Cross River Rail Environmental Impact Statement

Request for Project Change 7
Design refinements and condition changes

Volume 3

Date: ***May 2020***

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

CROSSRIVERRAIL

Queensland Government

Table of Contents

1. Technical Report: Noise and Vibration

1.1 Introduction

This technical report assesses the noise and vibration impacts associated with the proposed changes, compared to the Evaluated Project. Since the previous evaluation of the project, the detailed design and construction planning phases have progressed, with more information now known about the proposed construction methodology, and the likely noise and vibration impacts. The proposed changes pertaining to noise and vibration relate to requested changes to the Coordinator-General's Imposed Conditions to achieve efficiencies in project delivery, while maintaining a reasonable environment for nearby sensitive receptors.

1.2 Assessment Methodology

This technical report assesses the effects of the proposed changes by comparing the Evaluated Project, including the current Coordinator-General's Imposed Conditions, with the proposed changes.

1.3 Proposed Changes

1.3.1 Condition 10

Condition 10 of the CGCR authorises hours of works for Project Works in each key area of the alignment.

Condition 10 places a limit of 80 hours continuous works on rail possessions.

There are a number of constraints on construction program and available rail possessions that dictate that the limit of an 80 hour possession is problematic.

It is proposed to remove the limitation of 80 hours continuous works for rail possessions at certain worksites.

From an acoustic perspective, undertaking construction works on extended possessions (greater than 80 hours) will change the potential impacts by increasing the duration of noise and vibration exposure to nearby sensitive receptors for a single possession. This extended impact is still limited by the relevant imposed conditions for noise and vibration, as these conditions impose criteria that are ‘peak’ events. This is especially important for the transient construction noise criteria which is assessed over a 15minute period. For possessions greater than 80 hours construction activity will not occur continuously, but instead allow a longer work program to be completed during any one possession. Whilst the magnitude and duration of noise impacts for a construction period may be greater than for an 80 hour period, this change will reduce the overall construction noise and vibration impact as less possessions will be required to construct the project.

1.3.2 Condition 11 – Noise and Vibration

As the project design has progressed, it has been identified that refinements are required to Condition 11 of the CG conditions, related to Construction Noise and Vibration.

1.3.2.1 Table 2 Noise goals (internal) for Project Works - Method of applying adjustment factors

The noise criteria are adjusted (denoted adj) for annoying characteristics. The Imposed Conditions do not specify what methodology is to be applied for determining adjustment factors. A change has been recommended to add a Note 3 stating that the method for applying adjustment factors outlined in the Department of Environment and Science Noise Measurement Manual Version 4 August 2013 be adopted.

It is proposed to provide an additional Note to Table 2 in Condition 11 as follows:

"*3. Adjustments (adj) will be applied as outlined in the Department of Environment and Science Noise Measurement Manual Version 4 August 2013.*

The above condition change is not forecast to have any impact on the project as the external façade reductions are considered appropriate for the sensitive receptors as described.

1.3.2.2 Table 2 Noise goals (internal) for Project Works - Heritage Structures

The imposed conditions state construction vibration goals in Table 3. No "Transient Vibration" criteria are provided for Heritage Structures, implying that 2mm/s applies in all situations. This criterion is very stringent and will mean that works nearby heritage structures may be unnecessarily restricted. Condition 12 (f) states "*vibration levels more than 2mm/s for continuous vibration and 10mm/s for transient vibration may occur only"* implying that the criteria for transient vibration for cosmetic damage should be 10mm/s in Table 3. It has been proposed to update this requirement to the British Standard (BS7385).

1.3.2.3 Condition 11(c)(iv and 11(f) (i) Noise and Vibration Respite Periods

Imposed Condition 11(f)(i) which requires respite periods is designed to apply to human comfort, and not structural (cosmetic damage). The building itself does not require respite.

It is therefore proposed that the condition be clarified (along with Imposed Condition 11(c)(iv)) so that a respite period only applies to a sensitive place that is occupied.

An example of this is works being undertaken next to an uninhabited structure (e.g. John MacDonald Grandstand at the RNA showgrounds or QR structures). This proposed change is not expected to change the project impacts as buildings do not require respite.

1.3.2.4 Condition 11 and Schedule 3 Definitions – Sensitive Places

Schedule 3 of the CG Conditions contains Definitions, including a definition of Sensitive Place.

Table 2 relates to noise goals and understood to apply at Sensitive Places, however this is not currently stated in these conditions.

It is proposed to modify Condition 11(a) to confirm that it applies at a Sensitive Place.

1.3.3 Condition 11(c) – Noise management for out of hours works

Condition 11(c) of the Imposed Conditions applies when Project Works are predicted or monitored as generating noise levels more than 20dBA above the relevant goal in Table 2.

Condition 11(a) Table 2 of the CG conditions outlines a 42 dB(A) $L_{A10\ adj}$ internal criterion for night works that are transient in nature. The subsequent conditions of the clause outline that *Project Works predicted to or monitored as generating noise levels more than 20dBA* $L_{Aeq\ 10min,\ adj}$ *above the relevant goal in Table 2 are authorised to occur in a locality only:*

(iv) between the hours 7:00am to 6:00pm Monday to Friday, with a respite period between 12:00noon and 2:00pm each day.

This condition therefore applies a limit for night works of 62 dBA $L_{A10\ adj}$ (internal), as Condition (iv) limits when these works can occur. As the design has progressed it has been found that this limit cannot be achieved for most night work activities, regardless of the duration. RfPC-4 has forecast external construction impacts of up to 85 dB(A) out of hours. A large quantum of the works, especially along F2S is proposed to be undertaken out of hours as part of rail possession works. The design process has considered the ability to undertake these works during the standard working hours however limitations on access to stations and the rail corridor during this time prohibit this.

It is therefore recommended that Imposed Condition 11(c) be amended to enable out of hours that are managed in accordance with the requirements of condition 10(d) to proceed. Where possessions are granted out of hours by the asset operators, but Imposed Conditions prevent these works from occurring in part or fully during the possession, these mutually exclusive requirements result in the Approved Project not being able to be delivered as initially evaluated as part of RfPC-4 .

It is however essential that impact to potentially and directly affected persons (DAPs) is adequately managed. Therefore, the requirement of consulting with the DAPs where the upper noise limits are predicted to be exceeded is a given.

It is therefore proposed Imposed Condition 11(c) be amended by adding the words "unless authorised by Condition 10(d)" at the start of Imposed Condition 11(c).

To demonstrate the impact of Condition 11(c) multiple noise modelling scenarios have been analysed, based on the proposed project works to date.

1.3.4 Scenario 1 – Signalised Intersection on Gregory Terrace

1.3.4.1 Activities scope

As part of site access works to enable construction vehicles access into Normanby and the Northern areas, a signalised intersection will be constructed along Gregory Terrace.

The existing Gregory Terrace / Victoria Park access road intersection will be temporarily upgraded to a signalised intersection, to enable safe access to the rail corridor for construction vehicles. This work is expected to take approximately three months to complete. The signalised intersection will also improve safety for motorists, cyclists and pedestrians, and will be used for the duration of construction. Upon project completion, it is planned that the signals will be removed, and the current intersection reinstated.

1.3.4.2 Proposed working hours

The following activities are scheduled to occur between 6:30am and 6:30pm, Monday to Saturday and will include:

- Removal of nine car park spaces on Gregory Terrace between Warry Street and Bowen Bridge Road
- Service location using vacuum trucks;
- Saw cutting concrete kerbing and asphalt, installation of concrete kerbing including pram ramps and pedestrian crossings;
- Excavation of signal post footings, trenching for power supply cables, installation of traffic signal posts and signal lanterns;
- Removal of line marking using a high pressure water cleaner, and installation of new signage and line marking;
- Traffic control for temporary single lane closures on Gregory Terrace adjacent to the Victoria Park access road.

The following activities are also scheduled to occur outside of the project's normal working hours, weather and construction conditions permitting. These activities must be undertaken at night due to worker safety when traffic volumes are at their lowest under approved road closures:

- Saw cutting for concrete removal and signalling cable installation;
- Line marking removal using a high pressure water cleaner, and line marking;
- Excavation for post holes and electrical conduit installation;
- Concrete, and signal post installation;
- Testing and commissioning of new signals;
- Traffic control.

These works will be intermittent night works.

1.3.4.3 DAPs

There are sensitive places located along Gregory Terraces consist mostly of multi-level residential buildings. The closest is a three-storey residential building located approximately 10m away from the area of works.

1.3.4.4 Predictive Noise Assessment

As part of the modelling, the out of hours activities have been assessed.

A vibratory plate compactor was modelled within the area of works which will be used to compact the road surface between the traffic signalling poles. This vibratory plate was modelled with a Sound Power Level (SWL) of 108dB(A) and a height of 0.5m above ground level.

A modelling scenario was also run to include a concrete saw to cut through the existing pavement to enable the installation of traffic signals. This saw was modelled with a SWL of 115dB(A) and at a height of 0.5m above ground level.

Table 1: Predictive Noise Assessment – unmitigated works

Receptor type	Internal intermittent noise goal - $L_{A10, 15min}$, dB(A) – Lower Limit (LL), Out of Hours Works	Internal intermittent noise goal - $L_{A10, 15min}$, dB(A) – Upper Limit (UL)	Highest Predicted $L_{A10, 15min}$ internal impact, dB(A)
Residential – Vibratory plate compactor	42	62	72
Residential – Concrete Saw	42	62	74

1.3.4.5 Additional Mitigation Measures

In addition to scheduling the majority of the activities during standard surface work hours, additional mitigations measures have been reviewed.

Due to the type of construction activities and sensitive places located near the work area the ability to adequately mitigate these works below the night time noise goals is limited because of the following reasons.

- Temporary site hoarding:
    - It will not break the line of sight from units located on the upper levels of residential buildings.
    - As such even with the installation of hoarding the noise goals are not achievable.
- Full acoustic enclosures
    - They will generally be able to result in a reduction of noise levels of 6-8 dB(A).
    - Due to the predicted level being 10dB(A) above the noise goals this method will not achieve compliance with the noise goals.
    - The use of full acoustic enclosures will be highly impracticable and result in extended duration of road closures and exposure to construction noise levels by nearly sensitive receptors.

1.3.4.6 Effects of the Imposed Conditions

Due to the limitations imposed by road closures and undertaking works during the night, the noise condition included in the CGCR (Condition 11) and its synergy with Approved Working hours (Condition 10) would not enable activities key to the intersection upgrade to be completed, therefore preventing the Relevant Project Works from being completed.

1.3.5 Scenario 2 – Enabling Track Works at Yeronga Station

1.3.5.1 Activities scope

There are track works required throughout each of the stations between Fairfield to Salisbury (F2S). These works are associated with localised modifications to the track network. Whilst the extent and requirements of these works are still being finalised by the Delivery team, the works methodologies for track works are standard.

1.3.5.2 Proposed working hours

Due to the works being within the rail corridor, these works will be required to be undertaken during an approved rail possession over a standard week end. These works will occur continuously and therefore will span standard surface working hours and out of hours / night works.

1.3.5.3 DAPs

There are sensitive places surrounding Yeronga Station consist mostly of multi-level residential buildings and commercial properties.

1.3.5.4 Predictive Noise Assessment

As part of the modelling for track works a Front End Loader was included within the area of works which will be used to drag track along the corridor. This Front Loader was modelled with a Sound Power Level (SWL) of 106dB(A) at a height of 2m above ground level.

The below table includes the highest predicted internal noise level at the residential and the commercial places located closest to the works.

Table 2: Predictive Noise Assessment – unmitigated works

Receptor type	Internal intermittent noise goal - $L_{A10, 15min}$, dB(A) – Lower Limit (LL), Out of Hours Works	Internal intermittent noise goal - $L_{A10, 15min}$, dB(A) – Upper Limit (UL)	Highest Predicted $L_{A10, 15min}$ internal impact, dB(A)
Residential	42	62	66
Commercial	42	62	68

1.3.5.5 Additional Mitigation Measures

Due to the type of construction activities and sensitive places located near the work area the ability to adequately mitigate these works below the night time noise goals is limited because of the following reasons.

- Temporary site hoarding
    - It will not break the line of sight from units located on the upper levels of residential buildings.
    - As such even with the installation of hoarding the noise goals are not achievable.
    - Installing hoarding within the rail corridor will also be unachievable within the possession timeframe.
- Full acoustic enclosures
    - They will generally be able to result in a reduction of noise levels of 6-8 dB(A) for stationary equipment.
    - Enclosures are not practicably able to be used for mobile plant.
    - Acoustic treatment of mobile plant will likely be ineffective as there are additional noise sources such as track dragging.

1.3.5.6 Effects of the Imposed Conditions

The only other alternative is to attempt to operate only during the standard working hours, that is on the Saturday between 6.30 am and 6.30 pm and have no productivity on the Sunday. The scope of works for the planned possession would therefore need to be reduced to track works only which can be fully completed within the Saturday period and be made operational again by the Monday morning.

The remainder of the planned scope would then have to be completed at the next available possession.

For example, were the works allowed to occur despites the predicted exceedances of the upper noise limit these works could theoretically have been completed over one approved possession from 15 to 16 February 2020.

Splitting the scope would result in the second half of the works having to be completed at the next available possession from 29 February 2020 to 02 March 2020, as such delaying the program of works by 2 weeks.

Since the scope planned to occur between 29 February 2020 and 02 March 2020 would not be able to be completed, it would have then to be pushed back to the next available approved possession from 16 to 18 May 2020, three months later than originally planned.

The current imposed conditions therefore limit the Delivery team from maximising the use of the approved rail possessions, resulting in the need to secure additional and more frequent rail possessions to complete the scope of works. This in turn would result in an increase of impact to not only the network customers, but also Queensland Rail and the DAPs.

1.3.6 Scenario 3 – Building Demolition at Yeerongpilly

1.3.6.1 Activities scope

As part of the construction works to be completed at Yeerongpilly Station, demolition of an existing building is required.

1.3.6.2 Proposed working hours

The works are proposed to occur Monday to Saturday - 6.30am to 6.30 pm, that is during standard surface working hours.

As these works are occurring in a live train station and no platform closures are proposed, working hours will require to take into account peak rail and pedestrian traffic during the week.

Therefore, the effective window of work Monday to Friday would be 9am to 3pm for an estimated period of 6 weeks.

1.3.6.3 DAPs

The sensitive places surrounding Yeerongpilly Station consist mostly of multi-level residential buildings and commercial properties.

There is also the Brisbane City Council – South Region office located nearby to the work site which may have conference or meeting rooms sensitive to noise impacts.

1.3.6.4 Predictive Noise Assessment

The scope of works for the building demolition includes a small 12T Excavator fitted with a hydraulic hammer attachment and concrete cutting saw, which are the highest noise generating activities.

The saw will generate higher levels of noise compared to the Excavator and as such only the saw has been included in the model as a noise source.

This saw was modelled with a SWL of 115dB(A) and at a height of 0.5m above ground level.

The below table includes the highest predicted internal noise level at the residential and the commercial places located closest to the works.

Table 3: Predictive Noise Assessment – unmitigated works

Receptor type	Internal intermittent noise goal - $L_{A10, 15min}$, dB(A) – Lower Limit (LL), Out of Hours Works	Internal intermittent noise goal - $L_{A10, 15min}$, dB(A) – Upper Limit (UL)	Highest Predicted $L_{A10, 15min}$ internal impact, dB(A)
Residential – common areas	50	70	71 (one receiver only)
Residential – living areas	40	60	71 (one receiver only)
Municipal Building – conference and meeting rooms	40	60	71 (assuming façade reduction of 10 dBA only)

1.3.6.5 Additional Mitigation Measures

Due to the type of construction activities and sensitive places located near the work area the ability to adequately mitigate these works below the upper noise goals is limited because of the following reasons.

- Temporary site hoarding
    - Will not break the line of sight from units located on the upper levels of residential buildings.
    - Even with the installation of hoarding the noise goals are not achievable.
    - Installing hoarding within the rail corridor will also be unachievable within the possession timeframe.
- Full acoustic enclosures
    - They will generally be able to result in a reduction of noise levels of 6-8 dB(A) for stationary equipment.
    - Enclosures are not practicably able to be used for mobile plant.

1.3.6.6 Effect of the Imposed Conditions

Imposed Condition 11(c) requires that where works are predicted to exceed the upper noise limits, respite periods be implemented and works not allowed to occur on Saturdays.

The implementation of the respite period would mean that a 6 weeks program between 9am and 3 pm (outside peak) would the increase into:

- a 7.5 weeks program applying a proportional respite of 1.2 hours to the working day, or
- a 9 weeks program with 2 hours respite period as currently written.

This in turn would result in extended disturbance to the commuters and Queensland Rail at the station.

These works do not significantly impact multiple sensitive places however, is likely to exceed the upper noise goals at one residential sensitive place which becomes the primary driver for implementing additional mitigation measures and respite periods.

The noise goals included in Table 3 are based on the design sound level for residential living areas from AS2107-2016: *Acoustic – Recommended design sound levels and reverberation times for building interiors*.

Considering that the use of the saw may only be used very infrequently during the works and for a short period of time being able to communicate this to stakeholders and demonstrating a low level of impact would be the most practical and feasible mitigation option.

1.4 Effects of the Proposed Changes

1.4.1 Condition 10

From an acoustic perspective, undertaking construction works on extended possessions (greater than 80 hours) will change the potential impacts by increasing the duration of noise and vibration exposure to nearby sensitive receptors for a single possession.

This extended impact is still limited by the relevant imposed conditions for noise and vibration, as these conditions impose criteria that are ‘peak’ events.

This is especially important for the transient construction noise criteria which is assessed over a 15minute period.

For possessions greater than 80 hours construction activity will not occur continuously, but instead allow a longer period of construction to schedule more works than possible with just 80 hours possessions.

Whilst the magnitude and duration of noise impacts for a construction period may be greater than for an 80 hour limit, this change will reduce the overall construction noise and vibration impact as less possessions will be required to construct the project.

1.4.2 Condition 11

The proposed change to clarify the relationship between Imposed Condition 11 and the Sensitive Place definition in schedule 3 is not forecast to alter the impacts of the project as it is clarifying where the relevant construction noise and vibration goals are applied.

1.4.3 Condition 11(c)

From an acoustic perspective, undertaking construction works out of hours that are predicted to exceed the hard limit of 62 dBA indoors will change the potential impacts by increasing the extent of noise to nearby sensitive receptors during these events.

This extended impact is still limited by the relevant CG conditions for noise, as these conditions impose criteria that are ‘peak’ events.

This is especially important for the transient construction noise criteria which is assessed over a 15minute period.

This however does not remove the requirements for the Proponent or its agents to:

- Demonstrate all reasonable and practicable mitigation measures are being implemented; and
- Case by case consultation with DAPs has occurred.

The proposed amendment also restricts these situations to those described in Condition 10(d), and in accordance with the management regime in Condition 10(d).

1.5 Conclusion

The Proposed Changes will result in localised, short lived changes to the noise impacts of the project during construction works that must occur out of hours in the rail corridor or road possessions.

This is due to constraints imposed by the network operators that would either prevent Approved Project Works from being delivered or results in extensions of the delivery program.

2. Technical Report: Water Quality – Delivery Phase

2.1 Introduction

A preliminary surface water investigation has been undertaken to inform surface water management requirements for the works.

Upon further review of the available surface water data, it was concluded that changes to the imposed conditions were required to remove conflicts between Imposed Condition 15(a) and Imposed Condition 18 whilst providing the adequate level of protection to the following water bodies:

- Northern Area
    - Breakfast Creek
    - York's Hollow
- Southern Area
    - Moolabin Creek;
    - Stable Swamp Creek; and
    - Rocky Water Holes Creek.

2.1.1 Legislative Framework

2.1.1.1 Coordinator General Change Report

Imposed Condition 15(a)

The primary regulation for surface water quality is Imposed Condition 15(a) of the CGCR imposes the following obligation on the Project during construction:

Discharges of surface water and groundwater from Project Works must comply with the Brisbane River Estuary environmental values and water quality objectives (Basin no. 143 - mid-estuary) in the Environmental Protection (Water) Policy 2009.

Imposed Condition – Environmental Design Requirement 5(i) of the CGCR imposes the following obligation on the Project for the design (and therefore operations):

The Project design achieves the water quality objectives stated for the Brisbane River Estuary environmental values and water quality objectives (Basin no. 143 - mid-estuary) referred to in the Environmental Protection (Water) Policy 2009 for any water, including groundwater, released from Project infrastructure to surface waters.

Environmental Values (EVs) for Breakfast Creek Estuary include: aquatic ecosystems, human consumer, primary recreation, secondary recreation, visual recreation and cultural/spiritual values.

Whilst the CGCR states that construction phase surface and groundwater discharges and Operational phase surface and groundwater releases must achieve the WQOs, available surface water data collected from waterways intersected by and in the vicinity of the Project boundaries show that background conditions may regularly exceed these objectives.

Imposed Conditions 15(a) and Environmental Design Requirement 5(i) do not mention any other Water Quality Objectives that must be complied with under the *Environmental Protection (Water and Wetland Biodiversity) Policy 2019*.

The following surface water bodies have been identified as potential or actual receiving environments for the Project. The relevant EPP Water documents have been summarised in Table 4 to provide context to the content of this technical report.

Table 4: Summary of additional investigation areas and associated WQOs

Investigation Area	Associated Receptor	Relevant EPP Water Document	Water Types (as defined by EPP Document)
Mayne Yard	Breakfast Creek	*Brisbane River Estuary environmental values and water quality objectives Basin No. 143 (part), including all creeks of the Brisbane River estuary, other than Oxley Creek*.	Mid Estuary
Northern Corridor (between College Rd and Bowen Bridge Road)	York's Hollow		Lowland freshwater
Moorooka Station and Clapham Yard	Moolabin Creek	*Oxley Creek environmental values and water quality objectives Basin No. 143 (part), including all tributaries of the creek*	Lowland freshwater
Moorooka Station and Clapham Yard	Rocky Water Holes Creek		Lowland freshwater
Salisbury Station	Stable Swamp Creek		Lowland freshwater

Imposed Condition 18

Imposed Condition 18 of the CGCR imposes the following obligation on the Project during construction:

An erosion and sediment control sub-plan that is consistent with the Guidelines for Best Practice Erosion and Sediment Control (International Erosion Control Association, 2008) and the Department of Transport and Main Roads' Technical Standard MRTS52 – Erosion and Sediment Control must be submitted as part of the Construction Environmental Management Plan.

IECA nominate numerical water quality criteria in Table 4.15.13 of the Manual.

MRTS 52 does not nominate water quality criteria for discharges. MRTS 52 however refers to MRTS 51 for the determination of WQ criteria.

Table 8.2.2 of MRTS51 details what the water quality criteria should be for discharges.

Discharges are defined in section 8.2.3 of MRTS 51 as stormwater flows moving into waterways within the site, waterways adjacent to the site and beyond the boundary of the site where it could reasonably enter a waterway such as in defined drainage lines (discharges).

Discharges criteria also apply to discharges from sediment basin(s) prior to dewatering. Discharge criteria do not extend to overland flows.

Therefore, using Table 8.2.2 of MRTS51 the CRR Project be classified as a medium to high water quality risk, resulting in the following criteria recommended for Discharges to waters:

> **TSS:** Discharges shall be < 50 mg/L TSS or equivalent turbidity as determined by laboratory analysis by correlating turbidity with the suspended solids limit.
>
> **pH:** 6.5-8.5 General Sites: 6.5 - 8.5 / Wallum/Acid ecosystems: 5.0 - 7.0, With an allowable change Upstream / Downstream 1.0 pH unit change
>
> **Waste:** no waste or litter
>
> **Hydrocarbons, tannins, paints**: No visible trace

The below table compares the WQOs allowed for under Condition 15(a) under the WQOs allowed for under Condition 18.

Parameter	WQO - EPP waters (Condition 15a)	WQO – MRTS52/51 (Condition 18)	WQO – IECA (Condition 18)
Turbidity	8 NTU	Correlation with TSS required	Correlation with TSS required
Suspended Solids	20 mg/L	< 50 mg/L TSS or equivalent turbidity as determined by laboratory analysis by correlating turbidity with the suspended solids limit With an allowable change US / DS of 5 mg/L or 10% increase (whichever is greatest)	90 percentile total suspended solids not exceeding 50 mg/L
chlorophyll a	<4 µg/L	No criterion	No criterion
total nitrogen	<300 µg/L	No criterion	No criterion
oxidised N	<10 µg/L	No criterion	No criterion
ammonia N	<10 µg/L	No criterion	No criterion
organic N	<280 µg/L	No criterion	No criterion
total phosphorus	<25 µg/L	No criterion	No criterion
filterable reactive phosphorus (FRP)	<6 µg/L	No criterion	No criterion
dissolved oxygen	85 – 105% saturation	90% Saturation (lower limit)[1]	No criterion
pH	7.0-8.4	Stable pH reading; and General sites: 6.5 – 8.5, or Wallum/Acidic Ecosystems: 5.0 – 7.0	6.5-8.5
Waste	No objective	no waste or litter	No criterion
Hydrocarbons, tannins, paints	No objective	No visible trace	No criterion
Other toxicants (e.g. heavy metals)	No objective	No criterion	No criterion

The lack of criteria for nutrients in discharge waters in MRTS51/52 and IECA and the lack of criteria for other toxicant in all documents is related to the following factors:

- Nutrients availability is typically in the A horizon (or topsoil) of the soil profile, with nutrients availability significantly reducing the deeper the profile.
- Singular criteria for each toxicant do not exist:
    - Toxicants presence such as heavy metals and metalloids are variable:
        - presence / absence of contamination source;
        - lowland acid sulphate soils influence;
        - naturally occurring elements (such as copper) in Qld soils;
    - Toxicants levels that may adversely affect the receiving environment are dependent on the receiving water types (fresh vs marine) and the level of protection.
- The presence of toxicants in the surface water system above recognise levels does not necessarily reflect the actual risk to the environment. Indeed, the presence of total metals in

[1] Derived from the DEHP Queensland Water Quality Guidelines 2009, July 2013

waters above guideline values may not coincide with an actual acute or chronic risk to the receiving environment as it does not cater for the bioavailability of the metals.

As such it is important to understand the mechanism by which nutrients and other toxicants could be discharged to the receiving environment.

The following publication provides an insight on the relevance of imposing specific criteria on construction waters being discharged.

Wong, T., Breen, P., Lloyd, S. (2000). *Water Sensitive Road Design - Design Options for Improving Stormwater Quality of Road Runoff*. Cooperative Research Centre for Catchment Hydrology, Melbourne, Victoria.

In summary, water quality impacts associated with construction activities are predominantly associated with the mobilisation of sediment as a result of rainfall run-off over sub-soils exposed during construction activities.

Nutrients and other pollutants potentially generated from rainfall runoff over exposed soils (such as phosphorus, heavy metals and organic chemicals) often utilise sediment as the medium for transportation in runoff.

Consequently, the capture and retention of sediment on site using the best practice management principles outlined in IECA (2008) decreases the potential for a range of other pollutants degrading the receiving environment.

Furthermore, the mechanisms in place under the CEMP and its subplans ensure that toxicants of relevance are appropriately managed

- CEMP - Construction Environmental Monitoring Program:
    - It requires that for all dewatering activities in the event dewatering directly in creek or where run off could enter creek this will be undertaken only if an Approved Permit to Dewater has been issued by the environment team;
    - In situ Monitoring of the Source water and receiving water body will be undertaken to ascertain whether a Permit to Dewater can be issued.
- Waterways and Water Quality Management Sub-Plan (WWMP):
    - It 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 below (as well as applicable requirements from the ASSMP or the Contaminated Land Management Plan) will be authorised for release.
- Contaminated Land Management Sub-Plan:
    - It 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;
    - It 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.
- Acid Sulphate Soils Management Sub-Plan:
    - it 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.

2.1.1.2 Environmental Protection (Water) Policy 2009

Environmental Protection (Water) Policy 2009 was replaced by *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* on 01 September 2019.

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* is substantially like the previous legislation, with only minor amendments. Some amendments have been made to clarify the intent of provisions and align the policy to best available knowledge and contemporary practice.

The purpose of the policy is achieved by:

- identifying environmental values for waters and wetlands to be enhanced or protected;
- identifying management goals for waters;
- stating water quality guidelines and water quality objectives for enhancing or protecting the environmental values of waters;
- providing a framework for making consistent, equitable and informed decisions about waters; and
- monitoring and reporting on the condition of waters.

Environmental values, management goals / intent and water quality objectives are typically defined in subsequent documents developed under the Policy framework such as:

- Brisbane River Estuary environmental values and water quality objectives Basin No. 143 (part), including all creeks of the Brisbane River estuary, other than Oxley Creek, and
- Oxley Creek environmental values and water quality objectives Basin No. 143 (part), including all tributaries of the creek

These EPP related documents detail the identified EVs for particular waters and corresponding WQOs. This document also refers to several guidelines, codes and other reference sources on water quality.

In particular, the Queensland water quality guidelines (QWQG) prepared by DERM (now DES) provide a technical basis for the water quality objectives contained in this document. The QWQG also provide more detailed information on water types, water quality indicators, derivation of local water quality guidelines, application during flood events, monitoring, predicting and assessing compliance.

WQOs are long term objectives to protect and enhance Queensland Waters. WQOs detailed in the EPP documents for particular waters are intended to inform and assess compliance of the chronic health of the receiving water. Reviews of WQOs' exceedance are used as a system's health indicator for assessment programs such as state government monitoring programs.

Exceedance of WQOs can take several forms as detailed below:

- Chronic long-term non-compliance (months to years). In this case the system exhibits a small but consistent shift in the distribution of pollutant values above the guideline. This may be due to either catchment or point source pollutants.
- Medium term (weeks to a few months) non-compliance. Here, the system exhibits intermittent periods of non-compliance. The magnitude of non-compliance may be small or large. The cause may be natural or related to activities that discharge wastes on a seasonal or cyclic basis.
- Short-term (a few days) non-compliance. Here, the system is subjected to occasional large pulses of a pollutant that are well above the guideline. This can occur naturally due to storm inflows of pollutants but anthropogenic activities in catchments commonly cause these pulses to be much larger than they would have been under natural conditions, e.g. fine sediment runoff from urban areas is much larger than from natural bushland. Pulses occurring in dry weather are much more likely to be due to a discharge (sometimes accidental) from some form of human activity.

Compliance assessment approaches are well suited to assessing chronic non-compliance. Medium term non-compliance can also be picked up by such approaches provided they are tailored so that

they are focussed on the likely periods of non-compliance. WQOs are the meaningful performance criteria for the purpose of these compliance assessments.

WQOs are however not designed to assess compliance for short term pulses of pollutants or what would be deemed an acute impact.

The National and State frameworks as detailed in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) and the Queensland Water Quality Guidelines (QWQG, 2009) recognise that short term exceedance of a guideline value that is designed to provide protection from chronic effects may not necessarily cause significant impacts on the ecosystem (ref. s5.1 of the QWQG, 2009 – *assessing compliance with guidelines*).

Construction Activities, particularly surface developments subject to a lifecycle of activities with varying degrees of disturbance footprints do not typically result in chronic stress on the receiving environments/. Releases from construction site to surface water systems are better defined as short-term / acute releases.

Construction site stormwater quality management is typically addressed by the following management principles:

- Minimizing the extent of disturbed areas;
- Rapidly revegetating disturbed areas;
- Diverting run-off from undisturbed catchment around works areas; and
- Trapping eroded sediment from disturbed sites as close to the source as practical.
- The success of this approach is dependent on:
- Appropriate planning prior to the commencement of construction activities; and
- Appropriate monitoring and maintenance of the management practices.

Imposed Condition 18 addresses the management principles that must be implemented to manage Project Works. Indeed, the development and implementation of Erosion and Sediment Control Plans which have been prepared by Suitably Qualified Persons (as defined by IECA and MRTS52) to be consistent with Best Practice Guidelines is intended to protect the receiving waters from adverse impact from Relevant Project Works.

2.1.1.3 Other Legislative Requirements

Other relevant legislative requirements are the Environmental Protection Act (EPAct) 1994 insofar as it relates to

- The General Environmental Duty (s319),
- The Release of prescribed water contaminant to water (s440ZG), and
- Contaminated Land management provisions (Part 8)

The existing Rail Corridor infrastructure, inclusive the Mayne and Clapham stabling yards, is listed on the Environmental Management Register (EMR), the EPAct 1994 has also been used to inform this surface water monitoring scope.

Stormwater run-off from land development and infrastructure development sites has a high potential to cause water contamination and/or environmental harm. This is regulated under the EP Act, (all section references refer to the EP act unless otherwise specified).

Under s.440ZG it is an offence to unlawfully deposit a prescribed water contaminant to waters. Prescribed contaminants are listed in Schedule 10 of the Environmental Protection Regulation 2019 (EP Reg).

Under s.319 persons in Queensland carrying out activities which may cause environmental harm must comply with the general environmental duty (GED). This requires that all reasonable and practicable measures must be adopted to prevent and minimise environmental harm. Although not being able to demonstrate compliance against GED is not an offence, demonstrating that all

reasonable and practicable measures have been adopted is a defence for offences such as water contamination. For instance, under s.493A, where a person deposits a prescribed water contaminant to waters or causes unlawful environmental harm, it is a defence to demonstrate compliance with the GED. Demonstrating that all reasonable and practicable measures have been conceived and implemented should encompass:

- Thorough and ongoing site assessments.
- Consideration of, and adaptation for, site-specific erosion risk factors including topography, soil type, climate and season.
- Incorporation in the design, installation, operation, management, maintenance and monitoring of control measures which are consistent with the measures set out in the DES procedural guide – *Standard work method for the assessment of the lawfulness of releases to Water from Constructions – South East Queensland (2013)*.

The latter provides the following guidance with regards to acceptable performance criterion for the dewatering of sediment basins being 50 mg/L total suspended solids.

Under the EP Reg, substances that have a pH outside the range 6.5 to 8.5 are deemed prescribed water contaminants.

Schedule 10 of the EP Reg lists a total 23 prescribed water contaminants.

Through these documents the DES recognises that whilst it is critical environmental values of waters be protected as per the intent of the EPP, it is not reasonable nor practicable to impose for development projects' releases to achieve the WQOs during the construction phase.

These documents recognise that when Projects can demonstrate they are implementing erosion and sediment control practices consistent with Best Practice Principles, these practices will

- help achieve water quality objectives and management goals which in turn will
- help protect or enhance environmental values in SEQ waterways.

This approach is consistent with the approach Under the EPP Water (2019).

Acceptable Water Quality Objectives for the construction phase of medium scale (typically with a disturbance footprint between 2,500 m^2 and 10,000 m^2) and large-scale developments (typically with a disturbance footprint greater than>10,000m^2) in Qld are summarise in Table 8.2.1 of the Queensland Water Quality Guidelines 2009 (as amended).

This table has been reproduced below.

It is consistent with the water quality criteria presented in MRTS51 and IECA.

Table 2: Summary of design objectives for management of stormwater quality and flow – construction phase of development in Queensland – SOURCE: Queensland Water Quality Guidelines

Construction Phase Stormwater Design Objectives	Development Type large and medium scale construction sites[1] defined as disturbance area greater than 1 ha (large) or 2500m2 (medium density)
Intent	To protect water EVs by minimising hydrologic disturbance and the loads of contaminants in runoff.
Pollutant/issue	Stormwater design objectives[2]
Coarse sediment	Retain coarse sediment on site.
Fine sediment (Total suspended solids—TSS)	Take all reasonable and practicable measures to collect all runoff from disturbed areas and drain to a sediment basin—up to the design storm event.[3] Site discharge during sediment basin dewatering complies with a TSS concentration less than 50 mg/L up to the design event—flocculation as required. In storms greater than the design event take all other reasonable and practicable measures to minimize erosion and sediment export.
Turbidity	Released waters from the approved discharge point(s) have turbidity[4] (NTU) less than 10% above receiving waters turbidity—measured immediately upstream of the site.
Nutrients (N and P)	Manage through sediment control.
pH	Acceptable site discharge pH range 6.5 to 8.5[5]
Litter or other waste	Prevent litter/waste entering the site or the stormwater system or internal watercourses that discharge from the site—minimise on-site production, contain onsite and regularly clear bins.[6]
Hydrocarbons and other Contaminants[7]	Prevent from entering the stormwater system or internal watercourses that discharge from the site—control storage, limit application and contain contaminants at source. Waste containing contaminants must be disposed of at authorized facilities. Store oil and fuel in accordance with Australian Standard AS1940—no visible oil or grease sheen on released waters.
Wash down water	Prevent from entering the stormwater system or internal watercourses that discharge from the site.
Cations and anions	As required under an approved Acid Sulfate Soil Management Plan, including aluminium, iron and sulfate.

Notes:

1 For small scale construction sites (defined as disturbance area less than 2500 m2) and independent of a larger common development, the implementation of best practice environmental management should be in accordance with the Queensland Development Code, local government planning scheme requirements (including any deemed to comply provisions) and Draft urban stormwater – Queensland BPEM guidelines Appendix 1 'Model Provisions for Best Practice Erosion and Sediment Control'.

2 Compliance release limits for rainfall events less than the design storm event— (based on the design rainfall event of 80%ile five-day rainfall depth for developments involving land disturbed less than six months, and 85%ile for longer disturbance).

3 For sites with disturbance greater than 1 ha, drain such area to a sediment basin where practicable. See Table 6.3 of Urban Stormwater – Queensland BPEM guidelines and IECA 2008 for details.

4 A site-specific relationship should be developed between turbidity and suspended solids, prior to the commencement of construction on large and medium scale construction sites. Background refers to receiving waters immediately upstream of site waters release points.

5 Note the range may be further limited to prevent mobilisation of specific elements.

6 Avoid wind blown litter; remove gross pollutants.

7 See the prescribed contaminant list in the Environmental Protection Regulation 2019.

2.2 Effects of the Proposed Changes

This proposed change does not modify the intent of the Imposed Conditions to provide an adequate level of protection to the receiving waters against discharges from the Project Works.

This proposed change also consistent with how surface infrastructure projects are being delivered in South East Qld, supported by IECA and consistent with the way the DES assesses the lawfulness of releases to waters from construction sites.

2.3 Conclusion

The Proposed Changes ensure that the management measures are practicable whilst avoiding Environmental Harm or Environmental Nuisance within the Site and to waterways into which the Site Discharges.

3. Technical Report: Water Quality – Operational Phase

3.1 Introduction

This report addresses strategies for protecting surface waters that lie within and adjacent to the study area are provided during the operational phase.

Upon further review of the available surface water data and relevant legislation and guidelines, it was concluded that changes to Imposed Condition – Environmental Design Requirements 5(i) are required to reflect the operational requirements of Rail Infrastructure providing the adequate level of protection to the following water bodies:

- Northern Area
    - Breakfast Creek
    - York's Hollow
- Southern Area
    - Moolabin Creek;
    - Stable Swamp Creek; and
    - Rocky Water Holes Creek.

3.1.1 Existing Operational Requirements

Surface works for the Project include integration of the new CRR lines into the existing QR operational network, namely

- The North Coast Line at the Northern Portal near Victoria park
- The Gold Coast Line from Fairfield to Salisbury

In order to support the integration of the CRR lines, it is also necessary to augment the capacity of the existing Rail Yards:

- Mayne Yard along the North Coast Line
- Clapham Yard along the Gold Coast Line

The North Coast Line and the Gold Coast Lines are the principal regional freight and passenger line within the Queensland Rail network. The Brisbane City Sections of these lines are some of the oldest sections in the QR network having been established in the late 1880s.

The addition of the new CRR lines within the existing rail corridor must occur within the existing rail corridor. Whilst additional tracks will be constructed, there is little to no opportunity to widen the existing footprint of the existing rail corridor boundaries on adjacent land, due to the extensive nature of the urban development along the rail corridor.

Mayne Yard's development commenced around 1911 following a purchase of the land by QR in 1907. It has been growing alongside the operational demands of the North Coast line ever since. With the addition of the new CRR lines, the Northern section of Mayne, which has remained largely undeveloped to date, will now be augmented to cater for the additional rail traffic whilst maintaining its critical junction point for passenger trains traffic.

Whilst Clapham Yard is not as extensively developed as Mayne Yard it was established in the 1930s. Between the 1940s and 1990s Clapham Yard was the main yard where freight transfer between the standard gauge 1435mm line to the southern states and the 3foot 6inch/1067mm gauge Queensland trains occurred. In the 1990s, the traffic volume became too great for Clapham Yard and the handling of the main interstate traffic was transferred to the newer Acacia Ridge railway yards.

With the addition of the new CRR line and associated rollingstock, in order to prevent overloading Mayne Yard, Clapham Yard stabling facilities will be augmented.

3.1.2 Future Operational Settings

The surface works will not introduce a material change of use to the existing corridor, yards and stations along the footprint of the works.

The typical arrangements for each key area are:

- In the Corridor: Ballasted Rail Infrastructure and associated maintenance track
- In the Yards: Ballasted Rail Infrastructure, workshops, maintenance depots, crew facilities / offices and associated road networks and car-parking facilities
- At the stations: station platforms, buildings and car parking facilities for commuters and QR staff

All these arrangements are already existing. The surface works will either augment or upgrade them.

3.1.3 Relevant Legislation, Standards and Guidelines

3.1.3.1 Environmental Design Requirement 5(i) & Environmental Protection (Water and Wetland Biodiversity) Policy 2019

Environmental Design Requirement 5(i) requires that

The Project design achieves the water quality objectives stated for the Brisbane River Estuary environmental values and water quality objectives (Basin No. 143 mid-estuary) referred to in the Environmental Protection (Water) Policy 2009 for any water, including groundwater, released from Project infrastructure to surface waters.

The Environmental Protection (Water) Policy 2009 has been replaced by the Environmental Protection (Water and Wetland Biodiversity) Policy 2019, herein referred to as the EPP Water Policy.

The quality of Queensland Waters is protected under the EPP Water Policy which achieves the objective of the EP Act to protect Queensland Waters while supporting ecologically sustainable development.

In order to assess if an activity has an impact on the environment, the Environmental Values (EVs) of the receiving environment must be identified. EVs are defined as the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses (DERM 2010a). These EVs need to be protected from the effects of habitat alteration, waste releases, contaminated runoff and changed flows to ensure healthy aquatic ecosystems and waterways that are safe for community use.

The EVs of waters to be enhanced or protected under this policy are typically mentioned in Schedule 1 of the EPP Water Policy.

When the waters are not recognised under Schedule 1 of the EPP Water Policy then Section 6(2) applies for determining the EVs of the waters.

Schedule 1 list the relevant EPP water documents for waters for which EVs and Water Quality Objectives (WQOs) have been set.

The relevant EPP Water documents, as listed in Schedule 1 of the EPP Water Policy, for the surface waters that lie within and adjacent to the study area have been summarised in Table 5.

Table 5: Summary of relevant EPP Water Documents for surface waters

Investigation Area	Associated Receptor	Relevant EPP Water Document	Water Types (as defined by EPP Document)
Mayne Yard	Breakfast Creek	*Brisbane River Estuary environmental values and water quality objectives Basin No. 143 (part), including all creeks of the Brisbane River estuary, other than Oxley Creek*.	Mid Estuary
Northern Corridor (between College Rd and Bowen Bridge Road)	York's Hollow		Lowland freshwater
Moorooka Station and Clapham Yard	Moolabin Creek	*Oxley Creek environmental values and water quality objectives Basin No. 143 (part), including all tributaries of the creek*	Lowland freshwater
Moorooka Station and Clapham Yard	Rocky Water Holes Creek		Lowland freshwater
Salisbury Station	Stable Swamp Creek		Lowland freshwater

Each catchment EPP water document was made pursuant to the provisions of the EPP Water Policy. Published EVs for the receiving waterways are based on a combination of the following:

- EVs in the South East Queensland Regional Water Quality Management Strategy 2001; and,
- Work carried out by DERM (now DES) as part of the EVs/WQOs scheduling process.

The below table summarises the relevant EVs for each waterway.

Table 6: Scheduled Environmental Values for Waterways in the Study Area

Waterway	Management Intent	Applicable EVs
Breakfast Creek	Moderately Disturbed	Aquatic Ecosystem Human Consumer Primary recreation[2] Secondary recreation Visual Recreation Cultural and spiritual Values
York's Hollow	Moderately Disturbed	Aquatic Ecosystem Secondary recreation Visual Recreation Cultural and spiritual Values
Moolabin Creek	Moderately Disturbed	Aquatic Ecosystem Secondary recreation[3] Visual Recreation[4] Cultural and spiritual Values

[2] **Primary recreational use**, of water, means full body contact with the water, including, for example, diving, swimming, surfing, waterskiing and windsurfing – *Note it is highly unlikely that Breakfast creek is being used for primary recreation uses which would involve direct contact and a high probability of water being swallowed*

[3] **Secondary recreational use**, of water, means contact other than full body contact with the water, including, for example, boating and fishing.

[4] **Visual recreational use**, of a water, means viewing the water without contact with it.

Waterway	Management Intent	Applicable EVs
Rocky Waterholes Creek	Moderately Disturbed	Aquatic Ecosystem Secondary recreation Visual Recreation Cultural and spiritual Values
Stable Swamp Creek	Moderately Disturbed	Aquatic Ecosystem Secondary recreation Visual Recreation Cultural and spiritual Values

In each EPP document WQOs are provided based on the type of waters, their EVs and the associated management intent.

WQOs are long term goals for water quality management. They are numerical concentration levels or narrative statements of indicators established for receiving waters to support, protect and enhance the designated EVs for those waters. They are based on scientific criteria or water quality guidelines but may be modified by other (e.g. social, cultural, economic) inputs.

The water quality objectives were determined from a combination of documents (and supporting data), including:

- Queensland Water Quality Guidelines (2009);
- Australian Water Quality Guidelines (2000);
- Water Quality Guidelines in the Ecosystem Health Monitoring Program (EHMP);
- water quality objectives in local studies and the South East Queensland Regional Water Quality Management Strategy, 2001 (SEQRWQMS);

In accordance with s15 of the EPP Water Policy, where waters are released to the receiving environment, the following is applicable if the management intent is for moderately disturbed waters:

- if the measures for the indicators for all environmental values achieve the water quality objectives for the water—the measures for the indicators are maintained at levels that achieve the water quality objectives for the water; or
- if the measures for the indicators for all environmental values do not achieve the water quality objectives for the water—the measures for the indicators are improved to achieve the water quality objectives for the water;

Water quality measurement collected from all surface waters that lie within and adjacent to the study area consistently exceeded or did not meet their respective WQOs.

This is consistent with the findings of the monitoring program undertaken within the lower Brisbane River Catchment (within which the study area is located) by Healthy Land and Water as part of a broader EHMP. The reports cards are publicly available. Since 2015, the Lower Brisbane River catchment has been consistently rated a C-.

The Lower Brisbane River receives water from the Mid Brisbane River and the Bremer River. It is a highly modified urbanised catchment with some grazing lands and natural bush/forested areas remaining in the upper parts of the catchment. Riparian vegetation has been cleared from most waterways. Large volumes of stormwater runoff enter the waterways during/after storm events. Population growth is a major pressure on the catchment.

In 2019 the catchment condition had improved slightly from poor to fair for the first time since 2016. The below points summarise why the slight improvement has occurred.

- *Pollutant loads have reduced significantly from high to very low due to substantial reductions in sediment (mud) (613 to 152 kg/ha) and total phosphorus (0.75 to 0.33 kg/ha). Total nitrogen loads remain very low also (2 kg/ha).*

- *Freshwater health declined slightly, though remains good. The health of fish communities decreased at 10 of 13 sites and bug health improved slightly.*
- *The extent of freshwater wetlands in the catchment remains poor while the extent of mangroves and saltmarshes in the catchments estuaries which are critical for productive recreational and commercial fisheries remain in fair condition.*
- *The health of estuaries (Brisbane, Oxley and Cabbage Tree Creek) in the catchment remain poor with elevated nutrients and turbidity in the upper estuarine reaches. An increase in algae (phytoplankton) occurred in Cabbage Tree and Oxley Creeks driven by the accumulation of moderate to high nutrients (total phosphorus and nitrogen) from treated sewage discharges and low flows. Algal growth in the Brisbane River is lower than the other systems possibly due to poor water clarity.*

It is therefore not reasonable nor practicable to require that all waters released as part of the operations of the CRR project meet the WQOs nominated in the relevant EPP Water documents, let alone the WQOs for an estuarine environment when most of the waters are freshwaters.

However, it is reasonable to nominate, consistent with sections 3.1.4 of the relevant EPP Water documents, stormwater design objectives for new stormwater infrastructure to be constructed to manage surface water flows.

It is noted that QR currently operates a waste water treatment plant in Mayne Yard which is subject to a Development Approval under Section 621(4) of the EPAct (EPA Development Application: ENDC00526306 (Converted Development approval) number SR0513).

An application to release wastewater to waters must identify the EVs for the water body and demonstrate how the EVs will be protected. The long-term goal is to improve EVs, particularly in disturbed ecosystems under pressure from human impacts. In determining EVs, site specific information is preferred. WQOs are the aspirational targets that have been set to protect EVs.

In water bodies not achieving WQOs, the intent of the EPP Water is to progress towards the WQO (where achievable) through a number of catchment management actions and improvements to point sources.

Note that WQOs are not intended for and should not be used as discharge to water release limits. Appropriate release limits must be determined on a case–by-case basis and be established by appropriate water quality modelling or other scientific means.

More information is available on the publicly available technical Guideline developed by the DES for licensing of Wastewater release to Queensland waters.
https://environment.des.qld.gov.au/__data/assets/pdf_file/0031/88636/pr-gl-wastewater-to-waters.pdf

Additional operational groundwater releases to surface waters, if required due to the surface works are highly likely to be constrained to the Mayne Yard area and trigger a review and assessment either under the existing Development Approval under which QR is operating or as part of a development application to the DES.

The following sections of this report are therefore focusing on defining suitable WQO for surface stormwater releases, with a focus on the new stormwater infrastructure to be constructed as part of the surface works, based on pertinent, recognised and relevant guidelines and standards.

Queensland Water Quality Guidelines (2009) The Queensland Water Quality Guidelines (QWQG) (DEHP 2009) were developed to address the need identified in the ANZECC 2000 Guidelines by:

- providing guideline values (numbers) that are tailored to Queensland regions and water types; and
- providing a process/framework for deriving and applying more locally specific guidelines for waters in Queensland.

DERM (2010a) acknowledges that the WQOs presented in Section 2.4 are appropriate for baseflows or ambient environmental conditions. Stormwater runoff from the site is expected to be surface runoff

that occurs only during and immediately after rainfall. Hence, the relevant notes associated with that table (Note 8) state that

Nutrient objectives do not apply during high flow events. See Queensland Water Quality Guidelines (QWQG) Section 5 and Appendix D for more information on applying guidelines under high flow conditions.

Relevant extracts from QWQG (DEHP 2009) include:

(Page 100/184).

It seems likely that for some toxicants, short-lived increases in concentrations above guideline values may not have large consequences. However, there is very little information on this, so it is preferable to stay with the established guideline values….

*…With natural pollutants such as **suspended sediment** or **nutrients**, short term increases in values during flood events may not immediately impact on biota but may have longer term impacts or downstream impacts, e.g. effects on seagrasses or coral reefs. However, simple application of baseflow concentration guidelines to these types of indicators during the short period of an event is not appropriate. The ANZECC 2000 Guidelines suggest this type of issue is best dealt with using load-based guidelines….*

*…The difficulties in dealing with physico-chemical indicators during flood events highlight the need to include biological monitoring in all programs. **Biological information** integrates the various effects of short term spikes in water quality and provides the best measure of whether fluctuations during flood events are having a significant impact. For toxicants, measurement of sediment toxicant levels or use of passive samplers is similarly useful ways of integrating the impacts of short term fluctuations in water column concentrations.*

Hence, WQOs cannot routinely be applied to stormwater runoff, and alternatives such as load-based guidelines or biological monitoring are recommended.

The QWQG recommend that biological monitoring be employed to integrate the effects of short term spikes in water quality from surface runoff and provides a robust measure of water quality fluctuations during flood events and their impact on the receiving environment.

For toxicants, measurement of sediment toxicant levels or use of passive samplers may be used to integrate the impacts of short term fluctuations in water column concentrations.

Biological monitoring and passive sampling recommended by the QWQG (DEHP 2009) are unlikely to be able to measure impacts relating to the site due to the following factors:

- Large upstream catchments;
- Variety of urban land uses with high potential for contaminant generation;
- Tidal nature of the receiving environment at Breakfast Creek.

Section 8.1 of QWQG sets out ‘typical’ contaminant values for urban stormwater; these do not represent targets for urban stormwater quality in Queensland.

Section 8.2 of QWQG presents Water quality design objectives for water sensitive urban catchments.

These have been reproduced below.

Table 7: Summary of design objectives for stormwater quality – operational (post-construction) phase (QWQG 2009 as amended)

Region	Minimum* reductions in mean annual loads from unmitigated development (%)			
(See Figure 2.5 of Urban Stormwater—Qld BPEM Guidelines 2009)	Suspended solids (TSS)	Total phosphorus (TP)	Total nitrogen(TN)	Gross pollutants > 5 mm
South-east Queensland	80	60	45	90

* It is expected that application of best practice designed stormwater treatment technologies configured in an appropriately sequenced 'treatment train' will exceed the design objectives presented in Table 8.2.2.

Note: The MUSIC model sets the lower particle size as 0.002 mm (i.e. excludes clay); however, the upper limit recommended by Brodie and Roswell[1] of 0.125 mm (fine sand) is significantly finer than the 0.5 mm adopted as the upper TSS limit in the MUSIC v.3 computer model.[2]

1. Brodie & Roswell, 'Using soil loss models to estimate suspended solids concentrations in stormwater runoff from pre-urban areas', *Australian Journal of Water Resources*, vol. 12, no. 1, Institute of Engineers Australia, 2008.

2. Geoff Hunter, 'Predicting the waterway impacts of urbanization: modeling considerations pre, during & post urban development', proceedings of Urbanisation and Waterway Health: A forum for Policymakers & Managers, Kawana, 2008.

These requirements would be not be able to be achieved for the project due to the limited areas available. There is insufficient space available within the rail corridor to provide sufficient treatment to meet the GWQG WQOs along most of the rail alignment.

For example, the typical space allocation required to meet stormwater treatment targets would be about 2-3 % of the contributing catchment area of the project. i.e. for a catchment 200 m long x 50 m wide, a bioretention system of 200 to 300 m^2 would be required to treat stormwater runoff to the pollutant reduction targets. Such areas are not available within the inner city rail corridor, inclusive of the Yards.

For the Northern Corridor as a specific example, there are a lot of small catchments (about 40) within the corridor, which discharge to about 10 locations.

The total catchment area is about 9 ha (90,000m^2).

Bioretention systems require a footprint about 2-3 % of the contributing catchment (to include area for sediment forebays and maintenance, and batters or edge treatments) and therefore the required land to construct such system would be ~ 2500 m^2 in total.

Therefore, presuming that a stormwater treatment device (such as bioretention) was required at each outlet – on average, the project would require 10 basins of 250 m^2 each. One at each outlet along the northern corridor.

These basins would require to be installed between the northern boundary of the corridor and the ICB. Ongoing operation and maintenance of the basins would also require the basins to all be accessible by heavy machinery in the event that desilting must occur over the operational life of the corridor (e.g. 100 years).

This would require additional land resumption in the ICB corridor where it is not feasible to do so.

3.1.4 DTMR's Road Drainage Manual (September 2019)

The 3rd Edition of the Road Drainage Manual (September 2019) developed by Queensland Department of Transport and Main Roads (DTMR) has also been reviewed. This manual represents the policy of the DTMR with respect to the planning, design, operation and maintenance of road drainage infrastructure and must be applied on all road infrastructure projects for which the department is responsible for. It also has been developed to incorporate and cross-reference formally to the Australian Rainfall and Runoff (ARR) 2019, and the Queensland Urban Drainage Manual (QUDM), 4th Edition 2016.

Whilst this manual has not been specifically developed to also address surface rail infrastructure, it contains pertinent and relevant guidance for the surface works, especially for:

- Determining management objectives, and
- Establishing pollution control requirements.

3.1.4.1 Determine management objective

Section 7.4.1.1 of the Manual states that

Water quality objectives for a section of the asset are to be determined based on:

- *Existing ecological values of receiving waterbodies and broader environment;*
- *Existing water quality of receiving waterbodies;*
- *Current and potential future users of receiving waterbodies and the suitable water quality for those uses;*
- *Risk posed by the asset to the receiving waterbodies during operation phase. Considering AADT, % heavy vehicles, crash (spill) risk, traffic flow patterns (areas of heavy breaking can increase road runoff pollution).The management objective should also consider the scale and scope of project:*
    - ***Low**: minimal drainage works involved in scope of works, gravel roads*
    - ***Medium**: projects involve some drainage design, drainage already existing, some ability to make minor amendments to existing drainage and/or retrofit water quality measures*
    - ***High**: greenfield projects, major opportunities to optimise drainage design and achieve water quality objectives.*

The environmental assessment shall consider these factors and provide advice on the most appropriate water quality objectives for the asset in the study area.

On this basis the risk posed by the surface works is a ***Medium Risk for water quality.***

3.1.4.2 Determine water quality design criteria

Section 7.4.1.2 of the Manual states that

Design criteria for water quality may be set as:

- *reduction in mean annual load compared to unmitigated development (%)*
- *concentration of various pollutants in runoff.*

The design objectives for reduction in mean annual load are the same as the QWQG ones presented earlier.

The Manual however notes this approach is recommended to be adopted for road design in locations of high risk for water quality.

On this basis, load reduction WQOs are not suitable for the surface works.

SURFACE RAIL INFRASTRUCTURE

Re-development of highly developed areas is not likely to result in change to the total imperviousness. On this basis, if total imperviousness of the project area does not change substantially between the existing and proposed development, then pollutant loads discharged to the environment are also unlikely to change.

The design of drainage infrastructure associated with surface rail infrastructure can be found in QR Civil Engineering Structures Standard - Hydraulic design criteria for new cross drainage (including bridges & culverts) shall be in accordance with RISSB (rail industry safety and standards board) standard AS 763-2014 – Hydraulics and Hydrology.

A key element of the hydraulic design of the surface rail infrastructure is ballast. Indeed, ballast is a key element for fast and effective dissipation of stormwater run-off away from the operating rail network. Ballast therefore provides energy dissipation to stormwater flows /rainfall therefore minimising runoff and downstream erosion potential compared to other urban land uses such as road networks.

The mandate is for stormwater to be led away in the least possible time.

Surface rail infrastructures are therefore typically not considered to be a polluting land use due to:

- Ballast being required to comply with the Queensland Rail Specification which mandates that
    - Ballast be virgin quarry rock materials, and
    - Only contain a very low content of fines as fines can silt up the interstitial space between ballast rocks and subsequently prevent stormwater flows from being drained away from the track.
- Regular maintenance to remove fouled ballast as per the Standard's requirements to prevent track problems.
- The rail operating environment being an electrified environment
- The rail operating environment being a controlled environment and therefore having adequate emergency response measures in the event of a loss of containment

It is however noted that heavy metals from rollingstock and atmospheric fallout may deposit directly onto rack surfaces or become entrained in air flows and deposited some distance away depending on their particle size.

Where sections of track require lubricating, petroleum based lubricants may be used

These pollutants may subsequently bind to particulates such as sediment which get subsequently mobilised by rainfall events.

Crew facilities, roads, and car parks

Fine particulates and dissolved pollutants (such as heavy metals) can become attached to sediments or flocculate to form larger particles. Most of the pollutants in sediments are found attached to smaller particles owing to their greater surface area relative to larger particles. Pollutants attached to fine particles are easily transported because small flows (and hence low velocities) are sufficient to mobilise and keep them in suspension.

Heavy metals from motor vehicles and atmospheric fallout may deposit directly onto road surfaces or become entrained in air flows and deposited some distance away depending on their particle size. Particulate material on the road surface, such as sediment, bituminous products, rubber from tyre wear and particles coated with oils, actively adsorb heavy metals.

The particulates and associated heavy metals temporarily bind themselves to the road surface and particulate material until they are dislodged and transported by rainfall events.

Heavy metals contained in road runoff will be distributed in either bound or soluble forms. Chromium, iron, nickel, lead and hydrocarbons are predominantly adsorbed to sediments and particulate matter. This provides an opportunity for heavy metal removal by targeting the removal of sediments from runoff.

Identify pollutant transport processes

Pollutant runoff from the surface rail infrastructure compared to crew facilities, roads, and car parks will generally behave differently.

Surface Rail Infrastructure

The ballast layer will typically trap coarse sediments in its pore space, therefore reducing the pollutant load.

Since the surface works consist of the “Re-development” of highly developed areas it is not likely to result in change to the total imperviousness. On this basis, if total imperviousness of the project area does not change substantially between the existing and proposed development, then pollutant loads discharged to the environment are also unlikely to change.

Crew facilities, roads, and car parks

Pollutant runoff from a roadway will be generally transported by the roadway drainage infrastructure and will concentrate in gutters, pipes and channels. The pollutants associated with the stormwater runoff will be transported as coarse or bottom sediments, suspended (fine) particles or in solution. The rate of pollutant transport is dependent on pollutant size, water velocity, depth and the degree of turbulence.

The increase in imperviousness is likely to create a commensurate increase in runoff volume and pollutants washed off these surfaces. Hence, provision of stormwater treatment is recommended to mitigate the increase in pollutant loads.

Identify pollutant removal processes

Surface Rail Infrastructure

Section 3.4.4 of the AS-7637 deals with the design of all types of surface and underground drainage structures associated with the railway infrastructure, including:

- Longitudinal open channel drainage
- Longitudinal underground track drainage
- Cross drainage

On the basis of the above the focus for pollutant removal must however be for crew facilities, roads, and car parks. However, given the limited space available to the project, the provision of treatment will be highly space-constrained. Since the likelihood of an increase of pollutant loads in the rail corridor is minimal, ongoing compliance with AS-7637 for selected rail drainage solutions is considered suitable.

Crew facilities, roads, and car parks

Stormwater quality improvement measures rely on a variety of mechanisms for reducing pollutant levels within stormwater. The mechanisms employed may be either or a combination of physical (such as stormwater grate, continuous deflection systems), or biological (such as macrophytes) processes and their effectiveness may be dependent on the site conditions and stormwater characteristics.

Stormwater pollution removal devices can be grouped into three categories based on their dominant treatment processes:

- primary treatment – physical screening or rapid sedimentation techniques (for example, typically retained contaminants include gross pollutants and coarse sediments)
- secondary treatment – sedimentation of finer particles and filtration/chemical techniques (for example, typically retained contaminants consist of fine particles and attached pollutants)
- tertiary treatment – enhanced sedimentation and filtration, biological uptake, adsorption onto sediments (for example, typically retained contaminants are nutrients and heavy metals).

There is general industry recognition to, where possible, incorporate a combination of treatment mechanisms in one location, to optimise the amount and range of pollutants removed from stormwater runoff.

In other circumstances where space limitations and certain practicalities impose, single treatment measures are used to achieve the Design objectives.

Section 7.4.1.5 of the Road Drainage Manual provides additional considerations for the selection of the preferred treatment processes.

Assess potential pollutant control devices

Surface Rail Infrastructure

This will be done in accordance with AS-7637

Crew facilities, roads, and car parks

Each potential pollutant control device needs to be assessed to determine if it is suitable for the site conditions. Each pollutant control device can be accepted or rejected on the basis of screening criteria to provide a shortlist.

Table 7.4.1.6 of the Road Drainage manual provides a means of assessing common design elements in order to determine if a particular control device is suitable for a specific site condition.

Calculate potential pollutant removal

Crew facilities, roads, and car parks Only

The final selection of potential pollutant control devices should be made by comparing all potential treatments as follows with the required water quality design criteria.

- Determine the pollutant removal of each shortlisted control device based on relevant performance data or Table 7.4.1.7 of the Road Drainage Manual
- Determine the area of the catchment for which the device(s) can treat runoff.
- Factor the mean removal rate of each pollutant parameter by the ratio of area treatable by the device to total catchment area. For example, if a pollution control device has a 60% removal efficiency and will treat 50% of the catchment area, then the overall pollutant removal efficiency will be 30%.

3.2 Proposed Changes

The following water quality objectives are proposed to the design for the operational phase:

1. *No increase in pollutant loads as a result of the development for the surface rail infrastructure.*

Applicable areas: This is applicable to areas within the rail corridor that are highly developed in the existing condition i.e. areas of rail ballast

3.3 Mitigation Measures

Potential mitigation measures for internal roads, car parks and crew facilities areas consist of stormwater treatment facilities identified as appropriate for the site include:

- **Gross pollution traps** – such as CDS units can be installed underneath load-bearing pavements, and into the stormwater drainage network. CDS units can be used to treat runoff from car parks and roads.
- **Grass swales**. Swales can be used wherever runoff can be kept on the surface. However, the flat grades required at the stabling yard limit the potential for the use of swales, which require a surface grade to be free-draining.
- **Bio-retention pods**. The pods are small bio-retention basins which provide stormwater treatment by directing runoff to pass through a filter medium for removal of contaminants. They are incorporated into roads and landscape areas. The intensive use of the site is likely to limit the use of bioretention to only the streetscape verge or to the station's commuter car parks.

Mayne Yard has been used as an example to demonstrate how the potential mitigation measure can be implemented.

The proposed car parking facility at the Mayne Yard comprises two catchments. These car parks will be serviced by pit and pipe drainage, each with an outlet to Breakfast Creek (known as Enoggera

Creek further upstream). The car parks are tightly constrained by surrounding land uses such as roads and stabling yards, services such as power, and fences. Hence it is not considered feasible to use either grass swales or bio-retention pods.

It is proposed to use gross pollution traps such as CDS units (or equivalent) to treat the stormwater runoff from the car parks. Gross pollutant traps are currently elsewhere on the Mayne Yard site to successfully manage the treatment of stormwater runoff.

Devices such as the CDS units are designed to capture and retain gross pollutants, litter, grit, sediments and associated oils. The design relies on vortex flow and screen to collect pollutants within the centre of the chamber, with sump to trap the accumulated pollutants. A diversion chamber controls how much flow is directed towards the vortex in order to avoid resuspending the trapped pollutants.

These devices would be connected to stormwater pipes just downstream of the car parks, so as to filter runoff from these catchments prior to discharging treated flows to the creek. Each CDS unit would be sized appropriately to its catchment so that it would be capable of treating the flow equivalent to a 1-year event.

Treatment performance for CDS units is:

- Gross Pollutant Removal: 98 % (>3 mm)
- TSS removal: 70 %
- Total Phosphorus removal: > 30 %
- Hydrocarbon capture: 80-90 %

With this treatment in place, the quality of stormwater runoff from the site is likely to be improved in comparison to the existing condition.

Gross pollutant traps require periodic maintenance. Typically, this is done by an eductor truck, which lowers a strong vacuum hose into the sump to remove the accumulated pollutants. The maintenance interval is dependent on the catchment condition and rainfall, approximately annual. The sump is accessed via a manhole in the pavement. Access for eductor trucks would need to be accommodated for in the design.

3.4 Effects of the Proposed Changes

No increase in pollutant loads as a result of the development for the surface rail infrastructure.

Since the rail corridor is currently nearly fully developed (the railway formation would be considered largely impervious due to the compaction of the soil), re-developing these areas of the project is unlikely to cause increases in stormwater discharges or pollutant loads. Hence no impact to the receiving environment would be expected.

With stormwater treatment devices in place, the pollutants generated from the project site would be less than that of an equivalent impervious area from the surrounding existing urban developments and roads.

3.5 Conclusion

The nomination of set WQOs and the use of the EPP mid-estuary WQOs EPPs for all water releases in particular, is not appropriate for the surface works.

WQOs are concentration targets that are applicable to discharges during ambient or baseline conditions (dry-weather flows) and not for runoff associated with rain events.

These objectives may be appropriate for the release of groundwater or process water discharges during dry weather but should not be applied to stormwater runoff.

Dry weather discharges, such as groundwater discharges are often subject to operational licencing requirements, which takes precedence over the project conditions

The area proposed for development is currently highly impervious, with land uses comprising rail ballast, bitumen roads and car parking, buildings and hardstand. There are some small areas of landscaping where grass growth is visible adjacent to buildings and alongside existing tracks. The areas alongside the tracks support only poor grass growth and are likely to be highly compacted, given the industrial nature of the site.

Estimated imperviousness for the existing land use is about 90 % with extremely sparse opportunities to install treatment trains which would require additional land acquisition.

The proposed car parks would be nearly completely impervious with very little landscaping.

Overall, the project would result in a small increase in imperviousness.

The implementation of best endeavours approaches, consistent with the DTMR Road Drainage manual, in areas where treatment devices can be installed such as for the Mayne Yard crew facilities and car park would results in some improvements to water quality from current conditions.

The opportunities arising from this approach are that:

- Compliance can be determined during design
- Compliance is not reliant on water quality monitoring post-construction, for which there would always be ambiguity in attributing impacts to a specific land use
- Mitigation is measurable, implementable and defensible.

4. Technical Report: Spoil haulage and Material / Equipment deliveries

4.1 Introduction

The current Coordinator General (CG) conditions impose restrictions for Spoil Haulage and Materials / Equipment Delivery for works in the Fairfield to Salisbury (F2S) section during approved Surface works—standard hours. These hours are consistently Monday to Saturday, 6.30 am to 6.30 pm.

The approved Spoil haulage and materials equipment delivery hours are also separate to extended work hours which related to:

- approved rail possessions;
- approved road possessions;
- delivery of "in time" materials such as concrete, hazardous materials, large components and machinery;
- Project Works involving the transport, assembly or decommissioning of oversized plant, equipment, components or structures', and
- Project Works that require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident.

The restrictions would therefore also prevent certain operations from occurring that are required to construct the works (e.g. rail possession deliveries on weekends and on night shift, delivery & erection of oversize loads such as station bridge beams).

Monday to Friday approved hours for Spoil Haulage and Materials / Equipment Delivery appear to be intended to reduce traffic impacts during school drop and pick up times.

4.2 Assessment methodology

This report has been compiled to provide an overview of:

- Current restrictions review and effects on surface works
- Detailed analysis of heavy vehicle movements along the F2S footprint
    - Estimated heavy vehicle movements at each F2S Station and Moorooka Station
    - Planned heavy vehicle routes at each F2S station and Moorooka Station
    - Expected impacts on schools in the vicinity of work sites at F2S
- Comparison of the updated detailed analysis against the RfPC-4 technical analysis

4.2.1 Current imposed conditions

Table 8: Heavy Vehicle Movements restrictions – Northern area

<table>
<tr><th>Time</th><th>Monday to Friday</th><th>Saturday</th><th>Sunday</th></tr>
<tr><td>12:00AM to 6.30 AM</td><td colspan="2">No Spoil Haulage and Materials / Equipment Delivery Allowed</td><td rowspan="9">No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>6.30 AM to 7.30 AM</td><td rowspan="6">Spoil Haulage and Materials / Equipment Delivery Allowed</td><td rowspan="3">Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>7.30AM to 9.00 AM</td></tr>
<tr><td>9.00 AM to 2.30 PM</td></tr>
<tr><td>2.30 PM to 4.30 PM</td><td rowspan="3"></td></tr>
<tr><td>4.30 PM to 6.30 PM</td></tr>
<tr><td>6.30 PM to 10.00 P<</td><td>No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>10.00 PM to 12.00 AM</td><td colspan="2">No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
</table>

Table 9: Heavy Vehicle Movements restrictions – RNA

<table>
<tr><th>Time</th><th>Monday to Saturday</th><th>Sunday</th></tr>
<tr><td>12:00AM to 6.30 AM</td><td>No Spoil Haulage and Materials / Equipment Delivery Allowed</td><td rowspan="8">No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>6.30 AM to 7.30 AM</td><td rowspan="5">Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>7.30AM to 9.00 AM</td></tr>
<tr><td>9.00 AM to 2.30 PM</td></tr>
<tr><td>2.30 PM to 4.30 PM</td></tr>
<tr><td>4.30 PM to 6.30 PM</td></tr>
<tr><td>6.30 PM to 12.00 AM</td><td>No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
</table>

The approved Spoil haulage and materials equipment delivery hours are not consistent with extended work hours which related to:

- approved rail possessions;
- approved road possessions;
- delivery of "in time" materials such as concrete, hazardous materials, large components and machinery;
- Project Works involving the transport, assembly or decommissioning of oversized plant, equipment, components or structures; and
- Project Works that require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident.

Possession works will necessitate the involvement of heavy vehicles movement to support the successful undertaking of the works.

As an example, OHLE superstructure installation requires the delivery of steel masts and gantries and concrete pours for the mast foundations. Such works are typically undertaken in corridor under approved rail possessions, over nights and weeks ends.

Table 10: Heavy Vehicle Movements restrictions – F2S inclusive of Clapham Yard (and Moorooka)

<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="5">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="4">Spoil Haulage and Materials / Equipment Delivery Allowed</td><td rowspan="6">Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>7.30AM to 9.00 AM</td><td colspan="4">No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>9.00 AM to 2.30 PM</td><td colspan="4">Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>2.30 PM to 4.30 PM</td><td colspan="4">No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>4.30 PM to 6.30 PM</td><td colspan="4">Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
<tr><td>6.30 PM to 12.00 AM</td><td colspan="5">No Spoil Haulage and Materials / Equipment Delivery Allowed</td></tr>
</table>

The restrictions would therefore also prevent certain operations from occurring that are required to construct the works (e.g. rail possession deliveries on weekends and on night shift, delivery & erection of oversize loads such as station bridge beams).

Monday to Friday, the approved hours for Spoil Haulage and Materials / Equipment Delivery appear to be intended to reduce traffic impacts during school drop and pick up times.

The approved Spoil haulage and materials equipment delivery hours are not consistent with extended work hours which related to;

- approved rail possessions;
- approved road possessions;
- delivery of "in time" materials such as concrete, hazardous materials, large components and machinery;
- Project Works involving the transport, assembly or decommissioning of oversized plant, equipment, components or structures; and
- Project Works that require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident.

The following sections provide a detailed analysis of Heavy Vehicles construction Traffic along F2S.

4.2.2 F2S, Moorooka and Clapham Construction Traffic – Heavy Vehicles

4.2.2.1 Vehicle Types

With the exception of the Clapham Yard work site, the majority of heavy vehicle movements at F2S sites are not for spoil haulage.

Construction heavy vehicles (excluding spoil haulage) during construction includes materials and equipment deliveries, concrete (including precast), steel and quarry materials.

These will be transported to each of the worksites from various locations across Brisbane and the greater surrounding areas.

For all worksites is can be assumed that typical material delivery and removal will be undertaken by 12.5m long rigid trucks. Those trucks match in size and specifications typical delivery, removalist or garbage trucks. Delivery trucks will generally be via either 12.5m rigid trucks or 19m semi-trailer vehicles.

At F2S the ratio will be approximately 80/20 while at Clapham Yard a split of 60/40 can be assumed between the use of body trucks and semi-trailers or truck and dogs.

4.2.2.2 Traffic Volumes

The below tables outline the estimated heavy vehicle movements over a standard working day at each station and Clapham Yard. Movements listed are one way and based on typical Project Works that are undertaken during typical working hours (i.e. excludes possession works, excludes out of hours deliveries such as oversize beams etc).

Table 11: HV Construction - Day Time Traffic Volumes - aligned with CTMP

Worksite	AM Peak (3 hrs)			Daytime off-peak (5hrs)			PM Peak (4 hrs)			Program Duration
	(6:30am-9:30am)			(09:30am–2:30pm)			(2:30pm–6:30pm)			
	Average per hour	Peak Hour	Total for Period	Average per hour	Peak Hour	Total for Period	Average per hour	Peak Hour	Total for Period	
Fairfield	2	4	6	5	5	25	2	4	8	Jun 2020 to Dec 2021
Yeronga	2	4	6	5	5	25	2	4	8	Sep 2020 to May 2022
Yeerongpilly	2	4	6	5	5	25	2	4	8	Dec 2020 to Sep 2022
Rocklea	2	4	6	5	5	25	2	4	8	Jun 2021 to Nov 2022
Salisbury	2	4	6	5	5	25	2	4	8	Jan 2022 to Jun 2023
Moorooka	2	4	6	5	5	25	2	4	8	May 2022 to Sep 2023
Clapham	5	8	15	6	10	30	5	8	20	Anticipated start May 2022; Duration TBC

For the purpose of estimating expected impacts on the road network, heavy vehicle movements have been structured considering typical AM / PM traffic peaks rather than the Coordinator General restrictions. This is consistent with the overarching Construction Traffic Management approach for the surface works as well as similar major infrastructure projects in urban environments.

The above volumes are not considered heavy and would not have a significant impact in terms of traffic congestion or road safety at each of the proposed sites.

4.2.3 Heavy Vehicle Access / Egress Routes

The below route maps for each station worksite, demonstrate how heavy vehicle construction traffic will travel via the shortest routes to the closest arterial road and/or motorway. This is in alignment with the approved Haulage Management Plan. The maps further detail the location of schools and school zones as known generators of peak traffic conditions during the CG's restricted times.

4.2.3.1 Fairfield Station

Access to site will be from either side of the rail alignment from Fairfield Road and Ipswich Road.

Traffic from Fairfield Road will travel either via Ashby Street and Mildmay Street to the western side of the station or via Venner Street and Lagonda Street to the eastern side. Traffic from Ipswich Road will travel either via Venner Road and Lagonda Street to the eastern side of the station or via Annerly Road, Cronin Street and Equity Street. The latter is the least preferred approach to the eastern side of the station. All routes may also be used in return.

The closest school in the vicinity of the worksite is Junction Park School east of Ipswich Road. Drop-off / pick-up is located on Gowrie Street and Waldheim Street. It is expected that the estimated heavy vehicle construction traffic will have negligible measurable impact on school operations during or outside of peak hours.

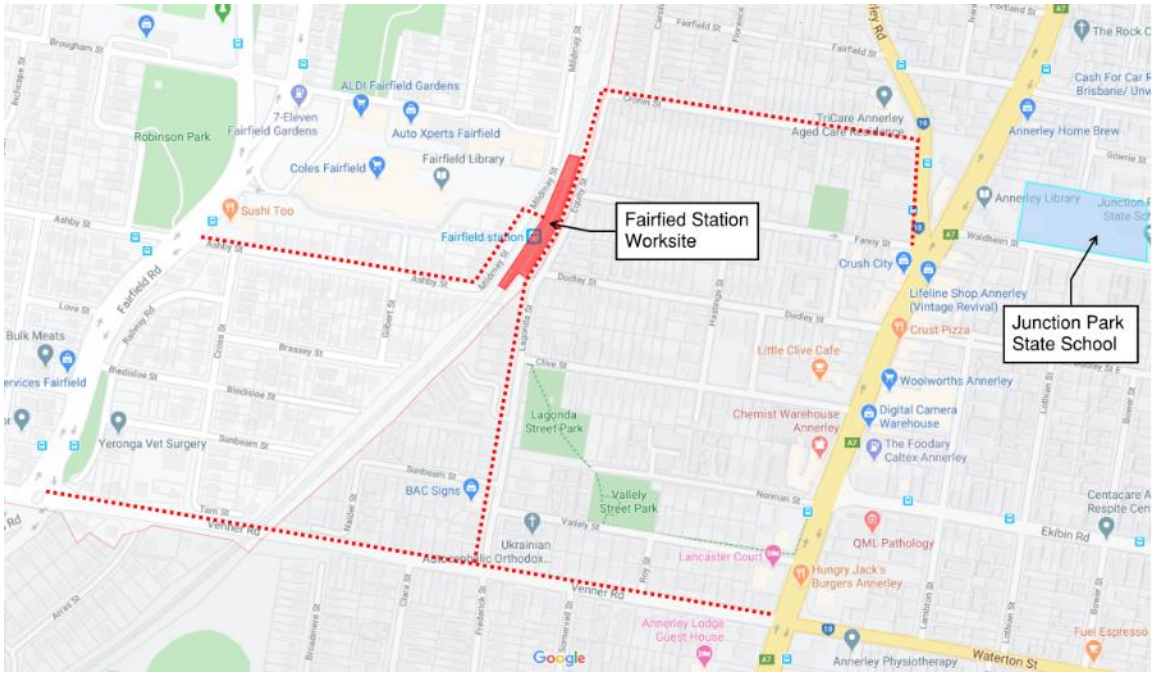

Figure 1: Fairfield Station - HV Access Routes

4.2.3.2 Yeronga Station

Access to site will be directly from Fairfield Road for works along Fairfield Road northbound or from Fairfield Road and Ipswich Road via local roads to the eastern side of the station.

Traffic from Fairfield will travel via Park Road and Killarny Street to the eastern side. Traffic from Ipswich Road will travel via Gow Street, Park Street, School Road and Lake Street to site. The section of Park street fronting Yeronga State School will be avoided.

There are two schools in the vicinity of the worksite that would share access routes with the project works with Yeronga State School being the closest.

Yeronga State High School drop-off / pick-up is located on Villa Street. Heavy vehicle movements are not proposed on this road. Yeronga State School drop-off / pick-up is located on Park Street between Killarny Street and School Road, off-street parking is provided on School Road east of Park Street intersection. Heavy vehicle movements are not proposed on either section of roadway.

It is expected that Park Street, School Road and Villa Street will be utilised during school drop-off / pick-up times. Impacts to school operations on Villa Street during peak hours is expected to be minor since both access routes bypass this school entirely and overall heavy vehicle numbers are limited. The measurable impact on school operations during peak hours on Park Street and to some extent on School Road is expected to be minor to moderate due to the overall limited number of heavy vehicles (average 2 per hour).

For the proposed access routes bypass the direct drop-off / pick-up zones of Yeronga State School, an even spilt of construction access from north and east is anticipated.

It is further anticipated that traffic volumes on the local roads west of Park Street will be substantially lower than on Park Street, School Road or Villa Street.

It is expected that the estimated heavy vehicle construction traffic will have nil measurable impact on school operations and minimal impact to local traffic.

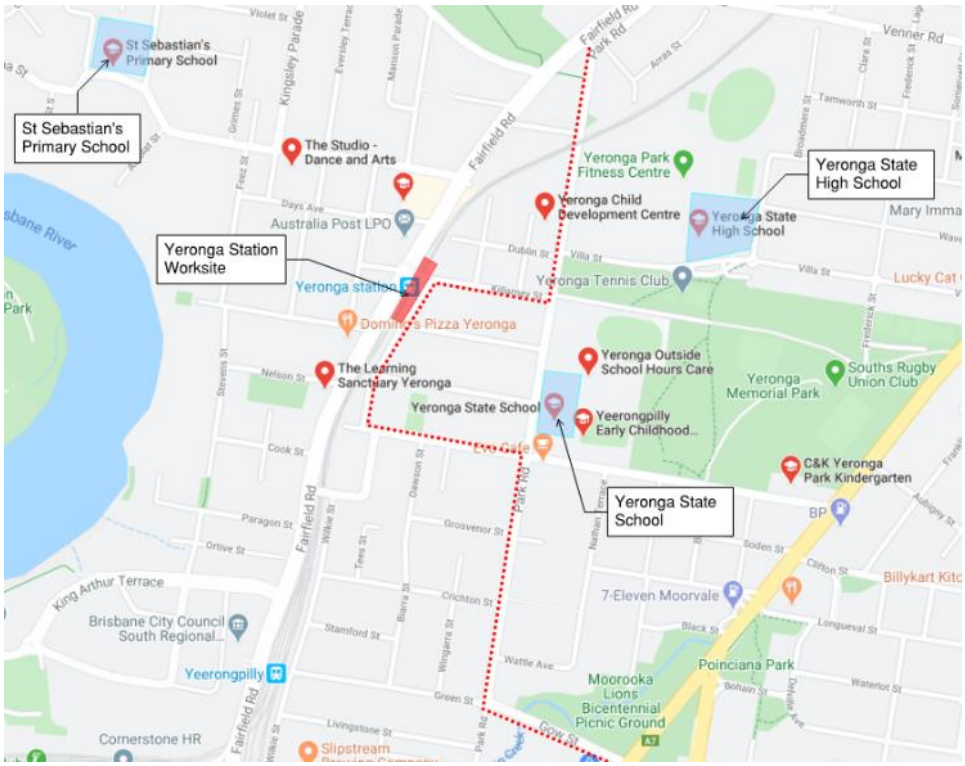

Figure 2: Yeronga Station - HV Access Routes

4.2.3.3 Yeerongpilly Station

Access to site will be directly from Fairfield Road for works along Fairfield Road or from Ipswich Road via local roads to the eastern side of the station.

Traffic from Ipswich Road will travel either via Gow Street and Green Street to site or via Station Road and Wilkie Street. The latter is through a commercial area of the suburb for the majority of the route and therefore the preferred approach.

No schools in the immediate vicinity of the work site could be identified.

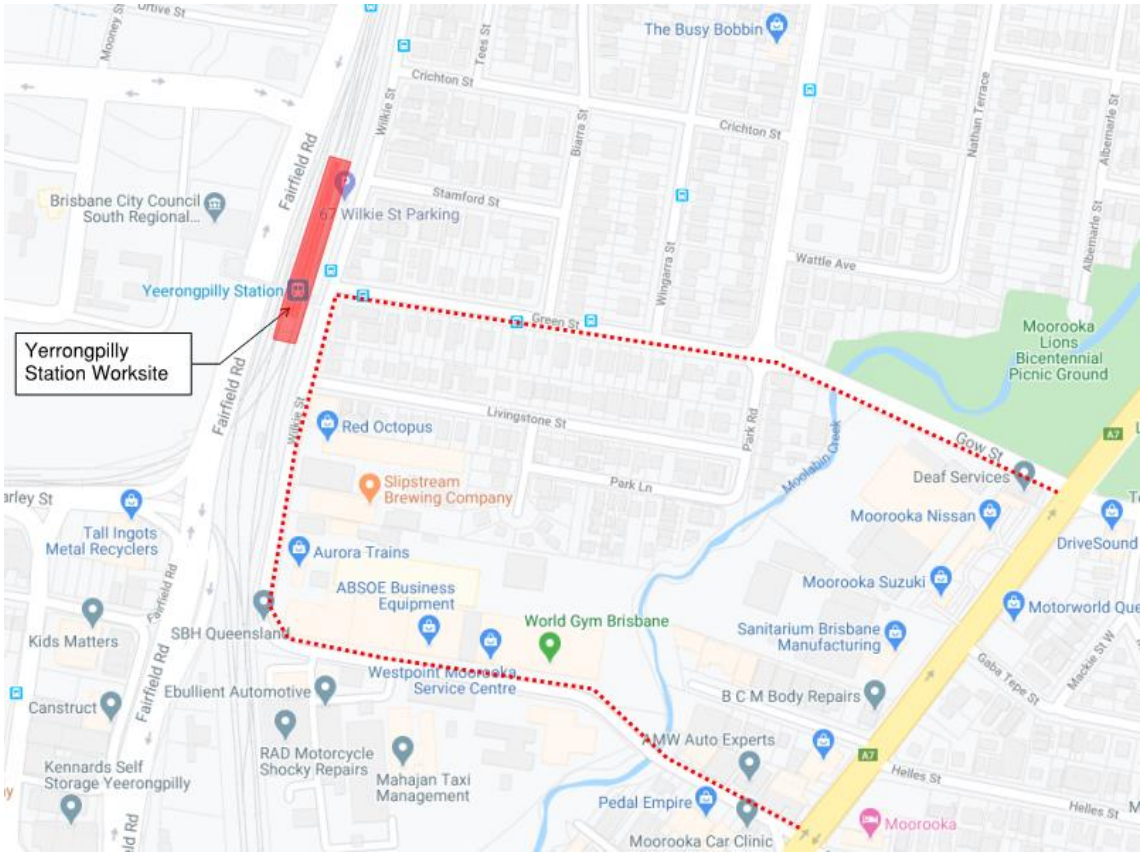

Figure 3: Yeerongpilly Station - HV Access Routes

4.2.3.4 Moorooka Station

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.

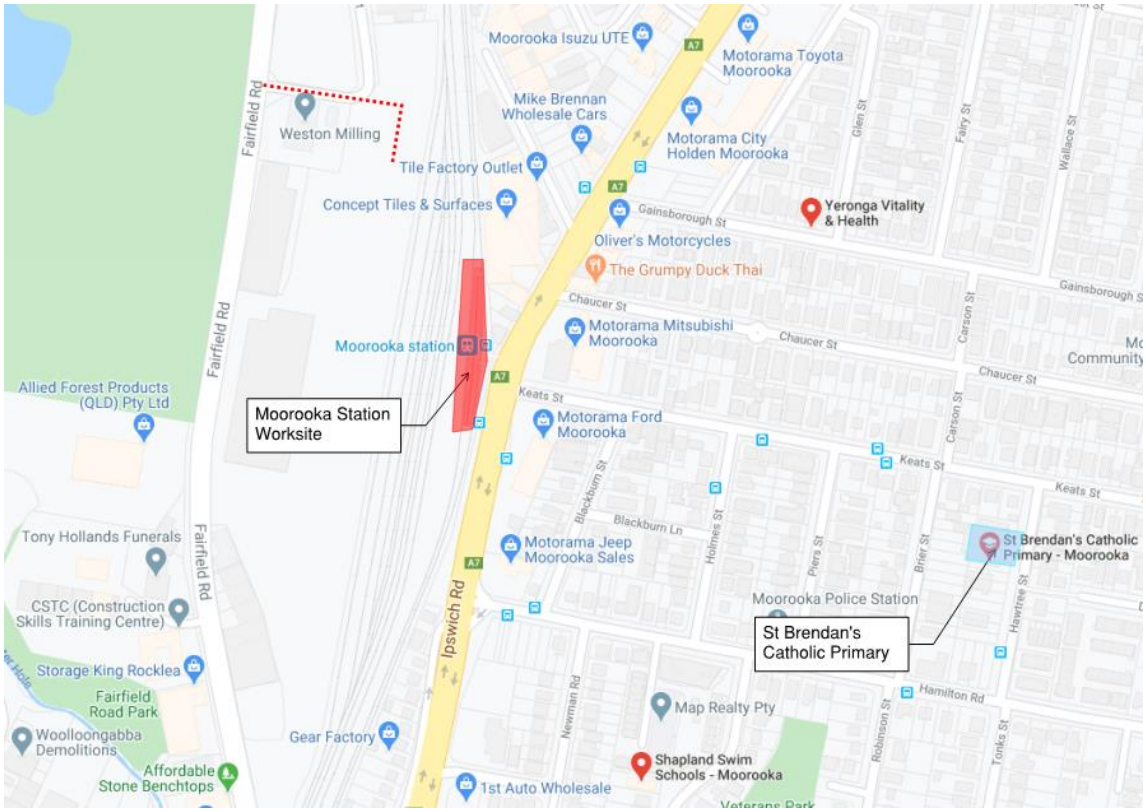

Figure 4: Moorooka Station - HV Access Routes

4.2.3.5 Rocklea Station

Access to site will either be from Fairfield Road of from Beaudesert Road.

Traffic from Fairfield Road will travel either via Ipswich Road and De Hayr Street to Station Road or via Ipswich Road, Elmes Road underpass and De Hayr Street. Traffic from Beaudesert Road will travel via the exit ramp to Tramore Street and then via Fairlie Terrace, Heaton Street and Annie Street to the station worksite. The area is mixed residential / commercial.

The closest school in the vicinity of the worksite is Rocklea State School south of the work site with drop-off / pick-up on Elmes Road. Heavy vehicle movements are not proposed on this section of roadway.

While it is expected that Elmes Road will be utilised substantially during school peak heavy vehicle construction traffic will have only very minor impact on school operations due to the overall limited vehicle numbers.

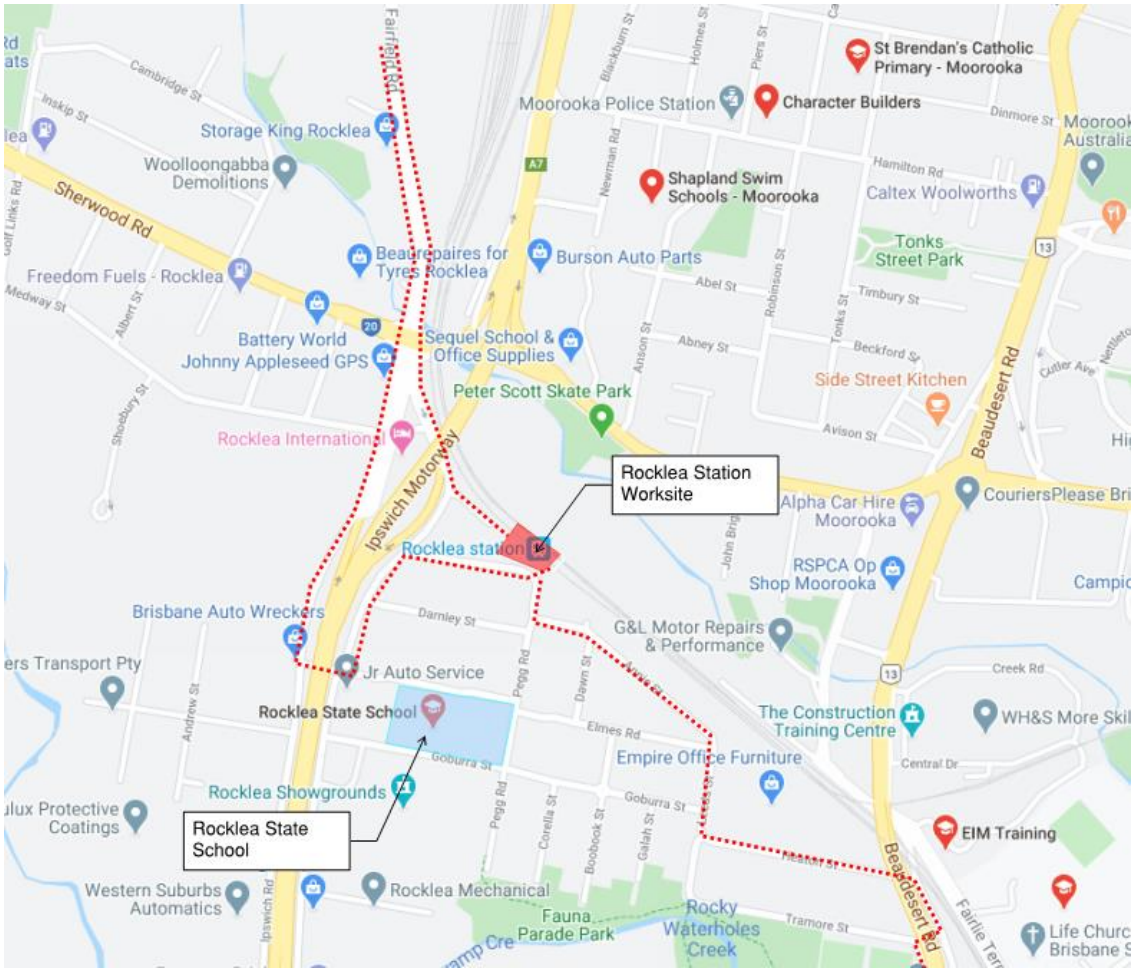

Figure 5: Rocklea Station - HV Access Routes

4.2.3.6 Salisbury Station

Access to site will be from Beaudesert Road.

Traffic will travel either via Lillian Avenue directly to the west side if the station work side or via Fairlie Terrace (west) and Fairlie Terrace (east) to the eastern side of the station. The area around the station is generally mixed residential / commercial.

The closest school in the vicinity of the worksite is the Brisbane Christian College along Fairlie Terrace (east). There are no drop-off / pick-up facilities on Fairlie Terrace itself. An access road onto the school grounds is provided with a protected turn pocket. Additional access to the school ground is available from Frewin Street.

While it is noted that Fairlie Terrace is the main access to the school it is expected that heavy vehicle construction traffic generated from the work site will have only very minor impact on school operations due to the overall limited vehicle numbers and the fact that drop-off / pick up is on the school grounds itself, well away from Fairlie Terrace.

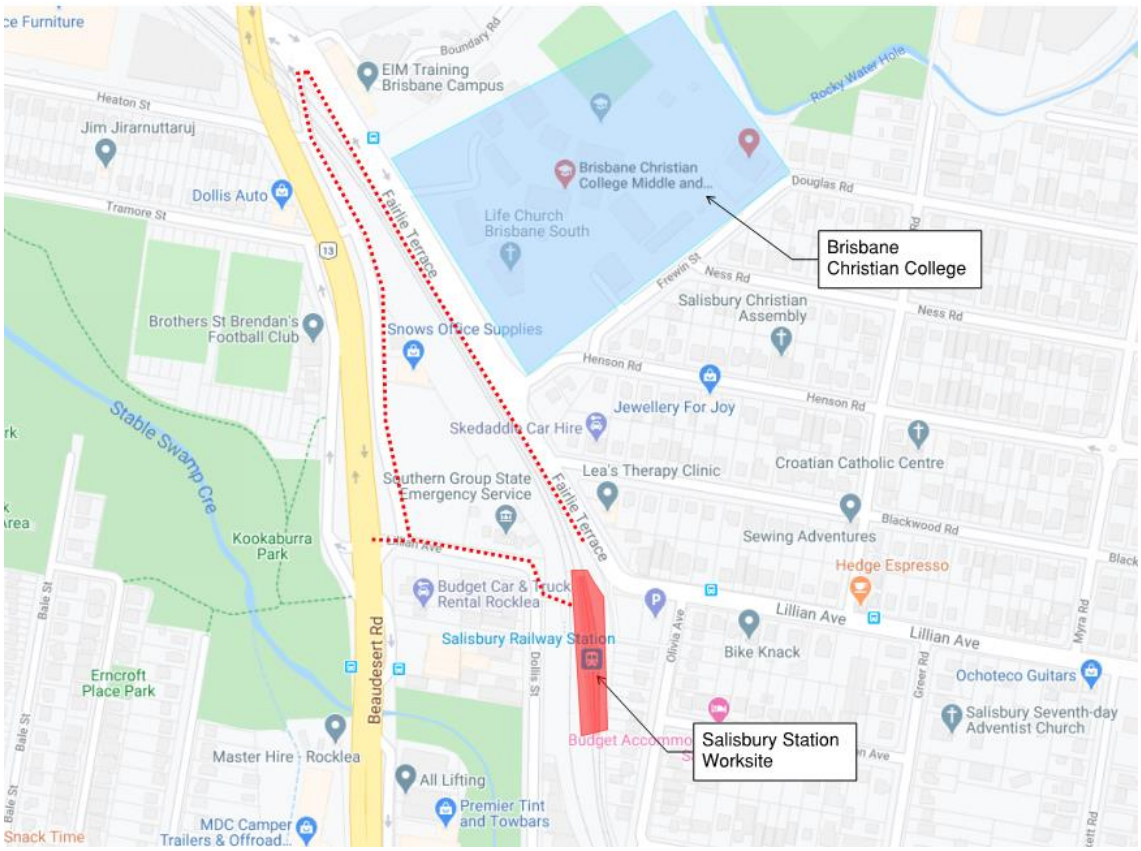

Figure 6: Salisbury Station - HV Access Routes

4.2.4 Comparison with RfPC-4 Input

The following table compares the inputs in RfPC-4 with the updated information presented above.

Worksite		Site Access/Egress	Peak Spoil Movement Loads/day (one way)	Peak Delivery Movement Loads/day (one way)	Peak Traffic Movement Load/hour (one way)	Intersection Impact	Change assessment
Fairfield Station	RfPC 4 Inputs	Primary: Midmay street Secondary: Equity street	nominal 0	sporadically maximum 10	4 to 5	No Impact	No change
	Updated Inputs	Mildmay Street and Equity Street either side of Fairfield Station, accessing to Fairfield Road and Ipswich Road	Haulage of spoil, granular pavement backfill material peak of four (4) movements per hour Materials delivery: one (1) movement per hour		5	No Impact	
Yeronga Station	RfPC 4 Inputs	Primary: Fairfield road Secondary: Lake street	nominal 0	sporadically maximum 10	4 to 5	No Impact	No change

Worksite		Site Access/Egress	Peak Spoil Movement Loads/day (one way)	Peak Delivery Movement Loads/day (one way)	Peak Traffic Movement Load/hour (one way)	Intersection Impact	Change assessment
	Updated Inputs	Fairfield Road, and Lake Street via Fairfield Road and Ipswich Rd including Park Road, Killarney Street, School Road and Gow Street	Haulage of spoil, granular pavement backfill material peak of four (4) movements per hour Materials delivery: one (1) movement per hour		5	No Impact	
Yeerongpilly Station	RfPC 4 Inputs	Primary: Wilkie Street Secondary: Fairfield road	nominal 0	sporadically maximum 10	4 to 5	No Impact	No change
	Updated Inputs	Fairfield Road, and Wilkie Street via Ipswich Rd including Green Street, Gow Street and Station Road	Haulage of spoil, granular pavement backfill material peak of four (4) movements per hour Materials delivery: one (1) movement per hour		5	No Impact	
Moorooka Station	RfPC 4 Inputs	Primary: Chale Street Secondary: Ipswich Road	nominal 0	sporadically maximum 10	4 to 5	No Impact	No change
	Updated Inputs	Chale Street via Fairfield Road, and Ipswich Road	Haulage of spoil, granular pavement backfill material peak of four (4) movements per hour Materials delivery: one (1) movement per hour		5	No Impact	
Rocklea Station	RfPC 4 Inputs	Primary: Brooke Street Secondary: Railway parade	nominal 0	sporadically maximum 10	4 to 5	No Impact	No change
	Updated Inputs	Brooke Street via Ipswich Motorway, Brooke Street via Beaudesert Road including Pegg Road, Annie Street, Leeds Street, Tramore Street	Haulage of spoil, granular pavement backfill material peak of four (4) movements per hour Materials delivery: one (1) movement per hour		5	No Impact	
Salisbury Station	RfPC 4 Inputs	Primary: Dollis Street Secondary: Fairlie terrace	nominal 0	sporadically maximum 10	4 to 5	No Impact	No change
	Updated Inputs	Fairlie Terrace and Dollis Street via Ipswich Motorway including Lillian Avenue	Haulage of spoil, granular pavement backfill material peak of four (4) movements per hour Materials delivery: one (1) movement per hour		5	No Impact	
	Updated Inputs	Ipswich Road south of Moorooka Station or from Fairfield Road via Chale Street.	AM Peak - eight (8) movements per hour Day time off Peak – 10 movements per hours PM Peak – eight (8) movements per hour		26	<5%	

There are no changes to the Evaluated Project in the information presented.

Therefore, the conclusions of RfPC-4 with regards to traffic impacts remain.

None of the Stations are constituting a major worksite or spoil haulage location and peak vehicle movements of approximately 4 to 5 per hour would not impact on the surrounding road network.

Construction traffic access to the sites, heavy vehicle routes and traffic management will be adequately managed as per the CTMP processes.

The CTMP relates to Imposed Conditions 14.

As per Condition 14 the CTMP and associated Haulage Management Plan have been developed in consultation with the relevant Road Authorities and subsequently approved by them.

4.2.5 Impacts of the current restrictions

The typical working day is between 06:30-17:30 worked as a continuous shift with two meal breaks (10:00-10:30 and 13:00-13:30).

The F2S sites are very restricted in terms of laydown and storage space so there is a heavier reliance on daily transport (throughout the shift) of equipment/materials etc from staging areas or subcontractor yards or suppliers. Beyond this, the delivery of permanent materials such as gravels and concrete needs to be able to be delivered on an as-needs basis to suit the daily sequence or program (e.g. concrete pours typically booked in the mornings and can run up to a few hours).

Having two delivery embargo windows mid-shift would cause considerable impact to productivity/efficiency on site.

- Loss of 1.5 hrs in the middle if the AM working window = 50% of working time without deliveries
- Loss of 2 hours from PM working window = 50% of working time without deliveries
- The small delivery windows either side are redundant given they are also during normal traffic peak hour periods
- This leaves a 4.5-hour effective delivery window in the middle of each typical working shift between 9.00 and 14.30.

Finally, in scenarios like the ones presented in the Noise & Vibration Technical Report for demolition works at Yeerongpilly Station, the Imposed Condition pertaining to noise, would impose a respite period, Monday to Friday from 12.00-14:00 were noise predicted to exceed the upper limit.

In these extreme circumstances the effective delivery window would be reduced to a mere 3 hours.

Attempting to restrict all deliveries to a window between 09:00-14:30 is not viable.

If this was feasible from a staging perspective, attempting to fit all required deliveries within a restricted delivery window would considerably increase the traffic intensity and pose potential traffic management and safety issues at each work site, therefore negating the current intent of the conditions.

The following required activities would not be able to be undertaken under the current restrictions:

- Out of hours and weekend deliveries (materials, plant, equipment) essential for the numerous weekend and extended possession works required to deliver the works in both the southern and northern corridors
- Delivery of plant and equipment required to construct works that need to be delivered outside of typical working hours due to Qld Transport restrictions (e.g. earthworks machinery, cranes)
- Delivery and installation of new infrastructure (e.g. station overpass structures, OHLE super portals, prefabricated buildings) that will need to be delivered and installed outside of typical working hours due to Qld Transport restrictions

4.3 Proposed changes

The following changes are proposed

- Lifting of restrictions on heavy vehicle movements for identified worksites where required for:
    - approved rail possessions;
    - approved road possessions;
    - delivery of "in time" materials such as concrete, hazardous materials, large components and machinery;
    - Project Works involving the transport, assembly or decommissioning of oversized plant, equipment, components or structures; and
    - Project Works that require continuous construction support, such as continuous concrete pours, pipe-jacking or other forms of ground support necessary to avoid a failure or construction incident.
- Authorising heavy vehicle movements at all F2S and Moorooka sites Monday to Saturday 6.30 am to 6.30pm.

4.4 Changes to Mitigation Measures

There are no proposed changes to the mitigation measures

The current measures detailed in the CTMP and associated Haulage management plan, as already reviewed an endorsed by the relevant road authorities in accordance with Imposed Condition 14 are sufficient.

4.5 Effects of the proposed changes

The proposed changed will enable the surface works to be delivered as intended, that is in an effective, efficient and timely manner whilst preserved the amenity and safety of the local communities.

5. Technical Report: Victoria Park

5.1 Introduction

A number of enabling works in Victoria Park, which is listed on the Queensland Heritage Register (QHR#602493), are planned to support the Project.

Amongst these works are:

- The widening of the existing access road off Gregory terrace into what is now the former BTS building footprint;
- The relocation of sewer infrastructure to facilitate the delivery of CRR infrastructure;
- Boundary works between the Queensland Rail (QR) corridor and Victoria Park associated with an additional scope which has been added to the CRR Project to deliver an additional rail holding road within the Normanby Rail Yard. In order to accommodate the additional scope item, the following works within Victoria Park and at the Boundary with Victoria Park are required
    - widening of the rail corridor to the current fence line between the QR corridor and Victoria Park to accommodate an upgrade of rail corridor access
    - a section of a rail maintenance access road
    - installation of underground stormwater drainage within the rail corridor
    - installation of retaining walls requiring that subsurface soil nails intrude into the curtilage of Victoria Park (subsurface)
    - a stormwater retention bund
    - limited tree works necessary under the Electricity Safety Act 2002 to protect future Overhead Traction Power Equipment to be installed as part of the new holding road.

5.2 Assessment Methodology

Since these works may result in direct or indirect impact to the Heritage and Social Values of Victoria Park, which includes plantings and a strong community attachment to the Park, all necessary due diligence investigations were undertaken to minimise the impact to Victoria Park.

The investigations and efforts consisted of the following:

- Numerous Arborist Surveys to adequately catalogue the type, nature, health of plantings within the potential project footprint and its immediate surroundings, or zone of influence of the works (herein referred to as the Study Area);
- Engagement with key stakeholders, including but not limited to
    - The Spring Hill Community Group who has a long standing affiliation with the Park. Indeed, they have been extensively involved over the years with promoting Victoria Park, inclusive of actively participating in consultations relating to proposed works within the Park and undertaking planting efforts amongst other essential contributions
    - The Heritage Unit of the Department of Environment and Science, who is a key stakeholder in providing authoritative advice on the Heritage Significance of various elements of the Park. They also are the ultimate decision makers on whether proposed works that will not have a detrimental impact, or will only have a minimal detrimental impact, on the cultural heritage significance of the place can proceed, subject to strict compliance conditions
    - The Brisbane City Council who is the Trustee of the Land and also has a vested interested in the protection of the plantings in the settings of a Community Park.
- Review of the arborist surveys results concurrently with the QHR entry for Victoria Park by a Suitably Qualified Heritage Specialist to determine the grading of significance of the planting within the Study Area.

- Review of the proposed works by a Suitably Qualified Heritage Specialist with the support of a Qualified Level 5 Arborist to determine the Heritage Values of the planting and the extent of the individual and cumulative Heritage and Vegetation Impact.

To support a consistent assessment of the Heritage Values of each planting, and since there is no available framework, the Suitably Qualified Heritage Specialist developed an assessment matrix to grade the significance of the plantings.

The method to develop the matrix is detailed below.

The following arboricultural information is taken from a series of tree surveys in Victoria Park, undertaken between 2019 and 2020 by a Qualified Level 5 Arborist (North Brisbane Trees). Heritage significance is based on the assessment provided in the QHR entry, particularly Criterion E, which identifies the 'mature figs, shade trees, palms and garden beds' as contributing to the park's aesthetic values.

Table 12: Planting age/class (adapted from North Brisbane Trees 2020)

Age/Class	Description
Historical	• 19th century planting • Established shade tree that makes a major contribution to aesthetic significance • Meets earliness/rarity thresholds for historical significance
Mature	• Mid-late 20th century planting • Established shade tree that makes a major contribution aesthetic significance
Early Mature	• Early 21st century planting • Developing shade tree that makes a moderate contribution to aesthetic significance
Juvenile	• 2010s planting • Undeveloped shade tree that makes a low contribution to aesthetic significance
Dead	• Dead tree • Makes no positive contribution to aesthetic significance • May make a slight negative contribution to aesthetic significance

Table 13: Planting health (North Brisbane Trees 2020)

Rating	Description
Excellent	Shows to have typical foliage condition and amount of foliage mass for a specimen of the species. May have a minor amount of deadwood, but no signs of any pest or disease factor that may affect its health.
Good	Shows to have typical foliage condition. Canopy foliage may be slightly chlorotic, or it may have a slightly higher percentage of deadwood than usual, or exhibit signs of being affected by environmental conditions. May have a minor pest or disease present that could start to affect its health.
Fair	Shows to have a relatively high percentage of deadwood than considered typical for a specimen of the given species and/or a low volume of live canopy leaf mass for a specimen of the given species. Apical sections of the canopy (may also be) dead. Signs of a pest or disease factor evident.
Poor	Canopy mass and foliage condition shows to be in a poor state for a specimen of the species. Has a high percentage of deadwood material in its canopy and a low volume of live canopy mass (typically <20%).
Dead	Shows to have either no live tissue within its structure, or at best has <5% live foliage mass remaining in its canopy.

Table 14: Planting heritage assessment matrix

		Health			
		Good-Excellent	Fair	Poor	Dead
Age/Class	Historical	Exceptional	High	Medium	None
	Mature	High	High	Medium	None
	Early Mature	Medium	Medium	Low	None
	Juvenile	Low	Low	Low	None
	Dead	None	None	None	None

5.3 Proposed Changes

5.3.1 Summary of Proposed Changes

The following table summarises the proposed changes from the Evaluated Project

Table 15: Summary of Proposed Changes

Scope	Evaluated Project	Change project	Effect of the Change
The widening of the existing access road off Gregory terrace	This scope of works was already identified	No changes of Impact	Nil – these works have also been authorised to proceed under an Exemption Certificate issued by the DES (201911-9710 EC).
The relocation of sewer infrastructure	PUP works are not Project Works for the purpose of the EIS	PUP works are not Project Works for the purpose of the EIS	Nil It is however noted that the project has complied with all other relevant laws and has applied for the works to undertaken under an Exemption Certificate since 1 x Umbrella Tree had the potential to be affected by the works. The Exemption Certificate was issued by the DES (202004-10189 EC)
Boundary works between the Queensland Rail (QR) corridor and Victoria Park associated with an additional scope	Not included in the Evaluated Project	Identified impacts to Victoria Park State Heritage listed place. Small increase in ground disturbance within Victoria Park from access road, RMAR and potentially at fencing locations. Trees within Victoria Park have been identified as forming part of the site's heritage significance. In order to manage potential impacts, trees have been identified as having no, low, medium or high heritage significance with the intent of aiming to avoid impacts to heritage significant trees. Similar to the heritage exemption obtained for the construction access road, a revegetation plan will be developed that provides guidance on offsetting potential impacts to trees through replanting. Any proposed tree works will also be required to be authorised by the Heritage division of the DES either under a General Exemption Certificate of a Heritage Exemption Certificate under the governance of the Project's Heritage Specialist team. These two mechanisms are a recognition of low to no detrimental impact to the Heritage Values of Victoria Park. Where arborist assessment or the Heritage Specialist team's assessment confirms the impact to the Heritage Values of the Park are no longer manageable under and Heritage Exemption Process, works will require re-design and review prior to discussion with the DES Heritage Unit.	Consistent. The construction of the fencing, retaining wall, RMAR and bund may result in impacts to a small number of trees along the boundary. Where trees have been identified as having a 'high' heritage value significance, a construction method has been developed that prioritises protection of these trees over trees with a lesser heritage significance. Where avoidance is not possible, measures will be considered that only require discrete trimming of branches to enable work to be delivered. Removal of high heritage significance trees will only be adopted if no other delivery solution is available. Similar to the previous heritage exemption certificate obtained for the delivery of the construction access road, it is anticipated that any further exemption certificates obtained will require replanting of removed trees at a 1:1 ratio, thereby offsetting impacts associated with vegetation removal.

5.3.1 Impact of boundary works

Arborist surveys completed by Unity for the Victoria Park/Rail boundary work identifies 190 trees in the project area potentially impacted by the boundary works.

Of these, 22 trees of low heritage value were identified as requiring removal, a further 6 trees of low heritage value were identified as potentially requiring removal, and 62 trees were identified as requiring trimming.

The identified impacts have been assessed under section 74 of the *Queensland Heritage Act 1992* and are approved under Heritage Exemption Certificate 202005-10289 EC.

Impacts will be offset by implementing the conditions of approval under Heritage Exemption Certificate 202005-10289 EC and mitigation measures detailed in the following section. The impact is temporary and will also provide opportunities to enhance sections of the Park where plantings that are weed species will be replaced with suitable native plantings.

Replanting with Native species will have the dual beneficial impact of improving the ecological values of Victoria Park.

This also is an approach that is likely to be supported by local community groups, who have expressed support in improving the presence of native species within the park vegetation communities.

Table 16: Impact Summary

Description of typical activities	Typical Associated Heritage Impact	Comments	Est. Number of Trees within the Study Area
Removal of Tree	Minor Negative Impact	Removal of some of the trees will have negligible or no impact when the trees have been assessment has having poor health and poor structure When the planting is identified as having an Exceptional Heritage Significance Grading, removal of such trees may be deemed a moderate negative impact. The Project will implement all reasonable and practicable endeavours to avoid such an occurrence	22 (plus 6 potential) Total 28
Canopy Trimming and / or encroachment within the TPZ,	Negligible to Minor Negative Impact	These works will be undertaken under the supervision of a Qualified Level 5 Arborist to ensure all mitigation measures are implemented with Best Practice Management to mitigate long term adverse impacts to the plantings	62
No works within the vicinity of plantings	No Impact		100
Total Number of Trees within Zone of Influence of the Works			190

5.4 Additional Mitigation

In addition to the conditions of approval under Heritage Exemption Certificate 202005-10289 EC, a CEMP, inclusive of key subplans has been developed which details management and mitigation measures to be implemented for works affecting Vegetation and Places of Heritage Significance.

These are the Nature Conservation Management sub-Plan and the Non Indigenous Heritage Management Sub-Plan.

The plans have been endorsed by the Environmental Monitor and are publicly available the Proponent's website (https://s3-ap-southeast-2.amazonaws.com/cross-river-rail/wp-content/uploads/2020/02/28103933/CRR-Construction-EMP-RIS_200228.pdf)

Some of the key mitigation measures have been extracted and reproduced below:

- Undertake a Heritage Assessment in accordance with the Non-Indigenous Cultural Heritage Management Plan. This must include an assessment of the Heritage Value of the vegetation;
- Obtain the relevant permits / approval from the DES and / or Heritage Council;
- Comply with the requirements of the permits /approvals ;
- Minimise disturbance to significant vegetation and habitat during construction through: — Installation of No-Go exclusions zones around protected / significant vegetation with access controlled using Permit to Enter No-Go Zone;
- Installation of Tree Protection Zones for NALL trees as required through pre-existing data or else as identified using UNITY's qualified arborist assessment prior to construction works;
- Implement and comply with the DES endorsed Archaeological Management Plan during the duration of the works;
- In the event of an unsuspected finds the approved protocols must be followed.

5.5 Effects of the Proposed Changes

The Proposed Changes will result in localised:

- Negligible or no impacts (does not affect heritage values either negatively or positively) when there is minimal to no intrusion on the plantings, or
- Minor negative impacts (reversible loss of local significance fabric or where mitigation retrieves some value of significance; loss of fabric not of significance but which supports or buffers local significance values) when there are significant works to be undertaken in the immediate vicinity of the planting that will either trigger its removal or an additional level of supervision, or
- Minor positive impacts (enhances access to, understanding or conservation of fabric or values of local significance) when plantings removed are either weed species and / or in such poor health that the replacement with native species will ultimately positively offset the impact.

This is consistent with the impacts currently approved for the Evaluated Project.