kilometre buffer
- Endangered - Dominant vegetation
- Endangered - Sub-dominant
- Of Concern - Dominant
- Of Concern - Sub-dominant
- No concern at present
- Water
- Cadastral Boundaries

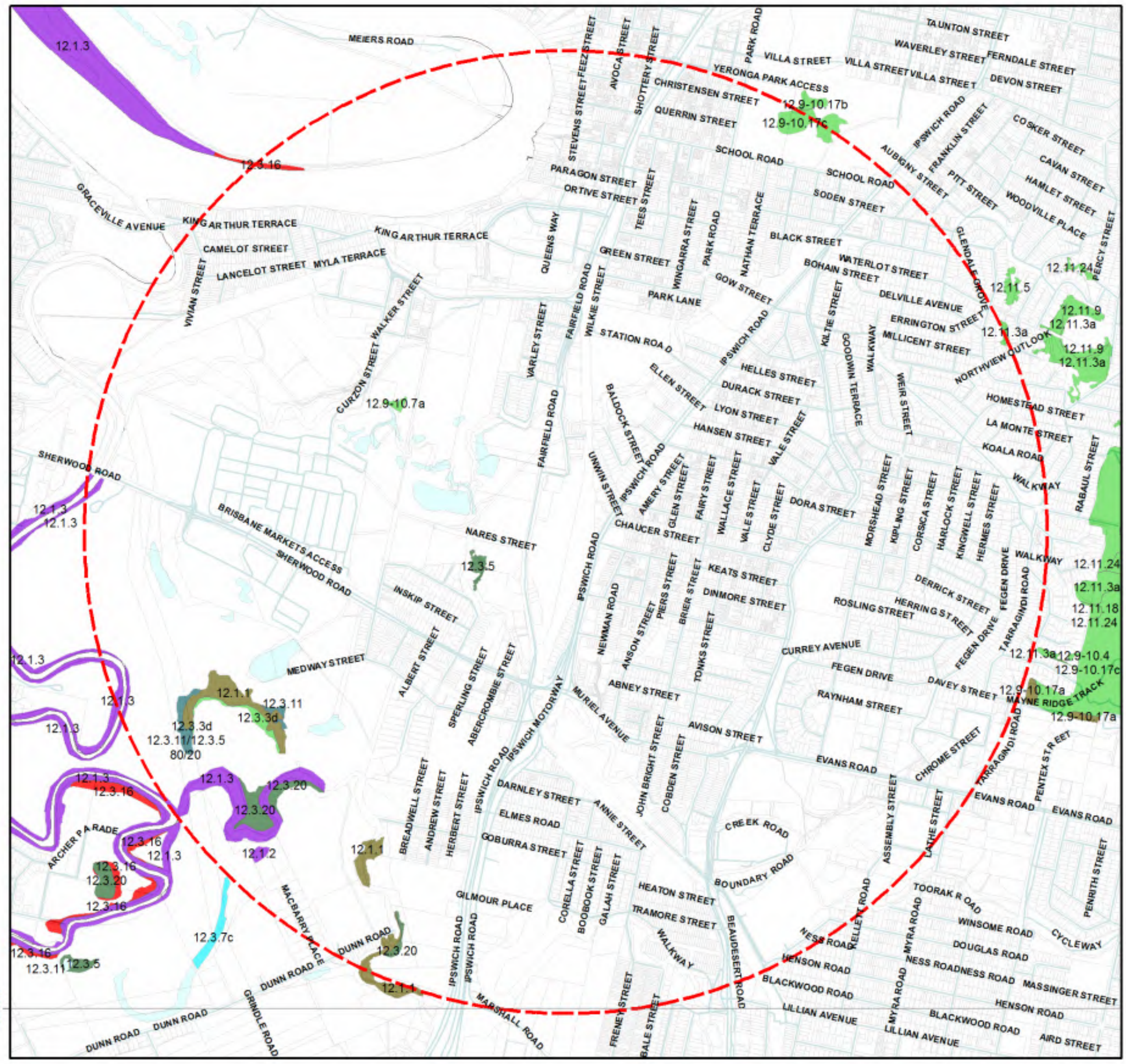
Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil.
The polygons are labelled by regional ecosystem (RE); where more than one RE occurs, the percentage of each is labelled. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

N

0 0.25 0.5 0.75 1 km

This product is projected into GDA 1994 Queensland Albers

Map 4 - Remnant 2017 regional ecosystems by BVG (5M)



Remnant 2017 Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups

BVG5M Description (BVG1M codes)

- 2 kilometre buffer
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Non-remnant vegetation, cultivated or built environment
- Water
- Cadastral Boundaries

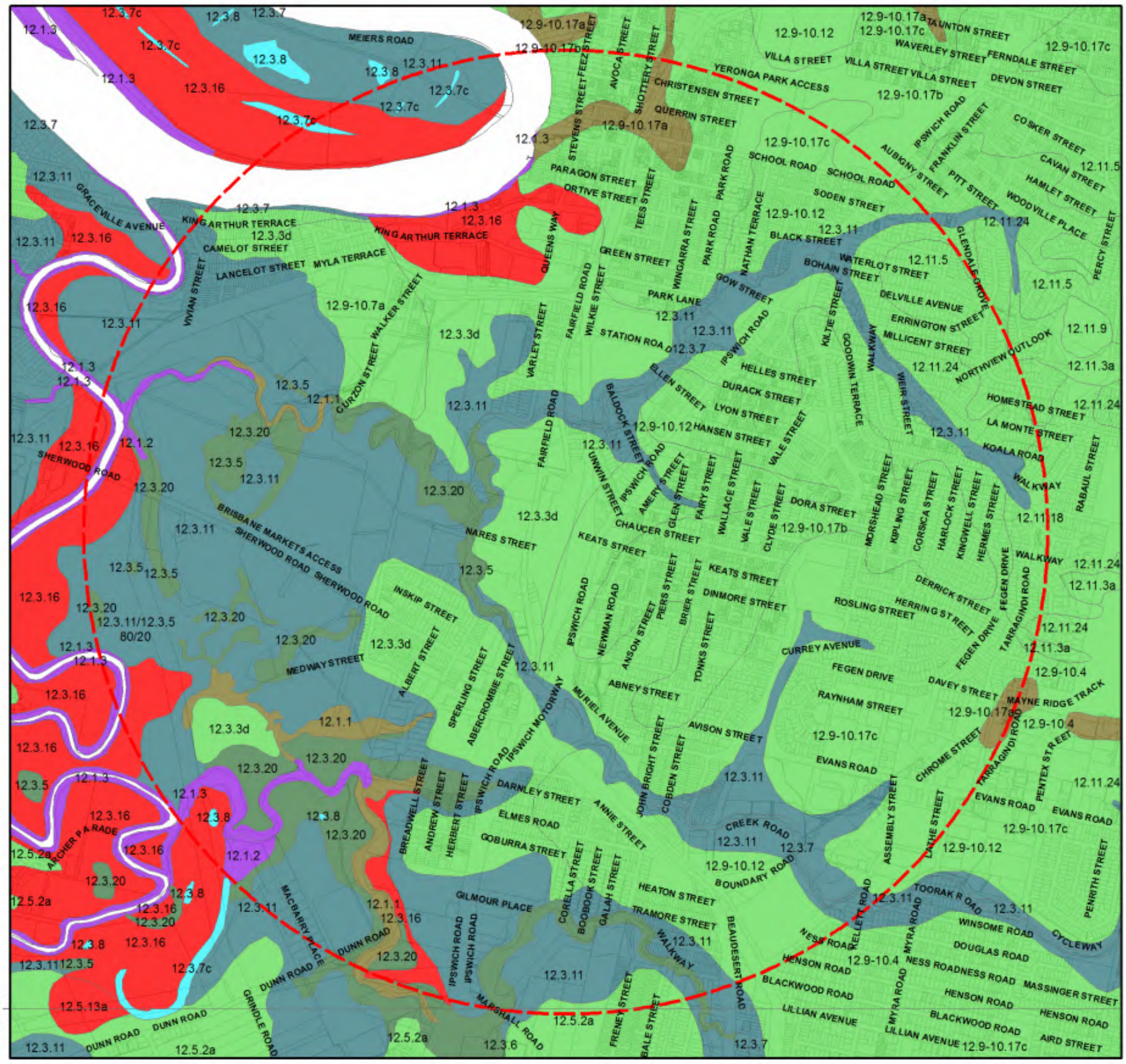
N

0 0.25 0.5 0.75 1 km

This product is projected into GDA 1994 Queensland Albers

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.
Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.
Remnant woody vegetation is defined as vegetation that has not been cleared or vegetation that has been cleared but where the dominant canopy has >70% of the height and >50% of the cover relative to the undisturbed height and cover of that stratum and is dominated by species characteristic of the vegetation's undisturbed canopy.
Non-remnant vegetation includes regrowth and disturbed native vegetation.

Map 5 - Pre-clearing regional ecosystems by BVG (5M)



Pre-clearing Regional Ecosystems coloured by Broad Vegetation Groups

Broad Vegetation Groups
BVG5M Description (BVG1M codes)

- 2 kilometre buffer
- 1. Rainforests and scrubs (1-7b)
- 2. Wet eucalypt open forests (8-8b)
- 3. Eucalypt woodlands to open forests (mainly eastern Qld) (9-15b)
- 4. Eucalypt open forests to woodlands on floodplains (16-16d)
- 5. Eucalypt dry woodlands on inland depositional plains (17-18d)
- 6. Eucalypt low open woodlands usually with spinifex understorey (19-19d)
- 7. Callitris woodland - open forests (20a)
- 8. Melaleuca open woodlands on depositional plains (21-22c)
- 9. Acacia aneura (mulga) dominated open forests, woodlands and shrublands (23-23b)
- 10. Other acacia dominated open forests, woodlands and shrublands (24-26a)
- 11. Mixed species woodlands, open woodland - (inland bioregions) includes wooded downs (27-27c)
- 12. Other coastal communities or heaths (28-29b)
- 13. Tussock grasslands, forblands (30-32b)
- 14. Hummock grasslands (33-33b)
- 15. Wetlands (swamps and lakes) (34-34g)
- 16. Mangroves and saltmarshes (35-35b)
- Water
- Cadastral Boundaries

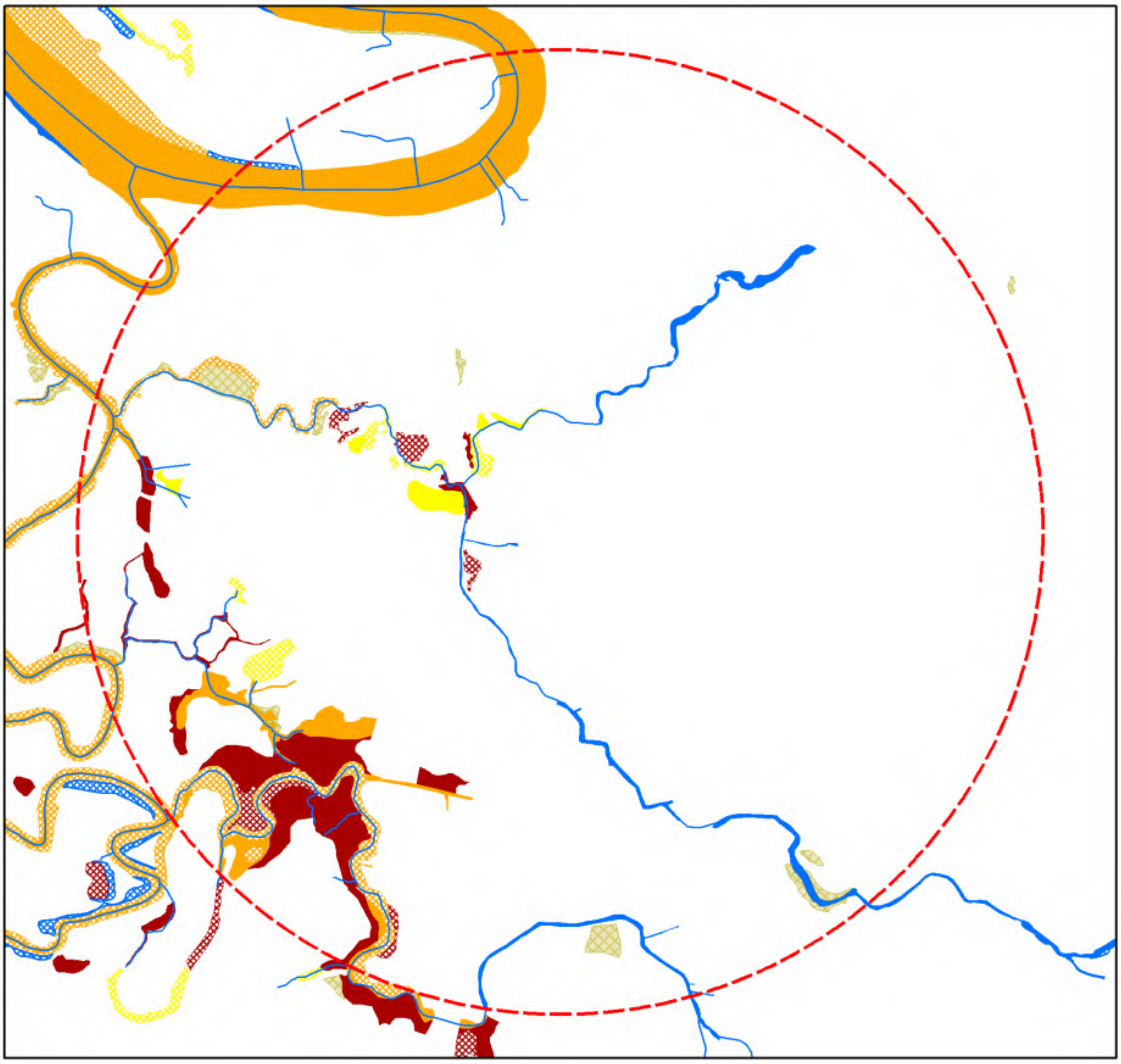
N

0 0.25 0.5 0.75 1 km

This product is projected into GDA 1994 Queensland Albers

Broad Vegetation Groups (BVG) of Queensland are applied by look up table to the regional ecosystem vegetation communities. Each polygon is coloured by the dominant BVG5M and the component regional ecosystems labelled. Where more than one regional ecosystem occurs, the percentage of each is labelled.
Regional ecosystem mapping over the majority of Queensland is produced at a scale of 1:100,000. At this scale, the minimum remnant polygon area is 5 hectares or minimum remnant width of 75 metres. Regional ecosystem linework reproduced at a scale greater than 1:100,000, except in designated areas, should be used as a guide only. The precision of polygon boundaries or positional accuracy of linework is 100 metres.
Regional ecosystems are defined as vegetation communities in a bioregion that are consistently associated with a particular combination of geology, landform and soil. The label consists of 3 components: bioregion, land zone, and vegetation community – the dominant canopy species. e.g.: RE 12.3.3. Descriptions of REs are found online. Use the search term "Regional Ecosystem Framework".
Regional ecosystem mapping at 1:100,000 map scale is derived from the following sources: 1:80,000 B&W 1960's aerial photography, Landsat TM imagery, geology, soils, land systems data, field survey and historical records.

Map 6 - Wetlands and waterways



Queensland Wetland Data

Legend

- 2 kilometre buffer
- Towns

Queensland Wetland Data

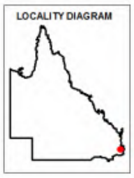
- Riverine Drainage Lines
- Springs

Wetland System - Water Bodies

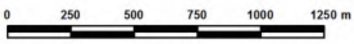
- Marine Waterbodies
- Estuarine Waterbodies
- Riverine Waterbodies
- Lacustrine Waterbodies
- Palustrine Waterbodies

Wetland System - Regional Ecosystems

- Marine RE
- Estuarine RE
- Riverine RE
- Lacustrine RE
- Palustrine RE
- RE 51-80% wetland (mosaic units)
- RE 1-50% wetland (mosaic units)



N



Accuracy information: The positional accuracy of wetland data mapped at a scale of 1:100,000 is +/-100m with a minimum polygon size of 5ha or 75m wide for linear features, except for areas along the east coa st which are mapped at the 1:50,000 scale with a positional accuracy of +/-50m, with a minimum polygon size of 1ha or 35m wide for linear features. Wetlands smaller than 1ha are not delineated on the wetland data. Consideration of the effects of mapped scale is necessary when interpret ing data at a larger scale, e.g. 1:25,000. For property assessment, digital linework should be used as a guide only. The extent of wetlands depicted on this map is based on rectified 2013 Landsat ETM+ imagery supplied by Statewide Landcover and Trees Study (SLATS), Department of Environment and Science. The extent of water bodies is based on the maximum extent of inundation derived from available Landsat imagery up to and including the 2013 imagery.

This product is projected into GDA 1994 Queensland Albers

Links and Other Information Sources

The Department of Environment and Science's Website -

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/

provides further information on the regional ecosystem framework, including access to links to the Regional Ecosystem Database, Broad Vegetation Group Definitions, Regional Ecosystem and Land zone descriptions.

Descriptions of the broad vegetation groups of Queensland can be downloaded from:

https://publications.qld.gov.au/dataset/redd/resource/

The methodology for mapping regional ecosystems can be downloaded from:

https://publications.qld.gov.au/dataset/redd/resource/

Technical descriptions for regional ecosystems can be obtained from:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/technical-descriptions/

Benchmarks can be obtained from:

http://www.qld.gov.au/environment/plants-animals/biodiversity/benchmarks/

For further information associated with the remnant regional ecosystem dataset used by this report, refer to the metadata associated with the Biodiversity status of pre-clearing and Remnant Regional Ecosystems of Queensland dataset (version listed in **Appendix 1**) which is available through the Queensland Government Information System portal,

http://dds.information.qld.gov.au/dds/

The Queensland Globe is a mapping and data application. As an interactive online tool, Queensland Globe allows you to view and explore Queensland maps, imagery (including up-to-date satellite images) and other spatial data, including regional ecosystem mapping. To further view and explore regional ecosystems over an area of interest, access the Biota Globe (a component of the Queensland Globe). The Queensland Globe can be accessed via the following link:

http://www.dnrm.qld.gov.au/mapping-data/queensland-globe

References

Neldner, V.J., Niehus R.E., Wilson, B.A. McDonald, W.J.F., Ford, A.J. and Accad, A. (2017) The Vegetation of Queensland. Descriptions of Broad Vegetation Groups. Version 3.0. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts.

(https://publications.qld.gov.au/dataset/redd/resource/78209e74-c7f2-4589-90c1-c33188359086)

Neldner, V.J., Wilson, B.A., Dillewaard, H.A., Ryan, T.S. and Butler, D.W. (2017) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. Version 4.0. Queensland Herbarium, Department of Science, Information Technology, Innovation and the Arts.

(https://publications.qld.gov.au/dataset/redd/resource/6dee78ab-c12c-4692-9842-b7257c2511e4)

Sattler, P.S. and Williams, R.D. (eds) (1999). *The Conservation Status of Queensland's Bioregional Ecosystems*. Environmental Protection Agency, Brisbane.

Appendices

Appendix 1 - Source Data

The dataset listed below is available for download from:

http://www.qld.gov.au/environment/plants-animals/plants/ecosystems/download/

- Regional Ecosystem Description Database

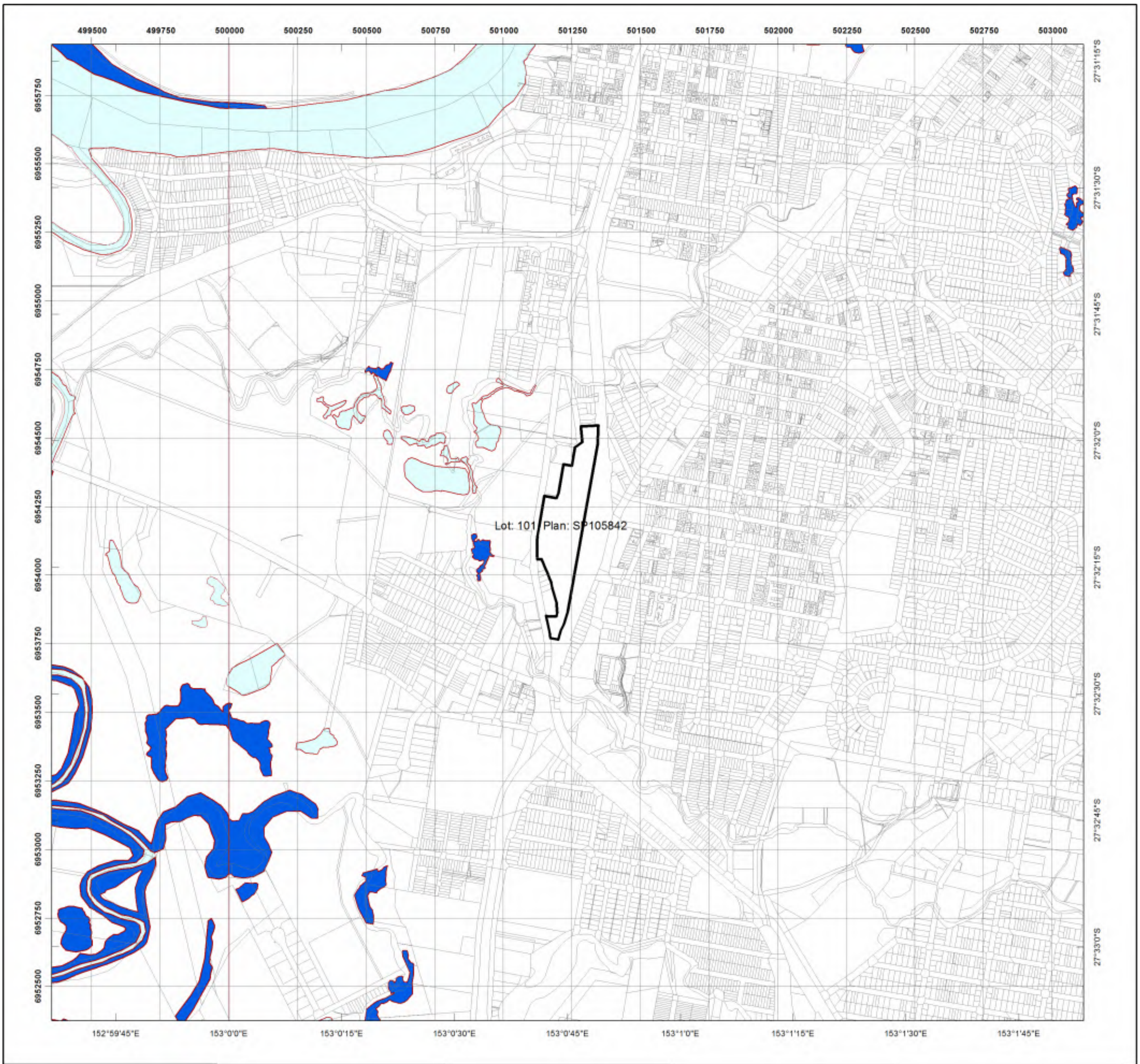
The datasets listed below are available for download from:

http://dds.information.qld.gov.au/dds/

- Biodiversity status of pre-clearing and 2017 remnant regional ecosystems of Queensland
- Pre-clearing Vegetation Communities and Regional Ecosystems of Queensland
- Queensland Wetland Data Version - Wetland lines
- Queensland Wetland Data Version - Wetland points
- Queensland Wetland Data Version - Wetland areas

Appendix 2 - Acronyms and Abbreviations

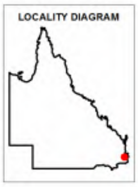
AOI	- Area of Interest
GDA94	- Geocentric Datum of Australia 1994
GIS	- Geographic Information System
RE	- Regional Ecosystem
REDD	- Regional Ecosystem Description Database
VMA	- *Vegetation Management Act 1999*



Regulated Vegetation Management Map

Legend

- Selected Lot and Plan
- Category A area (Vegetation offsets/compliance notices/VDecs)
- Category B area (Remnant vegetation)
- Category C area (High-value regrowth vegetation)
- Category R area (Reef regrowth watercourse vegetation)
- Category X area (Exempt clearing work on Freehold, Indigenous and Leasehold land)
- Water
- Area not categorised
- Other land parcel boundaries



N

0 200 400 600 800 1,000 m

This product is projected into:
GDA 1994 MGA Zone 56

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Resources makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

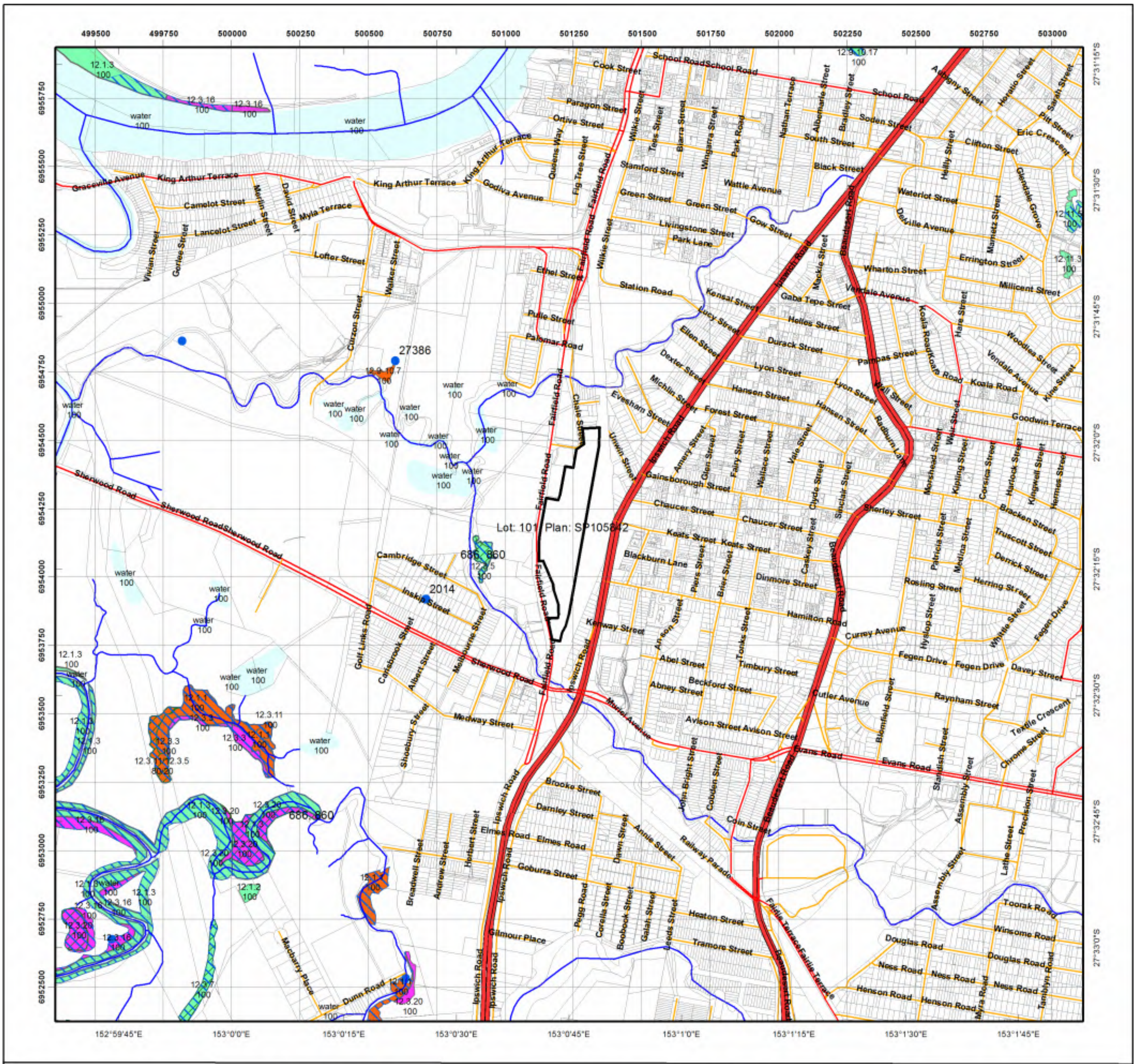
Additional information required for the assessment of vegetation values is provided in the accompanying "Vegetation Management Supporting map". For further information go to the web site: www.dnrme.qld.gov.au or contact the Department of Resources.

Digital data for the regulated vegetation management map is available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.

This map is updated on a monthly basis to ensure new PMAVs are included as they are approved.

Queensland Government



Vegetation Management Supporting Map

Legend

- Selected Lot and Plan
- Category A or B area containing endangered regional ecosystems
- Category A or B area containing of concern regional ecosystems
- Category A or B area that is a least concern regional ecosystem
- Category A or B area under Section 20AH
  These areas are edged in yellow and filled with the remnant RE Status
- Category C or R area containing endangered regional ecosystems
- Category C or R area containing of concern regional ecosystems
- Category C or R area that is a least concern regional ecosystem
- Category C area under Section 20AI
  These areas are edged in purple and filled with the remnant RE Status
- Category X area
- Water
- Wetland on the vegetation management wetlands map
- Essential habitat on the essential habitat map
- Essential habitat species record
- Watercourses and drainage features on the vegetation management watercourse and drainage features map
  (Stream order shown as black number against stream where available)
- Highway
- Connector
- Street/Local Road
- National Parks, State Forest and other reserves
- Other land parcel boundaries

Queensland Government

N

0 140 280 420 560 700 m

This product is projected into:
GDA 1994 MGA Zone 56

Labels for Essential Habitat are centred on the area of enquiry.

Regional ecosystem linework has been compiled at a scale of 1:100 000, except in designated areas where a compilation scale of 1:50 000 is available. Linework should be used as a guide only. The positional accuracy of RE data mapped at a scale of 1:100 000 is +/- 100 metres.

Disclaimer:
While every care is taken to ensure the accuracy of this product, the Department of Resources makes no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and disclaims all responsibility and all liability (including without limitation, liability in negligence) for all expenses, losses, damages (including indirect or consequential damage) and costs which you might incur as a result of the product being inaccurate or incomplete in any way and for any reason.

Additional information may be required for the purposes of land clearing or assessment of a regional ecosystem map or PMAV applications. For further information go to the web site: www.dnrme.qld.gov.au or contact the Department of Resources.

Digital data for the vegetation management watercourse and drainage feature map, vegetation management wetlands map, essential habitat map and the vegetation management remnant and regional ecosystem map are available from the Queensland Spatial Portal at http://www.information.qld.gov.au/

Land parcel boundaries are provided as locational aid only.

Vegetation Management Act 1999 - Extract from the essential habitat database

Essential habitat is required for assessment under the:

- State Development Assessment Provisions - State Code 16: Native vegetation clearing which sets out the matters of interest to the state for development assessment under the *Planning Act 2016*; and
- Accepted development vegetation clearing codes made under the *Vegetation Management Act 1999*

Essential habitat for one or more of the following species is found on and within 1.1 km of the identified subject lot/s on the accompanying essential habitat map.

This report identifies essential habitat in Category A, B and Category C areas.

The numeric labels on the essential habitat map can be cross referenced with the database below to determine which essential habitat factors might exist for a particular species.

Essential habitat is compiled from a combination of species habitat models and buffered species records.

The Department of Resources website (http://www.dnrme.qld.gov.au) has more information on how the layer is applied under the State Development Assessment Provisions - State Code 16: Native vegetation clearing and the *Vegetation Management Act 1999*.

Regional ecosystem is a mandatory essential habitat factor, unless otherwise stated.

Essential habitat, for protected wildlife, means a category A area, a category B area or category C area shown on the regulated vegetation management map-

1) that has at least 3 essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; or
2) in which the protected wildlife, at any stage of its life cycle, is located.

Protected wildlife includes critically endangered, endangered, vulnerable or near-threatened native wildlife prescribed under the *Nature Conservation Act 1992*.

Essential habitat in Category A and/or Category B and/or Category C

No records

Appendix 2 - Ecology Assessment Findings

Ecological assessments carried out in 2019, following whole of project refinements associated with RfPC-4, involved a review and update of the previously completed assessments and new field assessments in order to verify findings. Key assessment outcomes of relevance to the Proposed Changes are summarised in the following sections.

The southern footprint for the investigation of aquatic and terrestrial ecology values span from Fairfield to Salisbury inclusive of Clapham Yard, which includes the crossing of the Moolabin Creek waterway.

1. Aquatic ecology

The below survey findings provide considerations of aquatic ecological conditions within Moolabin Creek:

- The Moolabin Creek aquatic system demonstrates conditions typical of heavily urbanised waterways. Significant development has led to a generally degraded aquatic ecology, with reduced water quality conditions, impacted riparian vegetation (including weed disturbance) and a high incidence of introduced aquatic fauna.
- Despite these conditions, native species continue to find refugia within the waterways over their full length.
- The aquatic systems within Moolabin Creek waterways are considered moderately to heavily impacted.
- Moolabin Creek presents a long history of vegetation clearing and alteration to the riparian zone.
- The vegetation at Moolabin Creek is dominated by invasive weed species throughout.
- Moolabin Creek presents a significantly impacted riparian flora with dominance by the invasive Giant reed (*Arundo donax*), Chinese celtis and Singapore Daisy.
- No aquatic fauna species of conservation significance (*threta*) were recorded during the most recent surveys.
- The dusky moorhen is likely to breed in local waterways using shallow platform nests within reeds and associated riparian vegetation during the summer months. Moolabin Creek may present suitable nesting habitat for this species during the year.
- No active breeding places were recorded during field observations.
- Carp (*Cyprinus carpio*), tilapia (*Oreochromis mossambicus*) and mosquito fish (*Gambusia holbrooki*) have been recorded within the waterways. These species are listed in the *Biosecurity Act 2014* as restricted noxious fish.
- Five (5) aquatic weed species identified as Category 3 Restricted weeds were identified during field observations, these included alligator weed, cabomba, common water hyacinth, Salvinia and glush weed.

2. Terrestrial ecology

The following survey findings for terrestrial ecological values (flora, fauna and habitat) are broadly associated with the Fairfield to Salisbury corridor (inclusive of Clapham Yard):

- Vegetation within the corridor is dominated by weedy herbs, shrubs and grasses, though planted and naturally recruited natives are observed. Regular maintenance of existing vegetation is conducted adjacent to traction power supply lines and railway infrastructure as part of safety management and risk mitigation programs which limit the occurrence of tree and shrub vegetation generally.
- No protected flora has been observed within the disturbance footprint during field survey.
- No protected fauna species have been recorded within the disturbance footprint.
- 16 weed species identified as Category 3 Restricted weeds were identified during field observations, these included giant rat's tail grass, annual ragweed, ground asparagus fern,

Fireweed, Singapore daisy, groundsel bush, Lantana, prickly pear, Chinese celtis, camphor laurel, broadleaved pepper, African tulip tree, Madeira vine, balloon vine, cat's claw creeper and Singapore daisy

- One restricted Category 2 weed was identified, and it was limited to a single species observed within the footprint, Mother of millions (*Bryophyllum delagoense*). This common garden escape was observed most commonly along the corridor cuttings adjacent to residential housing, where specimens have established along the boundary fencing.

3. Mapping vs. Groundtruthing

To focus the scope of the ecological groundtruthing surveys; and ascertain whether any special considerations pertaining to vegetation clearing requirements were required, the following mapping has been reviewed

- Natural Assets Local Law 2003 (NALL)
- Matters of State Environmental Significance (MSES) under the State Planning Policy (SPP).
- Regional Ecosystem (RE) Mapping
- Protected Plants trigger Mapping under the Nature Conservation Act 1992 (NCA)
- Property maps of assessable vegetation under the Vegetation Management Act 1999 (VMA).

3.1 Mapping review

The mapping review identified that the vegetation at Moolabin Creek is identified as potentially significant vegetation as summarised in the below Table 2.

Table 2 Potentially Significant Vegetation

Location	NALL	MSES	RE	NCA	VMA
Moolabin Creek	Mapped as waterway and wetland vegetation	Mapped as Regulated Vegetation intersecting a watercourse	Non remnant Vegetation, cultivated or built environment	Not mapped as a high risk area	Category X area

3.2 Groundtruthing

The NALL mapping is not reflective of the actual vegetation values groundtruthed during the ecological field surveys.

Similarly, the MSES and VMA mapping is not fully reflective of the actual vegetation or habitat values along the watercourses of Moolabin.

Discrepancies between local and state government mapping and field observations are not uncommon.

It also is important to note that the NALL layers, particularly the waterway and wetland vegetation, is based on the waterway corridors mapping shown in the City Plan 2014 Waterways Corridor overlay map. The purpose of the Waterways corridor is to achieve overall outcomes such as avoiding fragmentation of corridors, avoiding or minimising clearing of riparian, native and significant vegetation but it is not always a true reflection of whether significant vegetation or habitat is present.

Similarly, the MSES, RE and VMA mapping are biophysical mapping products. The data used to create it is scale-dependent and care needs to be exercised in using the mapping at very large scales and it should not be used as a ‘point of truth’. It provides an indication of where the biodiversity values are expected to exist in the landscape. Site surveys are generally required to determine if the depicted values are present.

MSES mapping is not based on new or unique data. The primary mapping product draws data from a number of environment databases managed by state government agencies. The original data includes, but is not limited to:

- vegetation management regulated maps
- regional ecosystems remnant vegetation
- threatened species sightings (WildNet and other databases)
- protected area tenure mapping
- marine park zoning information
- Queensland wetland mapping

If there are inconsistencies in the MSES mapping, these typically must be raised with the relevant custodian of the original data, recognising that changes may not be possible.

According to the 'Method for mapping Matters of state environmental significance for the State Planning Policy 2017' (version 6.01), DES will only accept MSES mapping refinements on specific MSES mapping layers from local government intended for use in planning schemes. All other requests will be considered; however, no guarantee will be provided on updating the mapping.

Therefore, the only mapping that can typically be corrected are mapping such as property maps of assessable vegetation (PMAV), as long as the application to DES contains all the necessary information (https://www.qld.gov.au/environment/land/management/vegetation/maps/map-correction).

Review of the regulated vegetation mapping confirmed that Moolabin Creek is mapped as Category X. The field surveys support the categorisation of these areas as Category X. Therefore, is not necessary nor recommended for the Project to request an amendment to the PMAV mapping.

The review of the Survey Flora Trigger Mapping under the NC Act confirmed Clapham Yard and the creeks are not within or near mapped high risk areas. The field surveys support this mapping.

3.3 Approvals Consideration

One of the key approval considerations relates to the clearing of vegetation mapped as Category X under the VMA at Moolabin Creek.

Clearing of vegetation at Moolabin Creek is exempt clearing work (Planning Regulation, Schedule 10, Part 3, Division 2, Section 5) as it is for the construction of transport infrastructure that is government supported transport infrastructure.

However, since Moolabin Creek has been determined to be a watercourse under the Water Act 2000, the Project will require that a riverine protection permit (RPP) is obtained, unless an exemption applies.

NALL does not apply to the CRR Project. However, CRRDA intends to comply with the intent of the NALL and will discuss the need for any vegetation offsets with Council prior to undertaking activities that may impact on matters protected under the NALL. As new areas of mapped NALL will be impacted by the Proposed Change, additional offsets may be required to be considered.

4. Offsets

4.1 MSES

The trigger for identifying whether an offset may be required, for some matters (e.g. RE), is the relevant map. However, the assessment takes into consideration the on-ground presence or absence of the prescribed environmental matter.

Review of the MSES mapping in conjunction with the groundtruthed data confirms that the MSES identified are not prescribed MSES under the *Environmental Offsets Act 2014* (EOA). Therefore, no offsets will be triggered under the EOA.

4.2 MLES

A Matter of Local Environmental Significance is a matter that is prescribed under a local planning instrument as a prescribed environmental matter. A MLES cannot be the same or substantially the same as a MNES or MSES.

This includes MSES that are not prescribed environmental matters in urban areas (for example, remnant 'of concern' regional ecosystems). However, a local government may identify a MLES on land that also has MSES or MNES, provided that the MLES is not the same or substantially the same as a value that is a MNES or MSES.

The EOA also allows local governments to prescribe MLES through their planning schemes. As the Project is exempt from approvals under the Brisbane City Plan 2014, offsets for impacts to MLES do not apply.

5. Conclusions

The Moolabin Creek aquatic system demonstrates conditions typical of a heavily urbanised waterway. Significant development has led to a generally degraded aquatic ecology, with reduced water quality conditions, impacted riparian vegetation (including weed disturbance) and a high incidence of introduced aquatic fauna. Despite these conditions, native species continue to find refugia within the waterways over their full length. The proposed crossing at Moolabin Creek is situated in a heavily impacted reach displaying degraded water quality and a heavy infestation of introduced riparian and aquatic weed species. General litter accumulation and larger debris associated with periodic flood flows has also been recorded.

The Project footprint is fully developed, with a long history of railway infrastructure and ongoing disturbance. Vegetation within the corridor is dominated by weedy herbs, shrubs and grasses, though planted and naturally recruited natives are observed. Regular maintenance of existing vegetation is conducted adjacent to traction power supply lines and railway infrastructure as part of safety management and risk mitigation programs which limit the occurrence of tree and shrub vegetation generally.

The waterway crossings at Moolabin Creek present the greatest associated habitat value. Although heavily disturbed themselves, these areas may provide increased values with respect to movement corridors and refugia. Water birds including the dusky moorhen, common moorhen, white faced heron and cormorants have been observed feeding at both Moolabin Creek outside the Project footprint. eDNA analysis has further confirmed utilisation of the waterway by a broad range of terrestrial and aquatic species.

Overall, the proposed development footprint can be best described as being of low habitat value with increased corridor value being associated with creek crossings. Proposed activities should remain sensitive of the waterway habitats, minimising interactions and facilitating recovery/rehabilitation of areas which are disturbed during construction. The use of fauna spotters in these areas when initiating works is recommended, as is the consideration of potential disturbance during times of breeding.

Whilst the project will result in temporary and permanent disturbance of mapped vegetation, the mechanism under the requirements of State Legislation adequately cater for the minimisation of impacts and rehabilitation of temporary disturbance.

Cross River Rail Environmental Impact Statement

Request for Project Change 11

Changes to the Project and changes to the imposed conditions

Volume 3 Technical Reports

Attachment G Landscape and Visual Amenity

Date:	***April 2021***
Author:	***Cross River Rail Delivery Authority***

CROSSRIVERRAIL

Queensland Government

Table of Contents

1. Assessment Methodology

The methodology used for the assessment of landscape and visual amenity has been derived from the methodology adopted for the Evaluated Project (refer Appendix 1) to allow for a comparative analysis between the Evaluated Project and the Proposed Changes.

Additional assessment has been undertaken where the Proposed Changes may result in a change to the landscape, visual amenity and lighting using representative viewpoint locations based on previous viewpoint assessment undertaken for the Evaluated Project to further support a comparative analysis. Refer to Figure 1 for viewpoint locations.

The assessment has been undertaken in three stages:

1. *Impact assessment* - An analysis of the potential landscape, visual and lighting impacts that may arise as a result of the Proposed Changes
2. *Summary of change from Evaluated Project* - A comparative analysis to identify any potential changes or additional impacts, and
3. *Mitigation* - A comparative analysis to identify any potential additional mitigation measures that would be required to mitigate the changed impact.

Figure 1: Clapham Yard and Moorooka Station viewpoint locations plan

1.1 Landscape Impact

A landscape assessment has been undertaken where the Proposed Changes may result in a physical change to the character of the landscape from the existing condition or for the Evaluated Project.

Landscape impact assessment has been evaluated against two main criteria, being the sensitivity of the landscape and the magnitude of change to landscape character, as shown in Table 1 and Table 2.

Table 1 Landscape sensitivity criteria

Landscape sensitivity	Attributes of landscape sensitivity categories
High	A landscape protected by national designation and/ or widely acknowledged for its quality and value; a landscape with distinctive character and low capacity to accommodate the type of change envisaged.
Moderate	A moderately valued landscape, perhaps a regionally important landscape and / or protected by regional/state designation, or where its character, land use, pattern and the scale may have some capacity to accommodate a degree of the type of change envisaged.
Low	A landscape valued to a limited extent, perhaps a locally important landscape or where its character, land use, pattern and scale are likely to have the capacity to accommodate the type of change envisaged.
Negligible	A landscape which is not valued for its scenic quality or where its character, existing land use, pattern and scale are tolerant of the type of change envisaged, and the landscape has the capacity to accommodate change.

Table 2 Magnitude of change to landscape character criteria

Landscape magnitude	Attributes of landscape magnitude of change categories
High	Dominant change: A clearly evident and frequent/continuous change in landscape characteristics affecting an extensive area, which is likely to fundamentally change the character of the landscape.
Moderate	Considerable change: A considerable change in landscape characteristics, frequent or continuous and over a wide area or a clearly evident change, but over a restricted area.
Low	Noticeable change: A noticeable change in landscape characteristics over a wide area or a considerable change over a restricted area but will not fundamentally change the character of the landscape.
Negligible	Barely perceptible change: An imperceptible, barely or rarely perceptible change in landscape characteristics.

1.2 Visual Impact

A visual impact assessment has been conducted through an appraisal of the visual context of the Proposed Changes and the selection of representative viewpoints.

The sensitivity of each viewpoint varies from high to negligible based on the type of development and receptor audience. The sensitivity of a user or receptor refers to the context of the view and the appreciation associated with it. This may include the value placed on the viewpoint by viewers, including its contribution to the sense of place or local character of the area.

Visual impact assessment has been evaluated against two main criteria, being visual sensitivity (show in Table 3) and magnitude of change to visual amenity (shown in Table 4). The amount / frequency of viewers experiencing or visiting the views contributes to the sensitivity whilst visual magnitude of change refers to the extent of change expected to occur within the existing viewpoint.

Table 3 Viewpoint sensitivity criteria

Visual sensitivity	Attributes of visual sensitivity categories
High	Large numbers of viewers or those with proprietary interest and prolonged viewing opportunities such as residents and users of attractive and/or well-used recreational facilities. Views from a regionally important location whose interest is specifically focussed on the landscape, e.g. national park.
Moderate	Medium numbers of residents, e.g. rural communities and townships, and moderate numbers of visitors with an interest in their environment, e.g. visitors to state forests, including bushwalkers, horse riders, trail bikers. Larger numbers of travellers with an interest in their surroundings, e.g. local designated scenic routes.
Low	Small numbers of visitors with a passing interest in their surroundings or transient views, e.g. those travelling along principal roads. Viewers whose interest is not specifically focussed on the landscape, e.g. workers, commuters, truck drivers. Isolated or small clusters of rural residential properties.
Negligible	Very occasional numbers of viewers with a passing interest in their surroundings, e.g. those travelling along minor roads and views from the air.

Table 4 Magnitude of change to visual amenity criteria

Visual magnitude	Attributes of visual magnitude of change categories
High	Major changes in view at close distances, affecting a substantial part of the view, continuously visible for a long duration, or obstructing a substantial part or important elements of view. Generally, short distances (typically < 1 km) to the nearest project infrastructure element.
Moderate	Clearly perceptible changes in views at intermediate distances, resulting in either a distinct new element in a significant part of the view or a more wide-ranging, less concentrated change across a wider area. Generally, short to medium views (typically 1 km – 2.5 km) to the nearest project infrastructure.
Low	Minor changes in views at long distances or visible for a short duration, and/or are expected to blend in with the existing view to a moderate extent. Generally, medium to long distance views (typically 2.5 km – 5 km) to the nearest project infrastructure.
Negligible	Change which is barely visible at a very long distance or visible for a very short duration, and/or is expected to blend with the existing view. Distant views (generally, >5 km) to the nearest project infrastructure.

1.3 Impact Assessment

In order to maintain consistency with previously completed RfPCs, the landscape and visual impact assessments are based on themes of magnitude and sensitivity, as illustrated in Table 5. For each of the Proposed Changes, the *Summary of Change from Evaluated Project* to landscape character and visual assessment is also provided to identify whether the changed impact is increased, decreased or consistent with the Evaluated Project.

Table 5 Assessment Matrix

Level of impact		Magnitude: High	Magnitude: Moderate	Magnitude: Low	Magnitude: Negligible
Sensitivity	High	High Impact	High-Moderate Impact	Moderate Impact	Negligible Impact
Sensitivity	Moderate	High-Moderate Impact	Moderate Impact	Moderate-Low Impact	Negligible Impact
Sensitivity	Low	Moderate Impact	Moderate-Low Impact	Low Impact	Negligible Impact
Sensitivity	Negligible	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact

1.4 Lighting

A summary description of the lighting sources and potential lighting impacts that may arise as a result of the construction and operational phases was prepared for the Evaluated Project.

A review of previous lighting impact assessment summaries has been undertaken and the Proposed Changes have been identified to be generally consistent with the Evaluated Project. As a result, assumptions and limitations that were applicable to previous assessments are unchanged, including:

- The lighting assessment is qualitative. The assessment locations have not been visited at night to measure existing light levels.
- Lighting will be generally in accordance with the requirements of Australian Standard 4282 – Control of the Obtrusive Effects of Outdoor Lighting.
- Detailed design and construction planning will further develop the details of Project delivery, and visual impacts will be managed through a visual mitigation plan to minimise visual impact to surrounding receptors.
- Fencing material finishes will affect the extent of visual impact within Clapham Yard.
- Details of fencing materials will be determined prior to construction but have been assumed to be a wire mesh.

2. Changes to Potential Impacts

Landscape and visual impacts caused by the Proposed Changes are anticipated to be generally similar with the impacts as described for the Evaluated Project. The following sections provide an assessment of the change in impacts to landscape and visual amenity for the Proposed Changes. The assessment considers the change in impacts during construction and operation.

The key difference in the built form of Clapham Yard stabling area, which present potential changes to the landscape and visual impact as part of the Proposed Changes, are:

- the inclusion of the grade separated structure over Moolabin Creek
- the change in location of the Moorooka Station western platform to be located adjacent to the eastern platforms with the associated provision of accessible pedestrian footbridge for station platform access
- earthworks and associated retaining walls required to provide flood immunity for Clapham Yard.

2.1 Evaluated Project Context

2.1.1 Summary of Landscape Character Change from Evaluated Project

The Proposed Changes will be situated within a rail corridor and industrial land use environment. The Proposed Changes are considered to be consistent within the context of this visual environment. Therefore, it is considered that there will be no significant temporary or permanent change in impacts to the landscape character.

2.1.2 Summary of Visual Assessment Change from Evaluated Project

Overall, the Proposed Changes are unlikely to result in significant changes to the visual impact presented by the Evaluated Project for Clapham Yard during the operational phase. Generally, Clapham Yard is as described in the Evaluated Project. Where there are changes to what was presented for the Evaluated Project, the changes are considered to be relatively minor and would be accommodated within the context of the rail and industrial land use environment.

2.2 Construction Impacts

During construction, the visual impacts are likely to remain relatively unchanged from what was presented for the Evaluated Project. Heavy machinery will be present at the site and fluctuating volumes of vehicle traffic entering and exiting the site will be visible. Service infrastructure will be installed, and earthworks are anticipated to change the immediate visual amenity of the existing site.

2.3 Operational Impacts

2.3.1 Grade Separated Structure over Moolabin Creek

At approximately 430m long and approximately 8.5m high, the viaduct will result in a noticeable change to the built form within Clapham Yard. However, as it will be situated within a predominantly industrial and rail infrastructure area, the opportunity for it to be viewed or appreciated from nearby sensitive receivers will be limited. The nearest potentially sensitive receivers include:

- travellers along nearby road networks, such as Fairfield Road or Ipswich Road,
- workers and visitors to nearby commercial developments, or
- nearby residential dwellings, with the closest located more than 200m to the west and more than 400m to the east.

The potential for views of the viaduct may be further diminished through the ongoing redevelopment of the surrounding industrial land. The land surrounding Clapham Yard is zoned as either General Industry A or B under Brisbane's City Plan. In accordance with the Brisbane City Plan's Industry Use Code, development within these zones is able to achieve a maximum building height of 15m. Consequently, where development achieves the maximum building height, it will almost be double the height of the rail viaduct and will effectively limit expansive views of the structure from the east.

An example of this is the currently under construction development at 1133 Ipswich Road and 20 Unwin Street. This development includes a storage facility with a gross floor area of 9,016m² and a building height of 15m. The size of this development will present as a significant barrier to views of the rail corridor, including the rail viaduct for travellers along Ipswich Road and residents located to the east of Ipswich Road. As the development potential of the surrounding industrial land is realised, views of Clapham Yard are likely to be diminished further.

2.3.2 Moorooka Station Platform

The change in location of the Moorooka Station platform will reduce the potential for elevated views for commuters of the Clapham Yard operations as a publicly accessible footbridge over the rail yard will no longer be provided. Although views of the yard from the pedestrian bridge over the station will still be possible, these views are considered to be generally consistent with views already experienced from the pedestrian bridge over Moorooka Station.

2.3.3 Earthworks and Retaining Walls

The earthworks required for Clapham Yard will result in a raising of the surface level across the site. The likely most visible elements of this surface raising will be the introduction of retaining walls at specific locations around the site. Generally, retaining walls will be required at a number of locations within the western half of the site and will vary between 1.5m and 3.5m high depending on location. While views of the retaining walls may be possible to travellers along Fairfield Road and from the commercial developments located along Fairfield, the sensitivity of these locations is considered to be moderate to low.

2.3.4 Viewpoint Assessment

Three viewpoint assessments have been undertaken from the surrounds of Clapham Yard and are provided below.

We note that the Evaluated Project was not granular enough to determine the full height and location of all retaining structures and earthworks. Therefore, a direct comparison between the Evaluated Project and is not possible.

As such, a new Viewpoint Assessment has been undertaken. The outcomes of the new assessment are then compared to the outcomes of the assessment undertaken as part of the Evaluated Project to determine if there is a change to Landscape and Visual Amenity.

The viewpoint assessments also provide a comparison with a summary of the viewpoints previously assessed for the Evaluated Project. Refer to Figure 1 for viewpoint locations.

Viewpoint 1: View from Fairfield Road looking south east towards Clapham Yard

Viewpoint 17 Based on previous assessment of the Evaluated Project: Clapham Yard – looking east towards works from Fairfield Road

Aspect	Previous Assessment of the Evaluated Project Summary	Assessment of Clapham Yard and Moorooka Station design refinements
Location and description	Viewpoint 17	• Distance to rail corridor from viewpoint is approximately 175m. • Viewpoint 1 is adjacent to an industrial area with industrial buildings situated to the west and commercial use area to the east, where the topography is elevated heading away from the station. • Further south along Fairfield Road, beyond the industrial area and to the west, there is a large recreational golf course which comprises a vegetated buffer along its eastern boundary blocking major views of the proposed works. • This viewpoint mainly represents daily views of passing users of the footpaths or the road, however it can also include the views of workers and nearby residents of the area.

Viewpoint 1: View from Fairfield Road looking south east towards Clapham Yard		
Visual sensitivity	Moderate to low	• The transiting receptors to this view are considered to have a low or general interest in their surroundings, generally due to the existing industrial context and the minimum exposure time to the view for most viewers. • A golf course to the west of Fairfield Road is considered to be fairly protected with well screened fencing and mature vegetation. However, some interrupted glimpses towards Clapham Yard may be possible. • Direct views into the rail yards are experienced from this location with minimal variation in topography, street tree planting and built form. • The view lacks landscape and quality visual amenity as it is dominated by industrial land use and infrastructure. • Based on the above point, the sensitivity of this view is therefore considered to be **moderate** to **low. This is the same impact as the Evaluated Project**
Visual magnitude of change	**Construction:** Moderate **Operation:** moderate to low	**Construction:** • Throughout the construction stages of the Project, active traffic entering and exiting the construction site may impact surrounding views into the rail yards. • Heavy machinery will also be required to construct the structures such as the overpass/viaduct. Earthworks will be undertaken on the site including the introduction of large batters changing the levels and existing topography of the site. • Due to the largely unobstructed views of the rail yards and existing station infrastructure, this will produce a **moderate** visual magnitude of change from the existing conditions with periods of increased visual impacts during the construction program. This magnitude of change is consistent with the Evaluated Project for this viewpoint. **Operation:** • Once operational, the viaduct that is to be located on the eastern boundary of the yard may be visible from this viewpoint. This will contribute towards the increase of visual impacts. • Views of retaining walls may be visible from this viewpoint. This will contribute towards the increase of visual impacts. • The operational visual magnitude of change is expected to be **Low** due to the Proposed Changes occurring in an existing rail yard surrounded by industrial land use. This magnitude of change is consistent with the Evaluated Project for this viewpoint.
Visual impact	**Construction:** Moderate to low **Operation:** low	**Construction:** • The potential visual impact at this viewpoint during construction is considered to be **moderate to low impact** as the works are largely within an existing rail environment and due to the moderate to low sensitivity of the surrounding receptors and context. **Operation:** • The potential visual impact to this viewpoint during operation is considered to be **low impact** as the works are largely within an existing rail environment and will be consistent with the existing context. This visual impact is consistent with the Evaluated Project for this viewpoint.

Viewpoint 2: View from Fairfield Road looking north east towards Clapham Yard

Viewpoint 18 Based on previous assessment of the Evaluated Project: Clapham Yard – looking north-east from Sherwood Road

Aspect	Previous Assessment of the Evaluated Project Summary	Assessment of the Proposed Changes
Location and description	Viewpoint 18	• Distance to rail corridor from viewpoint is approximately 50m. • Viewpoint 2 is experienced from Fairfield Road near commercial businesses located towards the southern extent of Clapham Yard. • This viewpoint represents the view of motorists, pedestrians, local workers and residents. • Behind the viewpoint are a number of commercial/light industrial uses that face towards Fairfield Road and Clapham Yard. • The general character of the viewpoint is urban, comprising of highly utilised road corridors and commercial areas with light industrial properties.

Viewpoint 2: View from Fairfield Road looking north east towards Clapham Yard		
Visual sensitivity	Moderate to low	• This viewpoint is partially subject to vegetation along the western boundary of Clapham Yard. • While there are a relatively high number of receptors located at this viewpoint who are considered to have general or low interest in their surroundings, the viewpoint from this location is not specifically used for the purpose of appreciating the view. • Overall this viewpoint is judged to be of **moderate to low** sensitivity. **This is the same impact as the Evaluated Project**
Visual magnitude of change	**Construction:** low **Operation:** low	**Construction:** • During construction, the viewpoint will experience insignificant impacts due to the distance from the construction works. • The overall visual magnitude of change from this viewpoint is anticipated to be **low**. **This is the same impact as the Evaluated Project** **Operation:** • The operational visual magnitude of change is expected to be **low** due to the works occurring in an existing rail environment and the distance of the viewpoint from proposed operations. **This is the same impact as the Evaluated Project**
Visual impact	**Construction:** moderate to low **Operation:** low	**Construction:** • The potential visual impact of this viewpoint is identified as **low impact** due to the insignificant magnitude of impacts during construction and moderate to low sensitivity of the surrounding receptors and context. **This is the same or lower impact as the Evaluated Project** **Operation:** • The potential visual impact at this viewpoint following construction is considered to be **low impact** as the works are largely within an existing rail environment and will be consistent with the existing context. **This is the same impact as the Evaluated Project**

Viewpoint 3: View from Ipswich Road looking north west towards Clapham Yard

Viewpoint 19 Based on previous assessment of the Evaluated Project: Clapham Yard – looking north-west from Ipswich Road

Aspect	Previous Assessment of the Evaluated Project Summary	Assessment of the Proposed Changes
Location and description	Viewpoint 19	• Distance to Clapham Yard from viewpoint is approximately 40m. • Viewpoint 3 is looking towards Clapham Yard from the eastern edge of Ipswich Road, which is a major arterial connection corridor largely used by motorists during peak hours. • Viewpoint 3 provides prominent views of the Moorooka Railway Station that is sited within the Clapham Yard. • This viewpoint represents the view of motorists transiting Ipswich Road (mainly north bound). It also includes the viewing experience of pedestrians, local workers and residents. • The location of the viewpoint is adjacent to a car sale yard, alongside the eastern boundary of Ipswich Road. Industrial land is located further north, on the eastern boundary of the road and the general land use further out to the east is residential. • The general character of the viewpoint is urban, comprising of highly utilised road corridor and commercial areas with industrial and residential properties nearby.

Viewpoint 3: View from Ipswich Road looking north west towards Clapham Yard		
Visual sensitivity	Moderate to low	• Ipswich Road is a highly utilised corridor for both motorists, local workers and residents. • Ipswich Road is a major arterial connection corridor largely used particularly by motorists during peak hours. • While this viewpoint allows for clear and direct sight into Clapham Yard, there is limited quality of visual amenity. • Based on the above points and the general low exposure time of motorists, Viewpoint 3 is rated ***moderate to low*** sensitivity. **This is the same impact as the Evaluated Project**
Visual magnitude of change	**Construction:** moderate **Operation:** moderate to low	**Construction:** • During construction, the viewpoint will experience an increase in traffic entering and exiting the construction site impacting surrounding views into the rail corridor. • Heavy machinery will also be required for various earth works and construction of the overpass/viaduct. • Due to the largely unobstructed views of the rail yards and existing station infrastructure, this will produce a **moderate** visual magnitude of change with periods of increased visual impacts during construction. **This is the same impact as the Evaluated Project** **Operation:** • The pedestrian overpass and associated structures, including vertical transport, will have a greater visual impact due to the elevation of the structures. • However, an enhanced overpass and station design is anticipated to result in improvements to visual amenity. • The operational visual magnitude of change is judged to be **low. This is the same impact as the Evaluated Project**
Visual impact	**Construction:** Moderate **Operation:** moderate to low	**Construction:** • The potential visual impact of this viewpoint is identified as **moderate to low impact** due to the direct impacts during construction and moderate to low sensitivity of the surrounding receptors and context. **This is the same or lower impact as the Evaluated Project** **Operation:** • The potential visual impact at this viewpoint during operation is considered to be **low impact** as the works are largely within an existing rail environment and will be consistent with the existing context. **This is the same or lower impact as the Evaluated Project**

3. Changes to Mitigation Measures

3.1 Environmental Management Framework (EMF)

Recommended mitigation measures for the changed landscape and visual amenity impacts arising from the Proposed Changes are generally consistent with the Evaluated Project requirements as documented in the Project O-EMP.

The Project O-EMP contains the Visual Amenity and Lighting Management Plan and the C-EMP contains the Construction Activities Management Sub-Plan, which provide more detailed mitigation measures to prevent and manage impacts associated with visual amenity and lighting.

Furthermore, the Project is required to achieve the Environmental Design Requirements detailed in Schedule 1 of Appendix 1 of the Imposed Conditions. Environmental Design Requirement 9 of addresses design requirements for visual amenity and lighting. Environmental Design Requirements are addressed through the development of the design and will be reviewed through detailed design. This adopted process will continue to be implemented unchanged for the delivery of the design for the Proposed Changes.

3.2 Proposed Changes to the EMF

No required changes to the Project Imposed Conditions have been identified with respect to the landscape character and visual amenity impacts identified for the Proposed Changes.

4. Conclusion

The effects associated with landscape and visual amenity of the Proposed Changes are generally comparable with those assessed as part of the Evaluated Project.

The key difference in built form of Clapham Yard stabling area which present potential changes to the landscape and visual impact as part of the Proposed Changes did not present significant change in impacts during construction and operation.

No temporary or permanent change in impacts is anticipated for the landscape character of Clapham Yard and its surroundings.

Changes in impact to visual amenity during the operational phase is unlikely to be significant mostly due to the minor nature of the changed effects, which would be accommodated within the context of the rail and industrial land use environment. Construction or temporary change in impacts to visual amenity is likely to remain relatively unchanged from the Evaluated Project.

No required changes to the Project Imposed Conditions, C-EMP, O-EMP and the relevant sub-plan have been identified with respect to the landscape character and visual amenity impacts identified for the Proposed Changes.

Appendix 1 RfPC4 Extract – LVIA Technical Report

5. Technical Report: Landscape and Visual Amenity

5.1 Overview

This technical report has been prepared for the CRR Project to assess the potential changes to the landscape, visual and lighting impacts arising from the Proposed Changes in comparison to the Evaluated Project. Volume 1 describes the Proposed Changes to the design and delivery of the CRR Project, which are the subject of this RfPC.

5.2 Assessment Methodology

5.2.1 Landscape and Visual Approach

The landscape and visual impact assessment has been undertaken in three stages;

1. *Impact assessment* - An analysis of the potential landscape, visual and lighting impacts that may arise as a result of the Proposed Changes;
2. *Summary of change from Evaluated Project* - A comparative analysis to identify any potential changes or additional impacts; and
3. *Mitigation* - A comparative analysis to identify any potential additional mitigation measures that would be required to mitigate the changed impact.

Visual

A visual assessment has been conducted through the selection of representative viewpoints. Where possible, the representative viewpoint locations were selected based on previous viewpoint assessments carried out for the Evaluated Project to allow a comparative analysis to be undertaken. Where the Evaluated Project viewpoints were not applicable, viewpoint locations were selected based on analysis of the visual context and potential visual receptors. Refer to Figures 5.1 to 5.3 below.

Landscape

A landscape assessment has been undertaken where the extent of works may result in a physical change to the character of the landscape (from existing condition or from the Evaluated Project), for example, areas of land resumption or rail corridor expansion, including:

- Albert Street Station
- Dutton Park Station
- Clapham Yard

Otherwise only visual impact changes have been assessed.

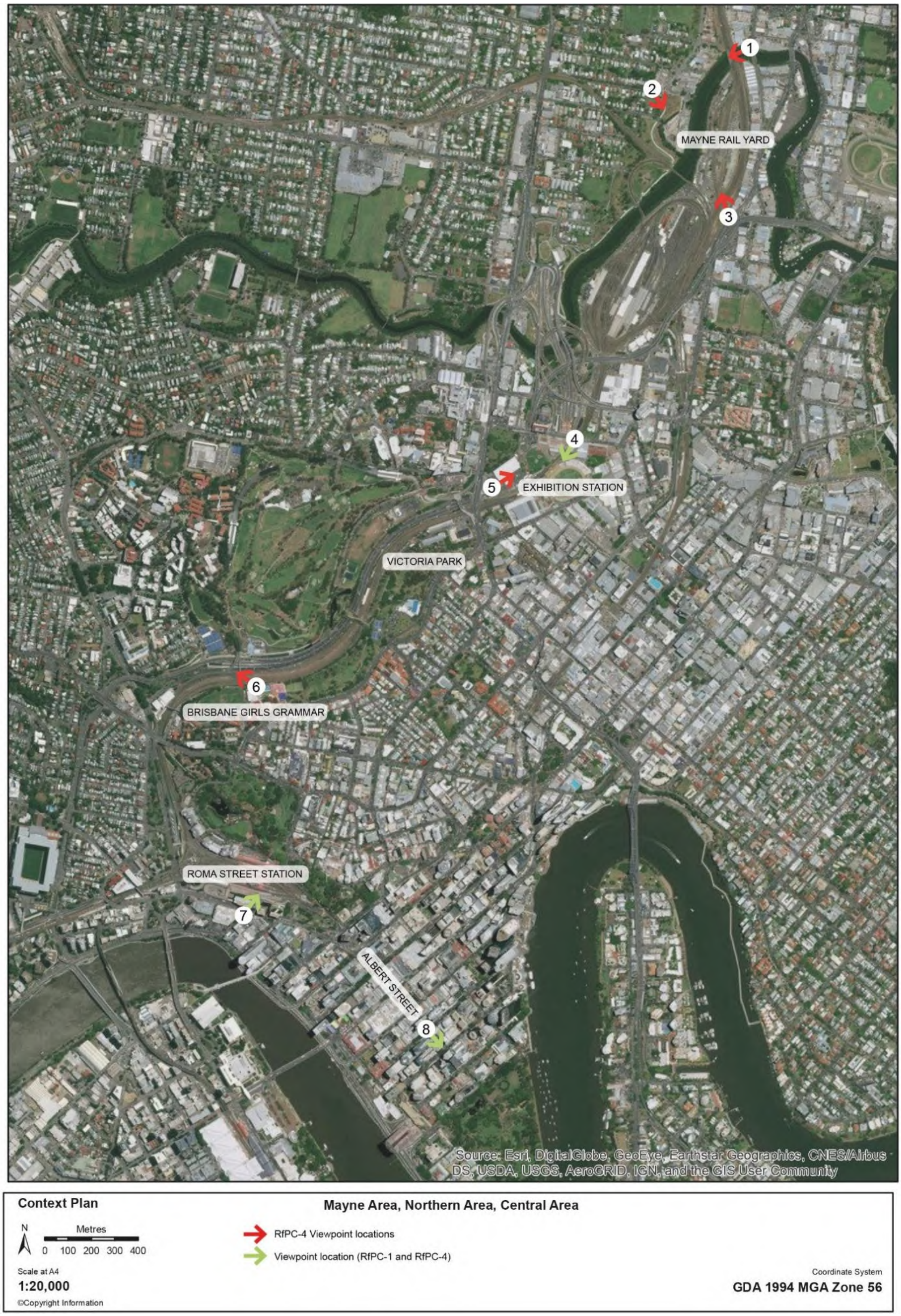


Figure 5.1: Viewpoint locations plan

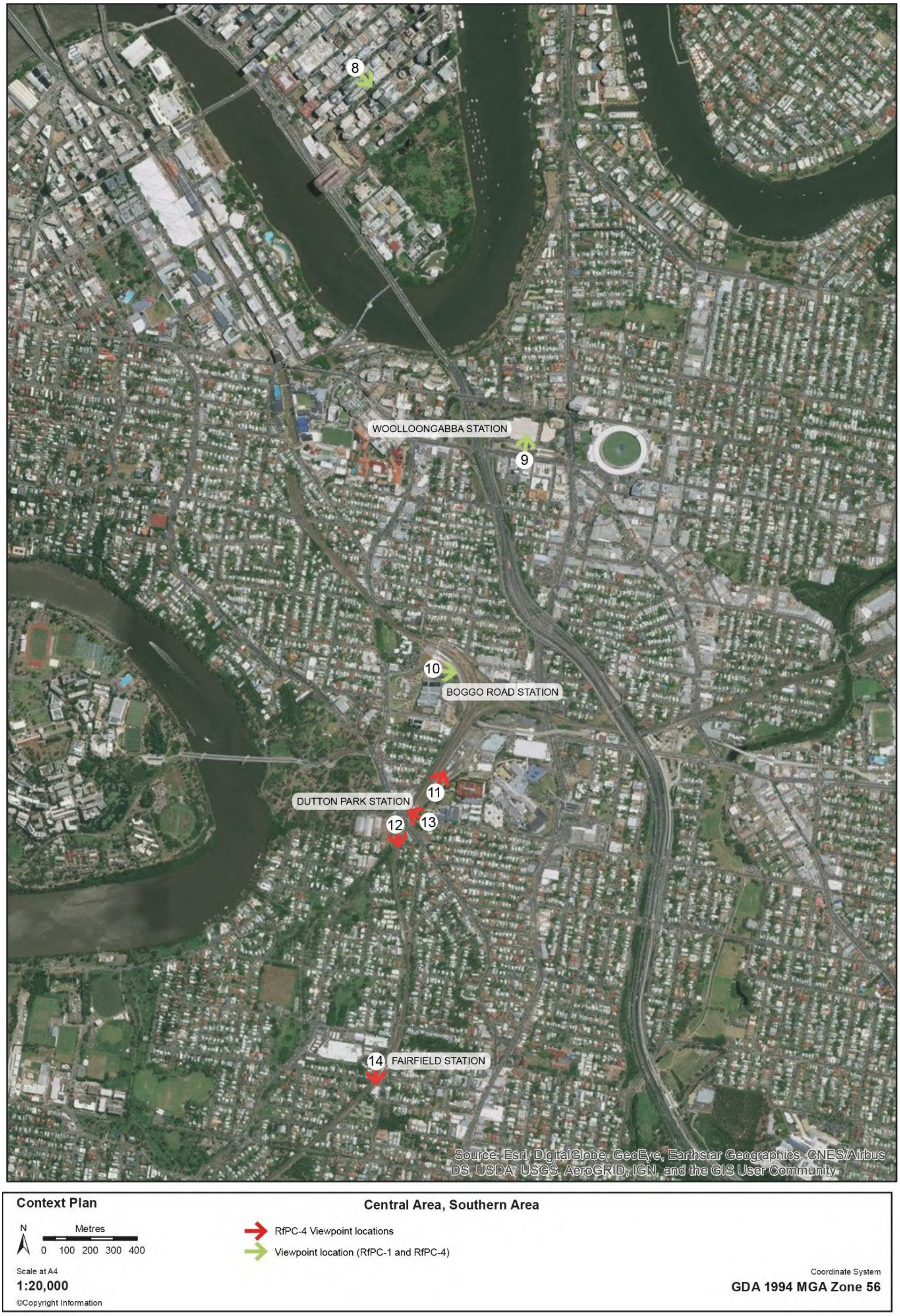


Figure 5.2: Viewpoint locations plan

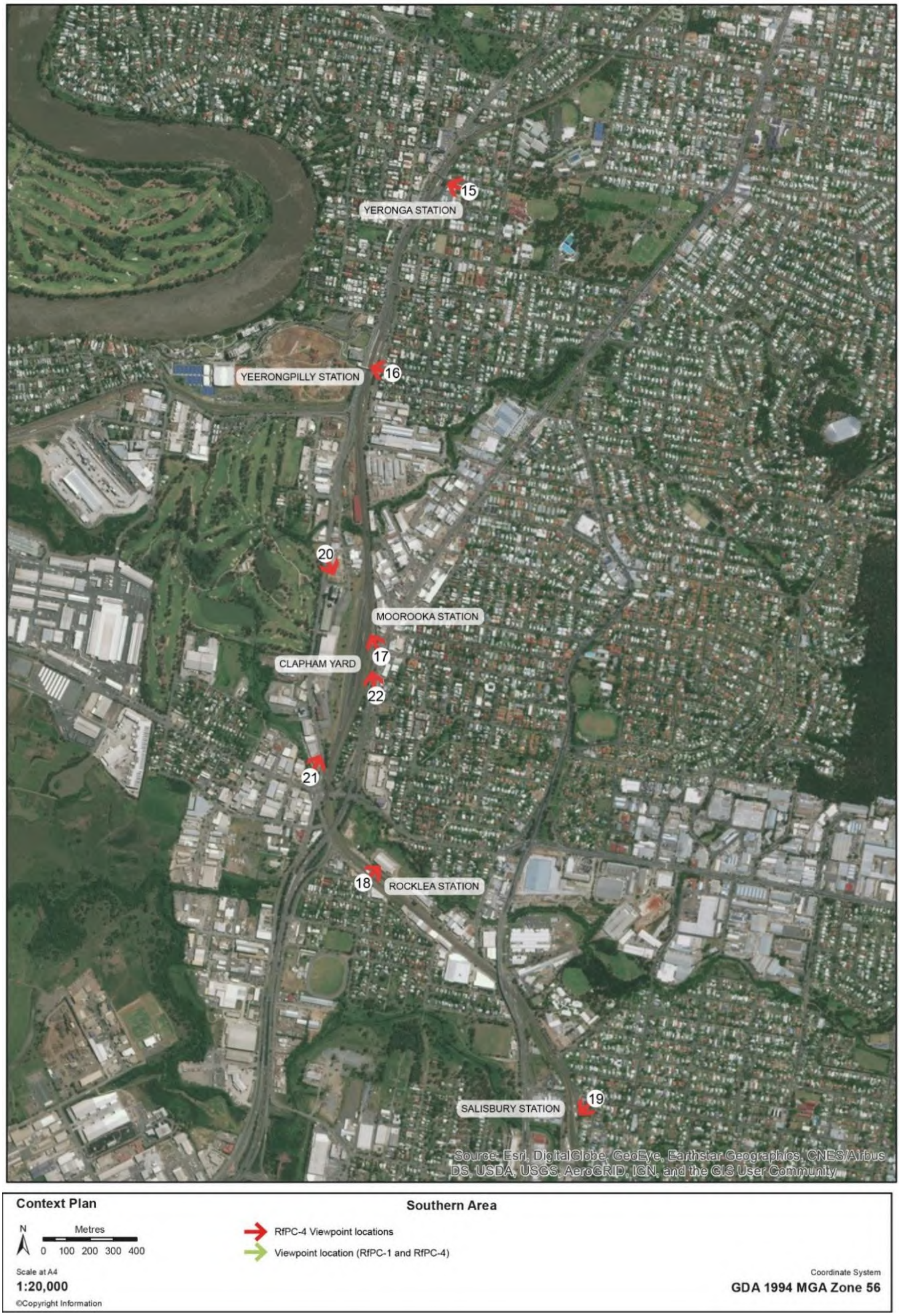


Figure 5.3: Viewpoint locations plan

Impact Assessment

The landscape and visual impact assessment are based on themes of magnitude and sensitivity, as illustrated in Table 5.1. For each of the Proposed Changes the *Summary of Change from Evaluated Project* is also provided to identify if the changed impact is increased, decreased or consistent with the Evaluated Project.

Table 5.1. Assessment Matrix

Sensitivity \ Magnitude	High	Moderate	Low	Negligible Impact
High	High Impact	High Moderate Impact	Moderate Impact	Negligible Impact
Moderate	High Moderate Impact	Moderate Impact	Moderate – Low Impact	Negligible Impact
Low	Moderate Impact	Moderate – Low Impact	Low Impact	Negligible Impact
Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact	Negligible Impact

5.2.2 Lighting

A summary description of the lighting sources and potential lighting impacts that may arise as a result of the construction and operational phases was prepared for the Evaluated Project.

A review of previous lighting impact assessment summaries has been undertaken with any proposed changes documented to assess the potential increases or decreases in overall lighting impacts as a result of the Proposed Changes.

Assumptions and Limitations

Assumptions applicable to this assessment include:

- The lighting assessment is qualitative. The assessment locations have not been visited at night to measure existing light levels.
- Lighting will be generally in accordance with Australian Standard requirements.
- Detailed design and construction planning will further develop the details of Project delivery, and visual impacts will be managed through a visual mitigation plan to minimise visual impact to surrounding receptors.
- Fencing material finishes will affect the extent of visual impact within Mayne Yard and Clapham Yard. Details of fencing materials will be determined prior to construction but have been assumed to be a wire mesh.

5.3 Changes to Potential Impacts

5.3.1 Mayne Area

The Evaluated Project had Mayne Yard being traversed by new CRR lines as well as some track and asset upgrade works. The Proposed changes realign the CRR lines, propose a new rail bridge over Breakfast Creek, new stabling and associated facilities in Mayne Yard North and an elevated road over rail vehicle access to Mayne East and Mayne North. The Evaluated Project also included a trough structure through the northern yard which is now proposed to be removed.

Summary of change from Evaluated Project - Visual assessment summary

Existing context

Mayne Area is predominantly industrial with the commercial buildings to the east blocking prominent views into the rail yard. The residential blocks to the western side of Breakfast Creek are visually protected by the vegetation and are set back behind the industrial lots. The most open view into the rail yard is from the Inner-City Bypass off-ramp down to Abbotsford Road.

Construction impacts

In comparison to the Evaluated Project, the Proposed Changes would increase temporary visual impacts at Mayne Yard North during construction due to the increased scale of works including additional stabling works in this area. Permanent visual impacts will result from the proposed new rail bridge over Breakfast Creek When reviewing Mayne Yard as a whole, the visual impacts would be generally consistent with the Evaluated Project.

Operational impacts

Due to the scale of additional works within the rail corridor at Mayne Yard North, the operational visual impacts in this part of the yard are likely to increase compared to the Evaluated Project. The Proposed Change includes road over rail bridges in Mayne Yard East and North to provide vehicular access to the stabling yards and supporting train crew facility building.

When comparing Mayne Yard as a whole against the Evaluated Project, the visual impacts would be generally consistent due to the nature of the works within the rail corridor and localised elevated elements.

<table>
<tr><th colspan="2">Viewpoint 1: Mayne Rail Yard - looking west towards rail overpass</th></tr>
<tr><td colspan="2"></td></tr>
<tr><td>Distance to yard from viewpoint</td><td>Approximately 90m</td></tr>
<tr><td>Visual sensitivity and context</td><td>This is a highly utilised road overpass bridge that connects Burrows St, Bowen Hills and Hudson Rd, Albion over Breakfast Creek. The viewpoint looks towards the creek and riparian buffer, the existing rail bridge overpass which has a background of vegetation. The majority of receptors using the adjacent bridge, and experiencing the view, consist of motorists with a moderate amount of pedestrian traffic along the connecting footpaths. The landscape amenity provides a quality view of the creek and dense mangrove vegetation contributing to the local character of the area. Visual sensitivity is assessed as low based on the existing visual amenity and daily transiting users.</td></tr>
<tr><td>Visual magnitude of change from existing conditions</td><td>Construction

The Proposed Changes include major works in Mayne Yard would produce a low-moderate visual magnitude of change from this viewpoint as it would be a noticeable change but consistent with the existing rail context, and with periods of increased visual impacts at periods in the construction program.

Operation

As a result of the existing infrastructure within Mayne Yard and the proposed design layout and surrounding context of industry, the visual magnitude of change to the area from the Proposed Changes would be low-moderate.</td></tr>
<tr><td>Visual impact</td><td>Construction

The potential visual impact of the Proposed Changes at this viewpoint is assessed as low-moderate due to the low sensitivity of the surrounding receptors and existing rail and industrial context.

Operation

The potential visual impact of the Proposed Changes at this viewpoint is considered to be low due to the existing rail environment and low sensitivity of the surrounding receptors and context.</td></tr>
</table>

Viewpoint 2: Mayne Rail Yard - looking east towards proposed works	
	
Distance to yard from viewpoint	Approximately 190m
Visual sensitivity and context	Viewpoint 2 is located along the North Brisbane Bikeway looking towards the proposed works. The cycle corridor, connecting Chermside to the CBD, consists of a two-way cycle lane and adjacent pedestrian zoned footpath. It is highly utilised, particularly at peak hours by daily cyclist commuters. The bike path is located within Flynn Oval which includes a playing field, a playground and picnic areas. Views towards the proposed works are obstructed by mature vegetation along both sides of Breakfast Creek. Due to the recreational nature of the viewpoint and the contextual location (close to Windsor residential areas), the visual sensitivity is considered moderate.
Visual magnitude of change from existing conditions	**Construction** Due to the screening of vegetation at this location, the magnitude of change would be low with possible periods of increased visual impacts at certain points in the construction program (for example, the presence of construction equipment may enter this view). **Operation** As a result of the existing infrastructure within Mayne Yard and surrounding industrial context, the visual magnitude of change to the area would be low.
Visual impact	**Construction** The potential visual impact of the Proposed Change from this viewpoint is considered to be low-moderate due to the moderate sensitivity of the surrounding receptors and context. **Operation** The potential visual impact of the Proposed Change from this viewpoint is considered to be low due to the distance from the yard, and existing industrial land uses and vegetation screening.

Viewpoint 3: Mayne Rail Yard - looking north-west towards the site	
	
Distance to yard from viewpoint	Approximately 55m
Visual sensitivity and context	Viewpoint 3 is looking towards the existing Mayne Rail Yard from the on-ramp road leading to the Inner-City Bypass – a major road and highly utilised motorway corridor. The viewpoint is located within a significantly industrialised area with direct sightlines towards the proposed works. Due to the existing dominant transport infrastructure and industrial context of the viewpoint location, the sensitivity has been categorised as low.
Visual magnitude of change from existing conditions	**Construction** The magnitude of change at this location would be moderate (including mitigation such as screening or hoarding) with periods of increased visual impacts during the construction program when larger equipment or machinery would be visible entering or leaving the site. **Operation** As a result of the existing infrastructure within Mayne Yard and surrounding industrial context, the visual magnitude of change to the area following construction would be low.
Visual impact	**Construction** The potential visual impact from this viewpoint is considered to be low-**moderate** due to the staging of the construction programme and the sensitivity of the surrounding receptors and context. **Operation** The potential visual impact from this viewpoint is considered to be low due to the existing rail and other transport infrastructure and low sensitivity of the surrounding receptors and context.

5.3.2 Northern Area

5.3.2.1 Exhibition Station

An upgrade to the Exhibition Station is part of the Evaluated Project. The Proposed Changes to this station include the removal of the overpass in the design, an island platform with open plaza under with access to the above platform from lifts and stairs. This station will incorporate urban design elements consistent with the visual appearance of the other CRR Project surface stations and improve the integrated pathway for independent access. The scale of works and the construction timeframes would be reduced compared to the Evaluated Project.

Summary of changes from Evaluated Project- Visual assessment summary

Construction impact

The construction works are anticipated to result in a consistent level of visual impact in comparison to the Evaluated Project as the station would be in a generally similar location and of a similar scale.

Operational impact

The operation of the upgraded Exhibition Station will improve the visual amenity of the area compared to the Evaluated Project with the removal of the overpass structure and enhanced connection to Bowen Bridge Road. The upgrade to Exhibition Station would therefore provide beneficial visual impacts over the Evaluated Project.

Viewpoint 04: Exhibition Station – looking north-east towards the station	
	
Distance from viewpoint	Approximately 35m to the rail corridor.
Visual sensitivity and context	The area around Exhibition Station is a combination of recreational event spaces at the RNA showground, high rise residential lots and commercial development, which surrounds the showground. To the north is major road infrastructure which includes the Inner-City Bypass and Clem Jones Tunnel. This viewpoint is located on the pedestrian footpath of Bowen Bridge Road. This view is experienced daily by predominantly vehicle traffic and pedestrian movement. Due to the width of the road, the main views into the station are from the inbound city lanes. The surrounding context is predominantly infrastructure with some significant cultural buildings and heritage elements nearby. The view has been assessed as low-moderate visual sensitivity.
Visual magnitude of change from existing conditions	**Construction** During construction, the site will be utilised as a construction compound with heavy machinery and construction activity present throughout the construction period. Fig trees will be impacted with the current design layout as per the

	Evaluated Project. These considerations would result in a moderate visual magnitude of change. **Operation** The upgraded station and pedestrian connections will improve the overall visual amenity of the view. The operational visual magnitude of change is expected to be low-moderate (beneficial) due to an enhancement of visual amenity to the area.
Visual impact	**Construction** The potential visual impact from this viewpoint is considered to be moderate due to the visibility from this location and the sensitivity of the surrounding receptors and context. The project will be implemented to minimise impacts on landscape and open space values. **Operation** The potential visual impact to this viewpoint following construction is considered to be low-moderate (beneficial) impact due to the overall station upgrade, improved connectivity and urban design, and the sensitivity of the surrounding receptors and context.

5.3.2.2 Victoria Park Access

The Evaluated Project includes a construction vehicle access through Victoria Park which is an upgrade of an existing track and enters the rail corridor via the BCC compound. The area surrounding the proposed access is a combination of parkland (Victoria Park), residential properties to the south, mixed land use to the east and a major road and rail corridor to the north.

The area around the access is experienced daily by pedestrians travelling along the footpath which connects Victoria Park to Roma Parkland and through to the city. There are passive views of the rail corridor with some existing vegetation screening the transport corridor to the north. Due to this, along with the regularity of receptors using the thoroughfares, this view is considered to be of moderate visual sensitivity.

The Proposed Changes realign the construction access through Victoria Park which would still be accessed from Gregory Terrace but with an alternative route through the park requiring demolition of the existing Department of Health building.

Visual impacts would arise from minor tree removal and building demolition of the Department of Health Building. This building is much larger than the previously impacted BCC compound building and is listed as local heritage. This property would also serve as a laydown area during construction. The intersection of the access road and Gregory Terrace would be signalised which would result in minor temporary visual impact for users of Gregory Terrace and adjacent residential properties during construction. This access is assessed as having an increased visual impact compared to the Evaluated Project, but impacts will be manageable with the implementation of the mitigation measures in the Project OEMP.

5.3.3 Central Area

5.3.3.1 Roma Street Station and Inner Northern Busway

A new underground Roma Street railway station is part of the Evaluated Project. The Proposed Changes would include lowering and relocating the Inner Northern Busway into the underground station, realignment of station location and changes to design and delivery aspects.

Summary of change from Evaluated Project - Visual assessment summary

Construction impacts

Proposed Changes to the Roma Street Station would result in an overall consistent visual impact during construction compared to the Evaluated Project due to the large-scale construction and similar nature of works. However, there will be a material increase in temporary visual impacts for the lowering of the Inner Northern Busway as a result of changes to road alignments, cut and cover tunnel works and construction worksites. These include temporary impacts to Emma Miller Place from vegetation loss, however, this will be reinstated following construction. The construction of the Inner Northern Busway will also require the installation of temporary bus stops along Roma Street with resulting visual impacts to the streetscape. A minor beneficial change is the removal of the College Close satellite site logistics area from the project as it will not be required during construction. This will avoid the temporary visual impacts to surrounding residents and park users associated with a construction logistics area in this location.

Operational impacts

The overall operational visual impacts of the Proposed Changes would be consistent when compared with the Evaluated Project due to the works being similar in nature and resulting in an upgraded station precinct. Overall, enhancement of the station and improvement of public transport alignment is anticipated to improve the visual amenity of the viewpoint, by removing buses from the surface to the underground and opening up viewpoints to the heritage station building.

Viewpoint 05: Roma Street Station – Corner of George Street and Roma Street looking north-west	
	
Distance to station from viewpoint	Approximately 40m to the rail corridor.
Visual sensitivity and context	The viewpoint is located on the corner of George Street and Roma Street looking towards the main Roma Station Entrances. This view is experienced daily by vehicle traffic and pedestrian movement. The surrounding context consists predominantly of transportation buildings, rail infrastructure, commercial office buildings and residential apartments. The view has been assessed as moderate visual sensitivity.

Visual magnitude of change from existing conditions	**Construction** Previous visual impact assessments (RfPC-1 and 3) have assessed the demolition of the Brisbane Transit Centre and Hotel Jen. The construction process for lowering the Inner Northern Busway would require the removal of the vehicular ramps to the west of the Transit Centre and additional impacts to Lot 60 to the east of the station with removal of vegetation. The site will include a construction compound with heavy machinery, cranes and continuous activity present. The temporary construction sheds, cranes and heavy machinery will be the most prominent visible construction elements. There will be additional visual impacts during construction as a result of works on the Inner Northern Busway which will require the installation of multiple temporary bus stops along Roma Street These considerations would result in a moderate-high visual magnitude of change due to the scale of construction required. **Operation** The new Roma Street Station with improved bus and rail integration will enhance public activation and improve pedestrian connections to recreational and commercial areas within the city. These improvements are expected to enhance the overall amenity of the place. The operational visual magnitude of change is expected to be moderate beneficial due to an enhancement of visual amenity to the area.
Visual impact	**Construction** The potential visual impact at this viewpoint during construction is considered to be moderate-high due to the length of time works will occur, the sensitivity and number of surrounding receptors and city context. **Operation** The potential visual impact to this viewpoint is considered to be moderate beneficial impact due to the overall station upgrade, improved connectivity and urban design approach, and a beneficial impact to the surrounding receptors and context.

5.3.3.2 Albert Street Station

The Proposed Changes would position the Albert Street Station 80m north along Albert Street compared to the Evaluated Project, with the main entrance on the corner of Albert Street and Mary Street and a second entrance at 142 Albert Street.

Summary of change from Evaluated Project- Landscape Assessment summary

Construction impacts

Albert Street Station works are proposed in the centre of the city (consistent with the Evaluated Project), and there are multiple highly sensitive receptors in the surrounding area. The construction of the CRR Project will directly impact several low-medium height shopfronts and commercial buildings. The existing character will be altered therefore the landscape sensitivity is considered to be moderate-high.

Major construction works are proposed at the site which impacts multiple landholding types. Due to the proposed works being similar in scale and type compared to the Evaluated Project, this would result in a consistent landscape character impact.

Operational impacts

The Proposed Changes will contribute to the delivery of the BCC’s Albert Street Vision by consolidating the entry points into two off-street plaza entrances, thus, removing structures from Albert Street. This will have a beneficial landscape impact to the surrounding precinct and be an increased beneficial impact compared to the Evaluated Project. The enhancement of pedestrian movement and improvement of the amenity will result in improved activation for public engagement.

Summary of visual assessment change from Evaluated Project

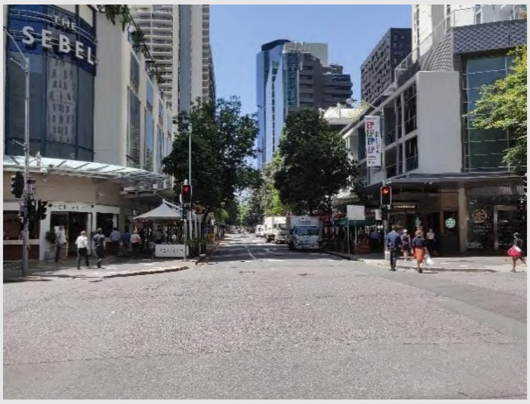
Construction impacts

The construction works at Albert Station for the Proposed Changes will result in an overall consistent visual impact compared to the Evaluated Project due to the similar scale, location and nature of works proposed.

Operational impacts

The station plaza footprint has been reduced and contained within one lot, allowing the adjacent lot to be fully developable after construction completion. Public verge activation has been improved through consolidated entrances and removal of structures from Albert Street, to contribute to the delivery of the BCC’s Albert Street Vision as part of the CRR Project in this area.

In summary, the design intent is similar to the Evaluated Project, however, the visual impact outcomes are beneficial compared with the Evaluated Project due to the improved public realm and visual amenity resulting from the Proposed Changes.

Viewpoint 06: Albert Street – looking south-east down Albert Street at Charlotte Street intersection	
	
Distance to Station from viewpoint	Approximately 40m.
Visual sensitivity and context	The viewpoint is located on the corner of Albert Street and Charlotte Street looking towards the Brisbane Botanical Gardens. This view is experienced daily by vehicle traffic and heavy pedestrian movement. The surrounding context consists of ground level shop frontages, Queen Street Mall, commercial office buildings and residential apartments. The view has been assessed as moderate-high visual sensitivity.
Visual magnitude of change from existing conditions	The project works for the new station, and 2nd entry point includes an integrated pathway for independent access, pathway connections to recreational and commercial areas and overall improved verge activation.

	Construction The construction would impact shopping outlets and commercial buildings which are currently low to medium height buildings. The site will have a construction compound with heavy machinery, cranes and continuous construction activity present throughout the construction period. The temporary construction sheds, cranes and air ventilation exhausts will be the most prominent visible construction elements. There will be a reduced impact along Albert Street, as construction will be moved from within the street to behind the site hoarding. These considerations would result in a moderate-high visual magnitude of change due to the extents of construction required. **Operation** The new station design with an additional entry point will facilitate public activation and linking pedestrian connections to recreation and commercial areas within the city which will improve the overall visual amenity of the view. The Myer ramp is not required to be relocated, which reduces overall impacts to Charlotte Street and Albert Street. The integration of the BCC's Albert Street Vision within the CRR development will provide a landscape and visual benefit to the surrounding area. Depending on development timeframes for future over station development for site on the corner of Albert and Mary Streets could be temporarily adversely impacted due to the site being vacant. Temporary activation of this site would mitigate adverse outcome for the empty city lot. The operational visual magnitude of change is expected to be moderate beneficial due to an enhancement of visual amenity in the area.
Visual impact	**Construction** The potential visual impact of this viewpoint is considered to be moderate-high due to the length of time of construction works and the sensitivity of the surrounding receptors and city context. **Operation** The potential visual impact to this viewpoint is considered to be moderate beneficial impact due to the overall station upgrade, improved connectivity and urban design approach, and a beneficial impact to the surrounding receptors and context.

5.3.3.3 Woolloongabba Station

The Proposed Changes would move Woolloongabba station approximately 70m west of its location for the Evaluated Project.

Summary of visual assessment change from Evaluated Project

Construction impacts

The proposed construction works at Woolloongabba Station for the Proposed Changes will result in an overall consistent visual impact compared to the Evaluated Project, as although the design for the Evaluated Project was positioned further to the east, the scale of the construction works and mitigation measures are similar (ie inclusion of an acoustic shed at the site). Since the Evaluated Project, early works have occurred at this site therefore the Proposed Changes would occur in an existing construction site.

Operational impacts

The Evaluated Project locates the Woolloongabba Station further east than the Proposed Changes, however the visual impacts to the surrounds would be similar due to the scale and form of the station, making the visual impacts consistent. Overall the new station development and pedestrian connectivity are anticipated to beneficial and improve visual amenity of the viewpoint.

Viewpoint 07: Woolloongabba Station – looking north towards Brisbane city on Stanley Street	
	
Distance to Station from viewpoint	Approximately 40m to the Station.
Visual Sensitivity and Context	The project site is currently under development as part of the Cross River Rail early works which included the removal of the existing building and supporting elements for future works. The viewpoint is located on Stanley Street looking towards the CBD. This view is experienced daily by predominantly vehicle traffic and heavy pedestrian movement during events at The Gabba. The surrounding context is predominately ground level shop frontages, commercial office buildings and residential apartments. The view has been assessed as moderate visual sensitivity.
Visual magnitude of change from existing conditions	**Construction** Early works in this area started in 2017 to remove the existing building and prepare the grounds for future works. The project works for the new station include parking, integrated pathway for independent access, pathway connections to recreational areas, linking access to the existing adjacent bus stop. During construction, of the station, the site will have a construction compound with heavy machinery, cranes and continuous construction activity present throughout the construction period. The temporary construction sheds, cranes and air ventilation exhausts will be the most prominent visible construction elements. These considerations would result in a moderate visual magnitude of change due to the extents of construction required. **Operation** The new station will facilitate public activation, car park spaces and linking pedestrian connections to recreational areas which will improve the overall visual amenity of the view. The operational visual magnitude of change is expected to be low-moderate beneficial due to an enhancement of visual amenity to the area.

Visual Impact	**Construction** The potential visual impact of this viewpoint is considered to be moderate due to the construction programme and the sensitivity of the surrounding receptors and context. **Operation** The potential visual impact to this viewpoint is considered to be low -moderate beneficial impact due to the overall station upgrade, improved connectivity and urban design approach, and beneficial impact to the sensitivity of the surrounding receptors and context.

5.3.3.4 Southern Portal

The visual impacts of the new Southern Portal were not specifically assessed previously as part of the Evaluated Project. However, the location, scale and form of the southern portal would be generally consistent with the Evaluated Project therefore the visual impacts are expected to be consistent, with minor changes to the location of dive structures.

The viewpoint assessment for the Southern Portal is provided below.

Viewpoint 8: Southern Portal - Kent Street looking north	
	
Distance from viewpoint	Approximately 40m to the rail corridor.
Visual Sensitivity and Context	The viewpoint is located on the corner of Kent Street looking north toward Dutton Park Station. This view is experienced daily by vehicle traffic and pedestrian movement. The surrounding context includes residential, medical facilities to the east, and commercial and industrial lots to the west across the rail corridor. The view has been assessed as low-moderate visual sensitivity.
Visual magnitude of change from existing conditions	**Construction** There will be major works to the area which will involve the use of temporary constructed sheds, cranes and heavy machinery being the most prominent visible construction elements. The portal alignment would result in the loss of Queensland Rail buildings within the rail corridor. These considerations would produce a moderate visual magnitude of change with periods of increased visual impacts at times in the construction program. **Operation**

	The new southern portal structure following construction works will be an integrated feature within the surrounding context due to its location. The portal would not be elevated which results in reduced views from vehicular traffic and certain views from surrounding mixed land use receptors running parallel to the rail line. The operational visual magnitude of change during operation is expected to be low-moderate due to its location within a heavily modified landscape of road and rail infrastructure.
Visual Impact	**Construction** The potential visual impact at this viewpoint during construction is considered to be low-moderate due to the length of construction works and the sensitivity of receptors and local context. **Operation** The potential visual impact at this viewpoint during operation is considered to be low due to the surrounding context of existing rail infrastructure.

5.3.4 Southern Area

5.3.4.1 Boggo Road Station

The Proposed Changes in the design for Boggo Road Station are generally similar to the design for Evaluated Project. A key proposed change is the removal of the pedestrian underpass and the addition of a new elevated surface connection pedestrian and cycle link from Princess Alexandra Hospital to Boggo Road Urban Village. There are existing noise walls adjacent to the rail corridor to the south of the proposed Boggo Road Station. These would be extended and increased in height as part of the Project.

Visual Assessment summary

Construction impacts

The Boggo Station construction site will result in visual impacts relating to elevated works involving cranes and temporary site sheds and the presence of heavy machinery at the site.

The Proposed Changes and the Evaluated Project are both located on the eastern side of Boggo Road adjacent to the railway with new pedestrian links. The Evaluated Project includes an underpass pedestrian tunnel where the Proposed Changes include an overpass which would incrementally increase the visual impact to the area.

Operational impacts

The operational visual impacts for the Proposed Changes would be similar to the Evaluated Project due to the station’s built form and location. However, the pedestrian bridge which was underground is proposed to be an elevated span, and residential properties are impacted which would result in an increased visual impact compared with the Evaluated Project.

Viewpoint 9: Boggo Road facing east-northeast

Distance to Station from viewpoint	Approximately 30m to the Station.
Visual Sensitivity and Context	The viewpoint is located on the eastern corner of Boggo Road facing east-northeast over the railway towards Park Road Railway Station. This view is elevated with areas of small linear parkland spaces for local workers and residents looking over the railway eastwards. The surrounding context includes the Boggo Road urban village and commercial Eco Sciences Precinct, Dutton Park Police Station to the west, and Princess Alexandra Hospital to the east. The view has been assessed as moderate visual sensitivity.
Visual magnitude of change from existing conditions	**Construction** During construction of the station heavy machinery, cranes and continuous construction activity will occur. The temporary construction sheds and cranes will be the most prominent visible construction elements. Taking into consideration, the station is on the eastern slope and would be highly visual from surrounding receptors. These considerations would result in a moderate visual magnitude of change. **Operation** The operational visual magnitude of change is expected to be moderate (beneficial) due to a consolidated built form for the station and the majority of work being underground. The proposed height extension of the noise walls south of the station location will further screen views towards the rail corridor. Enhanced visual amenity is designed to be reinstated to the station surrounds which will overall improve the surrounding context.
Visual Impact	**Construction** The potential visual impact of this viewpoint is considered to be moderate due to the length of construction and the sensitivity of the surrounding receptors and context. **Operation** The potential visual impact to this viewpoint is considered to be a moderate beneficial impact due to the construction of a new station, the provision of visual amenity, and improved connectivity.

5.3.4.2 Dutton Park Station

Dutton Park station upgrade is part of the Evaluated Project however the Proposed Changes will increase the extent of works, including moving the station location to the south, provision of a covered pedestrian overpass, demolition of existing ramp and station building and construction of retaining walls. A temporary platform is required during construction to enable the station to remain operational. This will result in impacts to properties on Cope Street to the south of Annerley Road.

Summary of landscape changes from Evaluated Project

Construction impacts

The Proposed Changes will impact adjacent low-medium height residential lots to the south-east of the station on Cope Street, resulting in a temporary change in land use in this area, in addition to the works at the station and within the rail corridor. There are multiple sensitive receptors (residential properties) in the surrounding area.

The landscape impact has been assessed as low-moderate. The site's sensitivity would be moderate, and the magnitude of change would be low-moderate due to the surrounding context being mostly residential and commercial properties and due to existing screening around the station and Annerley Road, which limits sightlines into the rail corridor. Due to the increase in the number of affected properties (compared to the previously Evaluated Project Dutton Park Station), the landscape impacts would increase in comparison to the Evaluated Project.

Operational impacts

The landscape impact following construction has been assessed as low-moderate impact to the surrounds due to the moderate sensitivity of the surrounding land use types, and the magnitude of the change would be low-moderate. The scale of operational landscape impacts to the surrounding precinct would increase compared to the Evaluated Project however the redevelopment of the impacted lots and the improved accessibility and architectural features at the station would result in a beneficial outcome for surrounding receptors.

Summary of visual impact changes from Evaluated Project

Construction impacts

The proposed construction works at Dutton Station would result in an overall increase in visual impact compared to the Evaluated Project as the works have increased in extent. The majority of works will be within the rail corridor which is below surrounding ground level and less visible from surrounding land uses. However, the elevated pedestrian overpass and retaining walls would likely be visible from adjacent residential areas and roads.

Operational impacts

The visual impact during operation associated with the station itself is considered to be generally consistent with the Evaluated Project due to the nature of the works predominantly in an existing rail environment. Overall enhancement of the station and improved accessibility provided by the new pedestrian overpass infrastructure is anticipated to improve visual amenity of the viewpoint from its existing condition.

Viewpoint 10: Dutton Station – Rusk Street and Cornwall Street looking north-west	
	
Distance to Station from viewpoint	Approximately 60m to the rail corridor.
Visual Sensitivity and Context	The viewpoint is located on the corner of Rusk Street and Cornwall Street looking north-west toward Dutton Park Station. This view is experienced daily by vehicle traffic and pedestrian movement. The surrounding context is predominately residential lots to the west and east, medical facilities to the east, and commercial and industrial lots to the west. The view has been assessed as low-moderate visual sensitivity.
Visual magnitude of change from existing conditions	**Construction** During construction, installation of the proposed pedestrian overpass to the eastern part of the station and construction works including new platform and station building will be visible from this viewpoint. This will include the introduction of heavy machinery into the rail corridor disrupting predominate views from this location. These considerations would result in a moderate visual magnitude of change. **Operation** Post construction, the enhanced platform and station infrastructure and pedestrian overpass will improve the overall visual amenity of the view. The operational magnitude of change is expected to be low due to the localised nature of the works and existing rail environment.
Visual Impact	**Construction** The potential visual impact from this viewpoint is considered to be low -moderate as the works are largely within the rail corridor and due to low-moderate sensitivity of the surrounding receptors and context. **Operation** The potential visual impact to this viewpoint as a result of the Proposed Changes is considered to be low-moderate (beneficial) as a result of improved access and updated architectural features at the station.

5.3.5 Fairfield to Salisbury Area

5.3.5.1 Fairfield Station

Fairfield station upgrade is not part of the Evaluated Project.

The project works for Fairfield station includes the replacement of existing platform shelters and the station building, upgrades to platform surfacing, the demolition of the existing overpass and replacement of an enhanced pedestrian overpass.

The viewpoint assessment for Fairfield Station is provided below.

Viewpoint 11: Fairfield Station – looking south-east towards the station and overpass	
	
Distance to Station from viewpoint	Approximately 60m to station boundary.
Visual Sensitivity and Context	The area is predominately residential with a multi-use commercial property situated behind the assessment viewpoint. The narrow local roads are undulating, the surrounding residential properties are 1-2 storeys high, and the commercial property is setback, limiting its view to the station. This viewpoint is located on Midmay St looking towards the station platform and overpass from a combination of a residential and commercial edge including an entrance into the Fairfield Shopping Centre. This view is likely to be experienced by local or neighbouring residents entering the shopping precinct, residential properties or the train station. Due to the mixed land uses within close proximity to the viewpoint and shaded, accessible footpath, the sensitivity associated with this viewpoint is moderate.
Visual magnitude of change from existing conditions	**Construction** During construction, the viewpoint will experience the removal and installation of the proposed pedestrian overpass and station infrastructure. This will include the introduction of heavy machinery into Midmay Street disrupting predominate views from this location. This would result in a low-moderate visual magnitude of change with periods of increased visual impacts depending on the staging of construction. **Operation** The enhanced platform infrastructure and pedestrian overpass will improve the overall visual amenity of the view. The operational change is expected to be low due to the minimal changes associated with these station works.

Visual Impact	**Construction** The potential visual impact from this viewpoint is considered to be low -moderate as the works are largely within the rail corridor and due to moderate the sensitivity of the surrounding receptors and context. **Operation** The potential visual impact to this viewpoint as a result of the Proposed Changes is considered to be low-moderate (beneficial) as a result of improved access and updated architectural features at the station.

5.3.5.2 Yeronga Station

Yeronga Station upgrade is not part of the Elevated Project.

The project works for Yeronga station include the introduction of enhanced platform infrastructure, the replacement of the existing ramp with an enhanced, compliant footpath, the replacement of the existing overpass with an enhanced pedestrian overpass and the replacement of the station building. The existing noise wall located to the south of Yeronga Station would need to be extended.

The viewpoint assessment for Yeronga Station is provided below.

Viewpoint 12: Yeronga Station - looking west towards the station	
	
Distance from viewpoint	Approximately 15m to the station entrance.
Visual Sensitivity and Context	The area consists of predominately residential properties to the east and multiple mix use commercial property to the west along Fairfield Road. The area is elevated with narrow local roads with the majority of the residential properties being one to two storeys high on the eastern side. This viewpoint is located on the corner of Lake Street and Killarney Street looking towards Yeronga Station from the adjacent footpath. The view is located within a residential landscape character and experienced mainly by local residents. Visual amenity of this viewpoint is considered to be low-moderate based on the sensitivity of the receptors surrounding the viewpoint.
Visual magnitude of change from existing conditions	**Construction** During construction, the eastern side of the rail corridor will experience removal of a mature tree at Lake Street that currently obstructs views towards the station infrastructure. Demolition and construction of the improved station infrastructure and pedestrian overpass will affect existing views. These

	considerations would produce a low-moderate visual magnitude of change with periods of increased visual impacts during the construction program. **Operation** The enhanced platform shelters, urban design and reinstated vegetation following construction works will improve the overall visual amenity of the view. The proposed extension of the noise wall will further screen views towards the rail alignment. The operational visual magnitude of change is expected to be low due to the minimal changes associated with these station works.
Visual Impact	**Construction** The potential visual impact from this viewpoint during construction is considered to be low-moderate as the works are largely within the rail corridor and due to moderate the sensitivity of the surrounding receptors and context. **Operation** The potential visual impact to this viewpoint as a result of the Proposed Changes is considered to be low-moderate (beneficial) as a result of improved access and updated architectural features at the station.

5.3.5.3 Yeerongpilly Station

Yeerongpilly Station upgrade is not part of the Evaluated Project.

The Proposed Changes at Yeerongpilly Station include enhanced platform infrastructure on both the middle and eastern platforms. Platforms will be raised, shelters will be replaced, and the existing overpass will remain.

The viewpoint assessment for Yeerongpilly Station is provided below.

Viewpoint 13: Yeerongpilly Station – looking west towards overpass and station entrance	
	
Distance from viewpoint	Approximately 20m to the station entrance.
Visual Sensitivity and Context	The area consists of predominately residential properties to the east and new developments underway to the west, including commercial property also to the west along Fairfield Road. To the south the majority of the land is industrial. This viewpoint is located directly across the road from the proposed works on the corner of Wilkie Street and Green Street. The land uses surrounding this viewpoint is predominately residential and likely to be experienced regularly, mostly by

	private residents. The sensitivity associated with this viewpoint is considered to be low-moderate.
Visual magnitude of change from existing conditions	**Construction** During construction, the existing carpark area, situated along Wilkie Street, is to be removed to assist the construction of the enhanced platform infrastructure and associated works. In addition, the removal of minimal vegetation on the eastern side of the alignment, near Livingstone Street, is anticipated. These considerations and other disturbance during construction would produce a low-moderate visual magnitude of change with periods of increased visual impacts during the construction program. **Operation** The enhanced platform shelters, urban design and reinstated vegetation following construction works will improve overall visual amenity of the view. The overall operational visual magnitude of change is expected to be low due to the minimal changes associated with these station works.
Visual Impact	**Construction** The potential visual impact from this viewpoint during construction is considered to be low-moderate as the works are largely within the rail corridor and due to low-moderate the sensitivity of the surrounding receptors and context. **Operation** The potential visual impact to this viewpoint as a result of the Proposed Changes is considered to be low-moderate (beneficial) as a result of improved access and updated architectural features at the station.

5.3.5.4 Moorooka Station

The upgrade of Moorooka Station is not part of the Evaluated Project.

The Proposed Changes at Moorooka Station include the demolition of the existing footbridge, the installation of a pedestrian overpass connecting to an additional, third platform integrated on the western side of Clapham Yard, the demolition of the existing station building, addition of enhanced station infrastructure and an improved integrated pathway for independent access.

The viewpoint assessment for Moorooka Station is provided below.

Viewpoint 14: Moorooka Station – looking west towards the overpass


Distance from viewpoint	Approximately 35m from the station entrance.
Visual Sensitivity and Context	The area consists of commercial properties to the east and industrial use to the west. Behind the commercial lots to the east are residential properties. The surrounding area has a main arterial road adjoining local roads with residential properties being one to two storeys high on undulating land to the eastern side. To the west, the topography is subtly undulating along the industrial frontage. This viewpoint is located on the eastern side of Ipswich Road and the corner of Keats Street looking north-west towards the proposed works. Adjacent land uses are commercial properties (car sale yards). Ipswich Road is a major arterial connection corridor largely used particularly by motorists during peak hours. Due to the high level of utilisation of the corridor for both motorists and local workers/residents, and the lack of quality visual amenity the sensitivity for this viewpoint is considered to be low-moderate.
Visual magnitude of change from existing conditions	**Construction** During construction, there will be a temporarily installed construction area to the west of Ipswich Road, directly adjacent to the rail corridor and station. Heavy machinery will be required to install and construct the proposed pedestrian overpass. Additional works will occur on the western side of Clapham Yard to install a third platform. Due to the unobstructed views towards the proposed construction area and the scale of proposed works for this station, this will produce a moderate visual magnitude of change with periods of increased visual impacts during the construction program. **Operation** The proposed pedestrian overpass will be the most visually dominant impact on this viewpoint. It will increase the visual prominence of rail infrastructure for motorists along Ipswich Road. However, enhanced station, additional platforms and overpass design will improve overall visual amenity of the view. The operational visual magnitude of change is expected to be **low** due to the minimal changes associated with these station works.
Visual Impact	**Construction** The potential visual impact from this viewpoint during construction is considered to be low-moderate as the works are largely within the rail corridor and due to low-moderate the sensitivity of the surrounding receptors and context. **Operation** The potential visual impact to this viewpoint as a result of the Proposed Changes is considered to be low-moderate (beneficial) as a result of improved access and updated architectural features at the station.

5.3.5.5 Rocklea Station

Upgrade to Rocklea Station is not part of the Evaluated Project.

The project works for Rocklea station includes the demolition of the existing overpass and the addition of an enhanced pedestrian overpass, the demolition of existing shelters and the addition of enhanced shelter infrastructure and the widening, raising and resurfacing of the platforms.

The viewpoint assessment for Rocklea Station is provided below.

Viewpoint 15: Rocklea Station – looking east towards the station	
	
Distance to Station from viewpoint	Approximately 40m from the overpass.
Visual Sensitivity and Context	The area is a mixture of commercial, industrial and residential properties to the south-west and isolated industrial use to the east. Behind the commercial lots to the south-west are residential properties. The surrounding area has a main arterial road adjoining local roads with residential properties being one to two storeys high on undulating land on the western side. To the northeast, the topography is undulating behind the industrial buildings which are situated parallel to the Rocky Water Hole creek system. This viewpoint is from Brooke Street looking east towards Rocklea station. The viewpoint is located within a residential street and in close proximity to commercial areas. Street trees lined along the western edge of the station carpark contribute to the local visual amenity of the street. This view is experienced by local residents and visitors entering the station carpark. Due to the existing mix of land uses at the location, the sensitivity of this viewpoint is considered low-moderate.
Visual magnitude of change from existing conditions	**Construction** During construction, the station carpark is proposed to be extended to the left of the viewpoint to accommodate space for construction access. Additionally, the material laydown area is located off Brooke Street to the right of the carpark. Heavy machinery will access from the carpark entrance to install and construct the proposed pedestrian overpass. Due to the unobstructed views towards the proposed construction area and the scale of proposed works for this station, this will produce a moderate visual magnitude of change with periods of increased visual impacts during the construction program. **Operation** The proposed pedestrian overpass will be the most visually dominant impact on this viewpoint. It will increase the visual prominence of rail infrastructure to residents located on Brooke Street. However, enhanced station and overpass design will improve overall visual amenity of the view. The operational visual magnitude of change is expected to be low due to the minimal changes associated with these station works.
Visual Impact	**Construction**

	The potential visual impact from this viewpoint during construction is considered to be low-moderate as the works are largely within the rail corridor and due to low-moderate the sensitivity of the surrounding receptors and context. **Operation** The potential visual impact to this viewpoint as a result of the Proposed Changes is considered to be low-moderate (beneficial) as a result of improved access and updated architectural features at the station.

5.3.5.6 Salisbury Station

Upgrades to Salisbury Station are not part of the Evaluated Project.

The Proposed Changes at Salisbury station include the demolition of the existing overpass and the addition of an enhanced pedestrian overpass, the demolition of existing shelters and the addition of enhanced shelter infrastructure, the addition of a platform to the west of the existing platform, the widening and raising of the platforms and the enhancement of existing footpaths to be compliant.

The viewpoint assessment for Salisbury Station is provided below.

Viewpoint 16: Salisbury Station – looking south-west towards the station	
	
Distance from viewpoint	Approximately 88m from the pedestrian overpass.
Visual Sensitivity and Context	The surrounding area has industrial land use to the west and residential land use to the east. The surrounding area has a main arterial road adjoining local roads with large industrial lots. To the east, the topography is elevated heading away from the station and generally flat to the west where the industrial buildings are situated. Due to most of the works being undertaken within Queensland Rail or Brisbane City Council owned property, the character of the area is not deemed to be significantly impacted. This viewpoint is from Lillian Avenue looking south-west towards the proposed station upgrades from a residential edge. Mature vegetation located within, and surrounding, the station carpark obstructs direct views to station infrastructure and provides quality visual amenity and distinct local character of the area. This view is experienced by local residents and visitors entering the station carpark. The street has residential land uses, and the sensitivity of this viewpoint is considered low-moderate.
Visual magnitude of change from	**Construction**

existing conditions	During construction, the site compound area and the location for site deliveries would be located along Dollis Street, adjacent to the rail corridor. This may increase traffic entering and exiting the construction site impacting surrounding views. Heavy machinery will also be present at the site to construct the overpass. Due to the intermittent views of the existing station infrastructure, this will produce a low visual magnitude of change with periods of increased visual impacts during the construction program. **Operation** The proposed pedestrian overpass will be the most visually dominant impact on this viewpoint. It will increase the visual prominence of rail infrastructure to residents located on Lillian Avenue. However, enhanced station and overpass design will improve overall visual amenity of the view. The operational visual magnitude of change is expected to be low due to the minimal changes associated with these station works.
Visual Impact	**Construction** The potential visual impact from this viewpoint during construction is considered to be low-moderate as the works are largely within the rail corridor and due to low-moderate the sensitivity of the surrounding receptors and context. **Operation** The potential visual impact to this viewpoint as a result of the Proposed Changes is considered to be low-moderate (beneficial) as a result of improved access and updated architectural features at the station.

5.3.5.7 Clapham Station

The Clapham Yard stabling facility and track works were assessed as part of the 2011 EIS, however, this component was subsequently excluded in the Evaluated Project.

The Proposed Changes at Clapham Yard are similar to that assessed in the 2011 EIS, including new stabling facilities, cleaning, maintenance and inspection facilities and northern (and limited southern) access for rollingstock. Other surface works are also similar in nature to those assessed in the 2011 EIS, including removal and installation of utilities, new crew facility and civil works.

Proposed Changes at the site include new staff car park, train storage area and supporting utilities, embankment along Fairfield Road, new bridges, elevated pedestrian crossing that ties in with Moorooka Station and resumption of industrial lots to the west of the yard.

The Proposed Changes would result in an increased visual impact compared to the Evaluated Project.

Landscape Assessment

Construction impacts

During construction, heavy machinery will be present at the site and fluctuating volumes of vehicle traffic entering and exiting the site. Service infrastructure will be installed, and earthworks are anticipated to change the immediate character of the existing site. The landscape impact has been assessed as low-moderate impact. The site's sensitivity would be low, and the magnitude of change would be low-moderate due to the surrounding context and an increase compared to the Evaluated Project.

Operational impacts

The operational landscape impact has been assessed as low due to the surrounding context and pre-existing rail infrastructure. The Proposed Changes would result in a low-moderate landscape impact to the surrounds due to the low sensitivity of the surrounding land use types, and the magnitude of the change would be low-moderate rating due to the surrounding context. The overall operational landscape impacts of the Proposed Changes to the station would increase compared with the Evaluated Project which did not include works at Clapham Yard.

The viewpoint assessment for Clapham Yard is provided below.

Viewpoint 17: Clapham Yard – looking east towards works from Fairfield Road	
	
Distance to Yard from viewpoint	Approximately 175m from rail corridor.
Visual Sensitivity and Context	The area has industrial land use to the west and commercial use to the east with residential blocks behind. Ipswich Road is a main arterial road adjoining surrounding local roads and commercial and large industrial lots. To the east, the topography is elevated heading away from the station and generally flat to the western side where the industrial buildings are situated. Beyond the industrial area, to the west, there is a large recreational golf course which has thick vegetation adjacent to Fairfield Road blocking major views towards the proposed works. This viewpoint is on Fairfield Road looking towards Clapham Yard. To the right of the viewpoint, there is a golf course which is well screened and protected with mature vegetation and fencing. Direct views into the rail yards are experienced from this location with minimal variation in topography, street tree planting and built form. The view lacks landscape and quality visual amenity as is dominated by industrial land use and infrastructure. It is heavily experienced by motorists, local workers and residents. The sensitivity of this view is therefore considered to be low-moderate.
Visual magnitude of change from existing conditions	**Construction** During construction, traffic entering and exiting the construction site may impact surrounding views into the rail yards. Heavy machinery will also be required to construct the overpass. Earthworks will be undertaken on the site including the introduction of large batters changing the levels and existing topography of the site. Due to the largely unobstructed views of the rail yards and existing station infrastructure, this will produce a moderate visual magnitude of change with periods of increased visual impacts during the construction program. **Operation** The proposed pedestrian overpass will have a dominant visual impact in this location. During operation, screening is anticipated to be installed around the rail

	yards, reducing the direct views into the site. Arriving from Moorooka Station (east of the site) users of the pedestrian overpass will experience a direct view into the rail yards. The operational visual magnitude of change is expected to be low-moderate due to the Proposed Changes occurring in an existing rail yard surrounded by industrial land use.
Visual Impact	**Construction** The potential visual impact at this viewpoint during construction is considered to be low-moderate as the works are largely within an existing rail environment and due to the low-moderate sensitivity of the surrounding receptors and context. **Operation** The potential visual impact to this viewpoint following construction is considered to be low as the works are largely within an existing rail environment and will be consistent with the existing context.

Viewpoint 18: Clapham Yard – looking north-east from Sherwood Road	
	
Distance to Yard from viewpoint	Approximately 100m from the rail corridor.
Visual Sensitivity and Context	This viewpoint is experienced from a green edge adjacent to Sherwood Road and Rocky Water Hole Creek looking towards Clapham Yard. The right of the viewpoint shows the rail bridges over Muriel Avenue. Sherwood Road, the main vantage point for which this viewpoint will be experienced, and Muriel Avenue are highly utilised road corridors and a key connector for motorists. This viewpoint is dominated by riparian vegetation surrounding the waterway which improves the quality of visual amenity for this location. To the left of the viewpoint, industrial warehouses occupy the view, and adjacent land uses. This viewpoint is heavily experienced by motorists, local workers and residents, and the sensitivity of this view is considered to be low-moderate.
Visual magnitude of change from existing conditions	**Construction** During construction, the viewpoint will experience insignificant impacts due to the distance from the construction works. The rail bridges over Muriel Avenue, to the right of the viewpoint, may involve minimal construction works slightly impacting existing views. However, existing fencing will screen the proposed construction. Therefore, the overall visual magnitude of change from this viewpoint is anticipated to be low. **Operation** During operation, boundary fencing is anticipated to be installed to obstruct views towards the site. Therefore, the operational visual magnitude of change is expected to be low due to the works occurring in an existing rail environment, the

	distance of the viewpoint from proposed construction and the screening effect of fencing.
Visual Impact	**Construction** The potential visual impact at this viewpoint during construction is considered to be low-moderate due to the distance from the works and as the works are largely within an existing rail environment with low-moderate sensitivity of the surrounding receptors and context. **Operation** The potential visual impact at this viewpoint following construction is considered to be low as the works are largely within an existing rail environment and will be consistent with the existing context.

Viewpoint 19: Clapham Yard – looking north-west from Ipswich Road	
	
Distance to Yard from viewpoint	Approximately 40m from Clapham Yard.
Visual Sensitivity and Context	This viewpoint is looking towards Clapham Yard from the eastern edge of Ipswich Road adjacent to the car sale yard. Ipswich Road is a major arterial connection corridor largely used particularly by motorists during peak hours. Due to the high level of utilisation of the corridor for both motorists and local workers/residents, and the lack of quality visual amenity the sensitivity for this viewpoint is considered to be low-moderate.
Visual magnitude of change from existing conditions	**Construction** During construction, the viewpoint will experience an increase in traffic entering and exiting the construction site impacting surrounding views into the rail corridor. Heavy machinery will also be required to construct the overpass. Due to the largely unobstructed views of the rail yards and existing station infrastructure, this will produce a moderate visual magnitude of change with periods of increased visual impacts during the construction program. **Operation** During operation, boundary fencing is anticipated to be installed to obstruct views towards the construction works. The pedestrian overpass will have a greater visual impact due to the elevation of the structure. However, enhanced overpass design will improve overall visual amenity of the view. The operational visual magnitude of change is expected to be low-moderate.

Visual Impact	**Construction** The potential visual impact at this viewpoint during construction is considered to be low-moderate as the works are largely within an existing rail environment and due to the low-moderate sensitivity of the surrounding receptors and context. **Operation** The potential visual impact at this viewpoint following construction is considered to be low as the works are largely within an existing rail environment and will be consistent with the existing context.

5.3.6 Lighting

Potential change

Potential changes to lighting for construction and operation have been reviewed in comparison to the lighting proposed for the Evaluated Project.

Construction impacts

Consistent with the Evaluated Project the construction programme will require nighttime construction works to be conducted at multiple locations. The installation of permanent and temporary lighting will be required to assist in site works, security risks and ensure safety requirements are met for all personnel. A majority of the project sites will require surface level lighting with the use of acoustic sheds and screening measures were applicable to minimise glare to the surrounding receptors.

The extent of lighting requirements at specific project locations may be visible by nearby surrounding receptors. The temporary lighting works will be focused on project elements and points of interest however, this may still result in light spill being visible to adjacent receptors.

Consistent with the Evaluated Project, residential receptors with minimal vegetation or lack of high screen fencing within the line of sight of the construction night works could be prone to lighting impact and passing glare from construction vehicles. Due to the staged construction program at each site, these impacts will be limited to a short period over the whole programme length.

Areas with increased construction lighting requirements compared to the Evaluated Project would include Mayne Yard due to the increased extent of works, and at the Fairfield to Salisbury Stations which would be an increase compared to the Evaluated Project. There would also be an incremental increase to the extent of construction works and associated lighting at Roma Street due to the proposed lowering of the Inner Northern Busway and associated road works.

Operational impacts

Consistent with the Evaluated Project, the Proposed Changes would increase the frequency of trains operating along the network. As a result, operational lights associated with train movement could increase lighting impacts on surrounding receptors when compared to the Evaluated Project.

Lighting situated along surface track alignments will be in accordance with Queensland Rail lighting requirements to minimise impact to surrounding receptors. The upgrade to stations will use more focused light options on points of interest and thoroughfares which will be coordinated with existing light elements.

5.4 Mitigation Measures

Mitigation measures which are consistent with the Project OEMP and apply to the Proposed Changes include the following:

- A visual impact mitigation plan should be prepared prior to construction to mitigate potential visual impacts of noise barriers and hoardings, where appropriate.
- Ensure that the design and siting of construction worksites considers topography, vegetation, scale, character of construction and construction materials, proximity to surrounding sensitive land uses and the duration of its use.
- Where possible, adopt pruning and selective trimming of mature trees in preference to their removal.
- Where possible, fence and protect trees of particular significance that fall within construction worksites and laydown areas.
- A suitably qualified arborist should be consulted regarding the management of mature vegetation to be retained.
- Provide noise barriers and hoardings around construction worksites to mitigate the views of construction works, incorporating landscaping and urban design measures where appropriate.
- Where possible, external night time construction activities and traffic movement within the worksites will be minimised.
- Where possible, design noise barriers to incorporate high quality materials, urban design treatments and landscape elements such as low, massed plantings.
- Project lighting to be designed in accordance with relevant standards.
- Construction phase works to minimise night-time impacts of lighting on residential properties where practicable.
- Place hoarding and visually impermeable barriers around worksites to minimise views of stockpiles and construction activities, particularly where worksites are visible to residential or recreational users.
- Where appropriate, use directionally-controlled, shielded lights that are mounted at a sufficient height to minimise light spill to surrounding properties.
- Restore, rehabilitate, and where appropriate enhance open space and public areas disturbed or damaged by construction as soon as practicable following construction.

5.5 Conclusion

A landscape and visual assessment has been conducted for the Proposed Changes to determine the extent of changes compared against the Evaluated Project.

Key changes compared to previous Evaluated Project for construction and operation include:

- **Mayne Yard** - project changes are predominantly to the northern yard with a reconfiguration of alignment, bridge over Breakfast Creek upgraded and new stabling and supporting facilities. The north yard works have increased**,** however, overall when compared against all of Mayne Yard the visual impact changes are still contextually consistent with the Evaluated Project.
- **Northern Area** – the upgrade of Exhibition Station and minor civil works are likely to have consistent landscape and visual impacts as those identified for the Evaluated Project due to the similar extent of changes required, including removal of fig trees. Revised access through Victoria Park is likely to

have a minor increase in visual impacts compared to the Evaluated Project due to demolition of the BTS building and signalisation of access off Gregory Terrace.

- **Central Area** – Roma Street Station works have increased in scale due to the addition of the Inner Northern Busway works. The Proposed Changes would result in an incremental increase in visual impacts at this precinct when compared with the Evaluated Project, with a beneficial outcome during operation due to the upgraded form and function of the station and surrounds. The Proposed Changes for Albert Street Station would include consolidated entry points and reduction in structures on Albert Street to contribute to the Albert Street vision in this location. Therefore, the works would have increased beneficial visual impacts compared to the Evaluated Project
- **Southern Area** – Additional land resumption requirements and associated landscape impacts will result from the Proposed Changes for Dutton Park Station. The visual impacts of the Proposed Changes would be an increase for Boggo Road Station due to the new pedestrian overpass and an increase for Dutton Park Station due to the increased scale of works and land resumption compared to the Evaluated Project.
- **Fairfield to Salisbury Stations** – station upgrades as part of RfPC-4 involve localised works largely within the rail corridor. The Evaluated Project does not include Fairfield to Salisbury Station upgrades therefore the Proposed Changes would be an increase compared to the Evaluated Project. The visual impacts for the station have been assessed as being low-moderate.
- **Clapham Yard** – Proposed Changes to the yard include the reconfiguration of existing stabling requirements and additional supporting facilities which are not part of the Evaluated Project but were assessed in the 2011 EIS. The visual impact has been assessed as being low-moderate.

The extent of project changes are still in accordance with the Coordinator General's Imposed Conditions for the Evaluated Project. No additional or changed Imposed Conditions are recommended.