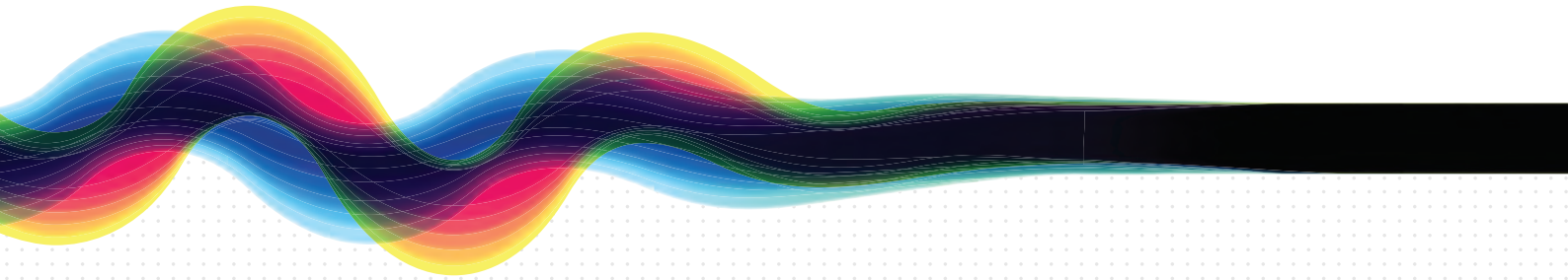
Bayswater Station

Appendices Part 2 – Appendix K-T

October 2020 | 20-362



element.

the art and science of place

We acknowledge the custodians of this land, the Whadjuk Noongar and their Elders past, present and emerging. We wish to acknowledge and respect their continuing culture and the contribution they make to the life of this city and this region.

Contents

Appendix K 1

Movement Network Diagrams prepared by Hassell Architects 1

Appendix L 11

Geotechnical Factual Report prepared by Golder Associates 11

Appendix M 85

Construction Environmental Management Plan prepared by Evolve Bayswater 85

Appendix N 199

Green Star Rating Strategy prepared by Evolve Bayswater 199

Appendix O 235

Construction Plan prepared by Evolve Bayswater 235

Appendix P 381

Operational Waste Management Plan prepared by Evolve Bayswater 381

Appendix Q 409

Tree Survey prepared by Paperbark Technologies 409

Appendix R 491

Microsimulation Modelling (Transport Modelling) Report prepared by WSP 491

Appendix S 575

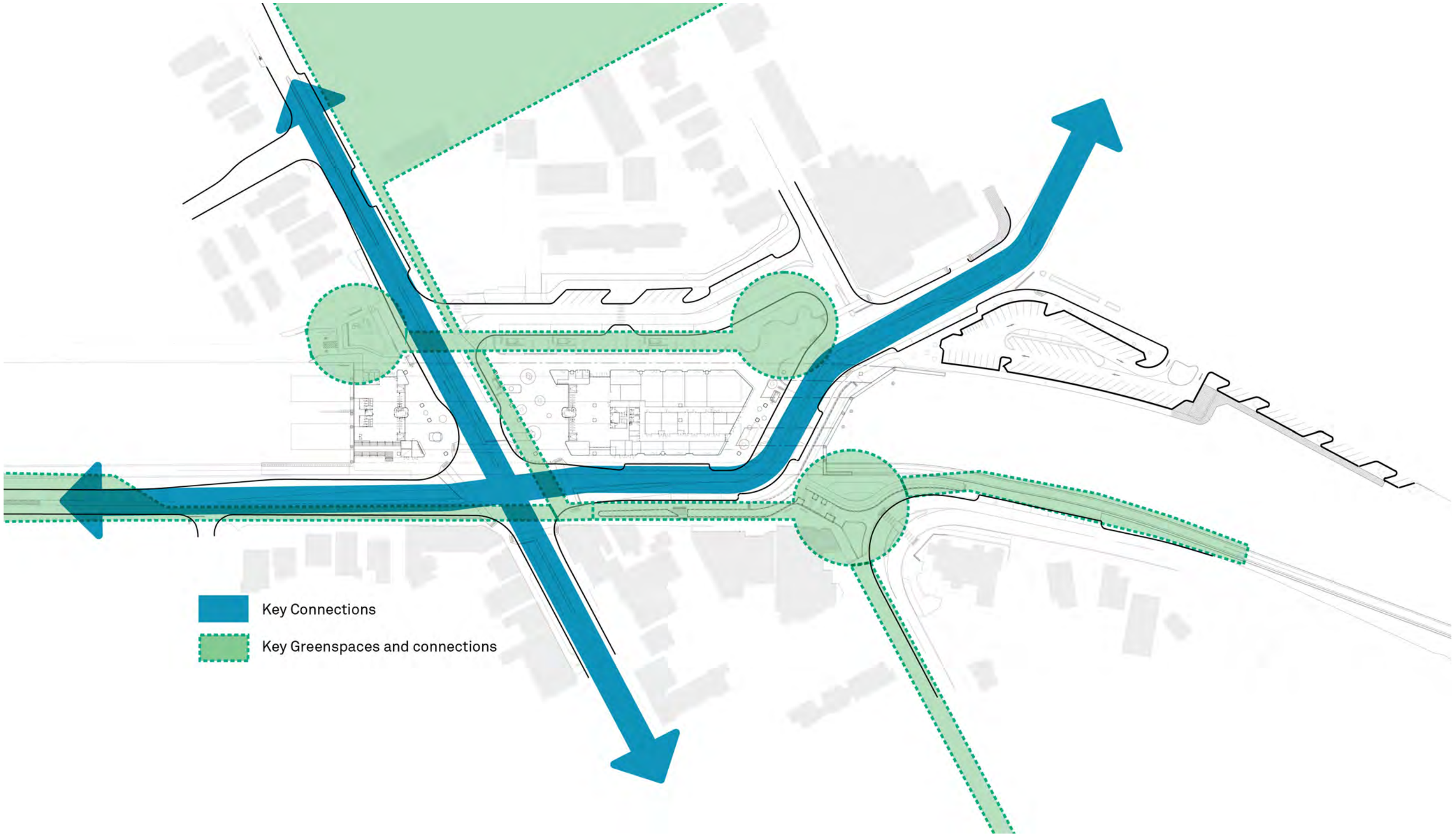
Water Management Plan prepared by Evolve Bayswater 575

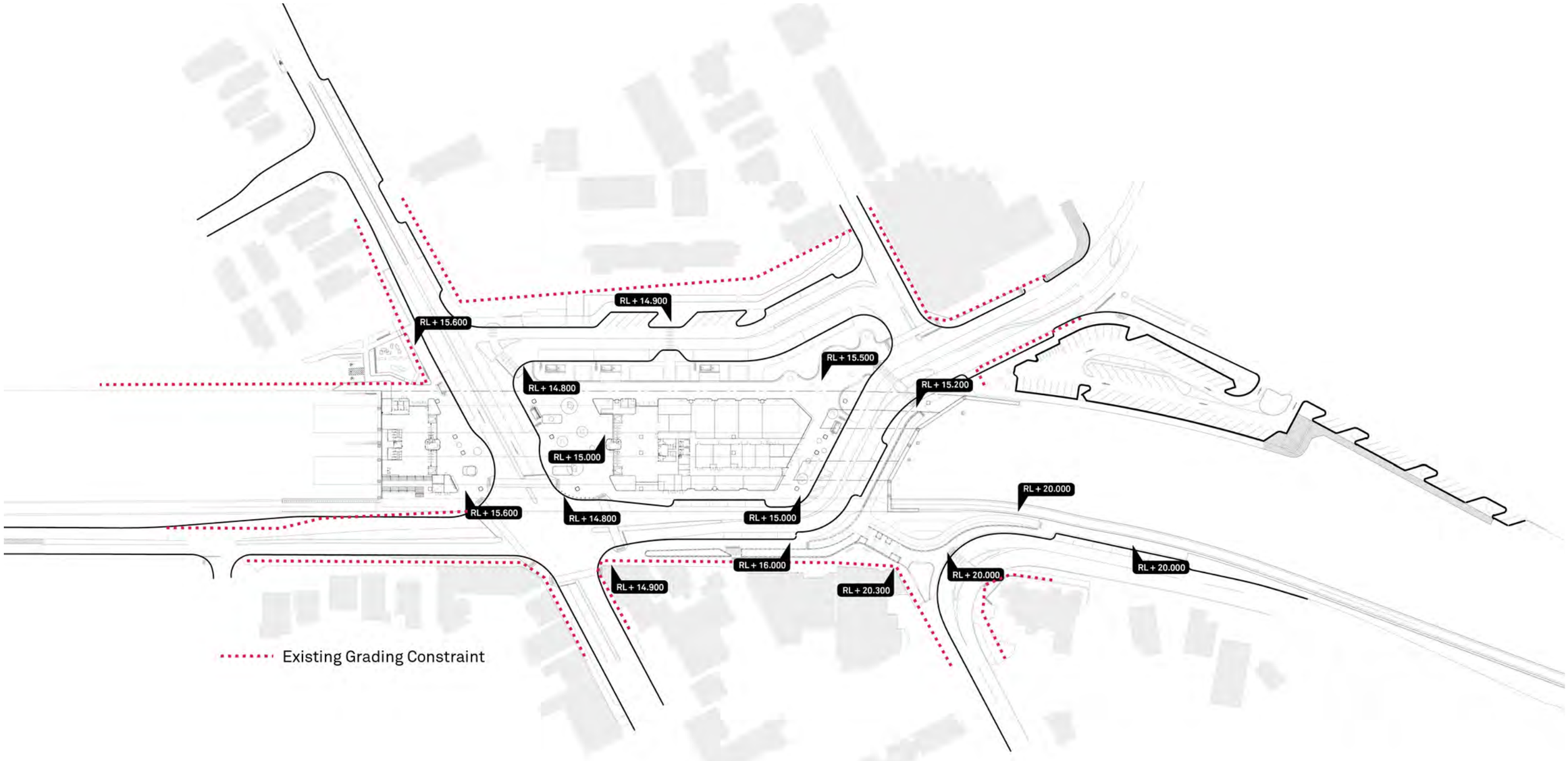
Appendix T 599

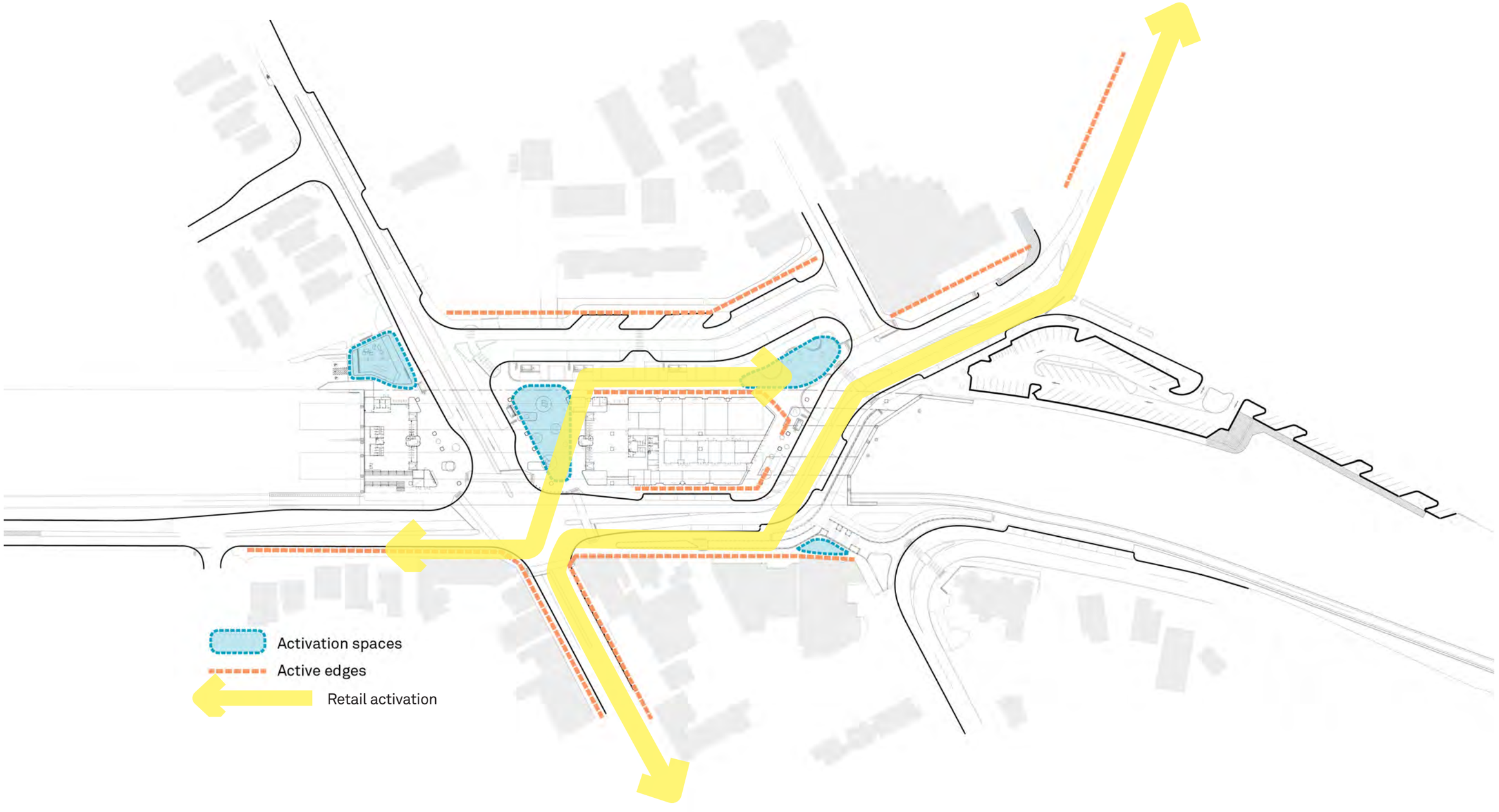
Design Principles Plan prepared by element in conjunction with Hassell 599

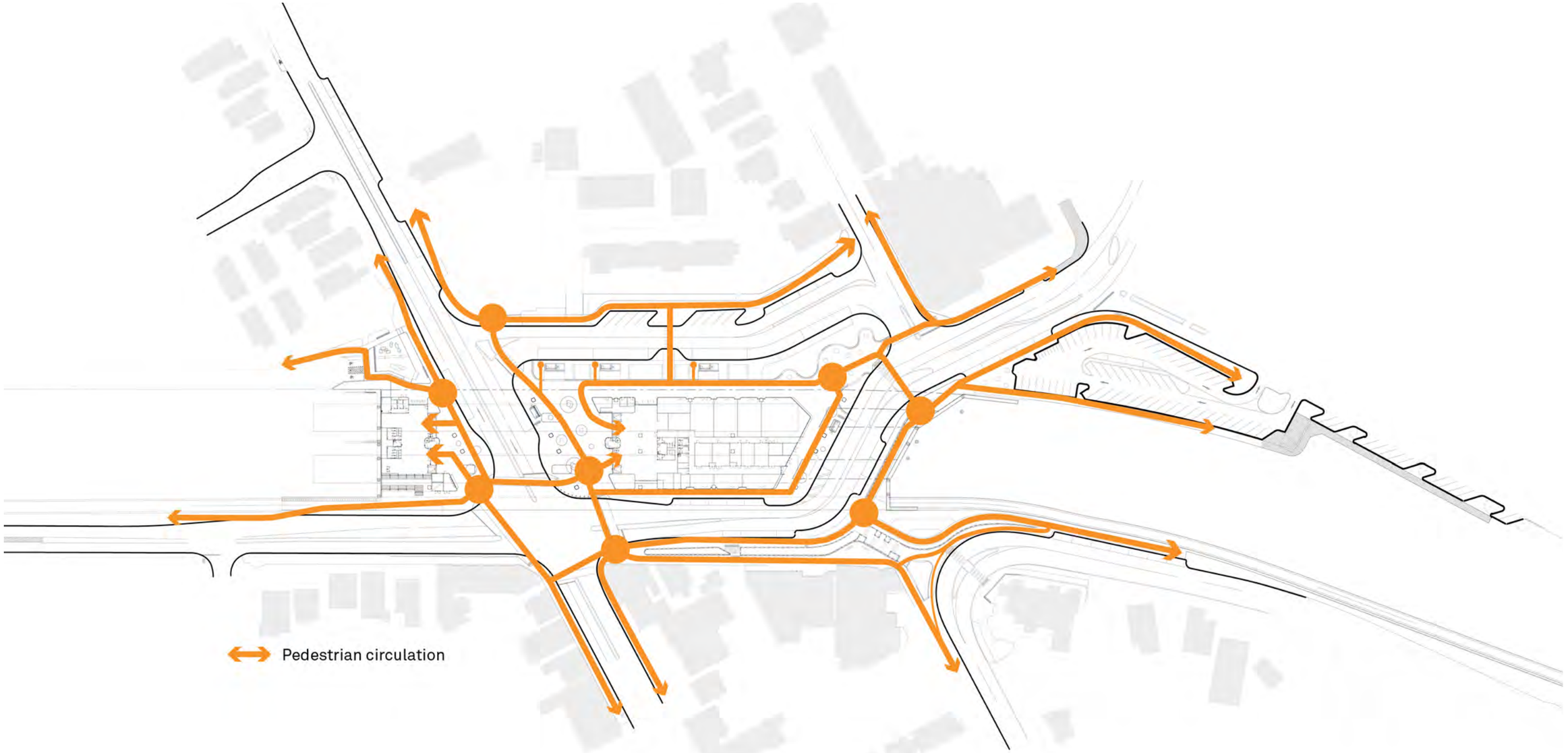
Appendix K

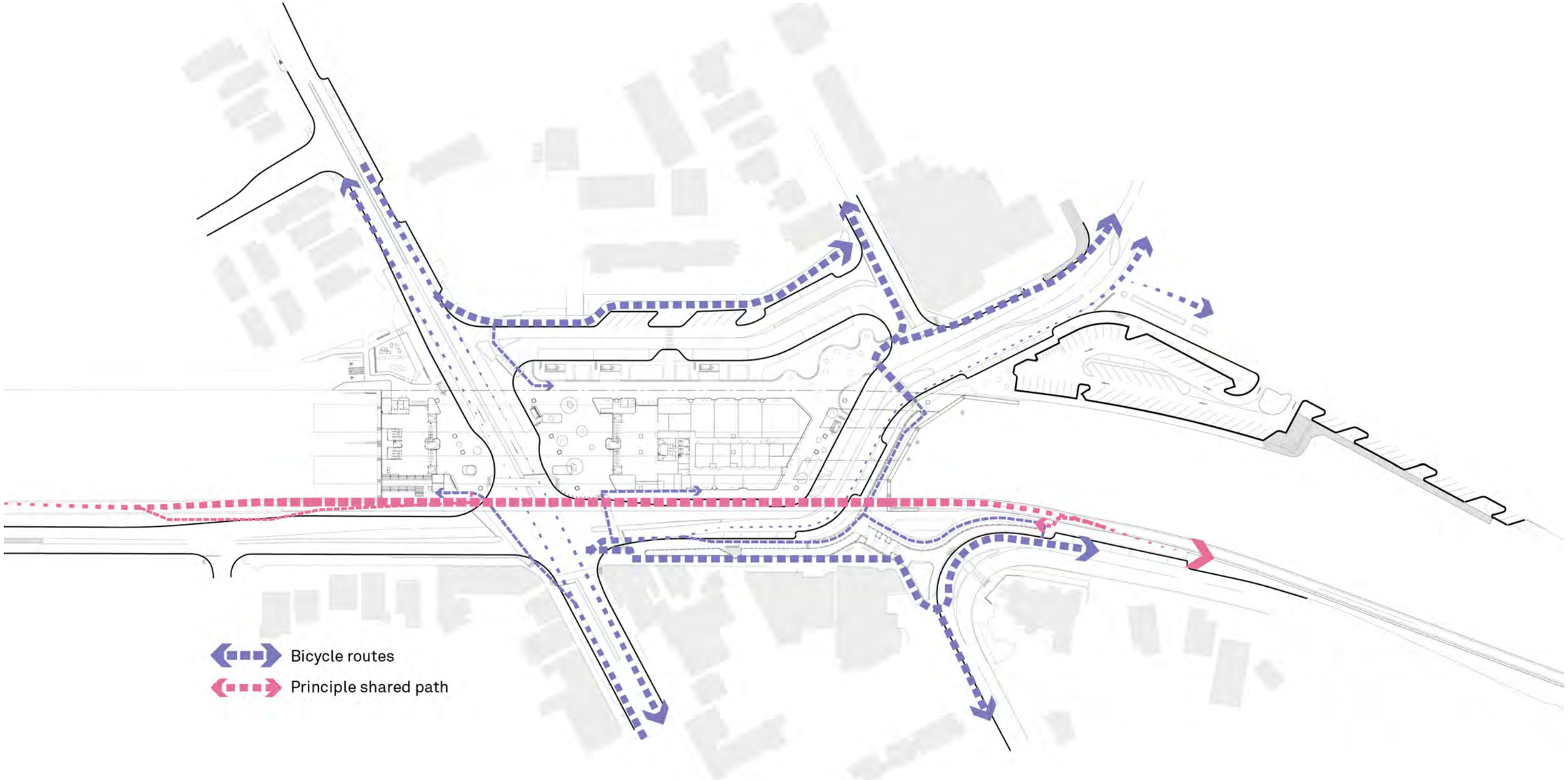
Movement Network Diagrams prepared by Hassell Architects

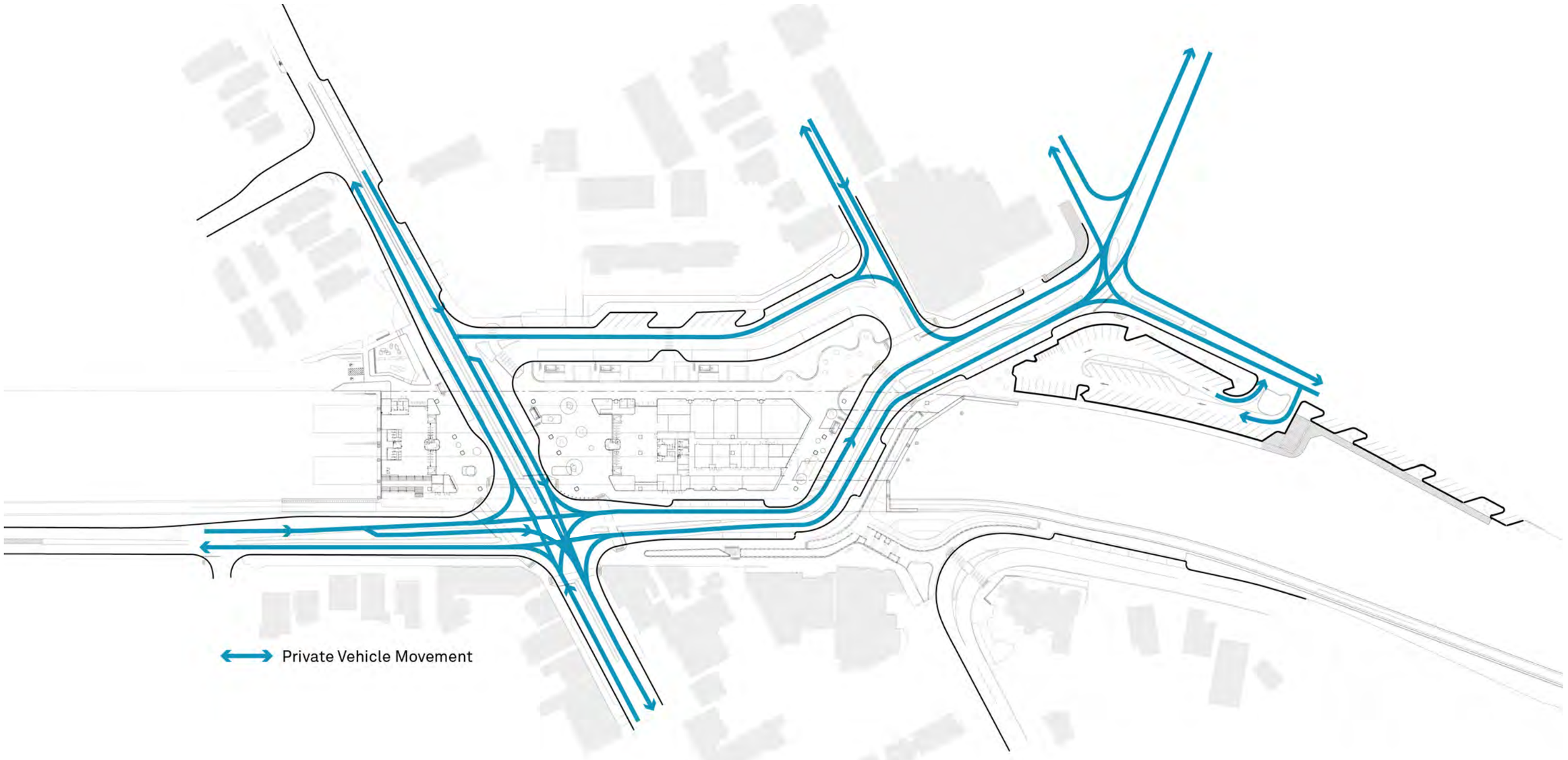

Key Connections
Key Greenspaces and connections

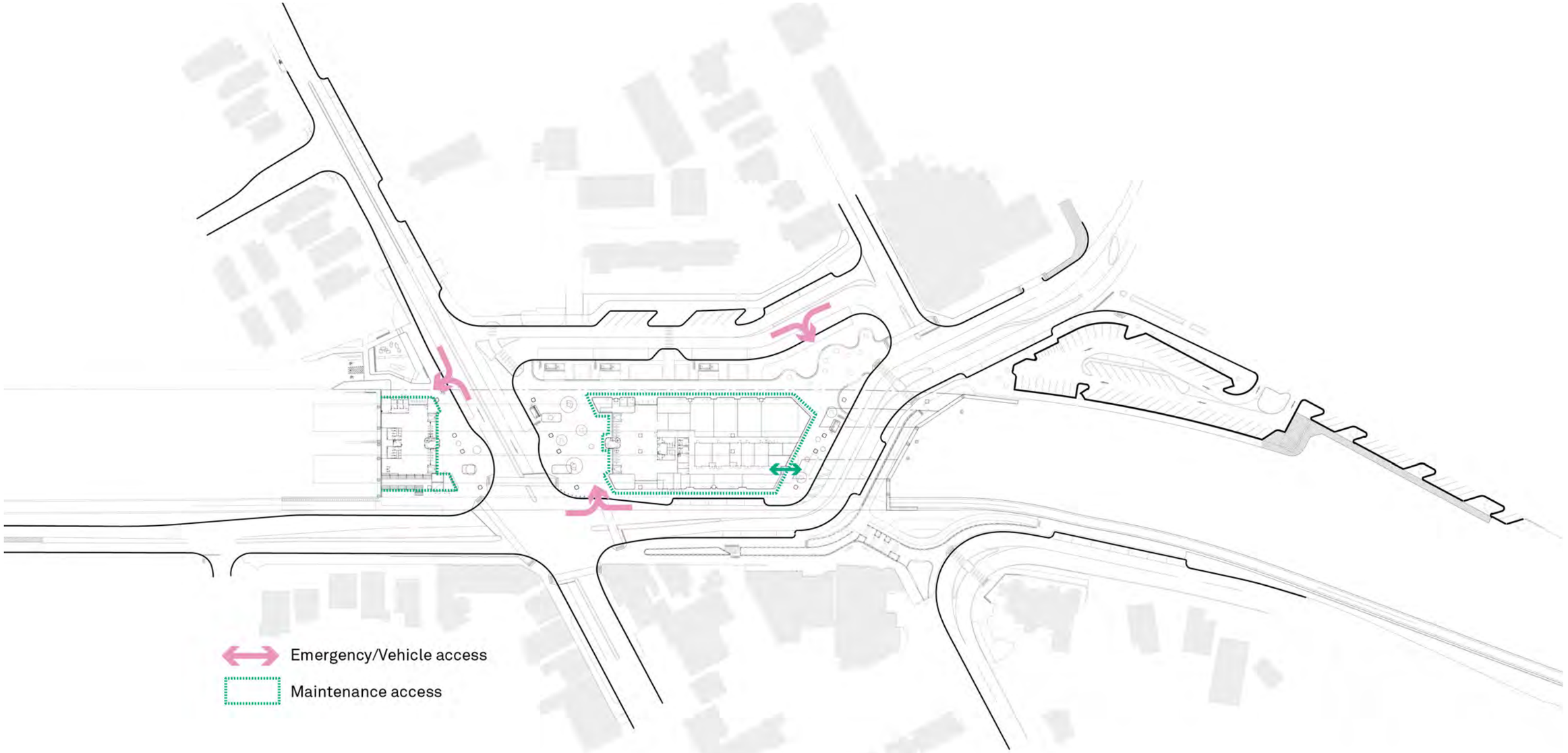

RL + 15.600
RL + 14.900
RL + 15.500
RL + 14.800
RL + 15.200
RL + 15.000
RL + 20.000
RL + 15.600
RL + 14.800
RL + 15.000
RL + 16.000
RL + 20.000
RL + 14.900
RL + 20.300
RL + 20.000
Existing Grading Constraint

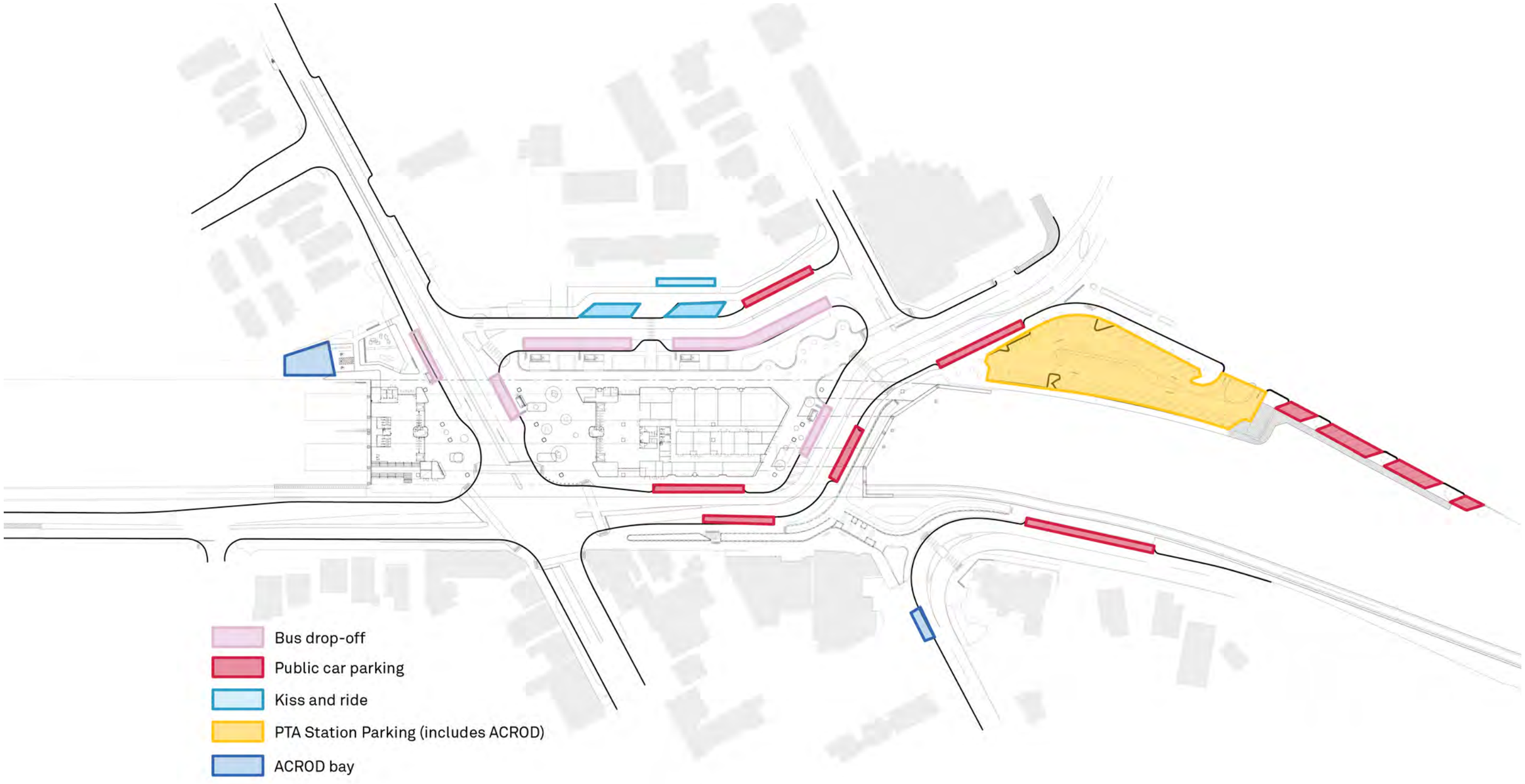

Activation spaces
Active edges
Retail activation


Pedestrian circulation


Bicycle routes
Principle shared path


Private Vehicle Movement


Emergency/Vehicle access
Maintenance access


R
Bus drop-off
Public car parking
Kiss and ride
PTA Station Parking (includes ACROD)
ACROD bay

Appendix L

Geotechnical Factual Report prepared by Golder Associates

evolve bayswater
connecting people + places

PTA

BAYSWATER STATION AND TURNBACK

PTA190037

GEOTECHNICAL PLAN – GEOTECHNIAL FACTUAL REPORT

BSTPR-EVO-GE-RPT-00013

AUTHORISED TO USE: _____(ALLIANCE MANAGER), DATE: _____

Submit to Client for Review and Approval where required in the Contract (Client to complete one box only):					
❑	Rejected, resubmit	Name:	Sign:		Date:
❑	Endorsed, with comments to add or change	Name:	Sign:		Date:
❑	Endorsed	Name:	Sign:		Date:
A1		Draft - Issued for Comment	DB		
Rev	Date	Reason for Issue	Prepared	Checked	Approval

Table of Contents

Compliance Matrix 4
Abbreviations and Acronyms 5
1 Project Description 6
1.1 Bayswater Station and Turnback Project 6
1.1.1 Stage One: Turnback Works 6
1.1.2 Stage Two: The Bayswater Station Southern Section 6
1.1.3 Stage Three: The Bayswater Station Northern Section 6
1.1.4 Optional Works Packages 7
2.0 Geotechnical Plan – Geotechnical Factual Report 8
2.1 Introduction 8
2.2 Previous Investigation 8
3.0 Field Investigations 9
3.1 Scope 9
3.1.1 Completed Scope 9
3.1.2 Future Scope 9
3.2 Test Location Planning 9
3.3 Permits and Approvals 10
3.4 Fieldwork Supervision 10
3.5 Survey Information 10
3.6 Site Walkover 10
3.7 Service Location 10
3.8 Cone Penetration Testing 11
3.9 Hand Auger Boreholes 11
4.0 Laboratory Testing 11
5.0 Site Conditions 12
5.1 Site History 12
5.2 Surface Conditions 12
5.3 Regional Geology 12
5.4 Subsurface Conditions 13
5.5 Groundwater 13
6.0 Geotechnical Suitability for Development 14
Appendix A – Summary of Test Locations 15
Appendix B – CPT Reports 1

Appendix C – Hand Auger Borehole Reports 1
Appendix D - Chemical Laboratory Test Certificates 2

Compliance Matrix

SWTC Reference	Description	Section in this Plan
Book 2, 14.3.26	The Geotechnical Plan must document that the following geotechnical factual report requirements will be met for supplementary investigation works:	Whole document
Book 2, 14.3.26 i.	the Alliance must prepare a comprehensive geotechnical factual Report that provides details of the supplementary site investigations, including all factual data and other requirements for future design and construction of the proposed Project;	Whole document
Book 2, 14.3.26 ii.	the Alliance must submit to the PTA a completed draft factual Report for review by the PTA;	-
Book 2, 14.3.26 iii.	the Report must be written at a level suitable for use by experienced geotechnical engineers. As a minimum, the report document must conform to AS 1726:2017 Geotechnical Site Investigations. Every effort must be made to ascertain the origin of the materials, where fill, transported or residual soils etc. and to include this in the materials descriptions logged. This will form a key part of the geological model presented;	2.1 5.4
Book 2, 14.3.26 iv.	the factual Report must as a minimum address the following: A. scope of the site investigation; B. description of the investigation methodology, standards and scope of Testing, including an account of any site constraints encountered; C. principal topographical features of the area; D. overview of subsurface soil and groundwater conditions; E. interpreted stratigraphy of the main units, including origin; F. investigation positions (eg. borehole, CPT, Test pit, etc.) tabulated and plotted on plans together with the existing features and the proposed works; G. the results of all field investigations (eg. borehole logs, CPT reports, dilatometer reports, Test pit logs and permeability Test results, etc.) with data plotted against depth, or as appropriate; H. estimated groundwater Elevation (m AHD), depth below ground level or depth below foundations and/or formation level must be presented as relevant to the construction location; I. laboratory Test results; J. tabulated summaries of field and laboratory Test results by borehole, including provision in MS Excel; and K. all other reporting items identified in this scope.	3.1 3.0 5.0 5.4 5.5 Appendix A Appendix B Appendix C Appendix D

Abbreviations and Acronyms

Term	Definition
ADA	Alliance Development Agreement
AHD	Australian Height Datum
BST	Bayswater Station
CPT	Cone Penetration Test
DBYD	Dial Before You Dig
PAA	Project Alliance Agreement
PSP	Principal Shared Path
PTA	Public Transport Authority
RSMP	Rail Safety Management Plan
SiD	Safety in Design
SWTC	Scope of Works and Technical Criteria
TMP	Traffic Management Plan

1 Project Description

1.1 Bayswater Station and Turnback Project

The Bayswater Station and Turnback Project as incorporated in the PAA for the Project includes:

- Stage One: The Turnback Works;
- Stage Two: The Bayswater Station Southern Section; and
- Stage Three: The Bayswater Station Northern Section.

1.1.1 Stage One: Turnback Works

Stage One: Turnback Works comprises the following:

- New turnback siding between Bayswater and Meltham stations (configured to provide accommodation for 1 x 6 car sets);
- A shunters path (walkway) and a new driver's washroom;
- Relocation of the Leake Street underpass;
- Maintenance of the principal shared path along the southern side of the railway reserve; and
- Other Project works including standard station systems, signaling, overhead line equipment, communications, utility relocations and noise mitigation.

1.1.2 Stage Two: The Bayswater Station Southern Section

Stage Two: The Bayswater Station Southern Section comprises the following:

- Two new rail bridges over King William Street, immediately south of the existing railway;
- New station island platform (150 m long and 10 m wide) complete with associated infrastructure and supported by the railway bridges;
- Provision for the principal shared path on the southern side of the southern railway bridge
- The first stage of western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts and stairs) and equipment rooms to service railway operations:
- Integrated pedestrian, cyclist, bus and vehicle access into the station and future Bayswater town centre;
- Relocation of the dual gauge tracks and all associated track infrastructure to align with the new platform faces;
- New bus bays and vehicle parking bays;
- Other Project works including standard station systems, signaling, overhead line equipment, communications, utility relocations and noise mitigation; and
- Landscaping and urban design features within the station precinct.

1.1.3 Stage Three: The Bayswater Station Northern Section

Stage Three: The Bayswater Station Northern Section comprises the following:

- Demolition of the existing Bayswater station and associated infrastructure;
- A second set of two new rail bridges over King William Street, located immediately north of the first new set of railway bridges delivered as part of Stage One;
- A second island platform (150 m long and 10 m wide) complete with station infrastructure again supported by the northern pair of railway bridges;

- The second stage of the western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts and stairs) and retail tenancies;
- Additional station infrastructure to meet the needs of the expanded (4 line, 4 platform face) station;
- Landscaping and urban design features within the station precinct;
- Other Project works including standard station systems, signaling, overhead line equipment, communications, utility relocations and noise mitigation;
- Completion of new bus bays and vehicle parking bays; and
- Landscaping and urban design features within the station precinct.

1.1.4 Optional Works Packages

The METRONET Initiatives include for other additional Project Works beyond the scope listed in 1.1.1, 1.1.2 and 1.1.3 above and these may be included during the Delivery Phase.

2.0 Geotechnical Plan – Geotechnical Factual Report

2.1 Introduction

This document presents Evolve Bayswater's (Evolve's) Geotechnical Factual Report for the PAA phase of the Bayswater Station Upgrade Project. This document forms part of the Geotechnical Plan has been prepared in accordance with SWTC Book 2: Management Plans.

This document details geotechnical factual information as part of the geotechnical investigation works for the project, completed to 10 September 2020. This report will be updated as further investigation works are completed.

All investigation works were conducted in accordance with AS1726 (2017).

2.2 Previous Investigation

Several phases of previous geotechnical investigation data have been completed previously and are listed in Table 1.

Table 1: List of inputs and references

Reference No.	Document title	Revision
Arup (2019)	Report No.: MEL-MNO-ARUP-GE-RPT-1002 METRONET Morley Ellenbrook Line (MEL) – Project Definition Plan (PDP) Package 1 – Bayswater Station to Tonkin Entry – Geotechnical Interpretive Report	2019
Golder (2018)	Report No.: 18100444-001-R-Rev0 Metronet FAL Bayswater Station and Turnback – Geotechnical Investigation	2018
Golder (2019)	Report No.: 18100444-006-R-Rev1 Metronet FAL Bayswater Station and Turnback – Groundwater and Dewatering Assessment	2019

3.0 Field Investigations

3.1 Scope

3.1.1 Completed Scope

The geotechnical investigation for the PAA phase of the project commenced on 27 July 2020. The works completed up to 10 September 2020, comprised:

- Completion of a site walkover
- Completion of 24 No. Cone Penetrometer Tests (CPT) in the bridge and station precinct area, BWS-CPT116 to 122, 124 and 126 to 140, extending to depths between 6.2 and 38.0 m below ground level (bgl).
- Drilling of three hand auger boreholes, HA12 to HA15, extending to depths of 3.0 m bgl.
- Collection of soil samples for laboratory testing.

Test location details are provided in Appendix A and are also shown on Figure 1.

3.1.2 Future Scope

Further geotechnical investigations will be completed at a later date, following development of project design. Geotechnical investigation items that are yet to be completed, but are currently planned include:

- 8 CPTs at bridge pier locations, following demolition of the existing rail bridge and Bayswater station structures
- 24 CPTs along retaining wall alignments west of the station area
- 6 test pits along retaining wall alignments west of the station area
- 4 hand auger boreholes along retaining wall alignments west of the station area
- 10 pavement dippings along King William Street, Whatley Crescent and Drake Street.

The scope of the above investigation items will be dependent on the finalisation of station design and therefore the quantities may be subject to change.

The results of further geotechnical investigations will be provided in a revision of this report.

3.2 Test Location Planning

Evolve developed the scope of field investigations, which was submitted for approval to PTA prior to commencement of this phase of the investigation works. The field investigation locations were developed with consideration to:

- Potential geotechnical risks and geo-hazards for the project.
- Obtain reasonable coverage with respect to expected geological conditions.
- Target the location of the proposed rail over-road bridge and major retaining walls.
- Comply with the requirements of PTA standards.
- Mitigate against interaction with underground and overhead services.
- Comply with the constraints and conditions of relevant permits required to complete the works.

3.3 Permits and Approvals

Prior to commencement of the geotechnical investigation fieldwork, a number of access and investigation permits were obtained, as follows:

- Traffic Management Plan (TMP) for investigation on or near roads, with approval provided by City of Bayswater.
- High pressure gas line proximity permit for Atco Gas.

3.4 Fieldwork Supervision

A geotechnical engineer from Golder supervised or carried out the following fieldwork tasks:

- Obtained permits, plans and approvals.
- Positioned the test locations, with consideration to nearby underground services.
- Supervised cone penetration testing and survey works.
- Drilled and logged the hand auger boreholes.
- Logged the materials encountered in the boreholes.
- Collected soil samples for laboratory testing from hand auger borehole locations.

3.5 Survey Information

All test locations were initially set out using hand-held GPS by a Golder geotechnical engineer, accurate to ± 5 m, with visual reference to surface features for improved accuracy.

Following completion of the field investigations, the test positions were surveyed and recorded by Crossland and Hardy Pty Ltd consulting surveyors, with the positions of all completed locations surveyed with an RTK GPS (generally accurate to ± 0.05 m) relative to the Perth Coastal Grid (PCG2020), Geocentric Datum of Australia (GDA2020) Coordinate Systems and Australian Height Datum (AHD).

The as-constructed surveyed coordinates and ground surface levels of the test locations are provided in Appendix A. Test locations and positions are also shown on Figure 1 in Appendix A.

3.6 Site Walkover

A site walkover was carried out by Golder on 15 July 2020 before the commencement of any intrusive site investigation works. The purpose of the site walkover was to confirm the position of test locations and review any site limitations, such as access for investigation equipment, and assess surface geology and geomorphology were feasible.

3.7 Service Location

Prior to ground penetration activities, Golder conducted a Dial-Before-You-Dig (DBYD) search to assess the location of underground services. An accredited service locator was engaged to assist in assessing the test locations for the presence of underground services using ground penetrating radar and line locating techniques. Vacuum potholing had previously been conducted to positively identify the location of high-risk services such as gas lines and a sewer trunk main. The results of this potholing were utilised to assess the position of underground services which were noted to be in close proximity to proposed test locations.

In general, most locations were pre-drilled using non-destructive digging (NDD) techniques such as hand auger borehole drilling, to depths of 1.5 m, to further mitigate against the potential for striking underground services. The pre-drilled holes were then backfilled with spoil prior to testing. The depth of the pre-drill is shown on the relevant CPT reports.

3.8 Cone Penetration Testing

The CPT locations were completed using a 22 tonne track-truck and a 22 tonne truck rig , supplied and operated by Probedrill Geotechnical Survey Ltd. Testing was performed in accordance with AS 1289.6.5.1-1999. Results of the testing are presented as a plot of cone resistance (q_c), and friction ration (FR = (f_s/q_c) × 100%) versus depth and are presented in Appendix B. A method of soil classification by Robertson et al (1986) based on values of q_c and FR is also included in Appendix B.

Groundwater measurements were recorded in the hole remaining open after the removal of the CPT rods and are shown on the CPT reports.

At completion of the CPT tests, the holes were patched with cold-mix asphalt at surface level.

No seismic testing or flat plate dilatometer testing has been undertaken as part of the works completed to date.

3.9 Hand Auger Boreholes

Hand auger boreholes were undertaken to assess near surface materials and to recover materials for laboratory testing. A 75 mm diameter hand auger was used to advance the boreholes to target depths.

Materials recovered from the boreholes were logged in accordance with AS1726 (2017). The hand auger borehole reports are provided in Appendix C, along with the method of soil classification, and notes and abbreviations used on the reports.

After completion of the hand auger boreholes, the holes were backfilled with spoil to surface level.

4.0 Laboratory Testing

Geochemical laboratory testing was conducted on samples recovered from the hand auger boreholes. The number and type of tests conducted at the time of this report, the laboratory that undertook the test and the test method (testing standard) adopted are summarised in Table 2.

Table 2: Laboratory soil aggressivity testing.

Test Type	Testing Laboratory	Number of Tests Completed	Test Method
pH, sulfate and chloride content	ALS	9	APHA 3120 APHA 4500

The geochemical laboratory test certificates are provided in Appendix D along with a summary of the chemical laboratory testing results.

5.0 Site Conditions

5.1 Site History

It is understood that Bayswater Station was opened in 1896 and was originally located in the current carpark area on the southern side of the existing rail line. The platforms in the carpark area were later demolished to create the carpark and the station was re-built as a single island platform in its current location in 1968.

5.2 Surface Conditions

The rail corridor runs approximately south-west to north-east between about RL 16 m and RL 24 m AHD and is bound by Railway Parade to the north and Whatley Crescent to the south. Whatley Crescent is separated from the railway by a principal shared path (PSP) which runs parallel to the railway corridor.

The railway is located within a cutting at the western extent of the project area, with the northern side being the largest cut with a maximum cut depth of about 8 m above rail level (approximately RL 32 m AHD). The height of the cutting reduces towards the east, and the rail level is close to surrounding surface levels in the vicinity of The Strand (approximately RL 24 m AHD). Between The Strand and the King William Street underpass, the railway is located on an embankment which is about 4 m high. Bayswater Station is located east of the King William Street underpass at an elevation of about RL 18.5 m AHD.

The level of the carpark located to the south of Bayswater Station is generally at grade with the adjacent rail line (approximately RL 17.3 m AHD), with Whatley Crescent to the south of the carpark, at approximately 2 m above the level of the carpark (approximately RL 19.5 m AHD).

The existing site conditions are shown on Figures 1A to 1D, Site Plan. The Site Plan shows the existing rail configuration and elevation contours against recent aerial imagery (Nearmap, April 2018).

5.3 Regional Geology

The Perth sheet of the 1:50,000 Environmental Geology series map sheet indicates that the site is generally underlain by Bassendean Sand, which is described as ‘very light grey at surface, yellow at depth, fine to medium grained, sub-rounded quartz, moderately well sorted of aeolian origin’. Localised swamp deposits of Peaty Clay are shown to be present north of Railway Parade (beyond the extent of the current project area), which is described as ‘dark grey and black with variable sand content of lacustrine origin’.

From previous experience in the Bayswater area, the Bassendean Sand is underlain by the Perth Formation (also known as the Guildford Formation), which is composed of alluvial sediments. The Perth Formation comprises layers that are both sand-dominated and clay-dominated.

The Perth Groundwater Atlas (2003) indicates that the base of the superficial formation in the project area is expected to occur between RL -16 m AHD and -20 m AHD, which is expected to coincide with the level of the underlying Osborne Formation unit.

Based on previous investigations undertaken to the east of the project area, we expect that the Osborne formation in the project area will comprise the sand-dominated Kardinya Shale member.

5.4 Subsurface Conditions

The generalised subsurface conditions at the new bridge and station area are presented in Table 3.

Table 3: Inferred sub-surface ground conditions

Stratum	Unit Description	Base of Unit (RL m AHD)	Typical Unit Thickness
Bassendean Sand (Aeolian)	SAND (SP) – fine to medium grained, rounded to sub-angular, orange yellow grading to grey, generally medium dense to dense although with isolated loose zones near surface in some areas	7 to 13	8
Perth Formation (Alluvial)	Generally sandy soils with lenses and zones (up to 5 m thick) of clayey soils below about RL 7 m AHD. The soils are generally described as: SAND (SP) – medium dense to very dense, generally increasing density with depth. Clayey SAND/CLAY/Sandy CLAY (SC/CL-CH) – interbedded layers of medium to high plasticity clayey soils, hard or dense	-20 to -15	>19
Osborne Formation	Kardinya Shale Member - SAND/Silty SANDSTONE – very low strength silty sandstone, weathered sandstone to very dense sand on upper surface	not encountered	-

It should be noted that variation in the generalised sub-surface conditions exist and the individual borehole and CPT reports should be referred to for further information.

5.5 Groundwater

Following completion of the CPTs, the holes were dipped to measure the groundwater level. A summary of the groundwater measurements is presented in Appendix A.

Periodic groundwater monitoring is also currently being carried out at the pre-existing groundwater monitoring wells BH01, BH02 and BH03 (which were installed as part of the previous scopes of work), with these results provided in the Groundwater Management Report (BSTPR-EVO-GE-RPT-00013).

In general, maximum seasonal groundwater levels vary from about RL 15.5 m AHD west of the station and decrease to the east, to about RL 13.0 m AHD east of the station area.

6.0 Geotechnical Suitability for Development

Based on the results of the previous and current geotechnical investigations, we consider that the bridge and station area is suitable for development from a geotechnical point of view, subject to the following:

- The design for the proposed bridge foundations will need to consider the presence of the existing foundations for the current bridge and station structures
- The design of the proposed bridge foundations will need to consider movements of the foundations as a result of the bridge loads. At present bored piles are proposed to support the bridge structure and limit structural settlement/movement
- Dewatering is likely to be required to allow construction of pile caps, lift pits and underground services in the station precinct area
- The design of temporary and permanent retaining systems will need to consider ground movements as a result of installation and excavation of the retention systems, and these effects on adjacent structures and infrastructure.

Appendix A – Summary of Test Locations

396200 396250 396300 396350 396400 396450 396500 396550

6467900 6467850 6467800 6467750

WHITTAKER ST
TOOWONG ST
ARUNDEL ST
SHAFTESBURY AV
RAILWAY PDE
WHATLEY CR
HOTHAM ST
GARRATT RD
HAYWARD ST
RAILWAY PDE

SCOPE TO BE CONFIRMED PENDING CONFIRMATION OF TRACK DESIGN

CPTu01 HA01
CPTu02 HA02
CPTu03 HA03
CPTu04 HA04
CPTu05 HA05

BWS-HA101
BWS-HA102
BWS-HA103
BWS-HA104
BWS-CPT101
BWS-CPT102
BWS-CPT103
BWS-CPT104

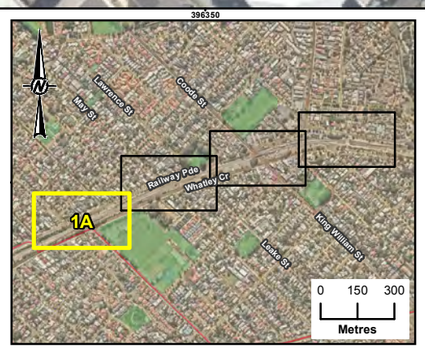
LEGEND

PREVIOUS INVESTIGATION:
- TEST PIT LOCATION (BY SPECIALIST TESTING AND TECHNICAL SERVICES)
- TEST PIT LOCATION (BY GOLDER - FAL STAGE 2)
- CONE PENETRATION TEST LOCATION (BY GOLDER - FAL STAGE 2)
- TEST PIT LOCATION (BY GOLDER - AUGUST 2018)
- BOREHOLE LOCATION (BY GOLDER - AUGUST 2018)
- HAND AUGER LOCATION (BY GOLDER - AUGUST 2018)
- CONE PENETRATION TEST LOCATION (BY GOLDER - AUGUST 2018)
- BOREHOLE LOCATION (BY ARUP)
- CONE PENETRATION TEST LOCATION (BY ARUP)

CURRENT INVESTIGATION (BY GOLDER):
- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION

PROPOSED INVESTIGATION (BY GOLDER):
- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION
- CPT TO BE CONDUCTED FOLLOWING DEMOLITION

PROPOSED INVESTIGATION (BY ADVISIAN):
- BOREHOLE LOCATION
- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION
- RETAINING WALL
- RETAINING WALL FROM RAIL EARTHWORKS



REFERENCES:
1. SITE LAYOUT PROVIDED BY CLIENT. DRAWING FILE: BST-BGE-MOD-Y-MO-ST-0001-R20_200724.DWG
2. AERIAL IMAGERY SOURCED FROM NEARMAP DATED MAY 2020.

NOT FOR CONSTRUCTION
DRAFT

NOTES:
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
2. TEST PITS UNDERTAKEN BY SPECIALIST TESTING AND TECHNICAL SERVICES. INFORMATION PROVIDED BY PUBLIC TRANSPORT AUTHORITY.
3. GEOTECHNICAL INVESTIGATION UNDERTAKEN BY GOLDER ON BEHALF OF THE PUBLIC TRANSPORT AUTHORITY FOR THE FORRESTFIELD AIRPORT LINK (FAL), STAGE 2 GEOTECHNICAL INVESTIGATION.

0 20 40
1:1,000 METRES

CLIENT
EVOLVE BAYSWATER

CONSULTANT
EB

YYYY-MM-DD	2020-09-11
DESIGNED	DAB
PREPARED	JRP
REVIEWED	
APPROVED	

PROJECT
BAYSWATER STATION PAA

TITLE
SITE PLAN
1 OF 4

PROJECT NO.	CONTROL	REV.	FIGURE
19119206	011 R	A	1A

PATH: B:\Evolve_Bayswater\Bayswater\99_PROJECTS\19119206_Bayswater_Station_AD\02_PRODUCTION\MXD\011-R\Rev A\19119206-011-R-F001-RevA.mxd PRINTED ON: 2020-09-11 AT: 7:21:53 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25mm

0

396550 396600 396650 396700 396750 396800 396850 396900

6467950 6468000 6468050

ARUNDEL ST
MAY ST
BURNSIDE ST
LAWRENCE ST
MILLS AV
RAILWAY PDE
THE STRAND
WHATLEY CR
LEAKE ST
ROBERTS ST
MERRICK CT

SCOPE TO BE CONFIRMED PENDING CONFIRMATION OF TRACK DESIGN

BWS-CPT105
BWS-CPT106
BWS-CPT107
BWS-CPT108
BWS-CPT109
BWS-CPT110
BWS-CPT111
BWS-CPT112
BWS-CPT113
BWS-CPT114

CPTu06
HA06
CPTu07
HA07
CPTu09
HA08
HA05

396550 396600 396650 396700 396750 396800 396850 396900

LEGEND

PREVIOUS INVESTIGATION:

- TEST PIT LOCATION (BY SPECIALIST TESTING AND TECHNICAL SERVICES)
- TEST PIT LOCATION (BY GOLDER - FAL STAGE 2)
- CONE PENETRATION TEST LOCATION (BY GOLDER - FAL STAGE 2)
- TEST PIT LOCATION (BY GOLDER - AUGUST 2018)
- BOREHOLE LOCATION (BY GOLDER - AUGUST 2018)
- HAND AUGER LOCATION (BY GOLDER - AUGUST 2018)
- CONE PENETRATION TEST LOCATION (BY GOLDER - AUGUST 2018)
- BOREHOLE LOCATION (BY ARUP)
- CONE PENETRATION TEST LOCATION (BY ARUP)

CURRENT INVESTIGATION (BY GOLDER):

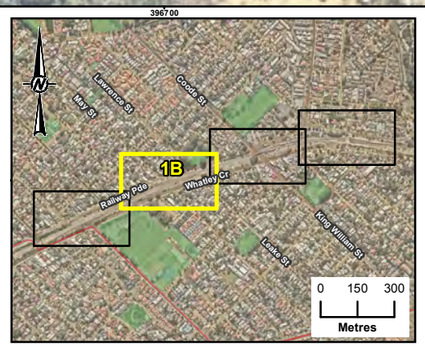
- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION

PROPOSED INVESTIGATION (BY GOLDER):

- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION
- CPT TO BE CONDUCTED FOLLOWING DEMOLITION

PROPOSED INVESTIGATION (BY ADVISIAN):

- BOREHOLE LOCATION
- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION
- RETAINING WALL
- RETAINING WALL FROM RAIL EARTHWORKS



REFERENCES:
1. SITE LAYOUT PROVIDED BY CLIENT. DRAWING FILE: BST-BGE-MOD-Y-MO-ST-0001-R20_200724.DWG
2. AERIAL IMAGERY SOURCED FROM NEARMAP DATED MAY 2020.

NOT FOR CONSTRUCTION

DRAFT

NOTES:
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
2. TEST PITS UNDERTAKEN BY SPECIALIST TESTING AND TECHNICAL SERVICES. INFORMATION PROVIDED BY PUBLIC TRANSPORT AUTHORITY.
3. GEOTECHNICAL INVESTIGATION UNDERTAKEN BY GOLDER ON BEHALF OF THE PUBLIC TRANSPORT AUTHORITY FOR THE FORRESTFIELD AIRPORT LINK (FAL), STAGE 2 GEOTECHNICAL INVESTIGATION.

0 20 40
1:1,000 METRES

CLIENT
EVOLVE BAYSWATER

CONSULTANT
EB

PROJECT
BAYSWATER STATION PAA

TITLE
SITE PLAN
2 OF 4

YYYY-MM-DD	2020-09-11
DESIGNED	DAB
PREPARED	JRP
REVIEWED	
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
19119206	011 R	A	1B

PATH: B:\Evolve_Bayswater\Bayswater\99_PROJECT\S19119206_Bayswater_Station_AD\02_PRODUCTION\MXD\011-R\Rev A\19119206-011-R-F001-RevA.mxd PRINTED ON: 2020-09-11 AT: 7:22:09 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

0 25mm

LEGEND

PREVIOUS INVESTIGATION:

- TEST PIT LOCATION (BY SPECIALIST TESTING AND TECHNICAL SERVICES)
- TEST PIT LOCATION (BY GOLDER - FAL STAGE 2)
- CONE PENETRATION TEST LOCATION (BY GOLDER - FAL STAGE 2)
- TEST PIT LOCATION (BY GOLDER - AUGUST 2018)
- BOREHOLE LOCATION (BY GOLDER - AUGUST 2018)
- HAND AUGER LOCATION (BY GOLDER - AUGUST 2018)
- CONE PENETRATION TEST LOCATION (BY GOLDER - AUGUST 2018)
- BOREHOLE LOCATION (BY ARUP)
- CONE PENETRATION TEST LOCATION (BY ARUP)

CURRENT INVESTIGATION (BY GOLDER):

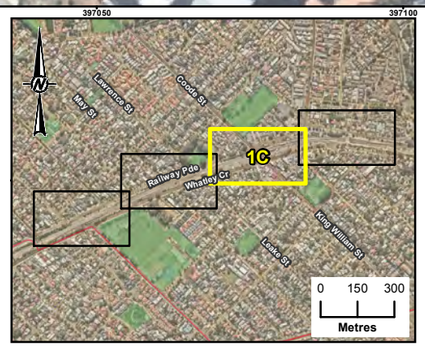
- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION

PROPOSED INVESTIGATION (BY GOLDER):

- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION
- CPT TO BE CONDUCTED FOLLOWING DEMOLITION

PROPOSED INVESTIGATION (BY ADVISIAN):

- BOREHOLE LOCATION
- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION
- RETAINING WALL
- RETAINING WALL FROM RAIL EARTHWORKS



REFERENCES:
1. SITE LAYOUT PROVIDED BY CLIENT. DRAWING FILE: BST-BGE-MOD-Y-MO-ST-0001-R20_200724.DWG
2. AERIAL IMAGERY SOURCED FROM NEARMAP DATED MAY 2020.

NOT FOR CONSTRUCTION

DRAFT

NOTES:
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
2. TEST PITS UNDERTAKEN BY SPECIALIST TESTING AND TECHNICAL SERVICES. INFORMATION PROVIDED BY PUBLIC TRANSPORT AUTHORITY.
3. GEOTECHNICAL INVESTIGATION UNDERTAKEN BY GOLDER ON BEHALF OF THE PUBLIC TRANSPORT AUTHORITY FOR THE FORRESTFIELD AIRPORT LINK (FAL), STAGE 2 GEOTECHNICAL INVESTIGATION.

0 20 40
1:1,000 METRES

CLIENT
EVOLVE BAYSWATER

CONSULTANT
EB

PROJECT
BAYSWATER STATION PAA

TITLE
SITE PLAN
3 OF 4

YYYY-MM-DD	2020-09-11
DESIGNED	DAB
PREPARED	JRP
REVIEWED	
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
19119206	011 R	A	1C

PATH: B:\Evolve_Bayswater\Bayswater\99_PROJECT\S19119206_Bayswater_Station_AD\02_PRODUCTION\MXD\011-R\Rev A\19119206-011-R-F001-RevA.mxd PRINTED ON: 2020-09-11 AT: 7:22:14 AM

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25mm

0

397300 397350 397400 397450 397500 397550 397600

6466250 6466200 6466150 6466100 6466050

BEECHBORO RD SOUTH

RAILWAY PDE

WHATLEY CR

SLADE ST

HAMILTON ST

COBDEN ST

ADV_P1-HA02(K)
TP2
TP1
ARUP_CPT003
ADV_P1-CPT04
ADV_P1-CPT05
ADV_P1-HA01
ADV_P1-BH02(VWP)
ADV_P1-HA03
ADV_P1-BH03
ADV_P1-CPT02
ADV_P1-CPT03
ADV_P1-CPT01
TP3
TP5
ADV_P1-CPT08
TP4
ADV_P1-CPT06
ADV_P1-CPT11
ADV_P1-BH17
HA10
CPTu17
CPTu16
ADV_P1-CPT07
BWS-CPT140
TP2-19
ADV_P1-CPT09
P2-56

LEGEND

PREVIOUS INVESTIGATION:

- TEST PIT LOCATION (BY SPECIALIST TESTING AND TECHNICAL SERVICES)
- TEST PIT LOCATION (BY GOLDER - FAL STAGE 2)
- CONE PENETRATION TEST LOCATION (BY GOLDER - FAL STAGE 2)
- TEST PIT LOCATION (BY GOLDER - AUGUST 2018)
- BOREHOLE LOCATION (BY GOLDER - AUGUST 2018)
- HAND AUGER LOCATION (BY GOLDER - AUGUST 2018)
- CONE PENETRATION TEST LOCATION (BY GOLDER - AUGUST 2018)
- BOREHOLE LOCATION (BY ARUP)
- CONE PENETRATION TEST LOCATION (BY ARUP)

CURRENT INVESTIGATION (BY GOLDER):

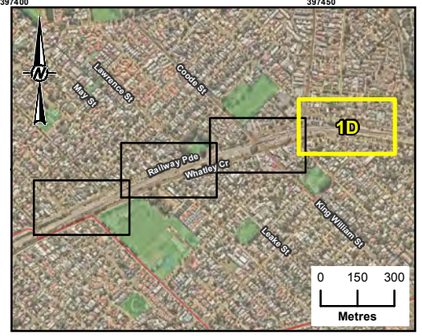
- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION

PROPOSED INVESTIGATION (BY GOLDER):

- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION
- CPT TO BE CONDUCTED FOLLOWING DEMOLITION

PROPOSED INVESTIGATION (BY ADVISIAN):

- BOREHOLE LOCATION
- HAND AUGER LOCATION
- CONE PENETRATION TEST LOCATION
- RETAINING WALL
- RETAINING WALL FROM RAIL EARTHWORKS



REFERENCES:
1. SITE LAYOUT PROVIDED BY CLIENT. DRAWING FILE: BST-BGE-MOD-Y-MO-ST-0001-R20_200724.DWG
2. AERIAL IMAGERY SOURCED FROM NEARMAP DATED MAY 2020.

NOT FOR CONSTRUCTION
DRAFT

NOTES:
1. COORDINATE SYSTEM: GDA 1994 MGA ZONE 50
2. TEST PITS UNDERTAKEN BY SPECIALIST TESTING AND TECHNICAL SERVICES. INFORMATION PROVIDED BY PUBLIC TRANSPORT AUTHORITY.
3. GEOTECHNICAL INVESTIGATION UNDERTAKEN BY GOLDER ON BEHALF OF THE PUBLIC TRANSPORT AUTHORITY FOR THE FORRESTFIELD AIRPORT LINK (FAL), STAGE 2 GEOTECHNICAL INVESTIGATION.

0 20 40
1:1,000 METRES

CLIENT
EVOLVE BAYSWATER

CONSULTANT
EB

PROJECT
BAYSWATER STATION PAA

TITLE
SITE PLAN
4 OF 4

YYYY-MM-DD	2020-09-11
DESIGNED	DAB
PREPARED	JRP
REVIEWED	
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
19119206	011 R	A	1D

evolve bayswater

connecting people + places

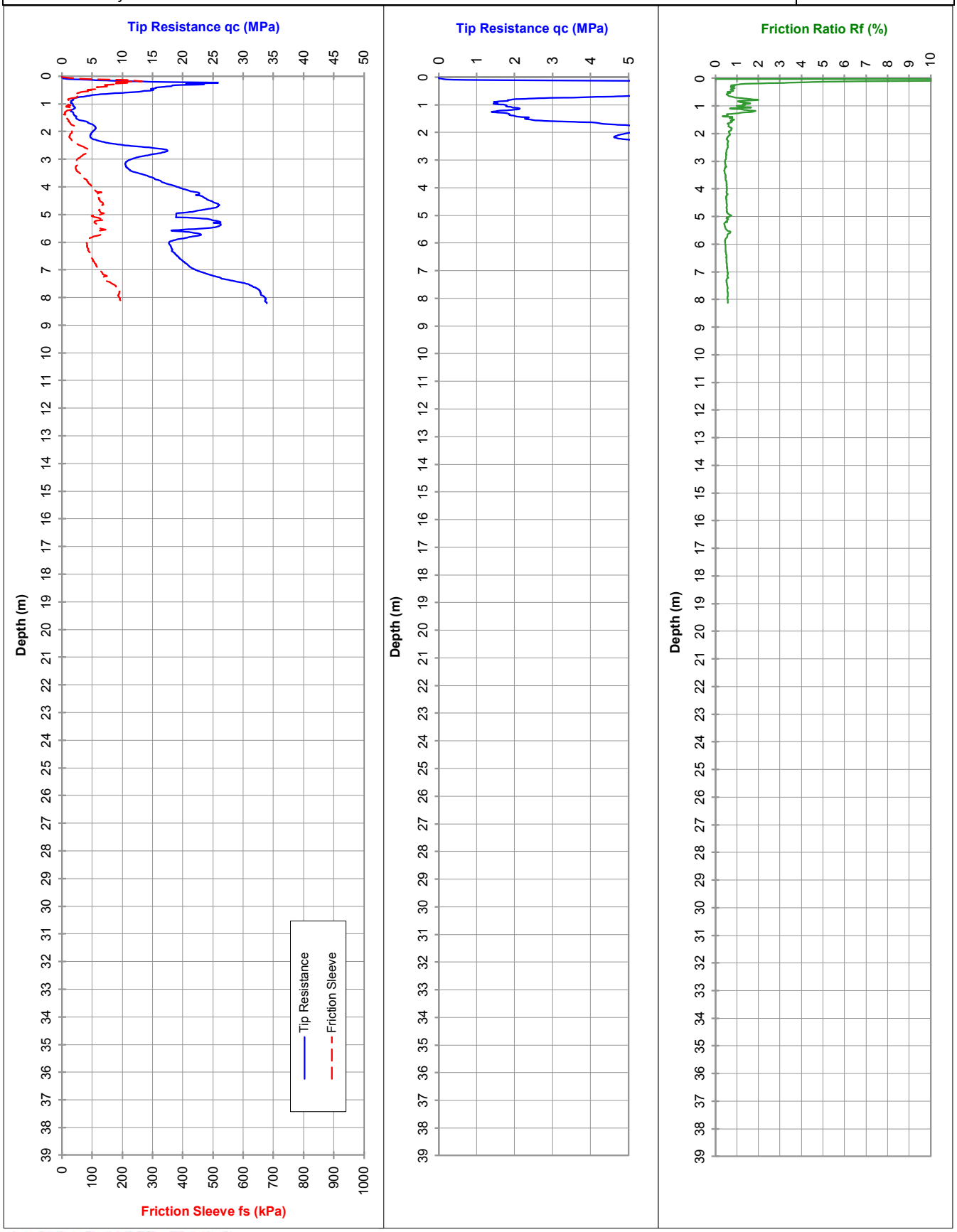
Test ID	Location Type	Coordinates (GDA2020)		Ground Surface Elevation (m AHD)	Termination Depth (m bgl)	Measured Groundwater Depth (m bgl)	Groundwater Level (m AHD)	Termination Reason
		Easting	Northing					
BWS_CPT116	CPT	396951.8	6468062.8	16.19	8.22	1.50	14.69	Target depth
BWS_CPT117	CPT	396973.4	6468069.4	16.58	8.40	1.85	14.73	Target depth
BWS_CPT118	CPT	397004.5	6468038.3	19.85	8.20	-	-	Target depth
BWS_CPT120	CPT	397038.3	6468043.8	19.63	8.20	-	-	Target depth
BWS_CPT121	CPT	397023.9	6468056.3	18.76	8.20	4.55	14.21	Target depth
BWS_CPT122	CPT	397013.8	6468084.3	16.35	38.64	1.90	14.45	Target depth
BWS_CPT124	CPT	397060.2	6468070.4	17.95	23.96	3.90	14.05	Refusal
BWS_CPT126	CPT	397077.4	6468058.7	17.85	36.14	3.80	14.05	Refusal
BWS_CPT127	CPT	397125.5	6468126.3	14.70	29.60	2.10	12.60	Refusal
BWS_CPT128	CPT	397116.3	6468080.9	14.51	33.66	2.00	12.51	Refusal
BWS_CPT129	CPT	397134.8	6468090.4	15.63	30.44	-	-	Refusal
BWS_CPT130	CPT	397142.9	6468081.3	15.60	31.88	-	-	Refusal
BWS_CPT132	CPT	397174.0	6468090.5	16.22	30.82	-	-	Refusal
BWS_CPT133	CPT	397212.5	6468112.9	17.10	21.86	-	-	Refusal
BWS_CPT133a	CPT	397211.6	6468110.6	17.94	20.10	-	-	Refusal
BWS_CPT134	CPT	397190.1	6468074.4	17.90	8.20	2.70	15.1	Target depth
BWS_CPT135	CPT	397190.2	6468103.9	18.08	33.86	5.20	12.88	Refusal
BWS_CPT136	CPT	397200.1	6468099.3	17.72	18.48	-	-	Refusal
BWS_CPT137	CPT	397178.0	6468145.6	17.63	28.26	3.90	13.73	Refusal
BWS_CPT138	CPT	397240.6	6468118.8	15.14	29.76	-	-	Refusal
BWS_CPT139	CPT	397234.3	6468111.9	17.81	32.08	-	-	Refusal
BWS_CPT140	CPT	397283.0	6468119.2	17.83	6.20	-	-	Target depth
HA12	Hand Auger Borehole	397125.3	6468129.8	14.67	3.00	-	-	Refusal

Test ID	Location Type	Coordinates (GDA2020)		Ground Surface Elevation (m AHD)	Termination Depth (m bgl)	Measured Groundwater Depth (m bgl)	Groundwater Level (m AHD)	Termination Reason
		Easting	Northing					
HA13	Hand Auger Borehole	397123.3	6468083.4	14.98	3.00	-	-	Refusal
HA14	Hand Auger Borehole	397165.7	6468083.5	16.84	3.00	-	-	Refusal
HA15	Hand Auger Borehole	397166.3	6468064.6	16.22	3.00	-	-	Target depth

Appendix B – CPT Reports

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT116**
LOCATION: Bayswater	Co-ords:	04-Aug-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 1.5

Hand Auger to (m): 1.5

Refusal:

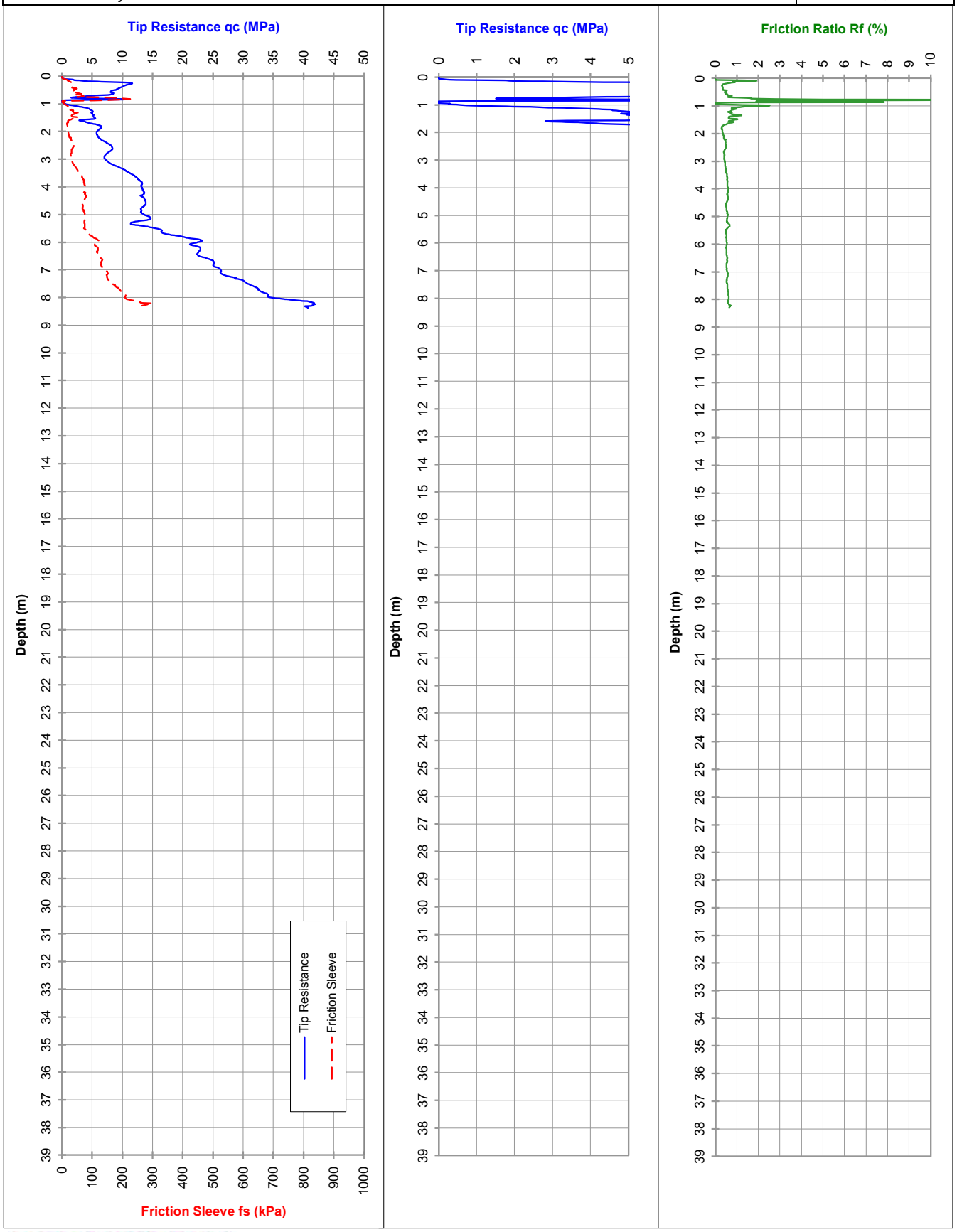
Cone I.D.: EC38

File: GA4249G

Rig Type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT117**
LOCATION: Bayswater	Co-ords:	04-Aug-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 1.85

Hand Auger to (m): 1.5

Refusal:

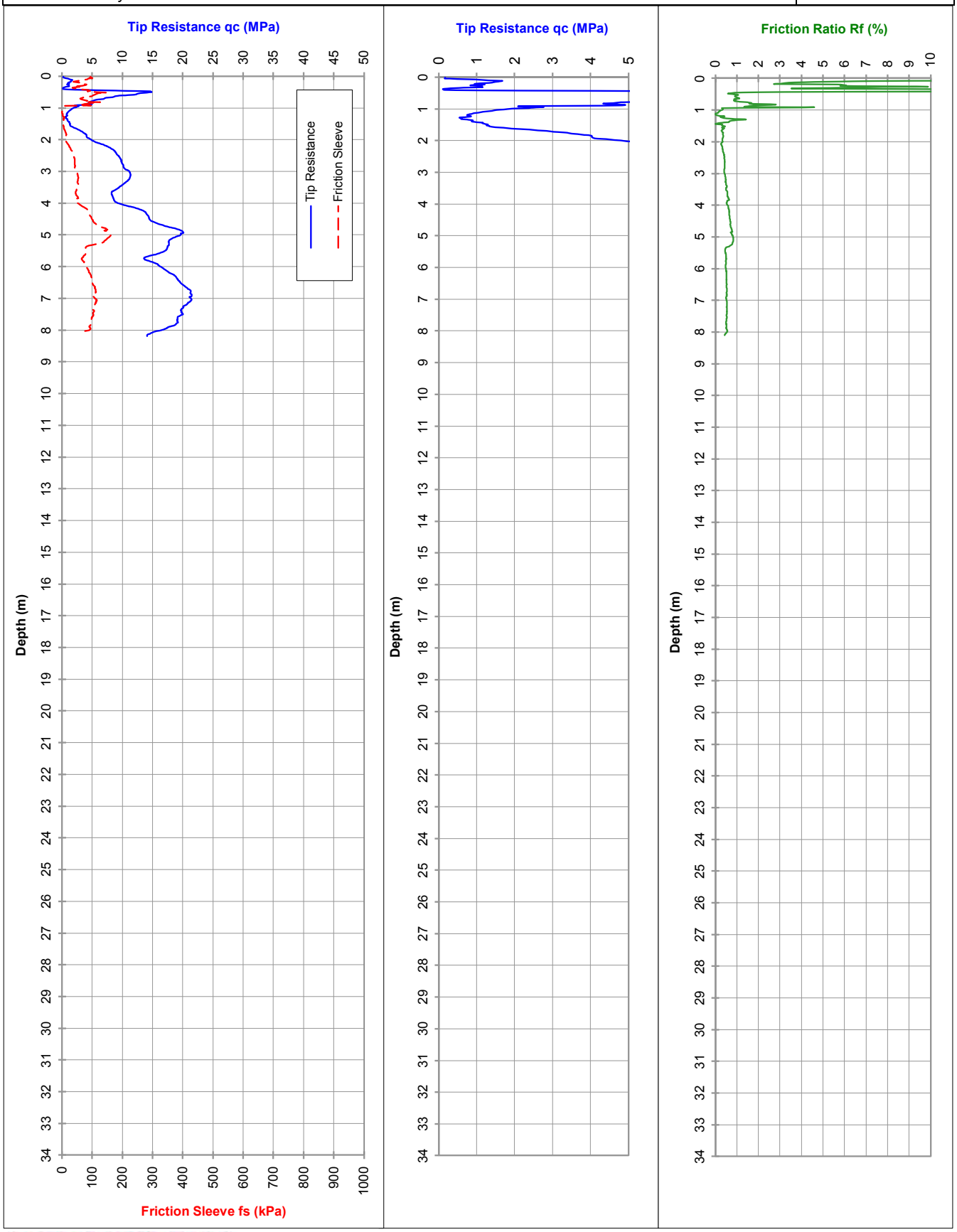
Cone I.D.: EC38

File: GA4248G

Rig Type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT118**
LOCATION: Bayswater	Co-ords:	27-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 5.2

Dummy probe to (m): 0.3

Refusal:

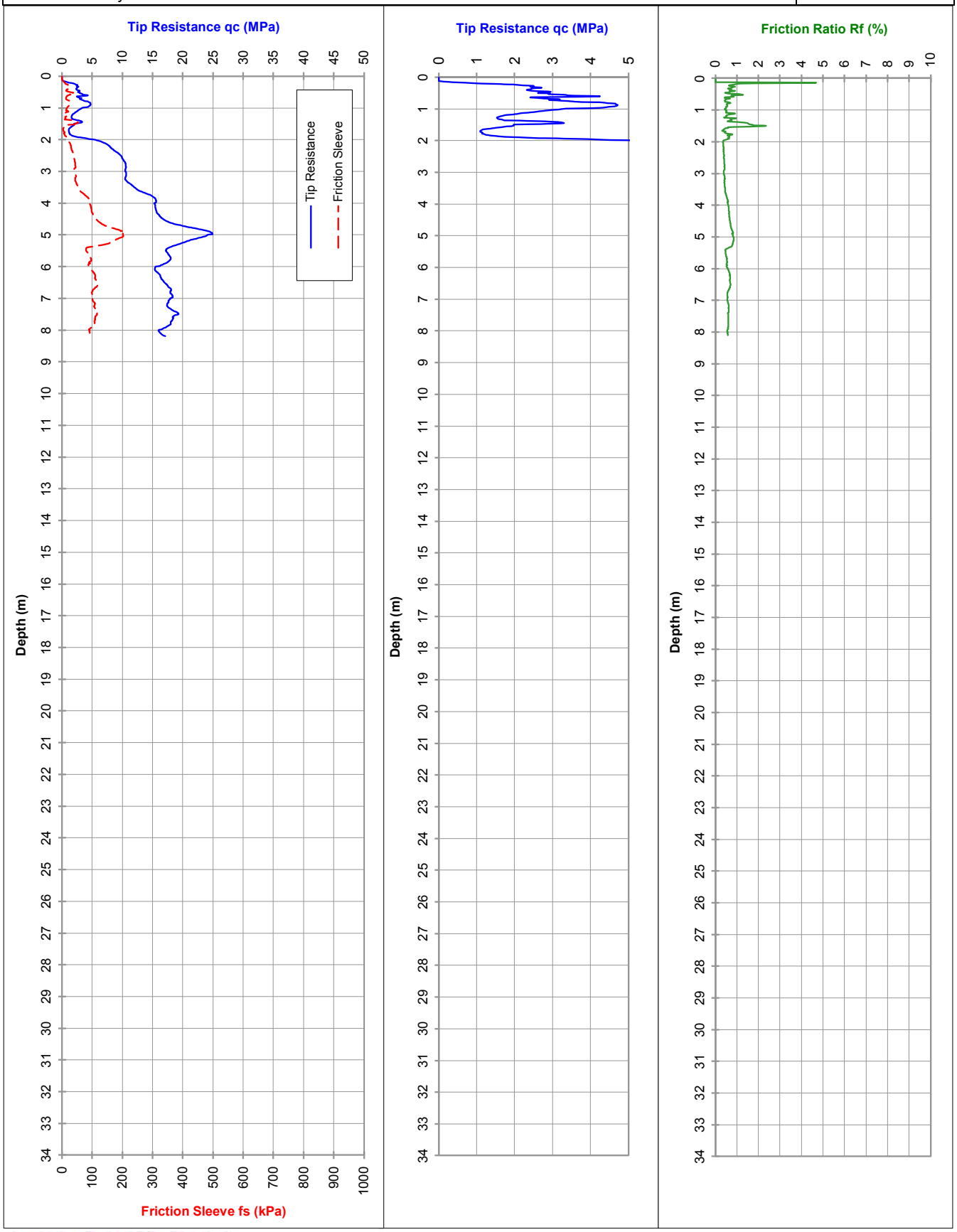
Cone I.D.: EC40

File: GA0767TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT120**
LOCATION: Bayswater	Co-ords:	28-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 5.1

Hand Auger to (m): 1.5

Refusal:

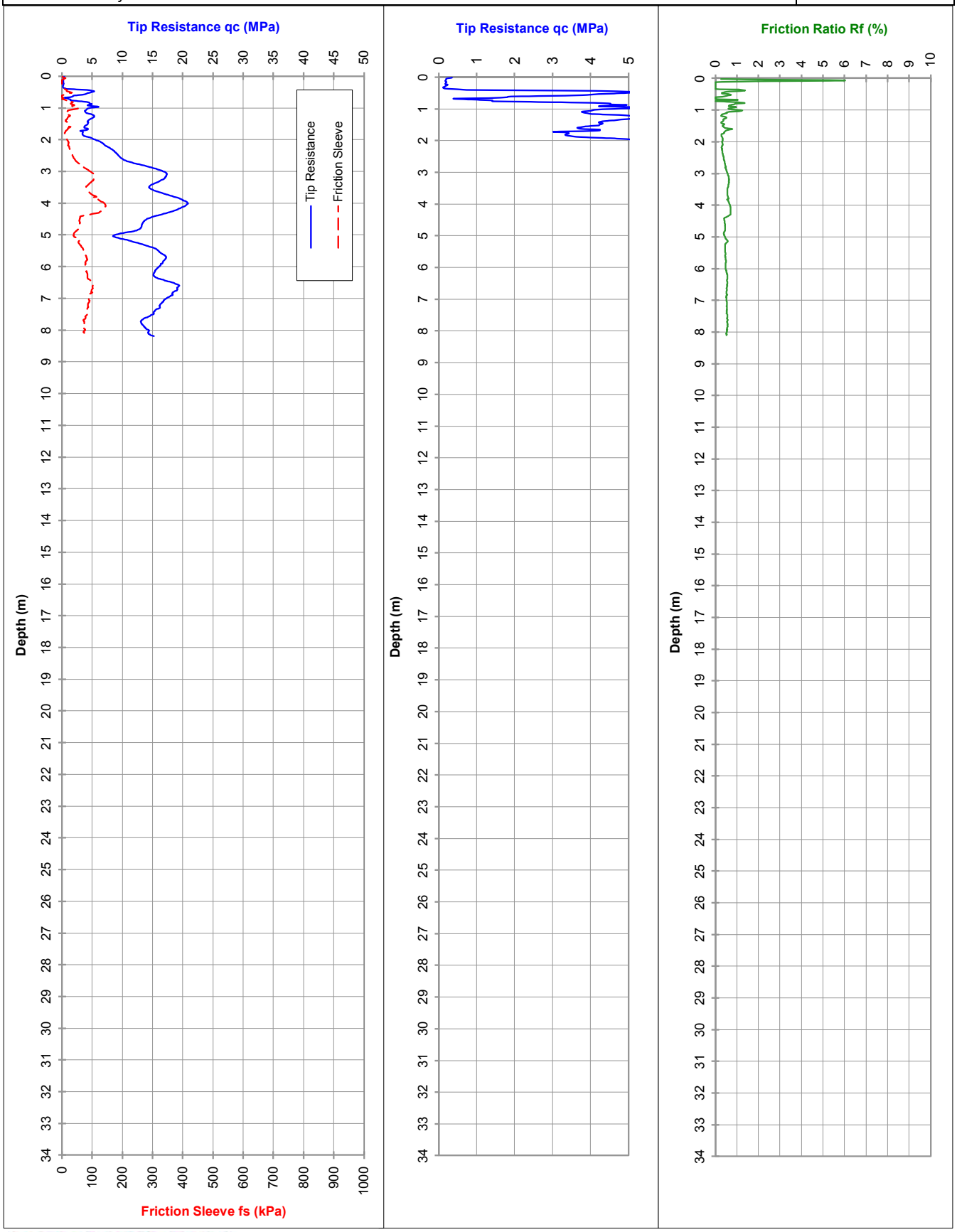
Cone I.D.: EC40

File: GA0769TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT121**
LOCATION: Bayswater	Co-ords:	27-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 4.55

Dummy probe to (m): 0.3

Refusal:

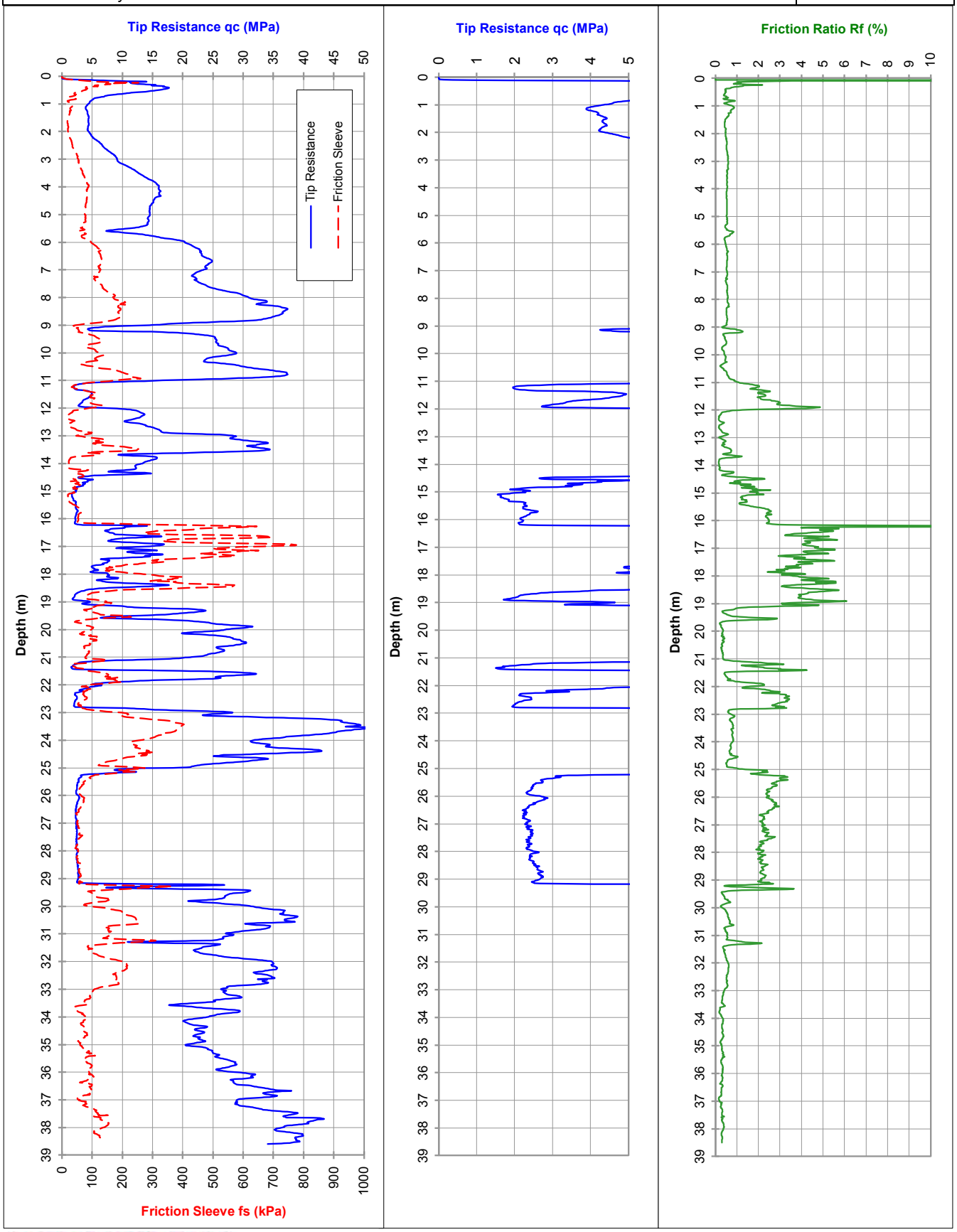
Cone I.D.: EC40

File: GA0768TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT122**
LOCATION: Bayswater	Co-ords:	04-Aug-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 1.9

Hand Auger to (m): 1.5

Refusal: Rod Friction

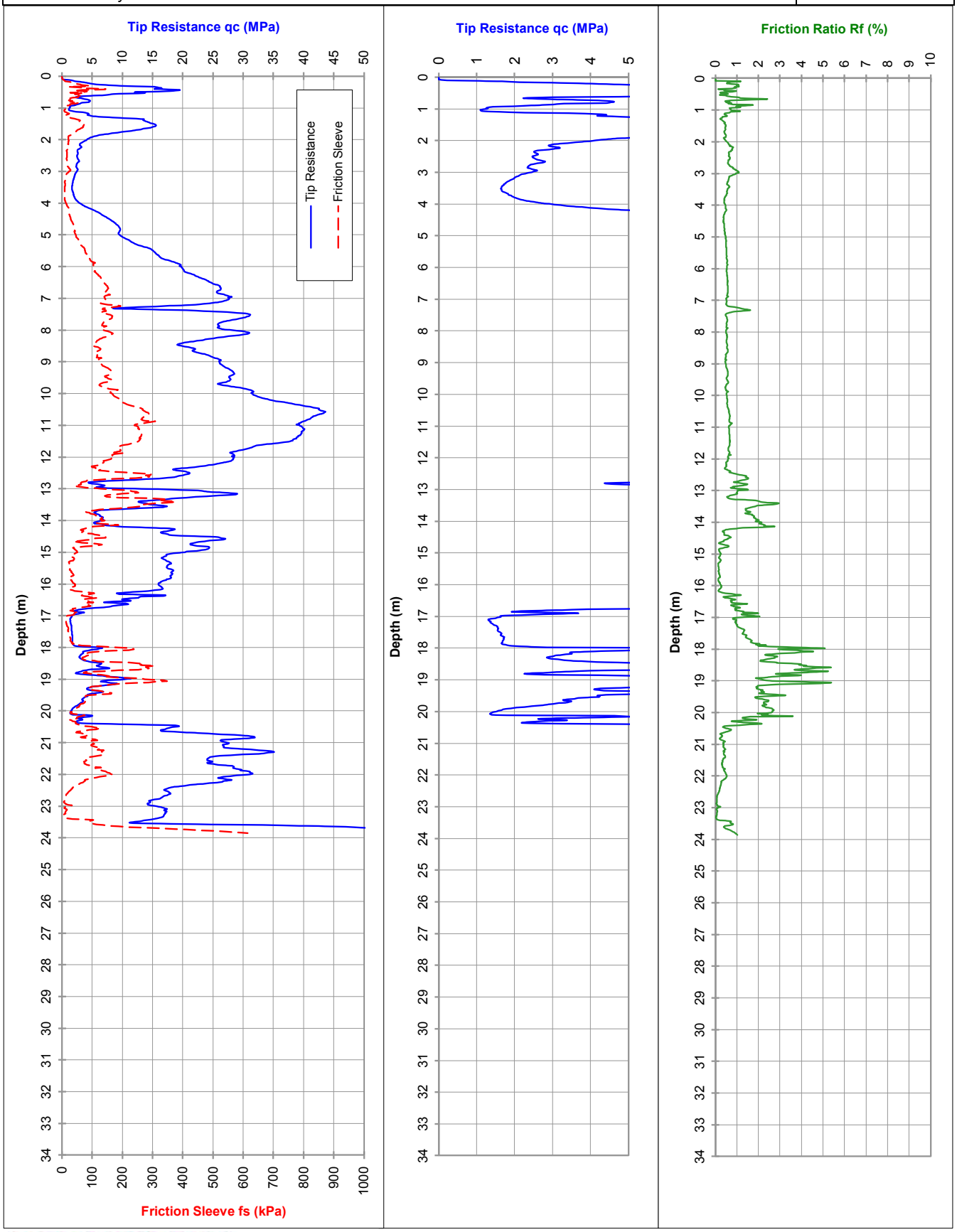
Cone I.D.: EC38

File: GA4247G

Rig Type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT124**
LOCATION: Bayswater	Co-ords:	28-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 3.9

Hand Auger to (m): 1.5

Refusal: Rod Friction + 60 MPa

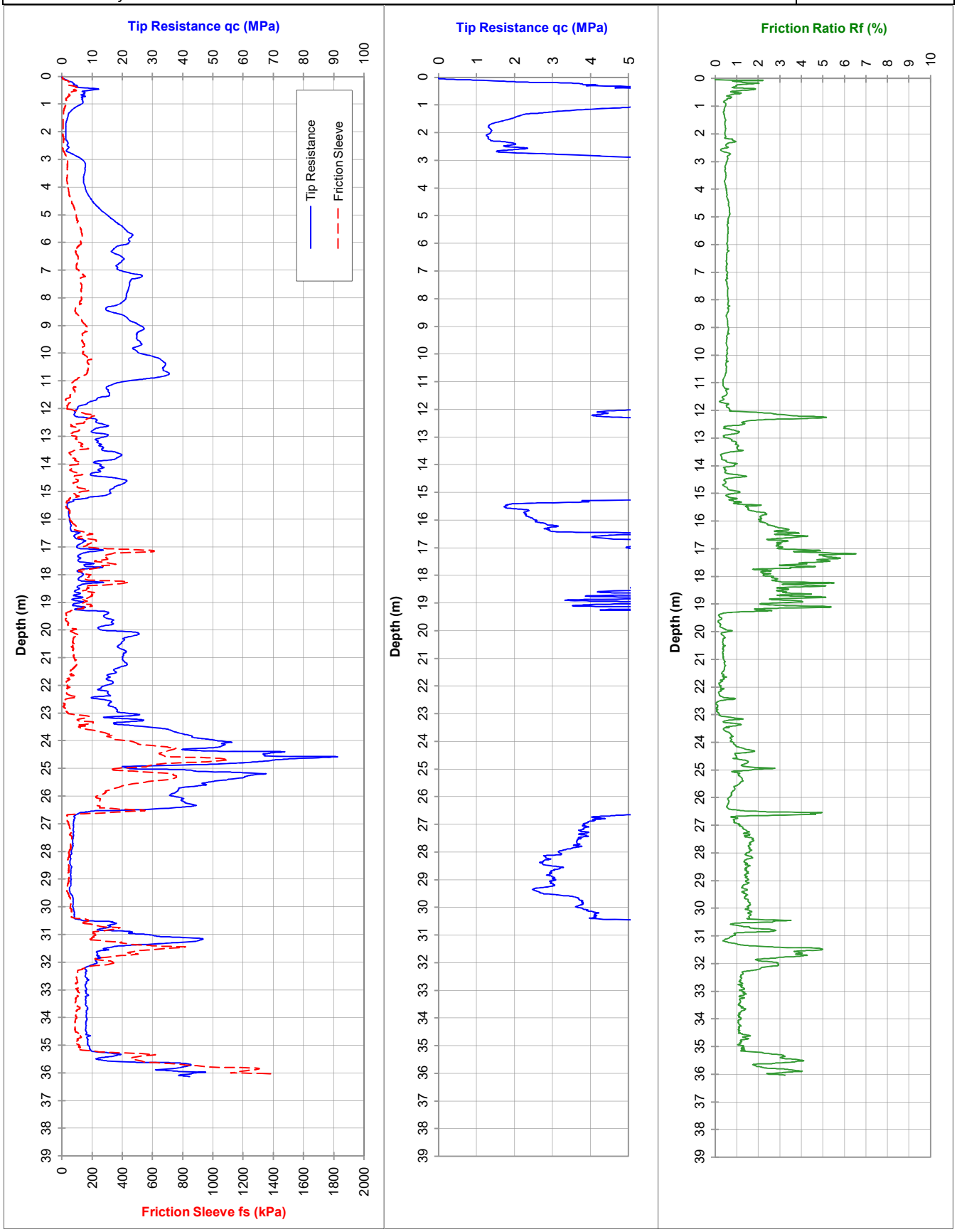
Cone I.D.: EC40

File: GA0770TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT:	Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT:	Bayswater Station	RL (m):	**BWS-CPT126**
LOCATION:	Bayswater	Co-ords:	3-Aug-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 3.8

Hand Auger to (m): 1.5

Refusal: Rod Friction + Lateral Rod Support

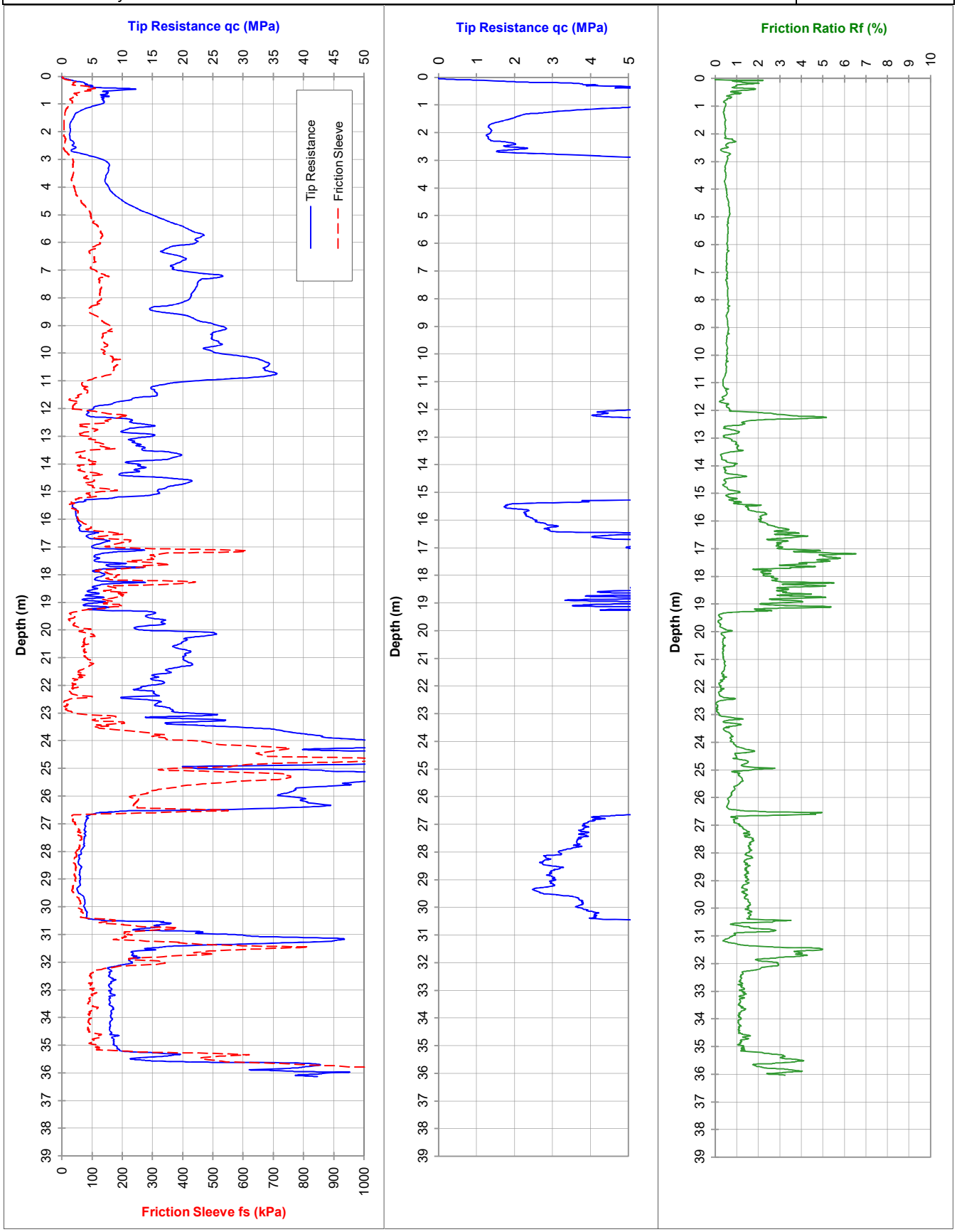
Cone I.D.: EC38

File: GA4246G

Rig Type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT126**
LOCATION: Bayswater	Co-ords:	3-Aug-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 3.8

Hand Auger to (m): 1.5

Refusal: Rod Friction + Lateral Rod Support

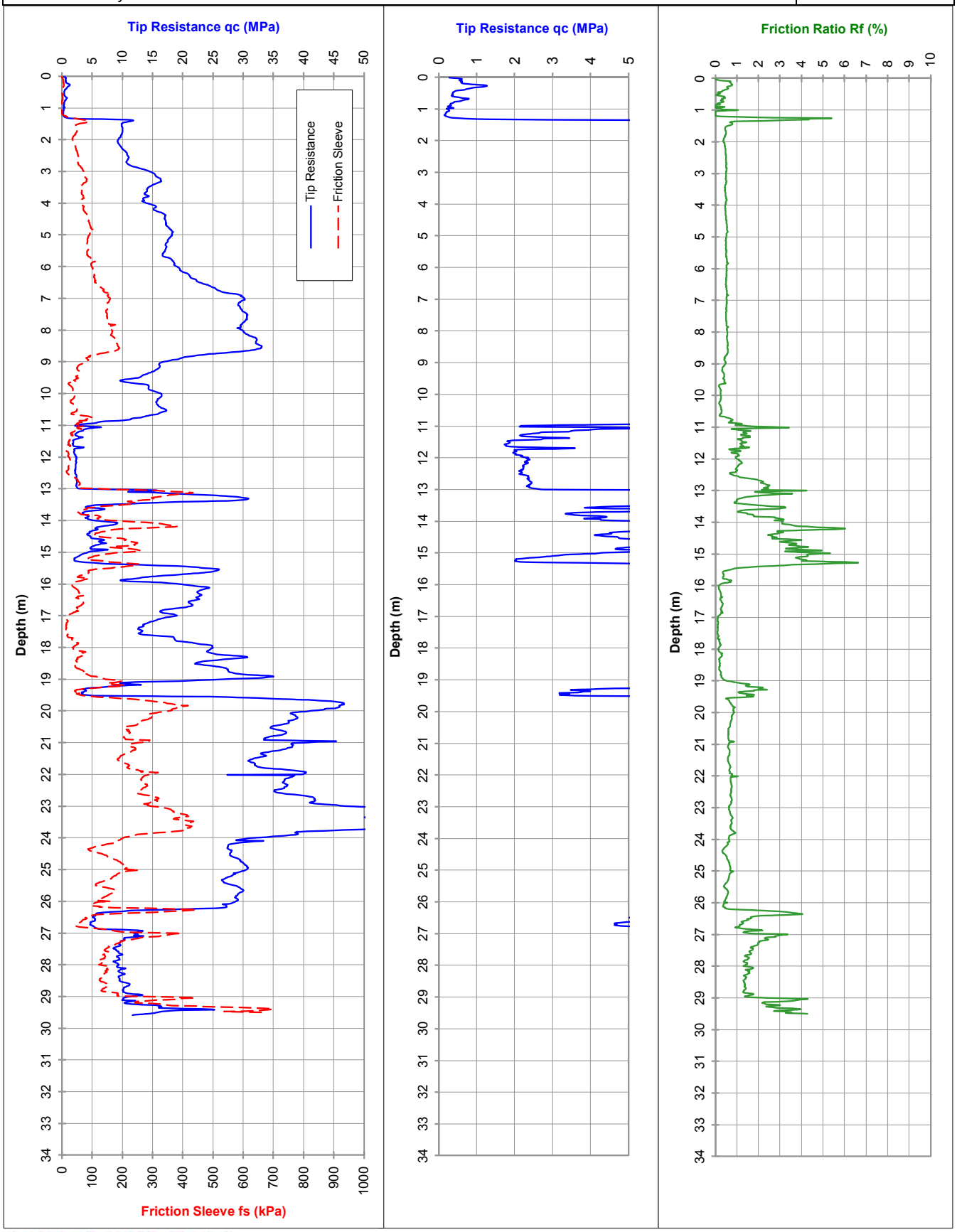
Cone I.D.: EC38

File: GA4246G

Rig Type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT127**
LOCATION: Bayswater	Co-ords:	27-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 2.1

Hand Auger to (m): 1.5

Refusal:

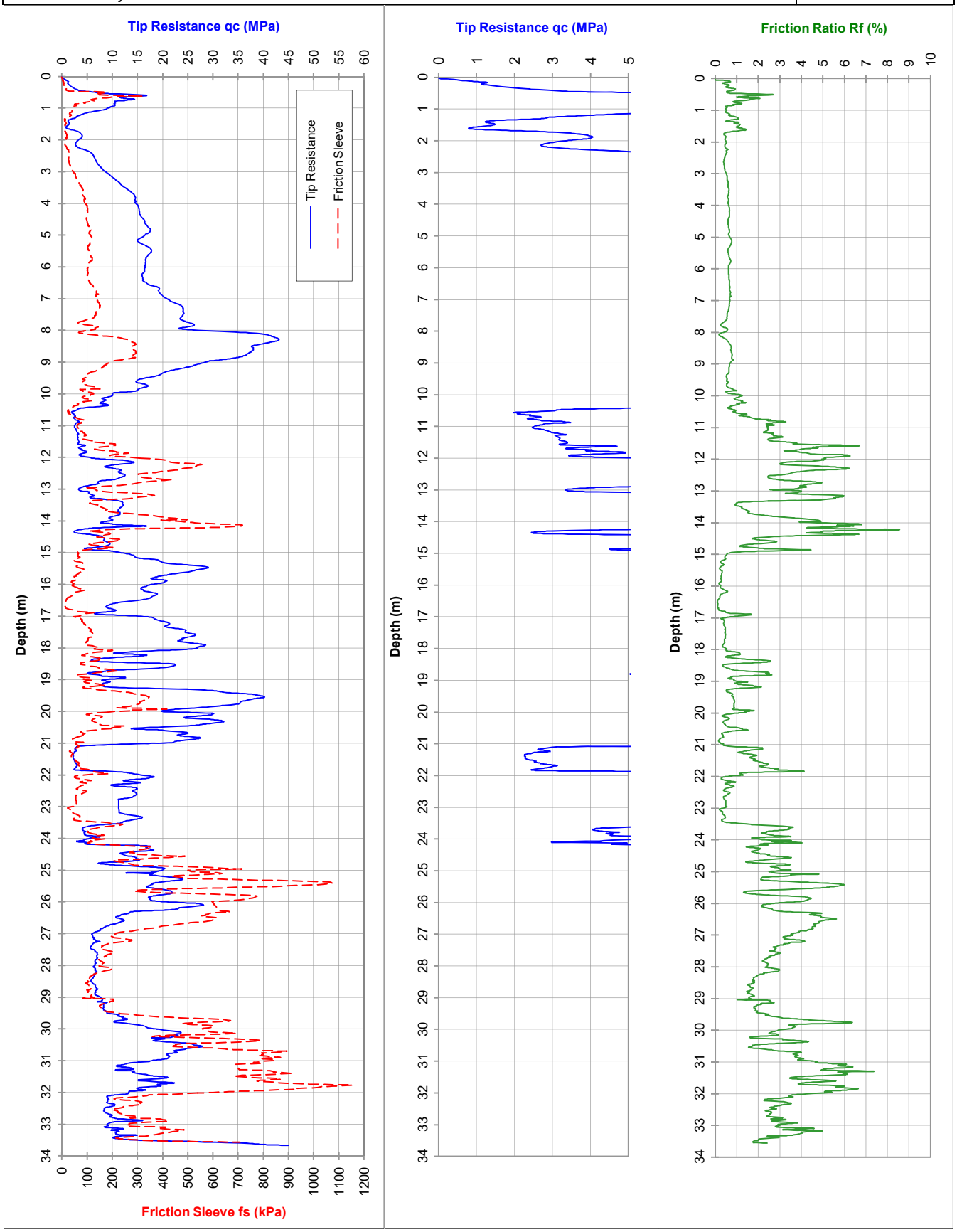
Cone I.D.: EC08

File: GA0766TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT128**
LOCATION: Bayswater	Co-ords:	29-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 2.0

Hand Auger to (m): 1.5

Refusal: 45 MPa + Rod Friction

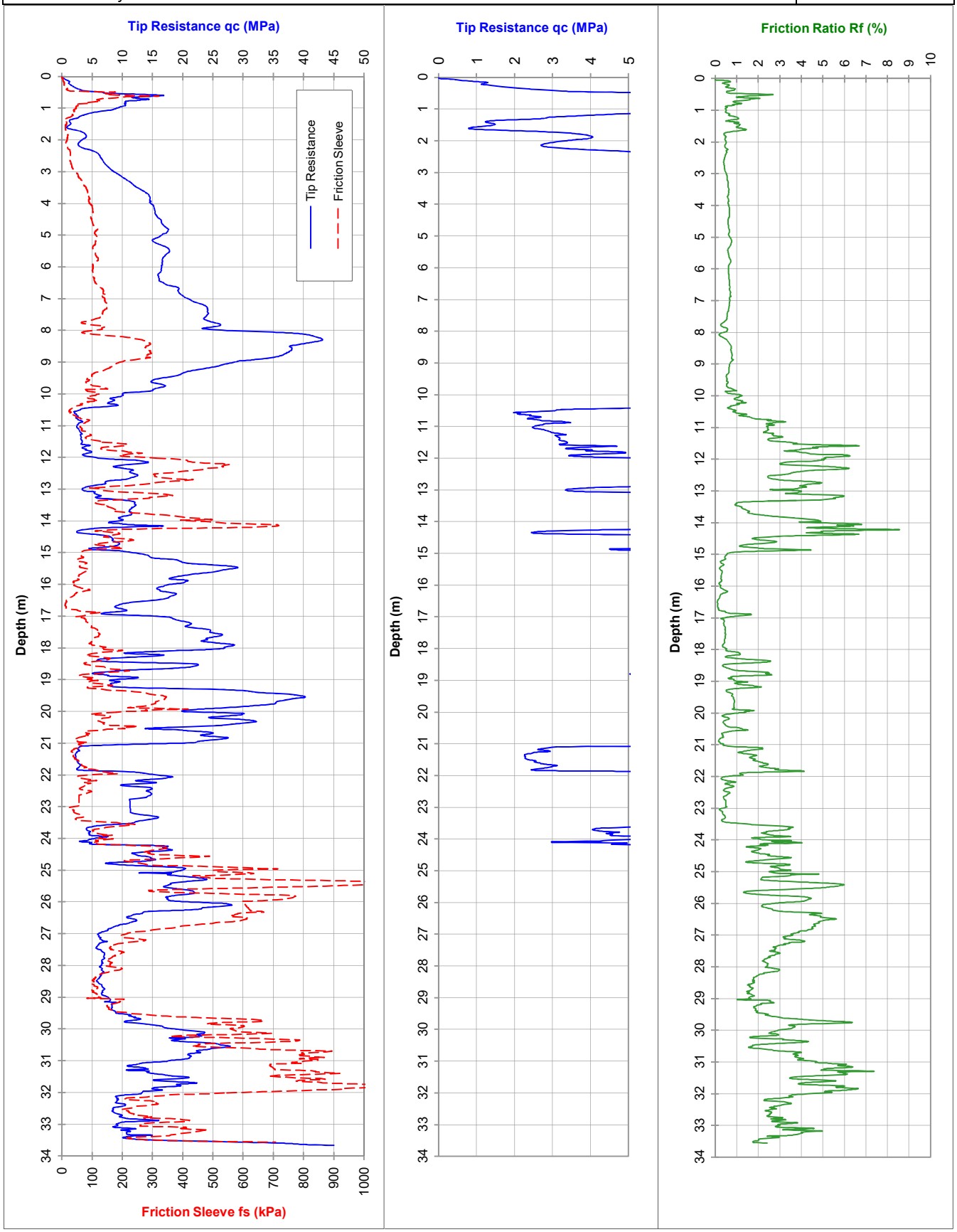
Cone I.D.: EC40

File: GA0776TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT128**
LOCATION: Bayswater	Co-ords:	29-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 2.0

Hand Auger to (m): 1.5

Refusal: 45 MPa + Rod Friction

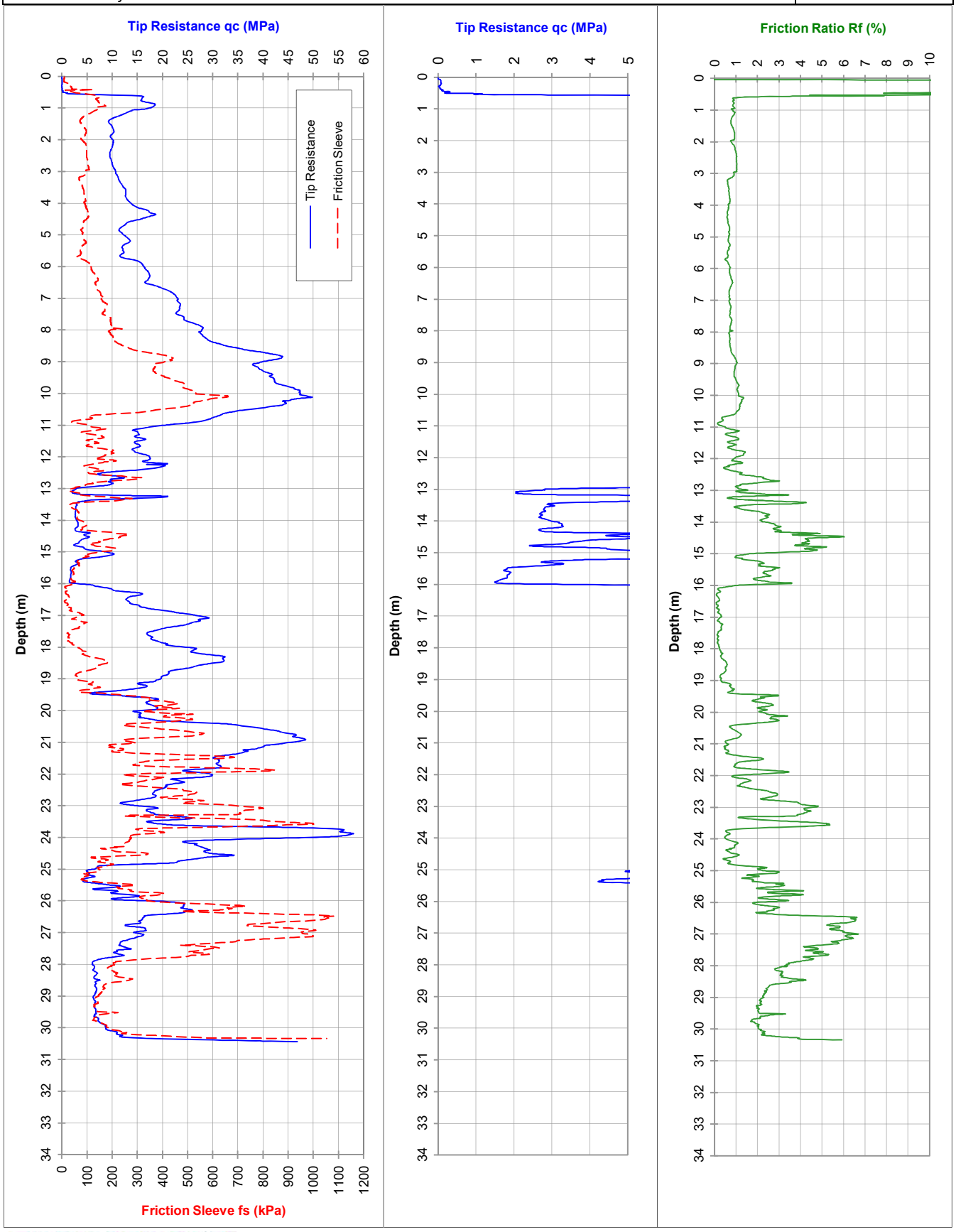
Cone I.D.: EC40

File: GA0776TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT129**
LOCATION: Bayswater	Co-ords:	29-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 0.9

Dummy probe to (m): 0.5

Refusal: Rod Friction + Max FS (2000kPA)

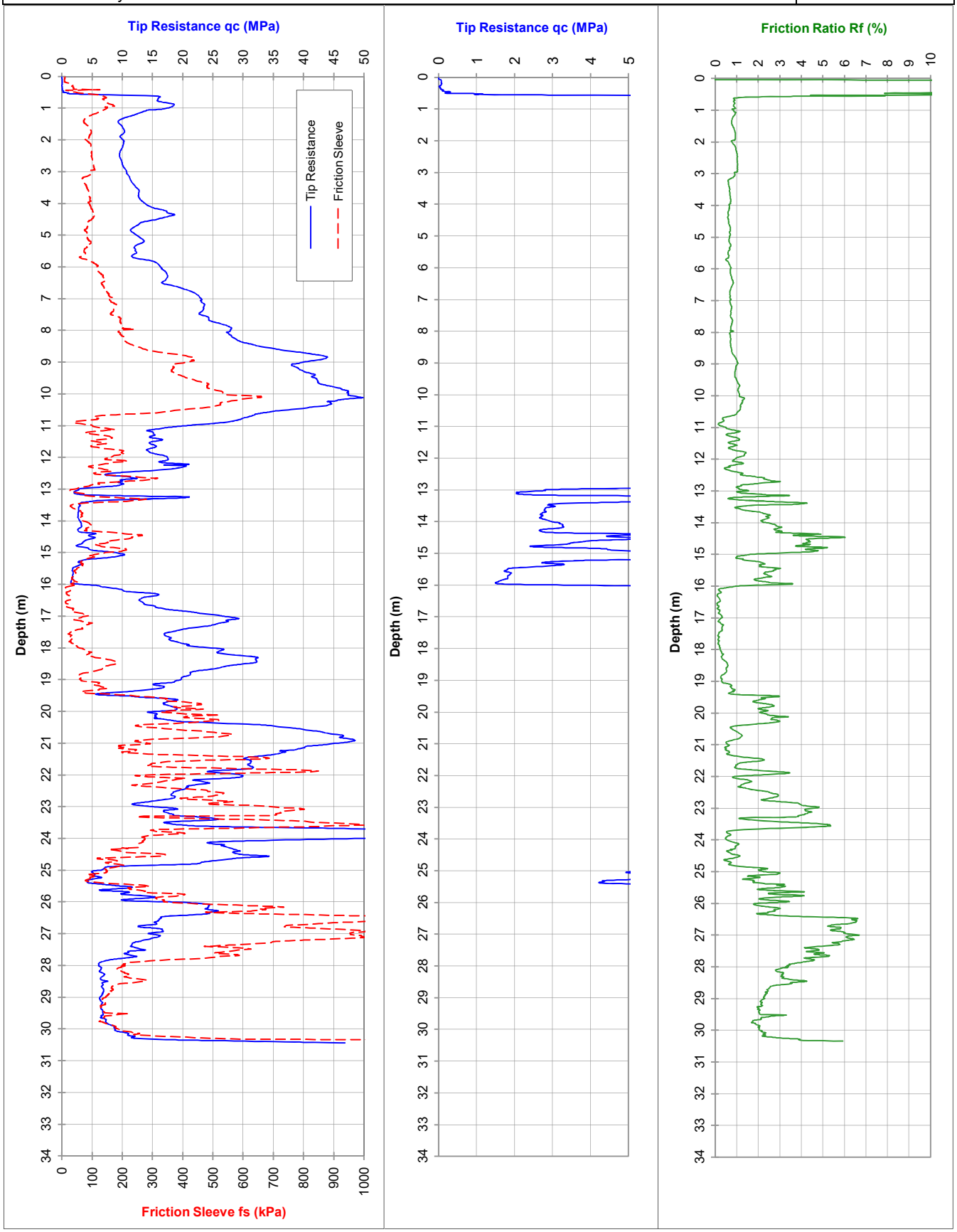
Cone I.D.: EC40

File: GA0777TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT129**
LOCATION: Bayswater	Co-ords:	29-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 0.9

Dummy probe to (m): 0.5

Refusal: Rod Friction + Max FS (2000kPA)

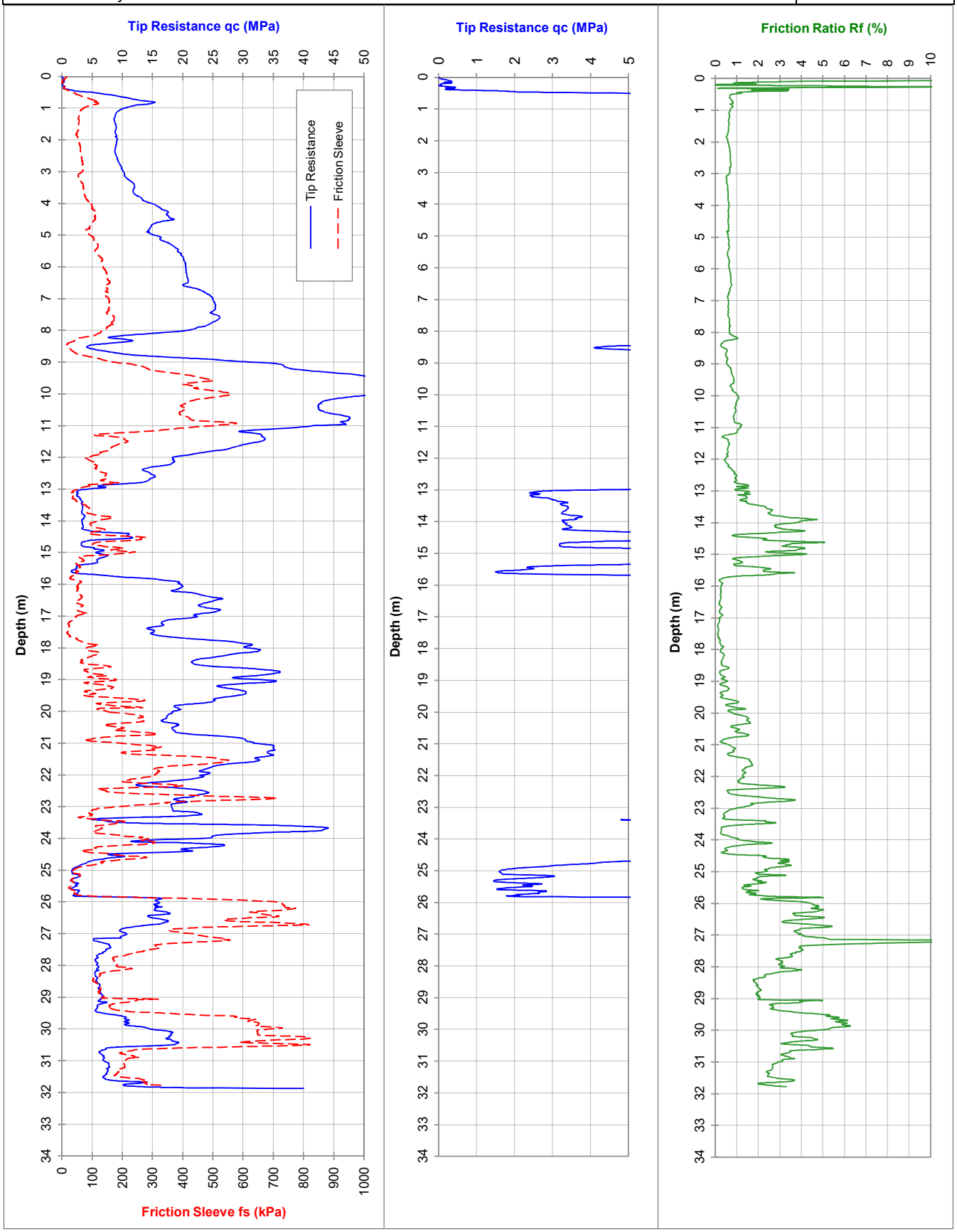
Cone I.D.: EC40

File: GA0777TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT130**
LOCATION: Bayswater	Co-ords:	29-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 2.1

Dummy probe to (m): 0.5

Refusal: 40 MPa + Rod Friction

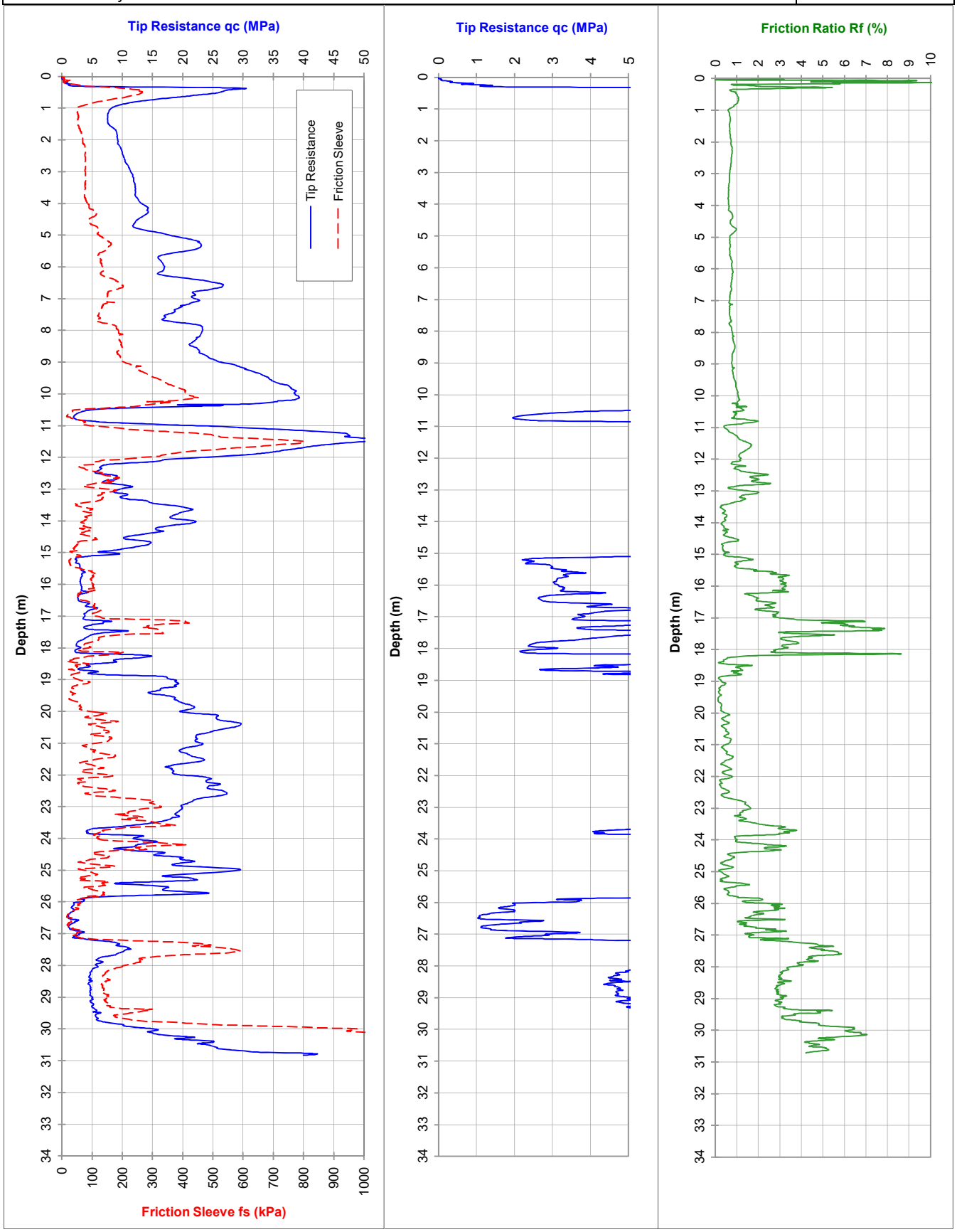
Cone I.D.: EC40

File: GA0775TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT132**
LOCATION: Bayswater	Co-ords:	29-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 1.6

Dummy probe to (m): 0.3

Refusal: 40 MPa + Rod Friction

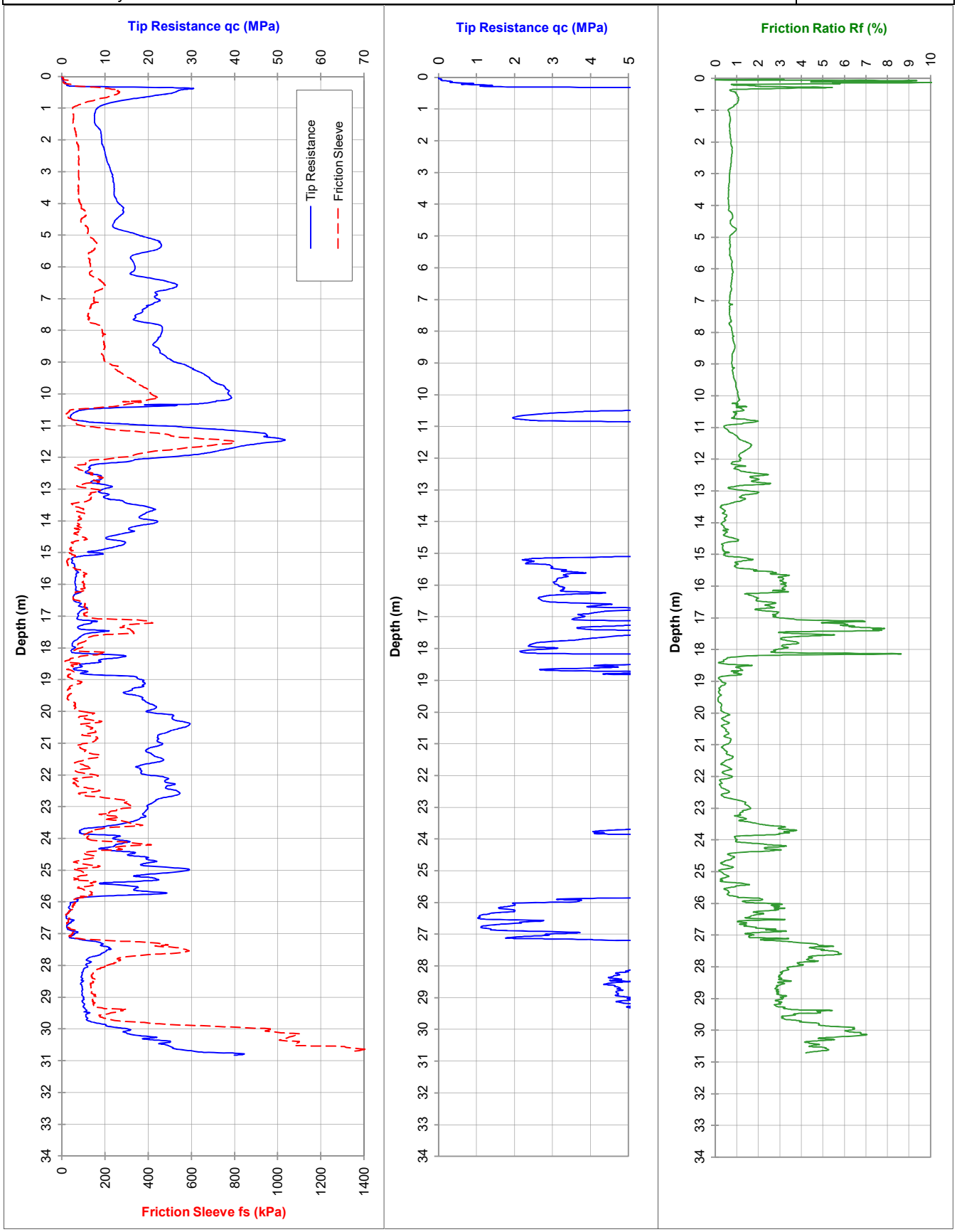
Cone I.D.: EC40

File: GA0778TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT132**
LOCATION: Bayswater	Co-ords:	29-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 1.6

Dummy probe to (m): 0.3

Refusal: 40 MPa + Rod Friction

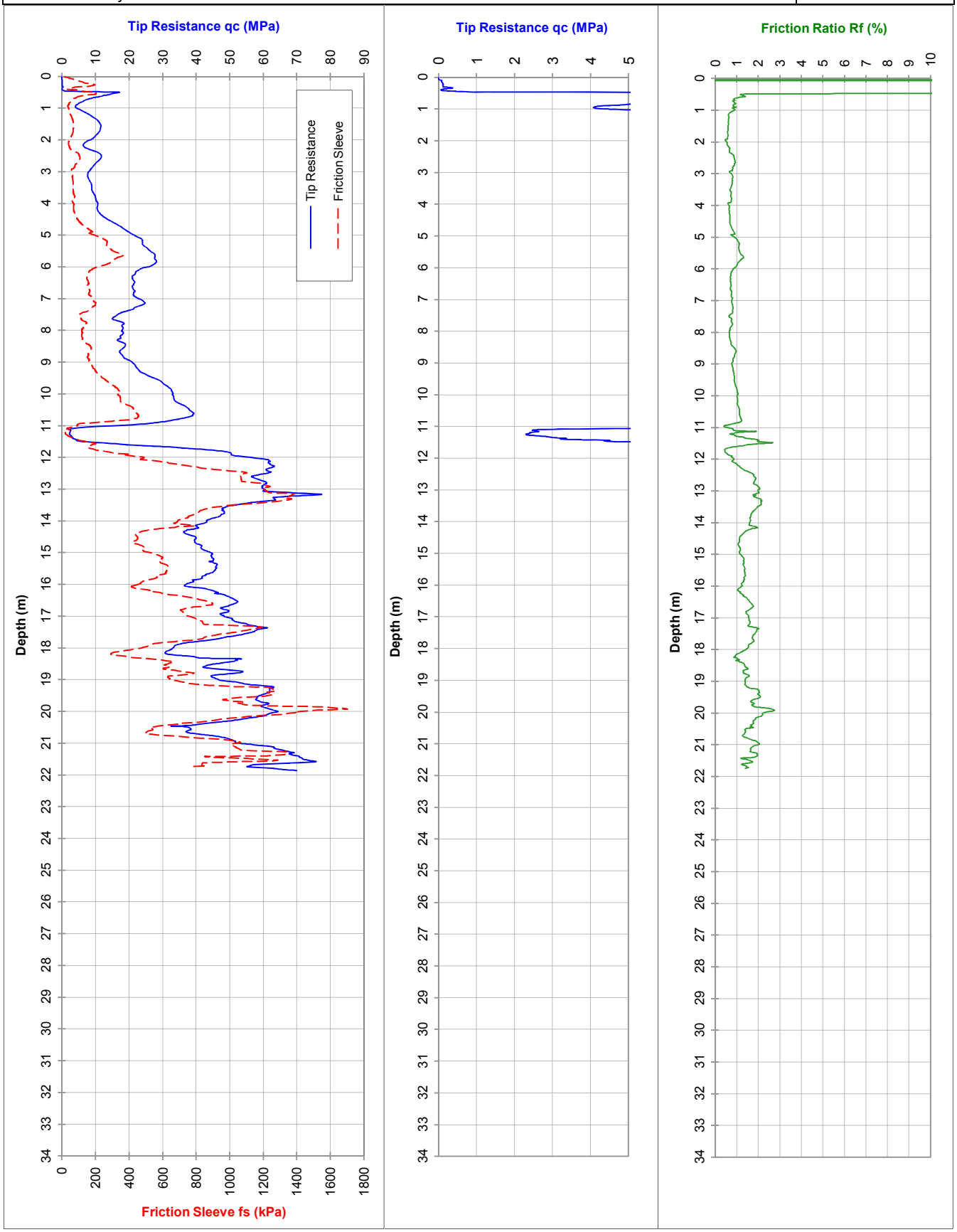
Cone I.D.: EC40

File: GA0778TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT133**
LOCATION: Bayswater	Co-ords:	29-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 0.8

Dummy probe to (m): 0.4

Refusal: 70MPa

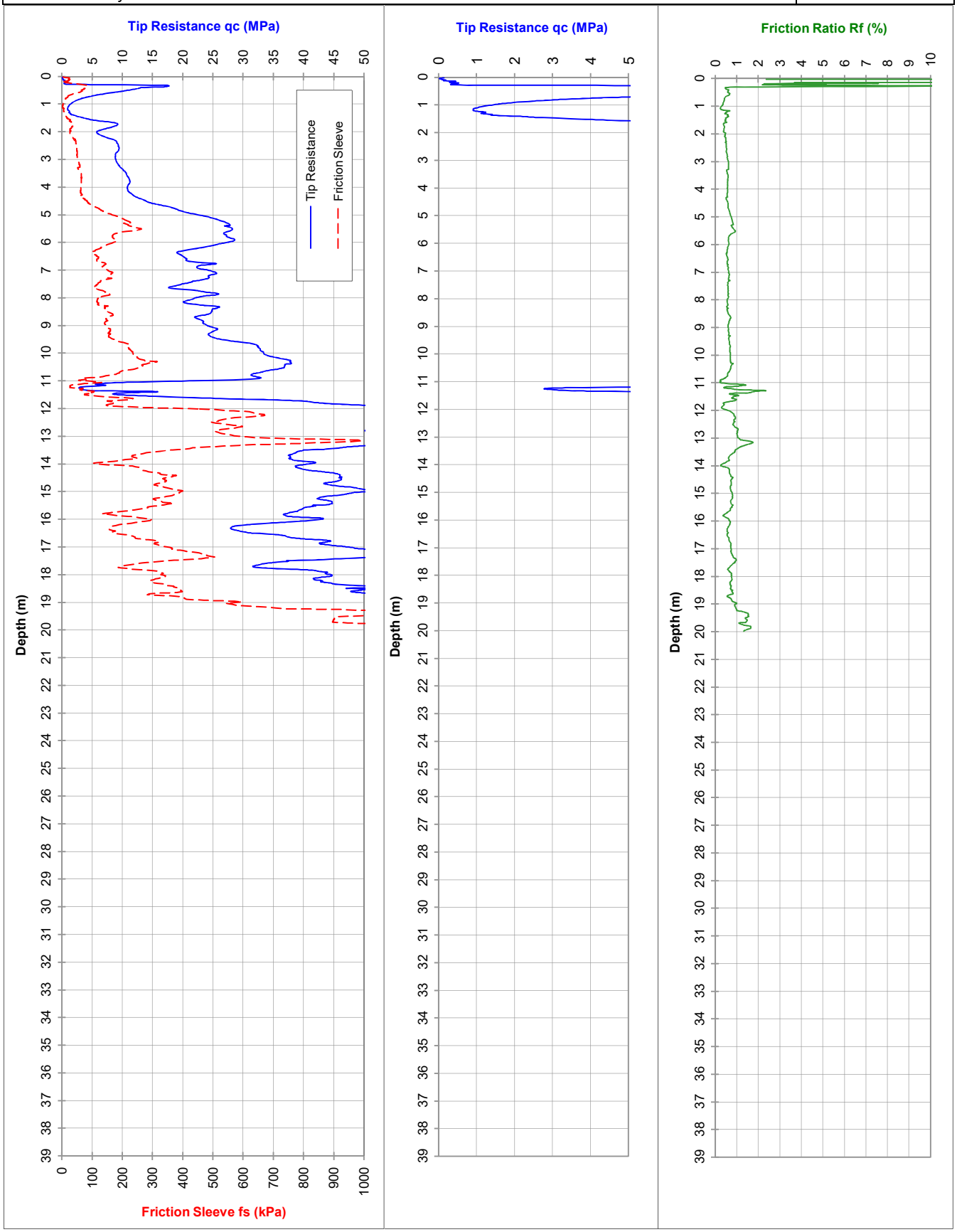
Cone I.D.: EC40

File: GA0779TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT133A**
LOCATION: Bayswater	Co-ords:	3-Aug-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 0.9

Dummy probe to (m): 0.3

Refusal: 90 MPa

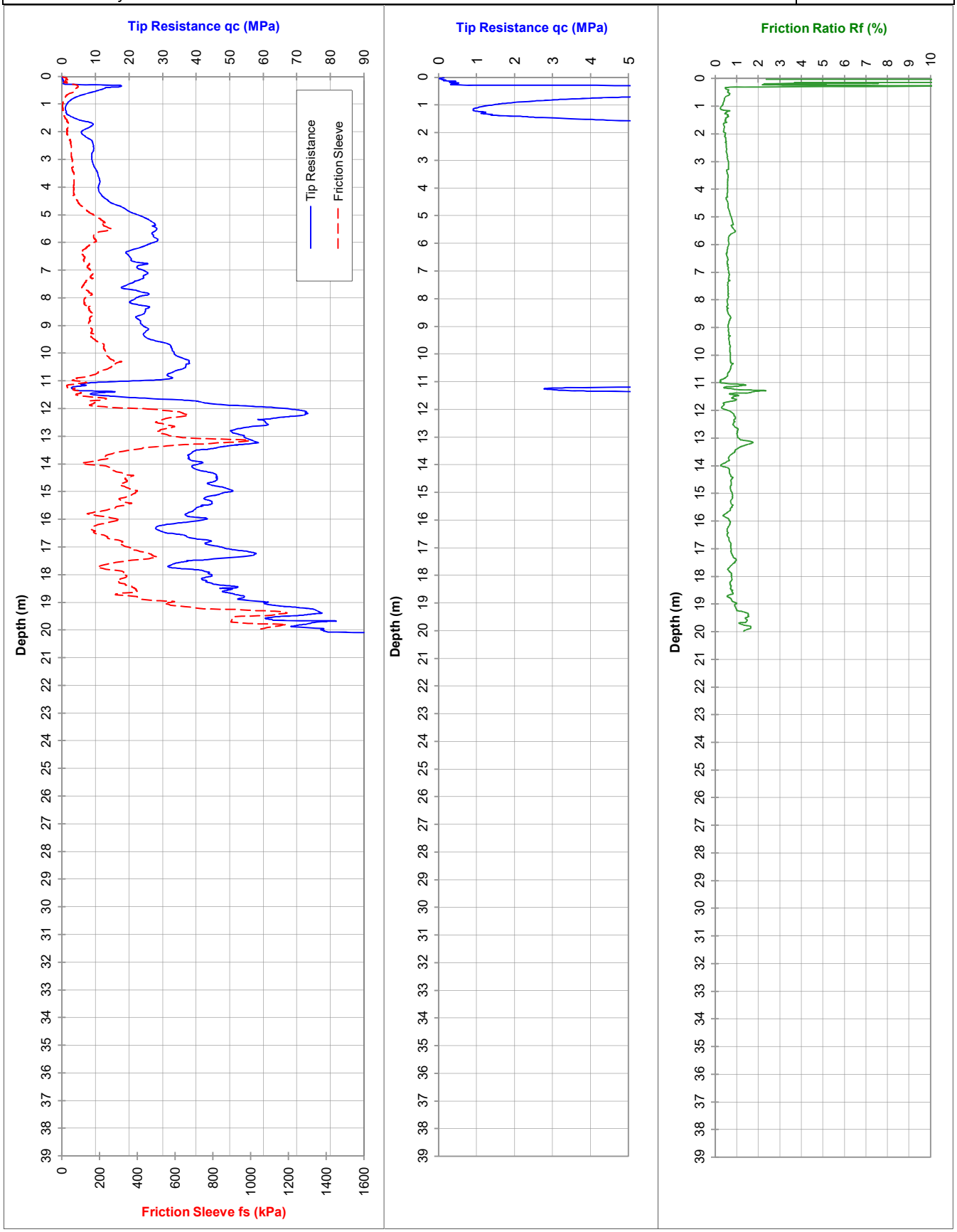
Cone I.D.: EC38

File: GA4245G

Rig Type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT133A**
LOCATION: Bayswater	Co-ords:	3-Aug-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 0.9

Dummy probe to (m): 0.3

Refusal: 90 MPa

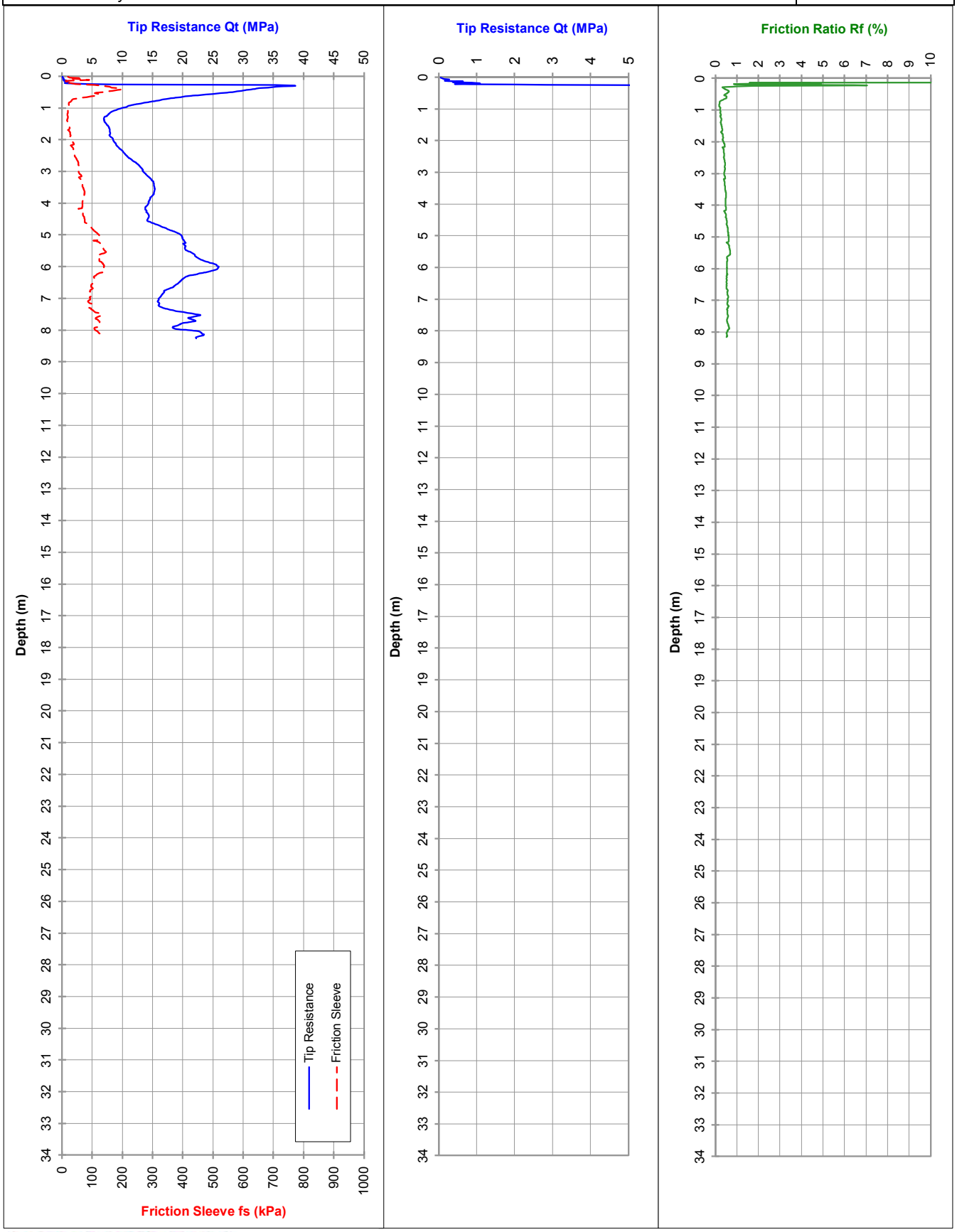
Cone I.D.: EC38

File: GA4245G

Rig Type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**CPTU 134**
LOCATION: Bayswater	Co-ords:	27-Aug-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 2.1

Dummy probe to (m): 0.3

Refusal:

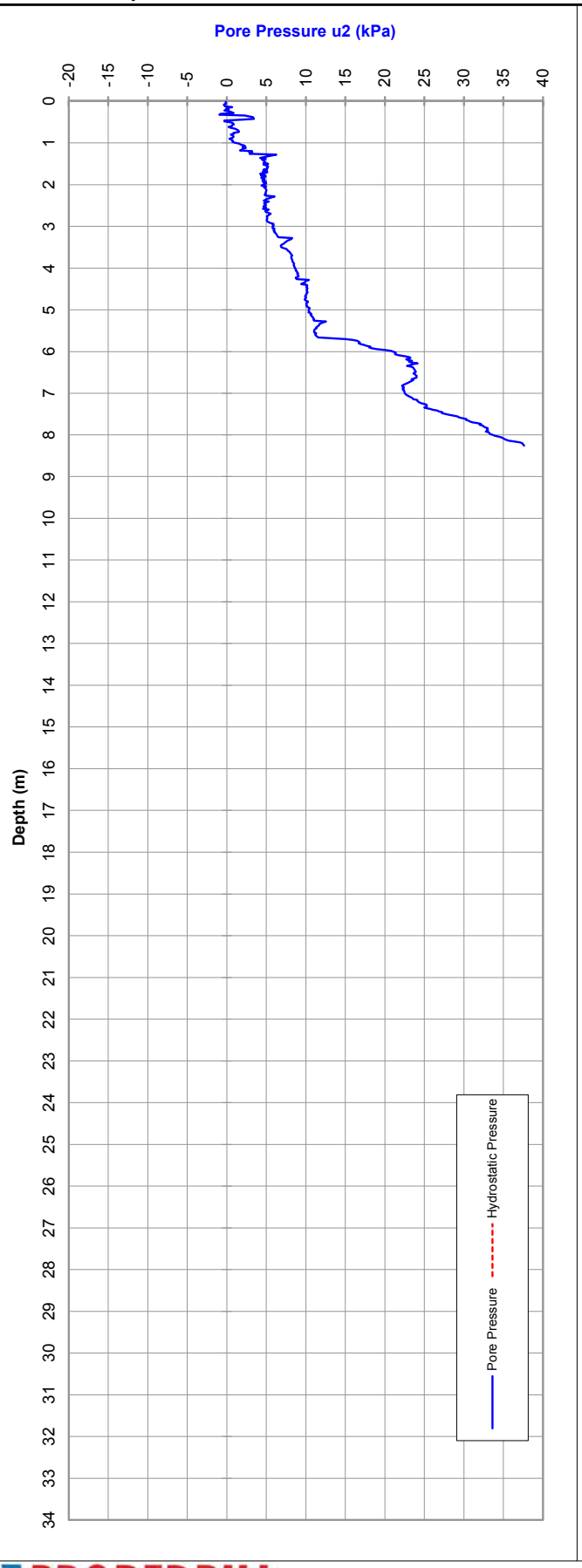
Cone I.D.: EC38

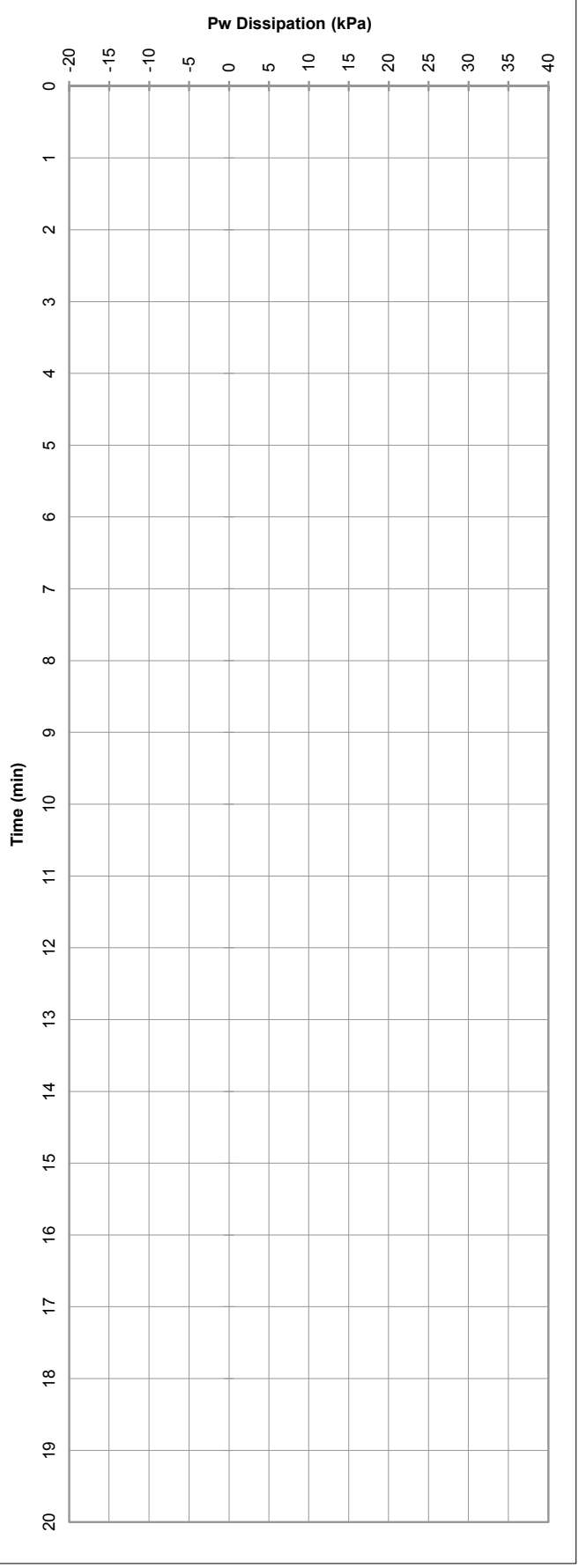
File: GA4250G

Rig Type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**CPTU 134**
LOCATION: Bayswater	Co-ords:	27-Aug-20





PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Please note: Hydrostatic Line is taken from the water level manually dipped by the CPT Operator following completion of the probe and, as such, should be used as a guide only.

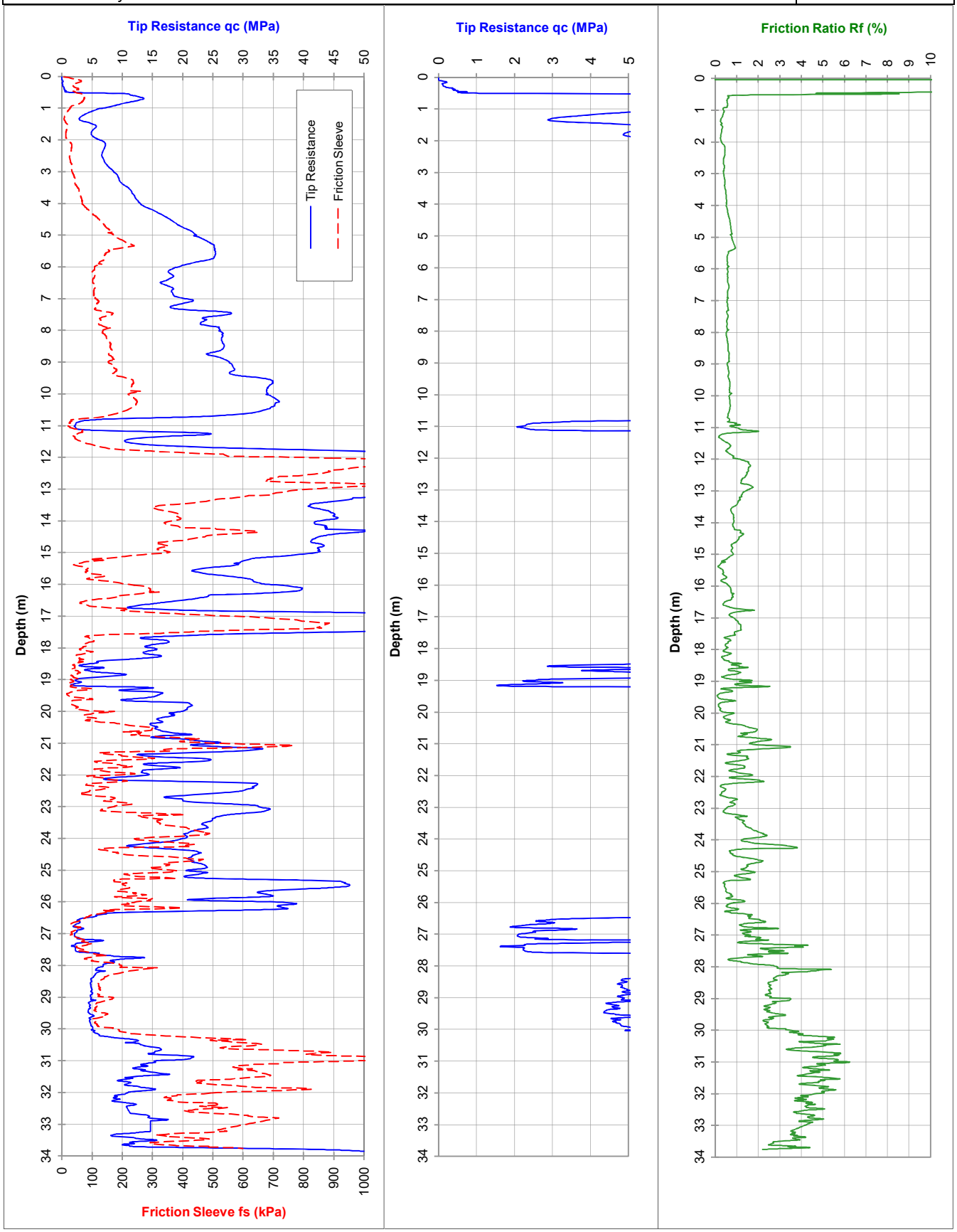
Approx. Water (m): Dry to 2.1

File: GA4250G.txt

Rig type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT135**
LOCATION: Bayswater	Co-ords:	28-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 5.2

Dummy probe to (m): 0.3

Refusal: 50 MPa

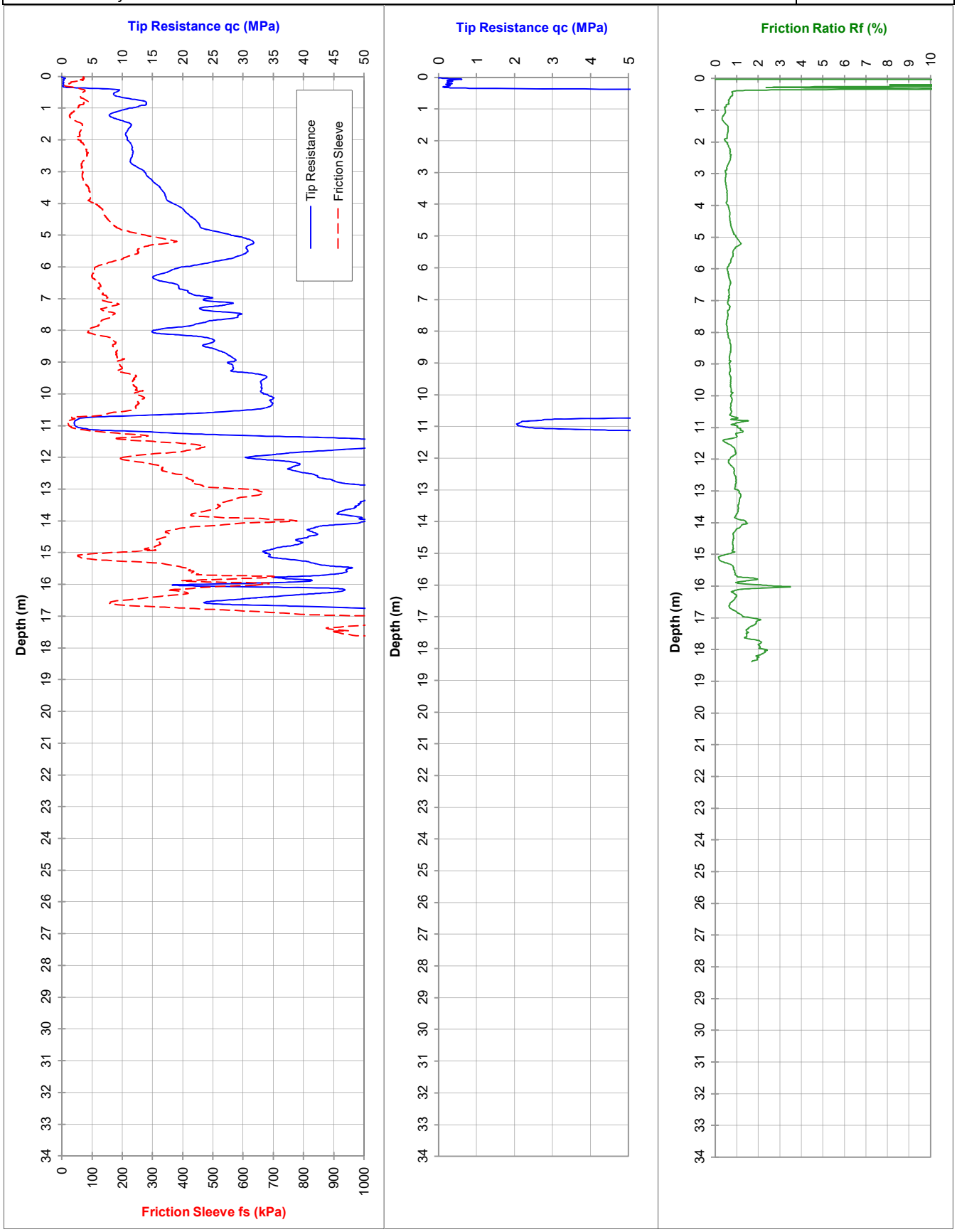
Cone I.D.: EC40

File: GA0771TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT136**
LOCATION: Bayswater	Co-ords:	28-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 0.6

Dummy probe to (m): 0.4

Refusal: 85 MPa

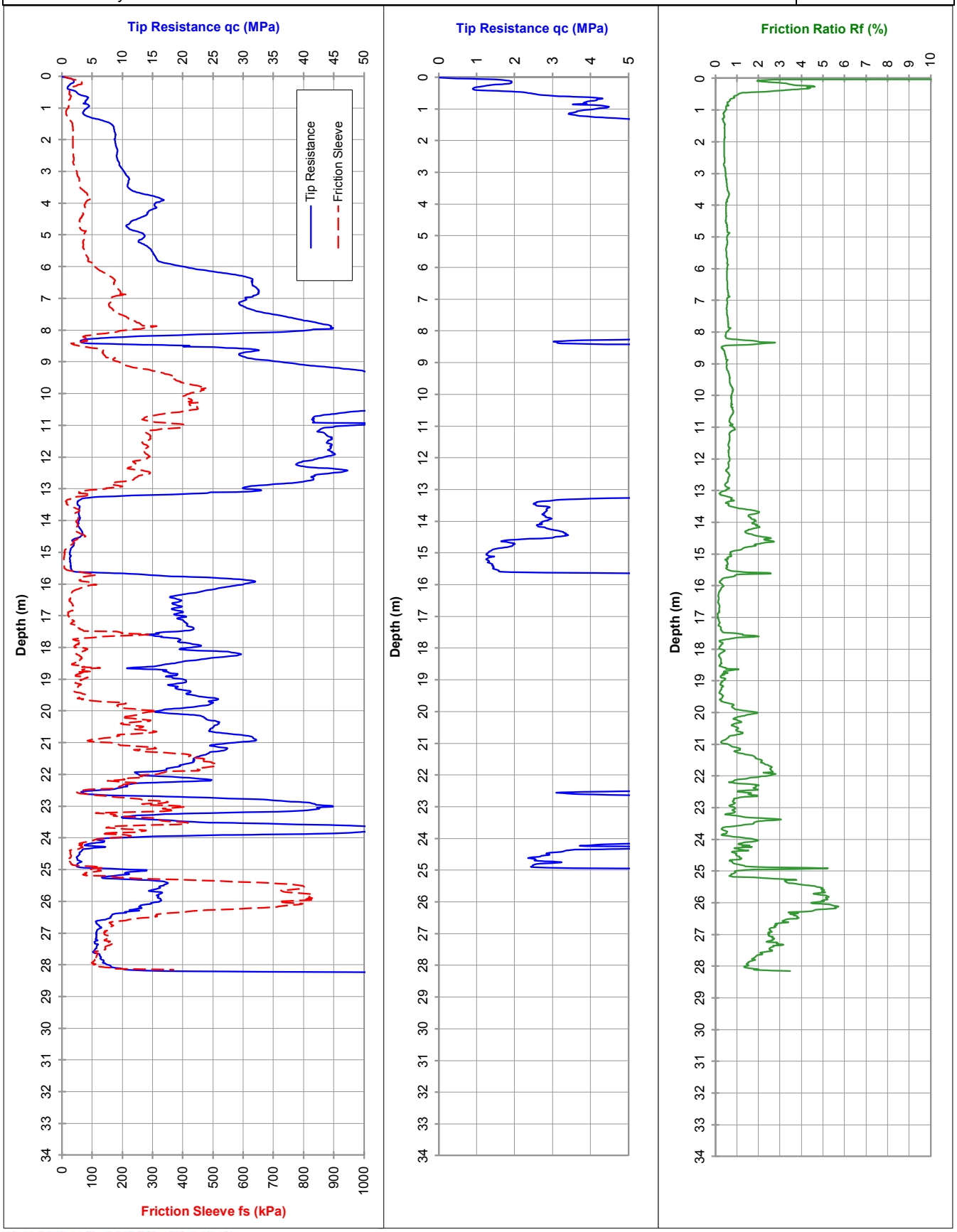
Cone I.D.: EC40

File: GA0772TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT137**
LOCATION: Bayswater	Co-ords:	27-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 3.9

Hand Auger to (m): 1.5

Refusal: 95 MPa

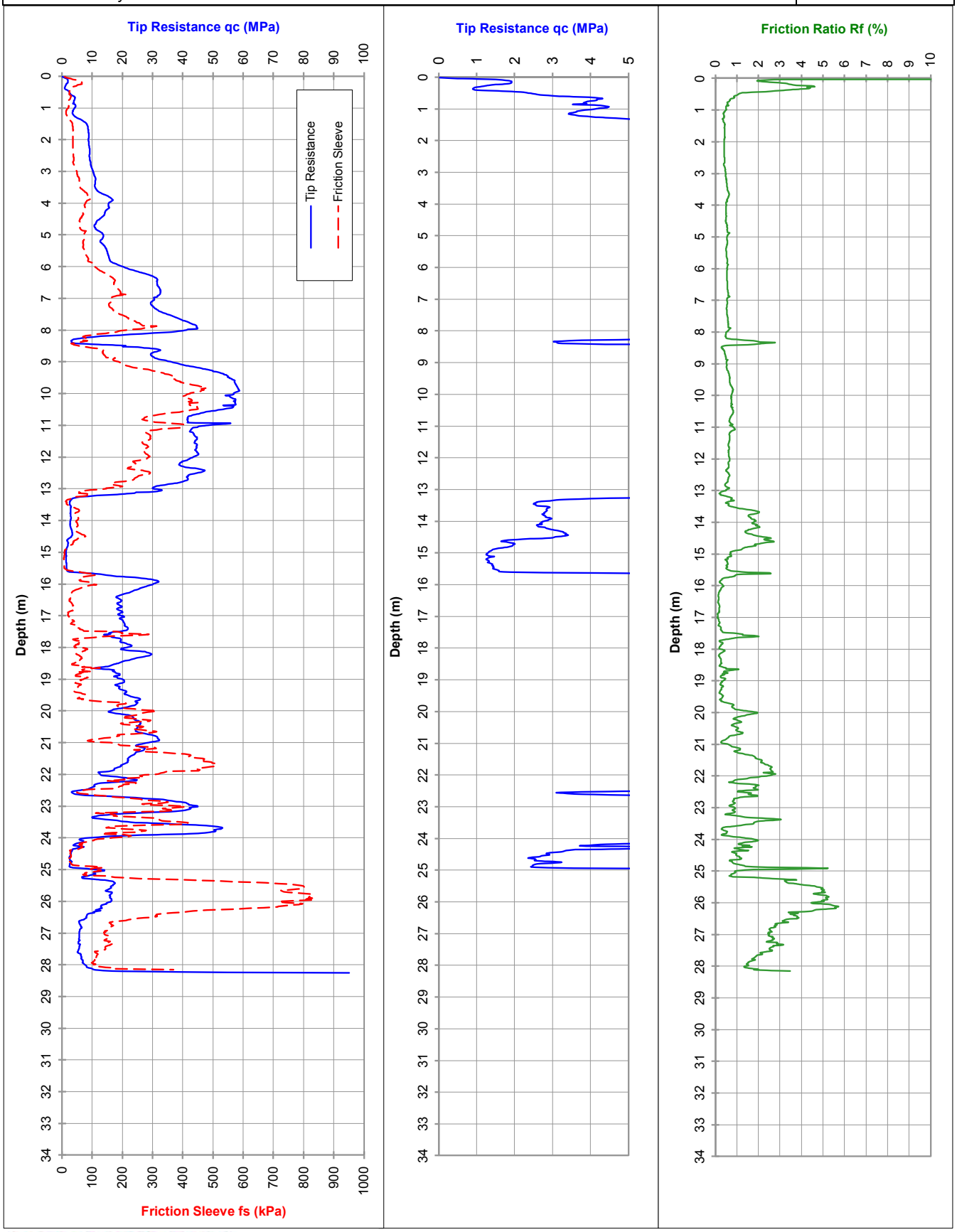
Cone I.D.: EC08

File: GA0765TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT137**
LOCATION: Bayswater	Co-ords:	27-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): 3.9

Hand Auger to (m): 1.5

Refusal: 95 MPa

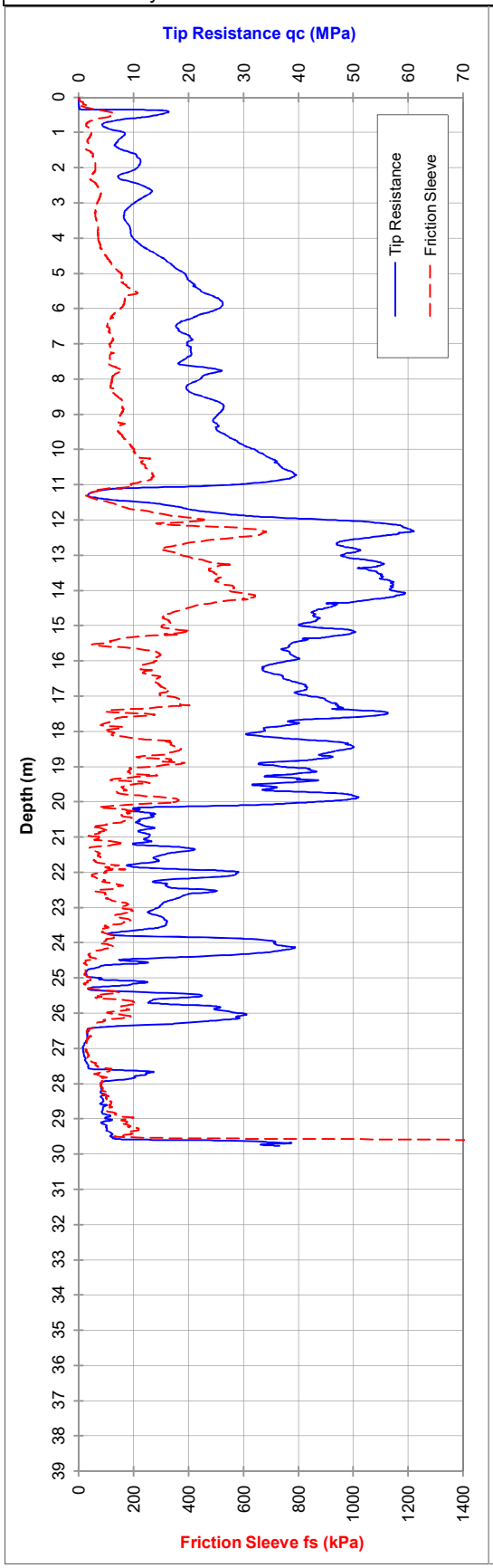
Cone I.D.: EC08

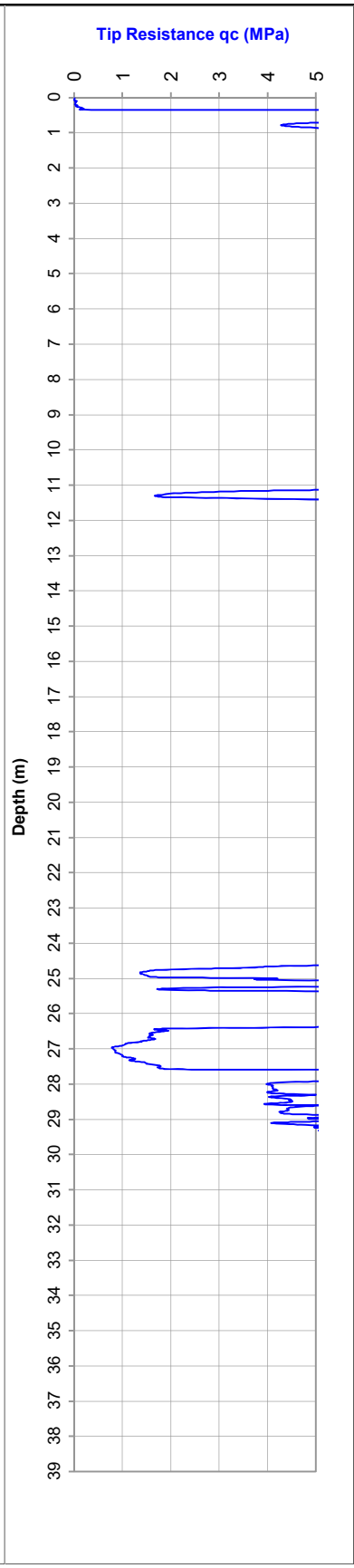
File: GA0765TT

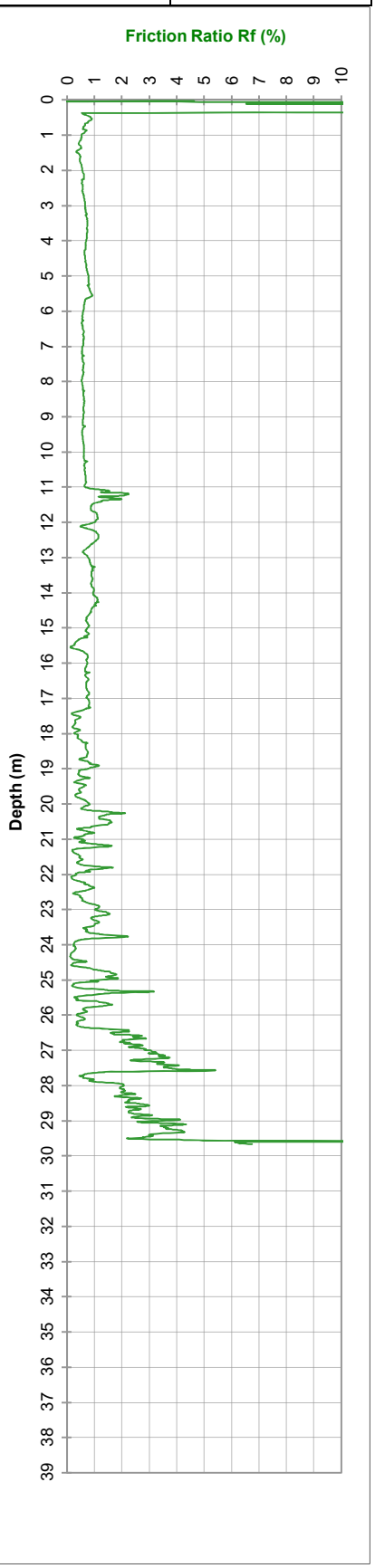
Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT138**
LOCATION: Bayswater	Co-ords:	3-Aug-20







PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 5.3

Dummy probe to (m): 0.3

Refusal: Max FS 2.4k

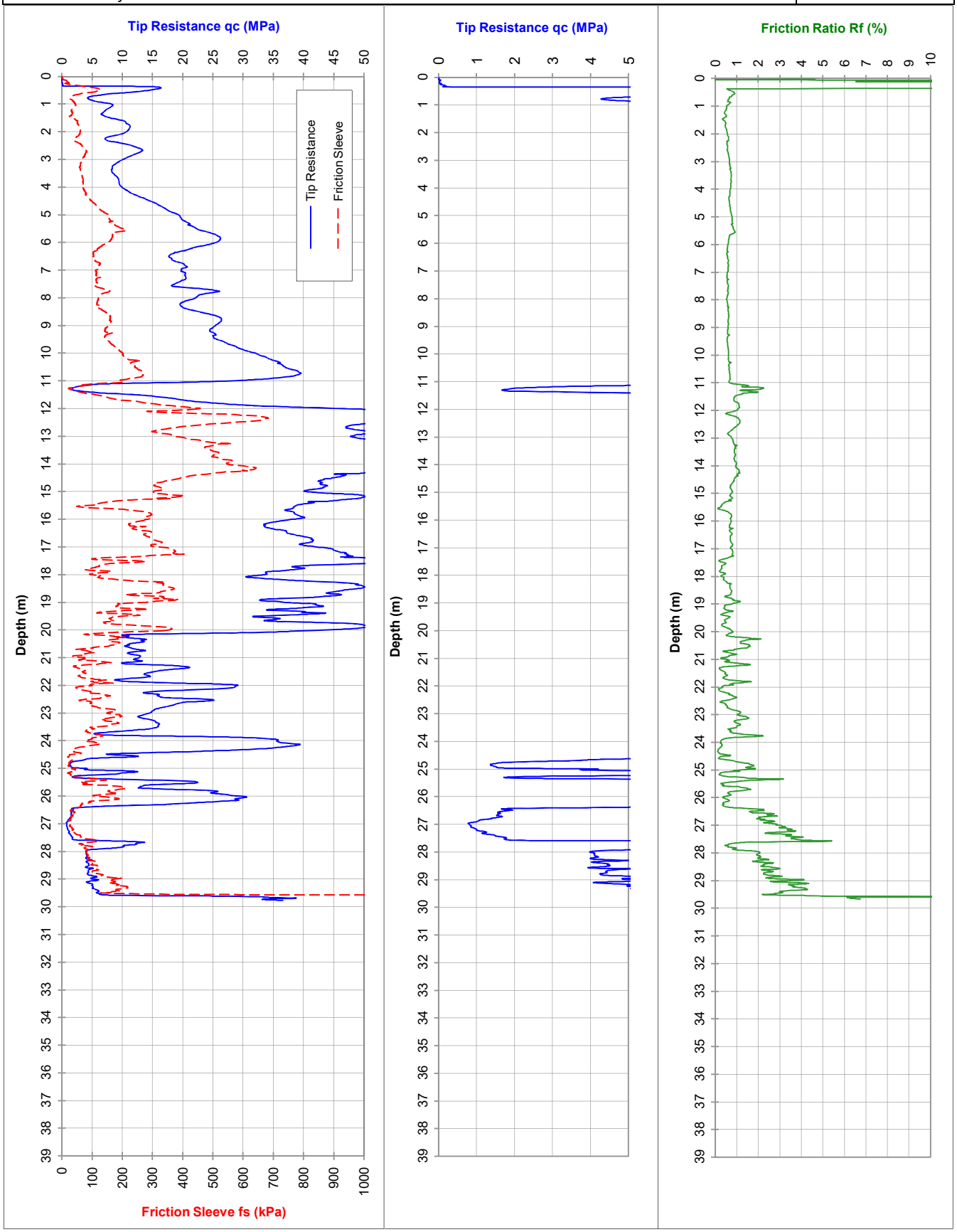
Cone I.D.: EC38

File: GA4244G

Rig Type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT138**
LOCATION: Bayswater	Co-ords:	3-Aug-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 5.3

Dummy probe to (m): 0.3

Refusal: Max FS 2.4k

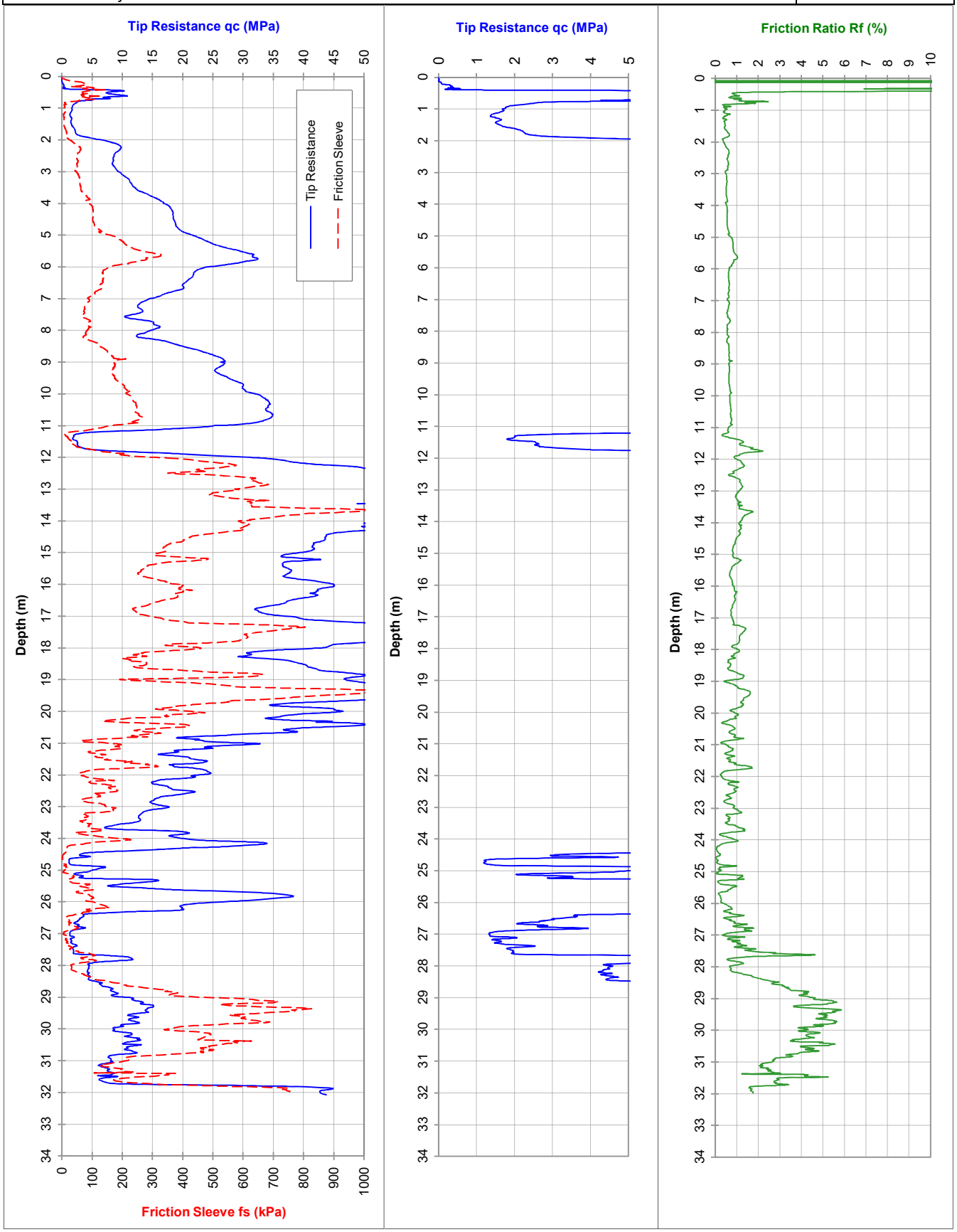
Cone I.D.: EC38

File: GA4244G

Rig Type: 22t truck (Merc)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT139**
LOCATION: Bayswater	Co-ords:	28-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 2.4

Dummy probe to (m): 0.3

Refusal: Rod Friction

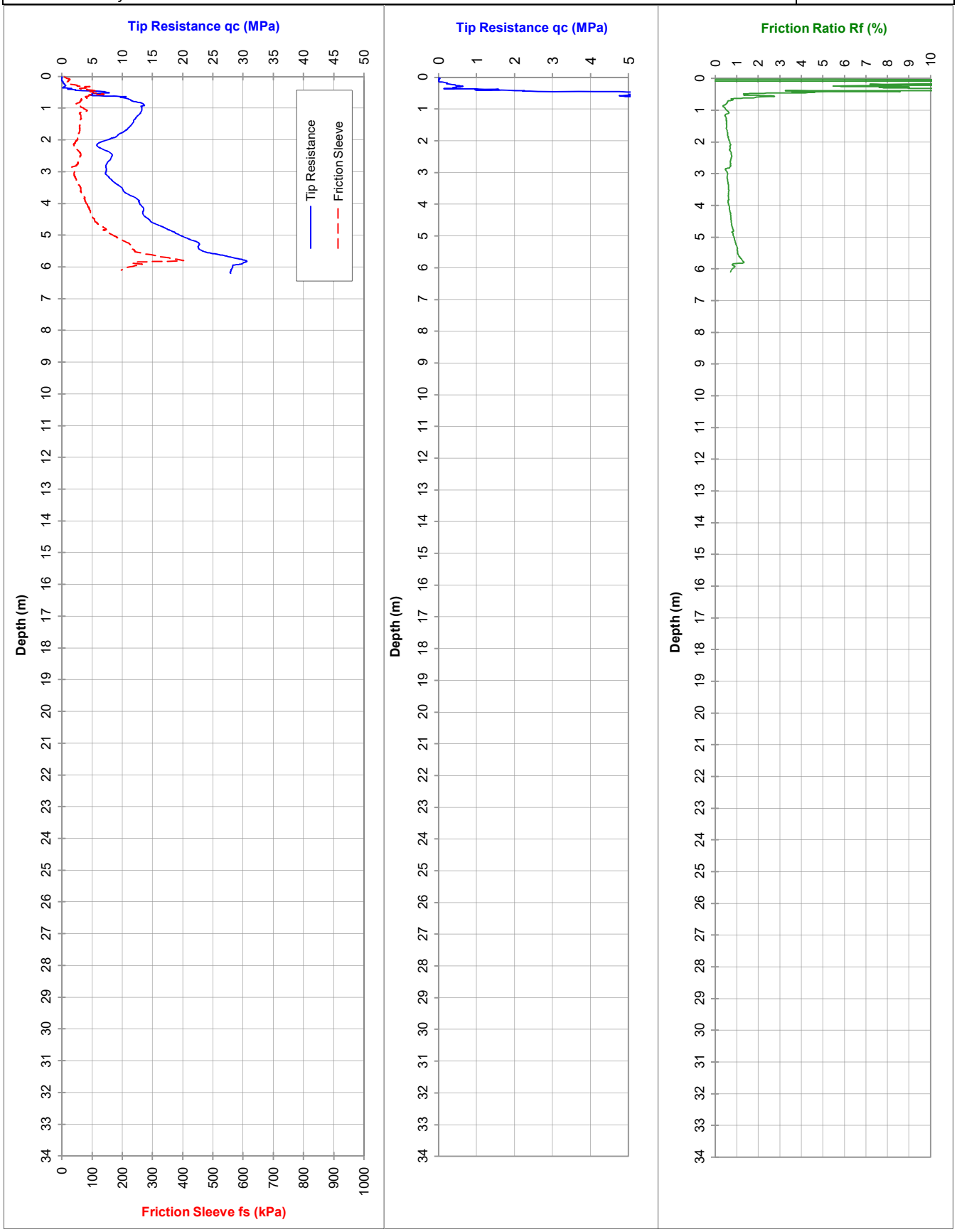
Cone I.D.: EC40

File: GA0773TT

Rig Type: 22t truck (Track-Truck)

ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Evolve Bayswater	Job No.: 19119206	Probe I.D
PROJECT: Bayswater Station	RL (m):	**BWS-CPT140**
LOCATION: Bayswater	Co-ords:	28-Jul-20



PROBEDRILL GEOTECHNICAL SURVEY

Tested in accordance with AS 1289.6.5.1-1999 and IRTP 2001 for friction reducer

Approx. water (m): Dry to 5.7

Dummy probe to (m): 0.3

Refusal:

Cone I.D.: EC40

File: GA0774TT

Rig Type: 22t truck (Track-Truck)

Appendix C – Hand Auger Borehole Reports

REPORT OF HAND AUGERED BOREHOLE: HA12

SHEET: 1 OF 1

CLIENT:	Public Transport Authority	COORDS: 397125.3 m E 6468129.8 m N MGA94 50	
PROJECT:	Bayswater Station and Turnback Project	SURFACE RL: 14.67 m DATUM: AHD	
LOCATION:	Bayswater, WA	INCLINATION: -90°	LOGGED: JK DATE: 4/8/20
JOB NO:	19119206	HOLE DEPTH: 3.00 m	CHECKED: DAB DATE: 9/9/20

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	14.67				SP	SAND fine to coarse grained, rounded to sub-angular, grey black, trace medium to coarse grained, brown gravel (AEOLIAN SOIL)			
				0.50								
			0.5	14.17					fine to medium grained, brown, no gravel			
				1.00								
			1.0	13.67					yellow			
HA	L									D		
				1.50								
			1.5	13.17					pale grey			
			2.0		DS 2.00 m							
			2.5		DS 2.50 m					M		
				3.00								
			3.0	**11.67**	DS 3.00 m				END OF HAND AUGER @ 3.00 m TARGET DEPTH BACKFILLED			
			3.5									
			4.0									
			4.5									
			5.0									

This report of hand augered borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01a
RL3

REPORT OF HAND AUGERED BOREHOLE: HA13

SHEET: 1 OF 1

CLIENT:	Public Transport Authority	COORDS: 397123.3 m E 6468083.4 m N MGA94 50	
PROJECT:	Bayswater Station and Turnback Project	SURFACE RL: 14.98 m DATUM: AHD	
LOCATION:	Bayswater, WA	INCLINATION: -90°	LOGGED: JK DATE: 4/8/20
JOB NO:	19119206	HOLE DEPTH: 3.00 m	CHECKED: DAB DATE: 9/9/20

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	14.98				SP	SAND fine to coarse grained, rounded to sub-angular, black grey (AEOLIAN SOIL)			
				0.50								
			0.5	14.48					fine to medium grained, orange yellow			
				1.00								
			1.0	13.98					pale grey			
HA	L		1.5							D		
			2.0		DS 2.00 m							
				2.50								
			2.5	12.48	DS 2.50 m				dark grey	M		
			3.0	11.98	DS 3.00 m				END OF HAND AUGER @ 3.00 m TARGET DEPTH BACKFILLED			
			3.5									
			4.0									
			4.5									
			5.0									

REPORT OF HAND AUGERED BOREHOLE: HA14

SHEET: 1 OF 1

CLIENT:	Public Transport Authority	COORDS: 397165.7 m E 6468083.5 m N MGA94 50			
PROJECT:	Bayswater Station and Turnback Project	SURFACE RL: 16.84 m DATUM: AHD			
LOCATION:	Bayswater, WA	INCLINATION: -90°	LOGGED: JK	DATE: 4/8/20	
JOB NO:	19119206	HOLE DEPTH: 3.00 m	CHECKED: DAB	DATE: 9/9/20	

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	16.84				SP	SAND fine to coarse grained, sub-rounded to sub-angular, grey, trace rootlets (AEOLIAN SOIL)			
				0.20 16.64					no rootlets			
			0.5	*0.50* 16.34					fine to medium grained, orange yellow			
			1.0							D		
HA	L		1.5	*1.50* 15.34					yellow			
			2.0		DS 2.00 m							
			2.5	*2.50* 14.34	DS 2.50 m				pale yellow	M		
			3.0	13.84	DS 3.00 m				END OF HAND AUGER @ 3.00 m TARGET DEPTH BACKFILLED			
			3.5									
			4.0									
			4.5									
			5.0									

This report of hand augered borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01a
RL3

REPORT OF HAND AUGERED BOREHOLE: HA15

SHEET: 1 OF 1

CLIENT:	Public Transport Authority	COORDS: 397166.3 m E 6468064.6 m N MGA94 50	
PROJECT:	Bayswater Station and Turnback Project	SURFACE RL: 16.22 m DATUM: AHD	
LOCATION:	Bayswater, WA	INCLINATION: -90°	LOGGED: JK DATE: 27/8/20
JOB NO:	19119206	HOLE DEPTH: 3.00 m	CHECKED: DAB DATE: 9/9/20

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0.0	16.22				SP	SAND fine to coarse grained, sub-rounded to sub-angular, yellow brown, with fine to coarse, sub-rounded to angluar, limestone gravel (FILL)			
				0.30 15.92				SP	SAND fine to coarse grained, sub-rounded to sub-angular, pale brown, with fine to coarse, sub-rounded to angluar, brown gravel (AEOLIAN SOIL)			
			0.5	*0.70* 15.52					fine to medium grained, grey			
HA	L		1.0							D		
			1.5									
			2.0	*2.00* 14.22					yellow			
			2.5	*2.50* 13.72					orange			
			3.0	13.22					END OF HAND AUGER @ 3.00 m TARGET DEPTH BACKFILLED			
			3.5									
			4.0									
			4.5									
			5.0									

This report of hand augered borehole must be read in conjunction with accompanying notes and abbreviations. It has been prepared for geotechnical purposes only, without attempt to assess possible contamination. Any references to potential contamination are for information only and do not necessarily indicate the presence or absence of soil or groundwater contamination.

GAP gINT FN. F01a
RL3

Appendix D - Chemical Laboratory Test Certificates

Test ID	Sample Depth (m)	Sulfate, $S0_4^{2-}$ (mg/kg)	Chloride, Cl^- (mg/kg)	pH
HA12	2.0	10	<10	7.0
HA12	2.5	20	10	6.7
HA12	3.0	30	10	6.7
HA13	2.0	10	<10	7.2
HA13	2.5	20	20	7.7
HA13	3.0	20	20	7.1
HA14	2.0	10	<10	6.7
HA14	2.5	<10	<10	6.7
HA14	3.0	<10	<10	6.5

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EP2008370**	Page	: 1 of 4
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: MR DAVID BARRETT	Contact	: Rebecca Shaw
Address	: PO BOX 1914 WEST PERTH WA 6872	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 9213 7600	Telephone	: +61-8-9406 1301
Project	: Bayswater Station	Date Samples Received	: 10-Aug-2020 16:05
Order number	: ----	Date Analysis Commenced	: 17-Aug-2020
C-O-C number	: ----	Issue Date	: 18-Aug-2020 16:32
Sampler	: JOSHUA KYLE		
Site	: ----		
Quote number	: EP/612/20		
No. of samples received	: 9		
No. of samples analysed	: 9		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	HA12 - 2.0m	HA12 - 2.5m	HA12 - 3.0m	HA13 - 2.0m	HA13 - 2.5m
			Client sampling date / time	04-Aug-2020 12:00	04-Aug-2020 12:00	04-Aug-2020 12:00	04-Aug-2020 13:00	04-Aug-2020 13:00
Compound	CAS Number	LOR	Unit	EP2008370-001	EP2008370-002	EP2008370-003	EP2008370-004	EP2008370-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	7.0	6.7	6.7	7.2	7.7
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	4.4	7.2	13.7	4.5	13.8
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	10	20	30	10	20
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	<10	10	10	<10	20

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	HA13 - 3.0m	HA14 - 2.0m	HA14 - 2.5m	HA14 - 3.0m	----
			Client sampling date / time	04-Aug-2020 13:00	04-Aug-2020 14:00	04-Aug-2020 14:00	04-Aug-2020 14:00	----
Compound	CAS Number	LOR	Unit	EP2008370-006	EP2008370-007	EP2008370-008	EP2008370-009	--------
				Result	Result	Result	Result	----
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	**7.1**	**6.7**	**6.7**	**6.5**	**----**
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**13.2**	**3.4**	**3.3**	**3.9**	**----**
ED040S : Soluble Sulfate by ICPAES								
Sulfate as SO4 2-	14808-79-8	10	mg/kg	**20**	**10**	<10	<10	**----**
ED045G: Chloride by Discrete Analyser								
Chloride	16887-00-6	10	mg/kg	**20**	<10	<10	<10	**----**

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EP2008370**	Page	: 1 of 3
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: MR DAVID BARRETT	Contact	: Rebecca Shaw
Address	: PO BOX 1914 WEST PERTH WA 6872	Address	: 26 Rigali Way Wangara WA Australia 6065
Telephone	: +61 08 9213 7600	Telephone	: +61-8-9406 1301
Project	: Bayswater Station	Date Samples Received	: 10-Aug-2020
Order number	: ----	Date Analysis Commenced	: 17-Aug-2020
C-O-C number	: ----	Issue Date	: 18-Aug-2020
Sampler	: JOSHUA KYLE		
Site	: ----		
Quote number	: EP/612/20		
No. of samples received	: 9		
No. of samples analysed	: 9		

ilac-MRA NATA
Accreditation No. 825
Accredited for compliance with ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Canhuang Ke	Inorganics Supervisor	Perth Inorganics, Wangara, WA

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EA002: pH 1:5 (Soils) (QC Lot: 3202179)									
EP2008321-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	9.2	9.2	0.00	0% - 20%
EP2008370-008	HA14 - 2.5m	EA002: pH Value	----	0.1	pH Unit	6.7	6.6	0.00	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 3202168)									
EP2008370-001	HA12 - 2.0m	EA055: Moisture Content	----	0.1	%	4.4	4.1	7.79	No Limit
ED040S: Soluble Major Anions (QC Lot: 3202181)									
EP2008370-001	HA12 - 2.0m	ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	10	<10	0.00	No Limit
ED045G: Chloride by Discrete Analyser (QC Lot: 3202180)									
EP2008370-001	HA12 - 2.0m	ED045G: Chloride	16887-00-6	10	mg/kg	<10	<10	0.00	No Limit

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA002: pH 1:5 (Soils) (QCLot: 3202179)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	99.8	70.0	130
				----	7 pH Unit	99.4	70.0	130
ED040S: Soluble Major Anions (QCLot: 3202181)								
ED040S: Sulfate as SO4 2-	14808-79-8	10	mg/kg	<10	250 mg/kg	102	91.8	114
ED045G: Chloride by Discrete Analyser (QCLot: 3202180)								
ED045G: Chloride	16887-00-6	10	mg/kg	<10	50 mg/kg	104	88.0	115
				<10	5000 mg/kg	106	88.0	115

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
ED045G: Chloride by Discrete Analyser (QCLot: 3202180)							
EP2008370-002	HA12 - 2.5m	ED045G: Chloride	16887-00-6	5000 mg/kg	102	70.0	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EP2008370**	Page	: 1 of 5
Client	: **GOLDER ASSOCIATES**	Laboratory	: Environmental Division Perth
Contact	: MR DAVID BARRETT	Telephone	: +61-8-9406 1301
Project	: Bayswater Station	Date Samples Received	: 10-Aug-2020
Site	: ----	Issue Date	: 18-Aug-2020
Sampler	: JOSHUA KYLE	No. of samples received	: 9
Order number	: ----	No. of samples analysed	: 9

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002: pH 1:5 (Soils)						
Snap Lock Bag						
HA12 - 2.0m, HA12 - 2.5m, HA12 - 3.0m, HA13 - 2.0m, HA13 - 2.5m, HA13 - 3.0m, HA14 - 2.0m, HA14 - 2.5m, HA14 - 3.0m	18-Aug-2020	11-Aug-2020	**7**	----	----	----

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002: pH 1:5 (Soils)							
Snap Lock Bag (EA002)							
HA12 - 2.0m, HA12 - 2.5m, HA12 - 3.0m, HA13 - 2.0m, HA13 - 2.5m, HA13 - 3.0m, HA14 - 2.0m, HA14 - 2.5m, HA14 - 3.0m	**04-Aug-2020**	**18-Aug-2020**	11-Aug-2020	×	**18-Aug-2020**	18-Aug-2020	✓
EA055: Moisture Content (Dried @ 105-110°C)							
Snap Lock Bag (EA055)							
HA12 - 2.0m, HA12 - 2.5m, HA12 - 3.0m, HA13 - 2.0m, HA13 - 2.5m, HA13 - 3.0m, HA14 - 2.0m, HA14 - 2.5m, HA14 - 3.0m	**04-Aug-2020**	**----**	----	----	**17-Aug-2020**	18-Aug-2020	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED040S : Soluble Sulfate by ICPAES							
Snap Lock Bag (ED040S)							
HA12 - 2.0m, HA12 - 2.5m, HA12 - 3.0m, HA13 - 2.0m, HA13 - 2.5m, HA13 - 3.0m, HA14 - 2.0m, HA14 - 2.5m, HA14 - 3.0m	**04-Aug-2020**	**18-Aug-2020**	01-Sep-2020	✓	**18-Aug-2020**	15-Sep-2020	✓
ED045G: Chloride by Discrete Analyser							
Snap Lock Bag (ED045G)							
HA12 - 2.0m, HA12 - 2.5m, HA12 - 3.0m, HA13 - 2.0m, HA13 - 2.5m, HA13 - 3.0m, HA14 - 2.0m, HA14 - 2.5m, HA14 - 3.0m	**04-Aug-2020**	**18-Aug-2020**	01-Sep-2020	✓	**18-Aug-2020**	15-Sep-2020	✓

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chloride Soluble By Discrete Analyser	ED045G	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	1	9	**11.11**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chloride Soluble By Discrete Analyser	ED045G	2	9	**22.22**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chloride Soluble By Discrete Analyser	ED045G	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Major Anions - Soluble	ED040S	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Chloride Soluble By Discrete Analyser	ED045G	1	9	**11.11**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Major Anions - Soluble	ED040S	SOIL	In house: Soluble Anions are determined off a 1:5 soil / water extract by ICPAES.
Chloride Soluble By Discrete Analyser	ED045G	SOIL	In house: Referenced to APHA 4500-Cl- E. The thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by the chloride ion to form non-ionised mercuric chloride.in the presence of ferric ions the librated thiocynate forms highly-coloured ferric thiocynate which is measured at 480 nm. Analysis is performed on a 1:5 soil / water leachate.

Preparation Methods	Method	Matrix	Method Descriptions
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Appendix M

Construction Environmental Management Plan prepared by Evolve Bayswater

Construction Environmental Management Plan

BST-EVO-EN-PLN-00003 (PTA DOCUMENT NUMBER)

Contractor Name	evolve bayswater *connecting people + places*				
Contractor Document No.	BST-EVO-EN-PLN-00003				
Contractor Revision	0	**No. of Pages**	111	**Contract No.**	PTA190037

PTA Revision	Submission Date	Description	Evolve Representative Approval	PTA Representative Approval
0	27/07/2020	Issued for Approval	Jason Flowerdew	

Status Information		
Approval Status	**TeamBinder Code**	**Description**
☐ **APPROVED**	**APP**	Work may proceed and no additional changes required
☐ **CONDITIONALLY APPROVED**	**CAPP**	Work may proceed for the portions not subjected to conditions or comments specified in the Review Comment Sheet. The document shall be revised and resubmitted for final approval within the timeframe specified by the Principal in the Review Comment Sheet.
☐ **ACCEPTED**	**ACC**	The design may proceed for the related design works and no additional changes required.
☐ **ACCEPTED WITH AMENDMENTS**	**ACC-AMD**	The design may proceed for the related design works. The design deliverable shall be amended and resubmitted for final acceptance within the time frame specified by the Principal in the Review Comment Sheet.
☐ **REJECTED, REVISE AND RESUBMIT**	**REJ-RSB**	The document contains significant gaps, errors and/or departures compared with the Contract requirements. The document shall be revised and resubmitted for approval before work may proceed.
☐ **REJECTED**	**REJECTED**	The document contains significant gaps, errors and/or departures compared with the Contract requirements. For quality reasons, PTA have declined to conduct a formal review of this submission.

NB: AUTHORISATION TO PROCEED DOES NOT RELIEVE THE CONTRACTOR OF ANY RESPONSIBILITY OR LIABILITY UNDER THE CONTRACT/PO

The related Document **Review Comments Sheet** may be located by clicking the linked documents icon: "🔗" next to the Document No. in the TeamBinder Documents register.

evolve bayswater
connecting people + places

PTA

BAYSWATER STATION AND TURNBACK

RFP: PTA190037

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

BST-EVO-EN-PLN-00003

AUTHORISED TO USE: _____ (ALLIANCE MANAGER)
DATE: 27-7-26

Submit to Client for Review and Approval where required in the Contract (Client to complete one box only):					
❑	Rejected, resubmit		Name:	Sign:	Date:
❑	Endorsed, with comments to add or change		Name:	Sign:	Date:
❑	Endorsed		Name:	Sign:	Date:
Rev	**Date**	**Reason for Issue**	**Prepared**	**Checked**	**Approval**
A	28/11/19	Outline – AD Stage	C. Hewitt	P. Zuvela	J.Flowerdew
B	29/05/20	Issued for Review	C. Hewitt P. Lee	T. Dunsire	J. Flowerdew
C	20/07/20	Updated with PTA comments	C.Hewitt	T. Dunsire K.O'Mara	J. Flowerdew

Table of Contents

Compliance Matrix 6
Abbreviations and Acronyms 15
Figures in Text 16
Tables in Text 16
Figures Attached 17
1.0 Background 18
1.1 METRONET 18
1.2 Bayswater Station and Turnback Project 18
1.2.1 Stage One: Turnback Works 18
1.2.2 Stage Two: The Bayswater Station Southern Section 19
1.2.3 Stage Three: The Bayswater Station Northern Section 19
1.2.4 Optional Works Packages 19
1.2.5 Forward Works Contracts 19
2.0 Purpose and Structure 20
2.1 Purpose 20
2.2 Scope of this Plan 20
2.3 Structure and Content 20
3.0 Statement of Responsibilities and Acknowledgement 21
3.1 Alliance Organisation 21
3.2 Alliance Leadership Team 23
3.3 Alliance Management Team 23
3.4 Alliance Project Personnel 23
4.0 Review 27
4.1 Management Review 28
4.2 Management Approval 28
4.3 Issue 28
5.0 Environmental Management Framework 29
5.1 Alliance Environmental Management System 29
5.2 Policies 29
5.3 Objectives and Targets 30
6.0 Evolve Bayswater System Documentation 32
7.0 Site Information 33
7.1 Site Identification 33
8.0 Environmental Setting 33
8.1 Topography 33
8.2 Geology 34
8.2.1 Published Geology 34
8.2.2 Site Specific Geology and Subsurface Conditions 34

8.3 Acid Sulphate Soils 35
8.3.1 Published Mapping 35
8.4 Hydrogeology 35
8.4.1 Regional Hydrogeology 35
8.4.2 Site Specific Groundwater Data 35
8.4.3 Licensed Groundwater Abstraction Bores 36
8.5 Hydrology 37
8.5.1 Surface Water Drainage 38
8.6 Flora and Vegetation 38
8.6.1 General 38
8.6.2 Conservation Significance 38
8.6.3 Vegetation Description and Condition 38
8.7 Fauna 38
8.7.1 General 39
8.7.2 Conservation Significance 39
8.8 Contaminated Sites 39
9.0 Environmental Planning 40
9.1 Aspects and Impacts 41
9.1.1 Environmental and Heritage Risk Workshop 41
9.2 Legal and Other Requirements 41
9.3 Timing of Construction Activities 41
10.0 Implementation and Operation 43
10.1 Communication, Consultation and Participation 43
10.1.1 Stakeholder Engagement and Consultation 43
10.1.2 Communications 43
10.1.2.1 Stakeholders 43
10.1.2.2 Alliance Team 44
10.1.2.3 Site Personnel 45
10.2 Environmental Record Keeping 46
10.2.1 Document Control 46
10.2.2 Environmental Registers 46
10.2.3 Permit System 46
10.3 Health and Safety 46
10.3.1 Training and Competency 46
10.3.2 Induction and Orientation 47
10.3.3 Management of Subcontractors 47
11.0 Access and Security 48
11.1 Traffic Management 48
11.2 Construction and Exclusion Zones 48
11.2.1.1 Rail Reserve 48

12.0 Fauna Management Plan 48
12.1 Existing Habitat and Species 48
12.2 Purpose 49
12.3 Objectives 49
12.4 Management Strategies 50
12.5 Contingency Management Strategies 53
13.0 Vegetation Management Plan 54
13.1 Existing Vegetation 54
13.2 Purpose 54
13.3 Approvals 54
13.4 Objectives 55
13.5 Management Strategies 55
13.6 Contingency Management Strategies 56
14.0 Demolition Management 56
14.1 Hazardous Materials 57
14.2 Underground Services 58
14.3 Unexpected Finds 58
15.0 Soil Management 59
15.1 Potential Environmental Impacts 59
15.2 ASS Management 59
15.3 Clearing and Topsoil Management 61
15.4 Land Rehabilitation and Demobilisation 61
15.5 Imported Fill Management 62
15.6 Material Reuse Management 63
15.7 Contaminated Soil Management 63
15.7.1 Objectives, Targets and Key Performance Indicators 64
15.7.2 Management, Monitoring, Reporting and Contingencies 64
15.8 Material Tracking Register 65
16.0 Unexpected Finds Management 68
16.1 General Management Strategy 68
16.2 Objectives, Targets and Key Performance Indicators 68
16.3 Management, Monitoring, Reporting and Contingencies 68
17.0 Waste Management 70
17.1 Objectives, Targets and Key Performance Indicators 70
17.2 Management, Monitoring, Reporting and Contingencies 70
18.0 Dewatering Management 73
18.1 Objectives, Targets and Key Performance Indicators 73
18.2 Management, Monitoring, Reporting and Contingencies 73
19.0 Stormwater and Surface Water Management 76
19.1 Objectives, Targets and Key Performance Indicators 76

19.2 Management, Monitoring, Reporting and Contingencies 76
20.0 Construction Noise and Vibration Management Plan 79
20.1 Objectives, Targets and Key Performance Indicators 79
20.2 Management, Monitoring, Reporting and Contingencies 79
20.3 Out of Hours Public Notification 82
21.0 Heritage Management Plan 83
21.1 Aboriginal Heritage Sites 83
21.1.1 Known Sites 83
21.1.2 Unknown Sites 84
21.2 Site Disturbance Process 84
21.2.1 Site Monitors 84
21.2.2 Observe, Secure, Report, Authenticate, Consult and Agree (OSRACA) 84
21.3 European Heritage 86
21.4 Skeletal Finds 88
22.0 Air Quality Management Plan 89
22.1 Objectives, Targets and Key Performance Indicators 89
22.2 Management, Monitoring, Reporting and Contingencies 89
23.0 Other Environmental Procedures And Guidelines 93
24.0 Emergency Response Management 93
24.1 Emergency Response Management Plan 93
25.0 Monitoring and Measurement 93
26.0 Incidents and Incident Reporting 93
27.0 Non-Conformance and Corrective Actions 94
27.1 Non-Conformance 94
27.2 Non-Conformance correction period Environmental Management 94
27.3 Corrective and Preventative Actions 95
28.0 Project Handover and Decommissioning Requirements 95
28.1 Handover 95
28.2 Close-Out Report 95
28.3 Lesson Learned 95
29.0 Inspection, Auditing, Monitoring and Review 96
29.1 External Audits 96
29.2 Internal Audits 96
29.3 Inspections 97
29.3.1 Daily Visual Environmental Inspections 97
29.3.2 Fortnightly Environmental Inspections 97
30.0 Environmental Performance Reporting And Monitoring 98
30.1 Monthly Reports 98
30.2 Annual Greenhouse and Energy Reporting 99
30.3 Environmental Close-out Report 99

References 100
Figures 101
Appendix A – Environmental Management Policy 102
Appendix B – Site Identification Details 103
Appendix C – EMS Certification 105
Appendix D – Detailed Scope of Work 106
Appendix E Legislation Reference Register 110

Compliance Matrix

SWTC Reference	Description	Section in this Plan
8.1 - GENERAL		
Book 2 Cl 8.1.1	The Alliance must produce a CEMP that describes how the Alliance will satisfy all of the environmental requirements of the PAA, the SWTC and the conditions of all environmental approvals received. The CEMP must also include a description of how the Alliance will satisfy all requirements identified in this section: Book 2—section 8, Construction Environmental Management Plan.	All sections
Book 2 Cl 8.1.2	The CEMP must comply with PTA Doc No. 9302-000-001 "Environment Policy", the relevant measures contained within the PTA's "Environmental Management System Manual" and the principles of ISO 14001 – Environmental Management Systems. The Alliance must plan, establish, implement and maintain a documented environmental management system to be compliant with and accredited to AS/NZS ISO 14001 until two years after Practical Completion.	2.3 and 5.2
Book 2 Cl 8.1.3	The CEMP to be prepared by the Alliance must meet the requirements of their AS/NZS ISO 14001 certified environmental management system, the PTA's Environmental Management System Manual and "Instructions on how to prepare EP Act Part IV environmental management plans" (EPA, April 2018).	2.3
Book 2 Cl 8.1.4	The CEMP must include the following:	
Book 2 Cl 8.1.4(i)	Alliance Environmental Policy	Appendix A
Book 2 Cl 8.1.4 (ii)	with regards to planning: A) aspects and impacts B) legal and other requirements C) timing of construction activities; and D) Alliance's environmental and heritage risk assessment.	9.0 9.2 9.1.1
Book 2 Cl 8.1.4 (iii)	implementation and operation including: A) roles and responsibilities of relevant Alliance Personnel B) competence, Training and awareness (including inductions); C) Alliance's environmental management of Subcontractors; D) Project communication - internal and external (pre-start meetings, toolbox meetings, post-shift debrief meetings, posting of Project specific environmental information on noticeboards and environment and heritage progress meetings between the Alliance and the PTA's Representative); E) control of documents; and F) detailed maps of proposed construction zones; for any work and exclusion zones (eg. high conservation areas, Aboriginal heritage sites).	A) 3.0 B) 10.1.1 and 10.3 C) 10.3.3 D) 10.1.2.2 E) 10.2.1 F) 9.3
Book 2 Cl 8.1.4 (iv)	environmental management operational controls including: A) ground disturbance management (including vegetation clearing and flora management);	A) 12.0,13.0,14.0 B) 13.4

SWTC Reference	Description	Section in this Plan
	B) weed management (including hygiene management program to minimise the spread of weeds and dieback); C) Aboriginal heritage management (including the extent of excavation requiring Aboriginal monitors); D) soils management (including stockpiles, topsoil, contaminated land and spoil management) and the prevention of mud and spoil displacement on public roads and access ways; E) material tracking register for all material imported to, exported from and transferred within the Project limit of works as part of the Scope of Works; F) ASS and potential PASS management; G) air quality management (including monitoring and dust suppression). H) construction noise and vibration management; I) hazardous materials and hydrocarbon management; J) waste management; K) water management (including groundwater and storm water management measures, prevention of offsite discharges and management of surface water to ensure contaminated run off from the Construction Site does not leave the site); L) fauna management including feral/introduced fauna management; M) unexpected finds management (including Aboriginal heritage, ASS and contamination); N) Construction Site access and travel routes for construction traffic; O) variation in seasonal weather conditions management; P) light emissions management; Q) demobilisation and rehabilitation management; and R) greenhouse emissions management.	C) 21.0 D) 15.0 E) 15.8 F) 15.2 G) 22.0 H) 20.0 I) 14.0 (Hazmat) and 23.0 (Hydrocarbons) J) 17.0 K) 19.0 L) 12.0 M) 14.3 N) 11.0 (overlap with Construction Plan) O) 22.0 (overlap with Construction Plan and Emergency Response Management Plan) P) 22.0 (overlap with Construction Plan) Q) 14.5 and 28.0 R) 22.0 (overlap with Sustainability Plan)
Book 2 Cl 8.1.4 (v)	preparedness and response to environmental emergencies.	24.0
Book 2 Cl 8.1.4 (vi)	monitoring and measurement (including Project environmental Reporting and national greenhouse and energy reporting): A) as a minimum the Alliance must provide detail how they intend to measure, collect and present environmental data required as part of the Project. Calibrated or verified monitoring and measurement equipment must be used and maintained. Calibration records must be kept for auditing purposes and be made available to the PTA's Representative upon request.	25.0
Book 2 Cl 8.1.4 (vii)	environmental incident management: A) as a minimum, environmental incidents must include events that can directly or indirectly cause environmental impacts or harm as well as events involving non-compliance with Project procedures and “near miss” events which may or may not result in an environmental impact. The Alliance must develop an environmental incident reporting and management procedure which must include; criteria	26.0

SWTC Reference	Description	Section in this Plan
	for the classification of environmental incidents and incident investigation requirements.	
Book 2 Cl 8.1.4 (viii)	Non-conformance and corrective actions: A) sources of corrective actions may include hazard Reports, incident investigations, audits, inspections, observations and management reviews. As a minimum, corrective actions must be systematically implemented and reviewed by the Alliance to ensure they adequately resolve the issue and minimise the risk of reoccurrence of the incident or hazard.	27.0
Book 2 Cl 8.1.4 (ix)	control of environmental records: A) as a minimum the Alliance must develop a process which outlines all relevant environmental records required to be provided to the PTA's Representative including induction attendances, Training matrices, Training records, audit and inspection Reports, minutes of meetings, incident Reports, approvals, permits, certificates and licenses. These environmental records must be available for checking and auditing by the PTA's Representative. Environmental records must be safeguarded against accidental destruction or deterioration to ensure that they remain legible, identifiable and traceable. At the completion of the Works, all environmental records must be provided to the PTA's Representative in the Project Environmental Close-out Report.	10.2
Book 2 Cl 8.1.4 (x)	environmental audits and inspections and schedule.	29.0
Book 2 Cl 8.1.4 (xi)	management review: A) the CEMP must be reviewed and updated periodically. The CEMP must be amended to reflect changes in contractual or Project requirements, to correct disparities identified during Project auditing and to ensure it is consistent with the commitments outlined within the Environmental and Heritage Obligations Register.	4.1
Book 2 Cl 8.1.4 (xii)	Project Handover and decommissioning requirements.	28.0
8.2 – ENVIRONMENTAL AND HERITAGE RISK ASSESSMENT		
Book 2 Cl 8.2.1	Within three months of the Date of this Agreement and prior to mobilisation, unless otherwise approved by the PTA's Representative, the Alliance must conduct an environment and heritage specific risk workshop and provide to the PTA a Project environmental and heritage risk assessment ensuring all approvals and environmental and heritage management requirements are in place prior to commencing ground disturbance or any Temporary Works or Works. The Alliance must invite the PTA's Representative to the workshop as active participants. The Alliance must pre-populate its own environmental and heritage risk assessment template prior to conducting the workshop.	9.1.1

SWTC Reference	Description	Section in this Plan
Book 2 Cl 8.2.2	The Alliance's Project environmental and heritage risk assessment must be reviewed quarterly by the Alliance as well as in response to any high or extreme environmental incidents, changes in legal requirements or following approvals obtained by the Alliance, changes in Project scope, and any inspection, audit and management review findings. Any updates to the Alliance's Project environmental and heritage risk assessment throughout the course of the construction activities must be provided to the PTA's Representative within the monthly environmental Report.	9.1.1
8.3 – PROJECT ENVIRONMENTAL AND HERITAGE INDUCTION		
Book 2 Cl 8.3.1	Within three months of the Date of this Agreement, unless otherwise approved by the PTA's Representative, the Alliance must submit an environmental and heritage site induction package for review and comment by the PTA's Representative. Unless otherwise approved by the PTA's Representative, work must not commence until the PTA's Representative issues written confirmation that the induction meets the PTA's requirements.	10.3.2
Book 2 Cl 8.3.2	The Alliance must maintain an environmental Training / induction matrix to ensure that relevant Personnel receive the necessary Training / inductions to implement the Project environmental and heritage requirements. Environmental and heritage induction records must be maintained by the Alliance in readily available auditable files and be made available to the PTA's Representative upon request.	10.3.1
Book 2 Cl 8.3.3	As a minimum, the environmental and heritage site induction package must cover the requirements of the CEMP, including:	10.3.2
Book 2 Cl 8.3.3(i)	ground disturbance work requirements;	30.0 15.0 20.0 21.0 14.1 17.0 and 13.5 13.0 29.0 24.0 14.3
Book 2 Cl 8.3.3(ii)	environmental monitoring and data reporting requirements;	
Book 2 Cl 8.3.3(iii)	ASS, groundwater and contaminated land management requirements;	
Book 2 Cl 8.3.3(iv)	noise and dust management requirements;	
Book 2 Cl 8.3.3(v)	Aboriginal heritage and Aboriginal heritage management requirements;	
Book 2 Cl 8.3.3(vi)	hazardous materials and hydrocarbon management requirements;	
Book 2 Cl 8.3.3(vii)	waste management requirements;	
Book 2 Cl 8.3.3(viii)	weed and hygiene management requirements	
Book 2 Cl 8.3.3(ix)	inspection and audit requirements (ie. audit schedule and protocols);	
Book 2 Cl 8.3.3(x)	environmental emergency / spill response and incident management and reporting; and	
Book 2 Cl 8.3.3(xi)	unexpected finds management	
8.4 – DEMOLITION		

SWTC Reference	Description	Section in this Plan
Book 2 Cl 8.4.1	Prior to decommissioning, salvaging or demolition works, the Alliance must undertake a HAZMAT survey of the Existing Bayswater Station and associated infrastructure within the limit of works. The findings of the HAZMAT survey must be used by the Alliance to develop a management process for any HAZMATs identified.	14.0
8.5 – LEGAL AND OTHER REQUIREMENTS		
Book 2 Cl 8.5.1	The Alliance must develop and keep updated a Project Environmental and Heritage Obligations Register throughout the Project. The Alliance will be responsible for keeping the Environmental and Heritage Obligations Register up-to-date throughout the entire duration of the Project and must provide a current electronic copy of the Project Environmental and Heritage Obligations Register within the Alliance's monthly environmental Report.	9.2
Book 2 Cl 8.5.2	The Project Environmental and Heritage Obligations Register must be maintained as a live document by the Alliance and be updated regularly throughout the Project and upon the Alliance and/or its Subcontractors obtaining any required approvals.	9.2
Book 2 Cl 8.5.3	The Alliance must ensure that it's CEMP and associated environmental management sub-plans and procedures incorporate commitments identified in the Environment and Heritage Risk Assessment and Project Environmental and Heritage Obligations Register and must be updated should the Project Environmental and Heritage Obligations Register or legal requirements change.	9.2
Book 2 Cl 8.5.4	The Alliance must keep copies of licenses, approvals and permits relevant to the Works on site with files available for audit and inspection purposes and provide these to the PTA's Representative upon request. A copy of all Alliance, and where applicable, Subcontractor, approvals, permits, licenses etc. obtained during the Project must be provided to the PTA within the Alliance's monthly environmental Report.	10.2
8.6 – ABORIGINAL HERITAGE		
Book 2 Cl 8.6.1	The Project falls within the South West Native Title Settlement area and the PTA are signatory to the NSHA. All PTA projects must comply with the requirements outlined in the NSHA.	21.1
Book 2 Cl 8.6.2	The PTA has submitted "Activity Notices" for the Project to South West Aboriginal Land and Sea Council (SWALSC) (OBJ ID. A3396452). An Aboriginal heritage survey has been undertaken in respect of the Project area. The survey boundary is defined in OBJ ID. A3715606. No Registered Aboriginal Sites or Other Heritage Places were identified within the survey boundary during the survey.	21.1
Book 2 Cl 8.6.3	The PTA has undertaken a review of the Project areas and findings of the Aboriginal Heritage Survey of Bayswater Station Upgrade Area (refer Book 5) and consider that approval under the Aboriginal Heritage Act 1972 (WA) is not required for the Works within the area defined by survey. The Alliance must undertake a review of existing documents and obtain any further approvals for unapproved	21.1

SWTC Reference	Description	Section in this Plan
	works, in consultation with the PTA, in order to undertake the Works.	
Book 2 Cl 8.6.4	The Alliance must engage and have onsite a minimum of two Aboriginal monitors when newly exposed ground is exposed following the removal of the Existing Bayswater Station and existing tracks to monitor for the presence of cultural heritage.	21.2
Book 2 Cl 8.6.5	The Aboriginal monitors who are engaged by the Alliance must have recognised cultural heritage knowledge of the area and include members of the Native Title Claimant Group (Whadjuk Native Title claimants (WAD242/11)).	21.2.1
Book 2 Cl 8.6.6	The Alliance must agree the extent of ground disturbing works requiring Aboriginal monitors with the PTA's Representative and the Native Title Claimant Group (Whadjuk Native Title claimants (WAD242/11)) prior to the commencement of work. The Alliance must inform the PTA's Representative immediately if cultiural heritage material is found. The Alliance must cease ground disturbing works if directed to do so by the PTA's Representative. The Alliance must then not recommence ground disturbing works until Approval from the PTA's Representative is obtained.	21.2.2
Book 2 Cl 8.6.7	The Alliance must inform the PTA's Representative, Western Australian Police Service and the Western Australian Museum immediately if suspected human skeletal material is found. The Alliance must cease works in the area immediately. The Alliance must then not recommence works in the area until approval from the relevant Government Agency is obtained. All Site Personnel must be informed of this requirement and of the requirement for work to cease in the area if such material is uncovered. If the remains are determined to be of Aboriginal origin, the Department of Planning, Lands and Heritage, Whadjuk Working Group and relevant Stakeholders must be consulted on management of the remains.	21.3.1
Book 2 Cl 8.6.8	Any suspected new Aboriginal site identified during the construction phase must be reported to PTA's Representative immediately, and any such site identified must not be further disturbed until the Alliance obtains all necessary approvals and provides a written copy of the approval to the PTA's Representative.	21.1.2
8.7 – AUDITING		
Book 2 Cl 8.7.1	Environmental Auditing and Inspections	
Book 2 Cl 8.7.1(i)	The Alliance must detail a schedule of environmental audits in the CEMP. As a minimum the Alliance must undertake and allow for: A) regular (ie. at least monthly) Subcontractor environmental audit / inspection assessing conformance with the CEMP; B) an internal environmental systems audit within three months of commencement of the Works or Temporary Works; C) six monthly internal environmental compliance management system audits;	29.0

SWTC Reference	Description	Section in this Plan
	D) internal environmental compliance audits within one week of the commencement of environmentally significant construction activities (ie. clearing, excavation and dewatering); E) annual third party environmental compliance and sustainability management system audits commissioned by the PTA's Representative; F) a post-mobilisation audit within three months of the date agreed for the finalisation of Alliance mobilisation; G) two demobilisation audits with PTA's Representative; one three months prior to demobilisation completion and one on the planned last day of demobilisation by the Alliance (demobilisation pre-audits may be arranged between the PTA's Representative and the Alliance before and during demobilisation to assist the Alliance to meet its demobilisation date); and H) fortnightly environmental site inspections to be undertaken by the PTA's Representative.	
Book 2 Cl 8.7.1(ii)	The Environmental Manager must accompany the PTA's Representative during any audit conducted by the PTA along with their Subcontractors' environmental representative (if applicable). The Alliance must allow a minimum of two days to assist the PTA in undertaking any audit outlined above and provide any required information within one week of it being requested by the PTA's Representative (unless otherwise agreed). All Alliance audit Reports / inspections etc. must be made available to the PTA's Representative within two weeks of completing the audit / inspections.	29.1
Book 2 Cl 8.7.1(iii)	The Alliance must provide the PTA's Representative with electronic access to the Alliance's environmental incident reporting and audit systems upon request. The Alliance must track and close out all audit / inspection actions to the satisfaction of the PTA's Representative within the agreed timeframe.	26.0
8.8 – MONTHLY ENVIRONMENTAL REPORTING		
Book 2 Cl 8.8.1	The Alliance must submit a monthly environmental Report as a component of its monthly Project reporting. The monthly environment Report must include as a minimum:	
Book 2 Cl 8.8.1(i)	a brief description of construction activities undertaken for the month including a summary of current key environmental issues and risks.	30.0
Book 2 Cl 8.8.1(ii)	an updated version of the Environmental and Heritage Obligations Register including status and copies of any obtained environmental approvals.	
Book 2 Cl 8.8.1(iii)	a summary of spoil type and classification, spoil quantity and disposal locations for the month, ASS treatment and Validation, analytical result, any unexpected finds and associated management actions (all spoil disposal documentation must be retained by the Alliance and made available to the PTA's Representative upon request).	

SWTC Reference	Description	Section in this Plan
Book 2 Cl 8.8.1(iv)	A summary of dewatering status including: A) areas being dewatered; B) water quality parameters pre and post treatment; C) dewatering flow rates (instantaneous and cumulative); D) Groundwater Levels; and E) daily discharges from the dewatering system. Separate metering for each discharge point (eg. each recharge well, sewer etc.).	
Book 2 Cl 8.8.1(v)	Records of: A) water usage (potable vs non-potable); B) fuel usage (in litres); C) waste including waste to landfill (in tonnes and m3), types of Wastes, (in tonnes and m3) and hazardous wastes such as fibrous materials, oily water, waste oil etc. (tonnes and m3), material recycled; D) water usage (in litres); and E) land cleared (ha).	
Book 2 Cl 8.8.1(vi)	a summary of environmental incidents and corrective actions.	
Book 2 Cl 8.8.1(vii)	a summary of audit / inspection findings and corrective actions undertaken.	
Book 2 Cl 8.8.1(viii)	a summary of community and Stakeholder complaints.	
Book 2 Cl 8.8.1(ix)	a summary of construction activities and key environmental risks for the next period and proposed mitigation measures.	
Book 2 Cl 8.8.1(x)	dewatering system records of construction progress (wells drilled, pipe installed etc.), a summary of system performance, any configuration changes (pumps on, pumps off, pipe work changes, maintenance performed) and records of issues identified and agreed solutions.	
Book 2 Cl 8.8.1(xi)	a summary of environmental monitoring undertaken for the month and a copy of any environmental Reports or data undertaken by the Alliance or its Subcontractors.	
Book 2 Cl 8.8.1(xii)	a summary of any environmental inductions, Training or awareness sessions.	
Book 2 Cl 8.8.1(xiii)	all spatial data (eg. monitoring wells, recharge wells, noise monitoring locations) in a format compatible with ArcGIS and AutoCAD.	
Book 2 Cl 8.8.1(xiv)	an update on sustainability performance, including progress against the Sustainability Management Plan	
Book 2 Cl 8.8.2	The Alliance must prepare and submit the monthly environmental Reports to comply with all relevant conditions of any approval and regulatory requirements.	
Book 2 Cl 8.8.3	The Alliance is responsible for national greenhouse and energy reporting for the Works.	
8.9 – ENVIRONMENTAL INCIDENT REPORTING		
Book 2 Cl 8.9.1	The Alliance must verbally notify the PTA's Representative immediately for all significant and high risk (as defined in the Alliance's incident reporting and management procedure) environmental incidents and submit an initial written environmental incident Report to the PTA's	26.0

SWTC Reference	Description	Section in this Plan
	Representative within 24 hours of the environmental incident occurring.	
Book 2 Cl 8.9.2	The Alliance must submit an environmental incident Report to the PTA's Representative for all other environmental incidents within 48 hours of the environmental incident occurring.	
Book 2 Cl 8.9.3	The Alliance must report all environmental incidents through the Alliance's management system. The Alliance's management system is to be an online system linked to the environmental management system to which the PTA's Representative has access.	
Book 2 Cl 8.9.4	The environmental incident Report must include as a minimum: i. description of incident (date, time, location, GPS co-ordinates, factual description of the incident); ii. incident type (environmental impact, environmental non-compliance, potential incident, community complaint); iii. incident classification; iv. incident investigation findings; and v. actions.	
Book 2 Cl 8.10.1	Project Environmental Close-out Report	
Book 2 Cl 8.10.1(i)	The Alliance must prepare a Project Environmental Close-out Report at the completion of the Works and prior to the completion of demobilisation which provides a detailed and collective summary of the information and data collected throughout the Project and through the monthly environmental Reports (as outlined in environmental Reporting section 8.8 of this Book 2). The Alliance must provide the Project Environment Close Out Report to the PTA for its review and approval. The Project Environmental Close-out Report is also to include an electronic copy of all environmental data obtained throughout the Works (eg. electronic shapefiles in a format compatible with ArcGIS and AutoCAD (DWG format in GDA2020), environmental monitoring data etc.).	30.3
Book 2 Cl 8.11.1	The Alliance must provide an environmental sub-plan for the Non-conformance Correction Period which includes:	
	i. ongoing environmental management requirements ii. timing for key management actions iii. monitoring, performance and completion criteria iv. reporting requirement v. contingency actions in the event performance criteria are not being met	27.2
Book 2 Cl 8.11.2	The Alliance must conduct its maintenance activities in accordance with the approved environmental sub-plan for the Non-conformance Correction Period.	

Abbreviations and Acronyms

Term	Definition
ABN	Australian Business Number
ACM	Asbestos Containing Material
AFM	Asbestos fibre monitoring
AHA	*Aboriginal Heritage Act 1972*
AHD	Australian Height Datum
ALT	Alliance Leadership Team
AM	Alliance Manager
AMP	Alliance Management Plan
AMT	Alliance Management Team
AS	Australian Standard
ASS	Acid sulfate soils
AASS	Actual acid sulfate soils
BST	Bayswater Station and Turnback Project
DBH	Diameter at Breast Height
DoH	Department of Health
DPLH	Department of Planning, Lands and Heritage
DWER	Department of Water and Environmental Regulation
DBYD	Dial Before You Dig
CEMP	Construction Environmental Management Plan
COPC	Chemical of Potential Concern
EB	Evolve Bayswater
EMS	Environmental Management System
GPS	Global Positioning System
HAZMAT	Hazardous Materials
HSSEQ	Health Safety Sustainability Environment and Quality
HR	Human Resources
IAR	Immediate Action Response
IMS	Integrated Management System
ISO	International Standard
ITP	Inspection Test Plan
ITR	Inspection Test Register
JHA	Job hazard analysis
JSEA	Job Safety Environmental Assessment
L	Litre
mbgl	Metres below ground level
mL	millilitre
mm	millimetre
MTR	Material Tracking Register
NEPM	National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)
OCP	Organochloride pesticides
ODP	Ozone Depleting Substance
OSRACA	Observe Secure Report Authenticate Consult Agree
PAA	Project Alliance Agreement

Term	Definition
PCB	Polychlorinated biphenyls
PM_{10}	particulate matter 10 micrometers or less in diameter
PPE	Personal Protective Equipment
Project	Bayswater Station and Turnback Project
PSP	Principle shared path
PTA	Public Transport Authority
QA/QC	Quality Assurance/Quality Control
RL	Reduced Level
SMF	Synthetic mineral fibre
SPOCAS	Suspension Peroxide Oxidation Combined Acidity and Sulphur
SWMS	Safe Work Method Statements
SWTC	Scope of Work and Technical Criteria
TO	Traditional Owner
TPZ	tree protection zone
UF	Unexpected finds
UFI	Unique Feature Identifier

Figures in Text

A. Alliance Organisation Chart
B. Evolve Bayswater Environmental Management Framework
C. Evolve Bayswater Alliance Management Plan Hierarchy
D. Location of Production Bore (Yellow Pin) and areas watered by the City (red shading)
E. Stage 1 Site Layout
F. Stage 2 Site Layout

Tables in Text

1. Evolve Bayswater Key Environmental Positions
2. Site Specific Geology and Subsurface Conditions
3. Site Specific Hydrogeology
4. Project Communication
5. Fauna Management – Objectives, Targets and Indicators
6. Fauna Management Strategies
7. Fauna Management Contingency Strategies
8. Vegetation Management – Objectives, Targets and Indicators
9. Vegetation Management Strategies
10. Vegetation Management Contingency Strategies
11. Buildings and Infrastructure to be demolished, salvaged or decommissioned
12. Types of Potential Unexpected Finds
13. Sample depths at which ASS was present
14. Imported Fill Compliance Criteria
15. Contaminated Soil Management – Objectives, Targets and Indicators
16. Contaminated Soil Management Strategies
17. Material Tracking Codes
18. Objectives and Targets for Unexpected Finds Management
19. Unexpected Finds Management
20. Objectives and Targets for Waste Management
21. Waste Management
22. Stormwater and Surface Water Management – Objectives, Targets and Indicators

23. Stormwater and Surface Water Management
24. Chemical and Spill Management
25. Objectives and Targets for Noise and Vibration Management
26. Noise Management
27. Vibration Management
28. Registered Aboriginal Heritage Sites and other significant Heritage Places
29. European Heritage Sites
30. European Heritage Management
31. Objectives and Targets for Dust and Air Quality Management
32. Dust and Air Quality Management

Figures Attached

1. Regional Location
2a.Site Identification
2b. Key Site Features
3.Surrounding Land Uses
4.Regional Geology
5a.Acid Sulfate Soils Mapping
5b.Previous ASS Investigation Locations
6a.Regional Hydrogeology and Hydrology
6b.Previous Groundwater Monitoring Locations
7.Vegetation Mapping and Fauna Habitat Trees
8.Registered Contaminated Sites

1.0 Background

1.1 METRONET

METRONET is the State's vision to integrate transport and land use planning in the State and provide a framework to support sustainable growth of greater metropolitan Perth over the next 50 to 100 years.

Aligned with Commonwealth planning and infrastructure policies and the State's metropolitan growth strategies, *Perth and Peel @ 3.5 million* and *Transport @ 3.5 million*, METRONET Initiatives will deliver around 70 kilometres of new passenger rail and up to 18 new stations.

More than just rail infrastructure works, METRONET recognises the potential for urban intensification in more than 5,000 hectares of land. Planning goes beyond the station forecourts to shape and support development of communities within a walkable distance of 400 metres from a public transport hub.

METRONET Initiatives include approximately 70 kilometres of new heavy passenger rail and 16 new rail stations, which represents the single largest investment in public transport in Perth's history.

The State has prioritised the following METRONET Initiatives:

- Forrestfield – Airport Link
- Thornlie – Cockburn Link
- Yanchep Rail Extension
- Morley – Ellenbrook Line
- Extension of the Armadale Line to Byford
- Bayswater Station Upgrade
- New station at Bellevue
- Station upgrade and relocation of Midland Station to Cale Street
- Extension of the Midland Line to Bellevue
- Level crossing removal program

1.2 Bayswater Station and Turnback Project

The Bayswater Station and Turnback Project (the Project) as incorporated in the Project Alliance Agreement (PAA) for the Project includes:

- Stage One: The Turnback Works
- Stage Two: The Bayswater Station Southern Section
- Stage Three: The Bayswater Station Northern Section

The Site location is identified in Figure 1 whilst the land parcels and boundary of the Site are identified in Appendix B and Figure 2a.

1.2.1 Stage One: Turnback Works

Stage One Turnback Works comprises the following:

- New turnback siding between Bayswater and Meltham stations (configured to provide accommodation for 1 x 6 car sets).
- A shunters path (walkway) and a new driver's washroom.
- Relocation of the Leake Street underpass.
- Maintenance of the principle shared path (PSP) along the southern side of the railway reserve.

- Other Project works including standard station systems, signaling, overhead line. electrifications, communications, utility relocations and noise mitigation.

1.2.2 Stage Two: The Bayswater Station Southern Section

Stage Two: The Bayswater Station Southern Section, comprises the following:

- Two new rail bridges over King William Street, immediately south of the existing railway.
- New station island platform (150m long and 10m wide) complete with associated infrastructure and supported by the railway bridges.
- Provision for the principle shared path on the southern side of the southern railway bridge.
- The first stage of western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts and stairs) and equipment rooms to service railway operations.
- Integrated pedestrian, cyclist, bus and vehicle access into the station and future Bayswater town centre.
- Relocation of the dual gauge tracks and all associated track infrastructure to align with the new platform faces.
- New bus bays and vehicle parking bays.
- Other Project works including standard station systems, signaling, overhead line electrifications, communications, utility relocations and noise mitigation.
- Landscaping and urban design features within the station precinct.

1.2.3 Stage Three: The Bayswater Station Northern Section

Stage Three: The Bayswater Station Northern Section comprises the following:

- Demolition of the existing Bayswater station and associated infrastructure.
- A second set of two new rail bridges over King William Street, located immediately north of the first new set of railway bridges delivered as part of Stage One.
- A second island platform (150m long and 10m wide) complete with station infrastructure again supported by the northern pair of railway bridges.
- The second stage of the western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts and stairs) and retail tenancies.
- Additional station infrastructure to meet the needs of the expanded (4 line, 4 platform face) station.
- Landscaping and urban design features within the station precinct.
- Other Project works including standard station systems, signaling, overhead line electrifications, communications, utility relocations and noise mitigation.
- Completion of new bus bays and vehicle parking bays.
- Landscaping and urban design features within the station precinct.

1.2.4 Optional Works Packages

The METRONET Initiatives include for other additional Project Works beyond the scope listed in 1.2.1, 1.2.2 and 1.2.3 above and these may be included during the Delivery Phase.

1.2.5 Forward Works Contracts

The Public Transport Authority (PTA) will be undertaking Forward Works in order to progress the Project with respect to long lead time items required for Statutory Approvals, design, procurement and relocation (or protection) of a number of services in or around the Bayswater Station precinct. It is expected that these works shall be completed, prior to the award of the Delivery Phase contract.

2.0 Purpose and Structure

2.1 Purpose

This Construction Environmental Management Plan (CEMP) outlines the Alliance's approach and procedures for environmental management during the Delivery Phase of the Project. The CEMP is a deliverable required under Table 3 of Book 2A of the Scope of Work and Technical Criteria (SWTC).

This CEMP has been specifically developed for this Project and will be implemented for the design, construction and commissioning phases of the Project.

This CEMP is a 'live' document and will be periodically reviewed and updated as required or addendums prepared to address changes in practices or include additional Optional Works Packages.

2.2 Scope of this Plan

This CEMP has been developed by the Evolve Bayswater team to meet the requirements of Section 8 of Book 2 of the SWTC (BST-PTAWA-PM-RPT-00010, Revision 1.0) (see Compliance Matrix) and address other additional Project requirements contained in the ADA and PAA.

This CEMP applies to the design, construction and commissioning phases of the Project and describes the following in accordance with the SWTC (see Compliance Matrix):

- Environmental Management System (EMS);
- the organisational structure for environmental management;
- applicable legislative requirements;
- procedures developed to manage the environmental aspects of the Project;
- reporting processes;
- environmental incident management processes; and
- processes to monitor and evaluate environmental performance.

2.3 Structure and Content

The content in this CEMP is intended to be high level, with more detailed specifics provided in individual subplans that will be produced for the individual construction activities relevant to each construction stage. Where required subplans will be submitted for approval by the relevant regulator.

The structure and content of this CEMP has been prepared with consideration of the following documents:

- Section 8 of Book 2 of the SWTC (refer to Compliance Matrix);
- PTA Environmental Policy (9302-000-001);
- Section 9 of the METRONET Environmental Management Plan (7901-700-005 Rev 0) (PTA, 2018);
- Part 9 Contractor Management of the PTA's Environmental Management System Manual (9300-000-001 Rev 2.00) (PTA, 2019); and
- Instructions on how to prepare *Environmental Protection Act 1986* Part IV Environmental Management Plans (Environmental Protection Authority, 2018).

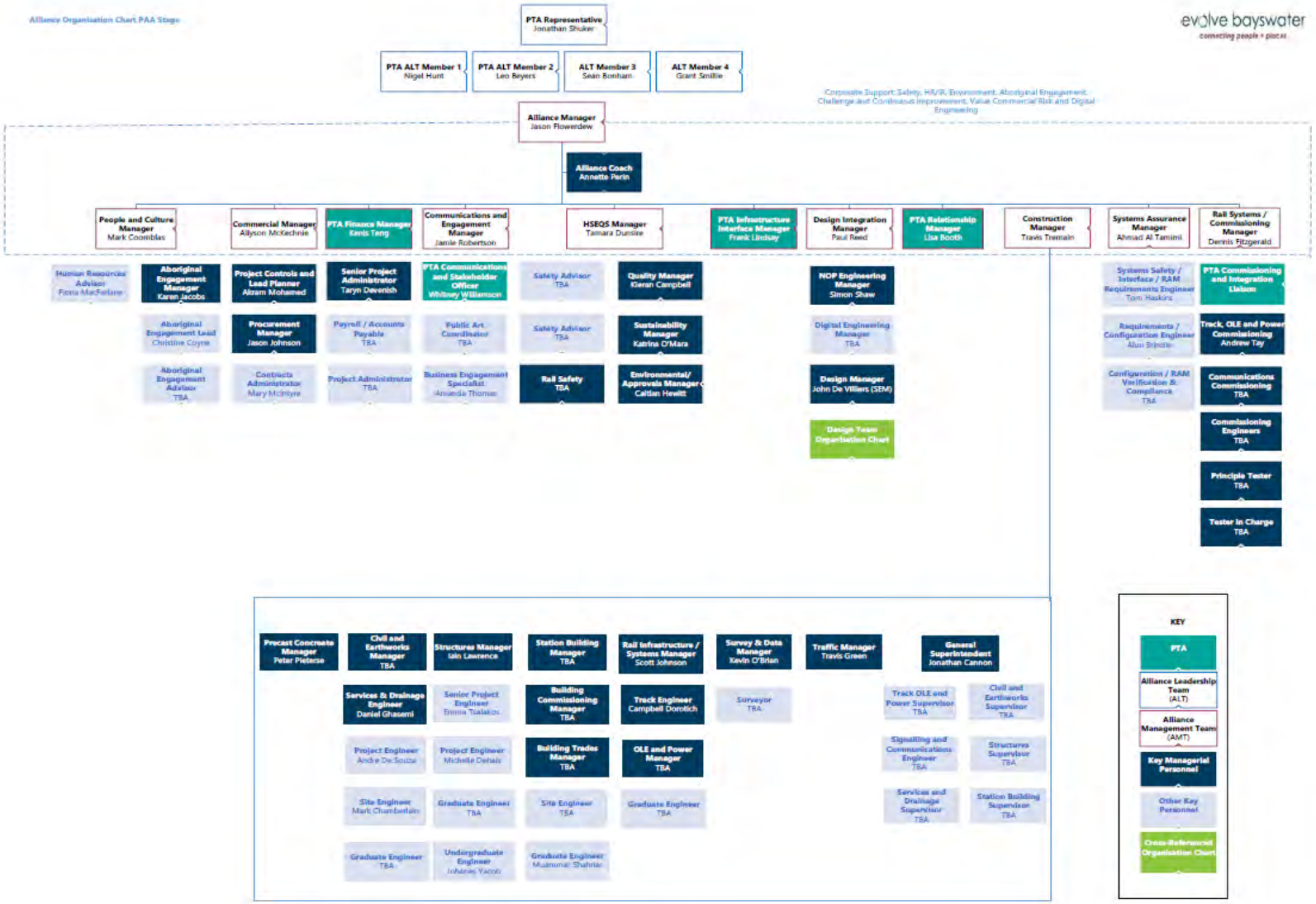
The Project scope of works in listed in Appendix D which will be executed within the limit of works, as defined by SWTC Book 1. The area within the limit of works is referred to herein as the 'Site'. This CEMP applies to the Project scope of works conducted within the limit of works.

3.0 Statement of Responsibilities and Acknowledgement

3.1 Alliance Organisation

The Alliance organizational chart is provided as Figure A.

Figure A. Alliance Organisation Chart



3.2 Alliance Leadership Team

The Alliance Leadership Team (ALT) is made up of two representatives each from the PTA and Evolve Bayswater. They have the responsibility to appoint the Alliance Manager and assign the necessary authorities, governance and accountabilities needed to perform the role. In relation to environmental management, the ALT has responsibility to:

- approve expenditure for environmental management, control and equipment;
- monitor environmental performance; and
- consult with the Alliance Manager on environmental issues and where improvement in environmental standards are required.

3.3 Alliance Management Team

As an Alliance, the Alliance Manager shall chair the Alliance Management Team (AMT), who collectively will undertake the day to day responsibility for environmental management for the Project on behalf of the PTA. The Environmental Manager shall be accountable to the Alliance Manager for all aspects of the environmental management system.

No deviations shall be made without AMT agreement and the written authority of the Alliance Manager.

3.4 Alliance Project Personnel

The responsibilities detailed in this CEMP are in addition to Position Descriptions established for each job function within the Alliance and contain essential Site-specific responsibilities established and assigned for the Bayswater Project.

Roles and responsibilities within the Project and required by this CEMP are summarised in Table 1.

Role	Responsibilities
Alliance Manager	**General** • Ensuring that the works are planned and undertaken in compliance to the SWTC. • Daily management, overall responsibility for the handover of the project in accordance with the SWTC specifications. • Promote continuous improvement of project results together with safety, quality and environmental standards. • Establish project team; Alliance staff, local staff and workers. • Motivate and coach personnel. Responsible for the human resource management. • Responsible for the earliest set up and agreeing of the Project Management Plan. • Management of project site personnel and project home office staff [work program, appraisal, remuneration, and training]. • Attends and prepares formal meetings with PTA and/or their representative. • Approval of all subcontracts, all purchases and all payments to third parties. • Responsible for preparation of the “close-out report” of the Project. • Compliance with quality assurance / quality control (QA/QC) procedures.

Role	Responsibilities
	• Monitoring of environmental protection actions. • Establishment and making known to all concerned the agreed contract program. • Organizing of the reporting process, originating from lower tier Subcontractors and its consolidation into the prescribed reporting format. • Provide PTA with weekly and monthly progress reports as per requirements. • Oversee the Project audit program in conjunction with the Health Safety Sustainability Environmental and Quality (HSSEQ) Manager. Ensuring those formal audits with respect to accounting, quality, health and safety and environment are carried out to the program set. • Managing employment and industrial relations issues on the project. • Effective operation of the budget and cost control system. **CEMP Specific** • Undertake quarterly (maximum interval of 3 months) management reviews of the CEMP. • Be aware of significant environmental aspects of the Project. • Review and understand controls to manage identified high risks, and acceptance of risk treatments for aspects that may cause significant environmental impacts. • Support the HSSEQ Manager to implement the CEMP.
Construction Manager	**General** • Manage and provide guidance to the Site construction and supervisory team. • Plan and establish the construction delivery program. • Establish goals and objectives for the site construction team. • Review and provide input to non-conformance corrective and preventative actions. • Comply with the requirements of the EMS. **CEMP Specific** • Comply with the requirements of the CEMP. • Support the HSSEQ in delivering the Project in accordance with the CEMP.
Health Safety Sustainability Environmental and Quality (HSSEQ) Manager	**General** • Engage with the Alliance Management Team to implement the SWTC and EMS. • Prepare and carry out environmental inductions. • Implement roles as outlined under the Safety Management Plan and Quality Management Plan. • Initiate internal audits. • Accountable for ensuring all environmental approvals are in place for the Project. • Liaise with the PTA Environmental Manager. **CEMP Specific** • Ensure that Contractors working within the Site are aware of the CEMP and associated sub plans and procedures. • Engage with the Project Team to ensure:

Role	Responsibilities
	- records and documentation relevant to the CEMP are maintained; - environmental monitoring prescribed in this CEMP is implemented and reported appropriately; - environmental incidents are identified, responded to / managed and reported as per CEMP; - community complaints are responded to within the required timeframe. • Prepare monthly environmental reports and milestone environmental reports (e.g. Closure Report) as required.
Environment Manager	**General** • Engage with the Alliance Management Team to achieve the requirements of the SWTC. • Liaise with the HSSEQ Manager and PTA as required. **CEMP Specific** • Prepare the CEMP. • Assist the HSSEQ Manager to implement the CEMP as required. • Provide advice on Unexpected Finds during the construction phase.
Communications & Engagement Manager	**General** • Responsible for planning and managing the project's community and stakeholder (not services) engagement activities and manages feedback in relation to the project. • Providing strategic communications advice to the Alliance Manager and project team in general. • Coordinating all community involvement activities and other legislative and project-specific requirements. • Liaising with PTA communications staff on community relations, consultation, involvement, participation, and stakeholder liaison matters. • Establishing and maintaining project protocols and systems for community relations, and stakeholder communication that are consistent with METRONET, PTA and Coleman Rail protocols, policies, and procedures. • Building positive relationships by proactively liaising with residents, the community, and stakeholders. • Preparing materials and attending Community Advisory Group meetings other community meetings. • Establishing a complaints management system and recording the resolution of complaints. • Notifying relevant authorities, stakeholders, and the local community of works, in accordance with the SWTC. • Drafting and distributing communication materials for METRONET including newspaper advertisements, website and social media content, construction updates, publications, and public displays. • Presenting community issues during project meetings, including the consideration, and drafting of impact mitigation options / studies. • Providing timely community related advice to the project leadership team to inform their decision making. • Raising internal (project level) awareness of community related issues and encouraging a proactive response from all project staff and contractors.

Role	Responsibilities
	• Promote community relations principles within the project team to increase general awareness and gain support to mitigate impact. • Provide feedback on the outcomes of community engagement. • Maintain registers that capture commitments and areas of influence. • Provide support to the Aboriginal Engagement Manager by facilitating conversations across stakeholder groups to achieve Aboriginal engagement objectives. • Support the Alliance Manager in preparing materials for the consideration of the Alliance Leadership Team. **CEMP Specific** • Liaise with the HSSEQ Manager if any stakeholders raise concerns related to environmental aspects. • Comply with the requirements of the CEMP. • Report environmental incidents immediately as per the CEMP.
Aboriginal Engagement Manager	• Establish a relationship with Traditional Owners • Reconfirm cultural context of the project site with Traditional Owners • Establish any potential unregistered sites with Traditional Owners • Establish a relationship with Aboriginal Elders for the Project as recommended by the Traditional Owners • Establish panel of Aboriginal Monitors for the Project
Site Superintendent	**General** • Day to day organization of plant, materials and labor for the work, including purchasing of materials, and hiring necessary equipment, plant or subcontract services. • Assist the engineering team in planning and monitoring of job progress and adherence to project quality requirements and of the deed. • Inspect work and sign off Inspection and Test Plans and test records. • Identify and raise Non-conformance reports and assist the engineering team in closing out Non-conformance reports. • Assist the engineering team in compilation of Quality documentation. • Assist the engineering team in maintenance of equipment calibration records. • Liaison with suppliers and subcontractors regarding forthcoming deliveries. • Carry out inspections of incoming goods. • Check goods received against delivery dockets / manifests. • Ensure all goods are stored as per manufacturer's recommendations. • Provide documentation of goods to the engineering team / Contract Administrators as required. Report any non-conforming goods to the engineering team / Contract Administrators. **CEMP Specific** • Comply with the requirements of the CEMP. • Ensure employees and sub-contractors are implementing the CEMP to the extent practicable for the role being undertaken. • Report environmental incidents immediately as per the CEMP.

Role	Responsibilities
Project Engineers	**General** • Prepare work packs and continually monitor implementation with site supervisors. • Develop and approve inspection and test plans and checklists prior to commencement of construction activities. • Plan and manage the quality inspection program including liaison with the PTA Representative to ensure compliance to the deed. • Manage the technical query process. • Oversee the process of management of Non-conformances. • Maintain Inspection Test Plan (ITP) registers (ITR) and oversee the process of completion of ITPs and associated records (forms, conformance certificates etc.). • Ensure that appropriate quality documentation is collated and compiled as per the approved index. • Ensure all other project deliverables are being collated and submitted in a timely manner to PTA for approval. Deliverables include but not limited to completed Quality documentation (ITPs, ITRs), test results, As-Built drawings, IOMs, commissioning reports and warranties. • Manage the onsite document control process and ensure current copies of drawings, specification and other documents are available at various locations within the project. • Manage equipment calibration registers and equipment and conduct regular checks to ensure calibrations are up to date and report any anomalies. **CEMP Specific** • Comply with the requirements of the CEMP. • Ensure all engineers are implementing the CEMP to the extent practicable for the role being undertaken. • Report environmental incidents immediately as per the CEMP.
Employees / Subcontractors	**General** • Undertake construction of the Project in line with contract requirements. • Be trained and inducted for the role being undertaken. **CEMP Specific** • Implement the CEMP to the extent practicable for the role being undertaken. • Report environmental incidents immediately.

Table 1: Evolve Bayswater Key Environmental Positions

4.0 Review

The Alliance Manager shall review this Management Plan, to reaffirm the Plan's continuing suitability and effectiveness at regular intervals over the life of the project, with a maximum interval of 3 months.

This CEMP is a 'live' document and will be reviewed and updated as required or addendums prepared to address changes in practices or include additional Optional Works Packages.

4.1 Management Review

The effective implementation and management of this CEMP and the EMS shall be reviewed at quarterly AMT management meetings.

These meetings shall be facilitated by the HSSEQ Manager and chaired by the Alliance Manager along with other relevant members of the AMT.

The agenda shall include:

- Health and Safety
- Environmental Management
- Inspection Test Plan (ITP) progress and documentation
- Technical queries and progress
- Non-conformances and effectiveness of corrective actions
- Audit results (internal, subcontractor and client)
- As constructed progress
- ALT and AMT feedback

Items raised at the reviews will be minuted and issued to the responsible person for close out.

4.2 Management Approval

This CEMP will be reviewed by the AMT and approved for use by the Evolve Bayswater Alliance Manager. For each and every revision this same approval process shall be applied.

4.3 Issue

The Evolve Bayswater Alliance Manager shall issue this project CEMP to all management, engineering, supervisory staff involved with the project, to all subcontractors / suppliers and any other employees involved with any environmental performance aspects of the works. The CEMP is to be used by Contractors to plan and manage their works and develop task specific Safe Work Method Statements (SWMS) (or similar). It is expected that personnel attending the Site will through the induction process and documentation prepared understand and acknowledge their understanding of responsibilities and accountabilities detailed in this CEMP.

5.0 Environmental Management Framework

5.1 Alliance Environmental Management System

The Alliance commit to establishing, implementing and maintaining an environmental management system compliant with the requirements of *ISO AS/NZS 14001:2016* to ensure a high standard of environmental management for the duration of the Project and 2 years after practical completion.

Some components of the EMS e.g. system procedures, sit within the Acconia's Integrated Management System (IMS), which are referred to throughout this CEMP. Acciona's EMS has been assessed and registered as complying with the requirements of *AS/NZS 14001:2015 – Environmental management systems – Requirements with guidance for use* (Appendix C). Other components e.g. Project specific management plans or registers, have or will be developed or existing documents modified to suit the Project (Figure B).

Each environmental aspect has specific environmental management designed to incorporate a hierarchy of control and best practice environmental management.

Figure B: Evolve Bayswater Environmental Management Framework

5.2 Policies

The Evolve Bayswater Environmental Management Policy is provided in Appendix B. The Alliance will also comply with PTA's Environmental Policy.

5.3 Objectives and Targets

The Objectives and Targets Register has been developed to align with the PTA's EMS manual, PAA and the SWTC.

Lead Indicators				
KPI	**Source**	**Target**	**Frequency**	**Responsible**
Compliance with the Projects HSE Management System.	Audit	No Non-Conformances.	Quarterly	HSSEQ Manager
Close out of any Environmental actions.	Audit	30 days.	Quarterly	HSSEQ Manager PTA HSE Advisor(s). Environmental Manager
Environmental Inspections/ Audits	Targeted Inspections / Audits	Conducted throughout the Project as scheduled by the Project Audit Schedule. Actions raised closed out within timeframes set.	As per the Project Audit Schedule Weekly	Project Manager. Construction Manager. Superintendent Manager. HSE Advisor(s). Environmental Manager
Environmental Training including Cultural and Heritage Awareness	Induction	All personnel inducted before starting work onsite.	As required.	HSE Advisor.
	Training Matrix	Developed and approved before mobilisation commences.	As required.	HSE Advisor/Environmental Manager People and Culture Team
		Identify new positions required for the works and update Training Matrix.	Monthly.	HSE Advisor/Environmental Manager People and Culture Team
	Toolbox talks and Environmental Alerts	100% attendance.	As required.	Construction Manager. HSE Advisor.
Internal and external reporting	Monthly Internal project report and PTA monthly report	Submitted on the agreed date	Monthly.	HSSEQ Manager
Manage the environment during construction in accordance with all relevant standards, regulations and the CEMP	Monthly reporting Inspections Audits	No complaints regarding the management of environmental aspects from the local community; No significant environmental impacts.	Monthly Weekly Quarterly	All

		No contaminated sites as a result of the Project.		
Lag Indicators				
KPI	**Source**	**Target**	**Frequency**	**Responsible**
Achieve a 'Goal Zero' project.	Environmental incidents resulting in harm to the environment.	No. of statutory environmental breaches or serious onsite emissions.	Zero.	All
	Noise and vibration impacts / complaints	No. of complaints or breaches of the CEMP or subplans		

6.0 Evolve Bayswater System Documentation

The CEMP is to be read in conjunction with the Alliance Management Plan (AMP) which is developed, issued and implemented by the Alliance Manager for the Project. The AMP is the overarching plan that governs the Alliance functions and performs its obligations to fulfil the requirements of the SWTC and other relevant documentation. This CEMP supports the AMP and is complemented with additional management plans, which collectively define the governance and assurance requirements across all activities on the Project (Figure C).

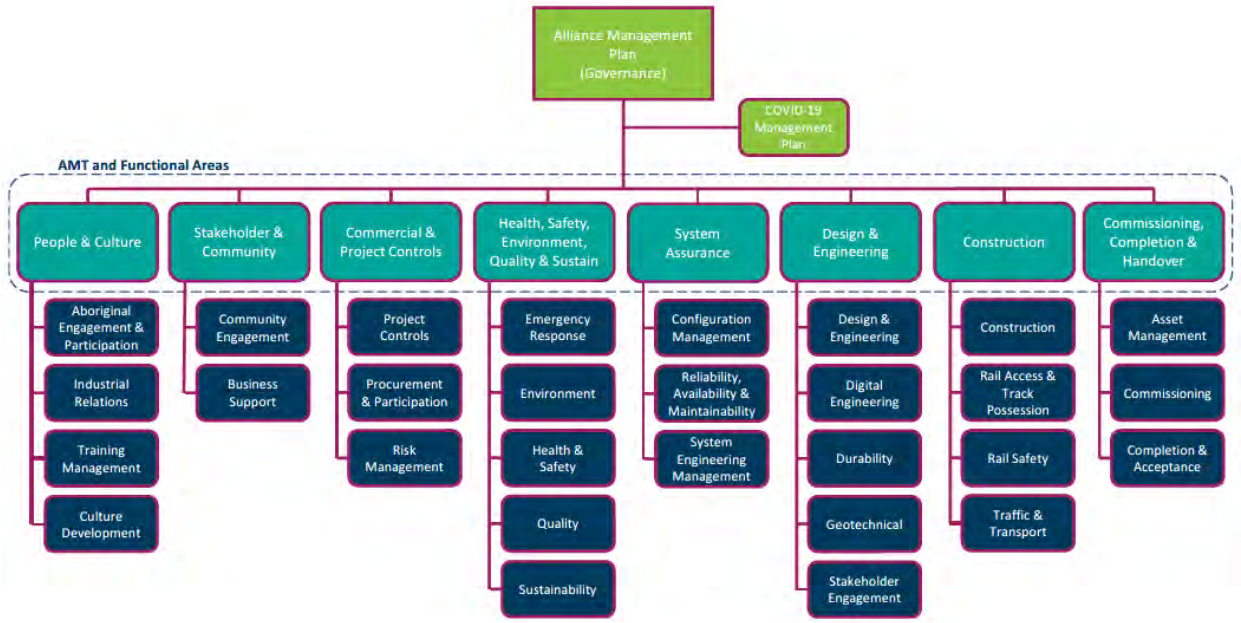


Figure C: Evolve Bayswater Alliance Management Plan Hierarchy

The Evolve Bayswater team recognises the similarities between Environment, Safety and other management systems and will ensure that integration of key components of the EMS within these other systems is achieved without conflict or duplication.

The processes that will be used to manage the environmental process are described in the following project management plans:

- *Alliance Management Plan BST-EVO-PM-PLN-00004*
- *Asset Management Plan BST-EVO-TC-PLN-0004*
- *Commissioning Plan BST-EVO-TC-PLN-00005*
- *Construction Plan BST-EVO-PL-PLN-00001*
- *Digital Engineering Management Plan BST-EVO-IM-PLN-00002*
- *Design and Engineering Management Plan BST-EVO-EA-PLN-00004*
- *Durability Plan BST-EVO-QA-PLN-00003*
- *Emergency Management Plan BST-EVO-SA-PLN-00003*
- *Project Controls Plan BST-EVO-PC-PLN-00002*
- *Quality Management Plan BST-EVO-QA-PLN-00004*

- *Rail Corridor Access and Possession Plan BST-EVO-RS-PLN-00002*
- *RAMS Plan BST-EVO-EA-PLN-00005*
- *Risk Management Plan BST-EVO-RI-PLN-00002*
- *Stakeholder Interface Management Plan BST-EVO-SM-PLN-00004*
- *Sustainability Management Plan BST-EVO-EN-PLN-00004*
- *Systems Engineering Management Plan BST-EVO-EA-PLN-00006*
- *Training Management Plan BST-EVO-PM-PLN-00007*
- *Communication Engagement Management Plan BST-EVO-SM-PLN-00003*
- *Aboriginal Engagement and Participation Plan BST-EVO-PM-PLN-00006*

7.0 Site Information

7.1 Site Identification

The Site includes 32 separate parcels of land as listed in Appendix B and shown on Figure 2a. Additional information (land type [free hold/ crown], certificate of title details, street address and landowner) is provided in Appendix B.

Appendix B Notes:
1. *Land parcels omitted from previous environmental investigations, namely the Preliminary Site Investigation (JBS&G, November 2018).*
2. *Cadastral boundaries of Lot 9915 and Lot 100 will need to be amended to reflect road reserve separate from private / other public property.*

Key Site Features prior to construction of BST are shown on Figure 2b.

Under the Metropolitan Region Scheme the Site is zoned as 'Railways' (Figure 3) and parts of the Site are zoned as 'Local Distributor Roads' under the City of Bayswater Town Planning Scheme No. 24. Surrounding land uses are primarily residential however other zones (e.g. commercial, public purposes) are located in the vicinity of the Site (Figure 3).

8.0 Environmental Setting

8.1 Topography

The Site generally comprises a gently undulating linear area, largely parallel with and to the north of the Swan River. Regional topography slopes down to the south towards the Swan River approximately 1.5km south of the Site (see Section 8.5 for additional hydrology information).

Golder's (2019) indicate:
- The rail corridor runs approximately south-west to north-east and is bounded by Railway Parade to the north and Whatley Crescent to the south. Whatley Crescent is separated from the railway by a PSP which runs parallel to the railway corridor.
- King William Street underpass is the current lowest elevation point at Bayswater Station with all roads sloping towards the underpass. The level of the carpark located south of Bayswater Station is generally at grade with the adjacent rail and hen slopes to the west (towards King William Street).

- Whatley Crescent slopes upward from King William Street and is up to 2m higher than the rail level at the eastern end.
- It is understood that currently several design options are being considered. The options will include cut/fill with the future station entry ground level ranging between approximately Reduced Level (RL) 14.5m to 15.6m Australian Height Datum (AHD). The concourse entry level will at approximately RL 15.2m AHD. The lowest elevation will still be at the King William Street underpass, through the road will be raised by up to approximately 1.5m from the current RL 13.2m AHD (at its lowest point).
- The area with most planned cut is expected to be in the eastern portion of the Site.

8.2 Geology

8.2.1 Published Geology

Based on the extent of the Site as described in Section 7 and identified in Figure 2a and mapping (Perth Metropolitan Region, 1:50,000 Environmental Geology Series Sheet 2034 II, Geological Survey of Western Australia [GSWA], 1986) the following information is provided in regards the mapped geology within the Site.

- The majority of the Site is mapped as being underlain by sand (S8) associated with Bassendean Sand (QPb) (see Figure 4) which is very light grey at surface, yellow at depth, fine to medium grained, subrounded quartz, moderately well sorted and of eolian origin.

- Two small areas, between Lawrence Street and Coode Street and between Coode Street and Beechboro Road (see Figure 4) are mapped as comprising 'peaty clay' (Cps) of lacustrine origin.

8.2.2 Site Specific Geology and Subsurface Conditions

JBS&G (2018) and Golders (2018 and 2019) both undertook investigations which included an assessment of Site-specific soil conditions. Key findings are summarised in Table 2. The Geotechnical Investigation (Golders, 2018) should be referred to for more detailed information on subsurface conditions.

Data Source	Key Findings
JBS&G (2018)	• 'Area of Soil Disturbance' identified between King William Street and Beechboro Road. • Additional detail is provided in soil bore logs.
Golders (2018)	• Golder (2018) inferred that the base of the superficial formation is expected to occur between -16mAHD and -20mAHD, coinciding with the underlying Osborne Formation unit. • Golders (2018) indicated that the Bassendean Sand had an average thickness of 8m and was overlain by a topsoil layer (0.1m thick). The Perth Formation was up to 17m thick. • Additional detail is provided in soil bore logs.

Table 2: Site Specific Geology and Subsurface Conditions

8.3 Acid Sulphate Soils

8.3.1 Published Mapping

Based on the extent of the Site as described in Section 7 and identified in Figure 2a, the following information is provided in regard to mapped areas of acid sulfate soils (ASS) within the Site (see Figure 5a).

- The majority of the Site (correlating with geological unit S8) is mapped as Risk Class 2 'Moderate to Low Risk' of ASS occurring within 3m of natural soil surface but high to moderate risk of ASS beyond 3m of natural soil surface (see Figure 5a).

- Two small areas, between Lawrence Street and Coode Street and between Coode Street and Beechboro Road (see Figure 5a) are mapped as Risk Class 1 ''High to moderate risk' of ASS occurring within 3m of natural soil surface' correlating with the mapped 'peaty clays' (Cps) (see Figure 5a).

Based on intrusive ASS Investigations conducted (Golders, 2018 and JBS&G, 2019), JBS&G have mapped an 'inferred ASS area', based on investigations to 5.5mbgl, as shown in Figure 5b.

8.4 Hydrogeology

8.4.1 Regional Hydrogeology

A review of the Department of Water and Environmental Regulation's (DWER's) Water Register (https://maps.water.wa.gov.au/#/webmap/register) and Perth Groundwater Map (https://maps.water.wa.gov.au/#/webmap/gwm) indicates the Superficial aquifer beneath the Site is approximately 6.5m bgl (9.0mAHD) and the base of the aquifer is 30.5m bgl (–15mAHD). The deeper aquifers in the region are the Leederville Aquifer and the Mirrabooka Aquifer. Underlying these aquifers is the Yarragadee North Aquifer.

An assessment of groundwater was undertaken by Golder (2019) for the Site whom describe the hydrogeology as Bassendean Sand, underlain by the Perth Formation (also referred to as the Guildford Formation), which is comprised of alluvial sediments. The Perth Formation comprised layers that are both sand-dominated and clay-dominated. Golder infer that the base of the superficial formation in the Project area is expected to occur between -16mAHD and -20mAHD, coinciding with the underlying Osborne Formation unit. A geotechnical investigation (Golder, 2018 as cited in Golder 2019) indicated the Bassendean Sand had an average thickness of 8m and was overlain by a topsoil layer (0.1m thick). The Perth Formation was up to 17m thick.

Groundwater flow direction is towards the river, south to southeast of the Site, as shown by historical maximum groundwater contours presented in Figure 6a.

8.4.2 Site Specific Groundwater Data

JBS&G (2019) and Golders (2019) both undertook investigations which included an assessment of Site-specific groundwater. Key findings are summarised in Table 3.

Data Source	Key Findings
JBS&G (2019)	• Results available for five groundwater monitoring wells (MW1, MW2, BH01, BH02, BH03) within or adjacent to the Site, located north and south of the rail corridor between Veitch Street and Slade Street (see Figure 6b). • Groundwater quality was summarised by as: – fresh to brackish and acidic conditions;

Data Source	Key Findings
	– total acidity ranged from 15mg/L to 28mg/L. – heavy metal concentrations were generally below the adopted assessment criteria with the exception of copper, zinc, nickel and cadmium whereby some samples exceeded the Fresh Water criterion; – hydrocarbons were not detected in groundwater.
Golders (2018)	• Golder (2018) estimates the current water levels to be between 11mAHD and 15mAHD. • Groundwater quality was summarised by as: - brackish and slightly acidic to neutral conditions; - total alkalinity was higher than total acidity, indicating positive net alkalinity and potential buffering capacity; - majority of the metal concentrations are relatively low; - total nitrogen ranged between 0.5mg/L and 1.4mg/L; - hydrocarbons and pesticides were not detected in groundwater.

Table 3: Site Specific Hydrogeology

8.4.3 Licensed Groundwater Abstraction Bores

Figure D shows the area that relates to the existing production bore operated by City of Bayswater within the Rail Reserve under groundwater licence 161084. The red shaded areas show the portions that the City of Bayswater watered up to the end of May 2019 (W. Peace, Irrigation Team Leader, pers. comm. 15 June 2020). Due to the redevelopment of the Bayswater Train Station between May 2019 and May 2020 the city only watered the corner of Rose Avenue Railway Parade from the production bore which will continue as long as it is possible during the redevelopment. The yellow pin is the bore location and the green pin is the electrical control cabinet.

License 161084 entitles the City of abstract 1,268,430 kilolitres (kL) annually for irrigation across the City, however only 1500 kL of the license allocation is abstracted from the bore (yellow pin in Figure D) located in the Rail Reserve.

The Alliance will investigate further whether the bore can be utilised for construction activities otherwise construction water will be obtained from scheme water.

Figure D: Location of Production Bore (Yellow Pin) and areas watered by the City (red shading)

8.5 Hydrology

The Site runs typically parallel with and to the north of the Swan River which is located approximately 1.5km to the south (see Figure 6a).

The following surface water bodies are also located between the Site and the Swan River:

- A Multiple Use Sumpland (Unique Feature Identifier (UFI) 8431) is situated just outside the Site boundary near the corner of Railway Parade and Tonkin Highway.
- Swan Lake located approximately 550m south east of Meltham Station.
- Gobba Lake located approximately 500m south of the Tonkin Highway / Guildford Road intersection.
- Unnamed water body within Eric Singleton Bird Sanctuary located approximately 700m south west of the Tonkin Highway / Guildford Road intersection. The unnamed water body discharges into the Swan River approximately 250 m to its south.
- The Bayswater Main Drain runs from the north bisecting (underlying) the rail reserve at Lot 2630 P2052 approximately 70m east of the Whatley Crescent / Anzac Street intersection. The drainage line flows south to Eric Singleton Bird Sanctuary and in turn discharges into the Swan River.

8.5.1 Surface Water Drainage

JBS&G (2018) indicate that with regards to the rail corridor, rails were situated on raised ballast preventing any inundation, with steep slopes observed away from the rail gauges down towards adjacent drainage lines / infiltration swales and/or open stormwater pits.

In sealed areas of the Site, particularly road reserves, water would be expected to flow towards stormwater drainage infrastructure. Water in unsealed areas would be expected to migrate across the surface consistent with local topography however, during periods of sustained rainfall water would be expected to infiltrate the surface at a rate reflective of the surface geology in the area.

8.6 Flora and Vegetation

A flora and vegetation survey was undertaken in October 2018 by PGV Environmental. Excluding the fenced rail reserve, the Site was walked to record the vegetation types and native species in the survey area. No quadrats or relevès were sampled as the survey area did not contain any intact native vegetation. PGV Environmental (2019) and Harewood (2019) reports provided specific flora and fauna advice for the Project which is summarised below.

8.6.1 General

- PGV Environmental (2019) recorded 42 plant species during the 2018 flora survey, 12 of which are considered locally native. Most of the native species identified have regrown naturally following construction of the Tonkin Highway / Guildford Road interchange. However, these are located outside of the construction footprint.
- Examination of historical aerial photographs indicate that the stand of Tuart trees at the intersection of Railway Parade and Bassendean Road (referred to as Location ID 18) were planted rather than being remnant trees (PGV Environmental, 2019).

8.6.2 Conservation Significance

- No Threatened or Priority flora species were recorded on the Site during the survey.
- As there was no intact native vegetation, no Threatened or Priority Ecological Communities occur on the site (PGV Environmental, 2019).

8.6.3 Vegetation Description and Condition

- All vegetation within the Site was mapped by PGV Environmental (2019) as non-native (Figure 7).
- The condition of the vegetation was assessed according to the system of Keighery as described in Bush Forever (Government of Western Australia, 2000).
- The condition of the vegetation across the entire site was rated as Completely Degraded and is shown in Figure 7 (taken from PGV Environmental [2019]).

8.7 Fauna

A fauna habitat assessment, which comprised of a desktop review and reconnaissance survey (undertaken on 28 September 2018), was completed by Greg Harewood (Harewood, 2019). Key information is summarised below.

8.7.1 General

- Overall fauna values of the Site are rated as extremely low given the highly degraded nature of the majority of the Site. Fauna biodiversity within the Site is depauperate, however given the presence of some vegetation, the area still has value for some species able to persist in degraded habitats of this type.
- Most of the fauna species likely to be present would be common, widespread species (mainly birds). The vast majority of the conservation significant species identified as having been previously recorded in the wider area would not persist on the Site primarily due to a complete lack of suitable habitat (i.e. quality and/or extent).
- Evidence of four fauna species (all birds) was observed during the reconnaissance survey. The limited number of species observed can be attributed to the small size of the Site, the limited extent of vegetation and it's generally highly degraded state.
- The Black Cockatoo habitat tree assessment identified a total of 28 trees with a Diameter at Breast Height (DBH) of >50cms within the site. None of these trees appeared to contain hollows of any size and no evidence of breeding activity by Black Cockatoos was observed. Additional details on each habitat tree observed can be found in Appendix D of the Harwood (2019) report.
- Evidence of Black Cockatoo foraging was observed during the reconnaissance survey in the form of chewed Marri fruits and Pinecones. This evidence was attributed to the Forest Red-tailed Black Cockatoo (Marri fruit) and Carnaby's Black Cockatoo (Pinecones). The foraging debris was observed in a small number of locations, a consequence of the low number of favoured trees species present on the Site.
- No evidence of Black Cockatoos roosting within trees located inside the Site was observed during the survey.

8.7.2 Conservation Significance

- Two species of conservation significance were positively identified as utilising the Site during the field survey (Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*) and Carnaby's Black Cockatoo (*Calyptorhynchus latirostris*)).
- Based on the habitats present it has been determined that two additional species of conservation significance may possibly occur at times (Baudin's Black Cockatoo (*Calyptorhynchus baudinii*) and the Peregrine Falcon (*Falco peregrinus*)) but their current status on-site and/or in the general area is difficult to determine because they were not identified during the survey and no evidence of their use of the Site was observed. Given the limited extent of suitable habitat present, it can be expected that these species only occur occasionally and then only for brief periods.
- Baudin's Black Cockatoo is endemic to south-west Western Australia and is gregarious, usually being seen in groups of three or more but occasionally gathers in large flocks of up to 300 birds where food is abundant.
- This species mainly feeds on the seeds and flowers of Marri but also seeds of Jarrah, apples and pears, Banksia and Hakea species, *Erodium botrys* and insect larvae.
- The Peregrine Falcon is generally uncommon and only likely to occur very infrequently for brief periods. This species generally feeds on small and medium-sized birds as well as rabbits and other species. It occupies a very wide range and forages across large areas. Given the degraded nature of habitat on the site, it is unlikely that the site provides significant food resources for the Peregrine Falcon.

8.8 Contaminated Sites

It is understood from the available documentation that none of the 32 parcels of land which make up the Site are currently classified under the *Contaminated Sites Act 2003.*

Given the historical use of the land within the Site, the following sources of contamination may be encountered during earthworks (cut to fill) required to be undertaken for the Project:

- Historical fill materials, particularly within the rail reserve
- Actual and Potential ASS
- Organochloride pesticides (OCPs) in soils beneath building slabs (see Note 1)
- Hazardous materials within buildings or other infrastructure (pits and underground pipes) (see Note 2)
- Soak wells / sumps

A contaminated site (the former BP Magnolia site at 2 Coode Street and 92 Railway Parade, shown in green shading on Figure 8) is located within the vicinity of the Site and was recently classified as 'Remediated – for restricted use' on 13 May 2020. Gemec completed a DSI in December 2019 (Gemec, 2020) and their conceptual site model and risk assessment was:

'..based on the identified COPC and other data gathered from these works, and our professional opinion, indicated that in general no risk to receptors was identified, with the exception of a very low risk to soil biota from the copper and zinc (residential setting only) impacts. The very low risk was predicated on the potential for landscaped garden beds to be located in the vicinity of impacts following redevelopment.'

The DWER' Basic Summary of Records obtained from the contaminated sites database describes the nature and extent of contamination as 'Following remediation, hydrocarbons (such as from petrol or diesel) remain in subsurface soil beneath the site.'

Notes:

1. *In* accordance with Section 4(2) of the Contaminated Sites Regulations 2006, *'land, water or a site is not contaminated where the only substance that is present in or on that land, water or site at above background concentrations that presents, or has the potential to present, a risk of harm to human health, the environment or any environmental value is - (f) a substance that is present as a direct result of the correct application of a fertiliser, herbicide or pesticide to land, subject to sub-regulation (3)."* Sub-regulation (2)(f) *'does not apply in respect of land, water or a site if there has been a change to the use to which the land is put since the application of the fertiliser, herbicide or pesticide. In this regulation correct application, in relation to a fertiliser, herbicide or pesticide means application in accordance with (a) any written law regarding the application of the fertiliser, herbicide or pesticide which was in force at the time of the application; or (b) if no such written law was in force at that time, any relevant recommendation of the manufacturer or distributor of the fertiliser, herbicide or pesticide.'*
   On this basis, pesticides, if present in soils beneath building pads, are not considered to be contamination whilst the buildings remain, however if the Site or a building is redeveloped, a new potential exposure pathway is created as part of a change in land use, then the potential presence of pesticides will need to be assessed in the context of the proposed new land use(s).

2. Asbestos containing materials (ACM) in buildings do not constitute contamination under the *Contaminated Sites Act 2003* whilst the buildings remain in use and an asbestos register is actively maintained with regular inspections undertaken. In the event that buildings or infrastructure is required to be removed, it is required to be managed in accordance with the Demolition Management Plan. This CEMP also includes strategies to manage Unexpected Finds including buried ACM infrastructure (see Section 16.3).

9.0 Environmental Planning

Within Acciona's Integrated Management System (IMS) is the Environmental Management of Permanent Workplaces Procedure (IMS-PRO-019) which outlines the environmental planning required for the Project, as described below. This Procedure is based on Parent Company

(ACCIONA Group) Standards for Environmental Management (NCMA01), which also complies with ISO 14001 Environmental Management System requirements.

9.1 Aspects and Impacts

Environmental aspects are identified (with particular emphasis on 'Significant Aspects'), potential impacts are assessed, and appropriate action implemented to control the environmental risks associated the Project.

The Environmental Aspects Register will be developed in accordance with the Identification and Evaluation of Environmental Aspects Procedure. The Environmental Aspects Register will be continually be reviewed as the Project develops and environmental investigations are completed, and potential impacts are reviewed.

Supporting Documentation: Environmental Aspects Register

9.1.1 Environmental and Heritage Risk Workshop

Evolve Bayswater will schedule an environmental and heritage risk workshop for the Project. Once the workshop is completed, the Environmental and Heritage Risk Register will be communicated to the project and reviewed at quarterly intervals by relevant stakeholders as well as responses to any high or extreme environmental incidents, changes in legal requirements or following any approvals obtained by the Alliance, Changes in the scope of works, any high or extreme outcomes from audits and inspections and management review findings.

Updated risk registers will be communicated to PTA through the Monthly Environmental Report.

Supporting Documentation: Environmental and Heritage Risk Register

9.2 Legal and Other Requirements

Environmental legal and other requirements including approvals, licenses and permits will be identified, registered and treated as per the Identification of IMS Legal and Other Requirements Procedure.

The Western Australian environmental legal and other requirements are identified on the Environmental Legislation Reference Register located within the Acciona IMS.

An Environmental and Heritage Obligations Register will be developed following the Risk workshop. The register will be updated and maintained as a live document throughout the project life and will form part of the Alliance's monthly environmental Report.

Supporting Documentation: Environmental and Heritage Obligations Register

9.3 Timing of Construction Activities

The works will be completed in two main stages:

1. construction of the new station and precinct south and;
2. north of the existing station and track formation.

The following figures show details of the site establishment for the two main stages. Refer to the Construction Management Plan for additional information.

Site Establishment for Works South of the Existing Station and Rail Formation

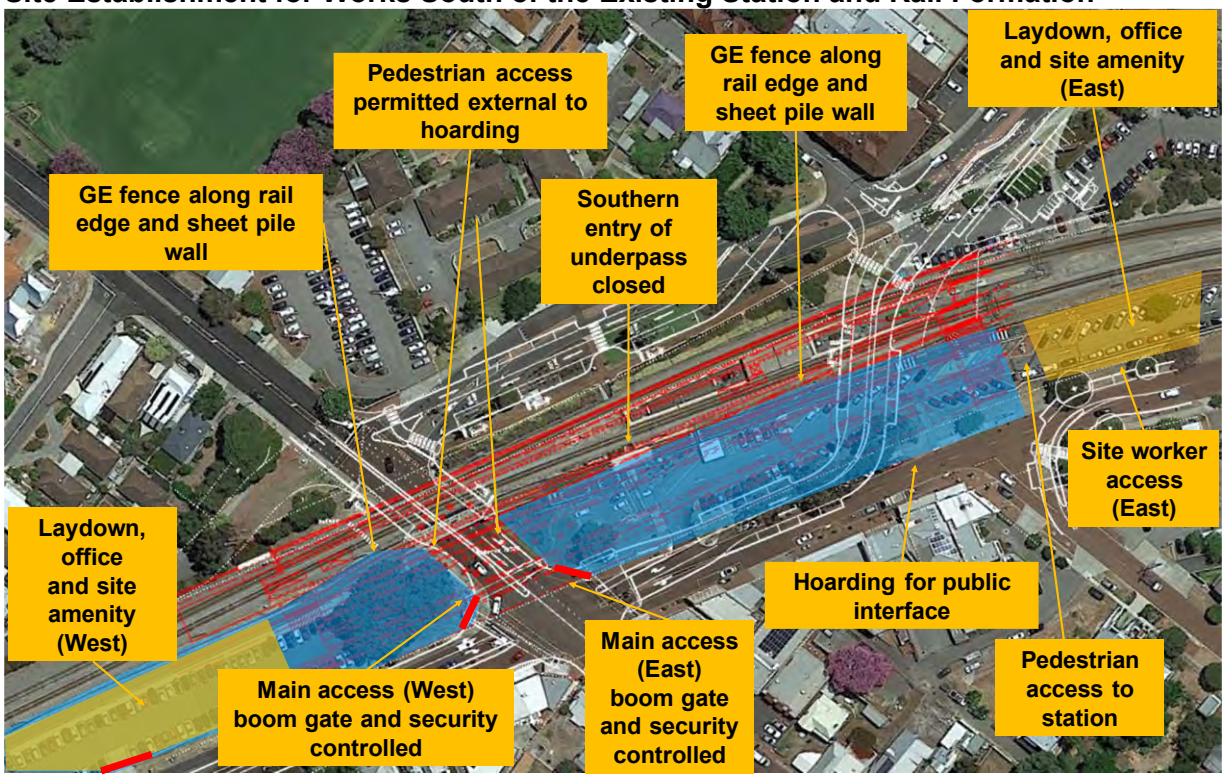


Figure E: Stage 1 Site Layout

Site Establishment for Works North of the Existing Station and Rail Formation

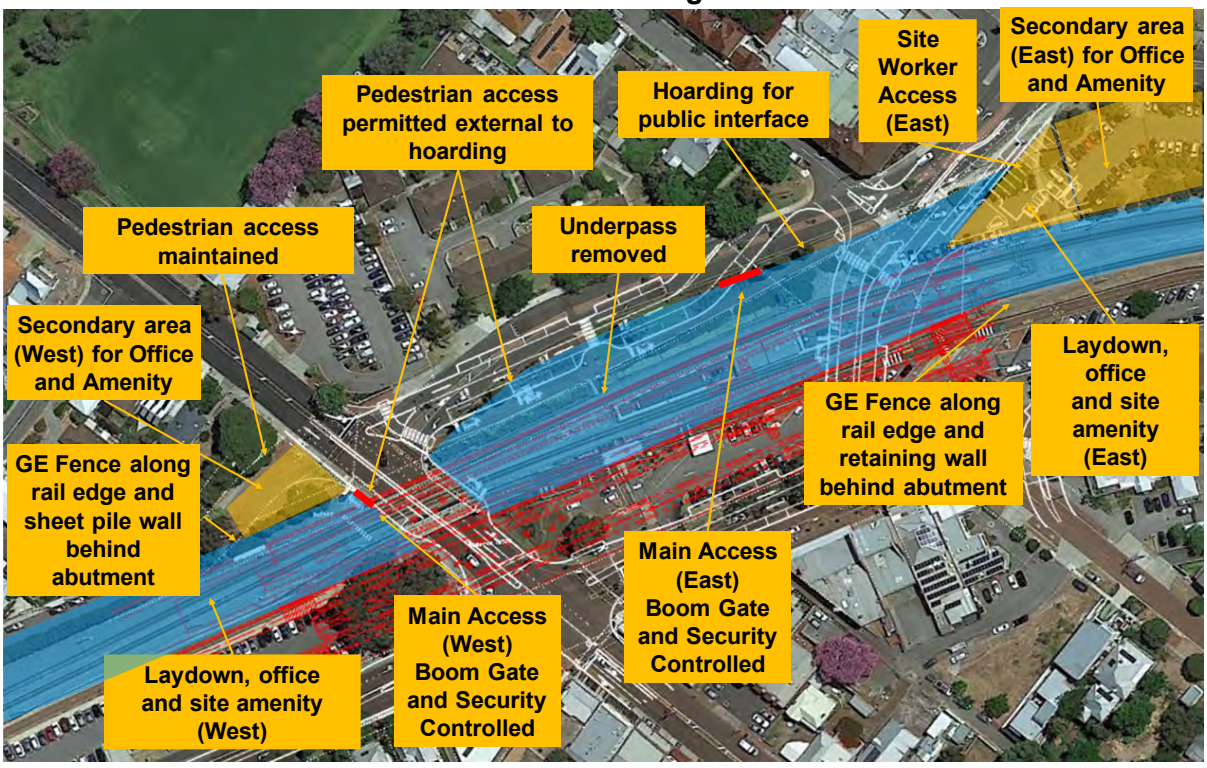


Figure F: Stage 2 Site Layout

10.0 Implementation and Operation

10.1 Communication, Consultation and Participation

10.1.1 Stakeholder Engagement and Consultation

A comprehensive and fully resourced Community Engagement Plan will detail Evolve Bayswater's commitment to effective community consultation and stakeholder engagement to inform its decision making and enable key elements of the community's vision for the Baywater townsite.

The Metronet call centre (www.METRONET.wa.gov.au) email (info@METRONET.wa.go.au) and phone (9326 3666) will be the first point of call for all project enquiries and complaints.

The call centre will act as a reception service and transfer calls the nominated representative. For afterhours calls, the project will create a dedicated 1800 number and promote this to stakeholders likely to be impacted by after-hours works. See section for call management details.

Refer to the Community Engagement Plan (BST-EVO-SM-PLN-00003) for the detailed process.

10.1.2 Communications

10.1.2.1 Stakeholders

Project stakeholders will be engaged across three categories - primary, secondary and remote. Stakeholders will also be allocated to an engagement category (based on the IAP2 Engagement Spectrum) at the commencement of the project and may shift categories during the project. The Alliance will engage the community in a proactive, transparent, open, and timely manner to understand their needs and concerns. The project's resources are however limited, with the greatest resources focused on stakeholder holders with high interest and power in the project.

Stakeholders identified are outlined in the Community Engagement Plan (BST-EVO-SM-PLN-00003 Section 5.2).

Key messages regarding the environment identified by the Community Engagement Plan are:

- The project includes street scaping, public art, and landscaping.
- The Alliance will only remove trees that it needs to remove, and trees will be replaced more trees than are removed at an agreed ratio for every tree removed.
- Cleared vegetation will be recycled.
- The Kurrajong tree was identified as a tree of community significance and this was relocated in early 2020.
- The METRONET expansion will cater for Perth's population growth and encourage more people to preference the use of public transport of personal vehicles.
- Transport Orientated Developments (TODs) have been proven to be highly effective in providing affordable opportunities for people to live in desirable inner-city locations. This reduces the demand for properties in new developments on Perth's urban fringe. These developments remove significant vegetation and rely heavily on personal vehicles for commutes increasing carbon pollution.

- Expert engineering advice, supported by local knowledge and input, will be used to finalise the project design.
- Careful planning will minimise disruption, but with a project of this size some inconvenience is unavoidable.
- Where there is disruption, businesses, residents, and commuters will be notified of impacts and, where necessary, alternative travel arrangements well in advance.

Further information on stakeholder engagement can be found in the Community Engagement Plan (BST-EVO-SM-PLN-00003).

10.1.2.2 Alliance Team

The Alliance aims to ensure that appropriate methods of communications, both internally and externally are adopted for the duration of the Project. Good communication practices enable individuals to be aware of environmental issues, participate in environmental management activities, identify risks, and assist in developing corrective and preventative actions. Communication on environmental matters may occur through one or more of the following mechanisms in Table 4.

EVENT	FREQUENCY / REQUIREMENT	PARTICIPANTS	RECORD / EVIDENCE
Project specific induction	Prior to commencement of contracted work	All personnel	Project induction and declaration form
Work activity induction (including SWMS or equivalent)	Prior to commencing any work	Personnel carrying out specific work activities	Record of induction Record of SWMS being reviewed and signed
Toolbox Meetings	Daily and during the introduction of a new process (SWMS) or when discussing environmental issues/topics	Supervisors and their employees including contractors, their employees, suppliers and service providers	Toolbox Talk Record or other
Environmental Site Inspections	Weekly	HSSEQ Manager	Environmental inspection records
Project and Contractor Meetings	Weekly / Fortnightly / Monthly	Project Team (as required) Lead Contractor (supervisors as required)	Minutes of meeting
Notice Boards Site Office and Entrance and other key areas (e.g. crib rooms)	As required	All personnel	Notice Boards
Enquiries and Complaints	As required	Project Team	Community Complaints / Queries Register

EVENT	FREQUENCY / REQUIREMENT	PARTICIPANTS	RECORD / EVIDENCE
External stakeholders	As required	Project Team (as required)	Minutes of meeting / workshop as applicable
Environmental Incident	As required	Project Team (as required)	Environmental Incident Report
Unexpected Finds	As required	HSSEQ Manager Project Team (as required)	Unexpected Find Register (including photographs) Immediate Action Response (IAR) Soil Investigation / Validation Clearance Report Interim Audit Advice
Clearance Inspections *(Applicable to Hazardous Materials such as asbestos containing material [ACM])*	As required	HSSEQ Manager Project Team (as required)	IAR Clearance Certificate and / or Close-Out Report
Soil Investigation / Validation Sampling	As per CEMP In response to unexpected finds	HSSEQ Manager Project Team (as required)	IAR Soil Investigation / Validation Clearance Report

Table 4: Project Communication

10.1.2.3 Site Personnel

All personnel working on Site are required to:

- Complete a Site induction. The induction will communicate content from the CEMP such as potential sources of contamination, management and mitigation measures for the Project including emergency and incident response.
- Attend on-the-job training and awareness e.g. toolbox talks, training in system procedures, SWMS particularly those which include significant environmental risks for the Project.

Communications related to this CEMP that will be performed on a regular basis include:

- Toolbox Meetings
- Environmental alerts
- Process monitoring and control
- Non-conformities
- Improvement Actions: corrective and preventive
- General office management aspects

10.2 Environmental Record Keeping

10.2.1 Document Control

All the documents related to and included in the CEMP will be version controlled, identified, distributed to the persons holding CEMP responsibilities, and filed in adequate conditions as per the Document Control and Records Management Procedure.

If the distribution includes external parties, this shall only be performed through formal transmittal. PTA communication and document control will be used through Teambinder.

Further information on document control is provided in the Quality Management Plan.

10.2.2 Environmental Registers

The following Project specific registers relevant to this CEMP will be established and maintained during the Project:

1. Environmental and Heritage Risk Register
2. Environmental and Heritage Obligations Register (including Licenses, Permits and Approvals)
3. Environmental Aspects Register
4. Environmental Incidents Register
5. Non-conformance Register
6. Hazardous Materials Register
7. Unexpected Finds Register
8. Material Tracking Register

Copies of all licenses, permits and approvals for the project will be saved in the project sharepoint, documented onto the register and available during the time of audits and inspections. Copies of approvals, permits, and licenses will also be obtained from subcontractors.

The relevant registers will be updated and form part of the monthly report.

10.2.3 Permit System

A permit system will be implemented on the project and will include permits such as

- Ground Disturbance
- Demolition
- Asbestos removal Permit

Refer to the Permit to Work Procedure HSE-PRO-1300

10.3 Health and Safety

The Safety Management Plan (BST-EVO-SA-PLN-00004) outlines the requirements for

- Inductions and Orientations
- Training and Competency
- Management of Sub-contractors
- Works in and around the rail reserve.

10.3.1 Training and Competency

Training and competency will be managed as follows:

- Environmental training sessions will be performed at the Evolve Bayswater office or onsite to assure awareness and competency of staff in the related matters, and is likely to include:
  - Toolbox meetings

  - Meetings.
  - One on one sessions.
  - External training.
- Recognized trade specific license's and competency requirements are verified prior to employment. If there are no trade specific license or competency requirements, the experience of the person in that particular trade shall be verified. This requirement is applicable to all Evolve Bayswater and Subcontractor employees.
- Further training and development needs may also be identified during and/or annual reviews, through normal supervision, auditing, complaints, or introduction to new machinery, work practices, changes in role and transfers.
- All training and inductions will be recorded on the project training matrix and copies of completed inductions will be uploaded to The Alliance's training database Lucidity and available upon request.

10.3.2 Induction and Orientation

All Project leadership and induction sessions shall include environmental requirements for the Project.

The Alliance induction and orientation program shall include information on environmental requirements specific to the Site and this CEMP such as;

- ground disturbance work requirements;
- environmental monitoring and data reporting requirements;
- ASS, groundwater and contaminated land management requirements;
- noise and dust management requirements;
- Aboriginal heritage and Aboriginal heritage management requirements;
- hazardous materials and hydrocarbon management requirements;
- waste management requirements;
- weed and hygiene management requirements;
- inspection and audit requirements (i.e. audit schedule and protocols);
- environmental emergency / spill response and incident management and reporting;
- unexpected finds management;
- Spill kit contents and how to use these tools and dispose of oily waste; and
- Animal handling.

Cultural awareness training will also form part of the induction process outlining

- Generic Cultural Awareness Training with the requirement that 100% of all Alliance personnel complete this within 3 months of their commencement date
- HR and Recruitment Cultural Awareness training specifically tailored towards Human resource professionals
- Supervisor Cultural Awareness Training specifically tailored for in the field.
- Corporate Cultural Awareness Training which shall be additional sessions which are tailored to members of the ALT and AMT

The induction will be provided to PTA for review.

10.3.3 Management of Subcontractors

Subcontractors are to be involved in site environmental audits as required; on at least a monthly basis one subcontractor shall be involved in a site environmental audit/inspection.

Major subcontractors and subcontractors of significant or high environmental risk will have in place systems that encourage written procedures, communication and workforce participation and may be required to nominate a site environmental representative.
Subcontractors are responsible for the following:

- Subcontractor employees are required to participate in the Alliance site specific induction prior to commencing works onsite
- Subcontractors are to ensure adequate instruction, training and supervision of their employees to enable them to perform their work without risk to the environment
- Subcontractors are to ensure employees are appropriately trained, qualified and licenced to perform their work. Evidence of training and qualifications must be produced at the site induction
- All plant and equipment to be maintained, certified and in good working order. Copies of logbooks and maintenance records for all plant and equipment are to be made available to the Alliance upon request
- Subcontractors are to ensure work is carried out in accordance with the applicable environmental legislation, associated regulations, relevant Codes of Practice and guidelines
- Subcontractors are to provide Safety Data Sheets (SDS) for all material to be used onsite
- Subcontractors are to ensure all employees are provided with Personal Protective Equipment (PPE) appropriate for the works being undertaken
- Subcontractors are to attend site safety meetings, site environmental meetings and toolbox meetings as requested
- Subcontractors are to undertake daily prestart meetings

11.0 Access and Security

11.1 Traffic Management

The Traffic and Transport Management Plan (TTMP) BST-EVO-TM-PLN-00002 outlines the traffic control and traffic management procedures to be implemented by Evolve Bayswater to manage potential hazards associated with the traffic environment during the project.

The project will deliver a series of key road network and rail network changes that include multiple stages. The TTMP will outline how the temporary changes to the road and path network will be managed to maintain the safety for all stakeholders.

11.2 Construction and Exclusion Zones

Construction and exclusion zones are set out in the Construction Management Plan BS-EVO-PM-PLN-00001. Refer to this plan for further details.

11.2.1.1 Rail Reserve

All environmental management requirements for the rail reserve will be outlined in the specific sub plans developed for the construction activity within the rail reserve.

12.0 Fauna Management Plan

12.1 Existing Habitat and Species

A fauna habitat assessment, which comprised of a desktop review and reconnaissance survey (undertaken on 28 September 2018), was completed by Greg Harewood (Harewood, 2019). The assessment included the following observations, conclusions and recommendations:

- Fauna values of the Site are rated as extremely low given the highly degraded nature of the majority of the Site.
- Fauna biodiversity within the Site is depauperate, however given the presence of some vegetation (see Figure 7), the area still has value for some species able to persist in degraded habitats of this type.
- Evidence of four fauna species, all birds, was recorded during the field survey. The limited number of fauna species observed can be attributed to the small size of the subject site, the limited extent of vegetation and generally highly degraded state.
- Two species of conservation significance were positively identified as utilising the subject site for some purpose during the field survey (Forest Red-tailed Black Cockatoo and Carnaby's Black Cockatoo).
- Based on habitats present two additional species of conservation significance may possibly occur at times (Baudin's Black Cockatoo and Peregrine Falcon) though their current status on-site and/or in the general area is difficult to determine because they were not sighted during the survey period and no evidence use of the subject site was found.
- Given the limited extent of suitable habitat present it can however be expected that all these species only occur occasionally and then only for brief periods. The assessment (Harewood, 2019) stated that the potential impact to conservation significant species from the proposed development would vary depending on their current degree of utilisation/population densities and preferred habitat requirements (e.g. quantity and quality of potential foraging habitat that will be affected when clearing of the site is undertaken).
- However, the potential impacts on these species and/or their habitat should be taken into consideration during ongoing planning.

Refer to Figure 7 for identified suitable Black Cockatoo habitat trees within the Site.

12.2 Purpose

The purpose of this Fauna Management Plan is to describe how the Alliance and all Project subcontractors will manage and control impacts on fauna values from construction activities associated with the Project.

This plan establishes protocols to follow for during the course of works associated with the Project with respect to pre-existing fauna management in addition to feral or introduced fauna.

12.3 Objectives

Project environmental objectives have been developed for general Site management, flora and fauna values, native vegetation and communities. This section describes the specific environmental performance objectives and requirements to be achieved for the duration of the Project. All construction works will comply with applicable legislation and this CEMP.

The environmental performance objectives and indicators for fauna are detailed in Table 5.

Objective	Target	Indicator
Minimise impacts of construction activities on conservation significant fauna species.	No death or injury of Carnaby's Black Cockatoo, Forest Red-tailed Black Cockatoo, Baudin's Black Cockatoo or Peregrine Falcon.	No records of environmental incidents that concern injury or death of individual Black Cockatoos or Peregrine Falcon.

Objective	Target	Indicator
Minimise impact to fauna habitat outside and adjacent to the Site boundary.	No clearing of fauna habitat outside of the Site boundary.	Visual inspections documented in Monthly Environmental Reports. Environmental incident records.

Table 5: Fauna Management - Objectives, Targets and Indicators

12.4 Management Strategies

The fauna management strategies are listed in Table 6.

Parameter	Management Strategy	Timing	Responsibility	Site Inspection / Audit Records
Site Induction	All personnel entering the site should be made aware of the CEMP and the importance of: • not clearing vegetation outside of the Site boundary. • the potential presence of Black Cockatoos and Peregrine Falcon's on the Site. • Importance of reporting any death or injury of conservation significant fauna.	Construction	HSSEQ Manager	Site Induction Records
Clearing Controls	Where possible clear potential Carnaby's Black Cockatoo or Forest Red-tailed Black Cockatoo (black cockatoo) habitat trees outside the black cockatoo breeding season.	January – July	HSSEQ Manager	Monthly Environmental Report Environmental Incident Report
	Inspect any habitat trees to be cleared for evidence of active nesting/breeding activity by Black Cockatoo, during breeding season. If active Black Cockatoo nesting activity is observed during	Within the 7 days prior to clearing stage during August – December only.	HSSEQ Manager	Monthly Environmental Report Environmental Incident Report

Parameter	Management Strategy	Timing	Responsibility	Site Inspection / Audit Records
	the inspection implement the contingency measure detailed in Table 13.			
	Inspection of clearing front/extents to ensure no clearing outside of the Site boundary.	Construction	HSSEQ Manager / Site Superintendent	Monthly Environmental Report Environmental Incident Report
	Walkover inspection for fauna ahead of and during vegetation clearing activities (such that further fauna relocation can be undertaken where appropriate using qualified personal as per pre-clearing management action).	Construction	HSSEQ Manager / Site Superintendent	Monthly Environmental Report Environmental Incident Report
Feral Animals and Pests	Waste will be disposed appropriately to discourage feral animals and pests entering the Project Site.	Construction	Site Superintendent / Construction Manager	Environmental Incident Report
	Site personnel will be prohibited from feeding or interacting with fauna (native or feral).	Construction	Site Superintendent	Environmental Incident Report
Injured Wildlife	If an animal is found within the Site that is injured an ecologist should be contacted to	Construction	HSSEQ Manager / Site Superintendent	Environmental Incident Report

Parameter	Management Strategy	Timing	Responsibility	Site Inspection / Audit Records
	determine the best course of action for the individual. If the injuries are too great for the animal to be relocated, then the animal should be taken to a Wildlife Carer or Veterinary Clinic. Contact: DPAW Wildcare Helpline: (08) 9474 9055.			
Monitoring	Daily inspections of construction work areas in the morning and afternoon to identify any trapped fauna and to enable capture and relocation.	Construction	Site Superintendent	Environmental Incident Report

Table 6: Fauna Management Strategies

12.5 Contingency Management Strategies

Table 7 identifies the appropriate contingency actions to be initiated in the event that the performance objectives for fauna management are not met.

Trigger	Contingency Management Strategy	Responsibility	Site Inspection / Audit Records
Active Carnaby's Black Cockatoo or Forest Red-tailed Black Cockatoo nesting is observed in trees proposed to be cleared.	1. Report nesting tree(s) to HSSEQ Manager and Construction Manager. 2. Install temporary fencing and signage within two metres of the base of the tree and record the tree GPS. Demarcate a 10m buffer around the base of the nesting tree(s). 3. Retain the nesting tree(s) until hollows are no longer in use and do not clear any vegetation within 10m of the nesting tree (s) while in use. Re-inspect the tree(s) 7 days prior to clearing to reconfirm all birds have vacated the nest.	Site Superintendent	Correspondence and photographs. Monthly Environmental Report

Trigger	Contingency Management Strategy	Responsibility	Site Inspection / Audit Records
	4. Report the status of nesting tree(s) to the HSSEQ Manager and suitability for clearing.		
Feral animals / pests are identified within the Site	1. Report sighting to HSSEQ Manager and Construction Manager.	Site Superintendent	Correspondence and photographs. Monthly Environmental Report

Table 7: Fauna Management Contingency Strategies

13.0 Vegetation Management Plan

13.1 Existing Vegetation

A detailed flora and vegetation survey, which comprised of a desktop review and field survey (undertaken on 22 October 2018), was completed by Dr Paul van der Moezel (PGV Environmental, 2019). The Study Area was larger than the Site to which this CEMP applies. The key findings relevant to the Site were:

- No intact areas of native vegetation were recorded on the Study Area;
- Some native species were recorded in the road reserve, particularly within the Tonkin Highway/Guildford Road interchange. These are considered to have all regenerated naturally after the interchange was constructed;
- A few isolated Marri and Tuart trees occur in road reserves outside the main interchange and are all likely to have been planted;
- The condition of all vegetation recorded was rated as Completely Degraded;
- No Threatened (Declared Rare) or Priority flora species were recorded on the Study Area;
- No Threatened or Priority Ecological Communities were recorded on the Study Area; and
- No weed species listed as Declared Pests under Section 22 of the *Biosecurity and Agriculture Management Act 2007* or as Weeds of National Significance were recorded on the Study Area.
- PGV Environmental (2019) described the vegetation within the Site as 'Non-native plants'. Refer to Figure 7 for vegetation mapping within the Site.

13.2 Purpose

The purpose of this Vegetation Management Plan is to describe how the Alliance and all Project subcontractors will manage clearing of vegetation.

13.3 Approvals

The PTA has received advice from DWER that no vegetation clearing permit is required to clear 'Non-native Plants' as described by PGV Environmental (2019).

DWER advice noted that should clearing of 'Non Native Mixed with Native Plants' (which was mapped outside of the Site boundary within the larger PGV Environmental Study Area) be required, a vegetation clearing permit may be required subject to a review of the DWER's *Guide to Exemptions and Regulations for Clearing Native Vegetation*.

Supporting Information: Email Correspondence between B. Laslett (PTA Environmental Officer Major Projects Unit) and K. Wilkes (DWER Environmental Officer) dated 28 and 29 May 2019.

No matters of national environmental significance have been identified by the flora and vegetation survey (PGV Environmental, 2019) therefore no approval under the EPBC Act is required to facilitate vegetation clearing.

13.4 Objectives

Project environmental objectives have been developed for vegetation. This section describes the specific environmental performance objectives and requirements to be achieved for the duration of the Project. All construction works will comply with applicable legislation and this CEMP. The environmental performance objectives and indicators for vegetation are detailed in Table 8.

Objective	Target	Indicator
Minimise impact to vegetation outside and adjacent to the Site boundary.	No clearing of vegetation outside of the Site boundary.	Visual inspections documented in Monthly Environmental Reports. Environmental incident records.

Table 8: Vegetation Management - Objectives, Targets and Indicators

13.5 Management Strategies

The vegetation management strategies are listed in Table 9.

Parameter	Management Strategy	Timing	Responsibility	Site Inspection / Audit Records
Site Induction	All personnel entering the site should be made aware of the CEMP and the importance of not clearing vegetation outside of the Site boundary.	Construction	HSSEQ Manager	Site Induction Records
Clearing Controls	Inspection of clearing front/extents to ensure no clearing outside of the Site boundary.	Construction	HSSEQ Manager / Site Superintendent	Monthly Environmental Report Environmental Incident Report
Dieback	All vegetation onsite is to be cleared, therefore the consequence of dieback infection in this vegetation is negligible. If dieback is suspected potentially being	Construction	HSSEQ Manager / Site Superintendent	Monthly Environmental Report Environmental Incident Report

Parameter	Management Strategy	Timing	Responsibility	Site Inspection / Audit Records
	transferred onto site via plant and/or equipment, site specific hygiene protocols will be put in place.			
Weeds	No Declared Plants or Weeds of National Significant were identified by PGV Environmental (2019), therefore no specific weed management is required for the construction phase.	Construction	HSSEQ Manager / Site Superintendent	Monthly Environmental Report Environmental Incident Report

Table 9: Vegetation Management Strategies

13.6 Contingency Management Strategies

Table 10 identifies the appropriate contingency actions to be initiated in the event that the performance objectives for vegetation management are not met.

Trigger	Contingency Management Strategy	Responsibility	Site Inspection / Audit Records
Vegetation has been cleared outside of the Site boundary.	1. Report the clearing to the HSSEQ Manager and Construction Manager. 2. Investigate the incident to determine if non-native or native plants were cleared, and the extent of clearing. 3. Review the DWER's *Guide to Exemptions and Regulations for Clearing Native Vegetation* (Regulation 5, Item 1 of the EP Act) to determine if the clearing has breached the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. 4. If a breach has occurred report to DWER as required.	Site Superintendent	Correspondence and photographs. Monthly Environmental Report Environmental Incident Report

Table 10: Vegetation Management Contingency Strategies

14.0 Demolition Management

Demolition activities include work to demolish or dismantle a structure or part of a structure that is loadbearing or otherwise related to the physical integrity of the structure. A structure is anything that is constructed, whether fixed or moveable, temporary or permanent, and includes buildings and sheds (Safe Work Australia, 2016).

14.1 Hazardous Materials

Prior to any decommissioning, salvaging or demolition works, the Alliance must undertake a Hazardous Materials (HAZMAT) survey of the Existing Bayswater Station and associated infrastructure within the limit of works. The findings of the HAZMAT survey must be used by the Alliance to develop a management processes for any HAZMAT identified. The following HAZMAT may be identified:

- ACM (Friable and Non-Friable)
- Lead based paint
- Synthetic mineral fibre (SMF) insulation
- Ozone Depleting Substance (ODP)
- Polychlorinated Biphenyl (PCB)
- Biological Hazards
- Stored Hazardous Materials and Substances

A Demolition Management Plan supported by the Demolition Procedure (HSE-OMR-008) and Demolition Permit HSE-PRO-PER-1600 will be developed for all demolition activities and include any findings and recommendations following the HAZMAT surveys.

Buildings and infrastructure which is required to be demolished, decommissioning or salvaged as part of the Project are summarized in Table 11.

Building / Infrastructure ID	Description	HAZMAT Survey Required
Existing Bayswater Training Station	Limit of demolition is everything (above and below) within the edge of the platform.	Yes
Station underpass	Soil behind and above the walls to be removed by others.	Yes
Station PSP Bridge	Removal of top deck and walls along with handrails on top.	Yes
King William St. Rail Bridge	Removal of entire bridge structure including concrete rail structure, steel girders and support frames and abutment walls. Footings to be removed by others.	Yes
King William St. PSP Bridge	Removal of entire bridge structure including concrete deck and abutment walls. Footings to be removed by others.	Yes
Leake St. Underpass	Soil behind and above the walls to be removed by others.	Yes
Retaining Walls	Demolition of retaining and wing walls adjacent to abutment walls of the bridges	Yes
Bike Ramp	Demolition of ramp and retaining wall going up to the station PSP bridge	Yes

Table 11: Buildings and Infrastructure to be demolished, salvaged or decommissioned

Note: All demolition and ground disturbing activities need to be undertaken with caution and in anticipation of unexpected finds (see Section 16.3) including previously unidentified underground services.

14.2 Underground Services

The Demolition Management Plan will identify underground utilities based on Dial Before You Dig and underground services survey. General procedures for exposing and decommissioning known infrastructure, solely with respect to environmental management will be provided within the Demolition Management Plan.

14.3 Unexpected Finds

Unexpected Finds (UF) or latent finds relating to unknown infrastructure and potential sources of contamination, which may be encountered during and post demolition broadly fall under the categories summarised above and listed in Table 12. Procedures for managing unexpected finds, solely from an environmental perspective, will be provided with the Demolition Management Plan.

GENERAL TYPE OF FIND	EXAMPLES
Asbestos in structures above and below ground and, in soil below ground	• Asbestos containing material (ACM) such as pipework, cladding / sheeting (whole or in fragments) • Asbestos fines (as stated in Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia [DOH, 2009]) • Fibrous asbestos which includes friable asbestos (as stated in Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia [DOH, 2009])
Structures and building footings	• Utilities services • Fuel (diesel/petrol) or oil storage tanks and associated pipework
Waste	• Demolition waste • Putrescible waste • Hazardous waste • Illegal and / or historical dumping • Dangerous goods / flammable liquids
Hazardous Materials (within Buildings)	• Asbestos (as per above) • Smoke alarms containing sealed radiation sources • Other radioactive sources • Synthetic mineral fibre (SMF) insulation • R22 refrigerant • Polychlorinated biphenyls (PCB) capacitors • Transformers - PCB containing oil • Lead paint

Table 12. Types of Potential Unexpected Finds

15.0 Soil Management

15.1 Potential Environmental Impacts

Potential environmental impacts caused by the mismanagement of soils during construction include:

- Placement of contaminated soil during construction on the surface of the site such that it represents a potential risk to construction works.
- Placement of contaminated soil without a sufficient capping layer, which represents a risk to future site users as the material may become exposed in the future.
- Impacts to human health from inappropriate handling of soils, which contain contaminants (e.g. metals and asbestos).
- Cross contamination of Clean Fill with contaminated soils.
- Generation of dust which can impact in human health.
- Emission of odours / vapours from disturbance of contaminated materials which may impact human health and the environment.
- Release of contaminants or acidity into the ground, groundwater, stormwater and ultimately the Swan River impacting water quality.
- Placement of ASS impacted soils below the water table, which represents a risk to groundwater, surface water and ecological receptors.

15.2 ASS Management

A desktop assessment for the potential to encounter acid sulfate soils (ASS) across the site was conducted using the ASS risk maps provided by the Department of Water and Environmental Regulation. The ASS risk maps (Figure 5a) indicate the Site to be generally within an area mapped as “Moderate to low risk of ASS occurring within 3 m of natural soil surface”. Areas of “High to moderate risk of ASS occurring within 3 m of natural soil surface” are shown to be present east of Coode Street, north of Railway Parade near Mills Avenue and to the east of the project area.

Golders (2018) and JBS&G (2019) have conducted ASS Investigations of the Site to a maximum depth of 2 mbgl (Golders) and 5.5mbgl (JBS&G). Figure 5b shows the locations of bore holes. A total of 58 samples have been analysed for Suspension Peroxide Oxidation Combined Acidity and Sulphur (SPOCAS). The net acidity results of 11 samples were equal to or greater than the DWER (2017) assessment criterion of 0.03%S. Table 13 summarises the sample depths at which ASS was present and where ASS was detected greater than the assessment criterion.

BOREHOLE ID	SOIL DESCRIPTION	DEPTH ASS WAS IDENTIFIED (mbgl)	NET ACIDITY (%S) = OR > 0.03%S
HA09 (total depth 1.5mbgl)	SAND – Brown, Trace gravel.	0.25	0.46
MW1 (total depth 4.0m bgl)	SAND, fine to medium grained, well graded, loose, light brown, homogenous, wet.	3.5	0.05
		3.75	0.05
		4.0	0.04
MW2 (total depth 3.5m bgl)	SAND, fine to medium grained, well	2.5	0.03

BOREHOLE ID	SOIL DESCRIPTION	DEPTH ASS WAS IDENTIFIED (mbgl)	NET ACIDITY (%S) = OR > 0.03%S
	graded, brown, homogenous, saturated.		
SB1 (total depth 5.5m bgl)	SAND, fine to medium grained, well graded, light brown, homogenous, saturated, thin,dark grey silt layer approximately 3mm thick was present at the beginning of the horizon at 5.0 mgbl.	5.0	0.03
		5.5	0.03
SB6 (total depth 5.5m bgl)	SAND, fine to medium grained, well graded, loose, brown, homogenous, wet	5.0	0.04
		5.5	0.04
SB8 (total depth 2.0m bgl)	Sandy CLAY, medium plasticity, black/dark brown, wet	2.0	0.04
SB9 (total depth 2.0m bgl)	SAND, fine to medium grained, well graded, loose, yellow, homogenous, dry	1.5	0.03

Table 13. Sample depths at which ASS was present

In summary the ASS Investigations to date have outlined:

- an inferred ASS area which is depicted in Figure 5b. This area was created with the assumptions that AASS extends horizontally below the maximum sample depth, and laterally to halfway between the adjacent,
- This ASS area encompasses the entirety of the proposed ground disturbance area and the northern carpark area from 3.5 m bgl. It is likely excavation works below 3.5 m in this area could result is ASS impacts if not effectively managed.
- Given the identified ASS at a minimum depth of 3.5 m bgl within the ground disturbance area, it is also assumed that ASS would likely be present at locations surrounding, and in the vicinity of, the proposed ground disturbance area. However, sampling locations outside of the ground disturbance area were restricted to a maximum of 2 m bgl and as such, did not identify any positive indicators for ASS which would likely be encountered at additional depths (JBS&G, 2019).

Further investigation of ASS, subject to project specific dewatering and earthwork design is scheduled for August 2020. Once further information is known then an Acid Sulfate Soils and Dewatering Management Plan will be prepared as a subplan to the CEMP, in accordance with DWER guidelines.

15.3 Clearing and Topsoil Management

The following Section should be read in conjunction with the Construction Management Plan.

Clearing on this Project will include the following activities within the Site boundary:

- the felling, cutting and removal of all trees standing or fallen;
- the removal of rubbish and debris;
- grubbing out of all stumps and roots larger than 80mm in diameter or with any dimension greater than 300mm, to a depth of 300mm below either the existing surface or the finished subgrade surface, whichever is lower.

Tree-felling and lopping shall be completed by a specialist subcontractor in areas which are close to overhead services, road alignments or to properties where trees can't be felled using an excavator or dozer.
Clearing, grubbing and tree felling/lopping shall commence following approval from the environmental team that the environmental commitments have been achieved.
Due to the limited storage space on site, cleared vegetation suitable for mulching is to be taken off site to be chipped into organic mulch material. Refer to Section 14.7 regarding material reuse and Section 14.8 regarding stockpile management).

Topsoil will be stripped to a of 75mm using a dozer to push up into local stockpiles ready for reuse or relocated to the designated stockpile areas for storage until required for re-use. Weed infested topsoil will be removed from site and not reused within the rail reserve.
Competent operators shall be utilised to ensure that the topsoil and subsoil layers are not mixed, and the subgrade integrity is not affected during the stripping and stockpiling process.

15.4 Land Rehabilitation and Demobilisation

The Project is not intended to be decommissioned; however, areas that do not provide permanent infrastructure will be landscaped and rehabilitated to a similar or improved condition prior to works having been conducted.
Trees that are to be afforded protection shall be surveyed and protected as per the following:

- Provide a 2m radius tree protection zone (TPZ) through 1.8m high fencing.
- Fencing is not to be moved or removed at any period.
- Signage notifying people of the TPZ and other requirements placed on each side of the fencing.
- Any roots identified to be pruned should be pruned with a final cut to be undamaged wood outside of the TPZ. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints. It is not acceptable for roots to be pruned with machinery such as backhoes or excavators;
- Any trees removed or significantly damaged as a result of this application should be replaced;
- All retained street tree(s) within the development site shall have measures consistent with AS 4970-2009 undertaken to ensure their protection during construction of the subject development.
- As specified in the Development Approval Condition 6 a Tree Management Report will be developed outlining the above prior to any works commencing.

All land areas used for construction supporting activities (i.e. laydown, office) within the site shall be surveyed by the environmental team. The survey shall comprise vegetation and topsoil

assessment and be mapped in accordance with the vegetation condition scale (Keighery 1994). The reinstatement shall match (as a minimum) the pre-construction classification.

Re-instatement of all land used to support construction activities outside of the site shall be subject to the obligations as specified by the land-owner, and any applicable approval/licensing conditions or approving authorities.
The following requirements shall be considered:

- the existing ground should be reinstated to meet the requirements of the pre-construction or future land-use (as approved), followed by placement of topsoil and revegetated as soon as possible, dependent on season;
- the site will be revegetated, to match pre-existing vegetation types, and percentage of ground covered by vegetation. Vegetation types shall be consistent with the neighboring land-use;
- rehabilitation shall be monitored against the site's nominated success criteria;
- consider the need for ongoing rehabilitation maintenance activities such as weed control and fencing; and
- prepare documentation to hand the site back to the relevant landowner.

15.5 Imported Fill Management

Any fill brought onto the Site must comply with the definitions provided in Table 14.

Type	Defintion / Description	Verification
Clean Fill	Means raw excavated natural material such as clay, gravel, sand, soil or rock fines that: a) has been excavated or removed from the earth in areas that have not been subject to potentially contaminating land uses* including industrial, commercial, mining or intensive agricultural activities; and b) has not been processed except for the purposes of: i. achieving desired particle size distribution; and/or ii. removing naturally occurring organic materials such as roots; and c) does not contain any acid sulfate soil; and d) does not contain any other type of waste. *As prescribed in *'Assessment and Management of Contaminated Sites' (Department of Environmental Regulation, 2014)* Reference: Landfill Waste Classification and Waste Definitions (DWER, 1996 as amended 2019)	Clean Fill imported to Site is required to be accompanied be certification completed by the supplier and recorded in the Materials Tracking Register (see Section 15.8). Visual inspection completed by HSSEQ to verify compliance with certification provided by supplier including photographs retained on file and included in Monthly Environmental Report.
Uncontaminated Fill	Means:	Uncontaminated Fill imported to Site is required to be

Type	Defintion / Description	Verification
	a) inert waste type 1 (excluding asphalt and bio-solids) that meets the requirements set out in Table 6 (DWER, 2019), as determined by relevant sampling and testing carried out in accordance with the requirements set out in Table 7 (DWER, 2019); and b) neutralised acid sulfate soil that meets the requirements for relevant metals, metalloids and sulfate set out in Table 6, as determined by relevant sampling and testing carried out in accordance with the requirements of Table 7 (DWER, 2019).	accompanied by documentation (e.g. soil characterisation report including laboratory analysis certificates which demonstrates the materials compliance with the assessment criteria) and recorded in the Materials Tracking Register (see Section 15.8). Visual inspection completed by HSSEQ to verify compliance with documentation provided by source including photographs retained on file and included in Monthly Environmental Report.
Fill from Other PTA Sites	To be discussed with PTA Rep.	To be discussed with PTA Rep.
All Fill	Must also comply with aesthetic criteria cited in the NEPM (NEPC, 2013) including being free of metal, glass or other sharp objects, not chemically discoloured, not malodorous or contain any quantities of various types of inert refuse such as bricks, plastic or timber.	Visual inspection completed by HSSEQ to verify compliance with documentation provided by source including photographs retained on file and included in Monthly Environmental Report.
All Fill	Free of naturally occurring pathogens, such as Dieback.	Laboratory certificates to accompany material and be included in Monthly Environmental Report.

Table 14: Imported Fill Compliance Criteria

15.6 Material Reuse Management

To be developed following consultation with Construction and Design Managers regarding what fill types and volumes will likely be available for reuse within the Site.

15.7 Contaminated Soil Management

It is understood from the available documentation that none of the 32 parcels of land which make up the Site are currently classified under the *Contaminated Sites Act 2003*.

Given the historical use of the land within the Site, the following sources of contamination may be encountered during earthworks (cut to fill) required to be undertaken for the Project:

- Historical fill materials, particularly within the rail reserve
- Actual and Potential ASS
- Organochloride pesticides (OCPs) in soils beneath building slabs (see Note 1)

- Hazardous materials within buildings or other infrastructure (pits and underground pipes) (see Note 2)
- Soakwells / sumps

Exposure to contaminated soil may have adverse health impacts to workers onsite, future Site users / occupants and the environment.

15.7.1 Objectives, Targets and Key Performance Indicators

Table 15 summarises the key management objectives, targets and key performance indicators for contaminated soil management during the Project.

OBJECTIVE	TARGET	KEY PERFORMANCE INDICATOR
To ensure that all known and suspected potential sources of contamination are identified, assessed and remediated / decommissioned as required.	Site reclassified in accordance with *Contaminated Sites Act 2003* such that it is suitable for the proposed use(s).	Unexpected Find managed as per Section 14.9. Site Remediation Validation Report DWER and target land use classification achieved (if applicable).

Table 15: Contaminated Soil Management - Objectives, Targets and Indicators

15.7.2 Management, Monitoring, Reporting and Contingencies

Table 16 lists the management strategies, monitoring and reporting requirements and contingency measures for this aspect during the Project.

Management Strategy	• The HSSEQ Manager will investigate, assess and remediate as required based on the results of Site inspections, field sampling and laboratory analysis. • Investigation and remediation (where required) will be undertaken in accordance the *Contaminated Sites Act 2003*, Contaminated Sites Regulations 2006 and the following guidelines: - National Environmental Protection Measures (National Environmental Protection Council [NEPC], 1999, as amended 2013). - Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia (DoH, 2009) and the anticipated updated guideline to be issued in 2020 (consultation process undertaken between November 2019 and 6 March 2020). - Landfill Waste Classification and Waste Definitions 1996 (as amended 2019) (DWER, 2019).
Monitoring and Reporting	• Site inspections, field sampling records, laboratory certificates.

Table 16: Contaminated Soil Management Strategies

15.8 Material Tracking Register

The Material Tracking Register (MTR) will be used to record all material movement relative to the Site (imported to, exported from and transferred within the Project limit of works as part of the Scope of Works). The MTR will record:

- Material (soil or water) brought on Site including records indicating quantity; quality and suitability for use on Site.
- Stockpiling and placement of materials on Site including details of material type, volume, location, depth (placed and relative to proposed finished level to ensure compliance with Site requirements).
- Materials (soil or water) taken off Site (contaminated or clean) including:
  - records of quantity;
  - on Site source;
  - suitability for re-use on an alternative site or waste classification to facilitate disposal to landfill (e.g. analytical results to enable characterisation/landfill classification) and landfill disposal documentation (weighbridge/transfer dockets or receipts).
- Materials (soil or water) transferred within the Site (contaminated or clean) including records of quantity, quality, volume and source and final placement locations.
- Details of any treatment of materials undertaken on Site.
- Tracking of any hazardous materials taken off site using the appropriate waste transport certificates.
- Reference to analytical results, including quality control results, characterisation i.e. statement of suitable for re-use or waste classification.

Note: Information relating to management of dewatering effluent including quality, rates and volumes (cumulative and total) and compliance with discharge criteria and licence conditions are also required to be recorded, however this is detailed in Section 17 (Dewatering Management).

The MTR will comprise of the number of elements detailed below that will ensure all materials are accurately tracked to minimise potential for the spread of contamination and ensure the final condition of the Site can be documented and managed in accordance with the *Contaminated Sites Act 2003.*

Materials to be transferred around site, onto or off site will be grouped into packages as per the Materials Classification Matrix in Table 17 below. These packages may be further refined as the detailed design is progressed and the Construction Plan is finalised.

Type	Code	Sub-code	Description
Construction Materials	CF (Clean Fill)	CF	As defined in Landfill Waste Classification and Waste Definitions (DWER, 1996 as amended 2019): Raw excavated natural material such as clay, gravel, sand, soil or rock fines that: e) has been excavated or removed from the earth in areas that have not been subject to potentially contaminating land uses* including industrial, commercial, mining or intensive agricultural activities; and f) has not been processed except for the purposes of: iii. achieving desired particle size distribution; and/or iv. removing naturally occurring organic materials such as roots; and g) does not contain any acid sulfate soil; and h) does not contain any other type of waste. *As prescribed in *'Assessment and Management of Contaminated Sites' (Department of Environmental Regulation, 2014)*
	UF (Uncontaminated Fill)	UF	As defined in Landfill Waste Classification and Waste Definitions (DWER, 1996 as amended 2019): a) inert waste type 1 (excluding asphalt and bio-solids) that meets the requirements set out in Table 6 (DWER, 2019), as determined by relevant sampling and testing carried out in accordance with the requirements set out in Table 7 (DWER, 2019); and b) neutralised acid sulfate soil that meets the requirements for relevant metals, metalloids and sulfate set out in Table 6, as determined by relevant sampling and testing carried out in accordance with the requirements of Table 7 (DWER, 2019).
	RSAND (Recycled sand)	RSF	Inert, clean sand, graded. No organic material. Excavated from above the water table. Sourced from within the Site from an area with no evidence of contamination and verified by Environmental Advisor to not be contaminated through visual inspection and / or laboratory analysis for contaminants of potential concern (COPCs).
		RGF	Inert, clean sand. May include minor silts and clays and up to 2% organic matter. Excavated from above the water table. Sourced from within the Site from an area with no evidence of contamination and verified by Environmental Advisor to not be contaminated through visual inspection and / or laboratory analysis for contaminants of potential concern (COPCs).
	RROCK (Recycled crushed rock)	RRB	Inert, clean, crushed limestone/rock suitable for use as subgrade in road construction, temporary pavements or piling platforms. Sourced from within the Site from an area with no evidence of contamination and verified by Environmental Advisor to not be contaminated through visual inspection and / or laboratory analysis for contaminants of potential concern (COPCs).

	TVASS (Treated and Validated ASS)	TVASS	ASS material has been treated and validated and deemed suitable for reuse onsite above the groundwater water table and fluctuation zone. Note: Treated ASS is not permitted to be reused below the groundwater table or fluctuation zone.
Water	W (Water)	GW	Groundwater.
		SW	Surface water.
		OW	Other water - Recycled/treated/contaminated/uncontaminated/other
Waste Materials	ASS / PASS	ASSSAND	Sand excavated from below the water table in ASS zones.
		ASSPEAT	Black, brown peaty clay.
		ASSOTH	Mixed sand, clays, silts, peat from ASS zones not able to meet a construction specification after treatment.
	OSR (Off site recycling)	OSR	Construction and demolition waste, mulch, topsoil, wood, steel, non-ferrous metals, light vehicle and heavy vehicle tyres, RAP (Recycled Asphalt Profiles), concrete. Sent to licensed facility for recycling.
	OSLF (Off site landfill)[2]	OS1	Non-hazardous, non-biodegradable wastes (e.g. concrete, bricks, rubble etc.).
		OS2	Putrescible/biodegradable mixed material, litter, illegally dumped rubbish, paper, cardboard.
		OS3	Contaminated soils, oil contaminated soil.
		OSASB	OS1 containing, or mixed with, asbestos containing materials.
	WOTH (Other wastes)	WOTH	Separated garden and green (vegetation) waste, miscellaneous mixed materials.

1. Assumes that the material meets geotechnical requirements for construction purposes.
2. Classifications comply with Environmental Protection (Controlled Waste) Regulations (2004).

Table 17: Material Tracking Codes

16.0 Unexpected Finds Management

16.1 General Management Strategy

Unexpected or latent finds relating to contamination or heritage, which may be encountered during and post demolition or earthworks broadly fall under the categories identified in Section 14 and 21 and are required to be managed generally as per below.

16.2 Objectives, Targets and Key Performance Indicators

Table 18 summarises the key management objectives, targets and key performance indicators for unexpected finds during the Project.

Objective	Target	Key Performance Indicator
Ensure all previously unidentified / unexpected sources of contamination or heritage are managed appropriately such that the do not result in damage to heritage items, cross contamination or existing soils or restrict the use of the Site in the future.	All unexpected finds are managed in accordance the procedures outlined in this CEMP including assessment, remediation / decommissioning and waste disposal.	Unexpected finds reported and register maintained including close out of each find. Site inspection records.

Table 18: Objectives and Targets for Unexpected Finds Management

16.3 Management, Monitoring, Reporting and Contingencies

Table 19 lists the management strategies, monitoring and reporting requirements and contingency measures for this aspect during the Demolition Phase.

Management Strategy	1. Upon discovery of the unexpected find, all work shall cease work in the area and access restricted to prevent damage or potential spread of contamination and mitigate risk to human health while the find is being assessed. The Construction Manager shall notify the HSSEQ Manager of the discovery of the unexpected find. 2. The HSSEQ Manager will determine what action is required and to arrange for the unexpected find to be recorded i.e. GPS coordinates and physical description and photographs in consultation with the Construction Manager. 3. Works shall not proceed within the area of impact until an appropriate management approach has been determined and authorisation has been received from the HSSEQ Manager. 4. The HSSEQ will develop an Immediate Action Response (IAR) including: - requirement to report to regulators; - requirement to undertake sampling; - requirement to remediate and validate, where applicable; and - documentation requirements.

	5. The HSSEQ Manager and Construction Manager will monitor the management procedure employed to ensure works are completed in accordance with the IAR. 6. The find and management actions taken, and status of the works will be detailed in the Monthly Environmental Report. 7. In the event large scale remediation or management is required (e.g. ACM in fill, hydrocarbons impacted soil), the HSSEQ will discuss with the AMT and agree the necessary management strategy.
Monitoring And Reporting	• Site inspections. • Immediate Action Response reports, Soil Investigation / Validation Clearance Report / monthly Environmental Report. • Monitoring and reporting as per Contaminated Soil and Waste or Heritage Management plans.
Contingency Actions	• In the event an Unexpected Find associated with contamination is managed inappropriately and results in cross contamination of surrounding soils, works in that area will cease until such time as the extent of the cross contamination / impact has been delineated and a remediation strategy approved by the HSSEQ Manager. • Refer to Section 20 in regards to additional contingency actions for unexpected finds relating to heritage / archaeological artefacts.

Table 19: Unexpected Finds Management

17.0 Waste Management

Wastes will be generated during the Project are expected to include:

- Demolition and construction waste including bricks, concrete, glass, plastics, timber and metal.
- Green waste (for potentially chipping and re-spreading upon completion)
- Hazardous waste including ACM.
- Putrescible waste (e.g. food wastes, bio-solids, office and packaging waste).

In addition, contaminated fill, ASS and dewatering effluent may need to be disposed of off-site. Refer to Section 17 for dewatering effluent management requirements.

For further details on management of waste, refer to Sustainability Management Plan (BSTPR-EVO-EN-PLN-00004).

17.1 Objectives, Targets and Key Performance Indicators

Table 20 summarises the key management objectives, targets and key performance indicators for waste management during the demolition phase.

OBJECTIVE	TARGET	KEY PERFORMANCE INDICATOR
Solid and liquid waste to be disposed of as per relevant State and local requirements including but not limited to those listed in this CEMP.	All waste to be disposed of by a licensed waste contractor.	Off Site waste / recycling disposal facilities confirmed and documented in Materials Tracking Register.
Maximise recycling to achieve targets for the Project.	Recycle demolition and construction waste where practicable.	Off Site waste / recycling disposal facilities confirmed and documented in Material Tracking Register.
No waste to affect identified receptors.	No incidents of waste being released / discharged to the environment.	Site inspection and environmental incidents recorded.
	No complaints related to construction waste affecting nearby premises during construction.	Number of complaints relating to waste.

Table 20: Objectives and Targets for Waste Management

17.2 Management, Monitoring, Reporting and Contingencies

Table 21 lists the management strategies, monitoring and reporting requirements and contingency measures for this aspect during the Project.

Management Strategy	Prior To Demolition
	• The HSSEQ, Sustainability and Construction Managers will identify all waste streams likely to be generated during the demolition phase and

estimate the volumes of materials to be handled and strategies to achieve the recycling targets prescribed for the Project.

- The Construction Resource Efficiency and Waste Management Plan will be updated to outline how the waste streams will be segregated including a map which identifies where waste will be segregated and stored pending removal from Site.
- Management of air quality is disused in Section 22.
- All personnel will be inducted in waste segregation requirements and instructed on management actions as required by this CEMP.

During Demolition and Construction

- A Material Tracking Register will be used to record the volumes of waste in each stream and the fate of each load removed from Site (from 'cradle to grave') including:
  - who transported the waste (company name, ABN, vehicle registration, date and time of transport, description and volume of waste); and
  - copies of waste dockets/receipts from the waste / recycling facility (date and time of delivery, name and address of the facility, ABN).
- The Material Tracking Register will be completed on a daily basis and available for audit. The Material Tracking Register will form part of monthly Environmental Reports.
- Asbestos is required to be removed by an appropriately licensed removalist and disposed to a landfill that accepts 'Special Waste (Type 1) as per DWER (1996, as amended 2019).
- All waste that is not recyclable is required to be disposed of to an appropriately licenced waste facility and dockets provided to the HSSEQ Manager on a regular basis (weekly as a minimum). This information will be included in the Material Tracking Register.
- Hazardous wastes will be kept separate from other waste streams to avoid accidental cross contamination and associated increased disposal costs / reduced recycling potential.
- Unexpected finds (e.g. buried waste) will be reported to the HSSEQ Manager who will investigate (as per Section 15) and advise on management / waste disposal option as required.
- No soils are permitted to be disposed of off-site without written advice from the HSSEQ Manager regarding the waste classification.
- Soils and other waste which cannot be recycled are required to be disposed of to landfills licenced to accept the applicable class of waste.
- Regular toolbox talks will be used to ensure that all personnel are aware of the Waste Management Plan and recycling strategies.

	• Daily collection of litter. • Provision of waste bins in accessible locations around the Site. All waste bins will be covered and have appropriate signage. • No discharge of trade waste to sewer unless a Trade Waste Permit is obtained from Water Corporation.
Monitoring and Reporting	• Monthly waste inventory reporting and tracking against recycling targets. • Site inspection and audits of Waste Management Plan and Material Tracking Register. • Waste disposal dockets. • Audit of the Material Tracking Register against waste disposal dockets and waste classification information.
Contingency Actions	• An Unexpected Finds procedure will be implemented where required.

Table 21: Waste Management

18.0 Dewatering Management

Groundwater management (excluding dewatering activities) is addressed in the Geotechnical Plan (BST-EVO-GE-PLN-00002). If dewatering is required the treatment, monitoring, disposal and reporting of dewatering discharge will be outlined in subplans for each construction activity.

Excavation to facilitate construction of the new station will likely be to a depth of 5.5m bgl. The regional water table level is approximately 6.5m bgl (9.0mAHD) and the base of the aquifer is 30.5m bgl (–15mAHD). Some dewatering may be required depending on individual construction activities and the presence of ASS in the soil profile to be dewatered however this will be addressed in the relevant subplan. General dewatering management is outlined below.

18.1 Objectives, Targets and Key Performance Indicators

Table 22 summarises the key management objectives, targets and key performance indicators for dewatering activities.

OBJECTIVE	TARGET	KEY PERFORMANCE INDICATOR
To ensure that dewatering activities including the discharge of water do not result in adverse impacts to sources and receivers.	No adverse impact on water quality of sources or receivers.	No exceedances of the adopted groundwater quality assessment criteria (as defined in subplans)..
	Minimise changes in groundwater levels of the Superficial aquifer.	Sustained change in background levels in the Superficial aquifer within the of dewatering cone of depression and recharge areas.

Table 22: Objectives and Targets for Dewatering

18.2 Management, Monitoring, Reporting and Contingencies

Table 23 lists the management strategies, monitoring and reporting requirements and contingency measures for this aspect during the Project.

Management Strategy	Prior To Dewatering
	• The HSSEQ, Design Interface will identify opportunities to avoid or reduce the need for dewatering during design development and for the staging of construction during summer, when groundwater levels are lowest, where practicable. • Dewatering, recharge and monitoring wells are to be managed in accordance with the Geotechnical Plan or individual construction activity subplans. • The HSSEQ and Sustainability Manager in consultation with the Design and Construction Teams will develop a Water Management Plan which identifies opportunities to reuse groundwater from dewatering activities during construction based on the water demand profile and the water quality required.

	• If dewatering is required, an ASSDMP will be prepared outlining the dewatering methods to minimize the cone of depression as well as the monitoring, treatment and disposal /recharge methods. • Where onsite treatment and reuse is not feasible, disposal into the existing sewer or stormwater system may occur following consultation with, and approval by the asset owner (Water Corporation and/or City of Bayswater), Department of Biodiversity, Conservation and Attractions (Swan River Trust) and the DWER. Discharges will be treated and/or tested prior to release as to ensure water is of suitable quality as required by any approvals. • All personnel will be inducted in dewatering requirements and instructed on management actions as required by this CEMP and, where applicable the ASSDMP.
	During Dewatering
	• Groundwater monitoring and dewatering effluent monitoring in accordance with approvals and subplans. • No discharge of water without confirmation that water quality is suitable for the receiving environment.
Monitoring and Reporting	• Monthly dewatering status reporting, including details of: - Areas being dewatered - Pre and post treatment water quality parameters - Dewatering flow rates (instantaneous and cumulative) - Groundwater Level - Daily discharge volumes from the dewatering system for each discharge point - Volumes of discharge that were reused onsite • Monthly dewatering system records, including: - Wells drilled, pipes installed, connections - Summary of system performance - Details of changes to configuration of the system including pumps on/off, pipe changes, maintenance - Record of issues associated with the dewatering system and agreed solutions • Site inspection and audits of: - Dewatering activities - Compliance with the ASSDMP, if applicable
Contingency Actions	• The frequency of groundwater level monitoring for all bores within 500m of dewatering activities to be increased when monitoring indicates that the potential for groundwater level change to exceed 1.0m.

	• Cease dewatering activity immediately in the event of spill, contamination or other adverse environmental impact in the dewatering area. • The HSSEQ Manager will develop an Immediate Action Response (IAR) including: - requirement to report to regulators; - requirement to undertake sampling; - requirement to remediate and validate, where applicable; and - documentation requirements.

Table 23: Dewatering Management

19.0 Stormwater and Surface Water Management

Potential impacts to the street stormwater system may occur if debris, litter, fill, soil rubbish or other deleterious material generated onsite is allowed to enter the system. This may reduce the system's ability to function.

19.1 Objectives, Targets and Key Performance Indicators

Table 22 summarises the key management objectives, targets and key performance indicators for stormwater and surface water during the Project.

Objective	Target	Key Performance Indicator
Debris, litter, fill, rubbish or other deleterious material generated on Site is prevented from impacting the stormwater system.	No debris, litter, fill, rubbish or other deleterious material enters the stormwater system.	Correct implementation and management of waste and storm water measures in accordance with the CEMP. No incidents of debris, litter, fill, rubbish or other deleterious material entering and blocking the stormwater system. Site inspections.
Spills (fuel, cleaning products, chemicals) are prevented from impacting the stormwater system.	No release of chemicals/pollutants as listed under the *Environmental Protection (Unauthorised Discharges) Regulations 2004* to the environment during the works.	Correct implementation of spill management protocols. No incidents of debris, litter, fill, rubbish or other deleterious material entering and blocking the stormwater system. Site inspections.

Table 22. Stormwater and Surface Water Management – Objectives, Targets and Indicators

19.2 Management, Monitoring, Reporting and Contingencies

Table 23 lists the management strategies, monitoring and reporting requirements and contingency measures to protect the stormwater whilst Table 24 details the chemical management requirements during the Project.

Management Strategy	• All contractors will be inducted in stormwater and surface water management actions (listed below) irequired under this CEMP. • Divert uncontaminated stormwater away from the work areas and into the stormwater system using flow diversion strategies and devices. • Protect stockpiles and other materials that may erode and ensure they are stored away from drainage paths and stormwater infrastructure. • Install appropriate drainage controls suitable for site conditions as the construction and demolition works progress. • Daily collection of litter. • Provision of waste bins in accessible locations around the site.

	• All waste bins will be covered. • Visual inspection of offsite discharges during and following rainfall events.
Monitoring and Reporting	• Daily inspection of the stormwater system for blockages. • If a blockage is identified record as an Environmental Incident and remediate as required. • Inspection records to be provided to HSSEQ Manager.
Contingency Actions	• Identify location and source of blockage. • Remove blockage. • Prevent surface water pooling water as required. • Notify local government.

Table 23: Stormwater and Surface Water Management

Management Strategy	• All contractors will be inducted in management actions (listed below) including spill management protocols required under this CEMP. • Safety Data Sheets which outline the procedures for handling, storage and emergency response for all hazardous chemicals stored or used on the Project shall be available in the first aid facility. • Spill kits are to be established at locations adjacent to where chemical spills have the potential to occur e.g. vehicle refueling. The spill kits are to be maintained and readily available in the event of a spill. • Spill Management Poster will be displayed in fuel or chemical storage areas. • Tank and mobile tankers to be fitted with a screw fitting or overflow protection connected to prevent leaks. • Bunds capable of storing 110% of the largest container volume shall be installed around areas where chemicals are stored. The bund is to be impervious, chemically resistant and fire resistant. Further, the bund is to be protected from weather to avoid rain reducing the bund capacity. Must be compliant with AS 1940 -2004. • All chemicals and dangerous goods used on site shall be appropriately labelled. • Fuel tankers shall be equipped with an appropriate device to prevent overfilling. An emergency shut off valve is also to be installed. • Handling of chemicals is to take place in a designated area where there is no potential for spills or contaminated runoff could reach stormwater.

	• Fuel stored on vehicles is to be stored in a spill tray or other approved container capable of handling a spill. • Refueling is to take place in designated areas or where the potential for contaminated runoff to reach the stormwater system is negligible. • Fuel tankers will use a spill tray beneath the refueling connection to prevent spills on ground. • Trucks that leak any sort of mechanical fluid shall not be permitted on or adjacent to the Site. • Oil contaminated water shall be disposed of to a licensed waste facility by a licensed sub-contractor. • Volumes of fuels and chemicals kept on Site are to include only those volumes necessary to complete the works within a reasonable delivery schedule.
Monitoring and Reporting	• Site inspections to confirm - all bunds are functioning and are the appropriate size and do not contain stormwater; - all chemicals are labelled, stored in a container in good condition and in a bunded area; - Safety Data Sheets are available; - equipment is free from faults and leaks; and - spill kits are available and adequately stocked. • Spills and/or leaks of chemicals (>10L) will be reported as an Environmental Incident. • Monitoring of groundwater / stormwater / surface water following a major spill, in consultation with relevant agencies.
Contingency Actions	• In the event of a spill, the Spill Management Procedure will be complied with. • If deemed necessary by the HSSEQ Manager, contaminated soils will be removed and excavation validation sampling undertaken as required. • Contaminated material will be placed in appropriate bins for disposal by a licensed contractor. Contaminated material is to be disposed of as per the Waste Management Plan. • The incident will be recorded and investigated, and remedies / improvement actions put in place. The effectiveness of the remedy will be monitored. • The HSSEQ Manager will provide specific advice in the event of a major spill affecting groundwater.

Table 24: Chemical and Spill Management

20.0 Construction Noise and Vibration Management Plan

20.1 Objectives, Targets and Key Performance Indicators

Table 25 summarizes the key management objectives, targets and key performance indicators for noise and vibration during the construction phase.

Objective	Target	Key Performance Indicator
Ensure that noise and vibration emissions do not adversely affect the amenity of surrounding communities.	No complaints from adjoining sensitive receptors in relation to noise and vibration emissions from the works.	Number of public complaints from the public related to noise and vibration.
Compliance with relevant State and local regulatory requirements in relation to noise and vibration management.	Specific noise and vibration mitigation measures are included in construction activity subplans. Separate Out of Hours Noise and Vibration Management Plan will be developed for regulatory approval.	Environmental Inspections and Audits Approval of Out of Hours Noise Vibration Management Plan Monthly Environmental Reports

Table 25: Objectives and Targets for Construction Noise and Vibration Management

20.2 Management, Monitoring, Reporting and Contingencies

The management strategies, monitoring and reporting requirements and contingency measures to address construction noise (Table 26) and vibration (Table 27) are presented below to define the management parameters for construction noise and vibration on receptors adjacent to the Site.

Management Strategy - Noise	• All construction works will be carried out within approved construction hours of 0700 hours to 1900 hours from Monday to Saturday (except public holidays), unless approved in a separate Out of Hours Noise and Vibration Management Plan • All construction work will be carried out in accordance with environmental noise control practices set out in Section 4.5 of *AS 2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites* • During construction activities, noise and vibration will be monitored at selected locations where there is the potential to impact local receptors. These locations will change throughout the project as the construction activities progress. Results will be provided on requested. Noise monitors will be fitted with alarms to provide immediate feedback to the Construction Manager if noise levels exceed targets • All public complaints shall be recorded and investigated

	• High noise generating works will be staggered where possible to minimise noise impacts • Where practicable, excessively noisy processes will be substituted with alternative processes • Site offices, compounds and workshops will be located so to minimise the impact on the noise amenity of nearby sensitive receptors • On-site generators and auxiliary power sources used during construction will be positioned among existing buildings to buffer noise where possible • Temporary acoustic fencing/barriers around noise intensive equipment/sites will be considered to mitigate high level off-site noise levels • Plant and equipment will be located away from noise sensitive areas as far as practicable • All 'warm-up' of equipment by employees and contractors arriving to site will be conducted during approved site construction hours • Generators, machinery and vehicles are to be switched off when not in use • Plant, machinery and vehicle reversing alarms will be broadband alarm type where required • High efficiency mufflers will be fitted to all plant and equipment to minimise the generation of noise where practicable. All plant will be maintained in accordance with the manufacturer's requirements. • Maintain vehicle, plant, equipment maintenance schedules and lubrication as per manufacturers' specifications • Site vehicles to adhere to speed limits throughout the Project • Vehicle movements will be restricted to approved access roads • Behavioural practices to be enforced, i.e.; no swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors
Monitoring and Reporting	• Regular checks (additional to scheduled maintenance) are to be undertaken to ensure all equipment and vehicles are in good working order and are being operated correctly (i.e. Daily Vehicle Daily Pre-Start Checklist). Checklist includes: - Engine cover condition - Defective silencing equipment - Rattling components - Leakages in compressed air lines • Operators will use the daily pre-starts to carry out maintenance checks

	• Toolbox and pre-start meetings on noise management requirements, sensitive receivers and measures will be completed during the project. • Environmental Toolboxes and pre-start briefings will be conducted, and work crews informed of the impacts of noise. These will work simultaneously with measures for reducing noise.
Contingency Actions	• In selecting plant and equipment for construction works, preference will be given to those which minimise noise and vibration

Table 26: Noise Management

Management Strategy - Vibration	• During construction activities, ground vibration will be monitored at selected locations where there is the potential to impact local receptors • Where plant and machinery may exceed limits during start-up i.e. Vibratory Roller, these items will have set designated areas and/or distances away from receptors where they can be turned on • Where plant and machinery may exceed limits during operation i.e. Vibratory Roller, these items will have set designated distance off-sets from relevant boundaries • All construction work will be carried out within the approved construction hours of 0700 to 1900 hours Monday to Saturday (except public holidays) unless approved in a separate Out of Hours Noise and Vibration Management Plan • Construction Teams are to comply with the Community Engagement Plan • Where possible works are to be scheduled in order to reduce the impact of intensive vibration generating activities on sensitive receivers • Where structural vibration action targets are exceeded, the offending process will be reviewed, and alternative equipment or methodology will be evaluated • Plant and equipment will be located away from vibration sensitive areas where possible • Where practicable, on-site generators and auxiliary power sources used during construction should be positioned among/behind existing buildings to buffer vibration
Monitoring and Reporting	• Awareness training and information will be provided to project personnel in relation to the vibration limits on the project and the need to minimise vibration during the works • Environmental Toolboxes and pre-start briefings will be conducted, and work crews informed of the impacts of vibration generating plant/machinery • All public complaints to be recorded and investigated. Where complaints relating to construction vibration are received, vibration

	monitoring will be undertaken to verify compliance with the specified limits.
Contingency Actions	• Selection, where practicable, of construction methodologies that minimise the generation of vibration • Selection, where practicable, of plant/machinery to minimise low frequency generation of vibration (e.g. selection of higher frequency generation of plant/machinery) • Vibration trials of specific plant and machinery may be conducted prior to vibration-intensive activities that may have an impact on receptors so to gauge potential setback distances or designated start-up locations.

Table 27: Vibration Management

20.3 Out of Hours Public Notification

As part of an Out-of-Hours works application the predictions of noise will provide an estimation of the potentially impacted premises. Occupants of nearby effected buildings likely to receive noise levels in excess of Assigned Noise Levels defined within *Environmental Protection (Noise) Regulations 1997* (WA) must be advised (i.e. letter drop) at least 24 hours prior to work commencing. The notification must provide reasons to why the work is necessary, reference to the City of Bayswater approval and contact details to register complaints.

21.0 Heritage Management Plan

21.1 Aboriginal Heritage Sites

The Bayswater area has long been significant to the Whadjuk people with a number of registered sites in the area along with potentially unknown sites. These sites may be viewed as significant from a historical / human / mundane viewpoint, and another from a mythological / sacred viewpoint. The area of proposed works considered, lie wholly within the Native Title area covered by the Whadjuk Indigenous Land Use Agreement.

The Heritage Management process will comply with all legislative requirements outlined in the IMS Legislation Reference Register and the below requirements

- Native Title Act 1993;
- PTA Noongar Standard Heritage Agreement (NSHA) – Whadjuk ILUA;
- Aboriginal Heritage Act 1972;
- Noongar Recognition Act 2016;
- The South West Native Title Settlement;
- EPA Environmental Factor Guideline – Social Surrounding;
- EPA Guidance Statement 41: Assessment of Aboriginal Heritage; and
- Guidelines for Engagement of Aboriginal Heritage Monitors.

21.1.1 Known Sites

Table 28 is a list of known sites in the area, although it is noted that these are not within the project site boundary.

DIA Site Number	Site Name	Status	Type / Summary
3326	Bayswater 1-3	Stored Data / Artefact Scatter	Artefacts / scatter /camp. Located to the north of the Project
3444	Bayswater Camp 2	Lodged / Other Heritage Place	Camp. Located to the north of the Project
3445	Bayswater Camp 3	Lodged / Other Heritage Place	Camp. Located to the north of the Project
3520	Maylands Scar Tree	Registered Site	Modified Tree. Located to the south of the Project
3536	Swan River	Registered Site	Mythological Located to the south of the Project
3616	Kenmure Avenue Bayswater	Other Heritage Place / stored data / not a site	Camp Located to the south of the Project
3749	Bayswater Camp 1	Other Heritage Place / stored data / not a site	Camp Located to the north of the project

24508	Gobba Lake	Lodged / Other Heritage Place	Historical / Camp / Water Source Located to the south of the Project

Table 28: Registered Aboriginal Heritage Sites and other significant Heritage Places

21.1.2 Unknown Sites

Evolve Bayswater understands that much of the Project footprint contains Aboriginal cultural heritage significance, however, as a result of the search of the Register of Aboriginal Sites, the consultative process with the Whadjuk representatives, and the survey in July 2018 of the proposed works areas at Bayswater Station, the Aboriginal Heritage Report recommends that Aboriginal heritage considerations should not be deemed an impediment to the proposed works proceeding as planned at that station.

With the above in mind, Evolve Bayswater acknowledge that Aboriginal heritage concerns remain a key focus, hence, have implemented where possible, reasonable and practicable measures for ensuring that activities are managed to avoid or minimise harm to Aboriginal sites.

Cultural Awareness Training will be compulsory for all the Alliance Team and all contracted businesses. Furthermore, Aboriginal heritage slides have been incorporated into the site induction program and contain site specific cultural heritage information.

21.2 Site Disturbance Process

Evolve Bayswater will operate an Excavation Permit process where the Aboriginal Engagement team will have a hold point established for approval to proceed. This hold point is a “last chance” trigger that Aboriginal Monitors be booked for the excavation being contemplated in the Excavation Permit.

21.2.1 Site Monitors

Evolve Bayswater will establish a Panel of Whadjuk Site Monitors that will be engaged during ground disturbance activities requiring Aboriginal Monitors as defined on the Excavation Permit. In accordance with the SWTC, two site monitors shall be engaged at any one time as determined on the excavation permit and the OSRACA process below.

21.2.2 Observe, Secure, Report, Authenticate, Consult and Agree (OSRACA)

Evolve Bayswater have a simple process for ground disturbance activities which is a developed set of actions informed by the requirements of legislation, regulations, standards, codes of practice and/or matters relating to the *Aboriginal Heritage Act 1972* (WA): OSRACA, which is defined below:

Observe
All personnel on site have a responsibility for observing with the intention of identifying physical evidence of Aboriginal heritage. All contractors, employees and land users are obliged to:

- Comply with the provisions of the *Aboriginal Heritage Act 1972* (AHA) (WA);
- Assess the planned activity and the potential impact on Country;
- Establish early engagement with Traditional Owners and Native Title holders to help to identify how to minimise or avoid any disturbance of Aboriginal sites;
- Engage Aboriginal monitors to prevent potential harm to registered Aboriginal Heritage Sites and identify items of significance and / or sensitivity on sites not registered.

Monitors are to:

- Attend pre-job safety briefing and participate in task risk assessment eg JHA, JSEA etc prior to commencement of monitoring activity;
- Agree and Test the preferred communication method for communicating with machine operator eg excavator, etc prior to commencement of ground disturbance activity;
- Be positioned in a safe location in the vicinity of the 'activity' eg excavation, trenching, civil earthworks etc to enable them to observe the ground impact zone;
- Be present during the initial 150mm of excavation of undisturbed ground and inspect spoils as appropriate;
- Maintain written records of site assessment as observed during ground disturbing activity.

Secure

If an item /material is identified and / or deemed to be significant or of a sensitive matter, the developer / land user must:

- Cease ground disturbance activity immediately by calling 'All Stop' and shut down works to the area in the immediate vicinity;
- Taking high resolution images of the item, leaving in situ and using a scale to indicate its actual size;
- Record the GPS coordinates / location;
- Secure the area appropriate to preserve and protect the item identified by;
  - Fencing / cordoning off the area around the site, including a 20 metre buffer zone.
  - Do not touch the material, and
  - Leave material in situ.

- The Monitor is to communicate the find through their lines of reporting back to the TO group and provide update on action taken to secure the area and preserve the find.

Report

In the first instance, all items/material fines are to be immediately reported by the Aboriginal Heritage Monitor to the Site Manager (or delegate).

The Construction Manager (or delegate) is to notify the nominated Heritage Consultant **within 2 hours** of discovering a find and is to provide a copy of images as soon as is practicable following initial notification.

The Site Manager (or delegate) shall notify the Registrar of Aboriginal Sites, DPLH in accordance with requirements under the AHA.
The Developer / Contractor / Land User must document and report the find by completing a Heritage Information Submission report form to the DPLH. The report form is located at the following:
dplh.wa.gov.au/information-and-services/aboriginal-heritage/aboriginal-site-preservation
or by phoning (08) 6551 7950.

Any unexpected finds will be communicated immediately to the PTA Environmental Representative.

Authenticate

To ensure authentication of the discovery, research consultation or physical investigations are required. The Developer / Contractor / Land User must:

- Request the attendance of a registered Heritage Consultant to come to the site to undertake the necessary artefact assessment investigation and reporting to determine heritage significance.

- If further investigation is required, the material will be extracted from the area and transported to a laboratory for further testing and identification.

The Whadjuk Traditional Owners must also be specifically engaged to oversee the investigation and monitor the excavation of the material.

Consult

The Developer / Contractor / Land User in conjunction with the relevant State government agency must:

- Organise consultation with the relevant Whadjuk Traditional Owners to advise of the 'find' and to seek a recommended approach moving forward;
- Develop an approval and ongoing management process for communication and dissemination of information;
- Once the investigation has concluded; seek advice and recommendations on preservation, presentation and interpretation, or if found to be of a highly sensitive manner; storage of the material.
- Following completion of groundworks or project, where the Traditional Owners and Landowner are in agreement for the return of the Artefacts.

Agree

Following determination of authenticity of the artefact or item of significance, it may be agreed that further investigation is required or it is recommended that the item may be removed from the area (as excavation may cause damage to an Aboriginal place or object, or diminish the heritage significance of a heritage site), an application for an Excavation Permit in the form required by s61E of the AHA must be made.

If the site was assessed and found not to be authenticate, then works may resume as planned.

At the completion of works the Traditional Owners and Landowner may agree for the return of the Artefacts to the GPS location or a close as practicable, this process is covered under s7 of the *Aboriginal Heritage Act 1972*

Incidents such as the below will follow the process outlined in section 26.0 Incidents and Incident Reporting of this document.
• Unauthorized or undesired disturbance by PTA employees and contractors;
• Removal or damage to a sacred object or site, respectively;
• Failure to report either of the above occurrences; or
• Any other impact to ethnographic, archaeological and anthropological aspects of the site's social and physical context.

21.3 European Heritage

There are 17 places within the City of Bayswater town Centre that have been identified as heritage significance. Four of which will be located adjacent to the Site as identified in Table 29.

Heritage Site	Description	Location
Campbells's Store	Built in 1919. The store was a grocery store until 1950's and then used to deliver and provide produce for farmers.	Corner of Hamilton Street and Whatley Crescent
Smoker's Store	The building was originally a grocery store and opened around 1920.	Net to Campbell's store along Whatley Crescent

Inglis Buildings	Constructed in 1905 this was the first building to be built along the railway line. In the late 1950's was occupied by a chemist.	Corner of Whatley Crescent and King William Street
Row of Shops	This site was built after the Second Word war and was home to the first bank in Bayswater	Corner of Whatley Crescent and King William Street

Table 29: European Heritage Sites

There is also the potential for unexpected historical artefacts to be found during ground disturbing activities. These should be managed in accordance with Section 16.0 Unexpected Fines.

Prior to construction, the management strategies listed in Table 30 will be undertaken.

Management Strategy	Prior to Construction Phase
	• All information is obtained on the location of European Heritage Sites in the area prior to mobilisation; • Respect any European Heritage Sites and ensure they are not disturbed unless written approval has been obtained in accordance with current legislation; • Immediately inform the Construction Manager of any previously unidentified heritage sites or suspected European heritage site located during on-site works; • Where there may be a requirement for cultural monitors to be present during excavation activities, undertake all reasonable steps to ensure and accommodate these monitors to undertake their work; and • Give all reasonable assistance to officers of the Department if they are investigating events or alleged events that have occurred within the Project area.
MONITORING AND REPORTING	• Communicate the appropriate management practices to Project personnel when working near these protected areas via site induction and toolbox meetings;
CONTINGENCY ACTIONS	• Protect any heritage sites from damage until further investigation by an independent third party. The discovery of any heritage sites or artefacts (including bones) requires that works cease immediately in the area and the site is not disturbed until otherwise authorised by the State Government;

Table 30: European Heritage Management

21.4 Skeletal Finds

The Alliance must inform the PTA's Representative, Western Australian Police Service and the Western Australian Museum immediately if suspected human skeletal material is found.

The Alliance will cease works in the area immediately and protect the area. The Alliance must then not recommence works in the area until approval from the relevant Government Agency is obtained.

All Site Personnel will be informed of this requirement and of the requirement for work to cease in the area if such material is uncovered. If the remains are determined to be of Aboriginal origin and of appropriate age, the Department of Planning, Lands and Heritage, Whadjuk Working Group and relevant Stakeholders will be consulted on management of the remains.

22.0 Air Quality Management Plan

22.1 Objectives, Targets and Key Performance Indicators

Table 31 summarizes the key management objectives, targets and key performance indicators for dust and air quality during the construction phase.
A Site-specific assessment may be completed to determine what quantitative monitoring (PM_{10}) is required during activities.

Objective	Target	Key Performance Indicator
Ensure that dust emissions do not adversely affect the health or visual amenity of surrounding communities.	No complaints from adjoining sensitive receptors in relation to dust and odour emissions from the works	Number of public complaints from the public related to dust.
Compliance with relevant State and local regulatory requirements in relation to dust management.	No visual evidence of dust migrating beyond the Site boundary. No exceedences of adopted PM_{10} trigger levels.	Visual monitoring of dust movement during environmental inspection. PM_{10} monitoring results.
Ensure that asbestos fibres are not released to the atmosphere (applicable to scenarios where hazards materials are being removed / asbestos impacted soils are encountered).	Compliance with quality limits for during monitoring events (both personal monitoring and work area perimeter monitoring). Control Level – 0.01 fibres/mL. Dust levels should remain sufficiently low for measured asbestos concentrations to be below the practical lower detection limit of 0.01fibres/mL.	AFM results.

Table 31: Objectives and Targets for Dust and Air Quality Management

22.2 Management, Monitoring, Reporting and Contingencies

Table 31 lists the management strategies, monitoring and reporting requirements and contingency measures for this aspect during the Project.

Management Strategy	Prior to Demolition and Construction Phase
	• Undertake consultation with stakeholders (importantly with respect to dust management the local Environmental Health Officer at the City of Bayswater). • Construction Manager to plan demolition in a strategic manner that prevents dust migrating beyond boundary towards sensitive receptors most likely to be impacted by prevailing wind directions. • All contractors are required to be inducted in dust control measures, targets for dust management and management actions required under this CEMP.

- Hazmat Surveys to be completed.
- Extent and height of hoarding / fencing with shade cloth and Site signage shall be established before any part of the Site is disturbed.
- Complaints management system in place as follows:
  - response protocol developed (as per Section 26 of this CEMP); and
  - register established and maintained by HSSEQ Manager.

During Demolition and Construction Phase

- Implementation of dust monitoring program (to be advised).
- Suitable watercart in good working condition and of not less than 10,000 litres capacity per 5 hectares of disturbed Site, or an appropriate alternative, shall be available to commence immediate watering on the Site.
- The Site fencing (hoarding / shade cloth) is to remain in position and in good condition until the Project has been completed and Site surface is stable.
- Surface stabilisation (e.g. Dustex) is to be applied to the disturbed area of each section of the Site upon completion of ground disturbance in that section. Surface stabilisation is to be protected by establishing exclusion zones around each area to prevent traffic / foot traffic crossing).
- In the event contaminated soil is encountered, an exclusion zone should be established around it and consideration should be given to covering back over the find until such time as all the necessary controls are in place to manage it appropriately.
- Stockpiles shall be constructed in a manner that allows for adequate dust suppression via water cart, sprinklers, hand hose, etc.
- The speed of all vehicles on site shall be restricted to 5 to 10km/hr (Construction Manager to advise in subplans). This speed shall be further reduced for safety reasons or if large amounts of dust are still being generated, until additional dust management measures are put in place and demonstrated to be effective.
- Dust generating activities shall be assessed during periods of excessively windy conditions (>40km/hr). Where dust cannot be adequately controlled work, is to be ceased and rescheduled where adequate control of dust generation can be achieved.
- All plant and equipment with access to the Site shall be properly maintained and serviced in accordance with the manufacturer's specification. During the works maintenance logs will need to be maintained and available during inspections.
- Operating machinery and vehicles shall be visually checked to ensure exhaust fumes are not discharged to adjoining buildings air intakes,

	enclosed areas or zones within the Site which have limited air circulation. • Trucks transporting demolition wastes are to be fitted with wind on tarps and secure tailgates. • All vehicles leaving the Site are required to exit through a wheel wash to remove excess soil, concrete etc. to ensure soil or mud is not carried onto the road reserve. Measures must be taken to ensure no materials are washed down onto the road reserve or into the stormwater system. • Drainage gullies, roads and footpaths surrounding the Site are to remain free from any sand or debris emanating from the Site. • Sealed roads, particularly access routes in / out of the Site shall be swept regularly to remove deposited material. This may be a combination of daily manual sweeping but supplemented with regular use of a mechanical road sweeper.
MONITORING AND REPORTING	**Dust** – general monitoring requirements are listed below, with further specific details to be provided in subplans for each construction activity: • Continuous dust monitoring at a minimum of three locations for the duration of Demolition Phase and weekly dust monitoring reports. • Exceedances of trigger levels to be reported to DWER and City of Bayswater. **AFM** – general monitoring requirements are listed below, with further specific details to be provided in subplans for each construction activity and based on the outcomes of HAZMAT surveys: • Daily AFM monitoring at locations to be determined by the HSSEQ Manager and daily reports. • Exceedances of trigger levels to be reported to DWER, City of Bayswater and DoH. **General** • Induction records. • Site inspections records. • Complaints register.
CONTINGENCY ACTIONS	• Stop relevant work activity and investigate the cause of excessive dust generation or complaint. • Review dust monitoring data and climatic conditions. • Implement additional appropriate dust control measures, which may include: - limiting the quantity of machinery/vehicles in operation; - further wetting down of roads/ stockpiles/ excavations/ other impacted areas; - removing dust source material within 24 hours; and - waiting until wind conditions improve to continue work.

	• Monitor success of control measures. If the measure is inadequate, implement additional alternative measures.

Table 32: Dust and Air Quality Management

23.0 Other Environmental Procedures And Guidelines

Operational procedures will be established to guide construction workers to ensure protection of the environment. These procedures will be instructional and diversion from the procedures will be considered a 'near miss' and be reported as an environmental incident.

For information on greenhouse gas emissions management refer to the Sustainability Management Plan (BSTPR-EVO-EN-PLN-00004).

For light emissions management refer to the Construction Management Plan.

Seasonal weather conditions will be monitored via the Bureau of Meteorology website and inclement weather will be managed via the Construction Management Plan and the Emergency Response Management Plan.

24.0 Emergency Response Management

24.1 Emergency Response Management Plan

A Project specific Emergency Response Management Plan (BST-EVO-SA-PLN-00003) has been developed outlining the arrangements in place for the effective management of security and emergencies. Refer to the plan for further details on site Emergency Management.

In the event of an emergency involving the Evolve Bayswater project personnel directly or indirectly, Evolve Bayswater resources are to be used in the following capacity:

- protection of Human Life;
- preventing further impact to the Health and Safety of personnel and to the environment;
- protection of Property and Information; and
- assist emergency services when requested in accordance with their training and competency.

25.0 Monitoring and Measurement

Environmental monitoring and measuring equipment will be controlled, calibrated and inspected in accordance with the Quality Management Plan BST-EVO-QA-PLN-00004.

26.0 Incidents and Incident Reporting

An environmental incident is defined as:

Events that can directly or indirectly cause environmental impacts or harm as well as events involving non-compliance with Project procedures and 'near miss' events which may or may not result in an environmental impact.

The Incident Reporting and Investigation Procedure (IMS-PRO-017) will be implemented for the Project, with the following modifications:

- Process to document, report and communicate environmental incidents. An outline of this process is shown in Figure B and has been developed to align with the requirements of Sections 8.1.4(vii) and 8.9 of the SWTC.
- Directs witnesses to the Alliance's online incident reporting system.
- States reporting deadlines (e.g. within 24 hours).
- Provides a template for the Environmental Incident Report.

- Provides criteria for the classification of environmental incidents, drawing from the Alliance and PTA's agreed risk matrix and consequences descriptors.

In accordance with PTA's EMS Manual, all environmental incidents shall be reported to the Alliance Site Supervisor and communicated to the PTA Environment Manager.
The Incident report will detail as a minimum

- description of incident (date, time, location, GPS co-ordinates, factual description of the incident);
- incident type (environmental impact, environmental non-compliance, potential incident, community complaint);
- incident classification;
- incident investigation findings; and actions.

Environmental incidents shall as a minimum include actual or near misses resulting in:
a breach of legal and other requirements;

- environmental damage (i.e. over clearing);
- environmental pollution / contamination;
- unapproved impacts on vegetation, flora, fauna, water, heritage sites/ unexpected finds and atmosphere;
- unapproved discharge to air, land and water; and
- public complaints.

The Alliance will provide the PTA's Representative with electronic access to the Alliance's environmental incident reporting and audit systems upon request.
The Alliance will track and close out all audit / inspection actions to the satisfaction of the PTA's Representative within the agreed timeframe.

27.0 Non-Conformance and Corrective Actions

27.1 Non-Conformance

The personnel responsible for monitoring the implementation of the CEMP will report actual or potential breaches of the CEMP using a Non-conformance Report (IMS-PRO-FOR-1501).

A Non-conformance register will be kept up to date in the IMS. The treatment on non-conformities is carried out in accordance with the Control of Non-Conformances, Corrective and Preventive Action Procedure.

The requirements for Non-conformances for the project are outlined in the Quality Management Plan BST-EVO-QA-PLN-00004.

27.2 Non-Conformance correction period Environmental Management

The Alliance will provide an environmental sub-plan for the Non-conformance Correction Period which includes:

- ongoing environmental management requirements
- timing for key management actions
- monitoring, performance and completion criteria
- reporting requirements

- contingency actions in the event performance criteria are not being met

The Alliance will conduct its maintenance activities in accordance with the approved environmental sub-plan(s) for the Non-conformance Correction Period.

27.3 Corrective and Preventative Actions

Corrective and preventive actions will be assigned and implemented to all non-conformances (or potential), near misses and hazards to avoid the occurrence or repetition of non-conformances by:

- identifying cause analysis and planning of efficient monitoring actions;
- adopting actions;
- communicating of actions;
- closing preventive/corrective actions upon completion; and
- implementing improvement actions
- Circulating lessons leant from internal and external parties

Assignment and implementation of corrective/preventive actions is carried out in accordance with the Control of Non-Conformances, Corrective and Preventive Action Procedure.

28.0 Project Handover and Decommissioning Requirements

28.1 Handover

Prior to handover, Evolve Bayswater shall obtain any approvals for the completed works from relevant authorities. Evolve Bayswater shall inform the Client when applying for such certificates, license's and approvals, and when inspection of completed works is to be carried out by the relevant authorities.

28.2 Close-Out Report

The Alliance will prepare a Project Environmental Close-out Report at the completion of the works and prior to the completion of demobilisation which provides a detailed and collective summary of the information and data collected throughout the Project and through the monthly environmental Reports (as outlined in environmental Reporting section 8.8 of Book 2).

The Project Environmental Close-out Report will include an electronic copy of all environmental data obtained throughout the works.

28.3 Lesson Learned

The lessons learned process is a formal part of project closeout and serves as a valuable tool for use by other, similar projects for Evolve Bayswater. This completed document (refer to Lessons Learnt, IMS-PRO-FOR-0910) may be used as part of new project planning in order to determine what problems occurred and how those problems were handled and may be avoided in the future.

The purpose of the lessons learned process is to learn from experience on ongoing activities in order to:

- Optimize cost.
- Improve time-schedule.
- Improve performance against KPIs.
- Evaluate team and personnel's performance.

- Evaluate the business case – whether the project created business benefit.

Lessons are categorized by project delivery sections and descriptions, impacts, and recommendations are provided for consideration on similar future new projects. It is important to note that not only failures are included but successes as well.

29.0 Inspection, Auditing, Monitoring and Review

29.1 External Audits

The Environmental Manager or the HSSEQ Manager will accompany the PTA's Representative during any audit conducted by the PTA along with their Subcontractors' environmental representative (if applicable).
The Alliance will allow a minimum of two days to assist the PTA in undertaking any audit outlined above and provide any required information within one week of it being requested by the PTA's Representative (unless otherwise agreed). All Alliance audit Reports / inspections etc. must be made available to the PTA's Representative within two weeks of completing the audit / inspections.

29.2 Internal Audits

Internal audits will be conducted as per the Quality Management Plan BST-EVO-QA-PLN-00004.
Evolve Bayswater will conduct audits on the Project Plans and procedures to verify compliance.
Audits will be conducted in line with the project life cycle whereby conducting audits on activities that are occurring at the time. Criticality and level of risk will also determine what are areas are to be audit.
All audit reports will be made available to the PTA Representative within five days of each audit.
All Actions arising from audits will be tracked until closure through Evolve Bayswater's compliance system.
The Project Audit Schedule will be updated at regular intervals by the Quality Management Representative to ensure the schedule adequately covers the planned activities and meets EB and the Client's requirements.
Results of Audits undertaken will be presented in written format to Management Team and relevant parties for review and take any required action accordingly.
Where a Non –Compliance is raised during the audit, they will be managed and responded within the timeframe set.

Other audits outlined in the SWTC will also added to the audit schedule

- environmental compliance audits within one week of the commencement of environmentally significant construction activities (ie. clearing, excavation and dewatering);
- two demobilisation audits with PTA's Representative; one three months prior to demobilisation completion and one on the planned last day of demobilisation by the Alliance
- Internal audits of the CEMP will be scheduled by the Quality Manager and be included within the Evolve Bayswater Project Audit Schedule (BST-EVO-PM-SCH-00001).
- Audits will also be scheduled around incidents that occur and any Non-conformances previously raised during an audit.

29.3 Inspections

29.3.1 Daily Visual Environmental Inspections

Daily visual inspections of environmental controls will be undertaken by the site supervisors or suitable delegated representative. These will be documented within the daily environmental inspection checklist. The daily site inspection will include visual inspections of, but not limited to the following;

- Adjacent waters to determine the presence of any sediment or chemical plume;
- Dewatering controls and monitoring requirements
- Erosion and sediment control structures to verify their condition and effectiveness;
- Cultural heritage controls and monitoring requirements;
- Noise, vibration and air quality mitigation measures to verify their condition and effectiveness;
- Contaminated site management strategies to verify their condition and effectiveness;
- Habitat preservation and vegetation management measures;
- The project site to identify the presence of pests (animals and plants);
- Housekeeping and waste management control measures;
- Fuel and chemical storage area.

The daily site inspection checklist ENV-PRO-FOR-1911 will be made available on request as part of the project records and be produced as evidence during audits when requested.

29.3.2 Fortnightly Environmental Inspections

Fortnightly Environmental Inspections using the Fortnightly Inspection Template ENV-PRO-FOR-1907 will be undertaken by the site supervisors. Completed checklists will be retained as project records and made available during audits when requested. A copy of the Fortnightly Environmental Inspection Template must be forwarded by the site Environmental Manager at the end of each week for collation and must also be kept onsite as a project record.

Fortnightly environmental site inspections will also be undertaken by the PTA's Representative.

30.0 Environmental Performance Reporting And Monitoring

30.1 Monthly Reports

A monthly environmental report using the template agreed with METRONET forms part of the Monthly Project Reporting for the project. This report will included:

- a brief description of construction activities undertaken for the month including a summary of current key environmental issues and risks.
- an updated version of the Environmental and Heritage Obligations Register including status and copies of any obtained environmental approvals.
- a summary of spoil type and classification, spoil quantity and disposal locations for the month, ASS treatment and Validation, analytical result, any unexpected finds and associated management actions (all spoil disposal documentation must be retained by the Alliance and made available to the PTA's Representative upon request).
- Gnarla Biddi (MAES) report for Aboriginal heritage incident reporting
- A summary of dewatering status including:
  - areas being dewatered;
  - water quality parameters pre and post treatment;
  - dewatering flow rates (instantaneous and cumulative);
  - Groundwater Levels; and
  - daily discharges from the dewatering system. Separate metering for each discharge point (eg. each recharge well, sewer etc.).
- Records of:
  - water usage (potable vs non-potable);
  - fuel usage (in litres);
  - waste including waste to landfill (in tonnes and m^3), types of Wastes, (in tonnes and m^3) and hazardous wastes such as fibrous materials, oily water, waste oil etc. (tonnes and m^3), material recycled;
  - water usage (in litres); and
  - land cleared (ha).
- Summaries of
  - environmental incidents and corrective actions.
  - audit / inspection findings and corrective actions undertaken.
  - community and Stakeholder complaints.
  - any environmental inductions, Training or awareness sessions.
  - environmental monitoring undertaken for the month and a copy of any environmental Reports or data undertaken by the Alliance or its Subcontractors.
  - construction activities and key environmental risks for the next period and proposed mitigation measures.

- dewatering system records of construction progress (wells drilled, pipe installed etc.), a summary of system performance, any configuration changes (pumps on, pumps off, pipe work changes, maintenance performed) and records of issues identified and agreed solutions.
- all spatial data (eg. monitoring wells, recharge wells, noise monitoring locations) in a format compatible with ArcGIS and AutoCAD.
- Documentation, reports or evidence to demonstrate compliance with conditions of approval and regulatory requirements for the project

Updates on the project's sustainability performance, including progress against the Sustainability Management Plan (SuMP), sub-plans, strategies and action plans are reported monthly separately as discussed in the SuMP (BST-EVO-EN-PLN-00004).

30.2 Annual Greenhouse and Energy Reporting

Evolve Bayswater will prepare and submit energy and emission reports in accordance with the requirements of the *National Greenhouse and Energy Reporting Act 2007*. It is expected that the project will be considered a Facility under the Operational Control of Acciona and the project's reporting obligations will be submitted as part of Acciona's corporate report.

30.3 Environmental Close-out Report

A Project Environmental Close-out Report will be prepared for review and approval by the PTA prior to the completion of demobilization summarizing the overall performance of the project based on the monthly reports, including native files of all electronic data obtained, including ArcGIS shapefiles, CAD (DWG files) and monitoring data during the delivery of the project.

References

Department of Water and Environmental Regulation (DWER) (1996) Landfill Waste Classification and Waste Definitions (as amended 2019).

Gemec Environmental Consultants (Gemec) (2020) Detailed Site Investigation Report Former BP Magnolia Site, Bayswater, December 2019, Revision 1, unpublished report prepared for Department of Communities.

Golders Associates Pty Ltd (Golder) (2018) Metronet FAL Bayswater Station and Turnback Geotechnical Investigation, August 2018, 18100444-001-R-Rev0, unpublished report prepared for PTA.

Geological Survey of Western Australia (GSWA) (1986) Perth Metropolitan Region, 1:50,000 Environmental Geology Series Sheet 2034 II.

Harewood (2019) Fauna Habitat Assessment Bayswater Train Station Development Works, Bayswater 27 January 2019, Final, unpublished report prepared for PTA.

JBS&G (2019) Detailed Site Investigation Bayswater Station and Surrounding Areas, 26 September 2019, 56431/122849 (Rev 0), unpublished report prepared for PTA.

JBS&G (2018) Preliminary Site Investigation Bayswater Station and Surrounding Areas, 16 November 2018, 55437/118571 (Rev 1), unpublished report prepared for PTA.

PGV Environmental (2019) Metronet Bayswater Train Station Flora and Vegetation Survey, 30 January 2019, 2018-410, Version 3, unpublished report prepared for PTA.

Figures

Appendix A – Environmental Management Policy

TBA

Appendix B – Site Identification Details

Site Identification Details are shown in Figure 2a and listed below.

Lot Number	Deposited Plan	Land ID Number	Current Use	Area
502 (Part of)	P002052	3820335	Rail Reserve Train Station Car Park R12520	
503		3820336		19,905 m^2
504		3828320		21,787m^2
2630 (Part of)		2008822		
'A Rail Way'	-	4296628[1]		570m^2
	-	3686714[1]	Rail Reserve Train Station Car Park	3,600m^2
	-	4296627[1]	Train Station Car Park	2,399m^2
14090	P027644	3014925[1]	Road Reserve Whatley Crescent	7,293m^2
P Road	-	3851295[1]		15,197m^2
P Road	-	3864410[1]		6,000m^2
P Road (Part of)	-	3856370[1]		
	-	3864409[1]		
P Road (Part of)	-	3851282[1]	Road Reserve Leake Street	
	-	3851294[1]	Road Reserve Veitch Street	
	-	3851280[1]	Road Reserve William Street	
	-	3864398[1]	Road Reserve Hamilton Street	
P Road (Part of)	-	3864445[1]	Road Reserve Railway Parade	10,320m^2
	-	3864446[1]		
	-	3850998[1]		
	-	3852505[1]		
P Road	-	3852504[1]		5,666m^2
P Road (Part of)	-	3850978[1]	Road Reserve Coode Street	
P Road (Part of)	-	3852507[1]	Road Reserve Rose Avenue	
P Road	-	4089181[1]	Road Reserve	15m^2
P Road	-	4113641[1]	Road Reserve	483m^2
P Road (Part of)	-	3852500[1]	Road Reserve Drake Street	
P Road (Part of)	-	3852494[1]	Road Reserve Beechboro Road South	
1	D000471	1162896	Road Reserve	93m^2
5365	P001321	2010318[1]	Road Reserve	260m^2
5269 (Part of)	P001321	2010272[1]	Road Reserve	425m^2

Lot Number	Deposited Plan	Land ID Number	Current Use	Area
9915 (Part of)	P002285	2013780[1]	Landscaped area in front of Police Station at 77 Whatley Crescent[2]	35m^2 (Approx.)
100 (Part of)	D010083	3916630[1]	Road Reserve but sits within Lot 100 which is largely occupied by Halliday Park[2]	<100m^2 (Approx.)

Appendix C – EMS Certification

dlcs ISO 14001 certified

Certificate of Conformity

Acciona Geotech Holdings Pty Ltd ABN: 99 616 868 314
Acciona Construction Australia Pty Ltd ABN: 66 618 030 872
Coleman Rail Pty Ltd ABN: 81 101 299 512
Geotech Pty Ltd ABN: 94 114 336 515
John Beever (Aust.) Pty Ltd ABN: 84 006 337 113

Acciona Industrial Australia Pty Ltd ABN: 20 620 692 784
Acciona Agua Australia Pty Ltd ABN: 84 128 531 742
Acciona Infrastructure Australia Pty Ltd ABN: 52 140 915 251

To certify that their

Environmental Management System

has been assessed and registered as complying with the requirements of
ISO 14001:2015 – *Environmental management systems – Requirements with guidance for use.*

Scope of works covered by certification and locations
Refer to the Certification Schedule for further details.

Certification Number 20056
Issue Date 04/12/2019
Issue Number 02

Period of Registration
22/01/2018 to 30/11/2020

John Edwards, Operations Director
dlcs international

Certification is subject to ongoing surveillance assessments
The validity of this certificate can be verified at www.jas-anz.org/register

This certificate and certification mark remains the property of dlcs international - www.dlcs.com.au
St Kilda Rd Towers, 1 Queens Road, Level 2, Suite 220-222 Melbourne, VIC 3004

JAS-ANZ
Accredited by the Joint Accreditation System of Australia and New Zealand.
Acc. No. MS250513AM

Appendix D – Detailed Scope of Work

Element	Description
Structures	• New bridge structures over King William Street to the west of the Bayswater Station and over the new link road (between Whatley Cresent and Beechboro Road) to the east of the Bayswater Station to support all rail systems, station infrastructure, shared paths and associated infrastructure. Includes associated ground level Bayswater Station entry buildings, associated facilities and tenancy spaces. • New Leake Street PShP Underpass.
Ancillary Buildings	• New Signalling equipment room at the Bayswater turnback and associated site works. • Drivers toilet at the Bayswater turnback.
Railway	• All track work on the Midland Line for dual gauge track: standard gauge (1,435mm) and narrow gauge (1,067mm) to accommodate the Bayswater Station to the extent and layout shown in the BST Concept Designs and future proofing for the MEL Concept designs. • All track work on the Midland Line for the narrow-gauge track (1,067mm) turnback siding between the Bayswater Station and Meltham Station to the extent and layout shown in the BST Concept Design and future proofing for the MEL Concept designs. • Earthworks and noise and vibration mitigation measures to address the BST Concept Design and MEL Concept Design (Refer to SWTC Book 5) scope and design. • Overhead wiring system to address the extent and layout shown in the BST Concept Design. • Removal and recovery of existing redundant booster transformer. • Colour light signalling system including ATP system and upgrade of TCS to address the extent and layout shown in the BST Concept Design. • Communication, control and monitoring systems to address the extent and layout shown in the BST Concept Design and accommodate the MEL Concept Design (Refer to SWTC Book 5). • Soft landscaping to rail reserve and verges. • Civil and drainage works to support the new Rail Infrastructure to address the BST Concept Design and MEL Concept Design (Refer to SWTC Book 5) scope and design. • Operational signage for railway operations to accommodate the extent and layout shown in the BST Concept Design; and • Transit space design to address the BST Concept Design and MEL Concept Design (Refer to SWTC Book 5) scope and design.
Railway Station	• The Bayswater Station – two elevated island platforms with four platform faces and at grade passenger entries (western station entry building and eastern station entry building with associated tenancy spaces).
Station Precinct and Station Surrounds	• Car park removal and amendments. • Urban plaza and surrounds - Provide a destination plaza space for public life and events that responds to the Placemaking Plan and that is minimum 1,250m^2 in area - approximate dimensions 35mx 35m. The plaza is to be designed and equipped to accommodate

Element	Description
	food trucks or similar with power and water supplies. The design must ensure the space is functional for station users while the plaza is in use for functions. • Hard and soft landscaping. • Irrigation to Station Surrounds and areas of the Station Precincts amended by the works under this Agreement. • Additions, alterations and reinstatement works as result of changes in site extents due to the Works or Temporary Works. Including but not limited to: - new replacement road surface, footpaths and associated kerbing along the southern edge of Whatley Crescent between Leake Street and Slade Street (up to nearest edge of adjacent existing tenancies and residents property boundaries); - new replacement road surface, footpaths and associated kerbing along Rose Avenue (up to nearest edge of adjacent existing tenancies and residents property boundaries); - new replacement road surface, footpaths and associated kerbing along King William Street, between Murray Street and Whatley Cresent/King William Street intersection (up to nearest edge of adjacent existing tenancies and residents property boundaries); and - new replacement road surface, footpaths and associated kerbing along Hamilton Street (up to nearest edge of adjacent existing tenancies and residents property boundaries). • Integration of the Works with the Station Precinct. • Statutory signage, signage and wayfinding.
Mechanical, electrical and hydraulic services for the Bayswater Station and Rail Infrastructure Works	• Ventilation and air conditioning systems for control temperature in the Bayswater Station, plant and control rooms. • Ventilation systems for smoke control, if required by the FEB and/or FER. • Ventilation systems for human comfort and contaminants control in the auxiliary spaces such as toilets, store rooms, plant rooms and the like. • All services provisions for retail tenancies. • Bayswater Station, plant room and surface drainage systems including sumps, pumps, rising mains, piping and pollution treatment. • Station Precinct and Station Surrounds, pathways, plant and control room, normal and emergency lighting systems. • LV electrical systems including cable containment and reticulation to switchboards, pumps and other equipment, lighting, general purpose outlets etc. • Automatic changeover standby LV power supply to critical railway system equipment and fire and emergency equipment. • Fire detection and protection systems, including wet fire mains, hydrants, extinguishers, inert gas, local and remote indicator panels and communication to the emergency services. • Lifts. • Earthing and Bonding systems. • Communication, control and monitoring systems including access control and fare gate monitoring.

Element	Description
	• Potable and non-potable cold and hot water, sewer, waste and vent systems, stormwater catchment and containment including overflow systems. • Fixtures and fittings for the Bayswater Station, Station Surrounds and plaza area. • All services for the Bayswater Station, Station Surrounds and plaza area.
Fencing, retaining, noisewalls, roads and pathways.	• Temporary realignment of roads and paths to maintain all vehicular, pedestrian and cycle movements and services whilst minimising disruption. • Reinstatement of, and tie into, all road, bus infrastructure, paths and other infrastructure that will be affected and interfaced by the work under this Agreement, including Works and Temporary Works. • Road, carparks, Short Term Parking and associated works to amend the existing arrangement of Beechboro Rd South, Railway Parade, Whatley Crescent and Coode Street/King William Street to achieve the configuration shown in the Bayswater Station & Turnback Project - Station & Bridge Concept Design Station Option 2 - Road Variant 4. • Road and associated works to amend Whatley Crescent and address intersections at Hamilton Street, Leake Street and Veitch Street. • Road and associated works to amend Railway Parade west of King William Street and it's intersection with Coode Street to achieve long term universal access parking for the Bayswater Station. • Road and associated works to the intersection area of Railway Parade, Beechboro Road South, Drake Street and Rose Ave. • Reinstatement of the PShP through Bayswater to provide the most direct route including grade separation over the roadways. • Provision of PShP connections between the PShP through Bayswater to the Bayswater activity centre, station entry buildings and Leake Street PShP Underpass. • Cycle routes to the Bayswater Station entry and through the Station Precinct and Station Surrounds. • Fencing enclosing the rail reserve along the length of all track sections including allowance for maintenance access and emergency egress. • Fencing for stabling of trains. • Fencing and barriers to address safety issues, movement control and the like. • Vehicular and emergency services access and required emergency vehicle hardstands to the Bayswater Station (its entry points), and Ancillary Buildings. • Drivers pathways. • On-tracking facility amendment. • Maintenance access to all wayside equipment and Ancillary Buildings. • Maintenance vehicle access along the Midland Line over the length of the at grade section railway line. • Noise walls including noise modelling to determine noise wall requirements to address the BST Concept Design and MEL Concept Design (Refer to SWTC Book 5) scope and design.

Element	Description
	• Retaining and abutment walls to address the BST Concept Design and MEL Concept Design (Refer to SWTC Book 5) scope and design.
Services	• Relocation, modification or protection of all services and other infrastructure which are affected by the Works or Temporary Works to address the BST Concept Design and MEL Concept Design (Refer to SWTC Book 5). • The protection of services which are relocated as part of the Interfacing Works. • Lighting to accommodate all roads and pathways.
Demolition, removal and reinstatement	• Any existing buildings or structures as necessary for the purposes of the Project Activities and removal of all obstructions and Temporary Works. • Existing Bayswater Station. • Existing Bayswater Station car parks. • Trees and vegetation. • Reinstatement of the PShP through Bayswater to provide the most direct route including grade separation over the roadways. Redundant railway infrastructure and associated reserve. • Affected Station Precinct and Station Surrounds works. • Removal of any existing uncontrolled fill within the limit of works and replacement with engineered fill.
Other Works	• Existing property protection, monitoring and control with varying monitoring response times. • Drainage for the rail reserve where it is impacted by the Works or Temporary Works, including the Bayswater Station, Station Precinct and Station Surrounds. • Signage and any pavement markings. • Modification to any roads and properties affected by the Project. • Road works to maintain connectivity for the local neighbourhoods. • Groundwater dewatering, recharge, treatment, monitoring and management systems. • Supplementary ground investigation for Detailed Design and construction. • Ground movement impact assessment. • Instrumentation and monitoring. • Management of design and construction interfaces with adjacent town centre works. • Existing services monitoring and protective works. • Public art. • Future proofing for future works. • Minimise reduction in service level on roads within and surrounding the construction Site during construction – through effective deployment of the TTMP. • Reinstatement and rehabilitation works. • Leake Street PShP Underpass and associated bike boulevard; and • All other works described elsewhere in this SWTC.
Staging Works	• All staging works necessary to achieve the Works.
Utilities	• Utilities relocation, protection and delivery. • Western Power HV cable relocation.

Table 1: Scope of Work

Appendix E Legislation Reference Register

Appendix N

Green Star Rating Strategy prepared by Evolve Bayswater

evolve bayswater
connecting people + places

PTA

BAYSWATER STATION AND TURNBACK

RFP: PTA190037

GREEN STAR STRATEGY

BST-EVO-SU-RPT-00001

AUTHORISED TO USE: _____(ALLIANCE MANAGER), DATE: _____

Submit to Client for Review and Approval where required in the Contract (Client to complete one box only):					
❑	Rejected, resubmit	Name:	Sign:		Date:
❑	Endorsed, with comments to add or change	Name:	Sign:		Date:
❑	Endorsed	Name:	Sign:		Date:

Rev	Date	Reason for Issue	Prepared	Checked	Approval
B					
A		Draft - Issued for Comment	K.O'Mara		

Table of Contents

Compliance Matrix 3
Abbreviations and Acronyms 3
1.0 Background 4
1.1 Introduction 4
1.2 Bayswater Station and Turnback Project 4
1.2.1 Stage One: Turnback Works 4
1.2.2 Stage Two: The Bayswater Station Southern Section 5
1.2.3 Stage Three: The Bayswater Station Northern Section 5
1.2.4 Optional Works Packages 5
2.0 Green Star Assessment and Strategy 6
2.1 Assumptions 6
2.2 Scope and Boundary 7
2.2.1 Boundary 7
2.2.2 Scope 7
2.2.3 Spaces 7
2.3 Targeted Credits 13
2.3.1 Management 13
2.3.2 Indoor Air Quality 20
2.3.3 Energy 24
2.3.4 Transport 25
2.3.5 Water 26
2.3.6 Materials 27
2.3.7 Land Use and Ecology 29
2.3.9 Emissions 31
2.3.10 Microbial Control 32
2.3.11 Refrigerant Impacts 32
3.0 Roles, Responsibilities and Resourcing 33
3.1 Sustainability Manager 33
3.2 Key Internal and External Stakeholders 33
3.3 Review and Update 34
4.0 References 34

Compliance Matrix

Reference	Description	Section in this Plan
SWTC		
Book 2: Management Plan Requirements (BST-PTAWA-PM-RPT-00010) Section 24.10.1	The Alliance must review with the PTA the key risks and opportunities for maximising sustainable outcomes through procurement as part of developing the Sustainability Plan and sub-plans, including: i. resource efficiency and whole of life improvements for use of energy, water and materials; ii. waste avoidance, recovering and management; iii. use of environmentally labelled products and suppliers; and local content (workforce and businesses).	Whole Plan
Book 4: Technical Criteria (BST-PTAWA-PM-RPT-00013), Section 24.1.1	The formal 4 star Green Star certification for 'Design' and 'As Built' stages of the Bayswater Station must be through the GBCA under the Green Star – Railway Stations rating tool (customisation of Green Star – Design & As Built v1.2). 24.1.1.2 The Alliance must review the Green Star – Railway Stations rating tool with PTA and agree the strategy to achieve the rating target to deliver best value outcomes, including identifying any specific priority credits within the rating tool. 24.1.1.3 The Alliance must ensure that a GSAP is appointed to the Alliance team to coordinate the preparation and submission of the deliverables to the GBCA for the Green Star certification for Bayswater Station.	Whole Plan Section
Development Approval		
Condition Number 23	Green Star Report to be submitted confirming achievement of a minimum 4 Star Green Start (Design and As-Built) ratings to Operations	Whole Plan

Abbreviations and Acronyms

Term	Definition
AMT	Alliance Management Team
BST	Bayswater Station and Turnout
EnvMgr	Environment Manager
LGA / WALGA	Local Government Authority / WA Local Government Association
MO	METRONET Office
Mgr	Manager
PTA	Public Transport Authority
SuMP	Sustainability Management Plan
UD Lead	Urban Design Lead

1.0 Background

1.1 Introduction

METRONET is the State's vision to integrate transport and land use planning in the State and provide a framework to support sustainable growth of greater metropolitan Perth over the next 50 to 100 years.

Aligned with Commonwealth planning and infrastructure policies and the State's metropolitan growth strategies, *Perth and Peel @ 3.5 million* and *Transport @ 3.5 million*, METRONET Initiatives will deliver around 70 kilometres of new passenger rail and up to 18 new stations.

More than just rail infrastructure works, METRONET recognises the potential for urban intensification in more than 5,000 hectares of land. Planning goes beyond the station forecourts to shape and support development of communities within a walkable distance of 400 metres from a public transport hub.

METRONET Initiatives include approximately 70 kilometres of new heavy passenger rail and 16 new rail stations, which represents the single largest investment in public transport in Perth's history.

The State has prioritised the following METRONET Initiatives:

- Forrestfield – Airport Link;
- Thornlie – Cockburn Link;
- Yanchep Rail Extension;
- Morley – Ellenbrook Line;
- Extension of the Armadale Line to Byford;
- Bayswater Station Upgrade
- New station at Karnup
- New station at Bellevue
- Station upgrade and relocation of Midland Station to Cale Street;
- Extension of the Midland Line to Bellevue; and
- Level crossing removal program.

1.2 Bayswater Station and Turnback Project

The Bayswater Station and Turnback Project as incorporated in the PAA for the Project includes:

- Stage One: The Turnback Works;
- Stage Two: The Bayswater Station Southern Section;
- Stage Three: The Bayswater Station Northern Section;

1.2.1 Stage One: Turnback Works

Stage One: Turnback Works comprises the following:

- New turnback siding between Bayswater and Meltham stations (configured to provide accommodation for 1 x 6 car sets);
- A shunters path (walkway) and a new driver's washroom;
- Relocation of the Leake Street underpass;
- Maintenance of the principle shared path along the southern side of the railway reserve;

- Other Project works including standard station systems, signalling, overhead line electrifications, communications, utility relocations and noise mitigation;

1.2.2 Stage Two: The Bayswater Station Southern Section

Stage Two: The Bayswater Station Southern Section, comprises the following:

- Two new rail bridges over King William Street, immediately south of the existing railway;
- New station island platform (150m long and 10m wide) complete with associated infrastructure and supported by the railway bridges ;
- Provision for the principle shared path on the southern side of the southern railway bridge
- The first stage of western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts and stairs) and equipment rooms to service railway operations:
- Integrated pedestrian, cyclist, bus and vehicle access into the station and future Bayswater town centre;
- Relocation of the dual gauge tracks and all associated track infrastructure to align with the new platform faces;
- New bus bays and vehicle parking bays;
- Other Project works including standard station systems, signaling, overhead line electrifications, communications, utility relocations and noise mitigation;
- Landscaping and urban design features within the station precinct; and

1.2.3 Stage Three: The Bayswater Station Northern Section

Stage Three: The Bayswater Station Northern Section comprises the following:

- Demolition of the existing Bayswater station and associated infrastructure.
- A second set of two new rail bridges over King William Street, located immediately north of the first new set of railway bridges delivered as part of Stage One;
- A second island platform (150m long and 10m wide) complete with station infrastructure again supported by the northern pair of railway bridges;
- The second stage of the western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts and stairs) and retail tenancies:
- Additional station infrastructure to meet the needs of the expanded (4 line, 4 platform face) station;
- Landscaping and urban design features within the station precinct;
- Other Project works including standard station systems, signaling, overhead line electrifications, communications, utility relocations and noise mitigation;
- Completion of new bus bays and vehicle parking bays.
- Landscaping and urban design features within the station precinct;

1.2.4 Optional Works Packages

The METRONET Initiatives include for other additional Project Works beyond the scope listed in 1.2.1, 1.2.2 and 1.2.3 above and these may be included during the Delivery Phase.

2.0 Green Star Assessment Strategy

Supporting the development of this SuMP the Green Star Assessment and Strategy (SWTC Book 3, Section 24.1.1) has been included to guide the implementation of the rating.

2.1 Assumptions

The following assumptions have been used as part of the development of the strategy to support achievement of at least a four-star rating:

- The METRONET Office has confirmed with the GBCA that the station meets the Eligibility Criteria for a Railway Station rating and will complete registration of the rating prior to, or immediately after signing of the PAA.
- Registration of the BST Green Star Rating is the responsibility of the PTA.
- Eligibility Criteria for the BST project as part of the Volume Certification has been confirmed by the PTA.
- BST is considered an above ground station as the station package consists of works which are at or above ground level which is defined as being at Railway Parade level.
- Where the Railway Stations Submission Guidelines (RS Guidelines) refer to buildings that the requirements are only applicable to the station buildings and does not include the track infrastructure.
- PTA is not committed to pursuit of a Green Star Performance rating post completion of the Evolve Bayswater works as this is not referenced in the *METRONET Sustainability Strategy* (BST-MET-PM-RPT-00001.5.0.IFI) and therefore credit requirements with this aspect are assumed to not applicable.
- Where percentage by project value or cost is specified as a credit requirement, this is determined to be associated only with the components of the project which form the scope of the rating.

2.2 Scope and Boundary

Green Star Railway Station Ratings are designed to assess the sustainability performance against business as usual for stations and their interface with the precinct in which they are located. To assist with defining the scope and boundary of the rating within the broader Bayswater Station and Turnback Project the following information has been prepared to explain the spatial differentiation within the context of the project.

2.2.1 Scope

The scope of the rating is defined by all components of the design for the Bayswater Station but does not include the infrastructure associated with the track and turnback infrastructure.

2.2.2 Boundary

The boundary of the Green Star Rating is aligned to all areas which are, or will be, owned and managed by the PTA as shown in blue in Figure 1.

2.2.3 Spaces

Primary (pink), secondary (blue) and tertiary (green) spaces for the project have been identified and are represented in

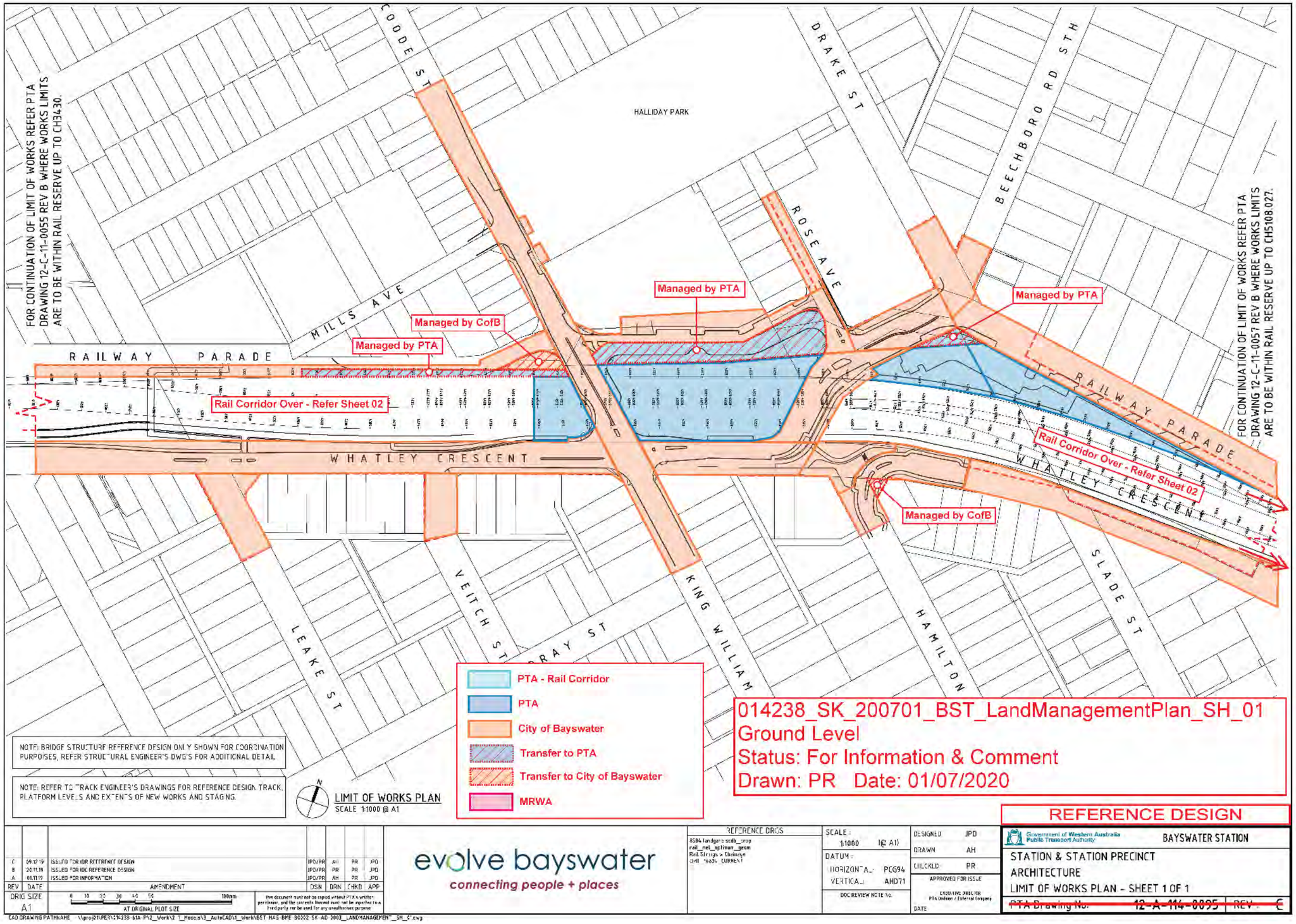


Figure 1 Boundary of the Green Star Rating for BST

Source BST-EVO-RFI-00046-00-014238_SK_200701_BST_LandManagementDiagramMarkup_SH-01_C

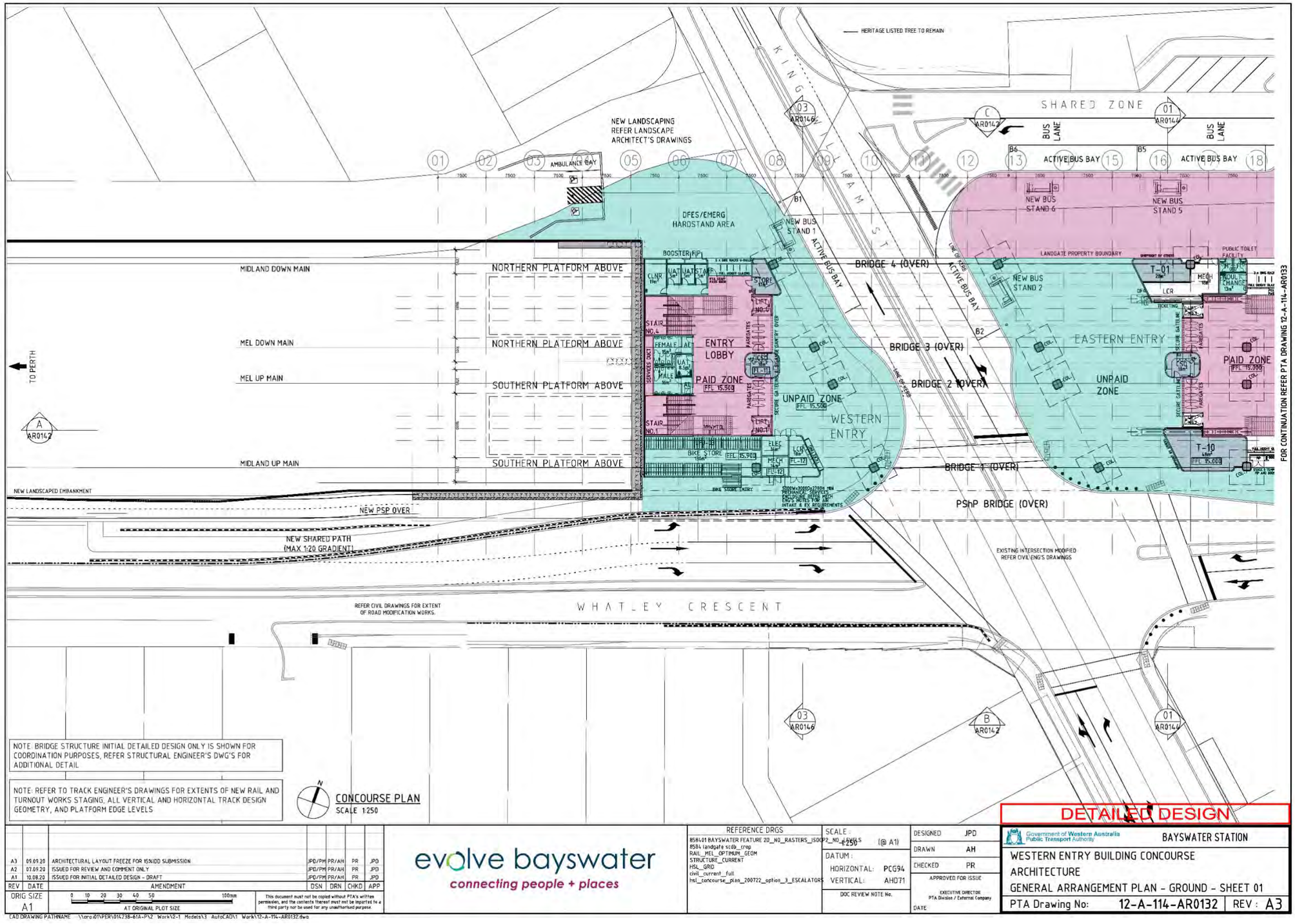


Figure 2 Primary, secondary and tertiary spaces for BST rating (west end, ground level)

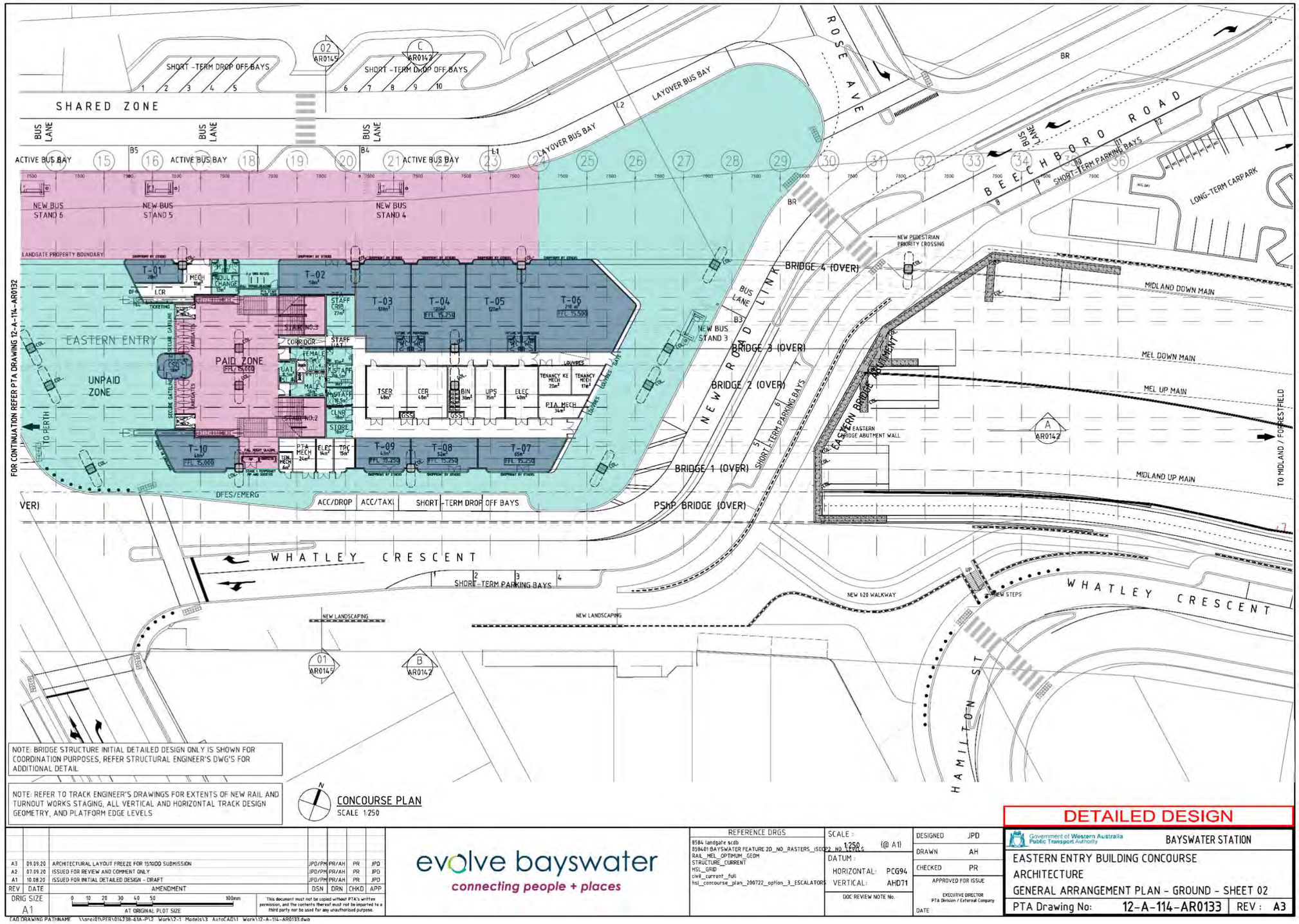


Figure 3 Primary, secondary and tertiary spaces for BST rating (east end, ground level)

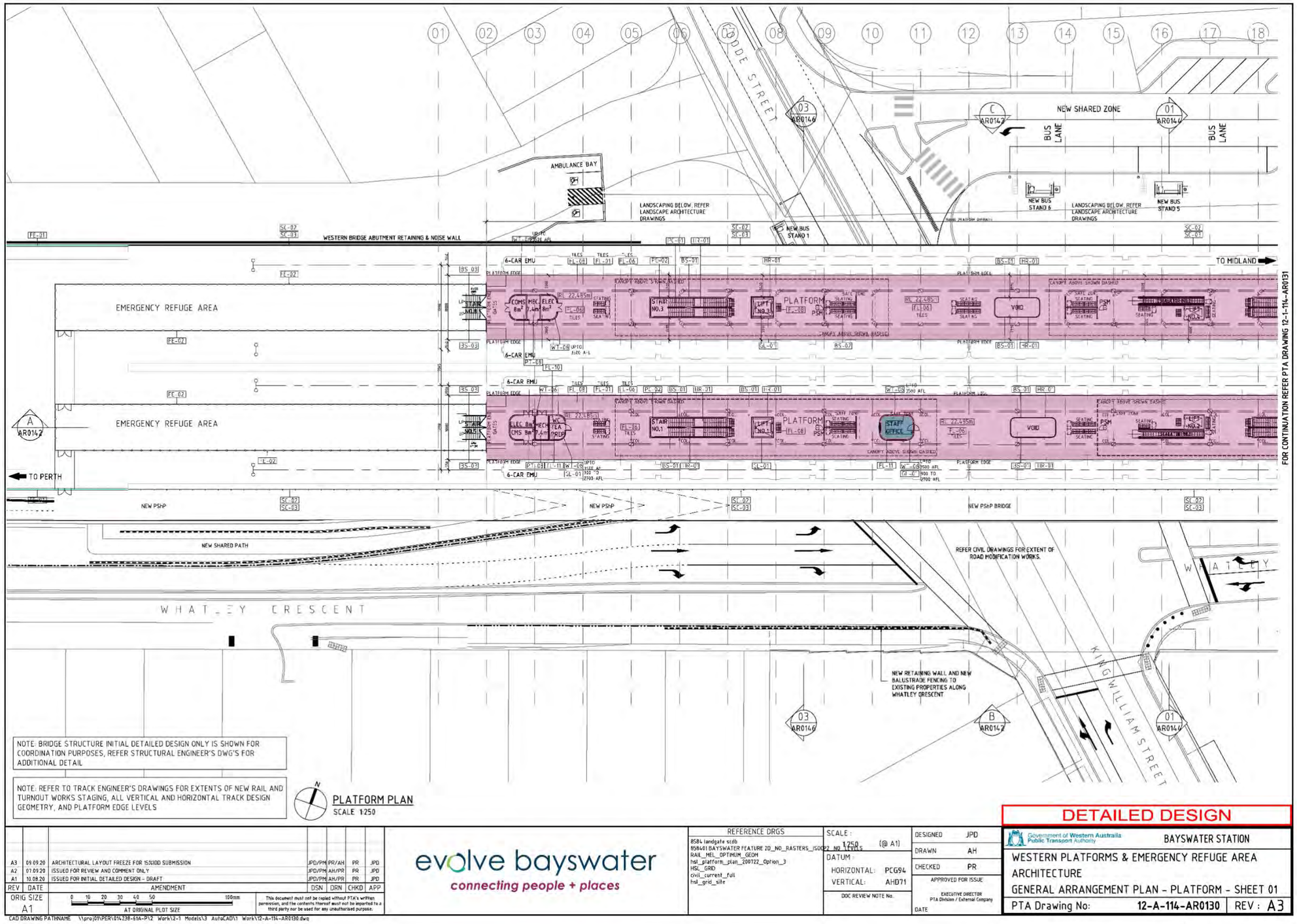


Figure 4 Primary, secondary and tertiary spaces for BST rating (west end, platform level)

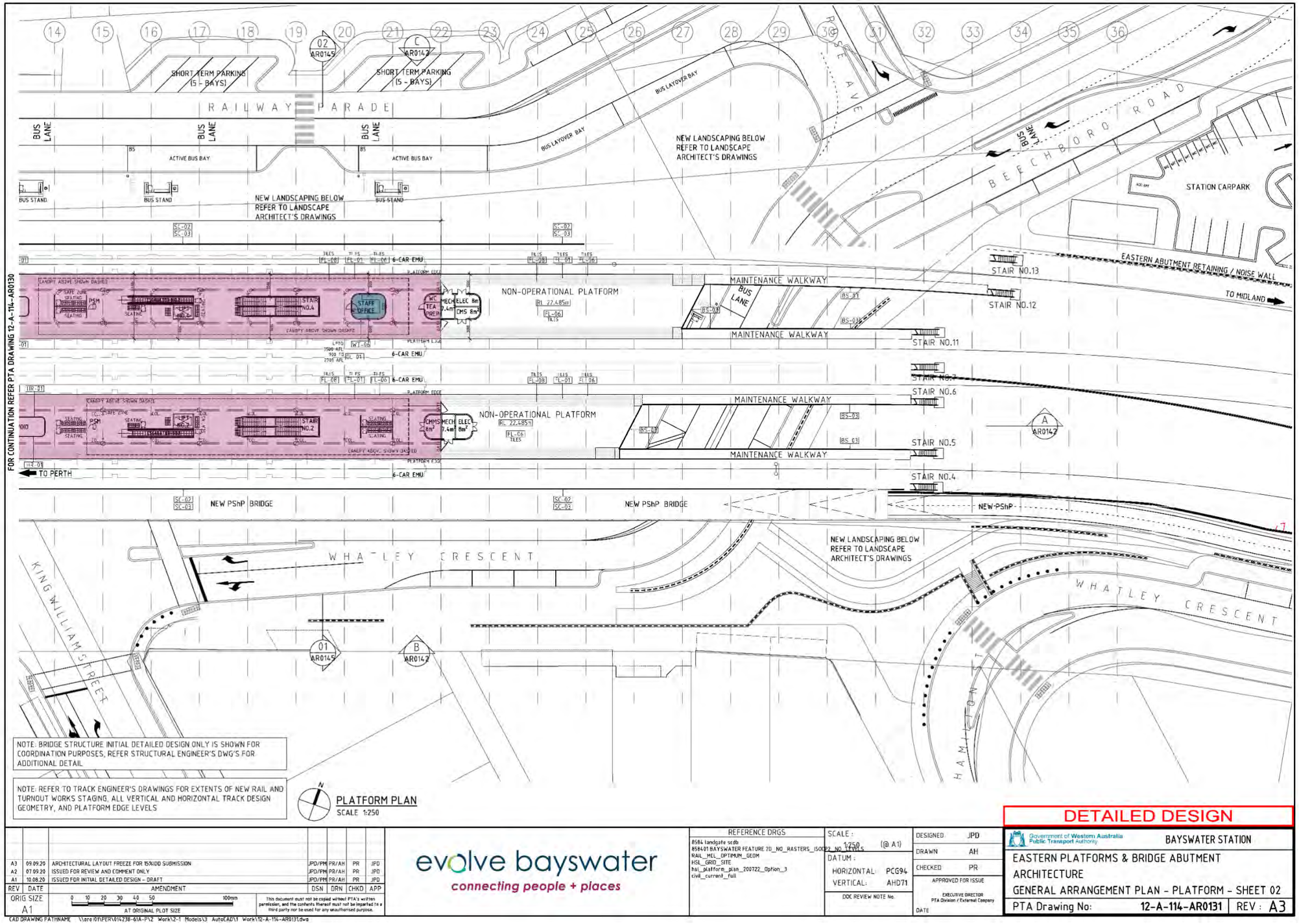


Figure 5 Primary, secondary and tertiary spaces for BST rating (east end, platform level)

3.0 Goals and Targets

Evolve Bayswater are committed to achieving a 4 Star Green Star Rating in Design and at As-Built. A total of 62 points, and a level of 5 Star has been targeted as part of the development of this Strategy and is outlined in Section 3.1 through to Section 3.10 respectively. Additional stretch target opportunities also identified, where appropriate in these sections.

3.1 Management

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
1. Green Star Accredited Professional					
1.0 GSAP	1	SWTC Book 4, 24.1.1.3, page 348	GSAP to be engaged on the project to support construction through to commissioning as represented by: • Volume Certification GSAP (outlined in Owner's Project Requirements prepared by METRONET • BST GSAP engagement letter or similar	• GSAP Certificate(s)	Volume Certification GSAP BST SusMgr
2. Commissioning and Tuning					
2.0 Environmental Performance Targets	Complies	SWTC Book 4 – 24.2.1 Owner's Project Requirements (OPR) (BST-MET-SU-SPC-00001.0.IFI)	• Preparation of metering strategy for energy and water	• Documentation used to support demonstration of SWTC requirements	Volume Certification GSAP BST SusMgr
2.1 Services and Maintainability Review	1	SWTC Book 4 – multiple locations	• Mapping of all sources of evidence and active management required • RAMs to be scoped to include the minimum GS requirements	• RAMs report • Services and Maintainability on buildings systems, signed off by all parties involved [likely to require additional quality information than is usual for Evolve Bayswater] • Evidence of review of the Services and maintainability documentation by the PTA	Systems Assurance Lead

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
2.2 Project Commissioning 2.2.1 Commissioning Specification 2.2.2 Commissioning Plan	1	SWTC Book 4 – multiple locations SWTC Book 2 – Clause 4	• Ensuring Commissioning Plan (Book 4, Section 4) is clear, concise and covers the requirements of 2.2.1 and 2.2.2 •	• Commissioning Specification - Demonstration that relevant Book 4 and GS2.2.1 requirements are met. • Commissioning Plan 2.2.2 - Demonstration that Commissioning Plan (Book 2, Clause 4, relevant SWTC Book 4 and GS2.2.2 requirements are met.	Building Services with input from MEP, RSA (PA and CCTV) and ACS
2.3 Project Systems Tuning	1	SWTC Book 2: Section 18.16 SWTC Book 4 – multiple locations	*Subject to confirmation that Small Building Approach is approved.* *Subject to confirmation of Volume Certification approach.* Assumed that 12-month tuning period will be managed by PTA N&I	• Demonstration that Demonstration that relevant SWTC Book 4 Inspection, Testing and Commissioning requirements for building services are met	PTA (N&I)
2.4 Independent Commissioning Agent	1	SWTC Book 2: Section 4	*Subject to confirmation of MNO or PTA and/or Volume Certification guidance.* Assumed that 12-month tuning period will be managed by PTA N&I	• Achievement of requirements for either Building Commissioning or Building Systems Tuning • Evidence of ICA type services are to be delivered by N&I and include documentation of the 'engagement' and services having been (or committed to being) provided • Potential for the regular engagement with PE's during design development could be continued to meet the credit requirements	PTA (N&I)
3. Adaptation and Resilience					
3.0 Implementation of a Climate Adaptation Plan 3.0.1 Climate Adaption Plan 3.0.2 Developing Climate Change Scenarios	2	MN Sustainability Strategy (p17) Target for Resilience and Adaptability	Addressing of credit requirements as part of the Climate Change and Green Infrastructure Strategy and the METRONET Program Climate Change Network Vulnerability and	• Climate Change Risk and Adaptation Report • Design Reports (particularly drainage) to demonstrate that	BST SusMgr

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
3.0.3 Recognised Standards 3.0.4 Risk Assessment 3.0.5 Implementation of the Climate Adaptation Plan			Risk Assessment (PRO-MNO-MET-SU-RAS-0001_0) *Consideration, where applicable, of the Resilience Risk Assessment and Action Plan, subject to guidance from MNO* SusMgr is recognized as a suitably qualified person (SQP) as required by the RS Guidelines Flooding is expected to be the key risk for the project based on similar risk assessments conducted by the SQP near the BST. Current Australian Rainfall and Runoff requires consideration of climate change and is anticipated to meet requirements	adaptation responses (treatment) have been included	
4. Building Information					
4.0 Building Information	1	SWTC Book 4: Section 4, Section 9.5 (Table 4 – Operation and Maintenance Manuals) OPR	*Subject to alignment with Volume Certification approach: Application of small building approach.*	• Operations Manuals and demonstration of compliance with GS requirements associated with conformance to Standards identified in the OPR	Discipline Lead – Building Services
5. Commitment to Performance					
5.1 Environmental Building Performance 5.1.1 Environmental Building Performance (5.1.1A Project Performance Metrics) 5.1.2 Application of Performance Targets 5.1.3 Performance Reporting	Stretch	-	*Subject to alignment with Volume Certification approach:* 5.1.1A and 5.1.3 - would require PTA to commit to measuring and reporting performance of the buildings beyond the Alliance duration. Whilst not difficult, may require additional resources beyond existing PTA practices 5.1.2 - would require commitment to integrate performance targets into the tenancy fit outs.		SusMgr

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
5.2 End of Life Waste Performance	Stretch	-	*Subject to alignment with Volume Certification approach:* 'Make Good' clauses would be required in tenancy leasing agreements and are considered outside the ability to influence of the BST. Opportunity would need to be discussed with, and agreed to by the PTA.	-	AM
6. Metering and Monitoring					
6.0 Metering 6.0.1 Metering Distinct Uses or Floors 6.0.2 Water and Energy Meters 6.0.3 Energy Metering Integrity 6.0.4 Small Stations Exception	Complies	SWTC Book 4: Multiple sections, in particular SWTC Book 2: Section 24.2.1.1	Achievement of requirements to be addressed as part of SWTC Book 2: Section 24.2.1.1 Note: SWTC Book 2: Section 16.6.4.1 v. notes that metering in accordance with Section J8 is not required by PTA.	• Demonstration that SWTC requirements, including Metering Strategy has been met	Discipline Lead – Building Services
6.1 Monitoring Systems 6.1.1 Monitoring Strategy 6.1.2 Automatic Monitoring System	Stretch	SWTC Book 4: Multiple sections, in particular SWTC Book 2: Section 24.2.1.1	Subject to 6.0 Metering Achievement of requirements to be addressed as part of SWTC Book 2: Section 24.2.1.1 Note: SWTC Book 2: Section 16.6.4.1 v. notes that metering in accordance with Section J8 is not required by PTA.	-	Discipline Lead – Building Services
7. Responsible Construction Practices					
7.0 Environmental Management Plan 7.1 Environmental Management System	Complies 1	SWTC Book 2, Section 8	Approval of CEMP Copies of Coleman Rail ISO14001 certificates Maintenance of ISO14001 certification	• Evolve Bayswater CEMP • Coleman Rail ISO14001, including auditor report demonstrating compliance with ISO14001:2015 (including evidence of certification covering the PAA)	Env Mgr

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
7.2 Quality Staff Support 7.2.1 Health Impacts of Site Activities 7.2.2 Knowledge of Sustainable Practices		-	Wellbeing program, beyond WHS requirements to be implemented during construction Inclusion of sustainability in induction, toolboxes and similar	• 7.21 - Evidence of Wellbeing programs, initiatives etc • 7.2.2 - Evidence of knowledge sharing practices	HR Workplace D&T Mgr SusMgr
8. Operational Waste					
8A Performance Pathway – Specialist Plan	1	Development Approval Condition	Operational Waste Management Plan (OWMP) to be developed SusMgr is a Qualified Waste Auditor	• Approved OWMP • CV of Qualified Waste Auditor	SusMgr
9. Culture, Heritage and Identity					
9.1 Understanding Culture, Heritage and Identity 9.1.1 Interpretation Plan 9.2 Enhancing Community Culture, Heritage and Identity 9.2.1 Demonstration of consultation during development of Interpretation Plan	2	Book 2: Section 2.4.2 i B) Gnarla Biddi METRONET Public Art Strategy	Consideration and adoption of Gnarla Biddi and METRONET Public Art requirements. Public Art Strategy and Kurrajong Tree expected to meet 'methods of interpretation requirements' May require evidence from prior to AD phase	• Expected to require portfolio of evidence including UD and evidence to demonstrate compliance with SPP 3.5 Historic Heritage, where applicable • Evidence of 'shared with the community', likely to be associated with Gnarla Biddi and Public Art requirements	Discipline Lead – Architecture
10. Urban Precincts					
10.0 Concept Review 10.0.1 Including Concept Review in the Planning and Design Process 10.0.2 Composition of the Concept Review Panel 10.0.3 Type of Concept Review	Complies	SWTC Book 2: Section 18.16	SDRP expected to meet requirements Confirmation that panel composition meets requirements is required.	• Records from SDRP Meetings • Bio's of SDRP member associated with the different reviews	Discipline Lead – Architecture

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
10.1 Site Planning and Layout 10.1.1 Terms of Reference of the Concept Review Panel 10.1.2 Type of Concept Review	3	SWTC Book 4: Section 19.2.3	*Subject to confirmation of Volume Certification approach.* One additional point is available for mixed concept review – subject confirmation that panel composition meets requirements.	• Concept review of aspects covered by the credit	Discipline Lead – Architecture
10.2 Urban Design and Public Realm 10.2.1 Terms of Reference of the Concept Review Panel 10.2.2 Type of Concept Review		SWTC Book 4: Section 19.2.3	*Subject to confirmation of Volume Certification approach.* One additional point is available for mixed concept review – subject confirmation that panel composition meets requirements.	• Concept review of aspects covered by the credit	Discipline Lead – Architecture
11. Safe Places					
11.0 Crime Risk Assessment	Complies	SWTC Book 4: Section 19.2.1.2	CPTED included in 15% and 85% Design reports Security in Design Report (include threat assessment and cyber security) also expected to assist in addressing credit requirements	• Evidence to demonstrate that Station Functional Planning and Urban Design Specification clause 3.4 included risk assessment	Discipline Lead – Architecture JME
11.1 Safe Places Through Design 11.1A.1 End to end visibility for underpass and overpass 11.1A.2 Open patron areas visible form at least one street	1	SWTC Book 4: Section 19.2.1.2	End to end visibility of Leake St underpass to be maintained despite increased length. Revised design for southern side opening up sight lines Confirmation that the PShP is considered overpass Confirmation that CCTV coverage to carparks as well as visual barriers, including plantings meet credit requirements Visibility of bus service way from CSO's to be considered and confirmed	• Evidence to demonstrate that Station Functional Planning and Urban Design Specification clause 3.4 was implemented, including Drawings, visualisations • Landscape Report and Tree / Landscape Selections	Discipline Lead – Architecture Landscape Architecture JME

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
12. Wayfinding					
12.0 Wayfinding Review	Complies	SWTC Book 4: Section 19.2.1.2	Delivery of a wayfinding review Signage and Wayfinding Strategy and compliance with Transperth Signage Manual and review	• Evidence to demonstrate that Station Functional Planning and Urban Design Specification clause 3.4 included wayfinding review(s)	Discipline Lead – Architecture Human Factors
12.1 Excellent Wayfinding Practices 12.1.1 Design and Lighting 12.1.2 Static and Dynamic Information 12.1.3 Audible Information 12.1.4 Tactile Information 12.1.5 Universal Design	1	SWTC Book 4: Section 19.2.1.2	Clear articulation in UD reports that align implemented wayfinding practices with those identified in the credit requirements Address specific GS requirements in reports and drawings.	• Evidence to demonstrate that Station Functional Planning and Urban Design Specification was implemented.	Discipline Lead – Architecture
Total	**18**				

3.2 Indoor Air Quality

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
13. Quality of Indoor Air					
13.1 Ventilation System Attributes 13.1.1 Entry of Outdoor Pollutants 13.1.2 Design for Ease of Maintenance and Cleaning 13.1.3 Cleaning Prior to Use and Occupation	NA		Confirmation from Volume Certification GSAP and or GBCA that tenancy spaces (primary space) can be excluded due to the likely cold shell nature of fit outs. Credit is likely to be applicable only to CSO. Inclusion of cleaning of HVAC to be included in OEMP (subject to approval by PTA)	• HVAC / Mech sections of Design Reports and Drawings • HVAC specification • Operational EMP	Discipline Lead – Building Services PTA EnvMgr
13.2 Provision of Outdoor Air 13.2A Comparison to Industry Standards 13.2C Natural Ventilation	2	SWTC Book 4: Section 17.2.1.2	Inclusion of outside area fans in nominated areas required. PCR to confirm acceptance by PTA for the specification of air-conditioning in primary and secondary spaces and crib room to include carbon dioxide sensors required 13.2B Performance based approach to be adopted if 13.2A cannot be met. 13.2C not expected to be able to be met due to the site constraints.	• HVAC / Mech sections of Design Reports and Drawings • Commissioning Report	Discipline Lead – Building Services
13.3 Exhaust or Elimination of Pollutants 13.3A Removing of Source of Pollutants 13.3B Exhausting the Pollutants Directly to the Outside	Stretch	OPR	Commitment from PTA to install low emission printers as described in the OPR required. 13.3A Performance based approach to be adopted 13.3B not expected to be able to be met	• HVAC / Mech sections of Design Reports and Drawings • Evidence of commitment or existing practice of procurement of low emission printers for CSO's, where applicable. • Printer specification •	Discipline Lead – Building Services

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
14. Acoustic Comfort					
14.1 Internal Noise Levels	Does not comply		SWTC Book 4 refers to 2000 version of the Standard which has been superseded by 2016. Confirmation of acceptance of AS2107:2016 by PTA is required via PCR Identification of opportunities to achieve credit to be pursued by Acoustic Consultant		Acoustic Consultant
14.2 Reverberation	Does not comply		SWTC Book 4 refers to 2000 version of the Standard which has been superseded by 2016. Confirmation of acceptance of AS2107:2016 by PTA is required via PCR Identification of opportunities to achieve credit to be pursued by Acoustic Consultant		Acoustic Consultant
14.3 Audibility 14.3.1 STI of 0.5 for ≥95% of platform, concourse and habitable patron areas 14.3.2 Evenness of coverage 14.3.3 EWIS sound level is dynamic	1	SWTC Book 4: Section 4.15.1 and Section 14.3.2.7 Table 48 (p212)	Achievement of 0.5 Speech Transmission Index is required for both PA and EWIS as per credit requirements for secondary spaces in patron areas,	• Public Address and Emergency Warning Systems section of Design Report and Drawings • Commissioning Report	Acoustic Consultant
14.4 Hearing Loop Coverage	1	SWTC Book 4: Section 4.15.1 and Section 14.3.2.7 Table 48 (p212)	Hearing loop coverage meeting NCC D3.7 required. SWTC refers to general 'BCA' requirements.	• Communication System section of Design Report and Drawings	Discipline Lead – Building Services

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
15. Lighting Coverage					
15.1 Minimum Lighting Comfort	Complies	SWTC Book 2: Section16.7	Compliance with Station Lighting Design and Maintenance Guideline	• Lighting Systems Section of Voltage Report and Drawings	Lighting Designer
15.2 General Illuminance and Glare Reduction 15.2.1 General illuminance 15.2.2 Glare reduction	1	-	Lighting design to align with GS credit requirements (AS1680 suite) for primary and secondary spaces where staff and patrons access. Prescriptive Methods (15.1.2A or B) to be evaluated during detailed design.	• Lighting Systems Section of Voltage Report and Drawings	Lighting Designer
15.2 Surface Illuminance	1	-	Prescriptive Methods (15.2A or B) to be evaluated during detailed design.	• Lighting Systems Section of Voltage Report and Drawings	Lighting Designer
16. Visual Comfort					
16.0 Glare Reduction 16.0A Fixed Shading 16.0B Blinds or Screens 16.0C Daylight Glare Model	Complies	-	Design to consider and include the credit requirements. 15% Design has already considered and included these in staff areas which are fully shaded at platforms and ground entry levels.	• Urban Design Report and Drawings • Glare Model and supporting calculations	Discipline Lead – Architecture
16.1 Daylight 16.1A Prescriptive Pathway 16.1B Daylight Factor 16.1C Daylight Autonomy	1	SWTC Book 2: Section 16.7.2.9	Platform level design is expected to meet credit requirements. Confirmation that this meets 50% of total primary spaces for staff and patrons required. Uncertainty around concourse and entry levels given the location of the CSO's.	• Urban Design Report and Drawings • Calculations to demonstrate percentage achieved	Discipline Lead – Architecture
16.2 Views	Stretch	-	To be explored during detailed design. Uncertainty around concourse and entry levels.	-	Discipline Lead – Architecture
17. Indoor Pollutants					
17.1 Paints, Adhesives, Sealants and Carpets 17.1.1 Paints, Adhesives and Sealants 17.1.2 Carpets	1	-	Specification of low-VOC and low formaldehyde products. Would need approval from PTA. Product Certification approaches to be adopted.	-	Discipline Lead – Architecture

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
Innovation opportunity – ultra low VOC Paints	Stretch	-	Specification of ultra-low VOC Paints would be required Would need approval from PTA and would have cost implications	-	Discipline Lead – Architecture
17.2 Engineered Wood Products	Stretch	-	To be reviewed if engineered wood products are included during design development.		Discipline Lead – Architecture
18. Thermal Comfort					
18.1 Staff Thermal Comfort 18.1.1 Natural Ventilation 18.1.2 Mechanically Ventilated	1	-	Refer to **Quality of Indoor Air**. Natural ventilation unlikely to be used. For Mechanically Ventilated Spaces 18.1.2A method to be adopted		Discipline Lead – Building Services
18.2 Patron Thermal Comfort	1	-	Design to consider and include the credit requirements. Design is expected to meet credit requirements but will require monitoring of compliance with GS requirements during design development.	• Urban Design Report and Drawings • Wind Amelioration Report • Calculations to demonstrate percentage achieved	Discipline Lead – Architecture
Total	**0**				

3.3 Energy

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
19. 19. Energy					
19B.0 Conditional Requirement: Reference Building Pathway	Complies		Reference Building based on NCC Section J deemed to satisfy to be prepared		
19B.1 Modelled Performance	Reduction - 10 points	-	Addressing of requirements as part of the Whole of Life Improvement Strategy Adopt eTool for energy and Greenhouse Modelling as implied in the MN Sustainability Strategy	• Energy Modelling Report and GHG Emissions Calculator	SusMgr
Innovation – Onsite Renewable Energy	Stretch	-	Installation of ≤100kWp photovoltaic system. Ability to contribute to additional points to be determined following energy modelling		SusMgr
20. 20. Peak Electricity					
20A Prescriptive Pathway	Stretch		Subject to Innovation associated with Credit 19, where solar PV is selected, then system design should be based on meeting peak electricity demand, but ≤100kWp..		Discipline Lead – Building Services
20B Modelled Performance	Alternate Stretch		If 20A is not proposed, 20B may be considered		Discipline Lead – Building Services
Opportunity, unlikely to be Innovation as defined by GBCA	Evolve Bayswater should consider scoping 19 and 20 as research projects for Masters students – for example as part of Murdoch University's Masters in Renewable Energy which has specializations in renewable energy, energy efficiency and carbon modelling.				
Total	**10**				

3.4 Transport

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
21. Sustainable Transport					
21.1 Connectivity	3	-	Subject to confirmation of proposed routes on day one, the station is expected to service >90% of bus routes which are <400m from station	• Figure showing 400m radius and Transperth service routes • Calculations to demonstrate percentage.	SusMgr
21.2 Reduced Car Parking Provision	1	-	Clarification of suburban station R1.12.02 is required from GBCA as worded this suggests that increased car-parking is acceptable.	• Design Report and Drawings associated with car parking	Discipline Lead – Civil
21.3 Emission Vehicle Infrastructure	1	SWTC Book 3: Part A 3.2.2 Long Term Parking	Dedicated infrastructure and parking spaces for EV required. SWTC allows for 2, 3-4 will be required (5% of 64)	• Design Report and Drawings demonstrating EV facilities	Discipline Lead – Civil With input from Electrical
21.4 Active Transport Facilities	1	SWTC Book 3: Part A	Confirmation that intended secure bicycle storage proposed for the project meets credit requirements	• Design Report and Drawings demonstrating storage locations	Discipline Lead – Architecture
21.5 Walkable Neighbourhoods	1	SWTC Book 3: Part A	Mapping based approach to demonstrate the project is located so that >4 amenities for industrial buildings or >8 for other types are located <400m	• Figure showing 400m radius labelled to demonstrate requirement met.	SusMgr
Total	**7**				

3.5 Water

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
22. Potable Water					
22B Prescriptive Pathway	4	-	6 Star WELS fixtures to be specified for bathroom facilities where available. Appropriate WELS rating for appliances. Achievement of natural ventilation for buildings and or use water free HVAC. Non potable water use for landscape irrigation included into the design Fire protection system to consider most appropriate condition based on credit requirements for each component of the system Rainwater reuse to be considered as stretch target but note that this typically delivers lower return on investment than other initiatives in Perth.	• Green Star RS Potable Water calculator • Design documentation for facilities • Manufacturer supplied documentation and certificates • Bore water licence • Water Management Plan	SusMgr with inputs from Landscape Architect, Discipline Lead – Architecture and PTA
Total	**4**				

3.6 Materials

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
23. Lifecycle Assessment					
23A Performance Pathway	2	SWTC Book 4: Section 24.3	Engagement of eTool to undertake assessment Addressing of requirements as part of the Whole of Life Improvement Strategy Opportunities to reduce impact assessment against Reference Design to be informed by the LCA process. Additional reporting requirements to be pursued as a stretch target	• Whole of Life Improvement Strategy • LCA Report • Design documentation and drawings • LCA practitioner competencies	SusMgr
24. Responsible Building Materials					
24.1 Steel	1	-	Procurement process for steel to preference suppliers with Responsible Steel Maker certification and accredited to the Environmental Sustainability Charter of the Australian Steel Institute.	• Design documentation and calculations to demonstrate that percentage by mass meets requirements.	SusMgr
24.3 Permanent Formwork, Pipes, Flooring, Blinds and Cables	1		Procurement process to preference suppliers who meet credit requirements	• Design documentation and calculations to demonstrate that percentage by cost meets requirements.	Procurement Team
25. Sustainable Products					
25.1 Product Transparency and Sustainability	Stretch	-	Procurement process seeks potential suppliers associated with the components included in the credit to advise on the status of the materials to be supplied against the five aspects of the credit.	• Design and specification documentation and calculations to demonstrate credit requirements have been met	SusMgr

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
Opportunity	Stretch		Consideration of specific opportunities to address aspects of ISO20400 such as Modern Slavery.	• Procurement documentation	Procurement Team
26. Construction and Demolition Waste					
26.0 Reporting Accuracy	Complies	-	Contractors and processing facilities to demonstrate compliance with the Green Star Construction and Demolition Waste Reporting Criteria as part of procurement process	• Tender responses	Procurement Team
26.1 Fixed Benchmark	Alternate		Waste sources (track and platform/building) will require separate reporting.	• Waste quantities and calculations to demonstrate requirements are met	Commercial Mgr
26.2 Percentage Benchmark	1				
Total	**4**				

3.7 Land Use and Ecology

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
27. Ecological Value					
27.1 Endangered, Threatened or Vulnerable Species and Communities	Complies	-	Project is a brownfield redevelopment	Development Application and other evidence to demonstrate that 27.0A is met	Procurement Team
27.2 Ecological Value	1	-	Landscape design to implement opportunities to improve the ecological value compared to the current site.	Ecological calculator and Landscaping documentation	Discipline Lead – Architecture
28. Sustainable Sites					
28.1 Conditional Requirement	Complies	-	Project is a brownfield redevelopment	Development Application and other evidence to demonstrate that 28.0 is met	-
28.2 Reuse of Land	1	-		Monitoring of design progression and construction planning to ensure that the threshold (>75% brownfield) is met.	Ecological calculator and Landscaping documentation
28.3 Contamination and Hazardous Materials	1	SWTC Book 4: Section 20.2.6		Site is not registered as contaminated site – 28.2A is not applicable 28.2B Where HAZMAT survey identifies contamination or hazardous material, management in accordance with SWTC and regulatory requirements	HAZMAT Survey, CEMP and/ or Asbestos Management Plan

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
29. Heat Island Effect					
29.1 Heat Island Effect	1	-		Hard and Soft Landscaping to adopt suitable initiatives to demonstrate that 75% or more of the project area reduces heat island effect.	Design documentation, Solar Reflectance Index calculations
Total	**4**				

3.8 Emissions

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
30. Stormwater					
30.1 Stormwater Peak Discharge 30.1.1 Climate Change Scenarios 30.1.2 Rainfall Data for Modelling Programs 30.1.3 Management of Stormwater Peak Flows	1	-	As for **Adaptation and Resilience.** Demonstration that post development peak stormwater discharge doesn't exceed pre development. Anticipated to be aligned to drainage asset owner requirements.	Design documentation and drawings Adaptation and Resilience evidence	Drainage Lead
30.2Pollution Targets 30.2.1 Pollution Reduction Targets 30.2.2 Modelling requirements	1		Achievement of pollution reduction targets as specified by the GS requirements. MUSIC modelling is not typically used in WA, but manual calculations (30.2.2B) maybe required to assist in meeting requirements if MUSIC is not being used.	Design documentation, including modelling	Drainage Lead
Innovation – Water Sensitive Urban Design	1		WSUD to be integrated into the landscaping and drainage design	Design documentation	Discipline Lead – Architecture
31. Light Pollution					
31.1 Light Pollution to Neighbouring Bodies	Complies	SWTC Book 4: Section 16.7.1.18 and Section 16.7.4.5	PTA to advise if SWTC references of AS4282 is referencing 1997 or 2019 version of the standard. If 2019, TQ to confirm if AS4282:2019 is an acceptable alternative would be required.	Design documentation, including light modelling	Lighting Designer
31.2 Light Pollution to Night Sky			Inclusion of LED lighting is expected to assist in meeting 31.1A Upward Light Output Ratio requirement	Design documentation, including light modelling and or specifications.	Lighting Designer
Total	**2**				

3.9 Microbial Control

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
25. 32. Microbial Control					
32.0 Legionella impacts	0	-	Unlikely to meet compliance requirement due to design. Seek scope out	SWTC and Design	
Total	**0**				

3.10 Refrigerant Impacts

Credit	Target Points	Reference	Implementation Approach	Expected Evidence	Credit Lead
26. 33. Refrigerant Impacts					
33.0 Refrigerant Impacts	1	-	Deemed to comply where there are no refrigerants based on the proposed design solution and where air conditioning specifications include no ODS.	Design documentation	Discipline Lead – Building Services
Total	**1**				

4.0 Roles, Responsibilities and Resourcing

As an Alliance, the delivery of sustainability is expected to be a shared responsibility throughout the project. This includes key internal (alliance) stakeholders as well as MO and other PTA representatives, including the Sustainability Reference Group.

4.1 Sustainability Manager

The Sustainability Manager is the Lead GSAP for the Evolve Bayswater Team. The SusMgrs responsibilities in relation to being the Lead GSAP include:

- Development, review and update of the Green Star Strategy to match desired performance level for the rating and performance targets aligned to Green Star credits and the METRONET Sustainability Commitments
- Lead the Green Star rating process activities as described in this document.
- Lead the development and implementation in collaboration with key stakeholders and the PTA credits where the SusMgr is responsible for delivering
- Providing sustainability advice and guidance in relation to Green Star
- Proactively support the project team to identify and realise sustainability opportunities, including those that are outside the scope of the Green Star rating, but align with the METRONET Sustainability Commitments
- Work with the Project Team to collate evidence and tell the 'story' of how sustainability has been integrated into the delivery of BST and the credit requirements are met, including reviewing evidence, credit summary forms and documents associated with the sustainability aspects of the project
- Liaise with MNO Volume Certification GSAP and the GBCA in relation to sustainability on the project.

4.2 Key Internal and External Stakeholders

The roles and responsibilities of the disciplines and roles that collaborate to achieve the Sustainability outcomes are presented in **Table 1**. The Lead may delegate tasks and activities but remains responsible for the delivery of the primary responsibilities.

Role	Responsibility
Volume Certification GSAP	• Represent and communicate the views of the PTA / METRONET in relation to BST's involvement in Volume Certification. • Provide advice and support to the Lead GSAP within the Evolve Bayswater team • Actively participate in multidisciplinary engagement activities including workshops and those associated with sustainability, including the Sustainability Leadership Committee
Green Star Credit Owners	• Deliver the requirements of the Green Star credits • Seek assistance from the lead GSAP where uncertainty exists, risks are identified or guidance is needed

Table 1 Sustainability support roles and responsibilities

4.3 Review and Update

This plan will be reviewed and updated as part of the transition from the Design Rating to the As-Built Rating and when required in response to:

- Changes to the project which may affect the scope
- Where opportunities for improvement are identified as an outcome of a formal review or by lessons learnt from other METRONET Projects

5.0 References

Government of Western Australia. (2019). *METRONET Sustainability Strategy.*

Green Building Council of Australia. (2020). *Green Star Railway Stations Submissions Guideline v1.1.*

METRONET . (2020). *Bayswater Station and Turnback Project: Owner's Project Requirements (OPR) (BST-MET-SU-SPC-00001.0.IFI).*

Public Transport Authority of WA. (2020). *Bayswater Station and Turnback Project: Scope of Work and Technical Criteria (SWTC; multiple books) Rev 1.0.*

Appendix O

Construction Plan prepared by Evolve Bayswater

evolve bayswater
connecting people + places

PTA

BAYSWATER STATION AND TURNBACK

RFP: PTA190037

CONSTRUCTION PLAN

BST-EVO-PM-PLN-00001

AUTHORISED TO USE: _____(ALLIANCE MANAGER), DATE: _____

Submit to Client for Review and Approval where required in the Contract (Client to complete one box only):				
❑	Rejected, resubmit	Name:	Sign:	Date:
❑	Endorsed, with comments to add or change	Name:	Sign:	Date:
❑D	Endorsed	Name:	Sign:	Date:

Rev	Date	Reason for Issue	Prepared	Checked	Approval
A	08/11/19	Draft - Issued for Comment	All	Travis Tremain	Jason Flowerdew
B	01/12/19	Revised to PTA Comments	Travis Tremain	Travis Tremain	Jason Flowerdew
C	24/07/20	Revised to PTA and Peer Review Comments	Travis Tremain	Travis Tremain	Jason Flowerdew
D	08/08/20	Revised to PTA Comments	Travis Tremain	Travis Tremain	Jason Flowerdew
0	18/08/20	Issued for Approval	Iain Lawrence	Travis Tremain	Travis Tremain

Table of Contents

Compliance Matrix 5
Abbreviations and Acronyms 24
1.0 Background 26
1.1 Introduction 26
2.0 Purpose 27
3.0 References 28
4.0 Project Conditions and Facilities 29
4.1 Working Hours 29
4.2 Site Access 29
4.3 Office and Amenities 29
4.4 Carparking 30
4.5 Office and Facilities for the PTA's Representatives 30
4.6 General and Office lighting 33
4.7 Temporary Fencing and Hoarding 33
4.8 Site Maintenance 33
4.9 Temporary Toilets and Shower Facilities 34
4.10 Waste Management 34
4.11 PTA Operations Access 34
5.0 Health and Safety 35
5.1 Safe Work Method Statements 35
5.2 Rail Safety 35
5.3 Emergency Management 36
5.4 Safety Risk Management 36
5.5 COVID-19 36
6.0 Risk Management 36
6.1 Planning 36
7.0 Project Controls 37
8.0 Environment 37
8.1 Discharge Water Quality 37
8.2 Construction Noise and Vibration 38
8.3 Construction Water 42
8.4 Site Reinstatement 42
8.5 Storage of Materials 43
8.6 Existing Ground 44
9.0 Quality Assurance 44
10.0 Design 45

11.0 Survey 45
11.1 Coordinates and Datum 46
11.2 Personnel 46
11.3 Existing survey and Mapping Data 46
11.4 Protection of Survey Control 46
12.0 Organisational Structure 47
12.1 Roles and Responsibilities 47
13.0 Resources 48
13.1 Labour 48
13.2 Plant and Equipment 49
13.3 Subcontractors 52
14.0 Digital Engineering Management 52
15.0 Community Engagement 52
15.1 Stakeholder and Community Management 52
15.2 Interface Management 55
16.0 Services 57
16.1 General 57
16.2 Utilities and Services in the Rail Corridor Owners 57
16.3 Avoiding and Protecting Utilities and Services Protection of Services and Utilities 58
16.4 Effective Management of Service and Utility Relocations 62
17.0 Bayswater Turnback Construction Methodology ..... **Error! Bookmark not defined.**
17.1 Site Establishment ..... **Error! Bookmark not defined.**
17.2 Traffic Management ..... **Error! Bookmark not defined.**
17.3 Services ..... **Error! Bookmark not defined.**
17.4 Earthworks ..... **Error! Bookmark not defined.**
17.5 Retaining Walls ..... **Error! Bookmark not defined.**
17.6 Leake Street Underpass ..... **Error! Bookmark not defined.**
17.7 Track Formation ..... **Error! Bookmark not defined.**
17.8 Track ..... **Error! Bookmark not defined.**
17.9 MCR ..... **Error! Bookmark not defined.**
17.10 Signals, Comms and control Systems ..... **Error! Bookmark not defined.**
17.11 OLE ..... **Error! Bookmark not defined.**
18.0 Bayswater Station and Precinct Construction Methodology 63
18.1 Site Establishment 63
18.2 Traffic Management 69
18.3 Bridges 80
18.4 Demolition 114
18.5 Station Structure 120
18.6 Station Precinct Services 129

18.7 Track 135
18.8 Signals, Communications and Control Systems 135
18.9 Lighting to Precinct 136
18.10 Retaining Walls to Precinct 136
18.11 Roadworks 138
18.12 PShP 141
18.13 Landscaping 141

Compliance Matrix

SWTC Ref.	Description	Section in this Plan
Book 2 9.1.1	The Alliance must produce a Construction Plan that describes how the Alliance will satisfy all the construction requirements of the PAA and the SWTC, and the Construction Plan must include a description of how the Alliance will satisfy all requirements identified in this section: Book 2—section 9, Construction Plan.	2.0
Book 2 9.1.2	The Alliance must construct the Works to meet the requirements set out in the PAA and SWTC.	2.0
Book 2 9.1.3	The Construction Plan must describe the construction methodology and sequencing for implementation of the Works and provide plant and equipment details proposed for use for each stage of construction.	2.0
Book 2 9.1.4	The Construction Plan must describe how construction interfaces must be managed.	2.0, 15.2
Book 2 9.1.5	The Construction Plan must include detailed site layout plans showing construction activities and locations, including: boundaries and operational restrictions, compounds and storage locations, construction staging, plant access routes, plant operating positions, safe personnel walkway routes, drainage and erosion protection measures and other relevant features. As far as reasonably practicable, access must be planned without the need for going 'on or near the line'.	**Error! Reference source not found.**, 17.0
Book 2 9.1.6	The Alliance must undertake a construction risk assessment and detail risk mitigation procedures.	6.0
Book 2 9.1.7	The Alliance must maintain a register of construction risks with mitigations measures identified and provide a description of processes for identifying previously undetected or emerging construction risks.	6.0
Book 2 9.1.8	The Alliance must provide a register of all plant proposed for all the Works, detailing which plant will be used for which works and provide details of how each plant will be operated.	**Error! Reference source not found.**, 17.0
Book 2 9.1.9	The Alliance must provide a description of methods to be employed to detect and protect services.	16.3
Book 2 9.1.10	The Construction Plan must describe the construction monitoring, reporting, intervention and contingency systems that the Alliance must implement.	7.0
Book 2 9.1.11	The Construction Plan must describe safety standards, safe systems of work, safety plan requirements and safe processes for each element of work including protection of workers, the public and property.	5.0
Book 2 9.1.12	The Alliance must seek and address feedback on the Construction Plan from all relevant Stakeholders.	15.1
Book 2 9.1.13	The technical specifications for the Works must, as a minimum, be in accordance with PTA and MRWA specifications, unless specified elsewhere in the SWTC. The requirements in these specifications must not be reduced unless the Alliance can demonstrate to the satisfaction of the PTA's Representative that the performance and durability requirements of the SWTC can still be satisfied.	2.0
Book 2 9.1.14	As a minimum, construction tolerances, surface requirements and finishes must meet PTA and industry standards, as specified in the PTA's and MRWA's specifications, Codes and Best Practices, unless specified elsewhere in the SWTC.	11.0
Book 2 9.1.15	The Construction Plan must describe how Construction Verification must be managed.	9.0
Book 2 9.1.16	Alliance must convene and chair a monthly construction planning meeting with the PTA and other relevant Stakeholders to discuss progress of current Works, notice of advance Works and issues arising.	15.0

SWTC Ref.	Description	Section in this Plan
Book 2 9.1.17	The Construction Plan must include reporting to demonstrate how dust, noise, delivery and storage of construction materials, parking arrangements and any other matters likely to impact on surrounding properties / streets will be managed during the Works.	4.4, 8.2
Book 2 9.1.18	The Construction Plan must also include details of a dilapidation survey of the Station Precinct and Station Surrounds, including public realm and private properties.	15.0
Book 2 9.2.1	Except as required by law, the maximum working hours permitted must be between 7.00 am and 7.00 pm, Monday to Saturday, except that work outside these hours may be permitted for specific operations subject to the approval of the PTA's Representative and compliance with the noise limits. Work will be allowed on public holidays except as permitted by law and then only with the prior approval of the PTA's Representative.	4.1
Book 2 9.2.2	Alliance must obtain the approval of the PTA's Representative for the start and finish times and Business Days prior to commencement of work on a Construction Site.	4.1
Book 2 9.2.3	All other works outside of the nominated and approved times cannot be executed without the express approval of the PTA's Representative.	4.1
Book 2 9.2.4	In all cases for working outside the normal working hours by law, the Alliance must promptly notify the PTA's Representative in writing of the circumstances in which the Alliance requests such approval and provide evidence of local Government Agency and /or DWER approval.	8.2.3
Book 2 9.3.1	Alliance must demonstrate to the satisfaction of the PTA that the plans it will put in place minimise disruption of Perth's public transport network during all phases of the Works. These plans must include, demonstration that construction methodologies and the duration of specific Works have been planned to minimise disruption to Perth's public transport network. Reference to Perth's public transport network includes all the different elements of public transport including rail and bus.	15.2.1
Book 2 9.3.2	The Alliance must demonstrate to the satisfaction of the PTA and GSR the plans that it will put in place to ensure that the GSR services will not be disrupted. This will include demonstration of how services will be maintained through shutdowns of the urban rail passenger network at the Site. Staging of the Works must ensure that the timetabled Indian Pacific services are maintained. All operational arrangements proposed to meet this requirement will need to fulfil PTA's obligations to GSR, be agreed by GSR and be approved by the PTA. Responses to achieve this requirement may include 'wrong line running', where approved by the PTA.	15.2.1
Book 2 9.3.3	The Alliance must demonstrate to the satisfaction of the PTA and Transwa rail operations the plans that it will put in place to avoid disruption or delay to Transwa rail operations. This will include demonstration of how services will be maintained through shutdowns of the urban rail passenger network at the Site (where possible). Staging of the Works must ensure that the timetabled Transwa services are maintained. All operational arrangements proposed to meet this requirement will need to fulfil PTA's obligations to Transwa, be agreed by Transwa and be approved by the PTA. Responses to achieve this requirement may include 'wrong line running', where approved by the PTA. The Alliance must demonstrate to the satisfaction of PTA, MRWA and/or the City of Bayswater, as applicable, the plans that it will put in place to avoid disruption or delay to roads and pathway users. This will include demonstration of how access will be maintained at all stages of delivery of the Works.	15.1
Book 2 9.4.1	All workmanship and materials employed by the Alliance in carrying out the Works must comply with this SWTC.	9.0
Book 2 9.4.2	All equipment and materials must be handled and stored appropriately to ensure no damage or degradation occurs, and all equipment and materials	9.0

SWTC Ref.	Description	Section in this Plan
	must be protected from damage that could be caused by animals or acts of vandalism.	
Book 2 9.4.3	Assets must be protected through design and installation from corrosion.	9.0
Book 2 9.4.4	Assets must be fitted in a manner to meet OS&H, human factor standards and maintainability requirements.	9.0
Book 2 9.4.5	Develop ITP's to confirm the quality of workmanship where workmanship can affect compliance, warranties, fitness for purpose or operations.	9.0
Book 2 9.4.6	The Construction Plan must identify procurement processes and on-site measures to ensure that no NCBPs are incorporated into the Works or utilised during the Temporary Works.	9.0
Book 2 9.4.7	The Construction Plan must also identify procurement processes and on-site measures to ensure that no NCPs are incorporated into the Works.	9.0
Book 2 9.5.1	The Alliance must submit sample As-Constructed Documentation for all Assets for review and Acceptance by the PTA's Representative prior to production of any As-Constructed Documentation.	11.0
Book 2 9.5.2	The Alliance must ensure As-Constructed Documentation complies with AS 1100 and the PTA CAD Manual and the requirements of section 4 unless otherwise instructed by the PTA's Representative.	11.0
Book 2 9.5.3	Alliance must where necessary to describe the Works, or where directed by the PTA's Representative, include digital photographs of specific aspects of the Works in As-Constructed Documentation.	9.0
Book 2 9.5.4	Alliance must identify and progressively cross reference all Assets and elements of work, against the work breakdown structure on the Detailed Design and As-Constructed Documentation.	11.0
Book 2 9.5.5	Alliance must ensure that information authored in the [3D graphical model/BIM] is retained as the single information source and for all drawing outputs derived and edited from the [3D graphical model/BIM] throughout the lifecycle of the Assets.	11.0
Book 2 9.5.6	As a condition of achieving Practical Completion, the Alliance must deliver to the PTA's Representative the following: i. a complete set of the as-constructed information listed in Table 4; ii. certification from a licensed surveyor with a current practicing certificate that the Works are located as shown on the As-Constructed Drawings; iii. Design Documentation presented and numbered in accordance with the PTA documentation and drafting standards; and iv. BIM requirements as stated in SWTC Book 2, Management Requirements and Associated Requirements: DE Management Plan.	11.0
Book 2 9.5.7	As part of the supply of As-Constructed Documentation, the Alliance must provide drawings and 3D digital models in accordance with SWTC Book 2, Management Requirements and Associated Requirements: DE Management Plan.	11.0
Book 2 9.5.8	The file names for electronic copies of drawings must comply with the requirements of PTA Procedure 8110-300-011 – Preparation of Computer Aided Drawings.	11.0
Book 2 9.5.9	During construction, the Alliance must keep up-to-date and accurate records of all documentation amendments and in particular, the exact size and location of all service pipes, ducts, etc., including all branches and changes in direction, fittings, cocks, points of access, cleaning manholes, sumps and junctions, site drainage, control valves and footing dimensions, including and depth below final ground level.	11.0
Book 2 9.5.10	Alliance must update the PIM and any relevant drawings as construction of each element of the work is completed. This 'ongoing' As-Constructed Documentation during the works must be regularly transmitted to the PTA or made available to the PTA's Representative upon request. Refer to Book 2— section 11.	11.0
Book 2 9.5.11	Alliance must keep up-to-date and accurate daily records of: the progress of all work undertaken, all plant and equipment used for each part of the	

SWTC Ref.	Description	Section in this Plan
	work, the Personnel roles and number of Personnel for each part of the work, details of any obstruction, progress issue, plant failure, safety event or near miss, and any incident.	
Book 2 9.5.12	During performance of the Works, the Alliance must log, sample for Testing, and classify the excavated ground materials in accordance with AS 1726:2017 for the purposes of: i. materials re-use suitability; ii. identification of Project risks; iii. assessment for contamination; and verification of design assumptions.	8.6
Book 2 9.5.13	The Alliance must also update the existing geotechnical longitudinal sections based on the actual materials encountered during the performance of the Works. As a minimum, these updated longitudinal geotechnical sections must be prepared to the same level of detail as the existing geotechnical longitudinal sections; and be provided to the PTA in Adobe PDF, AutoCAD, and AGS4 (for geotechnical data) digital media formats.	8.6
Book 2 9.6.1	The Alliance must provide an as-constructed version of the single fully federated and integrated PIM of the Works addressing the requirements within Book 2 - section 11, DE Management Plan.	11.0
Book 2 9.7.1	The Alliance must submit details of all proposed design changes and actions to address construction Non-conformances to the PTA's Representative and the Design Verifier Lead no less than seven days prior to inclusion within the Works.	9.0
Book 2 9.7.2	The Alliance must not propose any design change or action to address Non-conformances that would result in a lower standard or service level in respect of the Works.	9.0
Book 2 9.7.3	There must no outstanding Non-conformances upon reaching EIS unless prior consent is granted by the PTA.	9.0
Book 2 9.8.1	The work methods used by the Alliance in carrying out the Works must result in the use and application of materials and workmanship which, as a minimum, comply with all applicable State, National and International Regulations, Codes, Standards and Guidelines, including PTA's general specifications and with the general standards and guidelines.	9.09.0
Book 2 9.8.2	The Alliance must provide all Personnel involved in the Works with appropriate Training in the construction techniques and work methods to be applied to the Works.	13.1
Book 2 9.8.3	The methods of excavation, working at heights, protection from falling objects and other construction activities must conform to the requirements of relevant Government Agencies.	5.1
Book 2 9.9.1	Strictly no advertising will be permitted on the Construction Site other than Project signs, site access signs and names of manufacturer or names of owner on items of constructional plant.	15.2.3
Book 2 9.9.2	The Alliance must erect at least seven Project signs along the Construction Site at locations approved by the PTA's Representative.	15.2.3
Book 2 9.9.3	Project signs must comply with the approved PTA Project signs and be erected prior to the anticipated commencement date of the Project Works.	15.2.3
Book 2 9.9.4	The Alliance name, major Subcontractors and consultants may be included or may be on a separate sign if there is insufficient space on the Project sign.	15.2.3
Book 2 9.9.5	The PTA may require other details to be displayed on the sign, and the PTA's Representative will provide these details.	15.2.3
Book 2 9.9.6	The signs must be maintained in good condition for the full period of display and must be removed three months after the Date of Practical Completion unless otherwise agreed with the PTA's Representative.	15.2.3
Book 2 9.10.1	The Alliance must employ construction engineers and supervisors that are skilled in the construction techniques that must be used in the work. This	12.0

SWTC Ref.	Description	Section in this Plan
	includes the necessity to be able to control and manage all Works that are sub contracted to specialist organisations.	
Book 2 9.11.1	The Construction Plan must specify the Alliance construction team organisational structure including: • key Alliance construction Personnel, including details of their professional qualifications and professional registration • authority and roles of key Alliance construction personnel • lines of responsibility and communication • the minimum skill and competency levels of each role relationships and interfaces with the overall project organisational structure	12.0
Book 2 9.12.1	Where the Alliance is providing road-rail vehicles which are intended to operate on the PTA's rail network, the Alliance must comply with the PTA's certification requirements for road-rail vehicles, as detailed in Certification Requirements of Hi Rail Vehicles and 8110-400-029 "Applying For Access to the PTA Operating Railway Reserve and PTA Certification of Road Rail Vehicles Parts 1, 2 and 3.	13.2.1
Book 2 9.12.2	Certification prior to operation or Testing on the PTA network must meet the requirements of the following procedures: i. Part 1 – Overview and Engineering Assessment (PTA Doc No. 4010-100-101) ii. Part 2 – Interface and Technical Requirements (PTA Doc No. 4010-100-103) iii. Part 3 – Vehicle Information and Test Results (PTA Doc No. 4010-100-102) Section 5 – Safety Instructions for the Electrified Area (PTA Doc No. 8110-800-016)	13.2.1
Book 2 9.12.3	All on track road-rail vehicles must be presented for inspection and certification by a nominated representative of the PTA before they can be used within the electrified area.	13.2.1
Book 2 9.12.4	On track road-rail vehicles can only be used within the electrified area once the line has been de-energised and in accordance with PTA Doc No. 9100-000-007 PTA Safe Working Rules and Procedures.	13.2.1
Book 2 9.13.1	The Alliance must ensure that access to adjacent properties is not unreasonably impeded. Existing LOS access must be maintained 24 hours per day.	15.1.4
Book 2 9.14.1	The Alliance must comply with Part 3 of the Road Traffic (Vehicle Standards) Regulations 2002 (WA) when operating vehicles on public roads. The Alliance must operate vehicles with total or axle mass in excess of these limits within the Construction Site, subject to the following conditions: i. the operation of vehicles with excess mass will not be permitted on partially or fully completed pavement work, service pits, drainage or structures; and the operation of vehicles with excess mass must be limited to vehicles which have been loaded within the Construction Site only and be limited to manufacturer's specifications. Operation in excess of manufacturer's specifications is not permitted.	13.2.5
Book 2 9.15.1	Blasting must not be used for any Works.	**Error! Reference source not found.**
Book 2 9.16.1	The Alliance must take action to minimise the impact of the Works on nearby developments and the community. These include: i. PTA metropolitan rail network A) The Alliance must ensure zero unplanned disruption to the normal operation of the metropolitan rail network, including the access and egress to/from stations.	15.1.1

SWTC Ref.	Description	Section in this Plan
	ii. Paths A) Existing PSHP and footpaths must be maintained throughout construction. Temporary shared paths must have a bituminous or smooth concrete surface at least 2.0m wide with no loose material and have at least 0.3m clearance to any obstacles including fences. Temporary lighting must be provided where lighting is diminished by the Alliance's work. Any temporary fences or screens beside shared paths must be adequately restrained against overturning and deflection from wind. iii. Overhead Clearances A) A height clearance of no less than 5.3m must be maintained on all roads open to traffic unless effective advance warning devices are provided in which case the height clearance must be no less than 4.9m. iv. Security of Adjacent Properties A) Security of all properties affected by all Works must be maintained at all times to a standard equivalent to that which currently exists. v. Parking A) Vehicles associated with the Project Activities must not park in public bays or Transperth car parks available to the public. Access to the Site by public transport is strongly encouraged. B) All parked Alliance vehicles are to be contained within, and provided with parking within, the fenced area of the Site.	15.1.2 15.1.3 15.1.4 4.4
Book 2 9.17.1	Disused or abandoned pipes, cables, conduits or structures encountered while carrying out Works within the Construction Site (above surface or sub-surface) must be removed and trenches backfilled or filled with stabilised sand.	16.4
Book 2 9.18.1	Temporary fencing and hoardings must be provided and maintained as necessary to provide an aesthetically pleasing appearance, control public access to parts of the Construction Site and maintain safety and security.	4.7
Book 2 9.18.2	The temporary fencing and hoarding must be of a standard which is suitable to address the issues of public safety, road and rail safety, security, noise and visual impact arising from the work.	4.7
Book 2 9.18.3	The temporary fencing and hoarding must be designed for stability against wind loading, and must not obstruct the Signalling line of sight for railway operations.	4.7
Book 2 9.18.4	The Alliance must provide temporary hoarding at all Construction Sites adjacent to roads or other public access areas to provide an aesthetically pleasing appearance for passing motorists and pedestrians.	4.7
Book 2 9.18.5	Any temporary artworks must be consistent with the Project branding, provide wayfinding, and must be approved by the PTA's Representative.	4.7
Book 2 9.18.6	Temporary fencing and hoardings must comply to all relevant PTA standards and Codes of Practice, including the Earthing and Bonding Specification.	4.7
Book 2 9.19.1	The Construction Site, including the exterior of all perimeter fences/hoardings must be maintained in a clean and tidy manner throughout the Works. Rubbish or loose items must not be stored on the Construction Site. Use of the Construction Site must meet the environmental sensitivity requirements of the SWTC. The Alliance must take measures to prevent littering of the Construction Site by its Personnel. In addition, the Alliance must clean up any rubbish and dirt generated by the Works in the surrounding area.	4.8
Book 2 9.19.2	Temporary site facilities requirements are as follows: i. Site sheds must be maintained in excellent condition. ii. Site sheds must be established at locations and positions that minimise the impact on adjoining properties and residents.	4.3

SWTC Ref.	Description	Section in this Plan
	iii. all facilities utilised for the purpose of the Works must be sited, constructed and maintained to meet the requirements of the PTA and relevant Government Agencies. iv. the Alliance must provide site facilities for use by the PTA. v. temporary site facilities must satisfy the sustainability requirements of this SWTC. vi. all temporary site facilities, including site sheds, must be maintained free of graffiti and any advertising material. the Alliance must carry out daily inspections of all temporary site facilities including site sheds.	
Book 2 9.19.3	Suitable temporary toilets and shower facilities must be provided. Temporary facilities must be connected to the main sewer system wherever practical and maintained in a clean, tidy and hygienic state and shielded from public view.	4.9
Book 2 9.19.4	Any graffiti within the Construction Site, including outward facing surfaces of any hoardings and the like surrounding the Construction Site, must be covered or removed by the Alliance within 24 hours, subject to operational constraints. Offensive graffiti is to be removed within the shorter timeframe of two hours, in accordance with the PTA's and Government's graffiti removal policy.	4.8
Book 2 9.19.5	The Alliance must, prior to Practical Completion, clear away and remove from the Construction Site all plant, surplus material, rubbish and temporary Works of every kind and fill, consolidate and level off all excavations made by the Alliance on the Construction Site.	4.8
Book 2 9.19.6	In addition, prior to Practical Completion, the Alliance must clean and wash all sumps and internal rooms clear of any fine dusts to prevent false alarms due to dust in smoke detectors within the confined areas.	17.5.9
Book 2 9.20.1	All water including groundwater seepage captured within the Construction Site must be treated and disposed of in accordance with the requirements of the PAA, SWTC and the relevant Government Agencies.	8.1
Book 2 9.20.2	The Alliance must monitor the quality of water discharged from the Construction Site.	8.1
Book 2 9.21.1	The Alliance must, during the performance of the Works, comply with the noise and vibration requirements in the CEMP.	8.2
Book 2 9.21.2	The Alliance must select methods of construction and plant to minimise adverse vibrational impacts.	8.2
Book 2 9.21.3	The Alliance must undertake condition surveys to establish the condition of adjoining properties, existing carpark and bridge structures, existing site, existing signage, pedestrian paths, roads, services, existing station structures and other built items on sites and properties within 100 metres of the Works or Temporary Works before commencing any work under this Agreement on Site.	8.2
Book 2 9.21.4	The survey must be carried out, where possible, in the presence of the owners or representatives of the owners of the items being surveyed and evidence of contact with such owners must be retained and demonstrated.	8.2
Book 2 9.21.5	The Alliance must carry out a detailed vibration impact assessment based on the methods of construction, plant selected and prevailing site conditions.	8.2.2.1
Book 2 9.21.6	Based on the vibration impact assessment, the Alliance must implement vibration control measures and vibration monitoring where required.	8.2.2.3, 8.2.2.4
Book 2 9.21.7	Following the vibration impact assessment, the Alliance must assess the adequacy of condition surveys provided under Book 2 section 9.21.3 and any existing condition surveys and carry out additional condition surveys to ensure that all property that may be impacted by vibration from the Works or Temporary Works has had a condition survey undertaken to establish the existing condition of such property.	8.2.2.1

SWTC Ref.	Description	Section in this Plan
Book 2 9.21.8	The Alliance must consider guidance provided in BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites—Vibration.	8.2
Book 2 9.21.9	The Alliance must ensure that vibration monitoring equipment meets the requirements of BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites—Vibration; BS 7385-2:1993 Evaluation and Measurement for Vibration in Buildings—to Damage Levels for Groundbourne Vibration; and DIN 45669-1:2010 Measurement of Vibration Emission Part 1 Vibration Meters requirements and Tests, as applicable.	8.2
Book 2 9.21.10	When establishing the method of construction, selecting plant, and designing vibration control measures, the Alliance must not only consider potential structural damage, but also human response to vibration levels.	8.2
Book 2 9.21.11	The Alliance must comply with the Community Engagement Plan and which must also include managing perceptions for third parties potentially affected by vibration.	8.2
Book 2 9.21.12	If complaints of nuisance levels of noise and/or vibration from residents or other building occupants occur, the Alliance must either modify the construction method to reduce noise and/or vibration, or take measurements of noise and/or vibration to demonstrate that appropriate limits are not exceeded.	8.2
Book 2 9.21.13	For construction being undertaken by the Alliance between 7am and 7pm on any day which is not a Sunday or public holiday the Alliance must: i. ensure the Construction Work is carried out in accordance with section 6 of AS 2436-2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites; ensure the equipment used is the quietest reasonably available.	8.2
Book 2 9.21.14	For construction being undertaken by the Alliance between 7pm and 7am on any day and for construction on a Sunday or public holiday the Alliance must: i. ensure the work is carried out in accordance with section 6 of AS2436-2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites; ii. ensure the equipment used is the quietest reasonably available; and iii. advise nearby occupants of nearby buildings likely to receive noise levels which fail to comply with Assigned Levels defined within the Environmental Protection (Noise) Regulations 1997 (WA) of the work to be done at least 24 hours before it commences; iv. show that it was reasonably necessary for the work to be done out of hours; v. submit to the City of Bayswater for approval a Noise Management Plan for out of hours work in accordance with the Environmental Protection (Noise) Regulations 1997 (WA) at least seven days before the work starts vi. the Noise Management Plan must be approved in a form which describes the following: A) reasons for the work to be completed out of hours; B) types of activity that could be noisy; C) predictions of noise levels from the site; D) proposed measures to control noise and vibration; E) monitoring of noise and vibration; F) notifications to residents and Stakeholders of upcoming out of hours work; and G) complaint response procedures	8.2

SWTC Ref.	Description	Section in this Plan
Book 2 9.22.1	The Alliance must obtain all approvals and permits related to site access, establishment, haulage, stockpiling of materials and spoil management necessary to carry out the Works effectively, from the relevant Government Agencies including the PTA.	**Error! Reference source not found.**, 17.0
Book 2 9.22.2	The Alliance must carry out any Temporary Works or permanent enabling works, as agreed between the Alliance and the relevant Government Agency, which are deemed intrinsic to such approvals or permits being granted.	**Error! Reference source not found.**, 17.0
Book 2 9.22.3	The Alliance must allow for uninterrupted access for all emergency vehicles into the Construction Site at all times.	**Error! Reference source not found.**, 17.1
Book 2 9.22.4	The Alliance must liaise with the relevant Government Agencies and establish requirements in regards to the Works. The Alliance must provide the PTA's Representative with the appropriate approvals.	**Error! Reference source not found.**, 17.1
Book 2 9.22.5	The Alliance must obtain approval of the routes for cartage of bulk quantities of materials to and from the Construction Site, including excavated material and delivery of concrete, reinforcement and other materials, from the relevant Government Agencies.	**Error! Reference source not found.**, 17.1
Book 2 9.22.6	The Alliance must obtain all necessary transportation approvals and vehicle permits.	**Error! Reference source not found.**, 17.1
Book 2 9.23.1	The Alliance must, during the Works, do all things necessary to minimise the risk of fire within the Construction Site and minimise the risk of fire adjacent to the Construction Site due to the performance of the work.	**Error! Reference source not found.**, 17.1
Book 2 9.24.1	Where permanent demolition of infrastructure is required, the Alliance must: i. undertake the demolition work in accordance with AS 2601-2001 The Demolition of Structures; ii. provide a levelled site, free of depressions and undulations; iii. disconnect all services at the property boundaries in accordance with the requirements of the relevant service owners and Government Agencies; iv. cap all conduits and pipes at the disconnection points to prevent ingress of surface runoff and groundwater; v. remove all structures, facilities and debris above ground level; vi. remove all ground slabs, foundations, strip footings, pile caps, tanks and other structures below ground level excluding piles below pile cap level; vii. remove all demolished materials and debris from the Construction Site; viii. backfill all excavations with fill free of deleterious materials and compact to a density consistent with the surrounding ground; ix. for backfill operations consideration must be given to the local ground, groundwater and drainage conditions to ensure no adverse drainage effects;	17.4

SWTC Ref.	Description	Section in this Plan
	x. recycle, to the maximum extent possible, all demolished materials to be removed from the Construction Site; xi. comply with all regulations, planning and authority requirements; and develop and implement a demolition method that minimises noise, vibration and air quality impacts	
Book 2 9.24.2	Demolition works must be carried out in accordance with the requirements of: i. AS 2601-2001 The Demolition of Structures; ii. National Occupational Health and Safety Commission publication – "Asbestos: Code of Practice and Guidance Notes"; iii. the Department of Occupational Health and Safety of WA Guidelines – "A Guide for the Safe Removal of Asbestos Cement Building Products"; and the National Occupational Health and Safety Commission "Code of Practice or the Safe Removal of Asbestos"	17.4
Book 2 9.24.3	The Alliance must be responsible for the complete process of demolition works, including: i. execution of work in accordance with the relevant standards, OS&H Act, OS&H Regulations and the PTA's requirements; ii. design and Verification of temporary and permanent protection works; iii. property condition surveys, including a complete photographic record; iv. removal of trees that are authorised by the PTA; and preparation of demolition method	17.4
Book 2 9.24.4	Further to the requirements noted elsewhere in this section and AS 2601, prior to commencement of any demolition works, all preparatory works necessary to enable demolition to proceed must be completed including: i. establishment of all protective hoardings and gantries to ensure public areas remain safe at all times; ii. relocating, or securing and capping as required, all above and below ground services; iii. removal of all artefacts and materials of salvage value to a safe storage place; iv. pest and vermin treatments; v. establishment of alternative access and egress to adjoining properties that may be affected by demolition works; vi. contract with all regulating and controlling Government Agencies on the proposed temporary Works methodology that will affect pedestrian and vehicle traffic; and approvals from all regulating and controlling Government Agencies for temporary Works and demolition	17.4
Book 2 9.24.5	Prior to any demolition, the Alliance must salvage and transport elements of value to locations nominated by the PTA. The Alliance must remove demolished materials from the Construction Site, unless identified for retention. Demolished materials must not be burnt or buried on the Construction Site.	17.4
Book 2 9.24.6	The Alliance must take appropriate measures to control traffic on public roads and to protect the general public from injury or harm when carting demolished materials.	17.4
Book 2 9.24.7	The Alliance must notify the appropriate Government Agency immediately on encountering hazardous materials or conditions including the following: i. asbestos or material containing asbestos including asbestos cement products that have not already been identified; ii. flammable or explosive liquids or gases; iii. toxic, infective or contaminated materials;	**Error! Reference source not found.**

SWTC Ref.	Description	Section in this Plan
	iv. radiation or radio-active materials; v. noxious or explosive chemicals; and tanks or other containers which have been used for storage of explosive, toxic, infective or contaminated substances	
Book 2 9.24.8	The Alliance must provide all warning signs, pedestrian deviation signs, temporary and security lighting.	17.4
Book 2 9.24.9	Existing services, when encountered during the course of the demolition, must be treated in accordance with the relevant Third Party Utility Providers requirements and must be marked on the ground and recorded on drawings to be furnished to the PTA.	17.4
Book 2 9.24.10	Any items that are not scheduled for demolition or are otherwise outside the required extent of demolition must be retained and protected from damage.	17.4
Book 2 9.24.11	The Alliance must obtain agreement for relocation or disposal of flora and vegetation maintained by the City of Bayswater within the Project Activities.	**Error! Reference source not found.**
Book 2 9.24.12	Trees that are not identified for removal on drawings and that have not been authorised for removal by the PTA must be protected from damage.	8.4
Book 2 9.24.13	The Alliance must: i. prevent encroachment of demolished materials onto adjoining property, including public places; ii. provide covers to protect existing plant and equipment and materials intended for re-use; iii. minimise dust arising from demolition and control by watering or other approved means, and provide dust-proof screens, partition walls, bulkheads and covers to protect existing finishes and the immediate environment from dust and debris; iv. if a wall or roof is opened, provide security against unauthorised entry to the building; v. maintain safe existing pedestrian access or provide safe alternative access as required; and if demolition is to be staged, ensure structural integrity is maintained during each stage	17.4
Book 2 9.25.1	During the Works, the Alliance must maintain and repair: i. the Construction Site areas; and the local areas from the commencement of any construction activities within each local area until the Handover of that local area to the relevant Government Agency	4.8
Book 2 9.25.2	All PTA operational Assets must be freely accessible for uninterrupted day-to-day maintenance activities.	4.0
Book 2 9.25.3	The Alliance must ensure that all infrastructure, facilities and amenities in the areas being maintained are at all times fit for purpose, clean and tidy, free from graffiti and in a condition which satisfies the requirements of the PAA and SWTC.	4.8
Book 2 9.25.4	The extended storage of rubbish or loose items on the Construction Site, local areas or elsewhere is not permitted.	4.8
Book 2 10.25.5	The Alliance must monitor and remove graffiti within the following timeframes from the time the Alliance becomes aware of the graffiti: i. offensive graffiti must be removed or covered within two hour; ii. other graffiti on hoarding, fencing banners or fencing signage must be removed or covered within two hours; and all other graffiti must be removed or covered within 24 hours.	4.8
Book 2 9.26.1	As part of the method of construction, the Alliance must identify and describe all temporary Works requirements, including provision of a Temporary Works register.	**Error! Reference source not**

SWTC Ref.	Description	Section in this Plan
		found., 17.0
Book 2 9.26.2	The Alliance must provide a description of the method of construction for each element of the Temporary Works.	**Error! Reference source not found.**, 17.0
Book 2 9.26.3	The Alliance must inspect and maintain all Temporary Works each shift to ensure adequacy and safety.	**Error! Reference source not found.**, 17.0
Book 2 9.26.4	The Alliance must design, provide, maintain and remove on completion all Temporary Works as may be necessary for the execution of the Works.	**Error! Reference source not found.**, 17.0
Book 2 9.26.5	All lifting and piling activities undertaken by tracked plant must be carried out from working platforms designed and constructed to a standard not less than the standards provided in: BRE 470 Working Platforms for Tracked Plant.	**Error! Reference source not found.**, 17.0
Book 2 9.26.6	All lifting activities must be undertaken in accordance with: AS 4991 Lifting Devices, AS 3775 Chain Slings for Lifting Purposes, and AS 2549 Cranes (Including Hoists and Winches) Glossary of Terms.	**Error! Reference source not found.**, 17.0
Book 2 9.26.7	The Alliance's Temporary Works designs must be verified by the civil/structural and/or geotechnical and hydrogeological Design Verifiers as appropriate as part of the design process and submitted to the PTA's Representative for review and comment as part of that Design Package.	**Error! Reference source not found.**, 17.0
Book 2 9.26.8	All Temporary Works must be designed and constructed to the same standards and factors as the Works.	**Error! Reference source not found.**, 17.0
Book 2 9.26.9	Filling of voids resulting from the extraction of Temporary Works must be carried out simultaneously with the extraction. The method of extraction or removal must be such that there is no risk of damage to the Works or existing Assets.	**Error! Reference source not found.**, 17.0
Book 2 9.26.10	Before removing any strut or anchor the Alliance must ensure that there is sufficient support to the retained ground to avoid failure or excessive movement.	**Error! Reference source not found.**, 17.0
Book 2 9.27.1	The Alliance must carry out all works included as part of the Works and any other works made necessary as a consequence of the Works in accordance with this SWTC.	**Error! Reference source not found.**, 17.0
Book 2 9.28.2	The Alliance is responsible for any survey work necessary to design and construct the Works. This work must include as a minimum: i. detail ground survey and production of DTM of the area to be affected by the Works for final design;	11.1

SWTC Ref.	Description	Section in this Plan
	ii. establishment of any required reference marks as the basis of detail ground survey and the setting out and compliance checking of the Works; iii. setting out the Works; iv. monitoring and quality control during construction; v. establishment of track survey monuments; vi. construction audit surveys; vii. integration of all survey information into the BIM model (where applicable); and as constructed surveys and drawings of all completed work just be submitted to the PTA's Representative prior to Practical Completion	
Book 2 9.28.3	The Alliance must satisfy itself in relation to the accuracy and completeness of the survey and mapping information provided, and must take account of the details provided by the above surveys. The Alliance must carry out additional surveys and assessments where necessary to facilitate the Detailed Design and construction.	11.3
Book 2 9.28.4	Survey Personnel must satisfy the following criteria: i. Registered Building Surveyors must have a current practicing certificate; and engineering surveyors must be eligible for accreditation to the certification level of “Engineering Surveying Professional – Asia Pacific” as defined by the SSSI	11.2
Book 2 9.28.5	All survey work is to be connected to the Geocentric Datum of Australia and the AHD.	11.1
Book 2 9.28.6	All design and survey plan coordinates must refer to the GDA2020 in metres.	11.1
Book 2 9.28.7	The Alliance must undertake detailed ground survey of the Project corridor where necessary for the creation of a full DTM of the existing surface in accordance with PTA (New MetroRail) Technical Procedure 5610-350-002.0 Digital Ground Survey and Main Roads Survey and Mapping Standard 67-08-43 Digital Ground Survey.	11.3
Book 2 9.28.9	Reference marks must be established to form the basis for the detail survey and the construction control for the Works. Any additional control points required for the detail ground survey must be established as minor control points. All survey control must be established and submitted in accordance with the following PTA and Main Roads Survey and Mapping Standards: i. PTA technical procedure 5610-350-001.0 - Rail Reference Marks; ii. MRWA technical standard 67 -08-35 - Standard Survey Mark Control; iii. MRWA technical standard 67-08-36 - Road Reference Marks; iv. MRWA technical standard 67-08-37 - Minor Control Points; and v. MRWA technical standard 67-08-38 - Differential Levelling. Quality Statements in accordance with the Main Roads Guideline Document No. D12#434784 Metadata Requirements must accompany all survey data.	11.4
Book 2 9.28.10	All existing survey marks within the Construction Site must be protected until the end of the Non-conformance Correction Period. This includes cadastral survey marks defining property boundaries, rail reference marks, RRMs, SSMs, BMs and permanent survey marks.	11.4
Book 2 9.28.11	The Alliance must be aware of these marks and is responsible for all associated re-establishment costs as a result of any disturbance to or movement of these marks resulting from the Works.	11.4
Book 2 9.28.12	The Alliance must follow the following procedures when re-establishing these marks: i. for cadastral marks, in accordance with Landgate regulations, all reestablishment surveys must be carried out by a Registered	11.4

SWTC Ref.	Description	Section in this Plan
	Building Surveyor with a current practicing certificate, and a "Regulation 25A Certificate" provided to the PTA's Representative in accordance with the regulation. ii. for RRMs, all re-establishment surveys, construction and data lodging must be undertaken in accordance with Main Roads Standard 67-08-36 Road Reference Marks. Prior to any disturbance of RRMs the Alliance must notify the PTA's Representative. for SSMs and BMs, prior to any disturbance the Alliance must notify the PTA's Representative of the need to re-establish either of these types of marks. The PTA's Representative will arrange relocation and/or replacement through Landgate.	
Book 2 9.28.13	An adjusted and verified cadastral model in accordance with Main Roads Standard 67-08-48 Property Management Drawings must be used for all boundary definitions within the Project area. The Alliance must obtain the most current adjusted cadastral model from Landgate and check for any pending resumptions.	11.4
Book 2 9.28.14	The Alliance must establish the location of all property boundaries which are affected by the Works. Such boundaries include those upon which any part of the Works are located or are dependent upon. A Registered Building Surveyor with a current practicing certificate must set out all property boundary survey work and supply a "Regulation 25A Certificate" to the PTA's Representative prior to any work affecting property boundaries.	11.4
Book 2 9.28.15	All survey and mapping information for the Works must be lodged with the PTA's Representative for registration with the PTA, as outlined in the defined PTA survey and mapping standards and the Main Roads Survey and Mapping Standard 67-08-119 Data Lodgement.	11.4
Book 2 9.29.1	The Alliance must provide, maintain and clean daily, an office for the PTA's Representatives. The office size and capacity must be agreed with the PTA during the AD Stage, but space for a minimum of 5 PTA staff must be allowed for. The office must be separate from the Alliance's office but in the Alliance's office compound (with access to toilets and showers), and with a parking area adjacent. The office must be fully commissioned upon Commissioning of the Alliance's offices, but no later than commencement of any construction activity, and must remain operational for at least 12 months after the Date of Practical Completion to allow for the Non-conformance Correction Period.	4.5
Book 2 9.29.2	The office must be supplied and equipped as detailed with water, continuous 240 volt electric power and telecommunications services. All installation fees, connection fees and consumption costs associated with the use of the office must be paid by the Alliance.	4.5
Book 2 9.29.3	Site offices, workshops and equipment compounds must be located away from residences and other accommodation facilities. The site office must be located as close as reasonably practicable to a telecommunications access point to standard NBN broadband requirements (connected to PTA's Telstra MPLS). If this is not practicable as confirmed by the relevant service provider, then alternative telecommunication services must be provided by the Alliance.	4.5
Book 2 10.29.4	The office must be in good condition, vinyl floored and lined and thermally insulated and weatherproof and must be complete with windows fitted with security screens, curtains, fly screens and doors and have minimum area per person of 10m2 and height at wall plates of not less than 2.4m. By use of interior walls the office must be subdivided into separate areas. The office must include a covered area outside the front door of not less than 7.0 m length by 3.0 m width.	4.5

SWTC Ref.	Description	Section in this Plan
Book 2 10.29.5	The office equipped must be agreed with the PTA during the AD Stage, including numbers of: i. fully enclosed offices, with a minimum plan area; ii. fully enclosed meeting rooms, with a minimum plan areas, as well as tables and chairs for these rooms; iii. Yale type lock on external doors complete with 20 keys; iv. Yale type lock on each internal door complete with two keys; v. electronic monitored security system with motion sensors covering each room; vi. number and type of workstations with plan dimensions not less than 1.8 x 2.4 x 0.8 m, each equipped with lockable three drawer mobile pedestal; vii. desk in open room each partitioned to be 1.2m high; viii. office chairs with arm rests (AFRDI certified to AS/NZS 4438 Level 6) featuring full ergonomic height, back and seat adjustments and on castors suitable for hard flooring; ix. standard office chairs; x. four-drawer filing cabinets; xi. tables not less than 1.2 x 1.8 m dimensions for laying out drawings; xii. circular meeting table with dimensions of not less than 1.2 m diameter; xiii. kitchen table not less than 1.2 x 1.8 m dimensions, with six matching chairs; xiv. meeting table with dimensions not less than 3.6 x 2.4 m with 10 matching chairs; xv. lockable cabinets 0.9 x 0.3 x 1.8 m high with adjustable shelving; xvi. book cases with dimensions of 0.9 x 0.3 x 1.8 m high with adjustable shelving; xvii. fluorescent light fittings with the light switches to operate all units located on the right hand side wall at the front entrance door; xviii. quad power sockets and four single power sockets; xix. split system air conditioners (reverse cycle) in each room of capacity suitable for an office environment, including one air-conditioner to keep the store room containing the PTA's computer server at normal operating temperatures at all times; xx. refrigerators minimum capacity of 520 litres, complete with freezer compartment; xxi. stainless steel sink with cupboards under and a wall mounted urn mounted directly above the sink with continuous filtered potable water supply with a capability of heating water to 92 degrees Celsius; xxii. electric hot and cold water dispenser with ongoing supplies of 15 litre water refill bottles, with a capability of heating water to 92 degrees Celsius; xxiii. microwave oven, toaster and sandwich press; xxiv. ongoing supplies of tea, coffee, sugar and non-powdered milk; xxv. 15 Amp outlet with 24 hour power supply—the power must be located in a separate (secure) area of sufficient space to accommodate a separate server unit for PTA employee sole use; xxvi. wall mounted white boards (1.2 x 0.6 m) and pin up boards (0.9 x 0.6 m); xxvii. rubbish bins; xxviii. mats for each external door; and cutlery and crockery sufficient for the agreed number of persons.	4.5

SWTC Ref.	Description	Section in this Plan
Book 2 9.29.6	Concrete paths 600 mm wide must be constructed to connect the PTA office to the Alliance's office, and to ablution facilities. These paths must be adequately lit for night-time use.	4.5
Book 2 9.30.1	Lighting in the general work areas must be of a level to enable work to be carried out safely.	4.6
Book 2 9.30.2	A value of 160 lux is recommended for general work areas. Office environments require more lighting, for example moderately difficult visual tasks (such as routine office work) should have a range of 320-400 lux.	4.6
Book 2 9.30.3	This level should be considered as a minimum value when designing a lighting system. For more complex or intricate tasks, greater levels may be required.	4.6
Book 2 9.30.4	For more information refer to: AS/NZS 1680.2.4:2017 Interior and workplace lighting – Part 2.4: Industrial tasks and processes.	4.6
Book 2 9.30.5	Emergency lighting is important to assist workers to exit the workplace in an emergency situation.	4.6
Book 2 9.30.6	Section 2.7 of AS/NZS 3012:2010 Electrical installation – Construction and demolition sites, requires sufficient battery-powered lighting to be installed in stairways, passageways and next to switchboards. This allows for safe access and exit from the area if there is a loss of power and there is not enough natural lighting.	4.6
Book 2 9.30.7	Internally illuminated emergency evacuation signage may be used as part of an existing emergency lighting system. The system of lighting must have battery backup light fittings capable of illuminating the exit signage and provide clear directions for safe exit from the workplace in the event of power failure.	4.6
Book 2 9.30.8	For more information refer to: AS 2293.1 -2018 Emergency lighting and exit signs for buildings – System design, installation and operation.	4.6
Book 2 9.30.9	AS 2293.1 allows for an internally illuminated exit sign to perform roles of illuminated emergency exit signage and emergency escape luminaire provided that it meets the requirements of both purposes as set out in the standard.	4.6
Book 2 9.30.10	Emergency escape luminaires should be located within 2 metres of the approach side of each doorway requiring an exit sign and located to emphasise potential hazards to people exiting the workplace.	4.6
Book 2 9.30.11	For further guidance on emergency lighting and exit signage, refer to: i. AS 2293.1-2018 Emergency lighting and exit signs for buildings – System design, installation and operation AS 2293.3-2018 Emergency lighting and exit signs for buildings – Emergency luminaires and exit signs	4.6
Book 2 9.31.1	The Alliance must provide all telecommunications infrastructure and physical connections to the PTA's Representative's site office in accordance with the requirements of this section.	4.5
Book 2 9.31.2	The Alliance must ensure the location of the sites chosen have full 4G coverage and NBN connectivity.	4.5
Book 2 9.31.3	All telecommunications infrastructure and physical connections to the PTA's Representative's site office must be fully commissioned upon Commissioning of the Alliance's offices, but no later than commencement of any construction activity, and must remain operational for at least 12 months after the Date of Practical Completion to allow for the Non-conformances period.	4.5
Book 2 9.31.4	The Alliance must provide the entire infrastructure for the PTA's data telecommunications service up to and including the connection to the PTA's edge device (modem/router).	4.5
Book 2 9.31.5	For security reasons, the PTA's Representative will arrange with the relevant carrier for the PTA's data telecommunications service to utilise the data telecommunications infrastructure provided by the Alliance.	4.5

SWTC Ref.	Description	Section in this Plan
Book 2 9.31.6	The telecommunications infrastructure must be suitable for the data service specified in this section.	4.5
Book 2 9.31.7	The PTA will arrange the subscription to one data telecommunications service for connection to a server (to be installed by the PTA at the PTA's Representative's site office) to meet the data networking needs of the PTA's Representative.	4.5
Book 2 9.31.8	The data service must be connected from the PTA's Representative's site office to the PTA metropolitan area network.	4.5
Book 2 10.31.9	The data service arranged by the PTA will terminate in the PTA's Representative's site office on infrastructure provided by the Alliance, and must consist of one 2 Mbps (minimum) committed information rate: i. IP metropolitan area network or WAN service (the preferred data service); ii. Telstra Government Wideband IP telecommunications service; iii. Telstra Government BDSL IP telecommunications service; or xDSL service	4.5
Book 2 9.31.10	While the terrestrial services listed above will be given preference, a mobile data service (third generation, 3G or higher) equivalent in performance to the preferred data service may be offered to the PTA by the Alliance.	4.5
Book 2 9.31.11	The Alliance must make all reasonable efforts (to the satisfaction of the PTA's Representative) to ensure that a nominated PTA telecommunications service provider is able and willing to deliver the offered data service to the PTA's Representative site office.	4.5
Book 2 9.31.12	If the relevant telecommunications service provider confirms in writing that the data communications services specified in this section 9.31 are not practicable, then an alternative data communications service must be provided and must be approved by the PTA's Representative before installation, and allow full access by a minimum of 10 PTA staff and have sufficient bandwidth to allow for multiple download and uploads at the same time by 10 multiple users at once, and to run all current programs used by the PTA including Objective, TeamBinder, GRC Manager and any other programs.	4.5
Book 2 9.31.13	Where the data communications service specified in section 9.31 is provided, voice services for the PTA's Representative's site office will be provided by the PTA.	4.5
Book 2 9.31.14	Each voice service provided by the Alliance must be provided with Telstra Message bank service, caller identification (incoming and outgoing) and Easycall features including three party conference, call waiting and call transfer. If an alternative carrier is used, then equivalent features must be provided.	4.5
Book 2 9.32.1	The Alliance must provide one PSTN telecommunications service for dedicated connection and use with a facsimile interface unit that forms part of the MFD specified below at each office.	4.5
Book 2 9.32.2	The facsimile service must have caller ID enabled.	4.5
Book 2 9.32.3	The facsimile service must be fully commissioned upon Commissioning of the Alliance's offices, but no later than commencement of any construction activity, and must remain operational for at least two months after the Date of Practical Completion.	4.5
Book 2 9.33.1	The Alliance must provide one MFD in the PTA's Representative's site office for exclusive use by the PTA's Representatives.	4.5
Book 2 9.33.2	The MFD must be fully commissioned upon Commissioning of the Alliance's offices, but no later than commencement of any construction activity, and must remain operational for at least two months after the Date of Practical Completion.	4.5
Book 2 9.33.3	The MFD must be in 'as new' condition or new and with continuous supply of all associated consumables required by the PTA's Representative.	4.5

SWTC Ref.	Description	Section in this Plan
Book 2 9.33.4	The MFD must have the following features: i. B and W Digital Device 21 – 35 ppm ii. colour device- 15 ppm iii. paper input A4, A3, Manual iv. Bin500 Sheet v. duplex – Standard vi. security - password print, mailbox facility vii. memory - 512MB viii. power consumption energy star compliant ix. automatic document feeder Standard x. paper input additional tray (250 sheet) xi. finisher collator, stapler xii. scan supportable formats: email, fax, TIFF, JPG, PDF, scan to PC xiii. scanning resolution600 x 600 dpi, 400 x 400 dpi,300 x 300 dpi, 200 x 200 dpi xiv. print resolution 1200 x 1200 dpi xv. network interface or printer kit to support the following: Ethernet 100BaseT, TCP/IP, DHCP xvi. software – Template printing, OCR, electronic audit, web interface, MS W2000XP and MS W2007 compliant, Windows Server 2003 x32/x64, Windows Server 2008 x32/x64, certified print drivers PCL6, postscript 3 xvii. facsimile features and facsimile interface unit Group 3, enabled, minimum 14.4 kbps xviii. hardware - console (pedestal/cabinet) management reporting enabled	4.5
Book 2 9.34.1	The Alliance must ensure that significant trees (based on species, age or size) which may be affected by the Works are identified and appropriate protection management measures implemented including fencing and pruning where appropriate.	8.4
Book 2 9.34.2	The Alliance must reinstate the Construction Site and complete the architectural and landscaping work forming part of the Works progressively as each part of the work is completed.	8.4
Book 2 9.34.3	All parts of the Construction Site used for Temporary Works only and other land occupied or used by the Alliance for the purpose of the Works, including storage and site facilities, must be reinstated to a condition at least equivalent to that existing prior to the occupation or use unless otherwise stated in this SWTC.	8.4
Book 2 9.34.4	Site reinstatement must be undertaken in accordance with this SWTC.	8.4
Book 2 9.35.1	The Alliance must carry out all necessary monitoring during the Non-conformance Correction Period as specified in the PAA and SWTC.	9.0
Book 2 9.35.2	The settlement monitoring points installed in accordance with the SWTC must be monitored and assessed with a minimum measurement frequency of monthly during construction and the Non-conformance Correction Period, and reported every three months. Reports must include interpretation, identification of issues, comparison in graphical and tabular formats with all previous surveys including initial measurements, any recommendations for further action, monitoring or investigation arising from the survey; and	9.0
Book 2 9.35.3	Record of any other monitoring or Testing undertaken.	9.0
Book 2 9.36.1	After the Date of Practical Completion, the PTA, NOPs, Subcontractors or agents, along with the Alliance, will maintain the Works. Maintenance by or on behalf of the PTA or any other person does not relieve the Alliance from its obligations under the PAA and SWTC including regarding Non-conformance correction.	9.0

SWTC Ref.	Description	Section in this Plan
Book 2 9.37.1	The Alliance must relocate all existing private signs and entry treatments and other related features to equivalent positions alongside the new road alignment to an equivalent or higher standard of installation.	15.2.3
Book 2 9.38.1	Any modification of reticulation, bores, drainage and garden fixtures, must be of the equivalent standard to that existing prior to the commencement of the Works.	8.3
Book 2 9.39.1	The Alliance must relocate/reinstate all public amenities affected by the Works, for example bus shelters, rubbish bins, etc. The location and standard of the reinstated amenities must be approved by the relevant Government Agencies.	8.4
Book 2 9.40.1	Water used by the Alliance for construction purposes must be obtained from sources other than Water Corporation water supply service, existing wetland or the Swan River. Unless it can be demonstrated to the satisfaction of the PTA's Representative that alternatives are not viable, and all required approvals have been obtained.	8.3
Book 2 9.41.1	The Alliance must supply, install, Test, commission and maintain a system of time lapse cameras, with the ability for remote access, in accordance with the requirements set out in this section.	15.1.5
Book 2 9.41.2	The Alliance must provide all hardware, fabrication, installation and utility services required for continuous operation of the time lapse camera system.	15.1.5
Book 2 9.41.3	The Alliance must provide all software and licencing required for image capture and remote access with the ability to stream live to a website.	15.1.5
Book 2 9.41.4	All photographic material obtained by the time lapse camera system must remain the property of the PTA and be accessible to PTA's Representative at all times.	15.1.5
Book 2 9.41.5	The Alliance must not use any material obtained by the time lapse camera system for any purpose, unless agreed in advance with PTA's Representative.	15.1.5
Book 2 9.41.6	All Works undertaken by the Alliance in relation to the time lapse camera system must comply with all applicable Australian Standards, specifications, legislation, codes and guidelines.	15.1.5
Book 2 9.41.7	The system of time lapse cameras must provide adequate coverage of the Construction Site areas.	15.1.5
Book 2 9.41.8	The Construction Sites that require time lapse cameras will be nominated by the PTA, and the Alliance must make allowance in their method of working in relation to the camera locations.	15.1.5
Book 2 9.41.9	The PTA requires a minimum of 6 time lapse cameras, but may specify a greater number at the time of specification.	15.1.5
Book 2 9.41.10	The cameras must be located in a fixed position from the commencement of the work and for the duration of the work, unless agreed otherwise with PTA's Representative.	15.1.5
Book 2 9.41.11	Details of the proposed camera locations and viewing angles at each Construction Site must be submitted to PTA's Representative for approval.	15.1.5
Book 2 9.41.12	In the event it is necessary to install any cameras on land or Assets not owned by the PTA, the Alliance must: i. obtain the permission of the relevant land/Asset owner prior to installation; ii. supply attachment hardware that does not require any permanent deformation (e.g. drilling) to the Asset; iii. provide PTA with drawings that fully and accurately describe the constructed and installed equipment; iv. All reasonable efforts should be made to avoid views into private areas, such as parts of residential properties where residents would reasonably expect private activities to occur;	15.1.5

SWTC Ref.	Description	Section in this Plan
	v. A sample photograph taken from each camera must be submitted to PTA's Representative for approval prior to the Commissioning and operation of each respective camera; and All mounting arrangements shall take into account the required stability and rigidity, and must ensure that stable images are provided for typical weather conditions, air turbulence and structural vibration from work and passing vehicles.	
Book 2 9.41.13	The time lapse camera system must: i. operate without interruption, as i. far as practicable, commencing prior to any site clearing or demolition works through to completion of all work at each respective Construction Site; ii. include high resolution cameras of 10 megapixels or greater; iii. include cameras that are protected by an IP65 rated housing and sun visors; iv. be automated with a photo taken each 15 minutes starting at 7:00 am and ending at 7:00 pm; v. be capable of temporarily taking photos at increased frequency, up to a photo each minute, if requested by PTA's Representative for key milestone activities; vi. be capable of taking photos at night, if requested by PTA's Representative; vii. securely store photos both at native resolution and a screen optimised resolution of at least 1280x720 pixels; viii. upload photos using 4G/LTE wireless technology; ix. upload photos promptly so they are accessible remotely within 10 minutes of their being taken; and be capable of producing high definition time lapse videos with a minimum resolution of 1920x1080 pixels.	15.1.5
Book 2 9.41.14	All photos must: i. be of high quality with regard to image sharpness, noise reduction and dynamic range; ii. have no public areas out-of-focus; and be date and time stamped on-image and via the file name convention.	15.1.5
Book 2 9.41.15	The remote access must: i. provide access via a web browser and FTP server, or similar; ii. provide access to both native and screen optimised versions of each photo; iii. provide the PTA's Representative full access to all photos at all camera locations; and be capable of playing a slideshow of photos covering a period of time that is definable by the user.	15.1.5
Book 2 9.41.16	Immediately prior to and as a condition of achieving Practical Completion: i. the Alliance must remove all traces of the time lapse camera system including cameras, poles, wiring and utility service connections; and the Alliance must package and Handover all photos to the PTA in a format to be agreed prior to Practical Completion.	15.1.5

Abbreviations and Acronyms

Term	Definition
AD	Alliance Development
ADA	Alliance Development Agreement
AFRDI	Australasian Furnishing Research and Development Institute

Term	Definition
AHD	Australian Height Datum
ALARP	As Low As Reasonably Practicable
AMP	Alliance Management Plan
AS	Australian Standard
BDSL	Broadband Digital Subscriber Line
BEMEL	Bayswater Expansion Morley – Ellenbrook Line
BIM	Building Information Model
BM	Bench Marks
BRE	British Research Establishment
BS	Baseline Schedule
BST	Bayswater Station and Turnback Project
CAD	Computer Aided Drafting
CEMP	Construction Environmental Management Plan
DE	Digital Engineering
DIN	German Institute for Standardisation
DTM	Digital Terrain Modelling
DWER	Department of Water and Environmental Regulation
EIS	Entry Into Service
FTP	File Transfer Protocol
GDA	Geocentric Datum of Australia
GSR	Great Southern Rail
IP	internet protocol
ITP	inspection and test plan
JPG	Joint Photographic
Kbps	Kilobytes per second
LTE	long term evolution
MB	Megabyte
MFD	multi-function device
MPLS	Multiprotocol Label Switch
NBN	National Broadband Network
NCBP	Non-Conforming Building Product
NCP	Non-Complying Product
No	number
m	Metre
m2	Square metre
mm	Millimetre
MRWA	Main Roads Western Australia
NOP	Non-Owner Participants
NZS	New Zealand Standard
OS&H	Occupational Safety and Health
PAA	Project Alliance Agreement
PC	Practical Completion

Term	Definition
PDF	portable document format
PIM	project information model
ppm	pages per minute
PSHP or PhSP	Principal shared path
PSTN	public switched telephony network
PTA	Public Transport Authority
RRM	MRWA road reference marks
RTO	Rail Train Operator
SEMP	Site environmental management plan
SSM	state survey mark
SWTC	Scope of Works and Technical Criteria
TCD	Traffic Control Diagram
TIFF	Tagged Image File Format
WA	Western Australia
WAN	wide-area network
xDSL	X Digital Subscriber Line

1.0 Background

1.1 Introduction

METRONET is the State's vision to integrate transport and land use planning in the State and provide a framework to support sustainable growth of greater metropolitan Perth over the next 50 to 100 years.

Aligned with Commonwealth planning and infrastructure policies and the State's metropolitan growth strategies, *Perth and Peel @ 3.5 million* and *Transport @ 3.5 million*, METRONET Initiatives will deliver around 70 kilometres of new passenger rail and up to 18 new stations.

More than just rail infrastructure works, METRONET recognises the potential for urban intensification in more than 5,000 hectares of land. Planning goes beyond the station forecourts to shape and support development of communities within a walkable distance of 400 metres from a public transport hub.

METRONET Initiatives include approximately 70 kilometres of new heavy passenger rail and 16 new rail stations, which represents the single largest investment in public transport in Perth's history.

The State has prioritised the following METRONET Initiatives:

- Forrestfield – Airport Link;
- Thornlie – Cockburn Link;
- Yanchep Rail Extension;
- Morley – Ellenbrook Line;
- Extension of the Armadale Line to Byford;
- Bayswater Station Upgrade
- New station at Bellevue
- Station upgrade and relocation of Midland Station to Cale Street;
- Extension of the Midland Line to Bellevue; and
- Level crossing removal program.

1.1.1 Bayswater Station and Turnback Project

The Bayswater Station and Turnback Project as incorporated in the PAA for the Project includes:

- Stage One: The Turnback Works;
- Stage Two: The Bayswater Station Southern Section;
- Stage Three: The Bayswater Station Northern Section;

1.1.1.1 Stage One: Turnback Works

Stage One: Turnback Works comprises the following:

- New turnback siding between Bayswater and Meltham stations (configured to provide accommodation for 1 x 6 car sets);
- A shunters path (walkway) and a new driver's washroom;
- Relocation of the Leake Street underpass;
- Maintenance of the principle shared path along the southern side of the railway reserve;
- Other Project works including standard station systems, signalling, overhead line electrifications, communications, utility relocations and noise mitigation;

1.1.1.2 Stage Two: The Bayswater Station Southern Section

Stage Two: The Bayswater Station Southern Section, comprises the following:

- Two new rail bridges over King William Street, immediately south of the existing railway;

- New station island platform (150m long and 10m wide) complete with associated infrastructure and supported by the railway bridges;
- Provision for the principle shared path on the southern side of the southern railway bridge
- The first stage of western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts, escalators and stairs) and equipment rooms to service railway operations:
- Integrated pedestrian, cyclist, bus and vehicle access into the station and future Bayswater town centre;
- Relocation of the dual gauge tracks and all associated track infrastructure to align with the new platform faces;
- New bus bays and vehicle parking bays;
- Other Project works including standard station systems, signalling, overhead line electrifications, communications, utility relocations and noise mitigation;
- Landscaping and urban design features within the station precinct.

1.1.1.3 Stage Three: The Bayswater Station Northern Section

Stage Three: The Bayswater Station Northern Section comprises the following:

- Demolition of the existing Bayswater station and associated infrastructure.
- A second set of two new rail bridges over King William Street, located immediately north of the first new set of railway bridges delivered as part of Stage One;
- A second island platform (150m long and 10m wide) complete with station infrastructure again supported by the northern pair of railway bridges;
- The second stage of the western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts, escalators and stairs) and retail tenancies:
- Additional station infrastructure to meet the needs of the expanded (4 line, 4 platform face) station;
- Landscaping and urban design features within the station precinct;
- Other Project works including standard station systems, signalling, overhead line electrifications, communications, utility relocations and noise mitigation;
- Completion of new bus bays and vehicle parking bays.
- Landscaping and urban design features within the station precinct;

1.1.1.4 Optional Works Packages

The METRONET Initiatives include for other additional Project Works beyond the scope listed in 1.2.1, 1.2.2 and 1.2.3 above and these may be included during the Delivery Phase.

2.0 Purpose

This Construction Plan describes how Evolve Bayswater will satisfy all the construction requirements of the PAA and the SWTC, and the Construction Plan describes how the Alliance will satisfy all requirements identified in this section: Book 2—section 9, Construction Plan.

The Construction Plan describes the construction methodology and sequencing for implementation of the Works and provides plant and equipment details for each stage of construction.

The Construction Plan describes how construction interfaces are managed.

The Construction Plan includes detailed site layout plans showing construction activities and locations, including boundaries and operational restrictions, compounds and storage locations, construction staging, plant access routes, plant operating positions, safe personnel walkway routes, drainage and erosion protection measures and other relevant features. As far as reasonably practicable, access must be planned without the need for going ‘on or near the line’.

The construction plan will be in accordance with the technical specifications for the Works and, as a minimum, be in accordance with PTA and MRWA specifications, unless specified elsewhere in the SWTC. The requirements in these specifications will not be reduced unless Evolve Bayswater can demonstrate to the satisfaction of the PTA's Representative that the performance and durability requirements of the SWTC can still be satisfied.

The Construction Plan is based on the assumptions that the approvals required to commence prior to commencement of construction have been obtained as detailed in the Design and Engineering Management Plan (BST-EVO-EA-PLN-00004).

3.0 References

The Construction Plan is to be read in conjunction with the Alliance Management Plan (AMP) which is developed, issued and implemented by the Alliance Manager. The AMP is the overarching plan that governs the Alliance functions and performs its obligations to fulfil the requirements of the SWTC and other relevant documentation.

This Construction Plan supports the AMP and is complemented with additional management plans, which collectively define the governance and assurance requirements across all activities on the Project.

The relationship of the Alliance Management Plan, the Construction Plan and the other Project Plans is shown in the BST Management Plans Hierarchy.

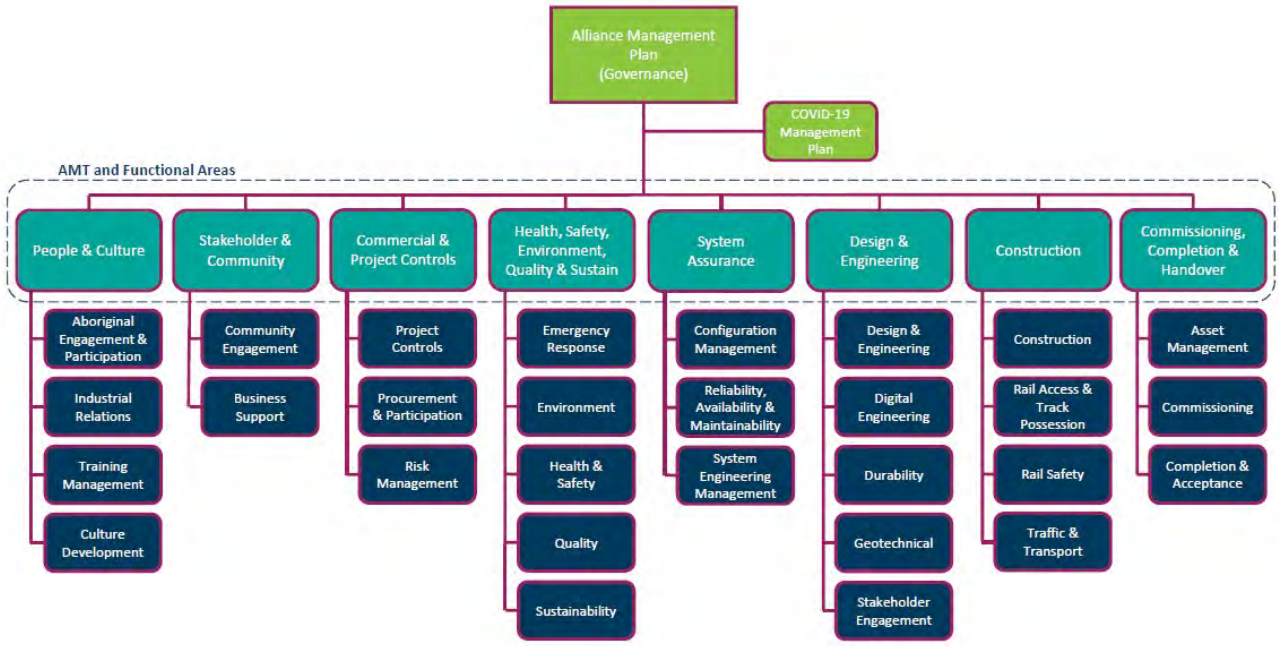


Figure 3.1: Evolve Bayswater Project Plan Hierarchy

The Construction Plan should be read in conjunction with the following documents:

- BST-EVO-PM-PLN-00004 - Alliance Management Plan
- BST-EVO-EN-PLN-00003 - Construction Environmental Management Plan
- BST-EVO-SA-PLN-00004 - Safety Management Plan
- BST-EVO-QA-PLN-00004 - Quality Plan
- BST-EVO-GE-PLN-00002 - Geotechnical Plan
- BST-EVO-IM-PLN-00002 - Digital Engineering Management Plan
- BST-EVO-SM-PLN-00003 - Community Engagement Plan
- BST-EVO-TM-PLN-00002 - Traffic and Transport Management Plan

- BST-EVO-TC-PLN-00005 - Commissioning Plan
- BST-EVO-RS-PLN-00002 - Rail Corridor Access and Possession Plan
- BST-EVO-EN-PLN-00004 - Sustainability Management Plan
- BST-EVO-RI-PLN-00002 – Risk Management Plan
- BST-EVO-PC-PLN-00002 – Project Controls Plan
- BST-EVO-PR-PLN-00002 - Procurement and Participation Plan
- BST-EVO-EA-PLN-00004 - Design and Engineering Management Plan
- BST-EVO-TC-PLN-00006 - Completion and Acceptance Plan

The Construction Plan will make references to these documents with further detail of the construction teams' responsibility for these areas detailed in those plans.

The Alliance Manager has overall responsibility over this Construction Plan, in accordance with the Alliance Management Plan.

4.0 Project Conditions and Facilities

4.1 Working Hours

The construction works will be scheduled for 0700 hours to 1900 hours Monday to Saturday (excluding public holidays). The PTA's Representative's approval will be confirmed for the construction working times prior to works commencing.

In order to meet the required project programme, minimise disruption to peak hour traffic and minimise disruption to PTA network, construction works will be required to be undertaken outside of the above approved construction hours. Prior to these works being undertaken outside of the standard working hours, approvals will be obtained from the PTA's Representative and the City of Bayswater.

Furthermore, emergency construction activities required to ensure ongoing rail services and uninterrupted traffic flow on public roads, no loss of life, no damage to property and no environmental harm may be completed outside the working hours without prior approval from PTA or LGA. However, notification will be provided to PTA and city of Bayswater as soon as reasonably practical.

After hour works will be completed in accordance with Construction Environmental Management Plan (BST-EVO-EN-PLN-00003).

4.2 Site Access

The Bayswater Station and Turnback project is located in the town centre of Bayswater in a residential area. Hence the management of movements deliveries including those by truck are crucial to minimise disruption to the local community. In this Construction Plan in Sections **Error! Reference source not found.** and 17.2 Evolve Bayswater has specified routes for which deliveries are to be directed to the various work locations around site. These routes will be constantly monitored to ensure compliance and to recognize areas where improvement can be made.

4.3 Office and Amenities

Evolve Bayswater will establish facilities using temporary buildings within the construction area. Space will be minimized and planned to reduce conflict with construction works. The locations of the site offices and amenities are:

- North-east carpark
- Behind the west and east abutments
- Rail corridor to the north

There will also be a requirement to relocate as the work progresses between Stage 1 and Stage 2.

Evolve Bayswater will explore possibility to establish its main site office and amenities in local established facilities. Potential facilities include the 300m² Bendigo Bank building on Whatley Crescent.

Challenges to establishing the office include:

- Proximity to Works
- Available Space
- Suitability – extra work required
- Disruption to community
- Timing – more opportunities once project confirmed

4.4 Carparking

Carparking in Bayswater is limited. Evolve Bayswater understands that:

- Vehicles associated with the Project Activities must not park in public bays or Transperth car parks available to the public
- All parked Alliance vehicles are to be contained within, and provided with parking within, the fenced area of the Site.

Accordingly Evolve Bayswater will:

- Maximise parking opportunities for local community
- Eliminate the requirement for site parking
- Provide incentives to use public transport
- Facilitate tool drop off arrangements
- Provide end of trip facilities to encourage riding to work

4.5 Office and Facilities for the PTA's Representatives

Evolve Bayswater shall provide, maintain and clean daily, an office for the PTA's Representative. For other PTA staff embedded in the Alliance, space will be allocated in the main Alliance office. The Alliance office shall be fully commissioned prior or upon commencement of any construction activity and shall remain operational past Date of Practical Completion to allow for the Non-conformance Correction Period.

The Alliance office shall be supplied and equipped as detailed with water, continuous 240 volt electric power and telecommunications services. All installation fees, connection fees and consumption costs associated with the use of the Alliance office shall be paid by Evolve Bayswater.

The Alliance office shall be located as close as reasonably practicable to a telecommunications access point to standard NBN broadband requirements (connected to PTA's Telstra MPLS). If this is not practicable as confirmed by the relevant service provider, then alternative telecommunication services must be provided by Evolve Bayswater.

The Alliance office shall be in a good condition, vinyl floored and lined and thermally insulated and weatherproof and shall be complete with windows fitted with security screens, curtains, fly screens and doors and have minimum area per person of $10m^2$ and height at wall plates of not less than 2.4m. This may be adjusted if an existing commercial premise is determined as being better for the project.

By use of interior walls, the Alliance office shall be subdivided into separate areas. The office shall include a covered area outside the front door of not less than 7.0 m length by 3.0 m width.

The office equipped shall include:

- fully enclosed offices, with a minimum plan area;
- fully enclosed meeting rooms as well as tables and chairs for these rooms;
- Yale type lock on external doors complete with 20 keys;
- Yale type lock on each internal door complete with two keys;
- electronic monitored security system with motion sensors covering each room;
- number and type of workstations with plan dimensions not less than 1.8 x 2.4 x 0.8 m, each equipped with lockable three drawer mobile pedestal;
- desk in open room each partitioned to be 1.2m high;
- office chairs with arm rests (AFRDI certified to AS/NZS 4438 Level 6) featuring full ergonomic height, back and seat adjustments and on castors suitable for hard flooring;
- standard office chairs;
- four-drawer filing cabinets;
- tables not less than 1.2 x 1.8 m dimensions for laying out drawings;
- circular meeting table with dimensions of not less than 1.2 m diameter;
- kitchen table not less than 1.2 x 1.8 m dimensions, with six matching chairs;
- meeting table with dimensions not less than 3.6 x 2.4 m with 10 matching chairs;
- lockable cabinets 0.9 x 0.3 x 1.8 m high with adjustable shelving;
- bookcases with dimensions of 0.9 x 0.3 x 1.8 m high with adjustable shelving;
- fluorescent light fittings with the light switches to operate all units located on the right hand side wall at the front entrance door;
- quad power sockets and four single power sockets;
- split system air conditioners (reverse cycle) in each room of capacity suitable for an office environment, including one air-conditioner to keep the store room containing the PTA's computer server at normal operating temperatures at all times;
- refrigerators minimum capacity of 520 litres, complete with freezer compartment;
- stainless steel sink with cupboards under and a wall mounted urn mounted directly above the sink with continuous filtered potable water supply with a capability of heating water to 92 degrees Celsius;
- electric hot and cold water dispenser with ongoing supplies of 15 litre water refill bottles, with a capability of heating water to 92 degrees Celsius;
- microwave oven, toaster and sandwich press;
- ongoing supplies of tea, coffee, sugar and non-powdered milk;
- 15 Amp outlet with 24 hour power supply—the power shall be located in a separate (secure) area of sufficient space to accommodate a separate server unit for PTA employee sole use;
- wall mounted white boards (1.2 x 0.6 m) and pin up boards (0.9 x 0.6 m);
- rubbish bins;
- mats for each external door; and
- cutlery and crockery sufficient for the agreed number of persons.

Concrete paths 600 mm wide shall be constructed to connect the Alliance office to ablution facilities and other amenities. These paths must be adequately lit for night-time use.

Evolve Bayswater shall provide the entire infrastructure for the Alliance and PTA Representative.

For security reasons, the PTA's Representative will arrange with the relevant carrier for the PTA's data telecommunications service to utilise the data telecommunications infrastructure provided by Evolve Bayswater.

The telecommunications infrastructure must be suitable for the data service specified in this section.

The PTA will arrange the subscription to one data telecommunications service for connection to a server (to be installed by the PTA at the PTA's Representative's site office) to meet the data networking needs of the PTA's Representative.

The data service shall be connected from the PTA's Representative's site office to the PTA metropolitan area network.

The data service arranged by the PTA will terminate in the PTA's Representative's site office on infrastructure provided by Evolve Bayswater, and must consist of one 2 Mbps (minimum) committed information rate:

i. IP metropolitan area network or WAN service (the preferred data service);
ii. Telstra Government Wideband IP telecommunications service;
iii. Telstra Government BDSL IP telecommunications service; or
iv. xDSL service

While the terrestrial services listed above will be given preference, a mobile data service (third generation, 3G or higher) equivalent in performance to the preferred data service may be offered to the PTA by Evolve Bayswater.

Evolve Bayswater shall make all reasonable efforts (to the satisfaction of the PTA's Representative) to ensure that a nominated PTA telecommunications service provider is able and willing to deliver the offered data service to the PTA's Representative site office.

If the relevant telecommunications service provider confirms in writing that the data communications services specified are not practicable, then an alternative data communications service shall be provided and must be approved by the PTA's Representative before installation, and allow full access by a minimum of 10 PTA staff and have sufficient bandwidth to allow for multiple download and uploads at the same time by 10 multiple users at once, and to run all current programs used by the PTA including Objective, TeamBinder, GRC Manager and any other programs.

Where the data communications service specified is provided, voice services for the PTA's Representative's site office will be provided by the PTA.

Each voice service provided by Evolve Bayswater shall be provided with Telstra Message bank service, caller identification (incoming and outgoing) and Easycall features including three party conference, call waiting and call transfer. If an alternative carrier is used, then equivalent features must be provided.

Evolve Bayswater shall provide one PSTN telecommunications service for dedicated connection and use with a facsimile interface unit that forms part of the MFD specified below at each office.

The facsimile service shall have caller ID enabled.

The facsimile service shall be fully commissioned upon Commissioning of Evolve Bayswater's offices, but no later than commencement of any construction activity, and shall remain operational for at least two months after the Date of Practical Completion.

Evolve Bayswater shall provide one MFD in the PTA's Representative's site office for exclusive use by the PTA's Representatives.

The MFD shall be fully commissioned upon Commissioning of Evolve Bayswater's offices, but no later than commencement of any construction activity, and shall remain operational for at least two months after the Date of Practical Completion.

The MFD shall be in 'as new' condition or new and with continuous supply of all associated consumables required by the PTA's Representative.

The MFD shall have the following features:

i. B and W Digital Device 21 – 35 ppm
ii. colour device- 15 ppm
iii. paper input A4, A3, Manual
iv. Bin500 Sheet
v. duplex – Standard
vi. security - password print, mailbox facility

vii. memory - 512MB
viii. power consumption energy star compliant
ix. automatic document feeder Standard
x. paper input additional tray (250 sheet)
xi. finisher collator, stapler
xii. scan supportable formats: email, fax, TIFF, JPG, PDF, scan to PC
xiii. scanning resolution600 x 600 dpi, 400 x 400 dpi,300 x 300 dpi, 200 x 200 dpi
xiv. print resolution 1200 x 1200 dpi
xv. network interface or printer kit to support the following: Ethernet 100BaseT, TCP/IP, DHCP
xvi. software – Template printing, OCR, electronic audit, web interface, MS W2000XP and MS W2007 compliant, Windows Server 2003 x32/x64, Windows Server 2008 x32/x64, certified print drivers PCL6, postscript 3
xvii. facsimile features and facsimile interface unit Group 3, enabled, minimum 14.4 kbps
xviii. hardware - console (pedestal/cabinet)
xix. management reporting enabled

4.6 General and Office lighting

Lighting in the general work areas shall be of a level to enable work to be carried out safely.

A lighting level of 160 lux shall be provided for general work areas and office environments requiring more lighting, for example to perform moderately difficult visual tasks (such as routine office work) shall have a lighting level range of 320-400 lux.

Emergency lighting shall comply with:

- Section 2.7 of AS/NZS 3012:2010 Electrical installation – Construction and demolition sites including providing sufficient battery-powered lighting in stairways, passageways and next to switchboards.
- AS 2293.1 -2018 Emergency lighting and exit signs for buildings – System design, installation and operation.
- AS 2293.3-2018 Emergency lighting and exit signs for buildings – Emergency luminaires and exit signs

4.7 Temporary Fencing and Hoarding

Temporary fencing and hoardings shall be provided and maintained as necessary to provide an aesthetically pleasing appearance, control public access to parts of the construction site and maintain safety and security.

The temporary fencing and hoarding shall be of a standard which is suitable to address the issues of public safety, road and rail safety, security, noise and visual impact arising from the work.

The temporary fencing and hoarding shall be designed for stability against wind loading and must not obstruct the signalling line of sight for railway operations.

Temporary fencing and hoarding shall be provided at all Construction Sites adjacent to roads or other public access areas to provide an aesthetically pleasing appearance for passing motorists and pedestrians.

Any temporary artworks shall be consistent with the Project branding, provide wayfinding, and must be approved by the PTA's Representative.

Temporary fencing and hoardings shall comply to all relevant PTA standards and Codes of Practice, including the Earthing and Bonding Specification.

4.8 Site Maintenance

The Construction Site, including the exterior of all perimeter fences/hoardings shall be maintained in a clean and tidy manner throughout the Works. Rubbish or loose items shall not be stored on the Construction Site. Use of the Construction Site must meet the environmental sensitivity requirements of the SWTC. Evolve Bayswater shall take measures to prevent littering of the Construction Site by its personnel. In addition, Evolve Bayswater shall clean up any rubbish and dirt generated by the Works in the surrounding area.

Temporary site facilities requirements shall be maintained as follows:

i. Site sheds shall be maintained in excellent condition.
ii. Site sheds shall be established at locations and positions that minimise the impact on adjoining properties and residents.
iii. All facilities utilised for the purpose of the Works shall be sited, constructed and maintained to meet the requirements of the PTA and relevant Government Agencies.
iv. Evolve Bayswater shall provide site facilities for use by the PTA.
v. Temporary site facilities shall satisfy the sustainability requirements of this SWTC.
vi. All temporary site facilities, including site sheds, shall be maintained free of graffiti and any advertising material.
vii. Evolve Bayswater shall carry out daily inspections of all temporary site facilities including site sheds.

Any graffiti within the Construction Site, including outward facing surfaces of any hoardings and the like surrounding the Construction Site, must be covered or removed by Evolve Bayswater within 24 hours, subject to operational constraints. Offensive graffiti is to be removed within the shorter timeframe of two hours, in accordance with the PTA's and Government's graffiti removal policy.

Evolve Bayswater will, prior to Practical Completion, clear away and remove from the Construction Site all plant, surplus material, rubbish and temporary Works of every kind and fill, consolidate and level off all excavations made by Evolve Bayswater on the Construction Site.

Any adjacent areas that have been damaged during construction activities will be repaired and/or reinstated to at least equivalent to the existing prior to the works unless otherwise stated. Reinstatement works may include the careful removal of redundant pavements, paths, foundations, embankments and furniture including backfill with appropriate material and reinstatement of disturbed or damaged pavements or surfaces.

4.9 Temporary Toilets and Shower Facilities

Suitable temporary toilets and shower facilities shall be provided. Temporary facilities must be connected to the main sewer system wherever practical and maintained in a clean, tidy and hygienic state and shielded from public view.

4.10 Waste Management

Evolve Bayswater will ensure all waste is consolidated to a single waste management location for sorting and suitable storage. Materials will be sorted into the following:

- Paper and cardboard and other packaging materials
- Steel and other metal recycling
- Green waste for potentially chipping and respreading upon completion
- General waste

Regular removal of waste from site will be managed to prevent build up and increase in management risk. For further details on management of waste, refer to Evolve Bayswater's Sustainability Management Plan BST-EVO-EN-PLN-00004.

4.11 PTA Operations Access

Access to PTA operational assets will be maintained throughout the duration of the project. This will be achieved by;

- Maintaining current access points such as the rail reserve gate on Whatley Crescent west of King William Street.
- Linking project locks and PTA locks on access gates so PTA operations have access to site 24hrs per day.
- Defining clear LV site tracks and pedestrian walkways to PTA operational assets within the project boundaries including the existing and new Bayswater station.
- Provision of project support to assist PTA operations in maintenance and repair tasks.
- Defining access for the station platform during Stage 1 and also in the final arrangement.

As the project progresses access to site will change. Any changes will be discussed with PTA representatives and once agreed, clearly communicated with the PTA organisation.

As work progresses specific details on how PTA are to access their operational assets will be developed and shared with PTA in the form of area plans or similar. The plans will clearly articulate the access provided enabling sharing with internal PTA shareholders and audited by the site team to ensure access is maintained.

5.0 Health and Safety

The Evolve Bayswater Safety Management Plan BST-EVO-SA-PLN-00004 (SMP) will be the guiding document for health and safety for completing works on the project. The SMP details the processes for management of risks specific to health and safety and review of risks during different phases of the project including mobilisation, construction, commissioning and handover.

5.1 Safe Work Method Statements

Safe Work Method Statements (SWMS), suitable for the tasks, will be developed by the responsible engineer / manager in consultation with the work crew undertaking the planned activities and will be included in the work pack for the task as outlined in the SMP. SWMS will be developed for any high risk construction activities as deemed by the engineers and managers. At minimum the tasks listed in the OSH Regulations will be addressed.

The SWMS will:

1. Identify the work that is high risk construction work
2. Specify hazards relating to the high risk construction work and the risks to health and safety
3. Detail the qualifications and training required to complete the task
4. Detail equipment used to the complete the task
5. Describe the measures to be implemented to control the risks, and
6. Describe how the control measures are to be implemented, monitored and reviewed

The SWMS will be short and focused on describing the specific hazards identified for the high risk construction work to be undertaken and the control measures to be put in place so the work is carried out safely.

The SWMS will be easily understood by workers, including those from non-English speaking backgrounds. All workers involved in the task will read, understand and sign their acceptance onto the SWMS.

SWMS will be available for information by anybody as requested and will remain with the work whilst works covered by the SWMS are being undertaken.

5.2 Rail Safety

Rail safety is critical to Evolve Bayswater for this project. The key areas of work that have been considered by Evolve Bayswater are:

- Rail reserve
- Danger zone
- Kinematic envelope of various rolling stock

Specific details on how Evolve Bayswater manage this risk during construction are covered later in this plan.

Evolve Bayswater's Rail Corridor Access and Possession Plan BST-EVO-RS-PLN-00002 addresses management of access to the key areas of work in detail.

5.3 Emergency Management

In the case of an emergency onsite the Alliance Emergency Management Plan (BST-EVO-SA-PLN-00003) (EMP) will be enacted by those with roles named in the EMP completing their responsibilities as required.

5.4 Safety Risk Management

During design, the construction team will participate in the design team led Safety-in-Design process throughout the design phase of the project. This process is further detailed in the Design and Engineering Management Plan (BST-EVO-EA-PLN-00004) (DEMP). This includes the various workshops such as CHAIRs and Human Factors. The hazards identified during this process will be addressed in design development with any residual risks then covered during the CRAW process.

The CRAW process is detailed in the Safety Management Plan (BST-EVO-SA-PLN-00004) (SMP). Numerous CRAWs will be conducted prior and during the construction phase with all relevant and available construction personnel to attend and participate.

The timing and frequency of workshops to identify and control / mitigate construction hazards is detailed in the relevant management plan as listed above.

5.5 COVID-19

The Construction Plan has considered the current COVID-19 requirements and have developed an Alliance COVID-19 Management Plan (BST-EVO-SA-PLN-00001) (COVIDMP) based on current conditions. This plan (including amendments to this plan) will be subject to change based on change in government directions to the approval of the Alliance Management Team.

6.0 Risk Management

Along with Safety risks, there are other risks which the construction phase will need to manage. These include but not limited to commercial, community and program. The management of risk for the Alliance will be in accordance with the Risk Management Plan (BST-EVO-RI-PLN-00002) (RMP) which the construction team will comply with and contribute to. This includes conducting risk assessments and the detailing of risk mitigation procedures. The identified risks with mitigation measures will be included in the Risk and Opportunity Register for the Alliance. The Risk and Opportunity register will be reviewed and updated as per the RMP and prior to major items of works commencing to identify undetected or emerging construction risks.

6.1 Planning

An important process to minimise risk is adequate prior planning. Planning for the construction team will include various tasks to optimise planning such as:

- Weekly construction team meetings to discuss action list and identify activities to be planned
- Identify key requirements to be delivered by the activity.
- Planning workshops with relevant stakeholders such as engineers and supervisors to detail construction methodologies to complete activities.
- Finalisation of methodology and associated supporting documentation into a work pack. This will include the required schedule to be delivered, the deliverables and associated risks.
- During the completion of activity, regular observations and checks will be conducted to track progress and compliance with the requirements and deliverables.
- Upon completion, close out permits etc. and quality documentation for submission with completion and acceptance in compliance with the Completion and Acceptance Management Plan.

6.1.1 Work Pack

The work pack will be developed to ensure that the following information is communicated effectively to the project team responsible for delivery of the works associated with that activity prior to commencement of the activity:

- Activity overview
- Sequencing and staging of the works
- Risk assessments
- Safety and environmental assessments
- Approvals and permits (including dig permits with service location details, as required)
- TCDs as required
- Rail Safe working Sub-plan, as required
- Resource requirements
- Relevant drawings and specifications
- ITPs and verification checklists

6.1.2 Master Program Update

The management of overall Alliance program including the required outputs is detailed in the Alliance Project Controls Plan (BST-EVO-PC-PLN-00002)(PCP). The construction team will contribute to the sequencing and logic of the activities initially and then provide weekly input into the progress to date and changes to the sequence via a formal program update meeting as detailed in the PCP.

7.0 Project Controls

The construction phase of the project will be monitored and reported upon as per the Project Controls Plan (BST-EVO-PC-PLN-00002) (PCP). The PCP also details the intervention and contingency systems which the construction will comply with.

8.0 Environment

The following sub-sections are to be read in conjunction with Construction Environmental Management Plan (BST-EVO-EN-PLN-00003) (CEMP). The CEMP details the environmental risks and the management process to manage these.

8.1 Discharge Water Quality

All water including groundwater seepage captured within the Construction Site must be treated and disposed of in accordance with the requirements of the PAA, SWTC and the relevant Government Agencies.

Evolve Bayswater must monitor the quality of water discharged from the Construction Site.

8.2 Construction Noise and Vibration

The CEMP has included sections addressing construction noise and vibration and will define the management parameters for construction noise and vibration on receptors adjacent to the site. The objectives of the noise and vibration section of the CEMP are:

- Manage noise emissions extending beyond the construction footprint and minimise the effects on adjacent receivers
- Minimise and manage vibration generation from construction works and reduce impacts to adjacent receivers
- All noise emitted from construction works are to comply with State Environmental Protection Act 1986 and Environmental Protection (Noise) Regulation 1997
- Undertake works in accordance with control of noise practices set out in Section 6 of AS 2436-1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites
- Works and activities are to be undertaken in methods that will minimise noise and vibration levels produced and the associated negative impacts on sensitive receivers

Further to this the CEMP will detail the management of the sensitive receivers including but not limited to completing condition surveys within the required radius of the works.

8.2.1 Noise

The potential impacts of noise on any particular location can vary greatly depending on factors such as the relative proximity of sensitive receptors to the source of the noise, the overall duration of works undertaken, and the character of the noise generated by the works. Activities associated with construction works have the potential to increase localised noise, impacting on the community and public adjacent to the project area.

Evolve Bayswater recognise that the Bayswater Station and Turnback project occurs in an existing town centre with immediately adjacent community. Hence noise is a critical consideration for the project team.

A wide range of plant including excavators, graders, loaders, vibratory rollers, tipper trucks, compactors, lifting and access equipment, drilling and piling machinery and rattle guns will be used during the construction phase of the project. Noise and vibration from these items will consist of steady production as well as some impulsive components.

Stationery plant such as generators and compressors will also be required, with noise from these items being mainly steady in nature. Deliveries shall be completed in standard working hours unless not fitting within “construction works”.

8.2.1.1 Noise Targets

Noise levels will be monitored with the aim to understand noise generated as a result of construction activities. Intervention and Action targets will be developed in the CEMP. Evolve Bayswater will use quantitative data from monitoring and qualitative data from stakeholders to understand noise emissions on-site. While the Projects aim to receive no noise complaints from the public, if received, Evolve Bayswater will utilise these reports to better assess noise propagation and attenuation from works. All works shall comply with occupational health and safety guidelines and be conducted in accordance with the Environmental Protection Noise Regulations 1997, Section 4.5 of AS 2436 –

2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites, and with reference to State Planning Policy 5.4 (WAPC, 2009).

8.2.1.2 Noise Controls

The management practices listed below will be implemented on the Project to minimise noise impacts on the surrounding residences, and to address the requirements for the implementation of reasonable and feasible measures for the duration of the construction work. The noise controls listed below are consistent with AS 2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites and the SWTC.

- All construction works will be carried out within approved construction hours of 0700 hours to 1900 hours from Monday to Saturday (except public holidays), unless approved in a separate Out of Hours plan
- All construction work will be carried out in accordance with environmental noise control practices set out in Section 4.5 of AS 2436-2010 Guide to Noise Control on Construction, Maintenance and Demolition Sites
- All public complaints shall be recorded and investigated
- High noise generating works will be staggered where possible to minimise noise impacts
- Where practicable, excessively noisy processes will be substituted with alternative processes
- Site offices, compounds and workshops will be located so to minimise the impact on the noise amenity of nearby sensitive receptors
- On-site generators and auxiliary power sources used during construction will be positioned among existing buildings to buffer noise where possible
- Temporary acoustic fencing/barriers around noise intensive equipment/sites will be considered to mitigate high level off-site noise levels
- Plant and equipment will be located away from noise sensitive areas as far as practicable
- All ‘warm-up’ of equipment by employees and contractors arriving to site will be conducted during approved site construction hours
- Generators, machinery and vehicles are to be switched off when not in use
- In selecting plant and equipment for construction works, preference will be given to those which minimise noise and vibration
- Plant, machinery and vehicle reversing alarms will be broadband alarm type where required
- High efficiency mufflers will be fitted to all plant and equipment to minimise the generation of noise where practicable. All plant will be maintained in accordance with the manufacturer’s requirements.
- Maintain vehicle, plant, equipment maintenance schedules and lubrication as per manufacturers' specifications
- Regular checks (additional to scheduled maintenance) are to be undertaken to ensure all equipment and vehicles are in good working order and are being operated correctly (i.e. Daily Vehicle Pre-start Checklist). Checklist includes:
    - Engine cover condition
    - Defective silencing equipment
    - Rattling components
    - Leakages in compressed air lines
- Operators will use the daily pre-starts to carry out maintenance checks
- Toolbox and pre-start meetings on noise management requirements, sensitive receivers and measures will be completed during the project.
- Environmental Toolboxes and pre-start briefings will be conducted, and work crews informed of the impacts of noise. These will work simultaneously with measures for reducing noise.
- Site vehicles to adhere to speed limits throughout the Project

- Vehicle movements will be restricted to approved access roads
- Behavioural practices to be enforced, i.e.; no swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors.

8.2.1.3 Noise Monitoring

Evolve Bayswater has made an allowance to observe noise volumes during approved out-of-hours works to confirm compliance with the CEMP and other requirements.

8.2.2 Vibration

The propagation of vibration caused by heavy machinery and more specifically plant and machinery designed to conduct vibratory activities can impact adjacent residences including occupants, buildings for residential, commercial and recreational purposes, heritage buildings / sites and public utilities and infrastructure. Vibration can not only cause aesthetic and structural damage if not monitored, it can generate community disruption, concern and complaints.

8.2.2.1 Vibration Impact Assessment

The intensity of vibration felt by a receiver can vary dependent on the strength of vibration produced from the source, the wave frequency, distance of separation and environmental factors e.g. ground condition, topography, physical barriers etc. In general, vibration emissions beyond Project footprint are expected to be critical due to the close proximity of sensitive receptors which include buildings with significant heritage.

Sensitive receptors are those premises which are most at risk to increases and the effects of vibration. For the BST project these receptors include residential properties, commercial properties, heritage buildings and sites, disability services and operating railways. Evolve Bayswater will conduct a detailed vibration impact assessment based on the construction methodology, plant selection and prevailing site conditions to identify the potential impacts and receptors for the project. Consideration is to be given not only to the potential impacts upon structures but the human vibration response. Upon completing these assessments Evolve Bayswater are to:

- Identify the requirement for additional condition surveys
- Establish and maintain vibration targets
- Establish vibration monitoring to protect sensitive receivers
- Implement vibration controls to minimise impacts to adjacent receivers and infrastructure during works

8.2.2.2 Vibration Targets

Vibration emissions are to be monitored based on the Impact Assessment findings and relevant nearby receptors. Intervention and Actions targets will be established through the Impact Assessment and will either be constant over the Project or be developed with allowable ranges at specific locations based on the nearby receivers, construction methods and distance separation. Vibration received at premises due to construction works should not exceed 5 mm/s peak particle velocity (ppv) so to prevent structural damage to buildings. An early warning indicator of 3mm/s is to be used to assist in regulating vibration intensive works. Evolve Bayswater strive to complete works with no community complaints but in cases complaints are received each case will be reviewed and investigated.

Due to the importance of quantitative data provided by vibration monitoring equipment units must meet the requirements of BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites—Vibration; BS 7385-2:1993 Evaluation and Measurement for Vibration in Buildings—to Damage Levels for Groundborne Vibration; and DIN 45669-1:2010

Measurement of Vibration Emission Part 1 Vibration Meters requirements and Tests, where applicable.

8.2.2.3 Vibration Controls

Construction vibration management measures detailed below will be employed by Evolve Bayswater throughout the Project to maintain vibration levels within the target criteria, especially with regards to sensitive receivers. The management measures are in accordance with section 6 of AS 2436-2010 Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites and have been derived with guidance from BS 5228-2:2009+A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites—Vibration but also with reference to AS 2670.2: Evaluation of Human Exposure to Whole Body Vibration:

- Selection, where practicable, of construction methodologies that minimise the generation of vibration
- Selection, where practicable, of plant/machinery to minimise low frequency generation of vibration (e.g. selection of higher frequency generation of plant/machinery)
- During construction activities, ground vibration will be monitored at selected locations where there is the potential to impact local receptors
- Where plant and machinery may exceed limits during start-up i.e. Vibratory Roller, these items will have set designated areas and/or distances away from receptors where they can be turned on
- Where plant and machinery may exceed limits during operation i.e. Vibratory Roller, these items will have set designated distance off-sets from relevant boundaries
- All construction work will be carried out within the approved construction hours of 0700 to 1900 hours Monday to Saturday (except public holidays) unless approved in a separate Out of Hours CNVMP
- Construction Teams are to comply with the Community Engagement Plan
- All public complaints to be recorded and investigated. Where complaints relating to construction vibration are received, vibration monitoring will be undertaken to verify compliance with the specified limits.
- Awareness training and information will be provided to project personnel in relation to the vibration limits on the project and the need to minimise vibration during the works
- Environmental Toolboxes and pre-start briefings will be conducted, and work crews informed of the impacts of vibration generating plant/machinery
- Where possible works are to be scheduled in order to reduce the impact of intensive vibration generating activities on sensitive receivers
- Where structural vibration action targets are exceeded, the offending process will be reviewed, and alternative equipment or methodology will be evaluated
- Plant and equipment will be located away from vibration sensitive areas where possible
- Where practicable, on-site generators and auxiliary power sources used during construction should be positioned among/behind existing buildings to buffer vibration

8.2.2.4 Vibration Monitoring

Vibration trials of specific plant and machinery may be conducted prior to vibration-intensive activities that may have an impact on receptors so to gauge potential setback distances or designated start-up locations.

8.2.3 Out of Hours Works

Construction outside of 0700 to 1900 hours Monday to Saturday (except public holidays) may be required from time to time to conduct particular scopes of work. These activities will be managed as out-of-hours works applications in accordance with Environmental Protection (Noise) Regulations 1997 WA for the approval of the local government authority, DWER and subsequently by the PTA's

Representative. An Out of Hours Noise and Vibration Plan application must be submitted to the LGA seven days prior to the works being proposed to be undertaken and must include the following:

- Reasons for the work to be completed out of hours
- Proposed noise and / or vibratory activities
- Predictions of noise levels from the site
- Predictions / assurance of vibration levels from site
- Proposed measures to control noise and vibration
- Monitoring of noise and vibration
- Notifications to residents and Stakeholders of upcoming out of hours work
- Complaint response procedures

8.2.3.1 Out of Hours Public Notification

As part of an Out-of-Hours works application the predictions of noise will provide an estimation of the potentially impacted premises. Occupants of nearby effected buildings likely to receive noise levels in excess of Assigned Noise Levels defined within Environmental Protection (Noise) Regulations 1997 (WA) must be advised (i.e. letter drop) at least 24 hours prior to work commencing. The notification must provide reasons to why the work is necessary, reference to the LGA approval and contact details to register complaints.

8.2.3.2 Target Exceedances and Complaints

Where noise or vibration targets are reached or a complaint regarding nuisance levels are received Evolve Bayswater will investigate the cause or potential source. The investigation may include the deployment of monitoring equipment to measure noise or vibration levels so to demonstrate compliance or alternatively the modification of the work methodology to reduce noise or vibration impacts. If noise or vibration levels are recorded in excess, the work must be modified to be conducted within allowable limits prior to continuing. Any recorded exceedances shall be provided to the PTA in the monthly environmental report.

8.3 Construction Water

Identifying suitable sources of water for construction activities is critical to the success of the project. Construction water will be used for ground treatment and dust suppression activities throughout the project duration.

Construction water sources comprise scheme water, surface water and the underlying aquifers. However, it is noted that construction water must be obtained from sources other than Water Corporation, existing wetlands and/or the Swan River. Therefore, existing water sources will be explored for potential construction water sources including local irrigation services sourced from existing groundwater bores targeting the relevant Superficial Aquifers.

If all options have been explored and determined to unviable then scheme water would have to be considered.

Installation new groundwater bores will be explored however will be an unlikely solution due to the characteristics of the site.

8.4 Site Reinstatement

The project is not intended to be decommissioned; however, areas that do not provide permanent infrastructure will be landscaped and rehabilitated to a similar or improved condition prior to works having been conducted.

Trees that are to be afforded protection as per the tree management report (as required by the DA) shall be surveyed and protected was per the following;

- Provide a 2m radius tree protection zone (TPZ) through 1.8m high fencing.
- Fencing is not to be moved or removed at any period.
- Signage notifying people of the TPZ and other requirements placed on each side of the fencing.
- Any roots identified to be pruned should be pruned with a final cut to be undamaged wood outside of the TPZ. Pruning cuts should be made with sharp tools such as secateurs, pruners, handsaws or chainsaws. Pruning wounds should not be treated with dressings or paints. It is not acceptable for roots to be pruned with machinery such as backhoes or excavators;
- Any trees removed or significantly damaged as a result of this application should be replaced;
- All retained street tree(s) within the development site shall have measures consistent with AS 4970-2009 undertaken to ensure their protection during construction of the subject development.

All land areas used for construction supporting activities (i.e. laydown, office) within the site shall be surveyed by the environmental team. The survey shall comprise vegetation and topsoil assessment and be mapped in accordance with the vegetation condition scale (Keighery 1994). The reinstatement shall match (as a minimum) the pre-construction classification.

Re-instatement of all land used to support construction activities outside of the site shall be subject to the obligations as specified by the landowner, and any applicable approval/licensing conditions or approving authorities.

The following requirements shall be considered:

- the existing ground should be reinstated to meet the requirements of the pre-construction or future land-use (as approved), followed by placement of topsoil and revegetated as soon as possible, dependent on season.
- the site will be revegetated, to match pre-existing vegetation types, and percentage of ground covered by vegetation. Vegetation types shall be consistent with the neighbouring land-use.
- rehabilitation shall be monitored against the site's nominated success criteria
- consider the need for ongoing rehabilitation maintenance activities such as weed control and fencing
- prepare documentation to hand the site back to the relevant landowner.

Any adjacent areas that have been damaged during construction activities will be repaired and/or reinstated to at least equivalent to the existing prior to the works unless otherwise stated. Reinstatement works may include the careful removal of redundant pavements, paths, foundations, embankments and furniture including backfill with appropriate material and reinstatement of disturbed or damaged pavements or surfaces.

8.5 Storage of Materials

Materials will be handled and stored onsite to protect them from damage, degradation, loss, theft, vandalism and corrosion where applicable.

- Design to consider requirements for delivery and storage as well as durability requirements.
- Secure location identified onsite for storage of materials protected from site works and movements.
- Protection in place to prevent unauthorised access including secure fencing and security.
- Materials to be handled and stored in accordance with manufacturers recommendations and product MDS.
- Supplier packaging to remain in place until required to be removed for installation or operation, whichever the latest.

- Final clean to be conducted to remove any foreign material and dirt to prevent degradation and corrosion.

Further to the above refer to the Quality Plan, Procurement and Participation Plan, Design and Engineering Management Plan and Durability Plan.

8.6 Existing Ground

During performance of the Works, the Alliance will log, sample for testing, and classify the excavated ground materials in accordance with AS 1726:2017 for the purposes of:

- Materials re-use suitability;
- Identification of Project risks;
- Assessment for contamination; and
- Verification of design assumptions.

The Alliance will also update the existing geotechnical longitudinal sections based on the actual materials encountered during the performance of the Works. As a minimum, these updated longitudinal geotechnical sections must be prepared to the same level of detail as the existing geotechnical longitudinal sections; and be provided to the PTA in Adobe PDF, AutoCAD, and AGS4 (for geotechnical data) digital media formats.

9.0 Quality Assurance

The Evolve Bayswater Quality Plan (BST-EVO-QA-PLN-00004) (QP) defines the practices, resources, authorities and underpinning activities that will be undertaken by Evolve Bayswater to provide assurance that all works shall be managed and controlled in a manner to meet the requirements of the SWTC including the design, durability and technical specification. Evolve Bayswater Quality Plan contains references to how the following will be addressed and managed:

- Quality of Materials and Workmanship
- Verification documentation required including ITPs and checklists which confirm quality of workmanship where workmanship can affect compliance, warranties, fitness for purpose or operations.
- Details of hold and witness points to be addressed during construction progression
- Construction Records/As-Constructed documentation
- Close out requirements for established lots
- Design Changes and Non-Conformances during construction
- Management of defects
- Monitoring during the Non-conformance Correction Period
- Record of any other monitoring or Testing undertaken
- Maintenance by Others during Non-conformance Correction Period
- Documents and Records Management

Refer to the QP for more detail on the above.

Furthermore, for the construction, the purpose of the QP is to describe how Evolve Bayswater will manage, control and verify the Quality Control (QC) aspects associated with the project through this phase.

This Alliance QP has been established to:

- Define elements of Evolve Bayswater's Quality Management System (QMS) that are applicable for the Project and how they are to be applied.
- Assist the project management team in understanding their operational and project responsibilities.

- Identify, measure, control and address all project Quality Assurance (QA) and QC requirements, including preventative measures for potential non-conformities.
- Continually review the effectiveness of controls and take appropriate measures to deliver a successful project.
- Define the management practices that will be implemented to ensure that the scope of work is executed in accordance with its contractual requirements and obligations.
- Provide confirmation of the roles and responsibilities of relevant parties in the project's structure.
- Agree processes for management of change, problems, issues and incidents that emerge during the project.
- Provide a comprehensive overview of quality methodologies and standards to be adopted in managing the project.

All equipment and materials will be handled and stored appropriately to ensure no damage or degradation occurs, and all equipment and materials must be protected from damage that could be caused by animals or acts of vandalism.

Assets will be protected through design and installation from corrosion.

Assets will be fitted in a manner to meet OS&H, human factor standards, aesthetics and maintainability requirements.

Procurement processes and on-site measures as detailed in the QP will ensure that no NCBPs are incorporated into the Works or utilised during the Temporary Works. As well as identify procurement processes and on-site measures to ensure that no NCPs are incorporated into the Works.

10.0 Design

The construction team will support the design team to deliver the requirements of the Design and Engineering Management Plan (BST-EVO-EA-PLN-00004) (DEMP). The construction team consists of but is not limited to:

- Participation in technical design meetings to provide a constructability perspective on the solutions being developed
- Provide assessment of proposed design solution changes including the impacts of those changes
- Participation in design reviews at the design review gates as stipulated in the DEMP
- Update design team on progress onsite and highlight areas where engineer inspections are required

11.0 Survey

Evolve Bayswater is responsible for any survey work necessary to design and construct the Works. This work shall include:

- Digital ground survey and production of DTM of the area of to be affected by the Works for final design
- Establishment of survey control network as the basis of the digital ground survey and the setting out and compliance checking of the Works. Reference marks will be established and submitted in accordance with PTA and Main Roads Mapping Standards:
    - PTA technical procedure 5610-350-001.0 – Rail Reference Marks
    - MRWA technical standard 67-08-35 – Standard Survey Mark Control
    - MRWA technical standard 67-08-36 – Road Reference Marks
    - MRWA technical standard 67-08-37 – Minor Control Points
    - MRWA technical standard 67-08-38 – Differential Levelling

    - Quality Statements will be supplied in accordance with Main Roads Guideline Document No. D12#434784 Metadata Requirements for all survey data
- A detailed digital ground survey (DGS) will be completed as per PTA (New MetroRail) Technical Procedure 5610-350-002.0 Digital Ground Survey and Main Roads Survey and Mapping Standard 67-08-43 Digital Ground Survey
- Setting out the works
- Monitoring and quality control during construction
- Establishment of track survey monuments including those for OLE mast monitoring. The Geotechnical Plan (BST-EVO-GE-PLN-00002) provides more information including for settlement monitoring.
- Construction audit surveys
- Integration of all survey information into the BIM model (where applicable)
- As constructed surveys and drawings of all completed work will be submitted to the PTA's Representative prior to Practical Completion
- Settlement monitoring of all existing bridge and tunnel structures in the project area will be undertaken MRWA technical standard 67-08-108 Settlement Monitoring

The BIM will be progressively updated to the As-Built condition during construction phase to enable monitoring of the program during project activities and managed in accordance with the Digital Engineering Management Plan (BST-EVO-IM-PLN-00002) (DEMP).

11.1 Coordinates and Datum

- All survey work is to be connected to the Geocentric Datum of Australia (GDA2020) and the Australian Height Datum (AHD)
- All design and survey plan coordinates must refer to the Perth Coastal Grid 2020 (PCG2020)

11.2 Personnel

All survey personnel engaged on the project must satisfy the following criteria:

- Licensed Surveyors must have a current practicing certificate as issued by the Land Surveyors Licensing Board of Western Australia
- Engineering Surveyors must be eligible for accreditation to the certification level of "Engineering Survey Professional – Asia Pacific" as defined by the SSSI

11.3 Existing survey and Mapping Data

The survey and mapping data supplied for this Project is a collection of data from various sources over a period of time, with varying accuracy. Evolve Bayswater have analysed this data for its accuracy and completeness and will undertake additional surveys and assessments to facilitate detailed design such as the area to the east of the proposed platforms location.

11.4 Protection of Survey Control

- All existing survey marks within the project zone must be protected until the Non-conformance Correction Period. This includes cadastral survey marks defining property boundaries, rail reference marks, RRMs, SSMs, BMs and permanent survey marks.
- Reinstatement of damaged or disturbed marks will be at the cost of Evolve Bayswater
- Re-establishing cadastral marks will be in accordance with applicable acts and regulations, all re-establishment surveys must be carried out by a Licensed Surveyor with a current practicing certificate, and a "Regulation 25A Certificate" provided to the PTA's representative in accordance with the regulation
- Re-establishment of RRMs will be undertaken in accordance with MRWA Standard 67-08-36 Road Reference Marks

- SSMs and BMs will be relocated or replaced through Landgate
- Prior to any disturbance to the primary control marks, RRMs, SSMs and BMs the Evolve Bayswater will notify the PTA's Representative

12.0 Organisational Structure

Evolve Bayswater has developed the following governance structure, resulting in four individual Area Managers supporting the Construction Manager and responsible for the construction delivery of Civil and Earthworks, Structures, Station Building and Rail Infrastructure and Systems. The Construction Manager is a member of the Alliance Management Team, reporting directly to the Alliance Manager.

The governance structure for Construction is shown below in Figure 12.1: Governance Structure as it sits underneath the Construction Manager. A detailed Organisation Chart detailing how the Construction team relates to the wider project team is located in the Alliance Management Plan BST-EVO-PM-PLN-00004.

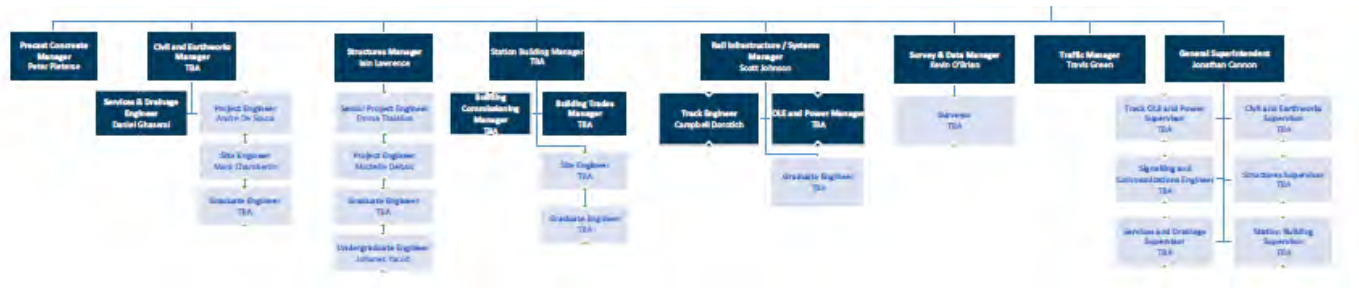


Figure 12.1: Governance Structure

Evolve Bayswater will employ construction engineers and supervisors that are skilled in the construction techniques that will be used in the work. This includes the necessity to be able to control and manage all Works that are subcontracted to specialist organisations.

12.1 Roles and Responsibilities

Management responsibilities for the construction roles are detailed in position descriptions and the Delegation of Authority Matrix. Key construction management responsibilities include achieving safety, cost, program, quality, environmental/sustainability, traffic and pedestrian management, interface coordination, stakeholder and community management, rail planning and access, commissioning and completion performance objectives. Key Construction Team Roles and Responsibilities are outlined in Table 12.1 below.

Role	Responsibility
Alliance Manager	Oversee construction of the project in accordance with the Alliance Way We Work, Project Objectives and project requirements. Lead, direct and coordinate the operation of the entire construction team.
Construction Manager	Plan, manage and provide direction across the project to effectively co-ordinate the design, procurement, fabrication building of all construction activities.
Area Managers	Plan, manage and provide direction within a work area to effectively co-ordinate the design, procurement and fabrication of construction activities including civil, structural, building, urban design, landscaping, Comms and Stakeholder, traffic management, track modifications, overhead line works, signalling and power upgrade.

Senior Project Engineer	Plan, manage and coordinate within a specific area or discipline to effectively co-ordinate the design, procurement and construction elements of an area / work activities. Develop relevant construction methodologies including verification of changes to construction methods and coordination of the Works including programming, plant, equipment, labour, materials and subcontractor management (as applicable).
Project Engineer	Plan, manage and coordinate on-site engineering support to assist in the delivery of the work activities. Ensure that works are being performed in accordance with work packs including to quality requirements.
Site Engineer (Graduate and Undergraduate)	Provide on-site engineering support to assist in the delivery of the work activities. Ensure that works are being performed in accordance with work pack
General Superintendent	Plan, manage and coordinate the availability, allocation and efficient utilisation of resources (plant, labour and materials) onsite. Ensure that works are being performed in accordance with work pack.
Supervisor	Coordinate all day-to-day activities in a specific area or in a specific discipline through management of leading hands, direct report site employees, plant resources and subcontractor teams.

Table 12.1: Roles and Responsibilities

Further definition of Responsibilities for team members are detailed in the area specific management plan.

13.0 Resources

13.1 Labour

Evolve Bayswater has a duty as an employer under Section 19 of the Occupational Safety and Health Act 1984 to provide information, instruction, training and supervision for employees to enable them to perform their work in such a manner that they are not exposed to hazards.

In addition, Section 117 of the Rail Safety National Law (WA) Act 2015 requires an RTO to ensure that each Rail Safety Worker is accredited and has the competency to carry out that work.

The Project will undertake a Training Needs Analysis in reference against the Project Scope of Works and in accordance with PTA's site requirements. A Project specific Training Management Plan BST-EVO-PM-PLN-00007 will be used to detail the training required.

The primary Evolve Bayswater reference for training management is the Training Management Plan. The People and Culture Manager, in conjunction with the relevant discipline manager will determine minimum competency requirements for staff appointed to key project positions. Potential sub-contractors and suppliers will be assessed on their ability to supply personnel with the competencies required to complete the activity or task.

Where training is project specific, or there is an identified skills gap that cannot be easily filled by procurement, the People and Culture Manager will coordinate the delivery of training to meet the competency requirement for the Project. Any training provided by Evolve Bayswater will be on a needs basis, and (apart from trainees and trade apprentices) will generally be restricted to:

- Construction Industry general WHS induction (White Card)
- Evolve Bayswater project and site inductions
- Third party inductions, if required
- Rail Safety Awareness
- Risk Management

- Other specialist skills training as necessary

Rail Safety Awareness training will be delivered to workers, including sub-contractors and suppliers who will be required to work within a rail reserve or construction zone where track has been laid. Personnel will not be granted an Exemption Certificate or be covered by a General Exemption authorised by the accredited RTO.

Rail Safety Awareness training will be delivered by a RTO, approved by PTA to achieve the competency standards required by PTA as appropriate.

Where Rail Safety Awareness training is provided directly by a sub-contractor or supplier, the People and Culture Manager is responsible for sighting evidence and recording the individual competency level achieved before the worker can work within a rail reserve or construction zone where track has been laid.

13.2 Plant and Equipment

13.2.1 Certification of Road/Rail Vehicles

Evolve Bayswater including partnering subcontractors will operate track machines, rail plant, and hi-rail vehicles on rails (collectively termed as rolling stock) for construction and commissioning of the Bayswater Turnback and the south platform of the Bayswater Station. Evolve Bayswater shall ensure that all rolling stock shall be compliant with the PTA's certification requirements for road-rail vehicles, as detailed in Certification Requirements of Hi Rail Vehicles and 8110-400-029 "Applying For Access to the PTA Operating Railway Reserve and PTA Certification of Road Rail Vehicles Parts 1, 2 and 3".

Evolve Bayswater will submit the technical details of all rolling stock to PTA as appropriate for certification in accordance with the PTA registration and certification procedures and comply with the safe working rules and procedures for the operation of rolling stock on the applicable railway network. Certification of all rolling stock shall occur prior to operation on the PTA network the certification shall be on accordance with:

- Part 1 – Overview and Engineering Assessment (PTA Doc No. 4010-100- 101)
- Part 2 – Interface and Technical Requirements (PTA Doc No. 4010-100-103)
- Part 3 – Vehicle Information and Test Results (PTA Doc No. 4010-100-102)
- Section 5 – Safety Instructions for the Electrified Area (PTA Doc No. 8110- 800-016)

Prior to rolling stock operating within the electrified area of the PTA rail network, all rolling stock shall be presented for inspection and certification by a nominated PTA representative.

Rolling stock operators will be required to hold current rolling stock operator training and competency approved by PTA as appropriate.

The Rail Safety Manager is responsible for managing and recording the certification for all rolling stock operated by Evolve Bayswater or its sub-contractors / suppliers.

Track machines and rail plant will be stabled in a suitable location as agreed with the PTA as appropriate before the rolling stock is allowed on site. Notwithstanding, rolling stock that is operating on disconnected sections of track under the project Construction Rule Book may be stabled in situ if approved by the RTO / Controlling Authority.

13.2.2 Operation of Construction Plant and Equipment

All Plant and Equipment required for the completion of the works shall be operated in accordance the minimum requirements for the safe operation of plant, mobile equipment and light vehicles as detailed in the SMP and in particular HSE-OMR-002 – Plant, Traffic and People. The minimum requirements aim to:

- To ensure all persons directly responsible for the operation of plant are aware of the associated hazards
- To demonstrate that residual risks are tolerable and are reduced to ALARP
- To formally record the actions taken to identify and control hazards associated with the operation of plant
- To identify requirements of Plant Registration requirements
- To defines monitoring requirements
- Regulatory Compliance
- Maintenance Records
- Plant Operation Risk Management

13.2.3 Plant and Equipment Pre-mobilisation Inspections

In keeping with Operational and Environmental requirements, all Plant and Equipment mobilised to the Project shall be required to undergo Pre-Mobilisation Inspections. The Project Plant and Equipment management team shall be responsible to collate all inspections records and ensure compliance with Project requirements. The Pre- Mobilisation shall consist of:

- Mechanical Inspection
- Weed and Seed Inspection
- Compliance with Regulatory requirements

Plant and equipment mobilisation will be managed through Lucidity as detailed in the SMP in particular IMS-PRO-016 Plant and Equipment.

13.2.4 Plant and Equipment Service and Maintenance

The scale of the work for the project and the related plant and equipment is such that a permanent workshop is not required to be based onsite.

Minor services or repairs will be completed at a designated location onsite by qualified personnel who are mobilised to site for this specific purpose. For a major service or repairs shall be mobilised off site for repairs or services at the responsible vendors' nominated location.

A Minor Repair shall be defined as actual or anticipated component or item failure in areas that are not in major oil containing compartments or preventative maintenance. A Major Repair shall be defined as actual or anticipated component failure in a major oil-containing compartment of the plant. These include:

- Main Engines
- Transmissions
- Differentials/Final Drives
- Implement Pumps

Tyre fitting of large plant and equipment shall also be conducted within the works by a specialist contractor.

Due to the volume of plant required to complete the works, Evolve Bayswater shall have specialist service truck for refuelling and servicing requirements (lubrication) visit site on an as needs basis.

General Superintendent, Supervisors or operators will inspect the plant to determine the type of repair required prior to commencing repairs.

13.2.5 Operation of Vehicles

Evolve Bayswater shall comply with Part 3 of the Road Traffic (Vehicle Standards) Regulations 2002 (WA) when operating vehicles on public roads travelling to and around the construction site.

Evolve Bayswater must operate vehicles with total or axle mass in excess of these limits within the Construction Site, subject to the following conditions:

- the operation of vehicles with excess mass will not be permitted on partially or fully completed pavement work, service pits, drainage or structures
- the operation of vehicles with excess mass must be limited to vehicles which have been loaded within the Construction Site only and be limited to manufacturer's specifications. Operation in excess of manufacturer's specifications is not permitted.
- all on track road-rail vehicles shall be presented for inspection and certification by a nominated representative of the PTA before they can be used within the electrified area
- on track road-rail vehicles shall only be used within the electrified area once the line has been de-energised and in accordance with the Network Rules 2000 and the appendix to the Network Rules

13.2.5.1 Keeping pedestrians and Vehicles Apart

Evolve Bayswater will implement the following control measures to keep pedestrians and vehicles apart at the construction workplace and when vehicles enter or exit the workplace:

- Providing separate traffic routes for pedestrians and vehicles, where possible
- Providing separate clearly marked pedestrian walkways that take a direct route
- Creating pedestrian's exclusion zones where powered mobile plant is operating
- Providing clearly signed and lit crossing points where walkways cross roadways, so drivers and pedestrians can see each other clearly
- Scheduling work so vehicles, powered mobile plant and pedestrians are not in the area at the same time
- Where required install delineation between pedestrians and vehicles with type to be determined based on a risk assessment completed with each situation. Delineation include but not limited to flagging, windrows, crowd control fencing, temporary fencing, concrete barriers etc.

A site layout plan will be developed and maintained to detail the above controls as they appear onsite. This will be shared with the wider project team via prestart briefings and on site noticeboard plus other forms of communication.

13.2.5.2 Minimise Vehicle Movements

Planning can help minimise vehicle movements around a workplace. To limit the number of vehicles, Evolve Bayswater will:

- Planning storage areas so delivery vehicles do not have to cross the site
- Provide alternative and encourage alternative methods for construction workers to attend site
- Controlling entry to the work area e.g. by using boom gates
- Scheduling work to minimise the number of vehicles operating in the same area at the same time

13.2.5.3 Reversing Vehicles

Where possible, Evolve Bayswater will avoid the need for vehicles to reverse as this is a common cause of plant interaction incidents.

One-way road systems and turning circles can minimise, especially in storage areas. Where this is not possible other control measures should be including:

- Using mirrors, reversing warning alarms, sensors and cameras
- Ensuring a spotter wearing high visibility clothing assists the driver who cannot see clearly behind their vehicle – the driver should always be able to see the spotter

- Ensuring workers and other people are familiar with reversing areas and these areas are clearly marked
- Ensuring plant operators are aware of workers who may be in the vicinity of the swing radius, articulation points and overhead load movement of their vehicle

Signs will be used to alert workers and to potential hazards from vehicles entering and exiting the construction workplace; and other requirements like pedestrian exclusion zones.

Traffic routes should be clearly signed to indicate restricted parking, visitor parking, headroom, speed limits, vehicle movement, key site areas and other hazards. Standard road signs should be used where possible and speed limits will be implemented and enforced.

13.3 Subcontractors

Evolve Bayswater will engage subcontractors, suppliers and consultants to deliver or assist in delivering portions of the works in accordance with IMS-PRO-010 Contractor and Supplier Management. The construction management team will engage with the subcontractors, suppliers and consultants with the same requirements as the project's management plans. The same standards set for direct labour will be applied to all that are engaged in the project.

13.3.1 Subcontractor Interface Management

As there will be numerous subcontractors onsite, management of subcontractor interface will be crucial for productivity and safety onsite. The interfaces will be managed by:

- Planning before commencement of construction including 4d modelling
- Kick off and ongoing formal regular meetings with individual subcontractors to identify requirements for and constraints from other subcontractors.
- Prestart meetings on a daily basis where interfaces with all Subcontractors are identified and details of management discussed
- Day to day informal discussions amongst supervisors as required

The General Superintendent will have ultimate responsibility of management of interface and will provide direction in times of competing requirements.

14.0 Digital Engineering Management

The requirements of Project Information Model development and delivery during the construction and practical completion phase of the project are addressed under the Digital Engineering Management Plan BST-EVO-IM-PLN-00002. An "as-constructed" PIM record model shall be developed as part of compliance with acceptance of EIS. At project handover, this PIM shall be coordinated and developed further to form an Asset Information Model tied in with PTA's FM network to comply with PTA's Asset Information Handover Procedures.

15.0 Community Engagement

The Community Engagement Plan (BST-EVO-SM-PLN-00003) and Stakeholder Interface Management Plan (BST-EVO-SM-PLN-00004) outlines Evolve Bayswater's approach to community and stakeholder engagement.

15.1 Stakeholder and Community Management

15.1.1 PTA Metropolitan Rail Network

Evolve Bayswater plan on zero planned disruptions to the normal operation of the metropolitan rail network including unplanned disruptions by passengers to the station. This Construction Plan, along with other Management Plans detail how this will be achieved.

In summary unplanned disruptions will be managed by:

- Completing risk assessments for all critical works activities to identify those that have the potential to impact the rail network.
- Identify and implement controls to mitigate the risk of impact on the rail network.
- If required complete Rail Safe working Sub-Plan to the SMP for the approval of the PTA
- Liaise and consult with PTA representatives and other stakeholders to confirm plans are suitable.
- Create Work Plans to ensure required information is with those that are completing the works.
- Continual oversight, review and audit of onsite activities to ensure work is being completed in accordance with the Work Plans and that no new risks eventuate that have not been previously identified.

15.1.2 Paths

Existing paths will be maintained for as long as possible during the construction phase. When required temporary Principal shared paths will have a bituminous or smooth concrete surface at least 2.0m wide with no loose material and have at least 0.3m clearance to any obstacles including fences. Temporary lighting will be provided where lighting is diminished by Evolve Bayswater's work. Any temporary fences or screens beside shared paths will be designed and hence adequately restrained against overturning and deflection from wind.

Further on in this Construction plan details on management of pedestrians, specifically the temporary realignment of the Principal Share Path and maintaining pedestrian access to the existing station will be detailed.

15.1.3 Overhead Clearances

A height clearance of no less than 5.3m will be maintained on all roads open to traffic unless effective advance warning devices are provided in which case the height clearance will be no less than 4.9m. Advanced waning will remain in place for the existing rail bridge until it is removed from service in Stage 2 of the Station erection.

15.1.4 Security of Adjacent Properties

Security of all properties affected by all Works will be maintained at all times to a standard equivalent to that which currently exists.

As outlined in the Community Engagement Plan, Evolve Bayswater's communications representative will provide information to the PTA's Project Communications Manager a minimum of 10-days prior to any potential disruptive activity occurring.

Evolve Bayswater's Community and Stakeholder Engagement Team will prepare specific communication action plans for issues, disruptions and milestones that will be anticipated for use throughout the project. These communications action plans will be developed to manage:

- Major shutdowns
- Disruptions / disturbances – access to property, machinery noise, vibration, dust, visual or pollution, potential property damage

- Road closures, cycle path closures
- Works to be undertaken outside of normal hours (Monday to Saturday 7am to 7pm excluding public holidays)
- Service and passenger disruptions on the Transperth Network

Any project activities that will occur outside of normal hours (Monday to Saturday 7:00am to 7:00pm) will be communicated to the local community. Evolve Bayswater will develop the communication, and once the material has been approved by the PTA's Project Communications Manager, distribute it. Written notices will include, as a minimum:

- A description of relevant works
- The dates, times and durations of the relevant disruptions
- The expected impact of the works on private property or access
- Alternative access arrangements
- Project contact details including a manned out-of-hours mobile number located on-site, the METRONET telephone information line, social media accounts, and website

15.1.5 Time Lapse Cameras

Evolve Bayswater will supply, install, test, commission and maintain a system of 6 no. time lapse cameras for the Bayswater Station and Turnback project.

The time lapse cameras will be;

- DSLR 24 megapixel digital camera producing high resolution images of 10 megapixels or greater.
- Complete with licensed software
- In continuous operation prior to any site clearing or demolition through to project completion
- Remotely operated with provision of hardware, fabrication, installation and utility service connection
- Solar powered and shall be completely autonomous with minimal site servicing required during the initial set-up time
- Have ability to stream live to a website where
    - high resolution photos can be reviewed a few minutes after the photo is taken
    - accessible by web browser and FTP server, or similar
    - access is provided to PTA's Representative in both native and screen optimised versions of all cameras
    - capable of playing a slideshow covering a period of time definable by the user
- Installed in weatherproof housing rated to IP65 with sun visor
- Be attached to a pole or a fixed structure on site
- Take photos every 15minutes starting at 7am and ending at 7pm with the ability to increase to every 1min if requested by PTA Representative.
- Capable of taking phots at night
- Located in fixed positions on the construction site as nominated by PTA which provide adequate coverage of the construction site for the entire duration of the project
- Compliant with Australian Standards, specifications, legislation, codes and guidelines
- produce photos that are;
    - high quality
    - accessible in native and screen optimised
    - showing all public areas in focus
    - date and time stamped on image and via file name convention

The photographic material remains the property of the PTA and is unable to be reused unless permission is granted by the PTA.

If the camera is to be fixed on land and/or to an asset that is not owned by PTA then Evolve Bayswater will:

- obtain the permission of the relevant land/Asset owner prior to installation
- supply attachment hardware that does not require any permanent deformation (e.g. drilling) to the Asset
- provide PTA with drawings that fully and accurately describe the constructed and installed equipment.
- make all reasonable efforts to avoid views into private areas, such as parts of residential properties where residents would reasonably expect private activities to occur
- provide a sample photograph taken from each camera to PTA's Representative for approval prior to the Commissioning and operation of each respective camera.
- ensure all mounting arrangements take into account the required stability and rigidity and must ensure that stable images are provided for typical weather conditions, air turbulence and structural vibration from work and passing vehicles.

Immediately prior to and as a condition of achieving Practical Completion Evolve Bayswater will remove all traces of time lapse camera system. Evolve Bayswater will also package and handover all photos in the PTA required format.

15.2 Interface Management

The Project includes parallel path activities, multiple stakeholders, modifications to key infrastructure and critical tasks both on the project and with adjacent projects. Consequently, there will be a need to ensure that all interfaces and overlaps are identified, any risks are mitigated and responsibilities, along with authorities, are adequately defined. This will ensure that all work items progress in a timely, efficient manner. The interface focus aims are:

- To ensure the earliest possible identification of all Project internal and external interfaces
- To ensure that all parties to each interface agree how and when it will be successfully closed
- To monitor the status of interfaces, facilitate their closure and ensure that successful resolution is agreed and documented
- To ensure that adequate and appropriate communication is taking place
- To act as an escalation route for issues related to interface closure and ensure resolution of same

Internal interface issues will be resolved at the lowest possible level to minimise bottlenecks. It is anticipated that each involved party will assign an interface co-ordinator who will be the single point of contact for their designated area of responsibility.

The external interface with stakeholders and projects such as FAL and RSR project will be resolved by the Project Management team as appropriate.

Escalation protocols and procedures will be developed and agreed between Evolve Bayswater and PTA, with pathways detailed as appropriate. Similar pathways will be clarified with external parties and included in the sub-contract and purchase management suite of procedures.

Stakeholders such as those mentioned above and others such as MRWA, utilities and service owners and City of Bayswater will be managed by the Stakeholder Interface Management Plan (BST-EVO-SM-PLN-00004) (SIMP). The SIMP contains the details of how the interfaces with these stakeholders are managed (i.e. regular meetings) and documented (i.e. Stakeholder Interface Register).

15.2.1 Disruption to Perth's Public Transport Network

Evolve Bayswater will ensure that bus services continue to operate during construction. The frequency, routing, and the functionality of existing public transport infrastructure affected by the

Works will be maintained or replicated during the delivery of the works unless otherwise agreed with Transperth.

Evolve Bayswater understands the importance of route 999 and 998 to the Transperth Network with all efforts made to maintain the current level of service is maintained and the expectations of the passengers are met.

Evolve Bayswater will coordinate with Transperth in relation to the arrangement of replacement services in the event that the works require planned route closures such as the erection of new bridge beams over King William St and the demolition of the existing rail bridge. Full closure of roads or detours during construction affecting scheduled bus services will be avoided where possible.

Where road closures or detours are required, they will be minimised and localised to preserve route integrity and excessive variance to travel times. Any proposed road changes, route alterations and temporary bus stops will be agreed with Transperth prior to the commencement of the relevant works.

Evolve Bayswater will ensure that bus stops impacted by the Works such as those located on King William Street will be replicated to provide capacity, accessibility and functionality to support patronage levels and pedestrian movements forecast for the delivery the works, and that any temporary bus infrastructure remains operable and maintainable over its Lifecycle.

Evolve Bayswater will ensure that rail services (metropolitan, regional and interstate passenger) continue to operate during construction. The frequency and the functionality of existing rail infrastructure affected by the works will be maintained or replicated during the delivery of the works unless otherwise agreed with the PTA.

Evolve Bayswater will coordinate with the PTA in the event that traffic management will require planned cancellations or line closures.

15.2.2 Adjacent Property access

Evolve Bayswater shall ensure that access to adjacent properties is not unreasonably impeded. Existing line of sight access will be maintained 24 hours per day.

Detail regarding the adjacent property access will be included within the Traffic and Transport Management Plan (BST-EVO-TM-PLN-00002) (TTMP). The specific Traffic Control Plans (TCP) will include the Traffic Guidance Schemes (TGS) to ensure construction activities impacting on access routes are managed and appropriate traffic control measures are implemented to ensure no physical barriers are blocking access to roads that lead to adjacent properties. Approved TCP's will become part for the overarching TTMP and added as an appendix as the approvals are completed.

Local residents and stakeholders to be engaged and consulted in accordance with the Stakeholder Interface Management Plan (BST-EVO-SM-PLN-00004) (SIMP) to ensure consideration is given to their access requirements for the duration of the works.

The Alliance shall ensure that there are no unplanned access disruptions to individual owners/occupiers and appropriate notification and consent shall be provided prior to any works commencing that could impact upon the level of amenity of adjacent properties.

Specifically, Department of Communities property access will be maintained throughout the completion of the second stage of bridge construction activities.

15.2.3 Advertising and site Signs

Evolve Bayswater will erect 7 no. project signs prior to the commencement of the works which comply with the PTA Project signs requirements at locations approved by the PTA's Representative. The sign will include:

- Alliance name
- Major Subcontractors and Consultants name

- Other details as required by the PTA Representative
- Site access requirements

If the above does not fit on a single sign then multiple signs will be erected.

The signs will be maintained in good condition until their removal 3 months after Practical Completion.

No further advertising will be permitted by Evolve Bayswater other than names of manufacturers or names of owners on items of construction plant.

The Construction Manager will be responsible for the implementation and policing of these requirements.

16.0 Services

16.1 General

Critical major services to avoid, protect or relocate during delivery of the project include the:

- ATCO and APA gas high pressures gas mains
- High Voltage transmission and distribution lines
- Water and Sewerage mains
- PTA Main Cable Route (MCR)
- Telstra and other communication lines
- Western Power for HV and LV transmission and distribution

In addition, new and upgraded utility connections are required for the rail station and carpark, railway communications and to supply lighting for the Principal Shared Path (PShP).

PTA will directly engage utility owners to relocate all services identified to require relocation prior to the commencement of the PAA with the exception of the Water Corporation assets and the PTA main conduit routes.

Evolve Bayswater will provide a Utilities and Services Team to:

- Ensure services that are remaining in place, both permanently and temporarily, are avoided and protected
- Provide effective management of service and utility relocations by Third Parties and Evolve Bayswater
- Construct the Water Corporation assets that require relocation or extension
- Engage asset owners and where required design and/or construct all new and upgraded utility connections for stations, traction power and other assets
- Design and construct any protection works for utilities and services not being relocated and any works required to protect railway infrastructure if services develop leaks in the future
- Remove or make safe by grouting redundant services in the Works area that have potential to impact on the Works under the Contract or existing assets
- If required engage asset owners and design and/or construct any additional services identified during the PAA that require relocation

16.2 Utilities and Services in the Rail Corridor Owners

A register of services in the Works area and corresponding drawings have been developed using the information drawings provided that includes:

- Service number
- Service type
- Service owner
- Likelihood of clash

- Potential scheduling impacts
- Need for asset or railway protection

A schedule of contacts will be developed to enable effective communication with asset owners during the relocation of services and when works are being undertaken when notice is required to be provided to the asset owner. The Schedule will contain:

- The name of the asset owner
- A contact person
- Contact Details

16.3 Avoiding and Protecting Utilities and Services Protection of Services and Utilities

16.3.1 Avoiding

Prior to any excavation works, a Dial Before You Dig (DBYD) shall be completed to assess the area for known services, followed by non-destructive potholing to positively identify service locations and depths in accordance with AS5488.1. Services will be marked with a post or similar demarcation. If any critical assets are identified, the necessary permits to work around them will be obtained prior to works. A spotter will be in place for all mechanical excavation works.

Excavations around assets will be limited as per asset owner recommendations and guidelines. If permits or approvals are required from the asset owner, these will be obtained prior to excavation around these services. HV/HP or other specialised spotters will be engaged while carrying out excavation works. Where applicable, exclusion zones will be demarcated to prevent breaching, and all personnel inductions will include information pertaining to asset exclusion zones.

16.3.2 Emergency Response

In the case of a service strike, the work area will be evacuated, and the relevant Supervisor and Project manager will immediately be notified, as well as all relevant Stakeholders (PTA/Asset owner). Following the incident, an investigation process as outlined in the Emergency Management Plan (BST-EVO-SA-PLN-00003) (EMP) shall be followed.

16.3.3 Dial Before You Dig

A Dial Before You Dig (DBYD) request will be submitted at the start of the project. The DBYD will be used in conjunction with other service investigation methods including GPR and potholing.

The asset owners have been notified that they are required to report any proposed service installations to the Services Manager during the project lifetime.

Proposed services will be checked prior to installation for clashes with the project works. The Services Manager will distribute the proposed service information to the relevant Evolve Bayswater personnel.

For services not shown on DBYD such as railway infrastructure in rail reserve information will be sort from the PTA. This information will be sourced prior to any works are set to commence. Once all information is consolidated a risk assessment will be completed to identify if any further controls are required to be implemented to protect the services in the rail reserves.

16.3.4 Locating Existing Utilities and Services

Notification of potholing activities will be carried out in line with the asset owner's specific recommendations as detailed in the "Approval to work near Service Assets" section below. Service locations will be performed by Approved Plant Location (APL) organisations.

Equipment used will include Ground Penetrating Radar (GPR), electronic cable locators. Vacuum and hand excavation equipment will be used for potholing to expose and measure the depth of a service. The vacuum equipment will be mounted on a light truck.

16.3.5 Standard of location

In accordance with AS5488.1, the quality level we have in the information related to buried services will be classed as follows:

- Level A: confirmed 3D survey following potholing
- Level B: confirmed 2D surface location via non-intrusive methods such as Ground Penetrating Radar and Metal Detection. (Indicative depth will also be marked when available)
- Level C: information available from service authorities via the DBYD service
- Level D: services which have not been documented but are thought to exist based on site observation or anecdotal evidence.

16.3.6 Frequency of Location Works

Services will generally be located 2 dimensionally on the surface (Level B) at 5m intervals and 3 dimensionally (Level A by potholing) every 20m or closer spacing at changes in direction or intersection with other services. It may be necessary to pothole high impact services, such as high pressure gas, at more frequent intervals.

Where services cannot be located, Evolve Bayswater will advise the asset owner and seek on site assistance to locate or confirm the abandonment of the un-located service.

16.3.7 Colour coding of Located Services

Evolve Bayswater will adopt the following colour codes for marking of services horizontally located on the surface of the ground with spray paint colour.

Service	Service Location Colour
Electric Power Distribution and Transmission	Safety Red
Gas Distribution and Transmission, Oil Product Distribution and Transmission; Dangerous Materials, Product Lines High Visibility	Safety Yellow
Telephone and Telegraph System; Cable Television	Alert Orange
Fibre Optics Communication Lines	Alert Orange
Water Systems; Slurry Pipelines	Safety Precaution Blue
Sanitary Sewer Systems	Safety Green
Reclaimed or Non-potable Water	Purple

Table 16.1: Utilities and Services Identification

16.3.8 Services Markers

Services located in 3 dimensions by potholing will have a 90mm PVC pipe inserted into the pothole. The bottom and top of the PVC pipe will be capped and the information about the service written inside the top cap. The PVC pipe will be cut such as the cap is level with the surrounding ground.

Where the pothole is situated in a footpath, a pipe will be installed with a cap no higher than the footpath surface. It will be surveyed as quickly as practicable following installation, then the footpath reinstated. At no time shall a pothole be left open and unprotected.

The naming system to be used for service identification has been developed in consultation with the APL's, the project survey team, and the project design and drafting team. The aim is for all parts of Evolve Bayswater to use a common nomenclature to reduce the chances of misinterpretation of data as it is potholed, surveyed, and then modelled.

New service locations will be recorded by the Project Surveyor using GPS equipment. This information will be uploaded to the BIM on a weekly basis (as minimum).

16.3.9 Development and Maintenance of BIM Model

The Evolve Bayswater services design team will develop a BIM model of all existing services based on the location and survey works being carried out throughout the project duration.

This model will be based in 12D with the string / layer conventions set out in the Design and Engineering Management Plan (BST-EVO-IM-PLN-00002).

The design team will then import the 12D information into a program called Navisworks Manager which will enable clash detection between various elements within the model. Where clashes are detected, the relevant service organisations will be consulted to determine a course of action to design around the clash.

The BIM model will be rendered in Navisworks Freedom and made available to the whole project team for use in construction planning and design coordination.

Through the life of the project, the BIM model will be maintained such that:

- When services are made redundant they are shown as either abandoned or removed
- When designs are completed they are shown on the model as designed
- When services are constructed they are shown as installed

It is important to note that as well as the services nominated by the service organisations, the BIM model will include information on all buried aspects of the project works, including but not limited to:

- Underground structures such as culverts and footings - Newly abandoned or redundant services
- Concrete encasements and sleeves

16.3.10 Approval to work near Service Assets

Evolve Bayswater is required to carry out a notification procedure to service providers along the project site when approaching their respective assets. This section outlines the requirements from those service providers and the manner in which Evolve Bayswater will submit an application.

16.3.10.1 Water Corporation

The Water Corporation require notification to work near their pipelines at least 5 working days before commencing work. All notifications must be made to a Technical Advisor and the contact number is 13 13 75. The Technical Adviser will determine whether a risk assessment is required before Works can commence.

Works conducted completely outside of the zones in the table below do not require a Water Corporation risk assessment.

Asset in the planned work area	Size	Contact Water Corporation if ground disturbing work involves
Water main – all materials	300 mm diameter or greater	working within 3 m of the pipe centreline, or crossing under or over a pipe
Water main - RC or AC	All sizes	working within 2 m of the pipe centreline, or crossing under or over a pipe
Sewerage pressure main	All sizes	working within 3 m of the pipe centreline, or crossing under or over a pipe
Drainage pressure main	All sizes	working within 3 m of the pipe centreline, or crossing under or over a pipe
Any pressure pipes	All sizes	working near key infrastructure such as railways, freeways, bridges or similar Extra caution required – be aware that damaged pressure pipes can undermine foundations and damage key infrastructure
For underground power installation: Gravity sewers, junctions and risers Drainage Pipes	All sizes	crossing within 1 m of a pipe wall, or excavating parallel within 0.5 m of a pipe wall Drainage pipe
All Assets	All sizes	For heavy vehicle crossings other than on established (i.e. permanent) roadways

Table 16.2: Water Corporation Notification Zones

16.3.10.2 ATCO Gas

ATCO Gas does not allow excavations within 15 metres of a high pressure gas main without prior approval from ATCO Gas Australia. In addition to the 15m requirement, an Approved Locator must be on site to attend and assess all works and activities within 5m of a high pressure gas main. In addition to the 15m and 5m requirements above, all digging within 1m of the high pressure gas main must be by hand until the gas main is visually located and confirmed. When working over High Pressure gas mains the location of the main must be pegged or suitably visually indicated.

16.3.10.3 Western Power

We must comply with the following document for notifications with Western Power.

http://www.westernpower.com.au/documents/applicationforms/work near overhead lines.pdf

We must comply with the following document for working distances for above and below ground power services.

http://www.westernpower.com.au/documents/workpowerlines/guidelinesexcavationworksnearwesternpowers.pdf

Evolve Bayswater must make contact with Western Powers' Customer Contact Centre on 13 10 87 where the risk assessment determines that the:

- Excavation work is within 3 metres of the electrical network and all or part of the electrical network is inside a collapsible area
- Plant or machinery may enter the Danger Zone when operated

In addition, for transmission conductors, Western Power does not allow personnel, plant and material to encroach within the 6m danger zone around overheads. If it is not possible to manage

the works to ensure no personnel, plant and material enters the 6m danger zone the Evolve Bayswater team must obtain an electrical permit from Western Power.

16.3.10.4 Telstra

Evolve Bayswater will contact Telstra before any site works begin to determine Telstra's requirements.

16.3.10.5 Optus

Evolve Bayswater will contact Optus before any site works begin to determine Optus' requirements.

16.3.10.6 Nextgen

Evolve Bayswater will contact Nextgen before any site works begin to determine Nextgen's requirements.

16.3.10.7 PTA

Evolve Bayswater will contact PTA before any site works begin to determine PTA's requirements. Further requirements as identified in the "Safe Working Rules and Procedures" section of the PTA main website shall be followed.

16.3.11 Embargos

Some asset owners impose embargos on working on or near their services at certain times. The standard embargo periods are generally Christmas / New Year and during special events. Other embargos may be imposed at short notice for other reasons, such as due to a failure somewhere remote from site which puts greater demand on the asset in the Evolve Bayswater work area.

The embargos are to be observed during this project. Controls and Permits

Evolve Bayswater will implement a detailed permit system for the project. For works regarding services, typically these include:

- Track Access Permit
- Permit to Dig
- Confined Space Permit
- Hot Work Permit
- Vicinity Permit

16.4 Effective Management of Service and Utility Relocations

Evolve Bayswater will effectively manage service and utility relocations, including Third Parties by:

- Make contact with the requesting organisation
- Confirmation of works with the organisation – on site meeting if required
- Detailed design information, or survey of proposed works to be provided by the requesting organisation
- Confirmation that the requested works will not adversely impact the Evolve Bayswater works
- Instruction to the requesting authority that the works may go ahead and any conditions which may apply
- Advice to PTA that the notice has been managed, and a copy of the Evolve Bayswater response sent to PTA representative for receipt of these notices

Evolve Bayswater will work closely with the utilities to:

- Identify existing assets through detailed investigation and survey
- Create a BIM model with data collected
- Determine in conjunction with asset owners if the asset may be abandoned, requires relocation or can be protected and left in place.
- Design coordination by asset owners and Evolve Bayswater
- Develop a scope of works to protect and relocate existing services to enable roadwork to proceed without delay
- Develop a seamless relocation process and schedule to allow the existing services to be relocated to a new corridor
- Coordinate the relocation of Services by considering
    - Staging
    - Traffic conflicts
    - Coordinate Track operations
    - Abandoned Services
    - Track occupations and available windows

17.0 Bayswater Station & Precinct Construction Methodology

17.1 Site Establishment

17.1.1 Typical Site Establishment

The Bayswater Station and Precinct sites will be established in accordance with the requirements of the SWTC and this plan. The works will be completed in two main stages, construction of the new station and precinct south and then north of the existing station and track formation. The following figures show details of the site establishment for the two main stages.

Site Establishment for Works South of the Existing Station and Rail Formation

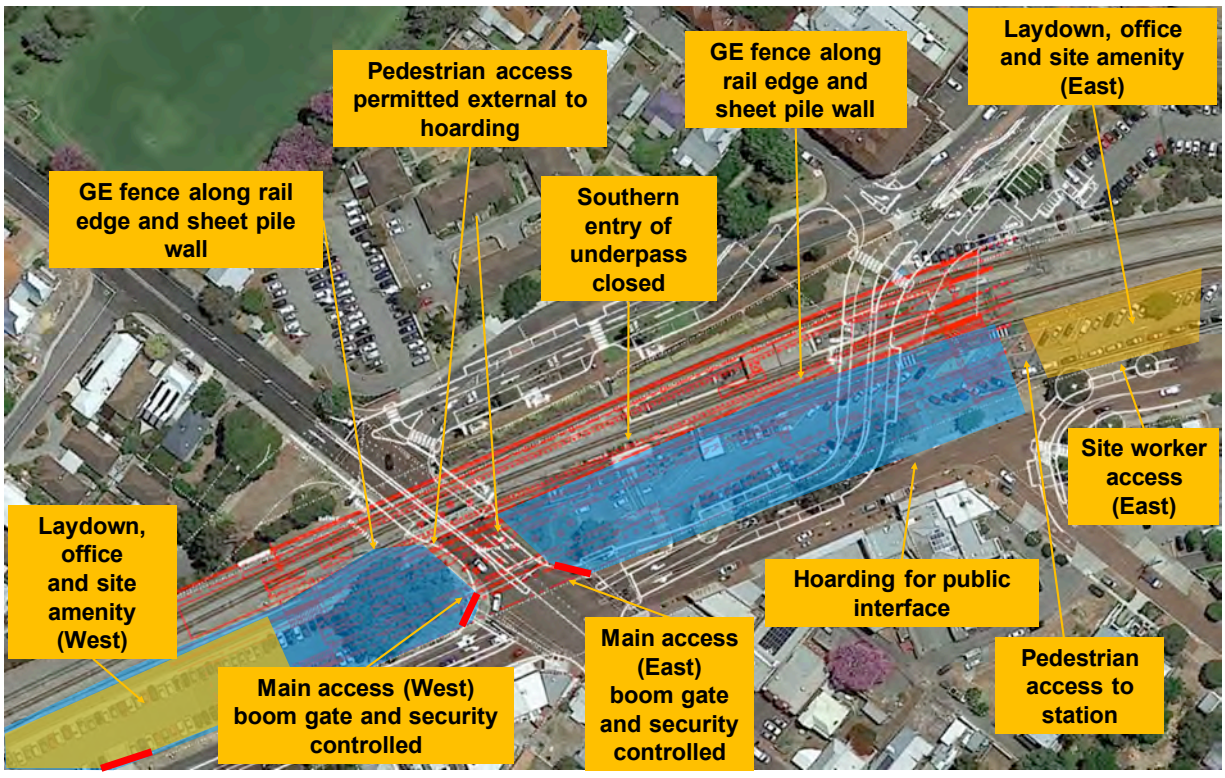


Figure 18.1: Stage 1 Site Layout

Site Establishment for Works North of the Existing Station and Rail Formation

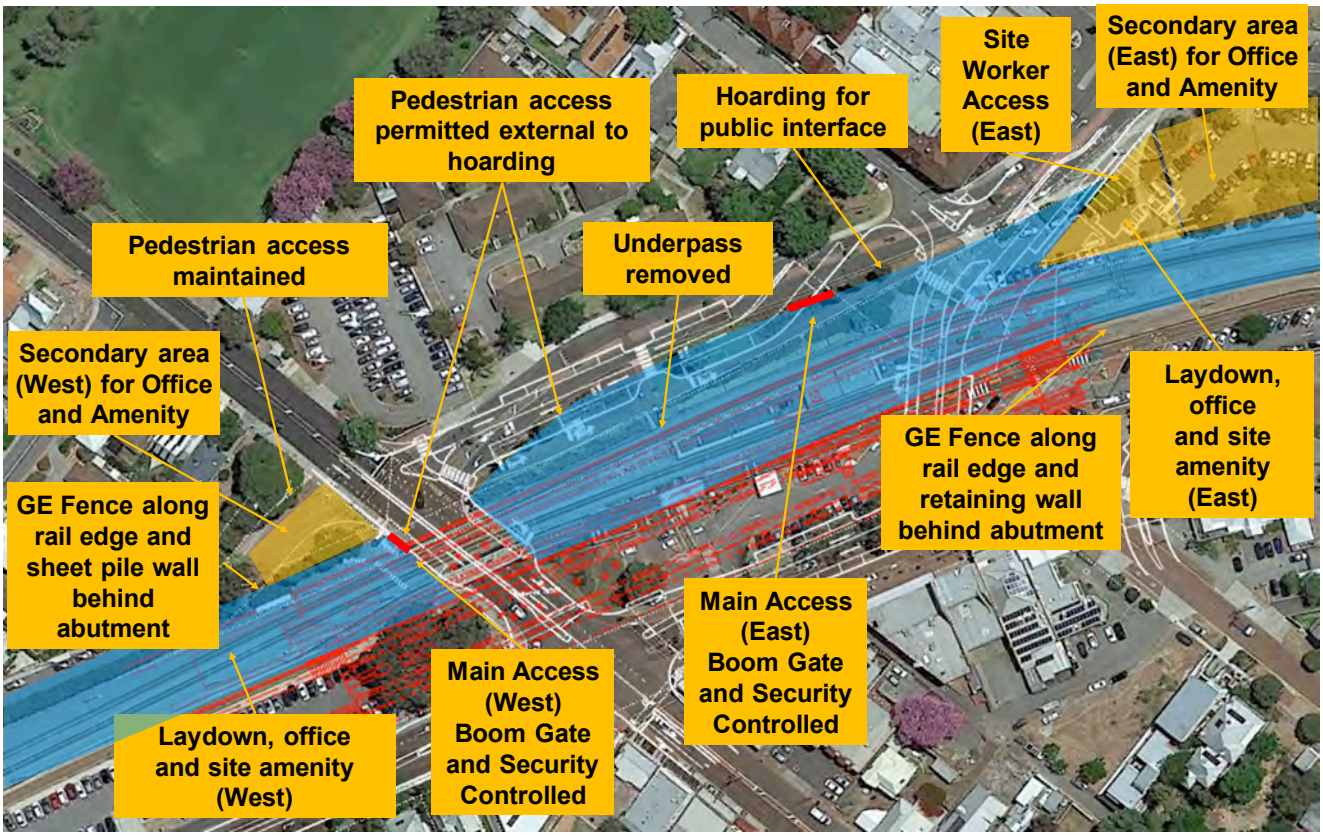


Figure 18.2: Stage 2 Site Layout

17.1.2 Detailed Site Stages

The site will be established in a number of stages as the Works area evolves to allow construction of the station and precinct. Some short term site stages will be established using temporary traffic management type controls (indicated by yellow shading in the following figures). The remaining stages will be established using hoarding (indicated in blue in the following figures) as shown by the typical site establishment figures.

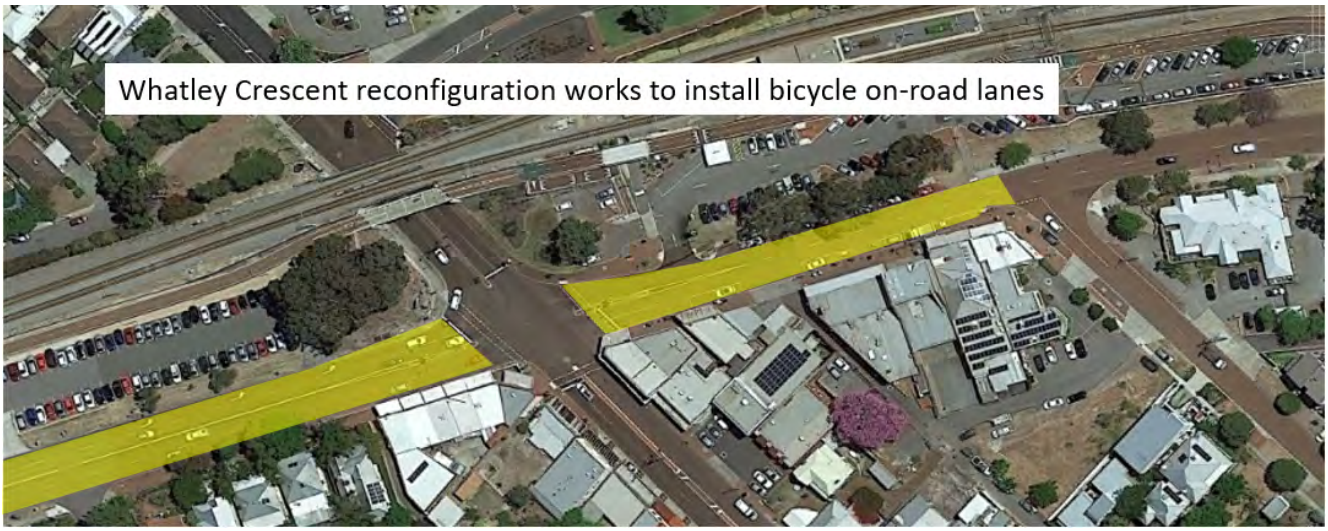


Figure 18.3: Stage 1 – Enabling Works Southern Bridges and Station Stage 1

Figure 18.4: Stage 2 – Southern Bridges Substructure Construction

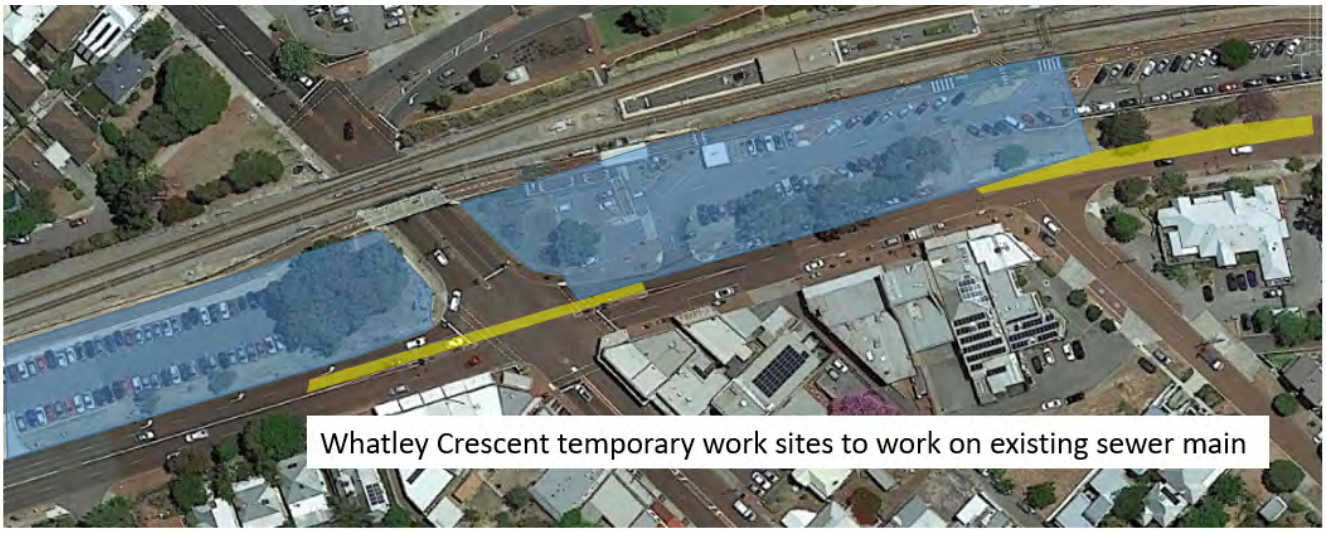


Figure 18.5: Stage 3 – DN700 Service Relocation

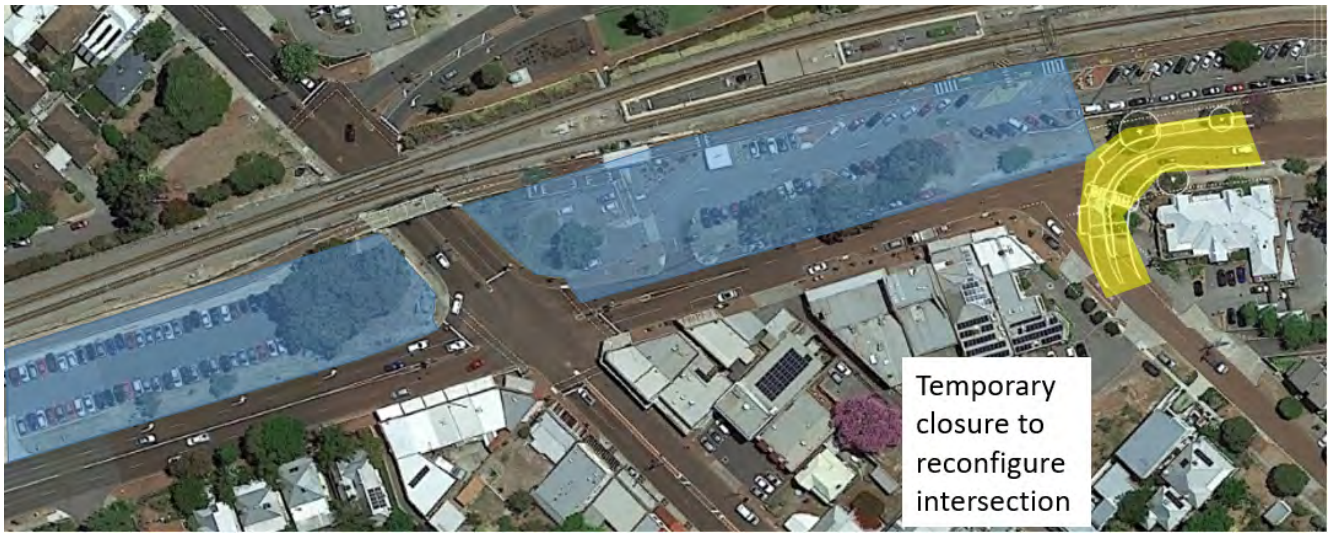


Figure 18.5: Stage 4 – Hamilton Street Corner Construction

Figure 18.5: Stage 5 – Southern Bridges Superstructure Construction

Figure 18.6: Stage 6 – Station and Whatley Crescent Construction Stage 1

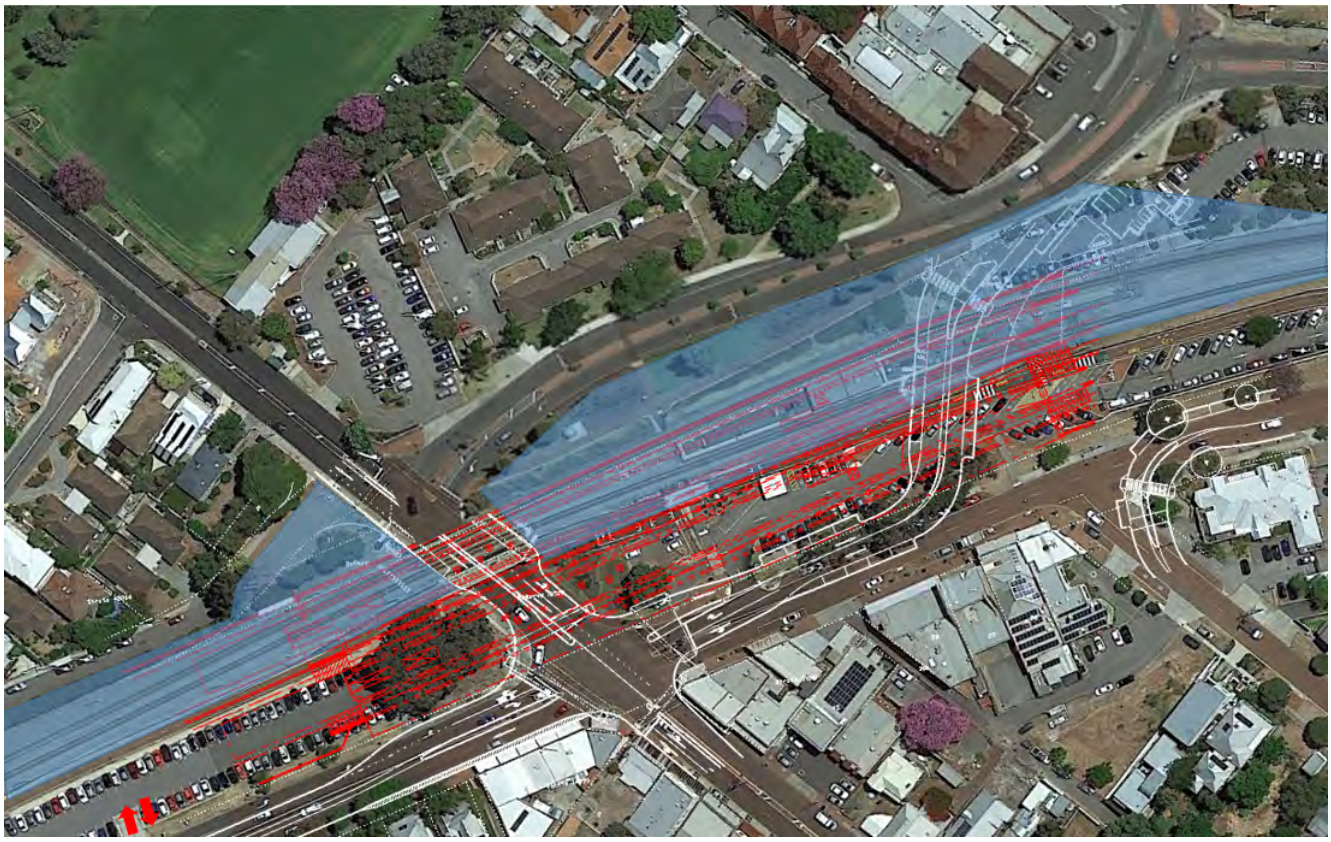


Figure 18.7: Northern Bridges Substructure and Whatley Stage 2 Construction

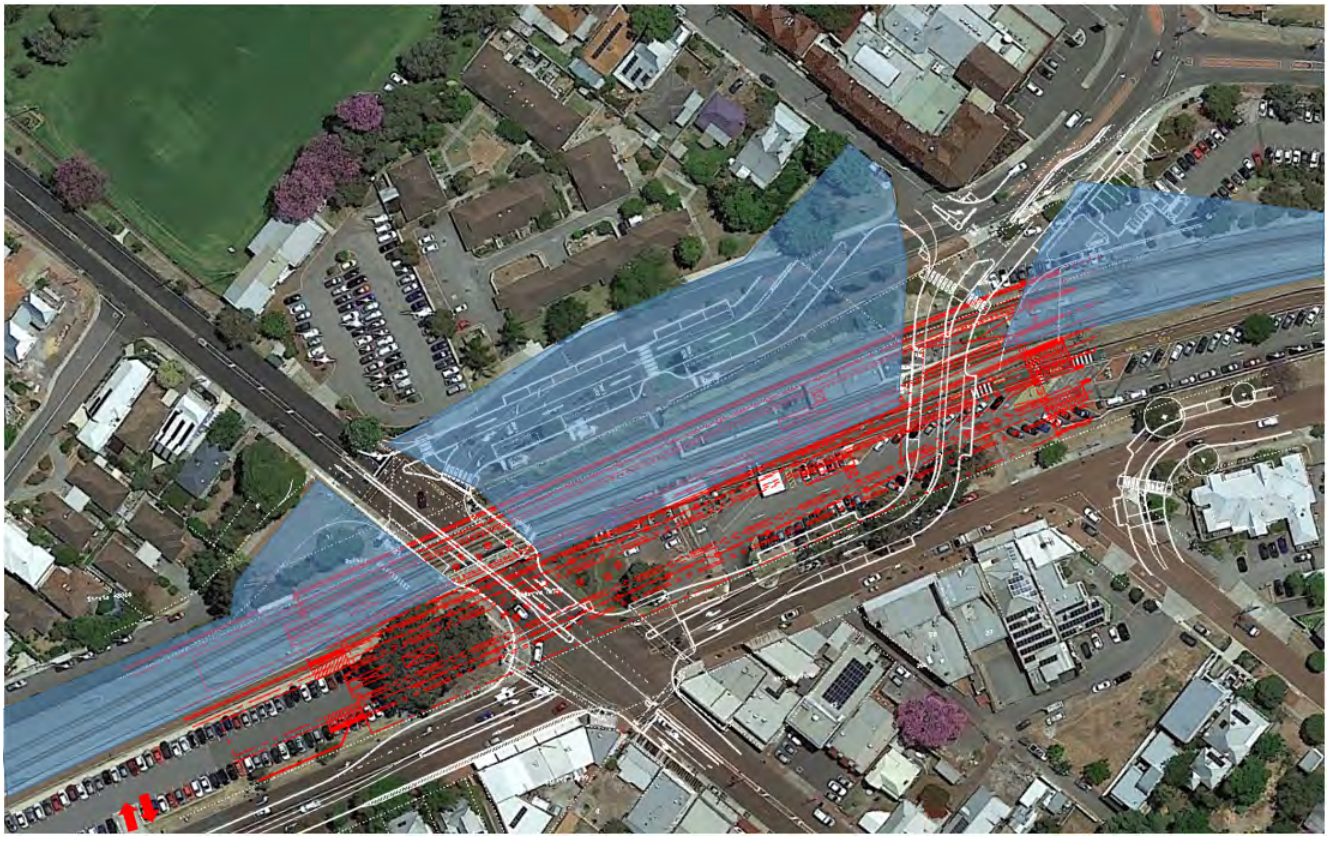


Figure 18.8: Closure of Railway Parade for Bridge and Station Construction

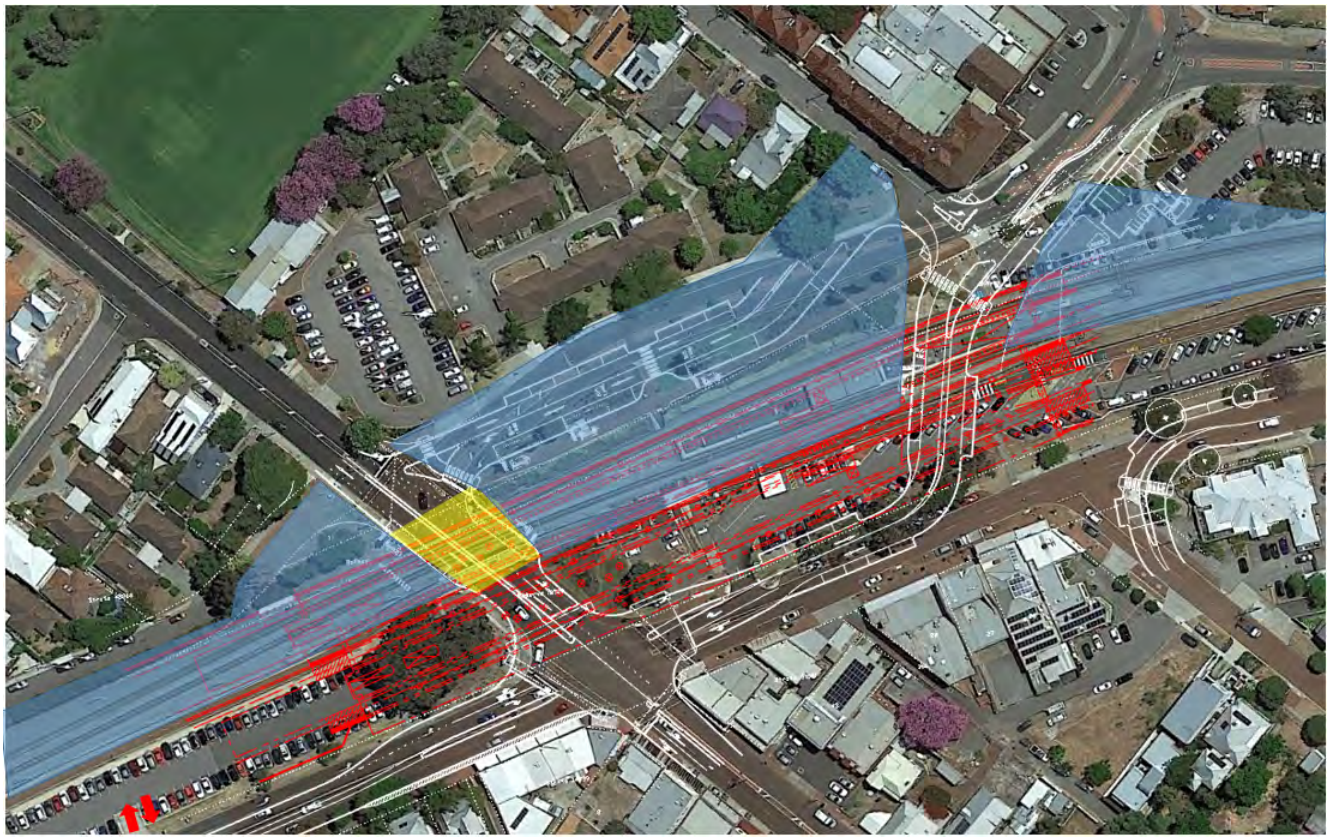


Figure 18.9: Bridges and Demolition and Erection of Bridges Over King William Street

17.2 Traffic Management

17.2.1 General

Traffic management for the station construction is to ensure the safe movement of plant and materials to the site whilst minimising disruption to road users and the local community. This will consist of an agreed route for construction traffic to follow and local traffic management controls including establishment of alternative arrangements for the PShP past the site. All vehicle, pedestrian and cyclist access is to be maintained or diverted to allow safe passage of users around the worksites including PShP connectivity during staging of works. MRWA approvals will be sought for any works to associated with the PShP. Please refer to Traffic and Transport Management Plan (BST-EVO-TM-PLN-00002) (TTMP) for further details.

Evolve Bayswater shall allow for uninterrupted access for all emergency vehicles into the Construction Site at all times.

Evolve Bayswater shall obtain approval of the routes for cartage of bulk quantities of materials to and from the Construction Site, including excavated material and delivery of concrete, reinforcement and other materials, from the relevant Government Agencies.

Evolve Bayswater shall obtain all necessary transportation approvals and vehicle permits.

17.2.2 Stage 1 – Southern Bridges and station Stage 1

17.2.2.1 Site Access Routes

The proposed route for construction traffic to access the southern side station site are shown in the following figure.

Figure 18.10: Access to southern station site

The proposed route for construction traffic to access the south eastern side of the station site for formation works are shown in the following figure.

Figure 18.11: Access to southern station site – east

The proposed route for construction traffic to access the south western side of the station site for formation works are shown in the following figure.

Figure 18.12: Access to southern station site - west

17.2.2.2 Temporary PShP Arrangement

It is not possible to construct the new station without closure of the existing PShP though the station construction site. Alternative arrangements were considered and following assessment it was determined that providing on-road bicycle lanes for commuter bicyclists and the existing footpaths for pedestrians and vulnerable bicyclists would be the best solution. Note collaboration with Main Roads and other stakeholders will be required to finalise the alternative arrangement.

The following figure shows the proposed extent of on-road bicycle lanes.

Figure 18.13: On road cycle lanes

The following figure shows the proposed western temporary closure point of the PShP and the exit and entry treatment for PShP users.

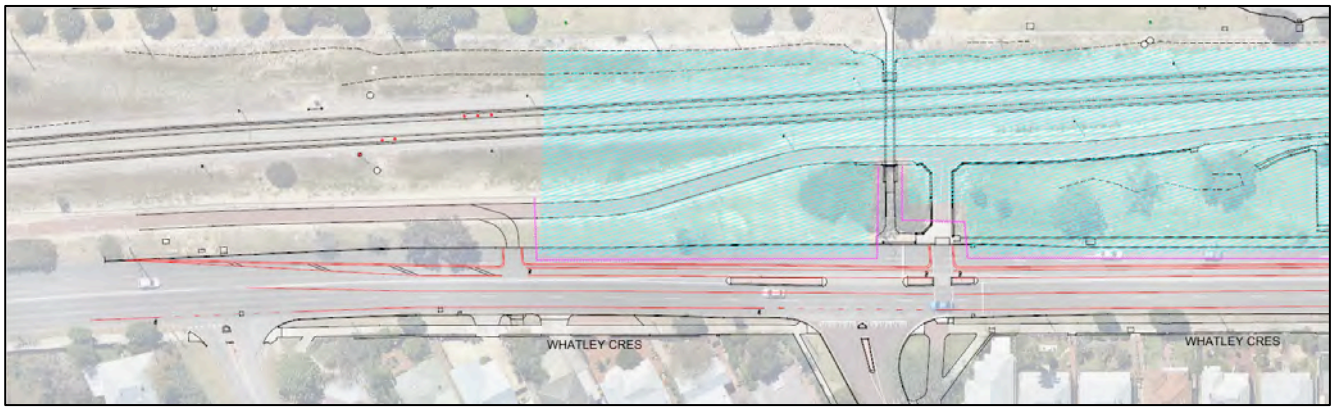


Figure 18.14: Western Closure

The following figure shows the on-road bicycle lane arrangement at the intersection of Whatley and King William Street.

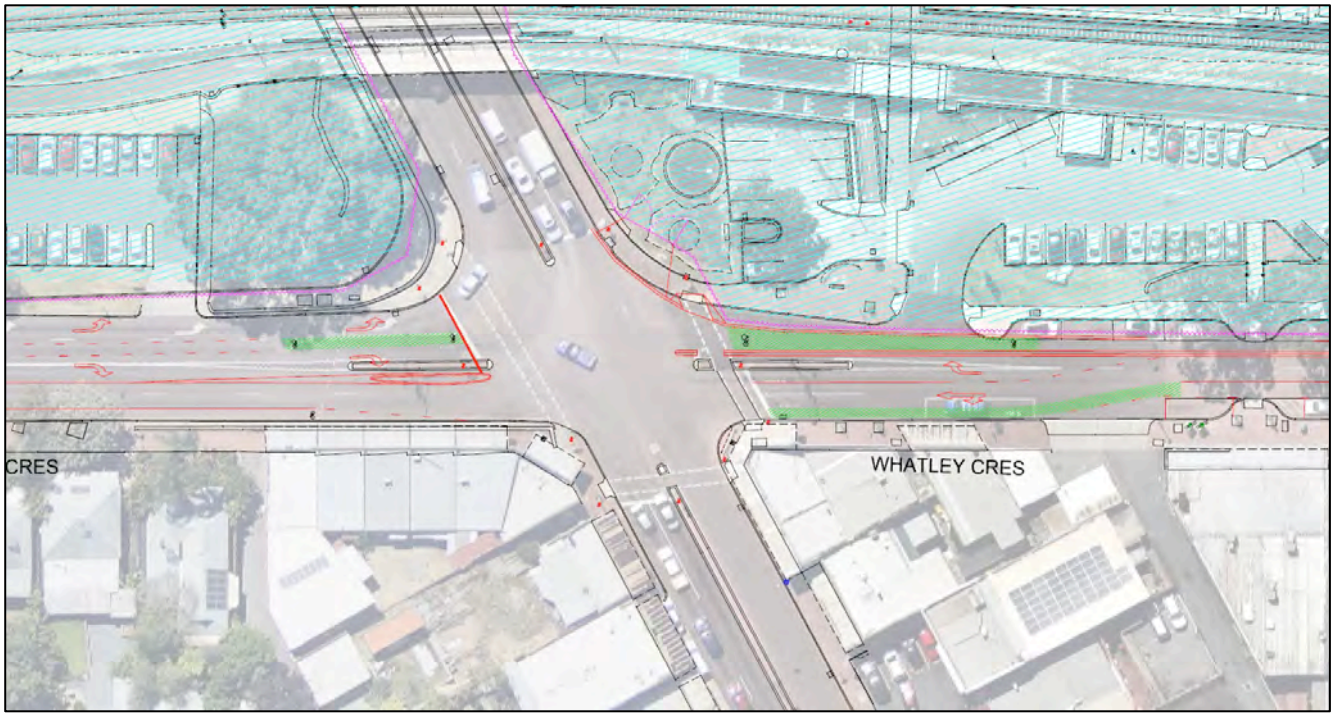


Figure 18.15: On-road cycle lanes - intersection

The on-road bicycle lanes are to be constructed prior to closure of the existing PShP.

Note west bound vehicular traffic will blocked from using Whatley Crescent between King William and Hamilton Street to facilitate the construction of the bicycle lanes. The closure of this lane is described further in the following section.

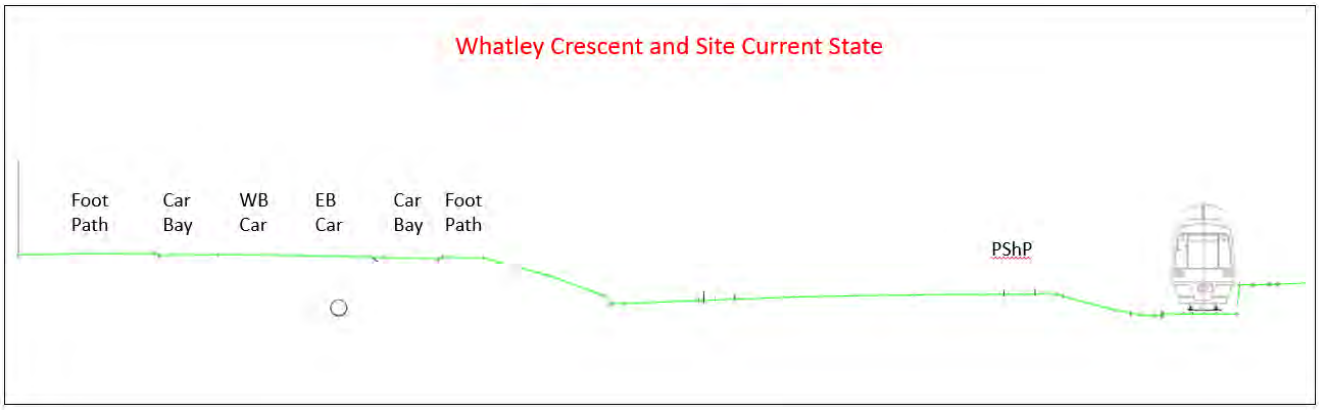
17.2.2.3 Whatley Crescent between King William Street and Hamilton Street

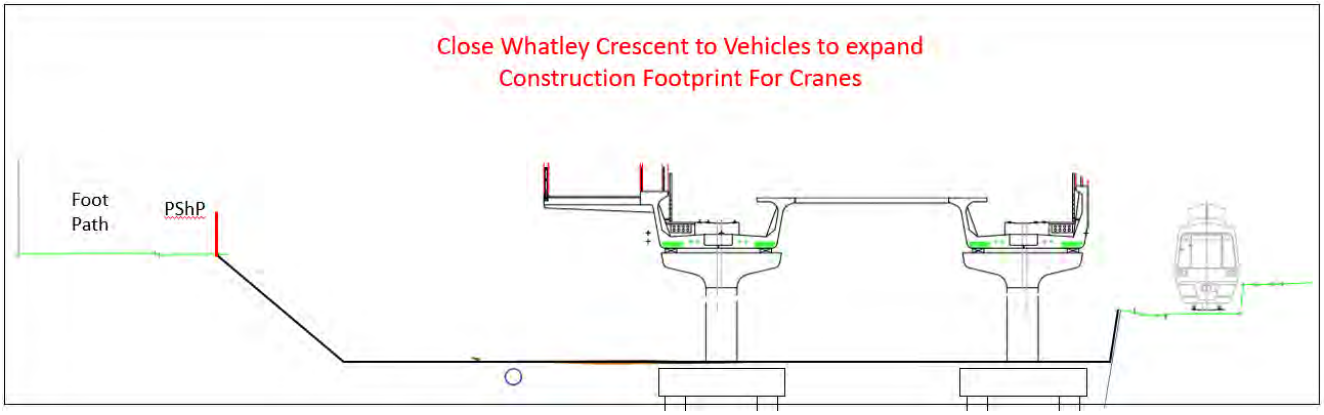
The existing businesses in Whatley Crescent between King William St and Hamilton Street consider the availability of street parking bays for customers and deliveries highly important to their business performance. Accordingly, the temporary traffic management arrangements for this section of Whatley Crescent have been developed considering the needs of the businesses and

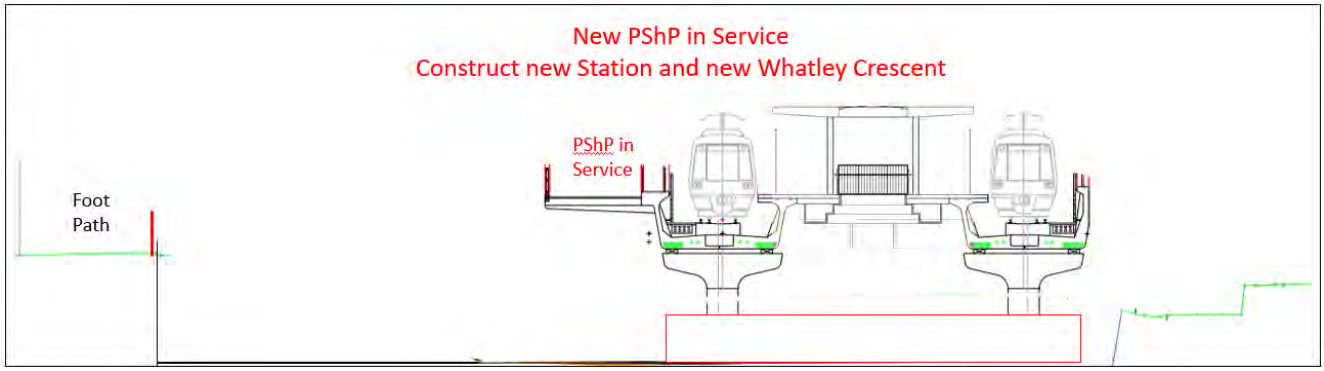
the requirements for the PShP temporary on-road bicycle lanes, bridge, station and landscaping construction requirements to minimise the impacts on street parking.

It is currently planned to close the westbound traffic lane and parking bays to create space for dedicated east and west bound bicycle lanes and maintain the west bound traffic lane and parking bays for customer and delivery vehicles to use to access the businesses. In addition, the works have always been planned to keep the footpath in front of the business open during business hours.

The following figures show the progressive stages of temporary traffic arrangement on Whatley Crescent.







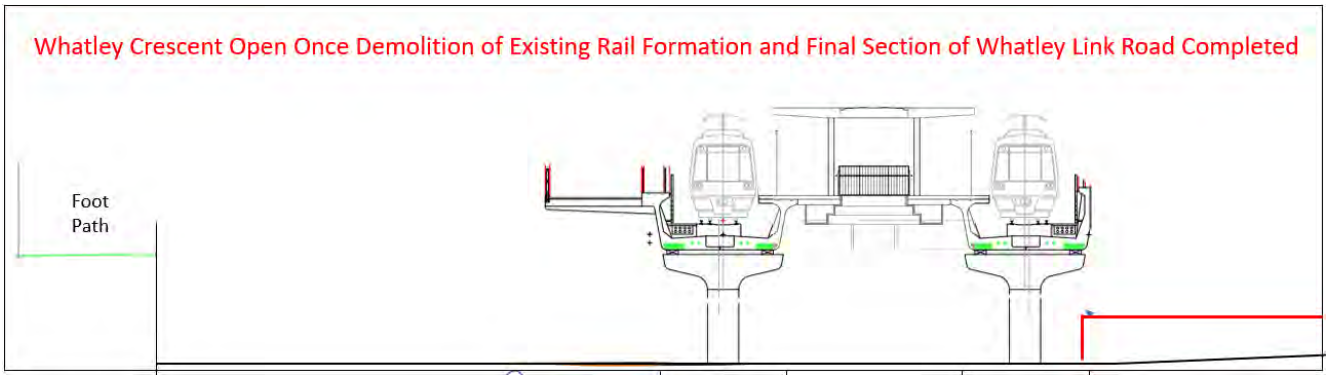


Figure 18:16: Temporary traffic arrangements to Whatley Crescent

As shown in the final figure, the works have also been planned to allow the new section of Whatley Crescent (The Link Road) to be opened as soon as possible. To facilitate this the new southern section of Whatley crescent and landscaping will be completed prior to the entry into service of the new station stage 1 so that construction of this section does not delay the opening of the road.

Once the new station stage 1 has entered into service, the existing rail formation will be removed and the final section of new section of Whatley Crescent will be constructed to allow the opening of the new Link Road as soon as possible.

17.2.2.4 Temporary Closure of King William Street Bridge

King William Street will need to be closed temporarily to erect the superstructure for southern bridges 1 and 2.

This temporary closure will occur prior to opening of new Whatley Crescent Link Road. Detours for westbound and eastbound traffic will be put in place as shown in the following figures.

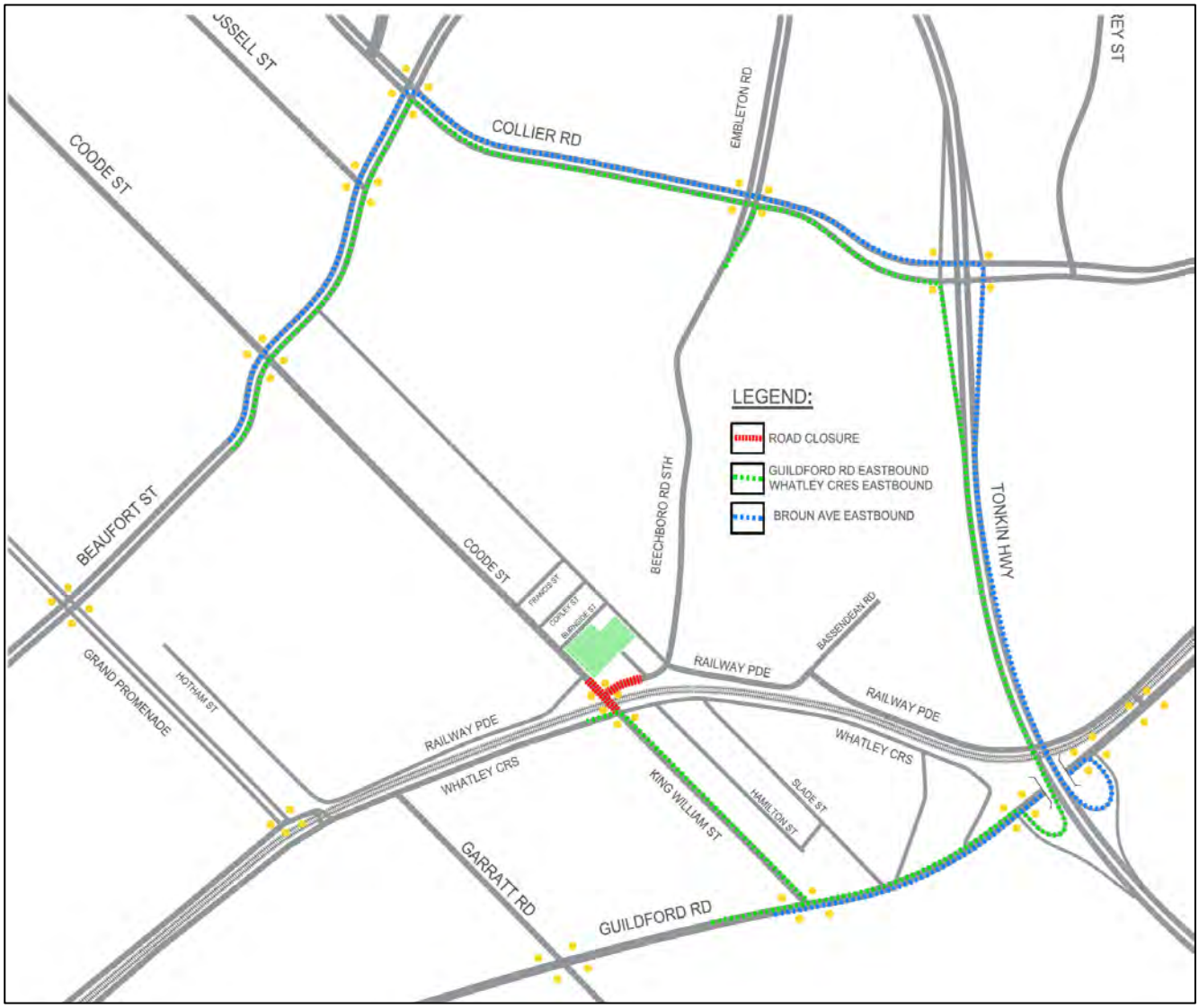


Figure 18.17: Temporary closure of King William St - westbound

Figure 18.17: Temporary closure of King William St - eastbound

17.2.3 Stage 2 – Northern Bridges and station Stage 2

17.2.3.1 Site Access Routes

The proposed route for construction traffic to access the northern side station site are shown in the following figure.

Figure 18.18: Access to northern station site east from east

The proposed route for construction traffic to access the north eastern side of the station site for formation works are shown in the following figure.

Figure 18.19: Access to northern station site east from west

The proposed route for construction traffic to access the north western side of the station site for formation works are shown in the following figure.

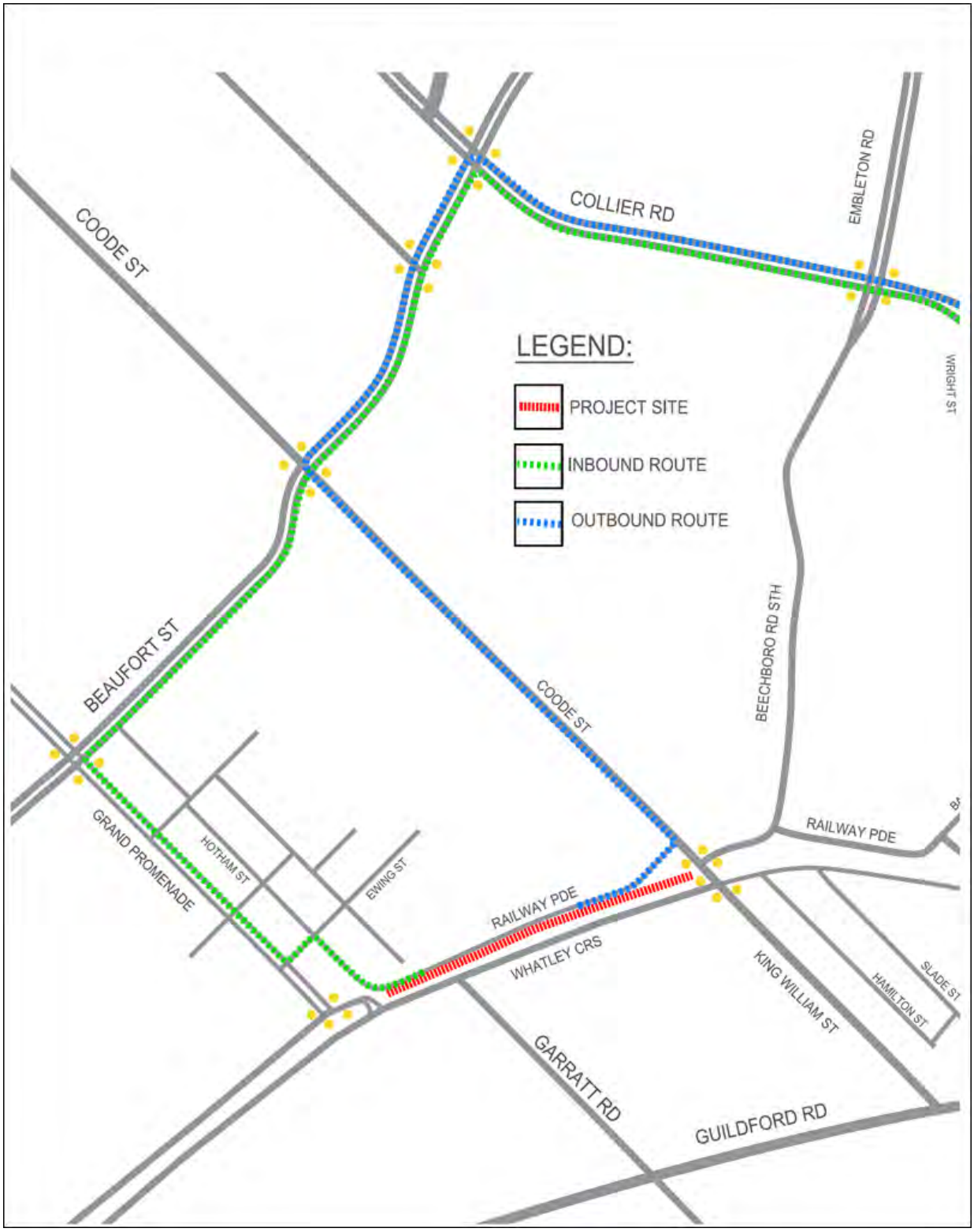


Figure 18.20: Access to northern station site west

17.2.3.2 Temporary Closure of King William Street after Opening of Link Road

King William Street will need to be closed temporarily to demolish the existing rail and PShP bridges over King William Street, to erect the superstructure for northern bridges 3 and 4 and for the reconstruction of King William Street.

The detours for westbound and eastbound traffic will be put in place as shown in the following figure.

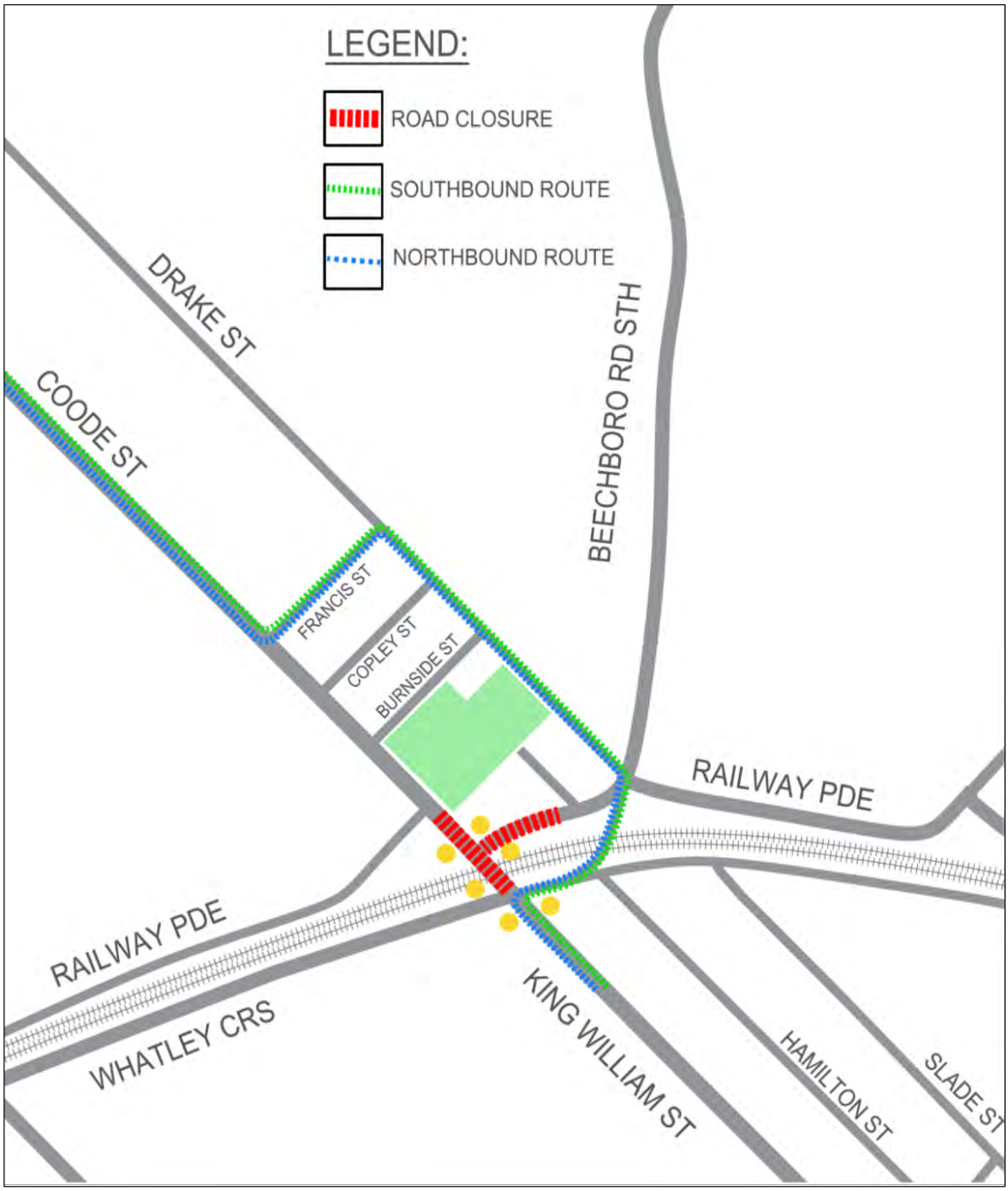


Figure 18.21: Temporary closure of King William St with New Link Road

17.3 Bridges

17.3.1 Overview

Evolve Bayswater have completed an analysis for the most efficient construction bridge structure which has resulted in the adoption of a piled foundations with pre-cast column and headstocks for the bridge piers, secant piled wall abutments and precast Superstructure. The Superstructure utilises precast “L Girders” that are installed in half shells, connected using a central insitu-

concrete strip. Post tensioning through the span ends provides continuity and improves structural efficiency.

The “L Girder” Superstructure concept selected over other solutions including incremental launch and segmental match cast results in:

- Reduced on-site construction footprint (e.g. no casting bed or extensive falsework required)
- Reduced interface with existing PTA rail. Long span precast members will be installed during discrete widows compared to ongoing in-situ works at the casting bed for incrementally launched construction or numerous segments install.
- Reduced number and frequency of material deliveries to site as superstructure elements are offsite and delivered as a completed precast unit
- Shorter on-site construction schedule
- Reduced temporary works (temporary bearings, launching nose, launching system, casting bed, design for construction loads during incremental launching, significant falsework required for segmental construction)

Precast construction is also used for a cantilevered PShP path and the platform with includes an insitu-concrete slab topping.

17.3.2 Temporary Works

17.3.2.1 Construction Platforms

Engineered construction platforms shall be designed and construction to facilitate safe and efficient construction for the various stages of the works. Suitable capping material (limestone or other crushed granular material) shall be placed above underlying approved foundation to provide a durable and stable working platform. The design of the platform shall consider construction staging, permanent works and temporary works requirements including site drainage, laydown requirements and construction loads including:

- Piling equipment (50-70T tracked piling rig, 100T crawler crane)
- General construction cranes and concrete pumps
- Heavy lift equipment including Mobile Cranes (90-500T), Crawler Crane ~250T & SPMT
- Major precast deliveries including stooling

Temporary construction platforms shall be generally constructed utilising similar methods and construction standards detailed further under Earthworks.

Where possible, suitable excavated material shall be directly incorporated into other work areas (cut to fill) or stockpiled for later re-use. Any material removed from site shall be disposed of at approved offsite spoil locations.

Platform levels for Stage1 and 2 shall be generally constructed either side of King William St to a formation level of RL15, consistent with future permanent works.

To enable the Superstructure installation over King William St from Abutment 1, it may be required protect the existing road infrastructure and construct a temporary access platform above to provide a consistent platform level between Stage 1A and 1B construction platforms that shall support heavy lift requirements. Final lift design shall determine the requirement and extent.

Construction platforms at the Abutments shall be constructed to a formation level of ~RL17 to facilitate top down construction piling and concrete construction. The level differential to the lower bridge pier level shall be battered to provide a safe and stable temporary batter.

Removal of battered material in front of each Abutment wall to complete ground level reduction to ~RL15 shall be competed after all abutment works are complete and either before or after

Superstructure is installed pending detailed lift design including temporary crane loads and access requirements.

The indicative construction platform concept is detailed below in Figure 14.22 and explained further under Construction Staging.

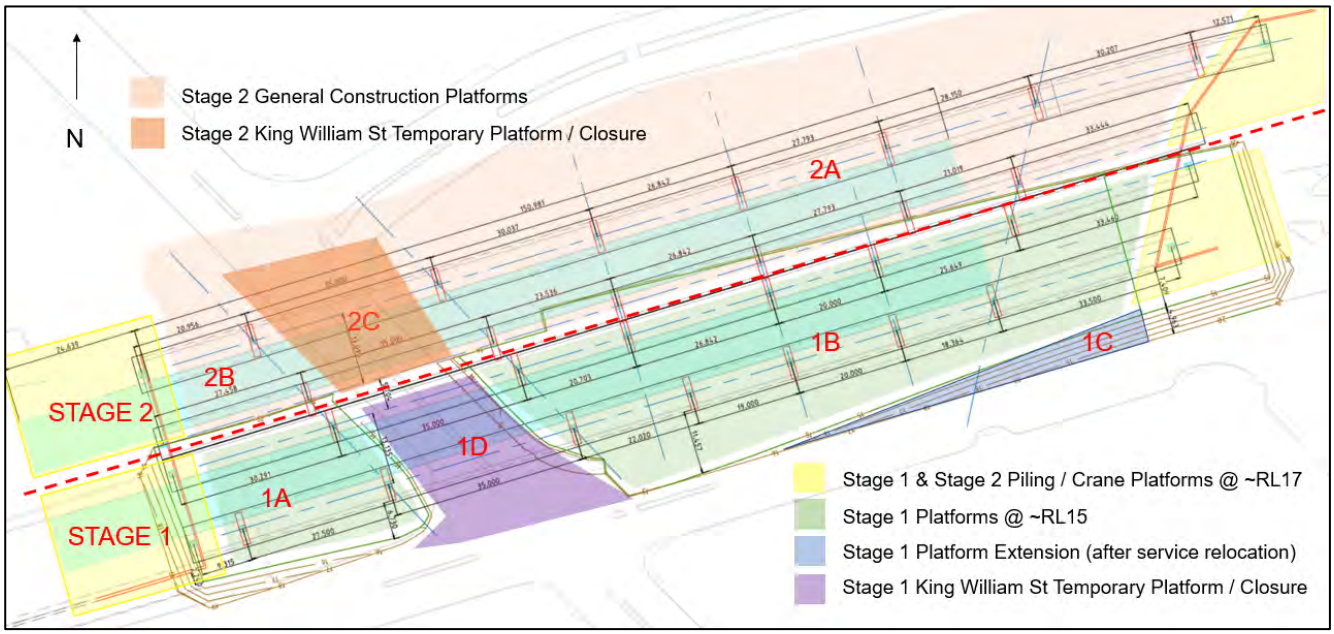


Figure 18.22: Indicative Construction Platforms

Calculated earthwork volumes excluding capping layer backfill volume are in Table 14.1.

Stage	Platform ID	Volume	Comments
1	1A	3200 m3 cut	
1	1B	10100 m3 cut	
1	1C	1700 m3 cut	Additional widening after WC pipe relocation
1	1D	700 m3 fill	Temporary for road closure
2	2A	10200 m3 cut	
2	2B	1900 m3 cut	
2	2C	500 m3 fill	Platform extended after New Link Rd opened

Table 18.1: Earthwork volumes

17.3.2.1.1 Construction Staging

Stage 1 - Bridge 1 & 2

Early works shall include construction of platforms 1A (west) and 1B (east). Platform 1B shall be further increased to include 1C following relocation of the Watercorp service to within the 1B platform.

Sequence:

- Early works including service location, traffic/ PSHP reconfiguration, fencing installation etc
- Construct upper Abutment platform for 1A to prepare access for sheet piling
- Construct upper Abutment platform for 1B to prepare access for sheet piling
- Install sheet piles
- Excavate and construct lower platforms at RL15
- Relocate Watercorp service from Whatley Crescent to within construction zone 1B
- Extend platform 1B to include 1C
- Construct temporary platform 1D to enable Superstructure installation, remove

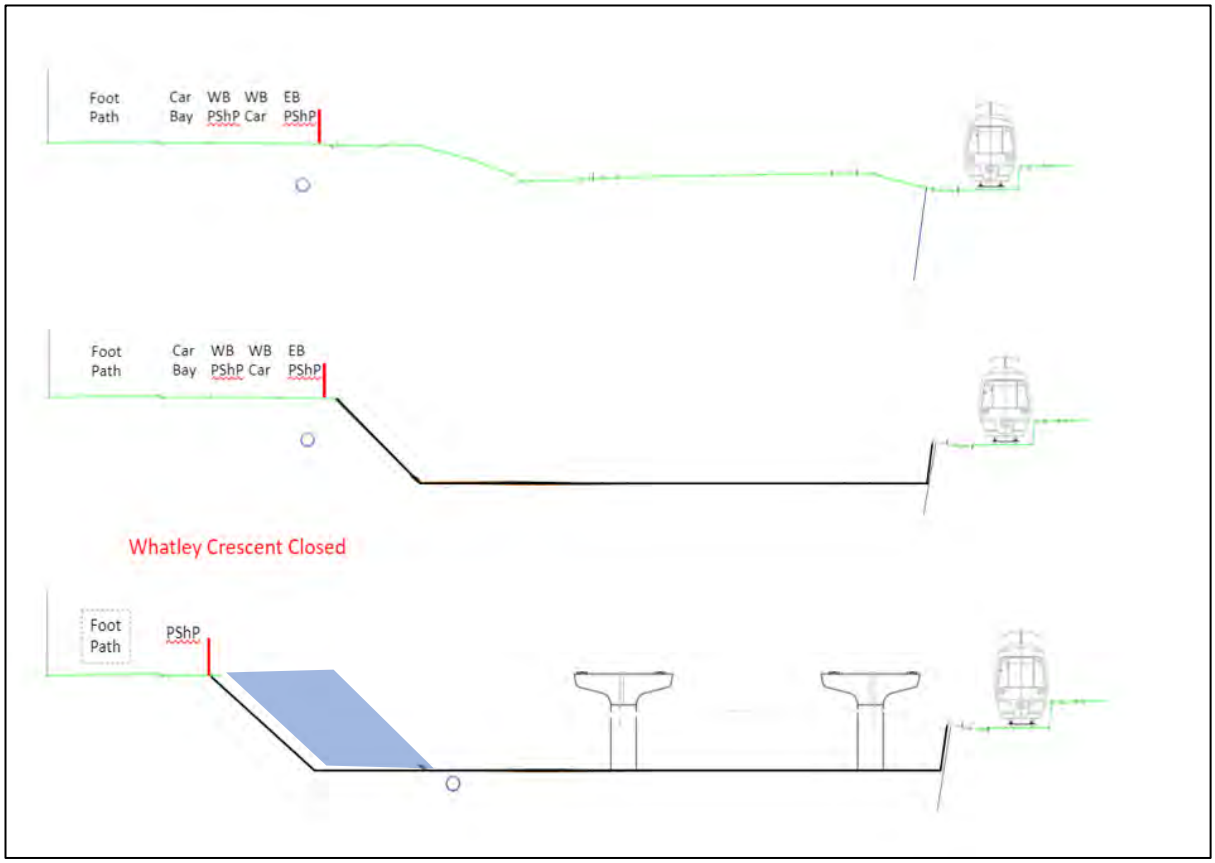


Figure 18.23: Typical cross section showing 1B extend to include 1C

Stage 2 - Bridge 3 & 4

Following commissioning of Station Stage 1, Stage 2 construction platforms shall commence with the demolition of the existing rail infrastructure and embankment either side of the existing bridge.

Stage 2 construction works shall initially focus on New Link Rd area to expedite opening of the new road that shall provide an acceptable traffic diversion before King William St is closed for existing bridge demolition and Superstructure construction.

Sequence:

- Excavate & construct platform 2A
- Complete New Link Rd thereby reducing construction platform
- Pending New Link Rd opening timing, extend platform to include 2B & 2C
- If access require earlier to 2C, construct independently and extend pad over King William St once New Link Rd open

17.3.2.2 Retaining Walls

17.3.2.2.1 Overview

Temporary retaining walls shall be required to facilitate staged construction of the works whilst maintaining existing asset integrity and unrestricted operations.

A range of retaining wall designs have been considered given the significant interfaces with live rail, construction stages and the varying impacts associated with specific installation and removal methods.

Table 14.2 provides a summary of the current concept application of temporary retaining walls.

Wall	Location	System
1	Stage 1 West – Northern Limit – Abut 1 to Existing Bridge Construction limit parallel and adjacent to existing live rail from Abutment 1 to existing PSHP Bridge ~34 LM @ 3m retained	Sheet Pile length 8m 310UC Soldier Pile @ 1.2m spacing
2	Stage 1 East - Northern Limit – Abut 2 to Existing Bridge Construction limit parallel and adjacent to existing live rail from Abutment 2 to existing PSHP Bridge ~130 LM @ 3m retained	Sheet Pile length 8m 310UC Soldier Pile @ 1.2m spacing
3	Stage 1 Whatley Cres East Sheet piling required to enable construction of new Whatley Cres works from lower New Link Rd ~62 LM @ 0.5 to 4.5m retained (variable height)	Sheet Pile lengths 2.5m – 12m
4	Stage 1 Whatley Cres East Sheet piling required to enable relocated of services and construction of new station access ~50m @ 4m retained	Sheet Pile length 8m
5	Stage 1 West - Rail Embankment ~250LM @ 4m retained	Panel & Post
6	Stage 1 East – Rail Embankment ~200LM @ 4m retained	Panel & Post

Table 18.2: Temporary Retaining Wall Summary

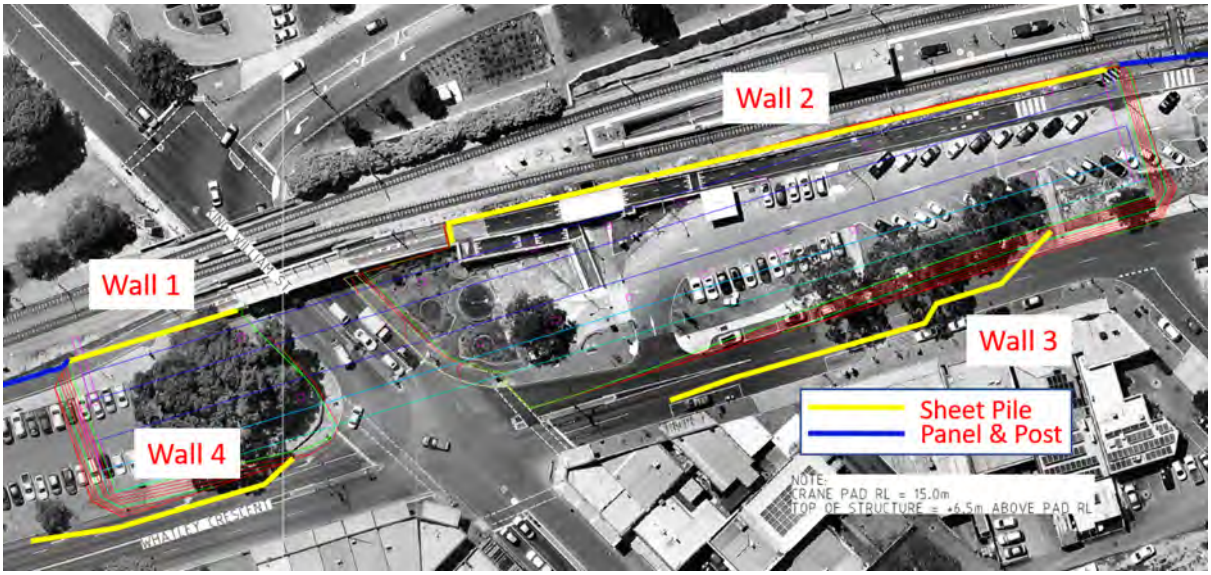


Figure 18.24: Proposed Temporary Sheet Pile Locations

17.3.2.2.2 Sheet Piling

Extensive sheet piling shall be utilised for temporary retainment. Subject to design loads and deflection requirements, sheet pile lengths and profiles shall vary with the need for additional solider piles to be included where required.

Sheet piles shall be predominantly installed by a 23-30T excavator mounted vibro hammer where sheets are 9m or less. For longer sheets, a specialist “leader” sheet pile rig shall be used.

For areas of restricted access for tracked equipment that would otherwise need to be positioned immediately adjacent to pile wall location, a crawler crane suspended vibro hammer and piling gate arrangement may be used.

Figure 18.25: Typical Pile Installation Methods

17.3.2.2.3 Panel and Post

The proximity of the existing live rail and interface with construction of Stage 1 requires significant temporary retaining walls to facilitate the construction of the embankment and relocated rail. The SWTC limits what “temporary” construction methods and materials can be used therefore the design concept is based on installation of permanent Panel & Post Walls to be used in a temporary capacity.

During the construction of Stage 2, as embankment construction is completed and before rail installation works process, the upper sections of the Panel and Post Structure can be removed to an acceptable level (not completely).

Footings for the posts will be constructed by installing bored piling with a rig, reinforcement cage and posts and panels installed using a mobile crane.

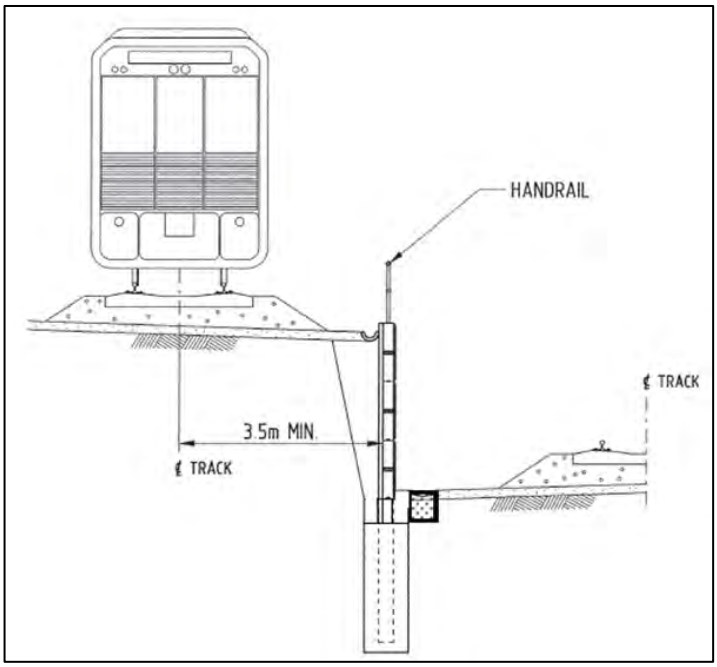


Figure 18.26: Typical Panel & Post Retaining Walls

17.3.2.3 Potential Rail Impact Activities

17.3.2.3.1 General

A General Exclusion "GE" fence shall be installed at a minimum distance of 3m from the closet live rail to delineate the general work zone from the live rail envelope.

Activities that have a potential impact to rail operations or are may encroach (temporarily or otherwise) beyond the vertical plane of the General Exclusion zone shall be classified as restricted activities, subject to further rigor, approval and controls i.e. shutdowns, possessions, de-energizations.

Key bridge structure construction activities are identified below as those as having a potential impact to rail operations. A thorough assessment of all potential interfaces and construction activity impacts be undertaken to determine agreed execution methods with appropriate controls.

Activity	Potential Impact & Control
Site preparation earthworks i.e. clearance, piling hardstands	Minimal potential impact as all works conducted within GE fenced construction zone only except for Abutment 2 wall (see separate section). Slew restrictors and height limiters for excavators.
Sheet piling between Stage 1 & 2 utilising excavator rigs	Sheet piles to be installed within GE fenced construction zone. Further risk assessment required due to proximity working plant with high masts / booms and crane lifts. Potential de-energisation / possessions required form some works. Slew restrictors and height limiters for excavators.
Abutment secant piled walls up to 2.5m from live rail using ~50T piling rig and support crane & Abutment wall pile insitu-concrete construction including pile-cap, support columns, bearings etc	Majority of piles to be installed within GE fenced construction zone however a limited section is located 0.5m within the 3m GE zone. It is proposed a physical hoarding shall be installed in advance to enable works to be completed up to the required Stage 1 extent. Approved hoarding to be installed at approx. 2m from love rail 4m high during a rail possession that shall be maintained for Stage 1 duration. For activities within the greater 3m GE construction zone but where risk assessment determines, slew limiters shall be used for service cranes that shall be used in lieu of mast winch etc. See separate section below.
Installation of Stage 1 Bridge 2 Span 7 using dual cranes where northern girder is located <3m from live rail with GE zone	Single shift de-energisation / rail possession required to install girder. Night shift after hours service possession anticipated.
Installation of Stage 2 Bridge 3 precast pier Crossheads installed using 250T crane <3m from live rail with GE zone	De-energisation / rail possession required to install girder. Night shift after hours service possession anticipated. Crossheads are only slightly located with GE zone however Columns located outside. Slew restrictors utilised for cranes operating in proximity but greater than 3m.
Installation of Stage 2 Bridge 3 southern girder spans installed using single / dual cranes located <3m from live rail with GE zone.	7 shifts de-energisation / rail possession required to install girders. Night shift after hours service possession anticipated.

Table 18.3: Rail Impact Activities

17.3.2.3.2 Abutment 2 (West)

A significant interface exists at the new Abutment 2 (east) location, in particular during Stage 1 construction. The new Abutment including secant piled wall, insitu-concrete capping works and the installation of the northern most girder section will all encroach less than 3m from the live rail (see below).

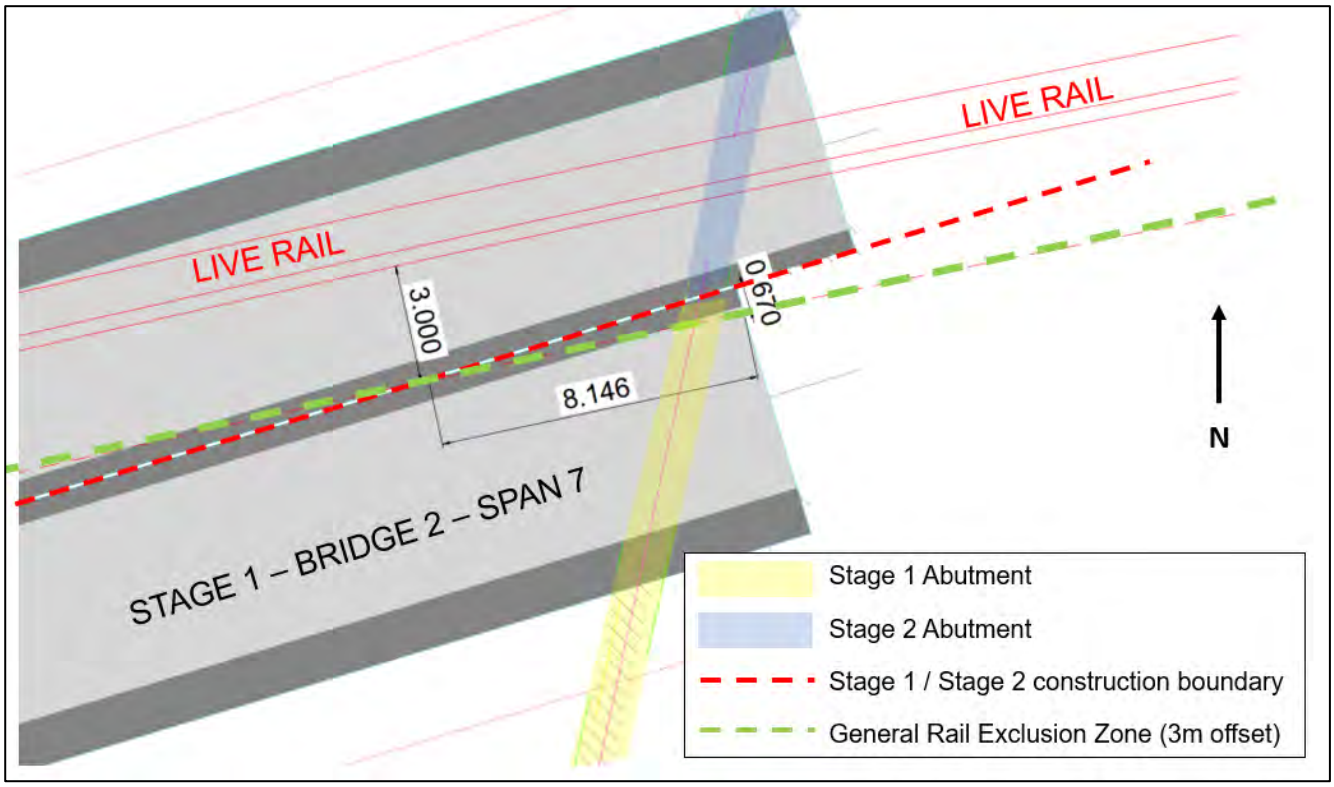


Figure 18.27: Rail proximity & staging at Abutment 2 (west)

To enable the safe and efficient construction of the Stage 1 works, it is proposed that a physical hoarding of an approved highly durable design is installed during a rail possession. A suitable of approximate 20m in length, tying into GE fences at either end shall provide physical protection and delineation for the duration of the works.

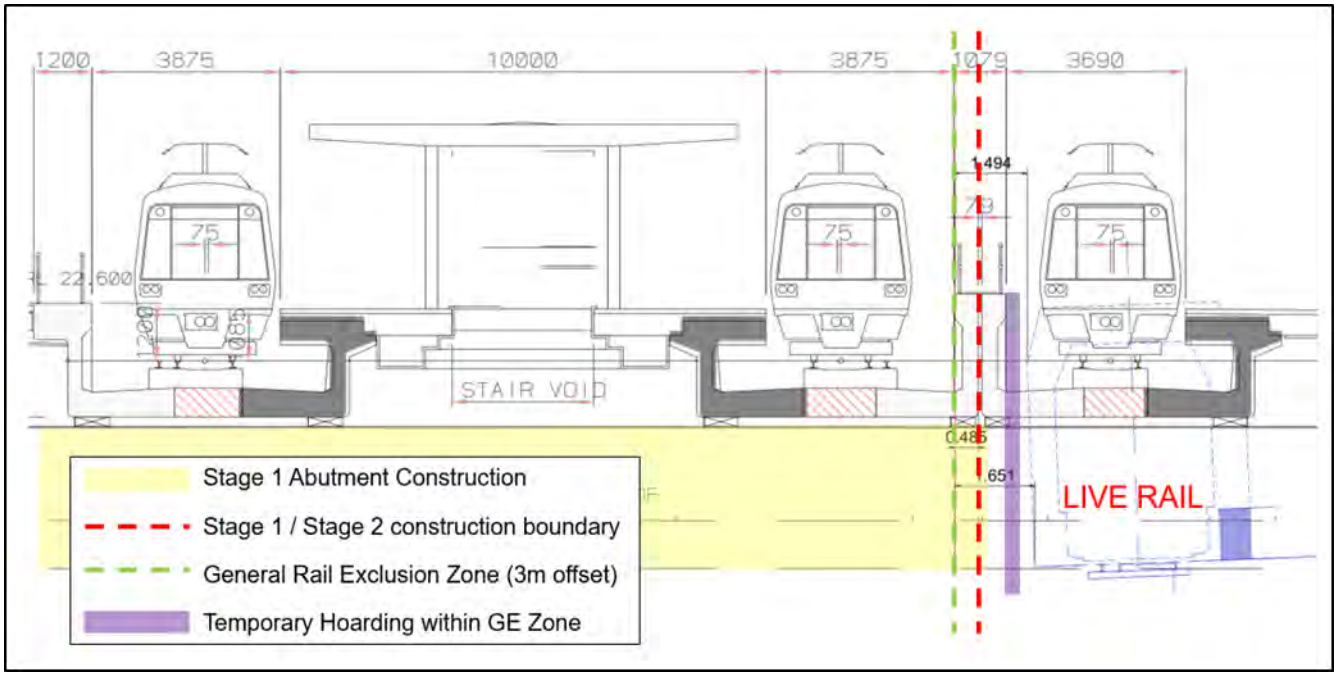


Figure 18.28: Abutment 2 Hoarding

17.3.3 Earthworks

17.3.3.1 General

The earthworks component for the Bridge Structure consists of the following activities:

- Vegetation clearing and topsoil stripping
- Bulk Excavations
- Embankment Foundation Preparation
- Embankment Construction (Abutment Backfill)
- Subgrade Preparation
- Detailed Earthworks

These activities will be constructed in accordance with the requirements outlined in Main Roads WA Specification 300 Series – Earthworks.

The requirements for aboriginal monitors during ground disturbance activities will be confirmed in conversation with the relevant aboriginal representatives.

17.3.3.2 Vegetation Clearing and Topsoil Stripping

Vegetation clearing shall take place in accordance with the following specifications:

- Main Roads WA Specification 301 – Vegetation Clearing and Demolition;
- Main Roads WA Specification 204 – Environmental Management Major Works
- Main Roads WA Specification 303 – Material and Water Sources

Clearing on this project will include the following activities within the site boundary:

- the felling, cutting and removal of all trees standing or fallen;
- the removal of rubbish and debris;

- grubbing out of all stumps and roots larger than 80mm in diameter or with any dimension greater than 300mm, to a depth of 300mm below either the existing surface or the finished subgrade surface, whichever is lower.

Tree-felling and lopping shall be completed by a specialist subcontractor in areas which are close to overhead services, road alignments or to properties where trees can't be felled using an excavator. Clearing, grubbing and tree felling/lopping shall commence following approval from the environmental team that the environmental commitments have been achieved.

Due to the limited storage space on site, cleared vegetation suitable for mulching is to be taken off site to be chipped into organic Mulch material.

Topsoil will be stripped to a depth of 75mm using a loader to push up into local stockpiles ready for re-use or relocated to the designated stockpile areas for storage until required for re-use. Competent operators shall be utilised to ensure that the topsoil and subsoil layers are not mixed, and the subgrade integrity is not affected during the stripping and stockpiling process.

17.3.3.3 Excavations

Excavations in cut sections including benching will be carried out as per the requirements outlined in the Main Roads WA Specification 302 – Earthworks.

All suitable excavated material shall be directly incorporated into other work areas (cut to fill) or stockpiled for later re-use where practical to do so. Any material removed from site shall be disposed of at approved offsite spoil locations.

General excavation works shall be typically completed using a ~23T Excavator and semi-tipper trucks for haulage. Where desirable, a loader shall be used to tram excavated material to designated stockpile areas for reuse of offsite removal.

17.3.3.4 Foundation Preparation

After the area is cleared and topsoil stripped, the foundation is to be prepared by compacting the surface in accordance with the following specification:

- Main Roads WA Specification 302 – Earthworks

For larger accessible areas i.e. construction platforms, trimming and compaction of the surface will shall utilise a grader, pad foot roller and 14KL watercart.

Smaller restricted areas i.e. concrete foundations shall typically use an excavator and/or skid-steer for trimming with heavy duty reversable compactors or small <3T rollers for compaction.

Vibration due to compaction will be measured and monitored to ensure the vibration levels do not reach the vibration limit.

17.3.3.5 Embankment Construction

Embankment backfill behind the Abutments will be constructed to the requirements outlined in specification Main Road WA Specification 302 – Earthworks.

Site won material is expected to be Bassendean sand as specified in the geotechnical report and will be tested for conformity prior to utilising as embankment fill material.

Embankment will be placed in layers no greater than 450mm utilising a loader with a skid-steer utilised for detailed placement and trimming adjacent to structures. Compaction shall be achieved using heavy duty "walk behind" compactors or 500kg plate compactors in "special compaction zones" close to structure elements with heavier compaction equipment such as a 12t Vibratory Roller used in general embankment areas.

Backfill shall be completed to the extent required to construct the run-on slabs. Completion of embankment and backfill material and placement of sub-ballast capping shall be completed under the rail formation scope.

17.3.3.6 Detailed Earthworks

Detailed earthworks required for construction of concrete elements, services and the likes shall be constructed utilising appropriately sized equipment determined by volume of work and access constraints.

Assessment of ground conditions including ground water suggest the Pile Caps can be constructed using conventional open benched excavation methods with local dewatering implemented as required to ensure safe and stable work access. Suitable select backfill material shall be placed typically using an Excavator with heavy duty “walk behind” compactors or 500kg plate compactor use for compaction.

17.3.3.7 Equipment Summary

A range of equipment best suited to the task and environment shall be utilised by competent operators. Where required by proximity to rail and other hazards, equipment such as excavators shall be fitted with height and slew restrictors.

Equipment requirements for various activities include:

Activity	Equipment
Clearing & Topsoil Removal	Grader, Loader 3m³, Skid-steer
Foundation Preparation – Large	Grader, Roller 12T
Foundation Preparation – Small	Excavator, Skid-steer, Compactor / Roller ~3T
Detailed Excavation – Pilecaps etc	Excavator 8-15T, Loader
Detailed Backfill – Pilecaps etc	Excavator 8-15T, Skid-steer, Compactor / Roller ~3T
Bulk Excavation – Platforms etc	Excavator 20-30T
Platform Construction – Large areas	Grader, Loader, Roller 12T
Embankment - Abutment backfill	Loader 3m³, Skid-steer, Roller 12T, Compactor
Material Haulage – Onsite / offsite	Semi, 8x4 or 6x4 road trucks as access permits
Conditioning / Dust Suppression	14KL 6x4 Truck or 20KL Dinosaur Unit as access permits

Table 18.4: Equipment Summary

17.3.4 Precast Manufacture

17.3.4.1 Overview

Delta Corporation is the precast concrete manufacturing partner of Evolve Bayswater. Established in 1966, Delta has been a key precast concrete supplier to numerous critical civil infrastructure projects over the past 50+ years. Delta are a local provider, situated in Herne Hill, an outer eastern suburb of Perth.

Delta Corporations operations are spread out over a footprint of 33Acres which include general production, concrete mixing, raw materials storage, finished product storage, maintenance workshops, administration and waste material recycling areas.

The manufacture of complex precast elements to demanding specifications and standards is underpinned by the implementation of stringent independently accredited, monitored and audited Quality Control Management System.

With multiple high capacity stressing beds, the largest a 2,250t capacity, Delta can simultaneously run multiple production lines independently to ensure project program remain on schedule.

Concrete is produced onsite from one of three modern batch plants incorporating computer controlled certified batching management systems. Refrigerated batch water system and steam curing equipment ensures the facility can meet the most demanding specification requirements.

The production facilities are supported with heavy lifting and handling equipment capabilities allowing for the manufacture of large, technically complex precast elements in excess of 200t.

Figure 18.29: Delta Corporation Facilities

17.3.4.2 Supply Scope

The bridge concept maximizes utilization of offsite precast elements summarized in Table 15.5.

Element	Quantity	Weight	Dimensions	Transport Strategy
Superstructure "L" Girders (half shells)	58	52-185T	9.7-35.0m long	Steerable "Jinker" under full escort, nightshift*
Piers	26	17T	1.35*1.35*3.5m	Quad float 50T, dayshift
Headstocks	26	25T	6.0*1.5*1.35m	Quad float 50T, dayshift
PSHP Cantilever Beams	64	3.5T	4.4*0.8*0.3m	Standard semi, dayshift
PSHP Planks including Parapet	63	4.5T	4.8*3*0.12m	Standard semi, dayshift
Platform Planks	100	7.8T	7.0*3.0*0.12m	Standard semi, dayshift
Superstructure soffit infill panel for stitch	NA	~6T	NA	Standard semi, dayshift

Table 18.5: Precast element summary

Precast elements shall be stored offsite at Delta's facility and delivered to site using a "just in time" strategy to maximize site efficiency.

Evolve Bayswater and Delta shall work closely with its established transport partners, service providers, regulatory authorities (Main Roads HVO etc) and other necessary parties manage the precast delivery logistics of the project in a manner the supports the program whilst minimizing impact to stakeholders.

Planning for deliveries shall also include detailed consideration of site interfaces including laydown locations, site access, temporary storage requirements and material handling resources.

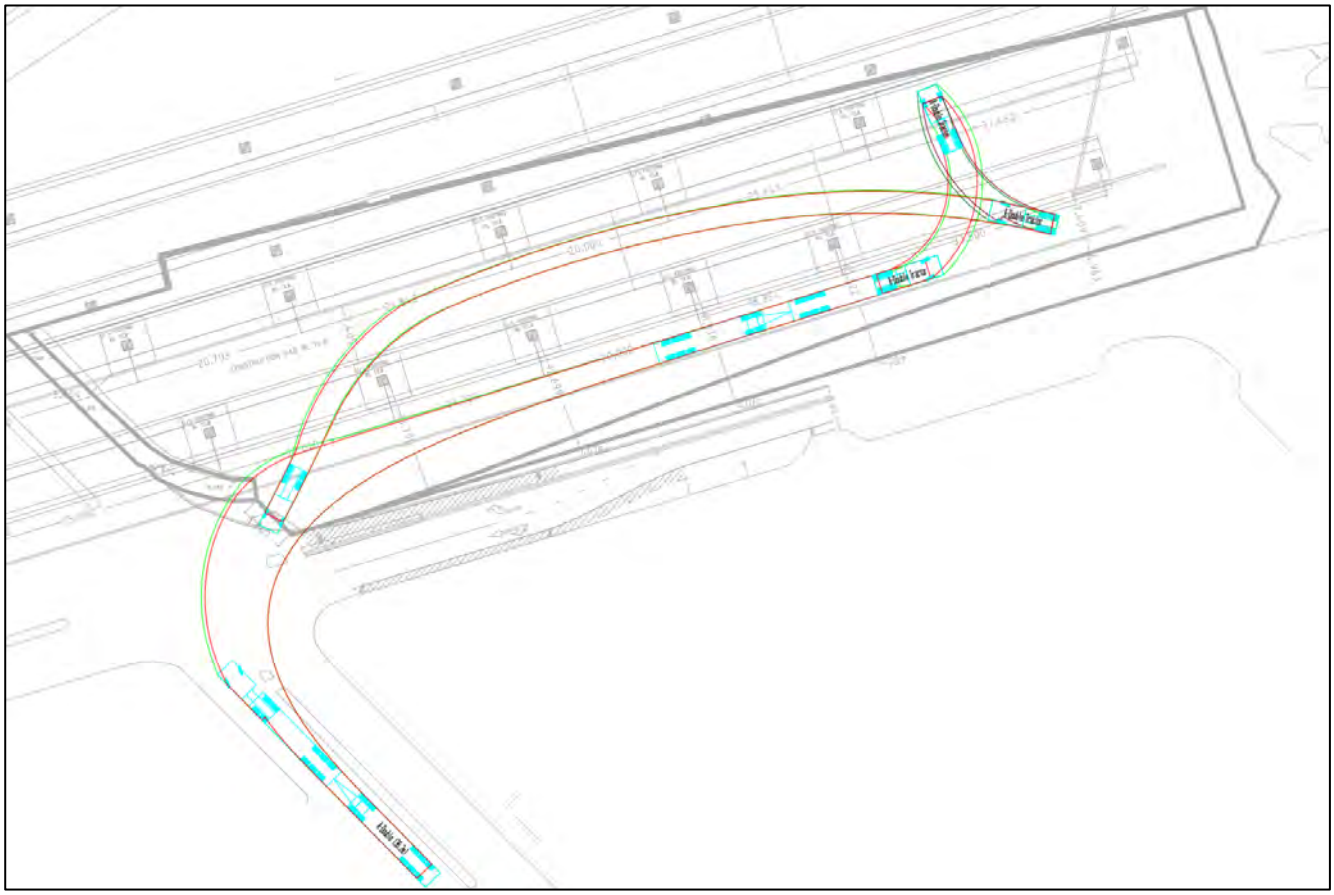


Figure 18.30: Example of major delivery "sweep path" assessment for site access

17.3.5 Substructure

17.3.5.1 Bridge Piers

17.3.5.1.1 General

Piled foundations have been selected to satisfy design load and settlement criteria. Bored piles have been selected due to ground condition and to minimize the impact to the existing PTA infrastructure and stakeholders. Reinforced concrete pile caps typically dimensioned 5.4m x 5.4m x 1.2m deep shall encompass pile sets and receive the precast Pier Columns and Crossheads.

17.3.5.1.2 Piling

The design concept provides for the 4 no. piles at each bridge pier, ranging between 20 to 24m in length and 0.90 to 1.05m in diameter.

It is anticipated that bored piles will need to be cased (temporarily) from the construction platform level to sound strata below to keep the hole open. Drilling fluids (bentonite / polymer) shall be used to provide further stability where required noting that the water table is observed to be at / near finished pile cut off level.

Designated test piles shall be installed in advance under the same conditions proposed for production piles and shall be in an approved permanent location. Once test piles have been adequately cured, testing shall be completed to verify pile capacity and installation methodology which shall be used for all production piles.

Test requirements as per STWC Technical Criteria Book 3B, Table 9:

Load Tests	Frequency
Static (including compression, lateral & tension	Greater of 2 no. or 2% of total
Dynamic (PDA / CAPWAP etc)	Greater of 5 no. or 5% of total
Integrity Tests	**Frequency**
Proof Coring	Greater of 2 no. or 0.5% of total
Sonic Logging	Greater of 2 no. or 1% of total
Low Strain	Greater of 2 no. or 2% of total

Table 18.6: Piling testing requirements

17.3.5.1.3 Construction Sequence

As the Abutments also include significant piling in a Secant Wall application, it is anticipated that the final construction program shall require two separate piling rigs supported by a common equipment spread. The following construction sequence is based utilisation of two dedicated bored piling rigs.

Piling Stage 1A & 1B – Bridge 1 & 2

- Mobilise Rig 1 & 2 to Stage 1A western construction zone to prioritize Station Platform works
- Complete test piles & verify
- Install production piles within Stage 1 western construction zone up to King William Street
- Breakdown piling spread (crane, rig, support equipment etc) and transfer over King William St to complete piles in Stage 1 eastern construction zone
- Recommence piles at Stage 1 Abutment 2 and head west back to King William Street
- Demobilise until Stage 2 access is available

Piling Stage 2A & 2B – Bridge 3 & 4

- Stage 2 station demolition is complete and access platform is progressively constructed up to either side of existing bridge (to be demolished) at King William St
- Remobilise rigs for Stage 2 works and complete / verify additional test piles (if required)
- Install production piles, commencing at Stage 2 Abutment 2 end and progressively install pile to both Bridge 3 and 4 in a westerly direction towards King William Street
- Subject to traffic ready stage of New Link Rd to provide an alternative traffic route, breakdown and transfer of piling spread over King William St may be required to complete piles in Stage 2 western construction zone. If the New Link Rd is ready, the construction access platform will be extended over King William St to avoid a rig breakdown.
- Demobilise on completion and verification of all piles.

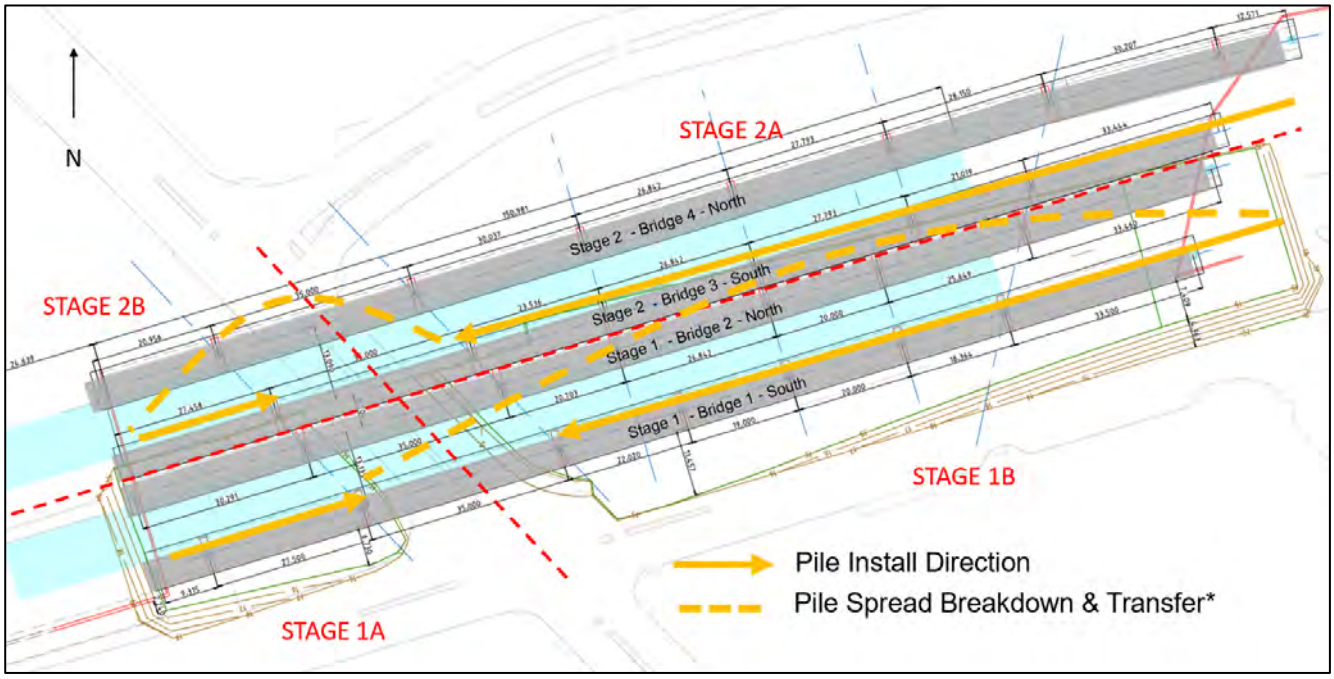


Figure 18.31: Pile Installation Sequence

17.3.5.1.4 Construction Methodology

The following typical construction methodology shall be implemented:

- A slurry plant including high speed shear mixers, pumps, storage tanks and recovery equipment will be established on site. The drilling slurry mix design consisting of bentonite/polymer/water will be based suitability to observed ground conditions.
- Temporary steel casings, typically 3m long shall be first installed so as to provide stability at the top of the pile, as well as to provide a safety barrier around the hole.
- A tracked drilling rig will be used to excavate all pile locations. Augers will be used to excavate each pile hole to the specified depth or to such a depth as to achieve the required capacity. The drilling rig will remove all bored material from the excavation and side cast material at ground level adjacent to the excavation. Cleaning buckets with reversible floors will be used to remove any loose material in the base of the piles once the specified level is achieved.
- Side cast material shall be removed from immediate area using a Excavator (~5T) and be monitored for APASS presence. Lime dosing or similar treatment methods shall be utilised to treat APASS material, making it inert before transportation to an approved disposal location.
- Reinforcing cages, prefabricated offsite, are delivered to site by truck with spacers placed on the sides of the fabricated cage to maintain cover. Fabricated cages are lifted into position using the winch line on the drilling machine or using a service crane (100T Crawler or similar).
- For wet piles, support fluid shall be de-sanded before reinforcement cage is installed. Concrete shall be placed using a tremie pipe or pump leg from the bottom up, with drilling fluid progressively expelled to recovery. Temporary pile casings are removed while concrete is still fresh.
- Piles shall be terminated piling platform level and backfilled the following shift for safety and access benefits.

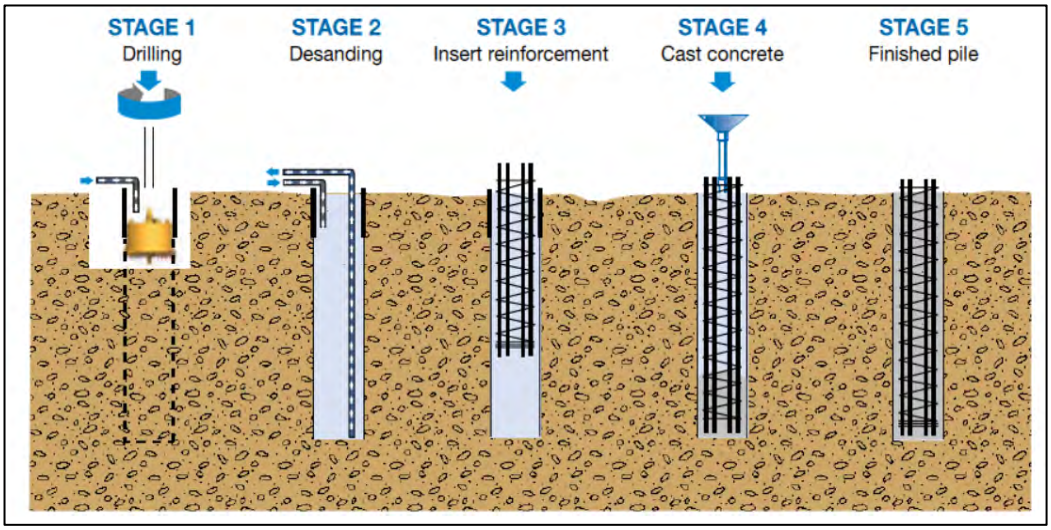


Figure 18.32: Wet Bored Pile Installation Sequence

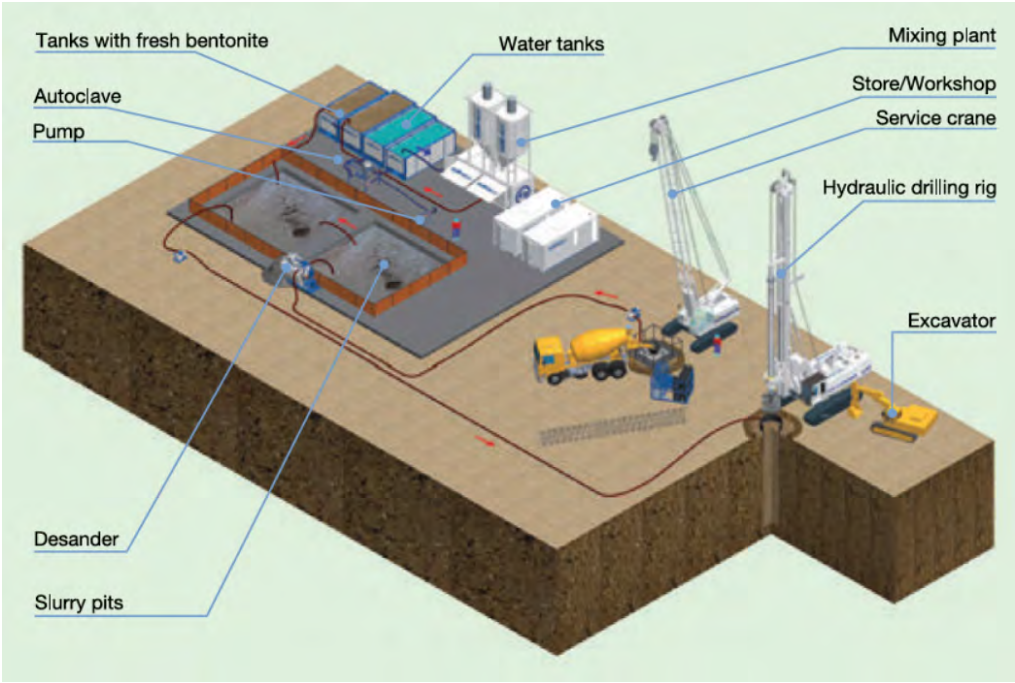


Figure 18.33: Typical Wet Bored Pile Spread

17.3.5.2 Pile Caps

17.3.5.2.1 General

Each bridge pier pile set shall be encompassed within an insitu-concrete pile cap, typically 1.2m deep, constructed in the manner further outlined below after pile construction has been verified.

The concept design elevation of Bridge Piers adjacent to King William Street suggests the horizontal offset and levels are favourable for simple construction methods and staging. Significant temporary works such sheet piling are not necessary. Best practice measures such as pedestrian hoarding and battered excavations considered adequate to permit safe and efficient construction of footings.

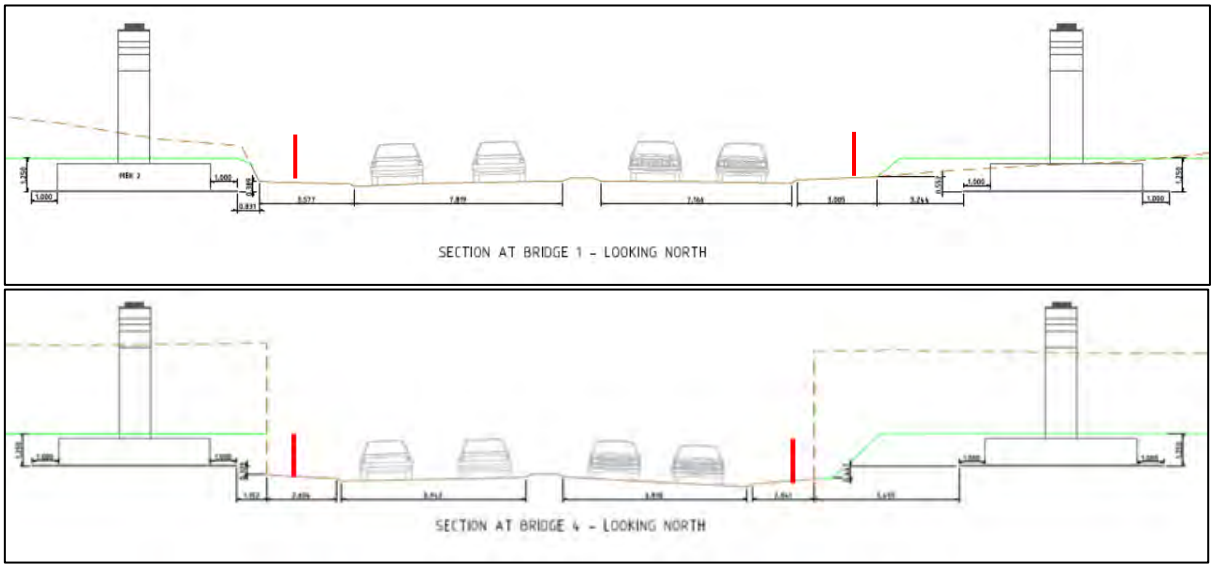


Figure 18.34: Example sections of Stage 1 and Stage 2 Bridge Piers at King William St

17.3.5.2.2 Construction Sequence

The construction of the insitu-concrete foundations to Piers and Abutments shall generally follow the same pile installation direction.

- Stage 1 A – Commencing at Abutment 1, head east towards King William St
- Stage 1 B – Commencing at Abutment 2, head west towards King William St
- Stage 2 A – Commencing at Abutment 2, head west towards King William St
- Stage 2 B – Commencing at Abutment 1, head east towards King William St

Abutment construction will be resourced to enable concurrent construction with Piers as required by the conduction program.

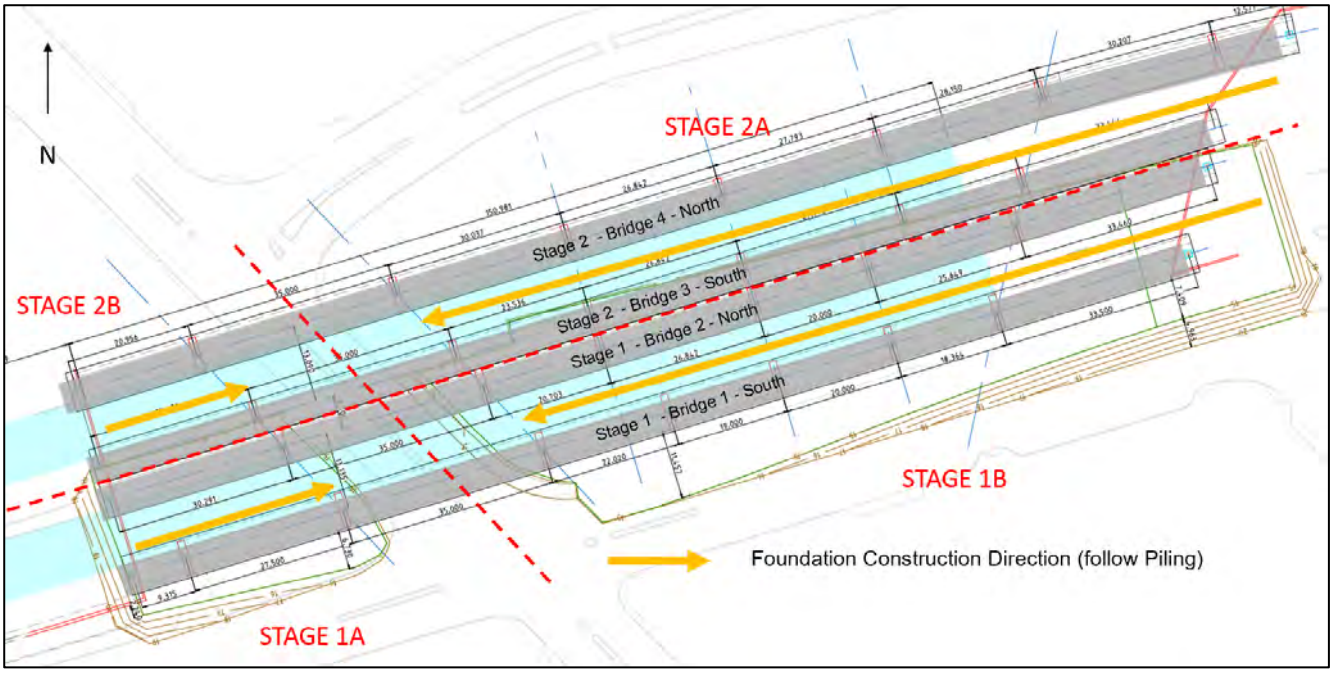


Figure 18.35: Foundation Construction Staging

17.3.5.2.3 Construction Methodology

The following typical construction methodology shall be implemented:

- Following installation and verification of piles, dewatering spares (if required) shall be installed to permit safe and efficient open excavation works to underside of concrete blinding level.
- A hydraulic powered diamond saw shall be used on its side to “ring cut” the piles at the design cut-off level, nominally 50mm above blinding level. Care shall be taken to ensure only the cover concrete is cut and no damage to the reinforcement bars occurs.
- Blinding concrete shall be installed to design level followed by controlled breakdown of piles to cut-off level using a combination of excavator mounted hydraulic breaker and heavy duty pneumatic / electric powered manual breakers.
- Pile reinforcement shall be carefully exposed and trimmed for bonding into the pile cap reinforcement cage.
- Insitu reinforced concrete foundations shall be constructed to the design line and level using industry best practice and compliance to all relevant specifications and standards. Approved construction joints shall be provided for subsequent pour elements, including kickers, reinforcement development and scabbling as required.
- Stress bars for the precast column connections and other cast-in elements i.e. drainage pipe, conduits, earthing etc shall be installed, securely fastened and protected from the possibility of movement and slurry ingress during concrete placement.
- Concrete shall be pump placed and finished to the required class within suitable proprietary formwork that incorporates safe work access.
- Formwork shall be stripped following initial curing (3 days) and hold point release. Any additional patching shall be completed immediately in conjunction with membrane curing.
- Backfill shall be completed as early as possible thereafter using hand / remote operated compaction equipment, verified by the necessary compaction QA. Dewatering shall be maintained until backfill is complete.
- Where pile-caps are to be backfilled over to facilitate heavy crane access, the stress bars, ducts and grout tubes shall be sealed and structurally protected using clean sand, hardwood packers and steel plates.

Material handling for insitu-concrete foundations shall be typically supported by a 20T Franna or larger site service crane as required.

17.3.5.3 Pier Columns and Crossheads

17.3.5.3.1 General

Offsite precast manufacture of Piers and Crossheads that are structurally integrated using post-tensioned stress bars with grouted joints provides significant benefits over conventional insitu-construction including:

- Reduced construction duration
- More consistent higher-class concrete finish
- Reduced site activity interfaces and resource requirements
- Improved planning flexibility where access constraints are significant

Each Pier and Crosshead weighs approximately 15t and 24t respectively and shall be manufactured and stored offsite until required. Elements shall be delivered in sets utilised standard 50t drop deck floats with rigging utilising a minimum 120t crane and mobile elevated work platform (EWP).

Following construction of the piles and pilecaps, the foundations may be protected and backfilled to improve access for delivery and installation of the Superstructure. The staged installation extents shall be determined in conjunction with preparation of heavy lift designs and final installation sequence. Provisional installation stages aligned with proposed Superstructure install sequence are detailed below.

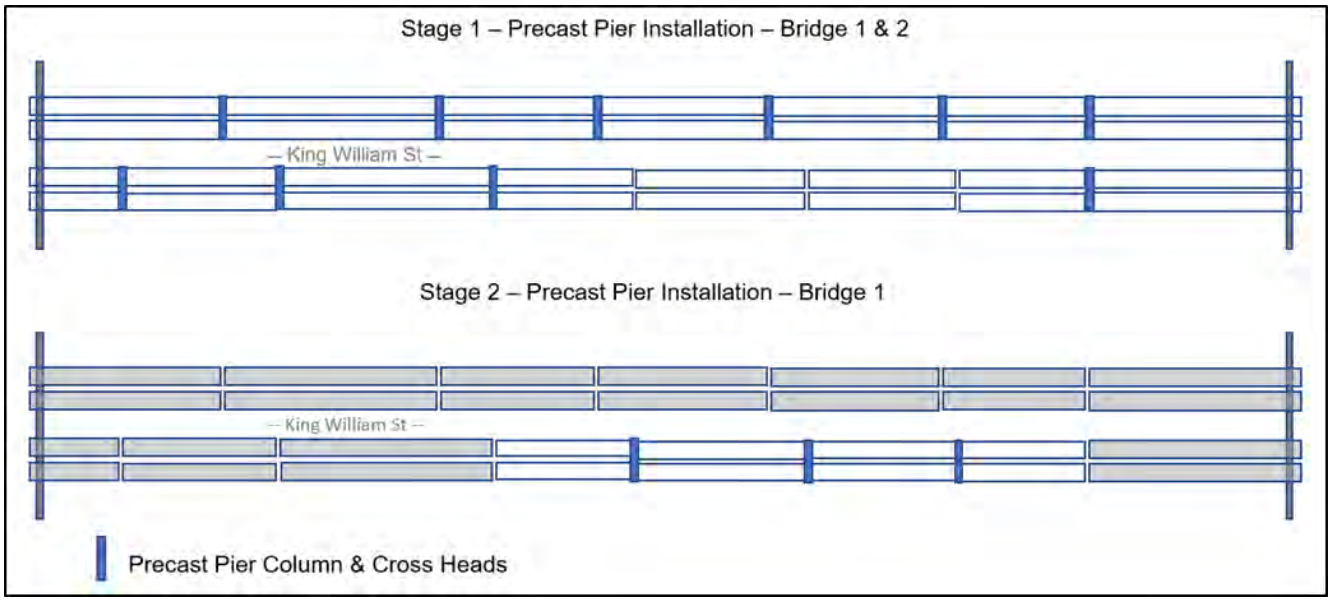


Figure 18.36: Stage 1 (Bridge 1 & 2) precast Column & Crosshead installation sequence

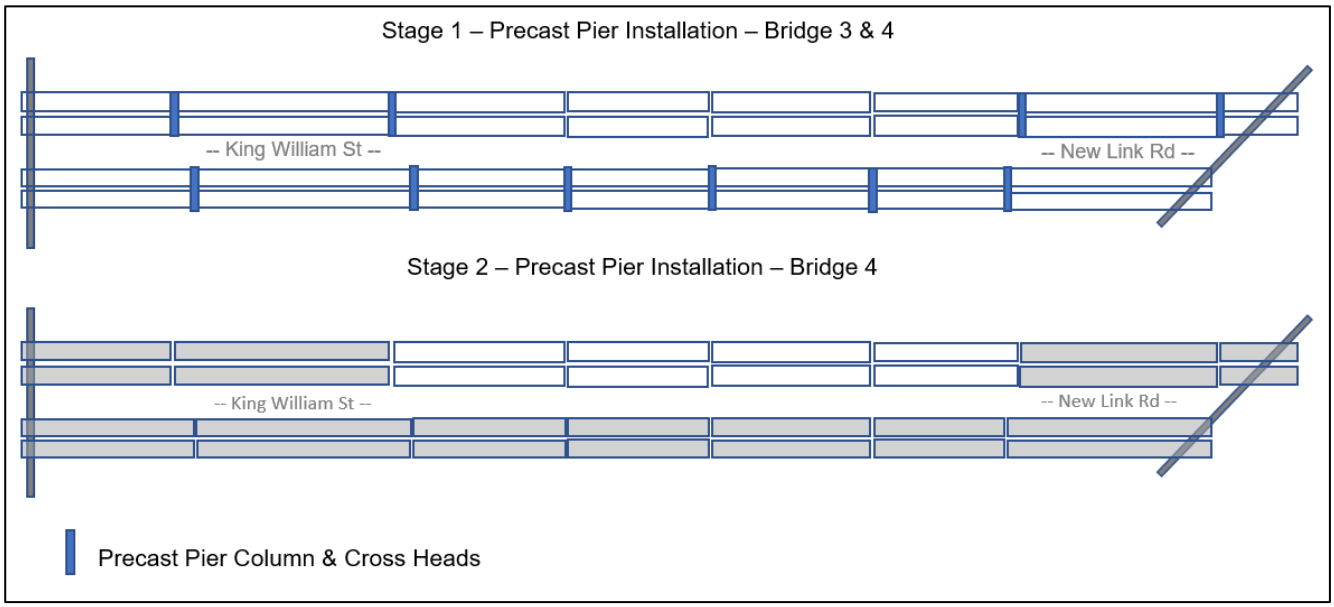


Figure 18.37: Stage 2 (Bridge 3 & 4) precast Column & Crosshead installation sequence

17.3.5.3.2 Construction Sequence

Installation of the Piers and Crossheads shall proceed as detailed below, sequenced to provide maximum flexibility to Superstructure major lift requirements.

Stage 1 – Foundation

- Construct foundations including stress bars, couplers, ducts, grout tubes and drainage / services conduits (where applicable)

Stage 2 - Column

- Install foam sealant around stress bar ducts, drainage pipes and service conduits (where applicable)
- Install stress bars to full height including protector sleeves
- Install non-metallic packers to achieve a nominal 15-25mm grout gap and complete survey verification
- Install precast Pier column

Stage 3 – Crosshead

- Install foam sealant around stress bar ducts, drainage pipes and service conduits (where applicable)
- Install non-metallic packers to achieve a nominal 15-25mm grout gap and complete survey verification
- Install precast Crosshead
- Install stress bar live end nut / plate and initially stress to 50KN to secure
- Install watertight grout formwork about connection joints and place epoxy grout for high early strength
- Complete full and final stressing when grout has achieved 30mpa minimum strength
- Grout stress bar ducts using low bleed post tensioning 50mpa cementitious grout
- Trim stress bars to achieve minimum 40mm cover and grout stressing pocket flush using 50mpa cementitious grout
- Once grout has achieved minimum 20mpa, temporary jacks and / or bearings can be installed in readiness to installation of Superstructure.

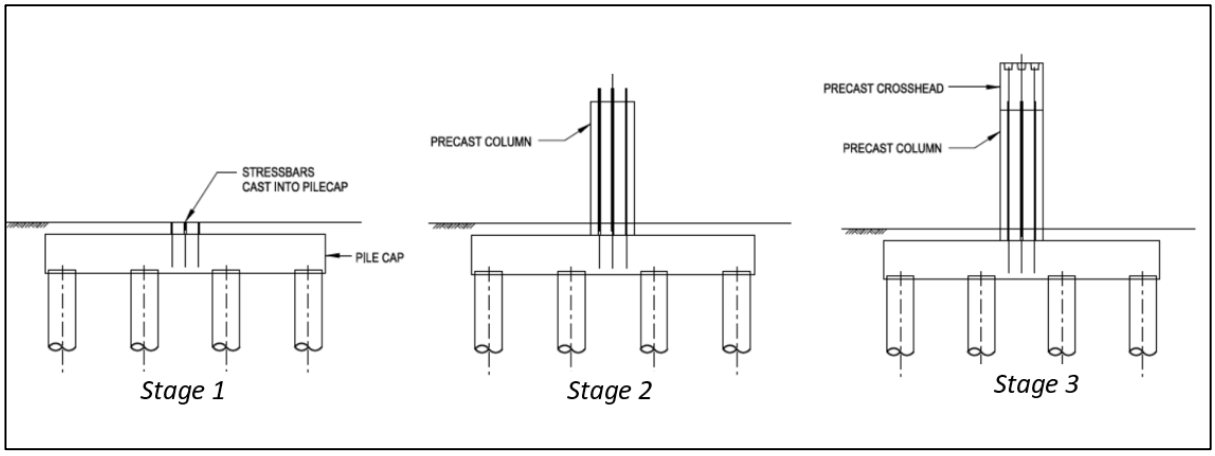


Figure 18.38: Pier Staging

Figure 18.39: Pier Installation Photos

17.3.5.4 Abutments

17.3.5.4.1 General

The design concept for the Abutments utilises a Secant piled wall with above ground reinforced insitu-concrete capping beam supporting the Superstructure. The main benefit of Secant piling is that it enables “top down” construction methodology and provides structural retainment of the rail embankment between Stage 1 and 2 where differential levels of approximately 3 metres exist until the Stage 2 embankment is complete.

Abutment 1 (western) secant piled wall are to be constructed from 900mm diameter piles at 1500mm centres with Abutment 2 (eastern) constructed from 750mm diameter piles at 1250mm centres. Both walls shall be constructed in a hard-soft arrangement where “soft piles” are unreinforced and constructed first to a lessor level primarily for ground retainment with the “hard piles” full depth reinforced piles primarily for load transfer. The standard construction methodology for individual secant piles is similar to bored piles outlined under Bridge Piers.

The pile capping Superstructure support concrete works shall be constructed before the ground level is reduced to the lower construction platform / permanent road level in front of the Abutment wall.

Where Abutment walls remain exposed, the secant piled wall sections shall be faced with a precast façade wall panel to satisfy SWTC requirements.

Each Abutment shall be constructed in half to facilitate the staged constructed and shall incorporate stage connection details that are considerate of equipment access requirements and live rail operation restrictions which shall maximise safety and efficiency of the works.

To expedite the construction program, it is anticipated that two piling rigs shall be mobilised with piling activities commencing commence at each Abutment, continuing to complete Pier piles on completion of Abutment piles.

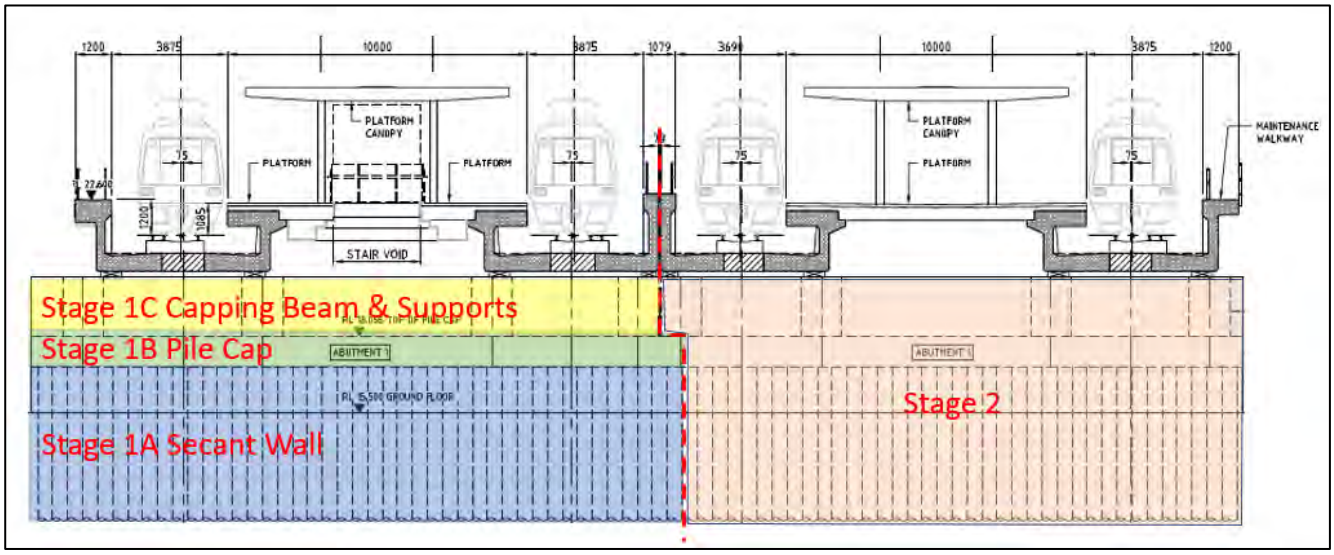


Figure 18.40: Typical abutment staging at Western Abutment 1

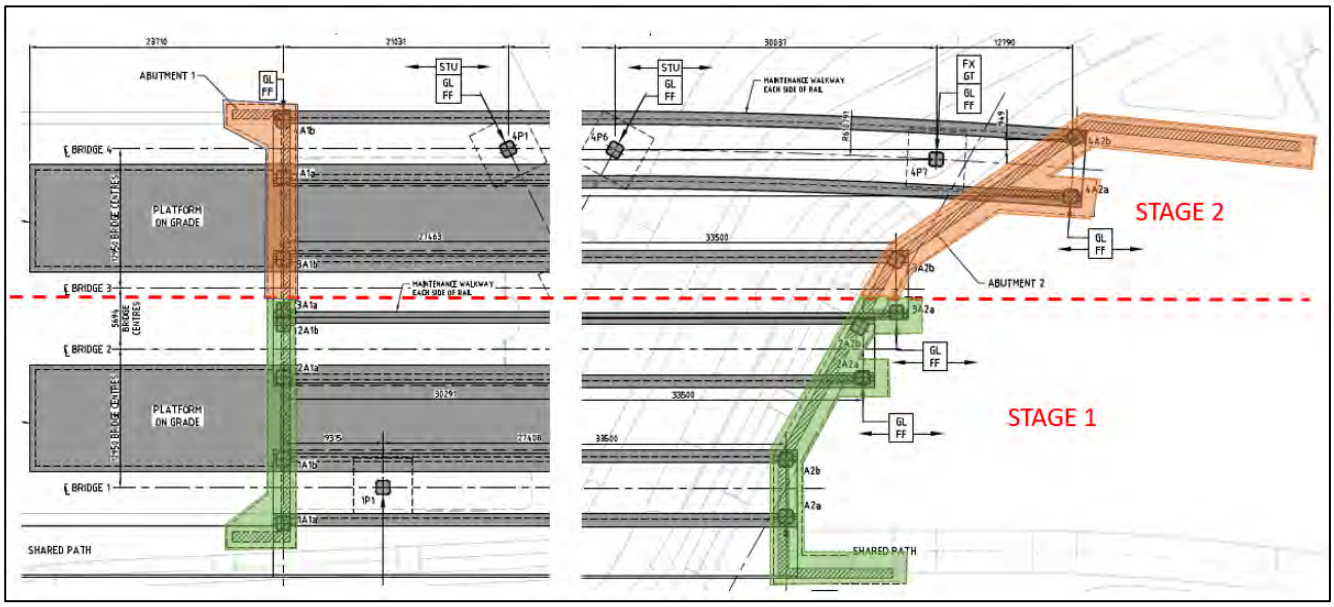


Figure 18.41: Stage 1 & 2 Abutment Construction

Where Abutment 2 Stage 1 encroaches within the 3m offset from live rail general exclusion zone, a physical hoarding shall be installed in advance to provide a physical exclusion barrier.

17.3.5.4.2 Construction Sequence

The construction of the Abutments shall proceed in the following typical sequence for each stage and Abutment:

- Prepare piling platforms at ~RL17
- Install GE fencing and additional fixed hoarding where works conducted <3m from live rail
- Construct concrete piling guide at underside of Pilecap level
- Install “soft” piles to specified lessor depth
- Install reinforced “hard piles” between “soft piles” thereby interlocking piles and forming a continuous piled wall
- Remove piling guide and complete detailed earthworks in preparation for Pilecap
- Ring cut piles at the design cut-off level, nominally 50mm above blinding level.

- Place blinding concrete
- Breakout and prepare pile tops to expose reinforcement for bonding into Pilecap
- Construct reinforced concrete Pilecap including construction joint for Capping Beam
- Construct Capping Beam inclusive of Bearing Supports and Curtain Wall
- Delay front wall excavation down to RL15 until after Superstructure installed or alternatively reduce ground level before hand
- Finish exposed Secant wall with a precast façade panel where exposed

Figure 18.42: Typical sequence for Secant Piled Walls

17.3.6 Superstructure

17.3.6.1 Overview

The Superstructure utilises precast “L Girders” that are installed in half shells and made structurally continuous with a central insitu-concrete strip and post tensioning through girder end diaphragms. The total length of each bridge is designed as two individual continuous section lengths, simply supported at each Abutment end and approximately halfway at Pier 4.

The concept design details a total of 60 no. “L Girders” or 30 spans in pairs ranging between 9.65m to 35.00m in length and 74T to 241T in weight, respectively.

The Girders shall not be installed until the precast Pier and Crosshead have been fully stressed and grout, typically after a minimum 3 days cure time where high early strength grout is used.

A crane-based methodology shall be adopted with SMPT units (Self Propelled Modular Transporters) used in support where access constraints prevent Girder delivery transport from “jacking down” at adjacent locations within the lift radius. Determination of final crane sizing, configuration (single vs dual) and support equipment requirements (SPMT etc) shall be determined by engineered lift design process.

Girders manufactured and temporarily stored at Delta’s Herne Hill facility shall be transported to site during night shift to minimise impact to traffic users and the wider public. Each Girder shall be delivered using “just-in-time” planning and set to rest upon load rated stools in carefully planned laydown locations.

Each Girder shall be rigged, lifted and installed onto temporary jacks to provide for detailed adjustment and support until full load transfer to the permanent bearings at completion of installation.

Temporary restraint and stability support of the “L Girders” shall be provided until insitu-stitching is complete. RMD mega-shore system or similar shall be used to provide a restraint frame,

connected to the precast Crosshead using stress bar couplers. Each Girder shall be “packed out” against the restraint frame using hardwood wedges and packers. Where possible, the restraint frame shall be pre-rigged to the Crosshead at ground level and be incorporated into access platform support. Alternative tie-down restraints using stress bar couplers cast into the Crossheads with stress bars the securing the overlying girders shall also be considered further. All temporary works systems including connection points shall be removed and reinstated on completion of works.

The design concept utilises a precast “trans-floor” plank for provide permanent soffit formwork which shall support the insitu-concrete stitch slab and potentially integrated track slab. Drainage elements and other embedment’s shall be installed, secured and sealed prior to concreting.

A 200mm wide transverse insitu-concrete stitch joint shall be provided at each continuous Girder joint location, providing adequate space to install and seal tendon duct couplers and install any necessary reinforcement. The vertical wall element stitch to be poured continuously with the floor stitch where possible utilising a maximum 14mm high flow concrete mix pumped from ground level.

Scaffold access shall be provided at each Pier location for landing of Girders and subsequent activities including bearing installation and stitching. Mobile elevated work platforms (EWP) shall also be utilised where possible or require i.e. in advance to scaffold installation.

Continuity post tensioning (PT) shall be completed following insitu-stitching works from within the Girder trough where stress pockets will be accessible. PT ducts shall be sealed, air-tested and protected during both Girder and onsite stitch casting stages to ensure they remain clear for strand pushing. PT tendons shall each consist of 9 strands of 15.2mm / 260KN MBL with each strand pushed separately using an electric strand-pusher and bullet. PT anchor castings shall be prepared to live and dead-end anchor head to enable stressing after strand pushing and termination. Theoretical strand extensions shall be calculated and approved prior to commencing stressing works for comparison against actual extensions recorded. Approval to cut shall be sort before anchors are sealed and grouting is completed using low bleed high strength cementitious grout. Stressing rebates shall be filled with minimum 30mpa grout or micro-concrete on completion of works.

General Superstructure installation sequence:

- Pier and Abutment construction
- Install temporary jacks and restraint
- Rig, lift, install and secure each “L Girder”
- Construction insitu-concrete stitch slabs inclusive of drainage etc
- Join PT couplers and construct transverse stitch to vertical wall elements (combined with above if possible)
- Install Post Tensioning
- Install permanent Bearings and remove temporary jacks
- Install track slab and other ancillary items

17.3.6.2 Stage 1

17.3.6.2.1 General

The anticipated crane configuration arrangement for Stage 1 consists of a 250T Crawler Crane as the primary construction crane with a secondary 500T Mobile Hydraulic Crane mobilised to site specifically for dual lift durations.

Given the construction constraints and limited lift radius’s, an SPMT shall be mobilised uplift the girders from their adjacent delivery location and reposition within the lift configuration capacity zone. Where possible, the girders will be delivered to the required locations to avoid double handling.

The proposed heavy lift configuration and span designation for Stage 1 is outlined below:

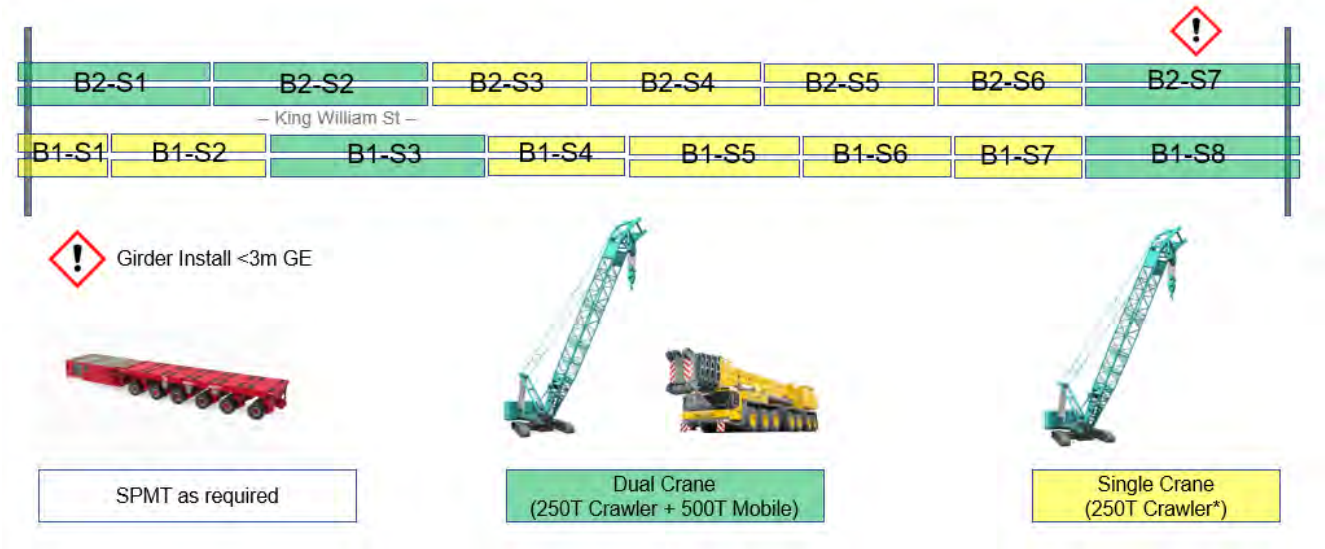


Figure 18.43: Stage 1 Lift Configuration

Where girder installation encroaches within the 3m General Exclusion Zone such as Span B2-S7, these installation works shall be completed under a de-energised track possession, expected to be made available for night shift.

A preliminary lift assessment has been completed to determine suitability of the proposed configuration which is outlined in Table 15.7 below.

OPTION – 250T Crawler & 500T All-Terrain Mobile									
250T Crawler Kobelco **CKE2500-2**					500T All-Terrain Liebherr **LTM1500-8.1**				
Load Chart	Boom	Equipment	Max Radius	Chart Use	Load Chart	Boom	Equipment	Max Radius	Chart Use
(T)	(m)	(T)	(m)	(%)	(T)	(m)	(T)	(m)	(%)
72.10	33.5	5.3	14	89.18	N/A				
101.65	33.5	4.3	11	92.43	97.00	26.5	4.3	15	96.87
120.30	33.5	4.3	9.5	96.56	122.00	26.5	4.3	12	95.21
141.40	33.5	5.3	8	87.20	N/A				
127.30	33.5	5.3	9	85.86					
127.30	33.5	5.3	9	85.07					
127.30	33.5	5.3	9	86.65					
120.30	33.5	4.3	9.5	95.56	122.00	26.5	4.3	12	94.23
101.65	33.5	4.3	11	96.57	104.00	26.5	4.3	14	94.38
120.30	33.5	4.3	9.5	91.57	122.00	26.5	4.3	12	90.30
127.30	33.5	5.3	9	87.43	N/A				
90.00	33.5	4.3	12	95.73	90.00	26.5	4.3	16	95.73
120.30	33.5	5.3	9.5	85.04	N/A				
90.00	33.5	4.3	12	95.07	90.00	26.5	4.3	16	95.07
113.30	33.5	4.3	10	95.11	113.00	26.5	4.3	13	95.36

Single Lift Dual Lift

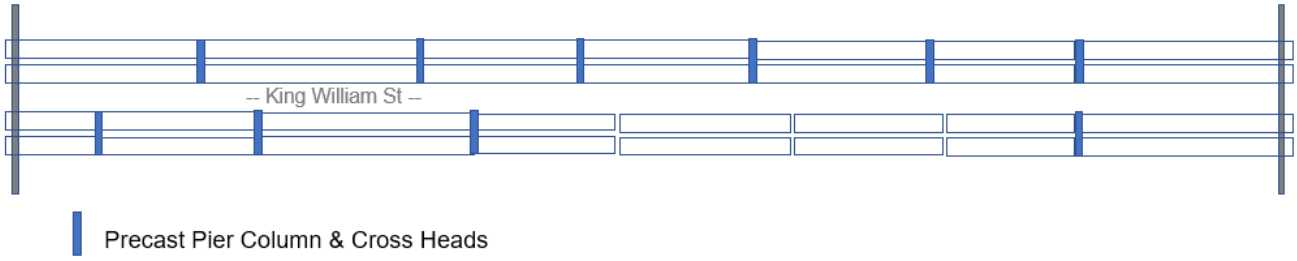
Table 18.7: Lift Configuration Assessment

17.3.6.2.2 Construction Sequence

To optimise mobilisations and prioritise station platform work areas at the western end of the structure, the Superstructure installation works shall commence at Abutment 1 (west) with the initial five spans installed during a closure of King William St. King William St shall be temporarily backfilled to provide heavy lift equipment access and prevent damage to the existing road that will be reopened after the closure.

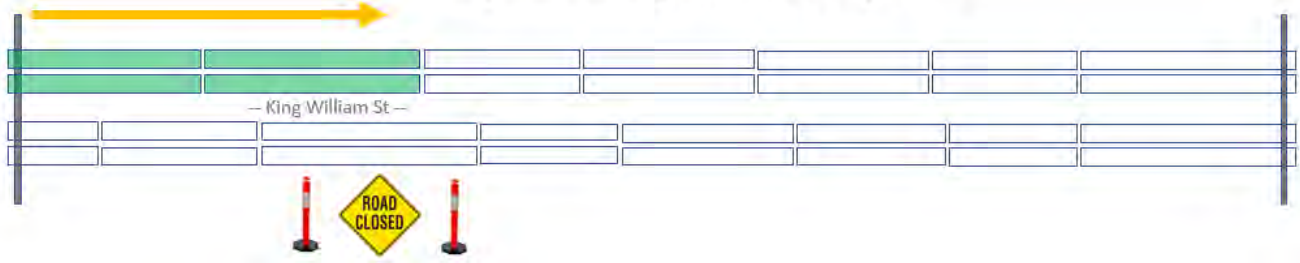
The proposed detailed installation sequence is outlined below:

Stage 1 – Precast Pier Installation

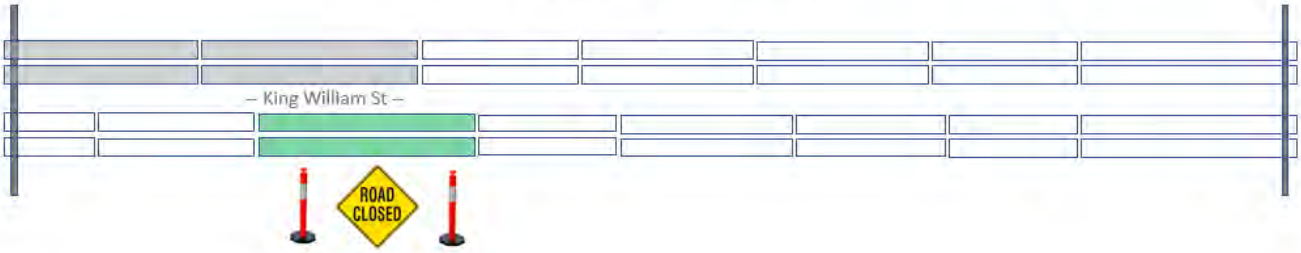


Precast Pier Column & Cross Heads

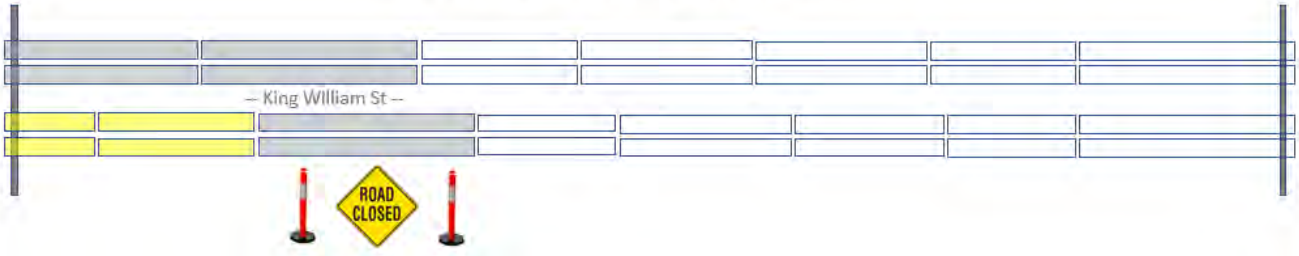
Stage 2 – Dual Lift @ Abutment 1 & King William St



Stage 3 – Dual Lift @ King William St



Stage 4 – Single Lift @ Abutment 1



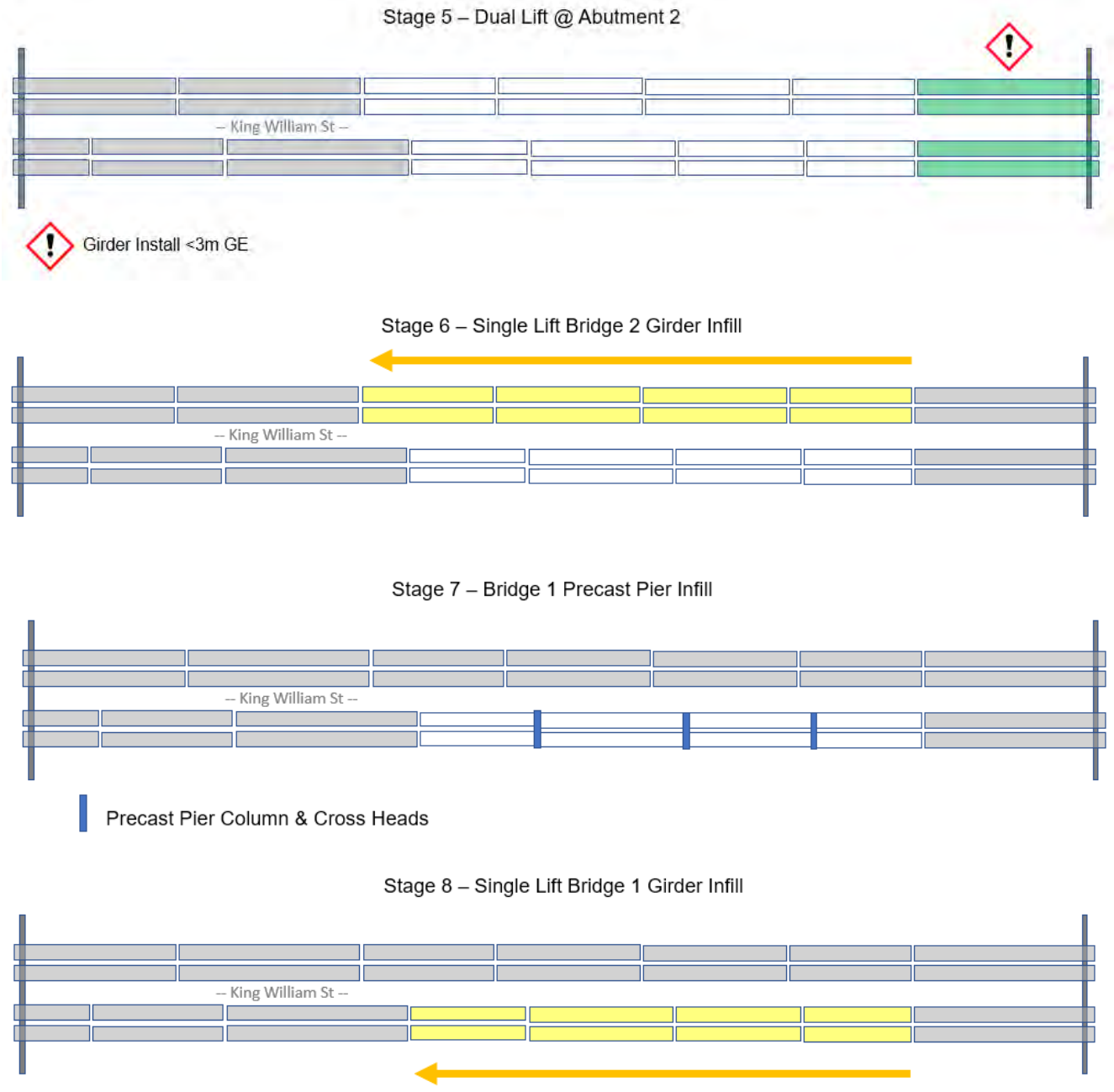


Figure 18.44: Beam lifting sequence stage 1

17.3.6.3 Stage 2

17.3.6.3.1 General

The dual crane configuration outlined for Stage 1 consisting of a 250T Crawler Crane and a secondary 500T Mobile Hydraulic Crane for dual lifts has also been adopted for Stage 2 however as additional room is available to the north of Stage 2 Superstructure, an option to utilize singular 400T Crawler Crane to complete all lifts is available will be considered further.

The proposed heavy lift configuration and span designation for Stage 2 is outlined below:

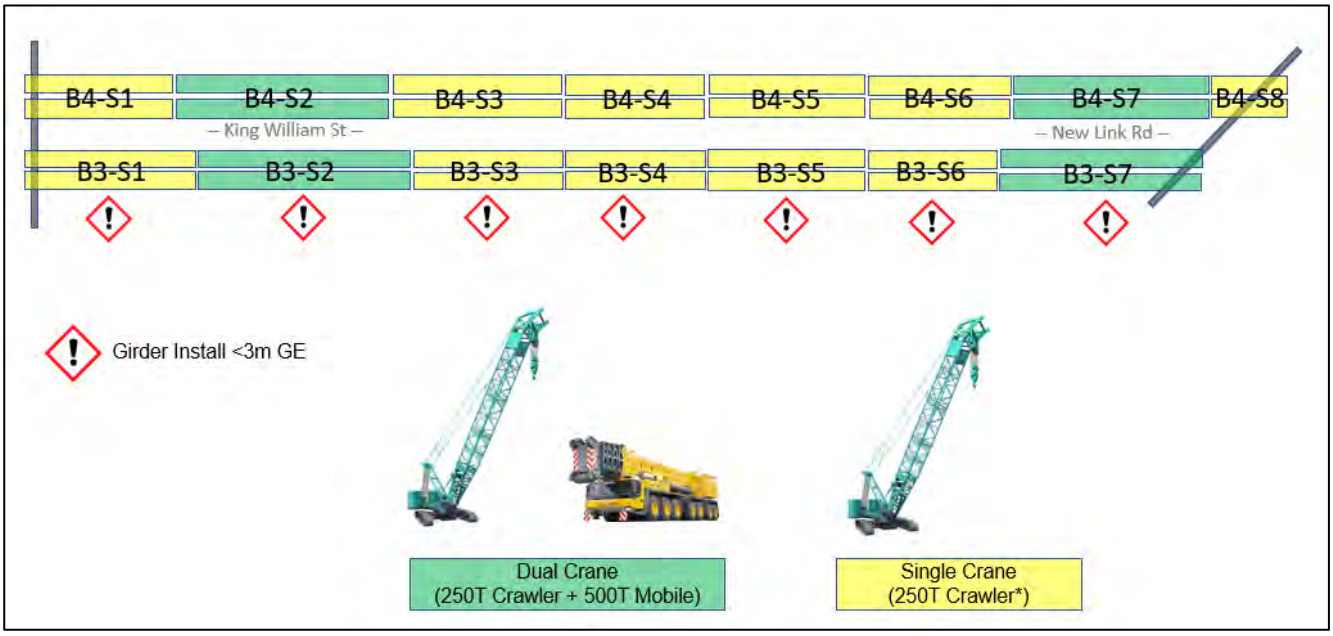


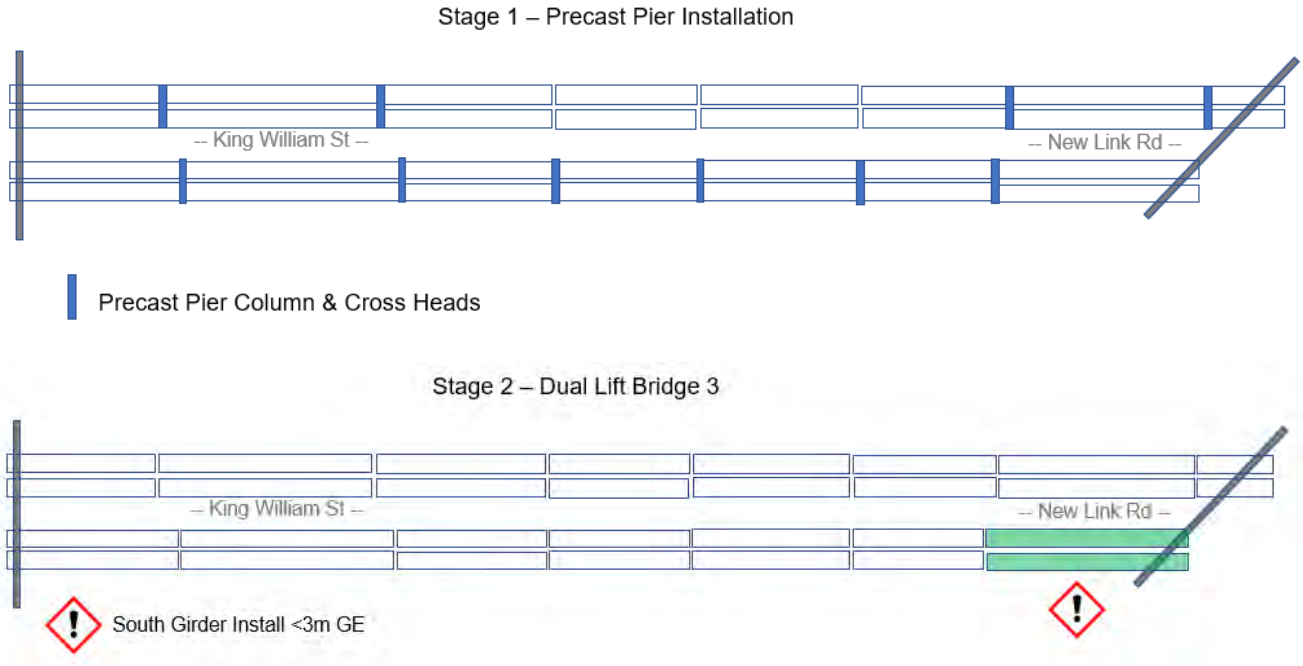
Figure 18.45: Stage **2 Anticipated Lift Configuration**

Of major consideration for Stage 2 is that the southernmost "L Girder" of Bridge 3 encroaches within the 3m General Exclusion Zone for the full length of the Superstructure therefore these installation works shall be completed under a de-energised track possession, expected to be made available for night shift. Further detailed planning will be undertaken to determine most efficient installation sequence given constraints.

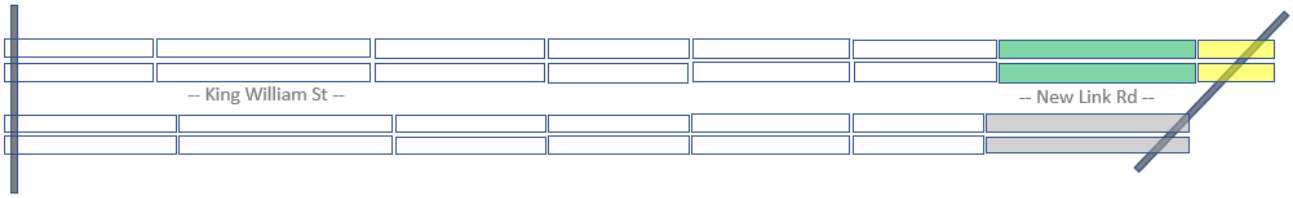
17.3.6.3.2 Construction Sequence

Stage 2 works shall be constructed to prioritize the completion and opening of the New Link Road so an acceptable traffic diversion can be established whilst King William St is closed to enable the demolition of the existing bridge and installation of new Superstructure.

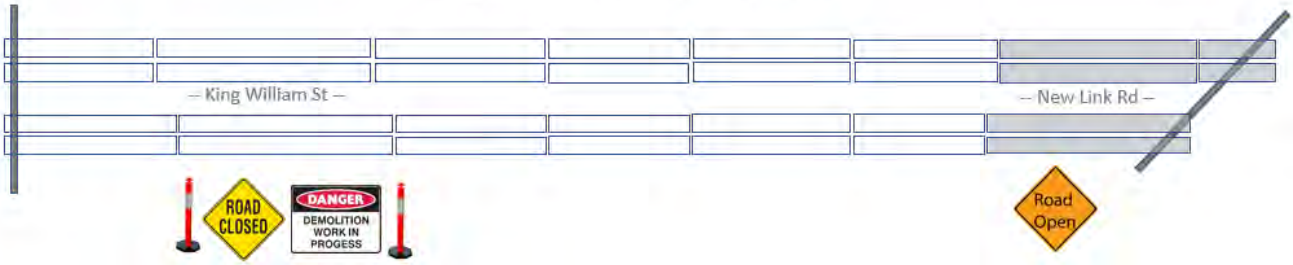
The proposed detailed installation sequence for Stage 2 is outlined below:



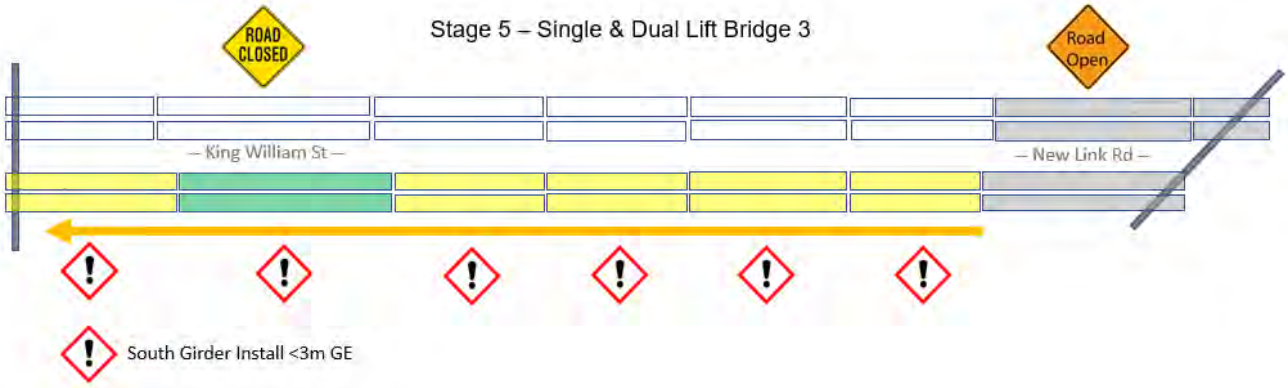
Stage 3 – Dual & Single Lift Bridge 4



Stage 4 – Traffic Diversion & Demolition

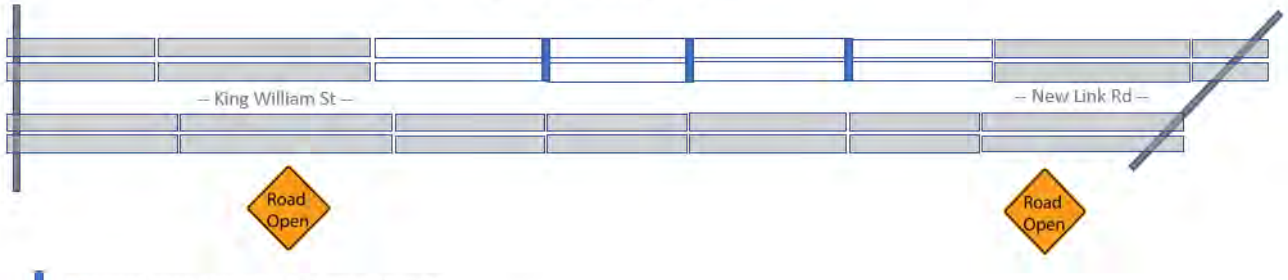


Stage 5 – Single & Dual Lift Bridge 3



Stage 6 – Single & Dual Lift Bridge 4

Stage 7 – Precast Pier Installation Infill



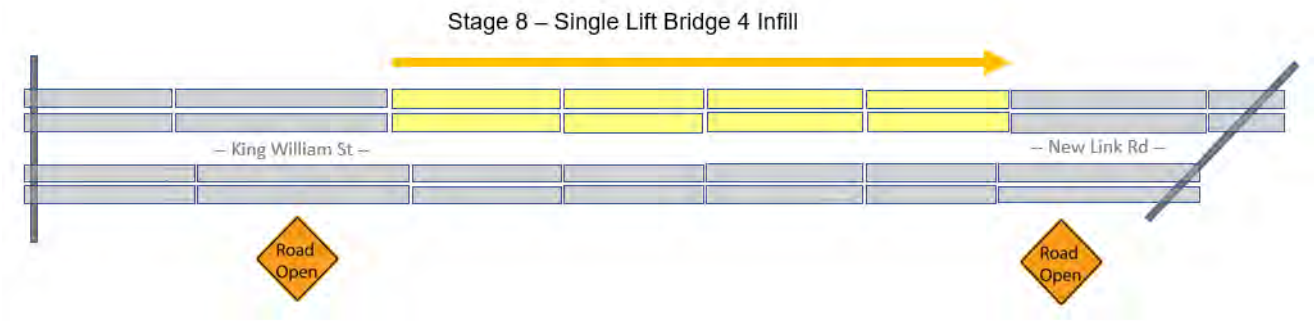


Figure 18.46: Beam lifting sequence stage 2

17.3.7 Bearings

The bridge superstructure is proposed to be supported on pot bearings however spherical bearings shall also be considered further given improved durability under rail type cyclic loading.

Longitudinal restraint to the superstructure is provided at the central pier location by providing fully fixed pot bearings. The superstructure is longitudinally free at Abutment No. 1 and Abutment No. 2 with transverse restraint to the superstructure is provided at all piers.

Temporary bearings shall be installed in advance to receive “L Girders” as described under Superstructure section.

Ferrules for fixing the top plate to the underside of the outside each girder shall be accurately cast into position using a steel template that is survey verified for each pour.

Bearings shall be pre-fixed to the girder before installation and “hung” in readiness for landing of girders. Temporary bearings, jacks and other items shall be carefully positioned to keep permanent bearing locations clear.

Oversize galvanised duct shall be cast into the Crossheads to receive the bottom fixing plate hold down bolts and the surface under the bearing shall be scabbled in readiness for grouting.

Once girders have been stitched and verified, the bearings shall be grouted into position from top of prepared Crosshead to underside of bearing bottom plate. Grout works shall follow best practice using high early strength cementitious (70Mpa) gravity forced into watertight formwork. Grout pads shall be appropriately finished and continuously cured to ensure high strength and durability.

Temporary jacks and bearing restrictors shall be removed once grout has gained at least 30Mpa or otherwise directed.

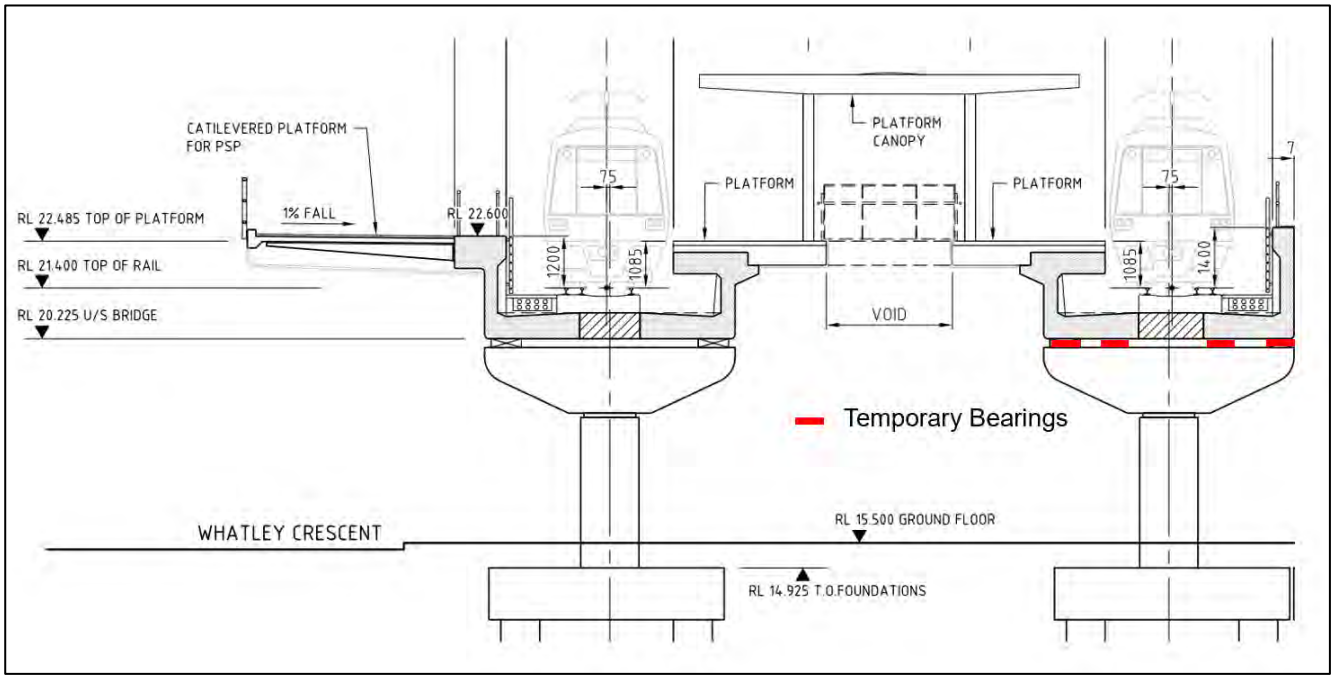


Figure 18.47: Indicative temporary bearing locations (right) and permanent bearing locations (left)

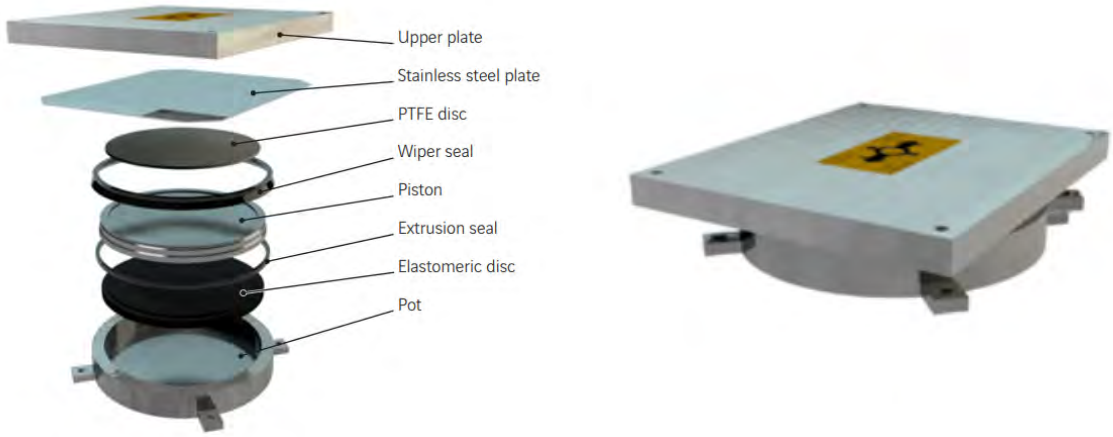


Figure 18.48: Typical Pot Bearing

17.3.8 Platform

17.3.8.1 Overview

The platform spanning between Bridge 1 and 2 for of Stage 1 and Bridge 3 and 4 for Stage 2 shall be constructed in a similar fashion, utilising transverse precast deck planks with an insitu-concrete slab topping.

The platform planks may be installed prior however the insitu-concrete topping slab shall not be completed until the Superstructure Girders and stitched and stressed in their permanent state.

The transverse planks shall be supported by a corbel integrated into each Superstructure beam. Each plank shall have integrated thickenings and truss reo to ensure plank is self-supporting under its own weight, and additional loads to arise during construction of insitu-topping slab, thereby removing the needs for any additional falsework propping.

Each plank weighing approximately 7t shall be rigged at ground level using dedicated riggers and then hoisted into position utilising the 250T Crawler Crane or a 90-160T mobile crane where access and availability determines. Riggers shall utilize two ground-based mobile elevated work platforms (EWP) or alternatively, position themselves within the Superstructure “trough” with suitable fall restraint, shall land panels in their final position. An oversize backing road used to seal each panel joint and contain cement slurry.

Panels shall be installed in an East to West direction with the planks over King William Street (live road) to be installed during a short traffic closure, co-coincided with other activities.

The reinforced concrete topping slab shall be accurately constructed to the design line and level. Concrete pours shall be limited to manageable sizes (<100m3) with a ground-based boom pump delivering concrete to the elevated work area.

Small service penetrations shall be detailed in the precast plans however suspended insitu-concrete slabs is anticipated for large penetrations such i.e. stair wells, elevator shafts. Formwork for suspended slabs shall appropriately designed to be propped from ground level (“rapid shore” or similar) or form decks, assembled at ground level shall be raised into position and suspended from the Superstructure.

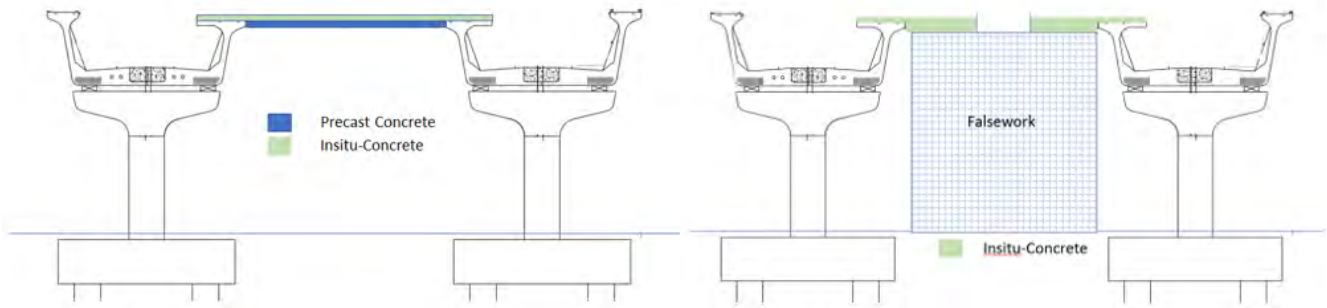


Figure 18.49: Platform deck construction options

Figure 18.50: Transverse deck planks c/w structural “truss” reinforcement

17.3.8.2 Construction Sequence

The platform slab shall be constructed in an east to west direction with the span over King William St shall be completed during a road closure with works not anticipated to take longer than 1 shift install and seal planks so the road can be safely reopened.

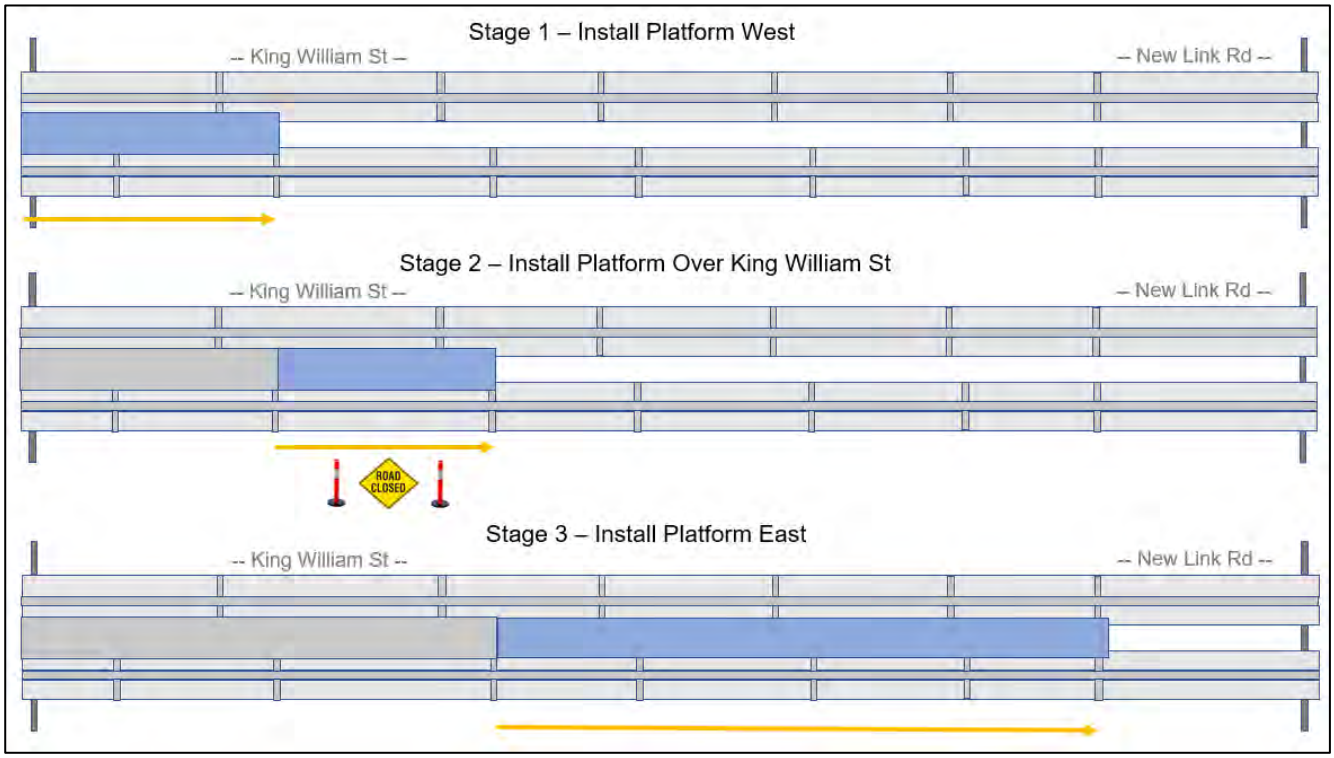


Figure 18.51: Typical Platform deck slab install sequence

17.3.9 PShP Path

17.3.9.1 General

Provision and maintenance of suitable PSHP paths throughout the project stages is a key project objective. Evolve Bayswater shall establish and maintain a temporary PSHP along the northern side of Whatley Crescent until such time that the new PSHP path affixed the new station bridge structure is complete and commissioned.

The design concept utilises offsite precast manufactured Cantilever Support Beam and Deck Planks with integrated Kerb. The PSHP structure shall not be installed until the Superstructure Girders and stitched and stressed in their permanent state.

Each Beam and Plank weighs approximately 3.5T and 4.5T respectively and shall be manufactured and stored offsite until required. Elements shall be delivered in sets utilised standard semi-truck transport with rigging utilising the 250T Crawler Crane or 90-120T mobile crane and 2 no. mobile elevated work platforms (EWP).

Cantilever Support Beams are evenly spaced at 3m centres and are structurally bonded using 3 no. post tensioned stress bars with a grouted joint. Each beam shall be rigged, temporarily supported by a temporary corbel plate or hanger, shimmed and then secured by initial stressing prior to grouting and final stressing activities.

Deck Planks are simply supported between each Cantilever Support Beam with an insitu-concrete stitch permanently integrating the elements. Once the stitch has adequately cured, a heat tolerant waterproof strip membrane shall be applied to all joints before finishing workings including Asphalt is placed.

Permanent handrail stanchions shall be affixed to each support beam before rigging into position and shall support temporary fall restraint prior to completion of permanent edge protection.

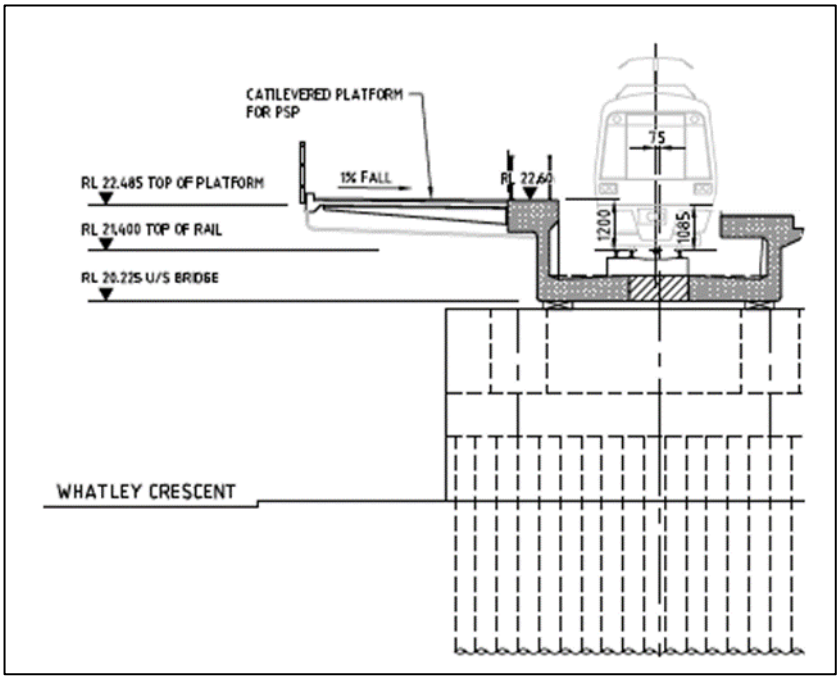


Figure 18.52: Typical PShP Section

17.3.9.2 Construction Sequence

The PShP path shall be constructed from both ends as access permits up to King William St. The span over King William St shall be completed during a road closure with works not anticipated to take longer than 3 shifts to where road can be safely reopened.

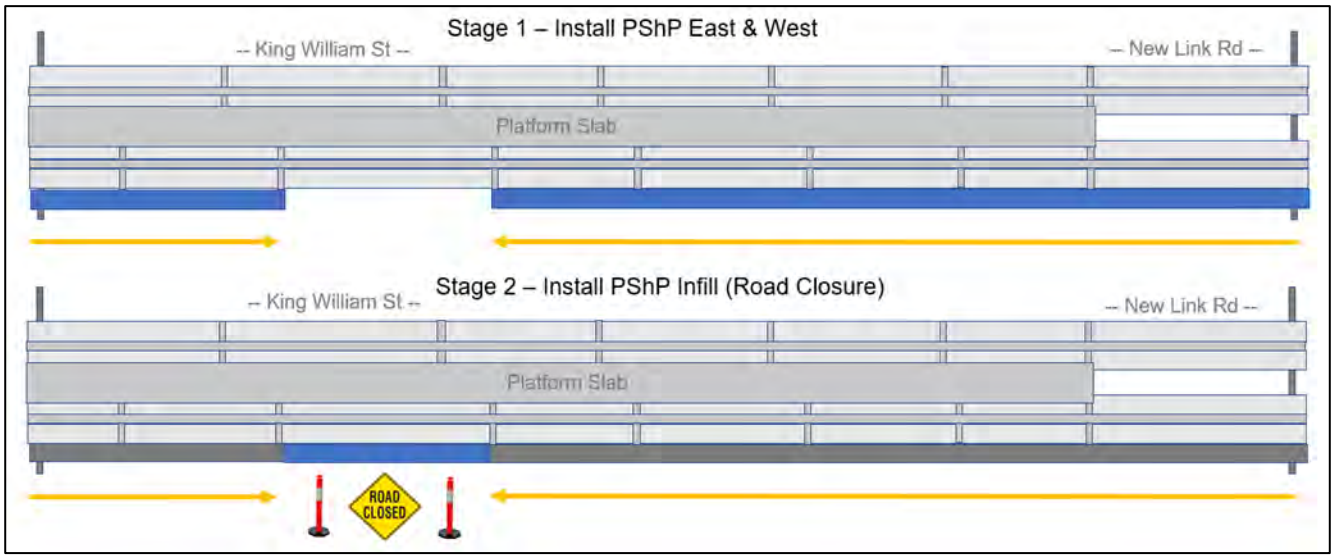


Figure 18.53: PShP Cantilever Path Installation Sequence

17.3.9.3 Construction Methodology

The installation works shall be complete using the following standard construction methodology:

Stage 1:

- Install Superstructure L Girders including insitu-stitch and post-tensioning

Stage 2:

- Install stress bars to full length including protector sleeves
- Install foam sealant around stress bar ducts
- Install non-metallic packers to achieve a nominal 15-25mm grout gap and complete survey verification
- Install precast Cantilever Support Beams already dressed with stanchion and rubber bearing strips for Planks
- Install stress bar live end nut / plate and initially stress to 50KN to secure
- Install watertight grout formwork about connection joints and place epoxy grout for high early strength
- Complete full and final stressing when grout has achieved 30mpa minimum strength
- Grout stress bar ducts using low bleed post tensioning 50mpa cementitious grout
- Trim stress bars to achieve minimum 40mm cover and grout stressing pocket flush using 50mpa cementitious grout

Stage 3:

- Rig and install Deck Planks
- Install temporary fall restraint handrails to exposed edge
- Install remaining stitching strip reinforcement
- Place and finish insitu-stitch concrete strip utilising 120t mobile crane and kibble
- Cure concrete and install permanent handrails
- Install temperature tolerant waterproof membrane to construction joints and L Girder
- Place Asphalt

17.4 Demolition

17.4.1 Standards and General

Evolve Bayswater shall:

i. undertake the demolition work in accordance with AS 2601-2001 The Demolition of Structures
ii. provide a levelled site, free of depressions and undulations;
iii. disconnect all services at the property boundaries in accordance with the requirements of the relevant service owners and Government Agencies;
iv. cap all conduits and pipes at the disconnection points to prevent ingress of surface runoff and groundwater;
v. remove all structures, facilities and debris above ground level;
vi. remove all ground slabs, foundations, strip footings, pile caps, tanks and other structures below ground level excluding piles below pile cap level;
vii. remove all demolished materials and debris from the site;
viii. backfill all excavations with fill free of deleterious materials and compact to a density consistent with the surrounding ground;
ix. for backfill operations consideration shall be given to the local ground, groundwater and drainage conditions to ensure no adverse drainage effects;
x. recycle, to the maximum extent possible, all demolished materials to be removed from the Construction Site;
xi. comply with all regulations, planning and authority requirements; and
xii. develop and implement a demolition method that minimises noise, vibration and air quality impacts

Demolition works shall be carried out in accordance with the requirements of:

i. AS 2601-2001 The Demolition of Structures;

ii. National Occupational Health and Safety Commission publication – “Asbestos: Code of Practice and Guidance Notes”;
iii. the Department of Occupational Health and Safety of WA Guidelines – “A Guide for the Safe Removal of Asbestos Cement Building Products”;
iv. the National Occupational Health and Safety Commission “Code of Practice or the Safe Removal of Asbestos”; and
v. Alliance Safety Management Plan including AGH HSE-OMR-008 Demolition.

Evolve Bayswater shall be responsible for the complete process of demolition works, including:

i. execution of work in accordance with the relevant standards, OS&H Act, OS&H Regulations and the PTA's requirements;
ii. design and Verification of temporary and permanent protection works;
iii. property condition surveys, including a complete photographic record;
iv. removal of trees that are authorised by the PTA; and
v. preparation of demolition method

Further to the requirements noted elsewhere in this section and AS 2601, prior to commencement of any demolition works, all preparatory works necessary to enable demolition to proceed shall be completed including:

i. establishment of all protective hoardings and gantries to ensure public areas remain safe at all times;
ii. relocating, or securing and capping as required, all above and below ground services;
iii. removal of all artefacts and materials of salvage value to a safe storage place;
iv. pest and vermin treatments;
v. establishment of alternative access and egress to adjoining properties that may be affected by demolition works;
vi. contract with all regulating and controlling Government Agencies on the proposed temporary Works methodology that will affect pedestrian and vehicle traffic; and
vii. approvals from all regulating and controlling Government Agencies for temporary Works and demolition

Prior to any demolition, Evolve Bayswater shall salvage and transport elements of value to locations nominated by the PTA. Evolve Bayswater shall remove demolished materials from the Construction Site, unless identified for retention. Demolished materials shall not be burnt or buried on the Construction Site.

The Alliance shall take appropriate measures to control traffic on public roads and to protect the general public from injury or harm when carting demolished materials.

The Alliance shall notify the appropriate Government Agency immediately on encountering hazardous materials or conditions including the following:

i. asbestos or material containing asbestos including asbestos cement products that have not already been identified;
ii. flammable or explosive liquids or gases;
iii. toxic, infective or contaminated materials;
iv. radiation or radio-active materials;
v. noxious or explosive chemicals; and
vi. tanks or other containers which have been used for storage of explosive, toxic, infective or contaminated substances

The Alliance shall provide all warning signs, pedestrian deviation signs, temporary and security lighting.

Existing services, when encountered during the course of the demolition, shall be treated in accordance with the relevant Third Party Utility Providers requirements and shall be marked on the ground and recorded on drawings to be furnished to the PTA.

Any items that are not scheduled for demolition or are otherwise outside the required extent of demolition shall be retained and protected from damage.

The Alliance shall obtain agreement for relocation or disposal of flora and vegetation maintained by the City of Bayswater within the Project Activities

Trees that are not identified for removal on drawings and that have not been authorised for removal by the PTA shall be protected from damage.

The Alliance shall:

i. prevent encroachment of demolished materials onto adjoining property, including public places;
ii. provide covers to protect existing plant and equipment and materials intended for re-use;
iii. minimise dust arising from demolition and control by watering or other approved means, and provide dust-proof screens, partition walls, bulkheads and covers to protect existing finishes and the immediate environment from dust and debris;
iv. if a wall or roof is opened, provide security against unauthorised entry to the building;
v. maintain safe existing pedestrian access or provide safe alternative access as required; and
vi. if demolition is to be staged, ensure structural integrity is maintained during each stage

Prior to decommissioning, salvaging or demolition works, the Alliance shall undertake a HAZMAT survey of the Existing Bayswater Station and associated infrastructure within the limit of works. The findings of the HAZMAT survey shall be used by the Alliance to develop a management process for any HAZMATs identified.

17.4.2 Plant used for Demolition Activities

- Mobile crane
- 22-ton excavator with attachments
- Semi-tipper/bin truck
- Water cart
- Loader 924
- Lighting towers

Throughout all demolition activities, tipper truck will be used to dispose materials off site and water cart to suppress dust. Lighting towers will be used for night time works while demolishing King William Street Rail and PShP Bridge.

17.4.3 Station PShP Bridge

17.4.3.1 Site Establishment

Station underpass will be blocked off midway so that pedestrians can get access to the platform through the northern opening of the underpass. In the absence of station underpass, King William Street underpass footpath will act as a detour for pedestrians.

Delineation can be seen in Section 15.2.

17.4.3.2 Methodology

This bridge will be demolished as part of the stage 1 works prior to building bridges 1 & 2. Fixtures within the underpass will be removed first. Holes will be cored through the deck to install rigging. The top deck will then be separated from the abutments. Using the crane, the top deck will be lifted

off and put in the laydown area on the south east side of the PSHP bridge. Using the excavator with rock-breaker attachment, abutment walls and footings from the top down will then be broken and removed. The ramp going up to the PShP will also be demolished at this stage.

Figure 18.54: Station PSHP Demolition

17.4.4 Leake Street Underpass

Demolition of the underpass will start after the relocation of the existing tracks to north and during the construction of New Leake Street Underpass as mentioned in Section 14.6. Soil behind the walls and top of the deck will be removed first. Demolition will start from the southern end and progress to the end. Excavator with rock breaker will be used to demolish the structure and loaded into semi tippers for disposal. Reinforcement, if required, will be oxy cut.

Figure 18.55: Leake Street Underpass Demolition

17.4.5 Station

17.4.5.1 Site Establishment

Station, Station underpass and adjacent retaining and wing walls will be demolished in one mobilization. Delineation can be seen in Section . King William Street underpass footpath will act as a detour for pedestrians in the absence of station underpass.

17.4.5.2 Methodology

All track, track accessories and equipment within the existing rail corridor will be removed first. Limestone road base access track will then be prepared to get the plants into the raised platform. Fixtures on the existing platform including handrails and lighting poles will be removed. The structure in the middle of the platform will then be demolished using excavator with breaker. Excavator will then be placed on the eastern end of the platform and will gradually demolish reaching the western end.

Figure 18.56: Station Demolition

17.4.6 Station Underpass, Retaining Walls and Wing Walls

17.4.6.1 Methodology

Following the demolition of the existing station, underpass demolition will be commenced. Firstly, soil behind the walls of the underpass and on top of the deck will be removed. Soil will also be removed from behind the eastern and western abutments of King William St. Rail & PSHP bridges. These will be done in preparation of their demolition. Demolition of the underpass will start from the northern side and gradually reach the southern end. Excavator with rock-breaker attachment will be used to break up the walls and top deck. Rubble will be pulled back and loaded onto semi tipper. If required, reinforcement bars will be oxy cut. Existing ground slab will then be removed to have a level ground surface.

Following the underpass demolition, the retaining walls and the wing walls (adjacent to the abutment walls of the bridges) are going to be removed as highlighted below. Excavator with rock breaker is going to be used for these tasks.

Figure 18.57: Underpass & Wing Walls Demolition

Figure 18.58: Wing Walls Demolition

17.4.7 King William Street Rail Bridge and PSHP Bridge

17.4.7.1 Site Establishment

These demolition activities will be conducted during road closure and traffic control will be in place. Pedestrian access to the new Station will be via New Link Road during the closure of footpaths under the bridge. Delineation of site can be seen in Section 15.1.

17.4.7.2 Methodology

Prior to commencement, all existing tracks, track accessories, overhead lines and other fixtures on top and adjacent to the bridges will be removed. Traffic signals and signs on King William Street will also be taken off. At this point, soil behind both abutments and the wing walls have been removed. A layer of soil will be placed on top of the pavement and footpath of King William Street to protect the surface from damage. All stormwater entry points will be covered with bidim and hard cover before laying soil cover to ensure no soil enters the drainage system. Demolition will start with the rail bridge from the north side. Props will be placed along the length of the rail bridge to prevent the deck from collapsing. Excavator with rock breaker and shear will be used to gradually dismantle the top concrete deck of the rail bridge. Bracing, longitudinal UB and intermediate UB bearing beams will be oxy cut. Prior to disposal, if required, they will be further cut on the ground. Following that, main bearing beams will be disconnected from abutment, lowered down to ground and cut to manageable lengths.

For the PSHP Bridge engineering control will be in place due to proximity to bridges 1 and 2 and adjacent overhead lines. Excavator with shear will be used to break out concrete infill panels. Remaining structural steel to be cut and lowered to ground where it will be further cut and disposed.

After this, excavators with rock breaker will be placed behind both abutment walls to demolish the walls top down and then the footings. If required, reinforcement bars will be oxy cut.

All demolition rubble will then be cleared, soil taken off from the road and traffic signals and signs reinstated.

Figure 18.59: King William St. Rail & PSHP Bridges Demolition

17.5 Station Structure

In relation to the building works that form part of the scope, the key components are:

- Ground Level Entry Buildings
- Lifts and Stairs
- Platform works
- Services
- Fit out

- Commissioning

17.5.1 Ground Level Entry Buildings

17.5.1.1 Stage 1: Eastern Side

Prior to works commencing a temporary boarding will be in place isolating Stage 1 and Stage 2 work to provide control for noise, dust and safe access for commuters.

All services connections will be located. Service pre-lays will then be run as required by design.

The station concourse is on grade. Initial works that will be undertaken will be below ground works in relation to the lift pit 2 and the footing for the stairwells. These will be formed and poured insitu. The footing for the stairwells consists of a 2400mm long * 750 mm wide concrete reinforced footing.

The lift pit will consist of a 600mm reinforced concrete slab with a 300 mm reinforced concrete walls as detailed below including the installation of a waterproof membrane.

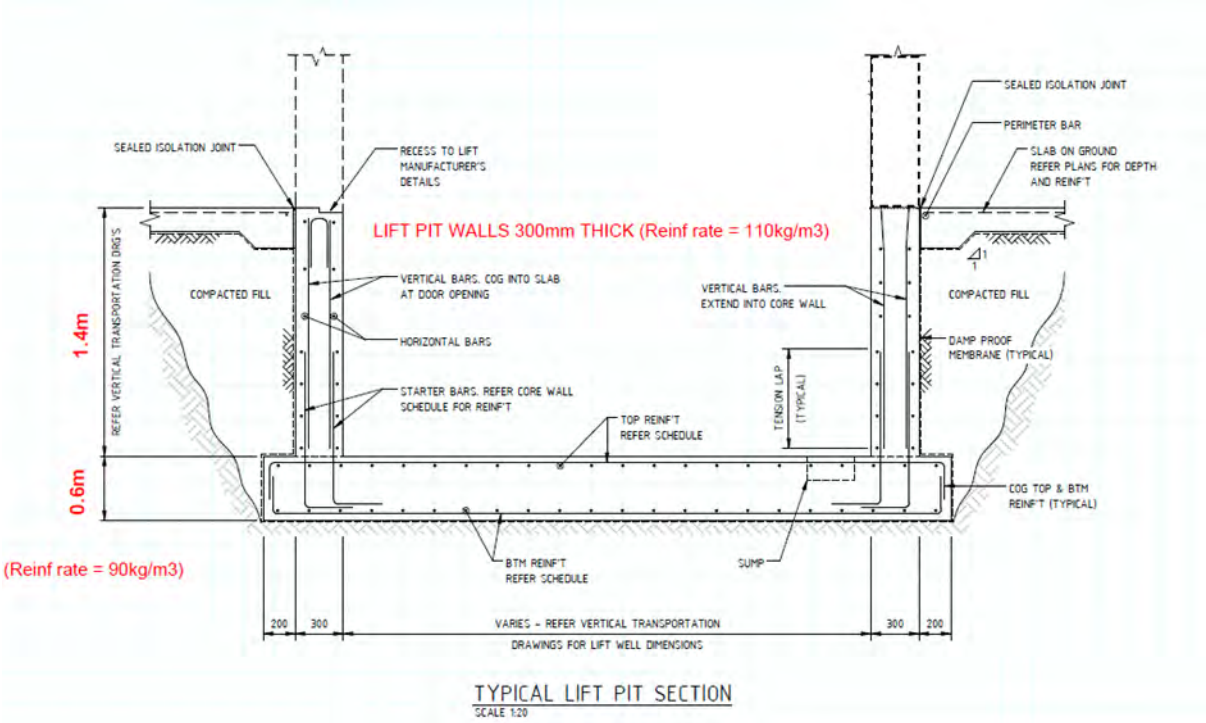


Figure 18.60: Lift pit detail

A retaining wall will be installed around the LCR and Elect/Comms room.

The station concourse level is on grade and a ground bearing slab will be used. Prior to works being undertaken final earthworks will be completed south of the existing railway and the temporary retaining wall installed to support it including final trim and compaction.

The slab will consist of 100 mm thick concrete on compacted fill using SL 72 mesh and N40 concrete. A 500 mm wide * 300 mm DP slab thickening will be installed at the perimeter of the slab and dividing Stage 1 and Stage 2.

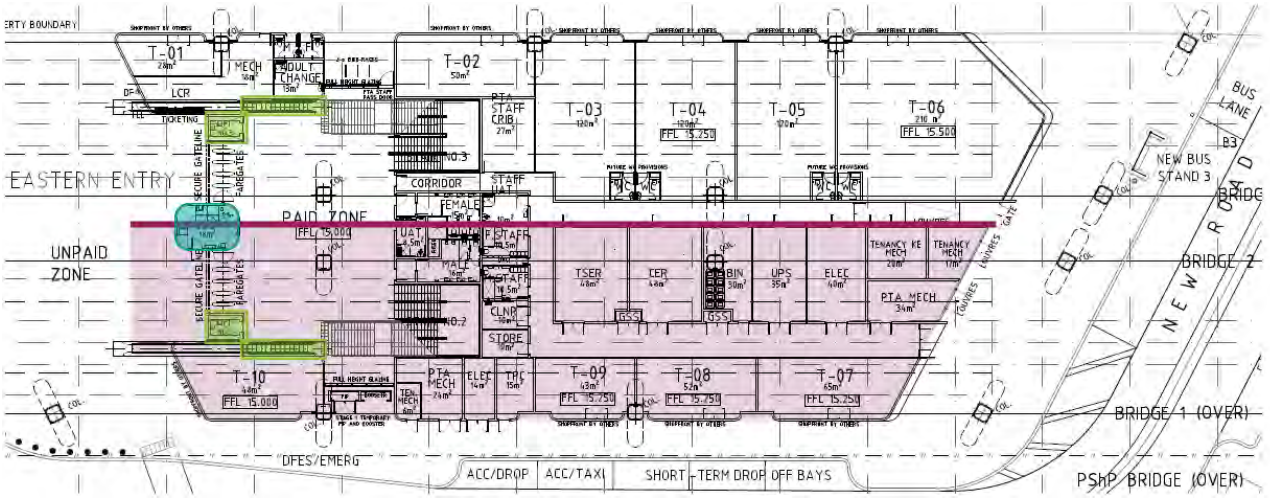


Figure 18.61: Eastern ground level entry

The Gate House Customer Services Office (CSO) located in Stage 1 will be installed during Stage 2 works.

17.5.1.2 Stage 1: Western Side

The station concourse is on grade. Initial works that will be undertaken south of the existing railway and the temporary retaining wall installed to support it and will encompass the below ground works in relation to the lift pit 1 and the footing for the stairwells will be formed and poured. The footing for the stairwells consists of a 4800mm * 750 mm long and a 2400mm long * 750 mm wide reinforced footing. The lift pit is per the typical detail.

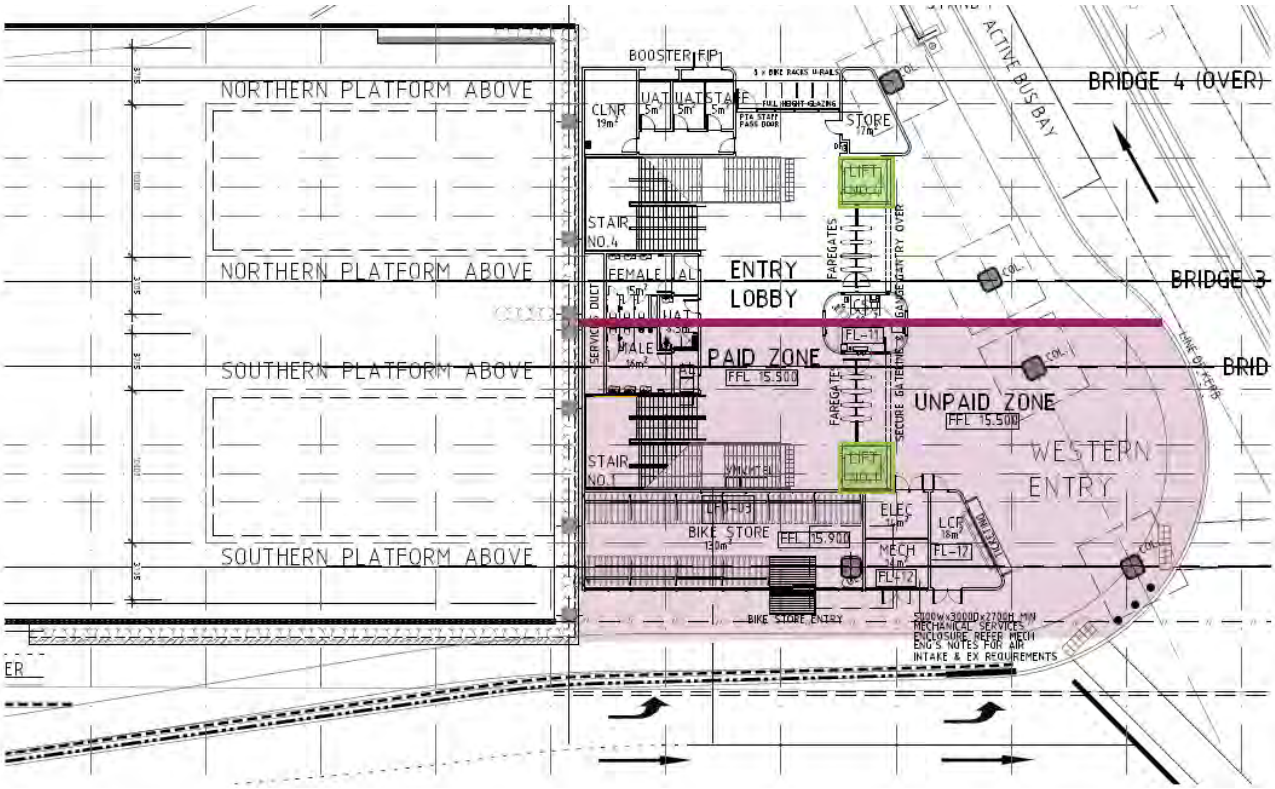


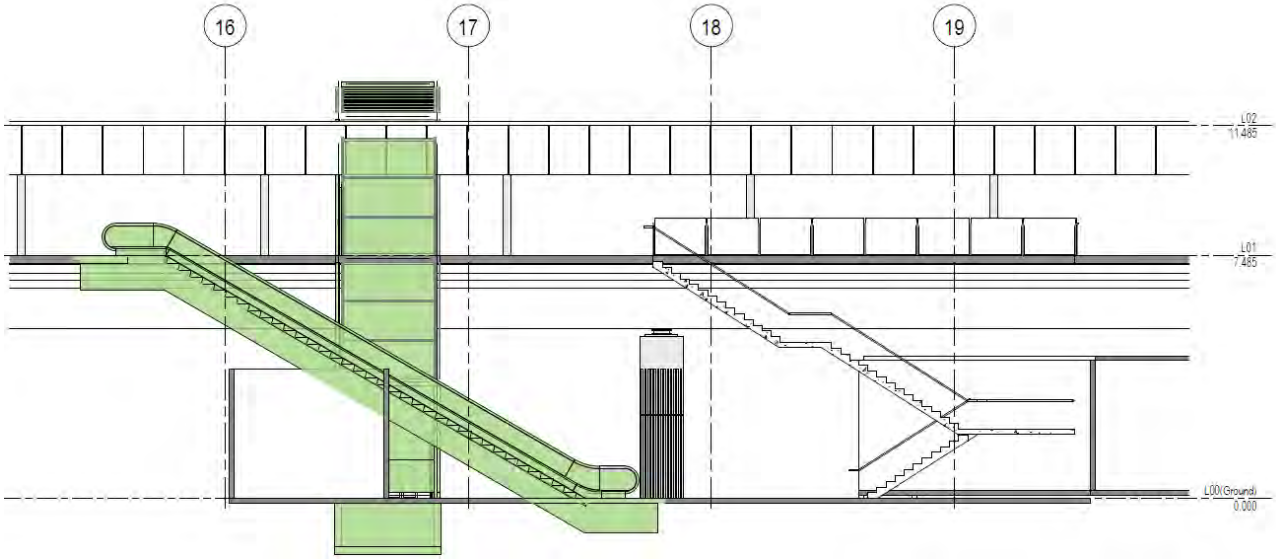
Figure 18.62: Western ground level entry

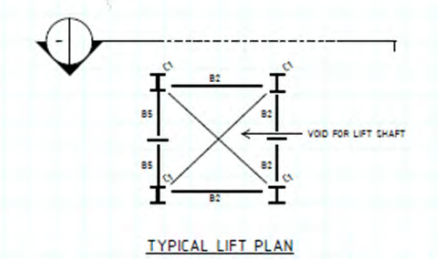
The concourse works on the western side will consist of the same design as the eastern section for the concrete slab works.

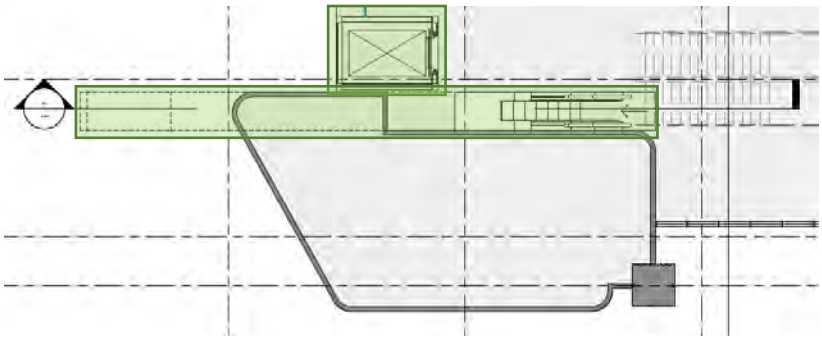
On completion of all the Stage 1 works, the concourse works will be undertaken for Stage 2 and will form a similar selection of activities to be undertaken as Stage 1 concourse.

17.5.2 Vertical Transport

Once the concourse slabs have been completed the lift & escalator support structure will commence. The lifts will be steel construction as detailed below. Lift installation and construction of the escalator support slabs will commence in line with the installation of the stair structure. The lifts will be sheeted with fire rated board and will be in accordance PTA standard design including stainless steel lift carriage doors, stainless steel kick plates and glass in fill panels.







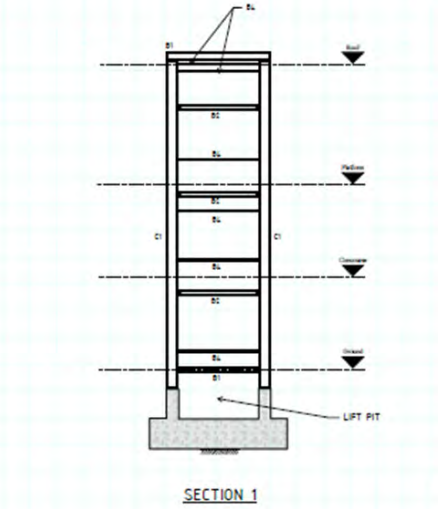


Figure 18.63: VT Details & Sections

STEEL FRAMING MEMBER SCHEDULE	
REFERENCE	MEMBER SIZE
B1	150DHS
B2	200UC
B3	150DHS
B4	150x50RHS
B5	310UB

STEEL COLUMN SCHEDULE	
REFERENCE	MEMBER SIZE
C1	400WC

Figure 18.64: Lift schedule

17.5.3 Platform Stairs

Steel stairs have been used for speed of construction. The stairs have a 2mm thick bent steel pan with a fillet welded to the stringers that enables the stringer and platforms to be topped and filled with concrete or alternatively pre cast concrete may be used. These works will be undertaken once the stairs have been installed. The stair structure will commence after the concourse slabs have been installed.

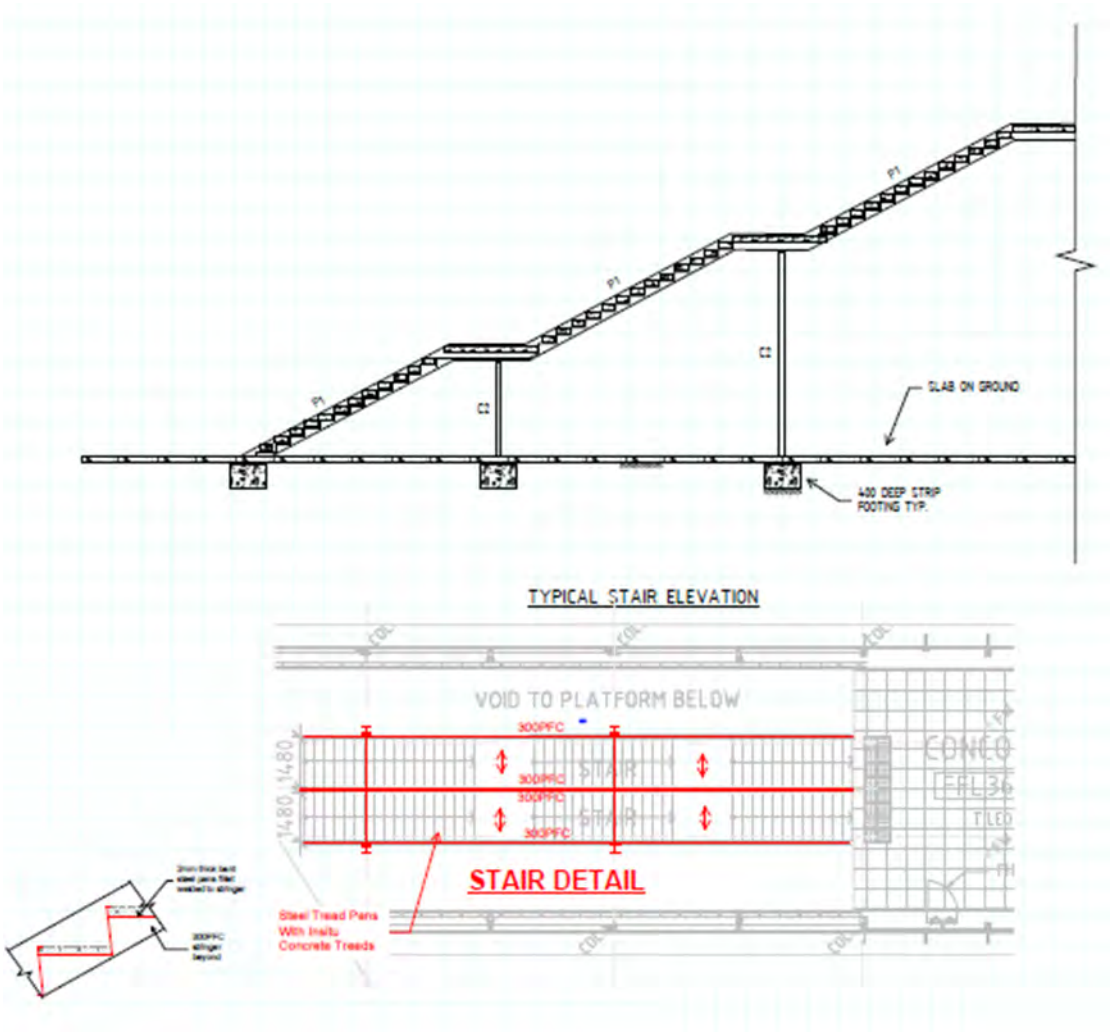


Figure 18.65: Stair detail

17.5.4 Platform Works

Platform works will commence after the stairwell structure and lift structure has been installed.

Access to platform works will be from access towers including loading platforms and from the western end of the platform via the bridge structures.

Temporary drainage will be installed to prevent any issues with stormwater drainage on the concourse level during the works.

Balustrades and handrails will be installed progressively.

The roof section is in four parts. One for each section of Stage 1 east and west and one for each section Stage 2 east and west.

The steel roof canopies are light weight steel framing . The columns will sit and be fixed to the T beams. The roof structure will have fascia beams and LVL's as part of the canopy structure.

Skylights will be installed followed by roof sheeting which will be Kliplok and gutters. A ceiling support system will be installed, together with services. Once completed pre finished panelling will be installed to the support system of the ceiling of the canopy. Fascia's, flashing and capping's will then be installed.

A screed laid to falls will be placed on final concrete topping for proposed floor finishes including paving tiling and will incorporate the mesh/edge angle required for earthing and bonding.

Staff offices and utility rooms will be constructed of prefinished CFC cladding on a 92mm stud work.

17.5.5 Station Services Internal

Services will be installed progressively ensuring that the Stage 1 works are fully operational. The majority of service-related items are housed in the Stage 1 works.

Platform systems that will be required to be operational for Stage 1 works includes but not limited to the following;

- Power systems (UPS, RPS);
- CCTV surveillance system;
- PSP (Passenger Services Panel) and PSM (Passenger Service Module);
- CIS (Customer Information System);
- LLPA (Long Line PA) system;
- DAVS (Driver Assisted Video System);
- BAS (Building Access System);
- Ethernet / structured cabling;
- Ticketing –tag-on/tag-off units

In relation to mechanical, electrical/communications, hydraulic and fire services the following items will be installed progressively pending on final design.

It is noted that the connections of building services to trunk utility services will be carried out as part of the civil works package.

17.5.5.1 Hydraulics

Hydraulics services include but are not limited to the supply and installation of the following;

- Sanitary Pipework
- Vent Pipes
- Floor Wastes
- Disconnector Gully
- Drainage Turn Up
- Tundish connections
- Stormwater Pipework (Downpipes)
- Acoustic Lagging
- Cold Water pipework
- Water Valve
- Hose tap and Valve
- Isolation Valve
- RPZD - DCV
- Tap set
- Water Meters
- Hot water units

17.5.5.2 Mechanical

Mechanical services include but are not limited to the supply in installation of the following;

- Western Platform South AC Units
- Refrigerant Pipework
- Control/Power Cabling
- Western Platform North AC Units
- Eastern Platform South AC Units
- Track Side East AC Units
- Western Platform South Exhaust/Fresh Air Fans
- Western Platform North Exhaust/Fresh Air Fans
- Eastern Entry South Exhaust/Fresh Air Fans
- Eastern Entry North Exhaust/Fresh Air Fans
- Mechanical Switchboards

17.5.5.3 Electrical

Electrical services include but are not limited to the supply in installation of the following;

- SER Main Switchboard
- Essential and non-essential DBs
- LV Cabling and Cable Containment
- Earthing and Bonding
- Cable Containment including all supports and penetrations
- Fire stopping
- Lighting and Lighting Control System
- Emergency Lighting
- EXIT Signages Lighting Control System
- Small Power GPOs/Isolators

17.5.5.4 Fire

Fire services include but are not limited to the supply in installation of the following;

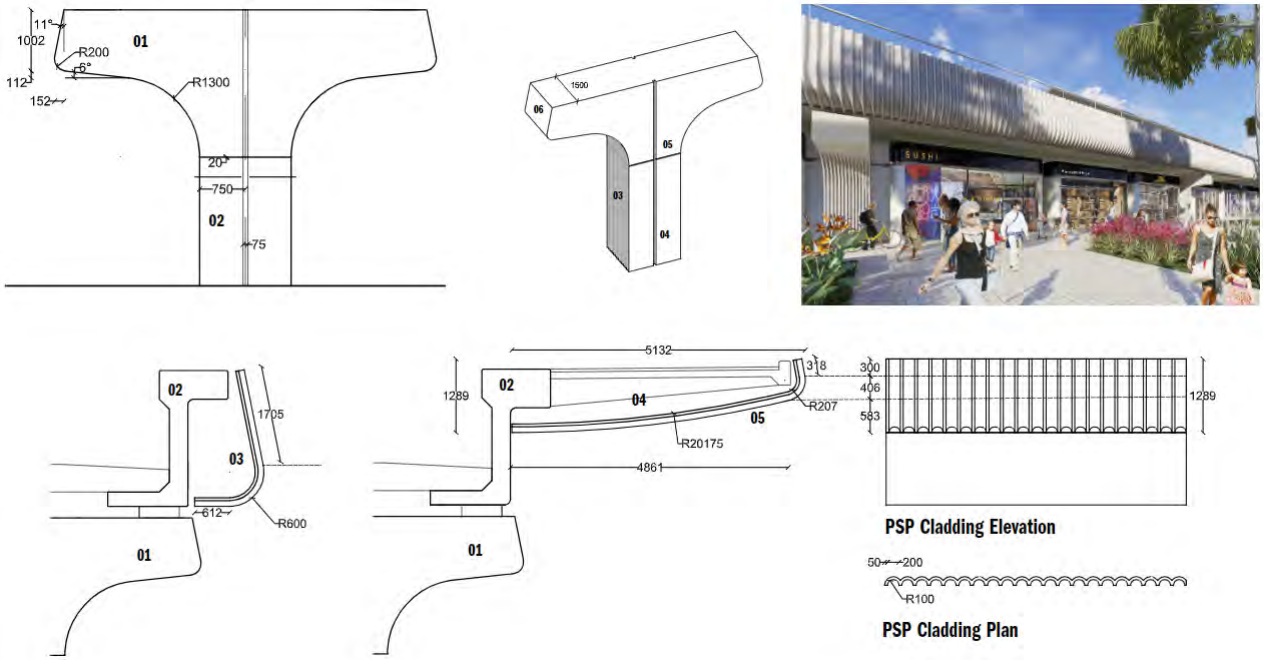
- East Building MIMIC Panel
- East Building Fire Indicator Panel
- East Building External Strobe/Visual Alarm
- Smoke Detectors
- Smoke Detectors with Sounder Base
- Thermal Detector
- Aspirating Smoke Detector
- Manual Call Button
- Lock Off Device
- Local Control Station
- Gas Control Panel
- Audible Alarm Device
- SER Room Sub-Indicator Panel
- West Building MIMIC Panel
- West Building Fire Indicator Panel
- East Building External Strobe/Visual Alarm
- Smoke Detectors
- Smoke Detectors with Sounder Base
- Manual Call Button
- ASD/ARM Panel

- Gas Detector
- Lock Off Device
- Platform Smoke detector with Sounder Base
- Platform Manual Call Point
- Fire Rated Fibre Optic Cabling
- Multi-pair cable input to SCADA System

17.5.6 Architectural Finishes & Cladding

The key areas where Architectural cladding options are being developed are:

- the bridge soffit and column treatments
- the North and South edge cladding of the bridge and the soffit of the PShP
- the station platform shelters



Once agreed, the design of each system will either be tied into the fabrication of the structural elements, with the cladding elements installed progressively as the structure is completed.

17.5.7 Fit Out

Fit out and Finishes for the works are detailed in the Architectural Materials and Finishes Legend. Fit out works will be installed progressively in Stage 1 with work on Stage 2 to follow when the structures are complete.

Works include but are not limited to the following:

- Walls
- Insulation
- Wall linings
- Ceilings
- Wet areas
- Screed
- Waterproofing
- Balustrades & Miscellaneous Metalwork
- Tiling
- Paving
- Windows
- Door frames
- Skirtings
- Floor treatments
- Doors
- Door hardware
- Painting
- Signage & Wayfinding
- Access ladders & fall arrest safety systems
- Fencing
- Benches
- Bins
- Bike storage
- Screens
- Louvres

17.5.8 Commissioning and Handover

As detailed within this plan the works are to be undertaken in two main stages due to the requirements of the scope in ensuring the rail line and station facilities continue to be operational for the Midland Line and for FAL. The works from a structural perspective do not differ substantially between Stage 1 and Stage 2. The majority of services that are required for the functionality of the works are housed in Stage one and as such will be completed as required to ensure works at the conclusion of Stage one is operational.

Commissioning will be in accordance with Commissioning Plan BST-EVO-TC-PLN-00005.

17.5.9 Final Clean

In addition, prior to Practical Completion, Evolve Bayswater must clean and wash all sumps and internal rooms clear of any fine dusts to prevent false alarms due to dust in smoke detectors within the confined areas.

17.6 Station Precinct Services

17.6.1 Services to be Relocated

There are a number of public utility services to be relocated. These are shown on the following drawings and listed in the Services Register.

- SK-SER-UT-001_A.pdf
- SK-SER-UT-002_A.pdf
- SK-SER-UT-003_A.pdf
- SK-SER-UT-004_A.pdf
- SK-SER-UT-004_A.pdf
- SK-SER-UT-005_A.pdf
- SK-SER-UT-006_A.pdf
- SK-SER-UT-007_A.pdf
- SK-SER-UT-008_A.pdf

Evolve Bayswater will coordinate and manage all relocations. PTA will engage all service providers, except the Water Corporation, to relocate the services. Evolve Bayswater will design and construct the Water Corporation relocations using specialist subcontractors to perform the works.

The Water Corporation Services to be relocated, the extent of works, scheduling, traffic management and other arrangements are detailed in the following table.

Station Precinct Water Corporation Relocations

Service Code/ Drawing No	Service Type/Size	Extent of Works	Typical Cover Depth	Scheduling Requirements	Traffic Management Requirements	Site Facility Requirements	Site Fencing and hoarding requirements
WCS-01 SK-SER-UT-006_A & SK-SER-UT-008_A	DN700 MSCL sewer pressure main	• 146m of new DN700 MSCL (711/6/675) Sintakote coated pipe • Pipe joints to be welded Sintalock Type 1, with additional welded convex bands • Additional convex band welded to existing RRJ', approximately 39m each side, assumed to be 3 pipe joints each side. • Disinfect redundant section of sewer to facilitate removal by others. Dispose of water used for disinfection.	• 1000mm cover • Central section of trench to be dug in area already excavated for bridge construction. More cover on eastern end.	• Construction Period **April 2021** • To be constructed following erection of new Bayswater station bridges 1 and 2. • Tie ins and welding of existing RRJ points to be completed when road traffic volumes are low. Tie ins to be completed when flow in sewer lowest.	• New pipe installation within Station Construction site. Traffic and pedestrian management for tie ins and welding of existing RRJ joints to be provided by Evolve Bayswater	• Site toilets and crib huts etc provided by Evolve Bayswater. • Construction water by Evolve Bayswater Site power by Evolve Bayswater	• Central section of work within existing Evolve Bayswater site hoarding Localised fencing for tie ins and welding of existing RRJ joints to be provided by Subcontractor
WCW-01 SK-SER-UT-006_A & SK-SER-UT-008_A	DN100 Water Reticulation Main	• 77m of new DN100 PVC (Class 12, series 2) pipe • New verge hydrant (WC Standards) • Concrete thrust blocks at changes in direction • Reconnection of existing property services (approx. 4-off) • New pipe to be installed within the existing southern verge on a typical alignment 3.5m to 4.0m Reconnect Hamilton Street DN100 C.I. main into new works, including new valve	600mm cover	• Construction Period **June 2021** • To be constructed prior to construction of the retaining wall in front of the footpath along Whatley Cres. • To be constructed when road and footpath traffic volumes are low. Access to businesses along Whatley Cres. to be maintained during the businesses open hours.	Traffic and pedestrian management to be provided by Evolve Bayswater	• Site toilets and crib huts etc provided by Evolve Bayswater. • Construction water by Evolve Bayswater Site power by Subcontractor	Fencing to be provided by Subcontractor

Service Code/ Drawing No	Service Type/Size	Extent of Works	Typical Cover Depth	Scheduling Requirements	Traffic Management Requirements	Site Facility Requirements	Site Fencing and hoarding requirements
WCW-03 SK-SER-UT-005_A	DN300 Water Reticulation Main	• 96m of new DN300 P-12 (Series 2) pipe • Concrete thrust blocks at changes in direction • New verge hydrant (WC Standards) • New pipe to be installed parallel to the existing pipe with a nominal lowering up to 600mm. • Reinstatement of existing property connections (North Side). • 2 x conversions from PVC (Series 2) to Cast Iron pipe Additional allowance required for final thrust blocks to cater for the final tie-in connections	1200mm cover	• Construction Period **June 2021** To be constructed after completion of the new station stage 1.	Traffic and pedestrian management to be provided by Evolve Bayswater	• Site toilets and crib huts etc provided by Evolve Bayswater. • Construction water by Evolve Bayswater Site power by Evolve Bayswater	• Work within existing Evolve Bayswater site hoarding.
WCW-04 SK-SER-UT-007_A	DN300 Water Reticulation Main	• 60m of new DN300 P-12 (Series 2) pipe • 2 x concrete thrust blocks at changes in direction • New verge hydrant (WC Standards) • 2 x conversions from PVC (Series 2) to Cast Iron pipe Additional allowance required for final thrust blocks to cater for the final tie-in connections	1200mm cover	• Construction Period **June 2021** To be constructed after completion of the new station stage 1.	Traffic and pedestrian management to be provided by Evolve Bayswater	• Site toilets and crib huts etc provided by Evolve Bayswater. • Construction water by Evolve Bayswater Site power by Evolve Bayswater	• Work within existing Evolve Bayswater site hoarding.
WCW-02 SK-SER-UT-003_A & SK-SER-UT-004_A	DN300 Water Reticulation Main	• 190m of new DN300 P-12 (Series 2) pipe • Concrete thrust blocks at changes in direction • New pipe to be installed parallel to the existing pipe at a nominal depth to existing ground of 700mm.	1200mm cover	• Construction Period **June 2021** To be constructed prior to construction of new underpass	Traffic and pedestrian management to be provided by Evolve Bayswater	• Site toilets and crib huts etc provided by Subcontractor. • Construction water by Evolve Bayswater	• Work along Railway Parade. Fencing to be provided by Subcontractor

Service Code/ Drawing No	Service Type/Size	Extent of Works	Typical Cover Depth	Scheduling Requirements	Traffic Management Requirements	Site Facility Requirements	Site Fencing and hoarding requirements
		• New verge hydrant (WC Standards) • 2 x conversions from PVC (Series 2) to Cast Iron pipe Additional allowance required for final thrust blocks to cater for the final tie-in connections				Site power by Subcontractor	
WCS-02 SK-SER-UT-002_A & SK-SER-UT-003_A	DN610S Sewer Pressure Main	• 160m of new DN610 MSCL (610/6/574) Sintakote coated pipe • Pipe joints to be welded Sintalock Type 1, with additional welded convex bands • Additional convex band welded to existing RRJ', approximately 36m on the western tie-in side, assumed to be 4pipe joints. • Eastern tie-in location to be incorporated into the existing bypass pit. • Connections likely to be carried out on a non-live pipeline subject to satisfactory bypass arrangement in the bypass pit. • Disinfect redundant section of sewer • Dispose of water used for disinfection. • Remove and dispose of redundant section of sewer.	700mm cover	• Construction Period **March 2020** ii. To be constructed prior to closure of PShP	Traffic and pedestrian management to be provided by Subcontractor	• Site toilets and crib huts etc provided by Subcontractor. • Construction water by Subcontractor iii. Site power by Subcontractor	• Work along Whatley Crescent. iv. Fencing to be provided by Subcontractor

17.6.2 Services to be Protected

There are a number of public utility services to be protected. These are shown on the following drawings and listed in the Services Register.

- SK-SER-UT-001_A.pdf
- SK-SER-UT-002_A.pdf
- SK-SER-UT-003_A.pdf
- SK-SER-UT-004_A.pdf
- SK-SER-UT-004_A.pdf
- SK-SER-UT-005_A.pdf
- SK-SER-UT-006_A.pdf
- SK-SER-UT-007_A.pdf
- SK-SER-UT-008_A.pdf

17.6.3 Provision of Connections to station and Precinct

17.6.3.1 Sewerage

Two sewerage connections are required for the toilets and facilities on the eastern and western concourses of the station. Both are currently planned to be connected to the existing sewerage system to the north as shown in the figure below.

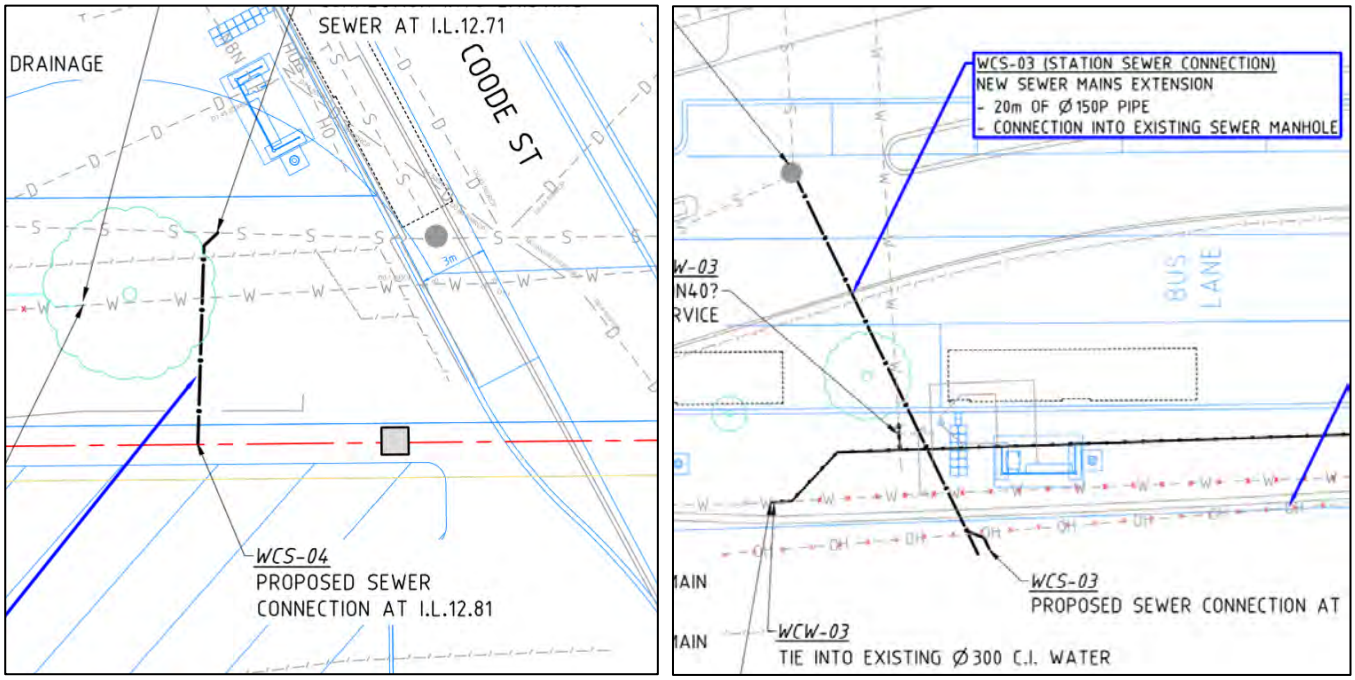


Figure 18.60: Sewer connections

17.6.3.2 Potable Water

Two new water services, a DN160 PE (PN12.5) fire service connection and a DN110 PE water supply. Both are currently planned to be connected to North as shown in the figure below.

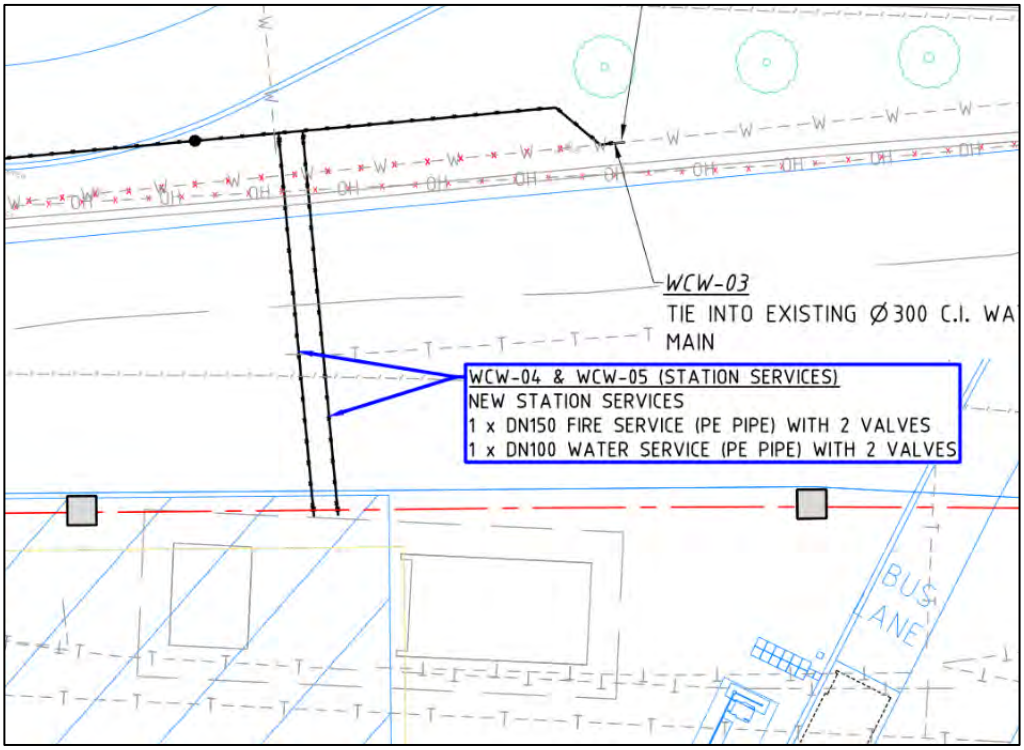


Figure 18.61: Water connections

17.6.3.3 Power

A new station precinct transformer and incoming power supply is required. Currently it is planned to the northern side of the Station.

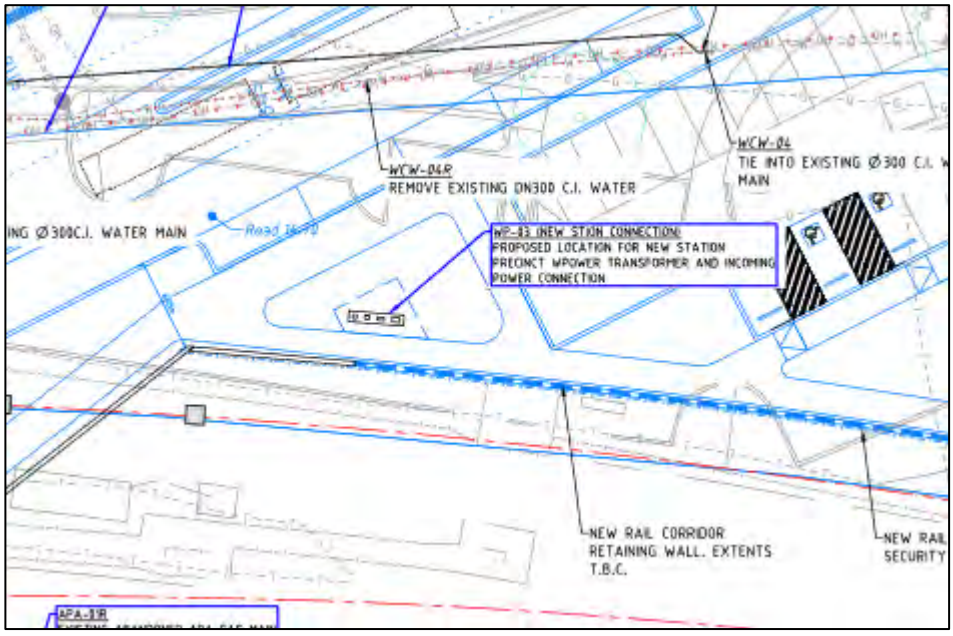


Figure 18.62: Power connections

17.7 Track

17.7.1 Trackslab

Slab track construction will used within the station area at Bayswater, with approximately 150m (plus transitions) of dual gauge track required.

Construction will be of bottom-up type, incorporating Delkor egg type baseplates or similar, fixed to concrete upstands formed within the rail trough.

Figure 18.63: Delkor Egg type fastener

As with ballasted track construction, short rails will be placed on the rail seat, and free welded in situ using a mobile flashbutt welder.

Destressing is done in up to 330m module lengths with weld crews in-situ clipping up at neutral temperature. End joins will be clamped with fishplates.

Post tamping, weld crews will use conventional welding techniques to complete the final adjustment welds at the fish-plated joins, centrally to destress module.

17.7.2 Ballast Track including Slews

Refer to Section **Error! Reference source not found.** for Ballasted Track construction methodology.

17.7.3 OLE

Refer to Section **Error! Reference source not found.** for OLE construction methodology

17.8 Signals, Communications and Control Systems

On completion of the new Bayswater station building, the MCR will be tied in with the new MCR transit. Communication system works will include the installation of new main optic fibre cables in the new MCR from Maylands Station to the new Bayswater Station and then through to Bassendean Station and associated secondary and tertiary optic fibre cables.

All communication back-bone system testing and cut-over will occur ahead of, and in a separate commissioning activity to any signalling system works and related commissioning to ensure it is ready and available to support the signalling system staging and support progressive sub-system and system commissioning of the Station communication and operational technology systems for the new Bayswater Station.

The process for ensuring the designed signalling is safe, constructible and maintainable will be completed as described at section **Error! Reference source not found.**. Several staged signalling relocations will be required to support the ongoing operation of the existing Bayswater Station while construction of the new Bayswater Station is completed. The key focus for these works will require attention to signal sighting for these movements to ensure compliance with PTA's signal sighting requirements and acceptance for operations. Signals installed but not in operation will be covered to ensure no operational confusion ahead of the new Bayswater station commissioning.

Signal moves required for consideration are as follows:

- Signal U 36 and U42 will be moved to the new temporary UP main during the Turnback stage works,
- D44 temporarily moved to the new permanent DOWN main,
- New, temporary 160/162 signals will be installed on the alignment for the existing Bayswater Station to support operations on commissioning of the turnback and U36, U42 and D44 will be decommissioned and recovered, and
- New 160/162 signals will be installed on the final alignment in parallel and covered until commissioning of the new station at which point the temporary 160/162 will be decommissioned and removed.

17.9 Lighting to Precinct

Lighting for the precinct shall be a combination of station and bridge mounted, light poles and feature lighting.

Some of the City of Bayswater heritage style lights will be stored, refurbished and reused and additional lights will be procured.

Ducting for cables and footings shall be constructed and install during the earth works stage for the road and hard landscaped areas.

Light poles shall be installed following compaction of final pavement layers and prior to install of paving bricks.

Where practicable, lighting shall be commissioned to enable it to be used for construction purposes and to allow earlier removal of temporary site lighting.

Lighting for the southern half of the precinct shall be commission prior to construction of the northern half of the precinct.

17.10 Retaining Walls to Precinct

Refer to section **Error! Reference source not found.** for the typical retaining wall details. The retaining walls to the precinct can be found in the Section **Figure** . The methodology for the installation of the L-Shaped precast walls and in-situ retaining walls is a bottom up approach. The foundation will be prepared in accordance with the PTA requirements and either L-shaped installed using a mobile crane or formed and poured for the in-situ walls. Insitu retaining walls have been selected in order to incorporate the architectural requirements of the retaining walls in the precinct area which includes cast in rebates.

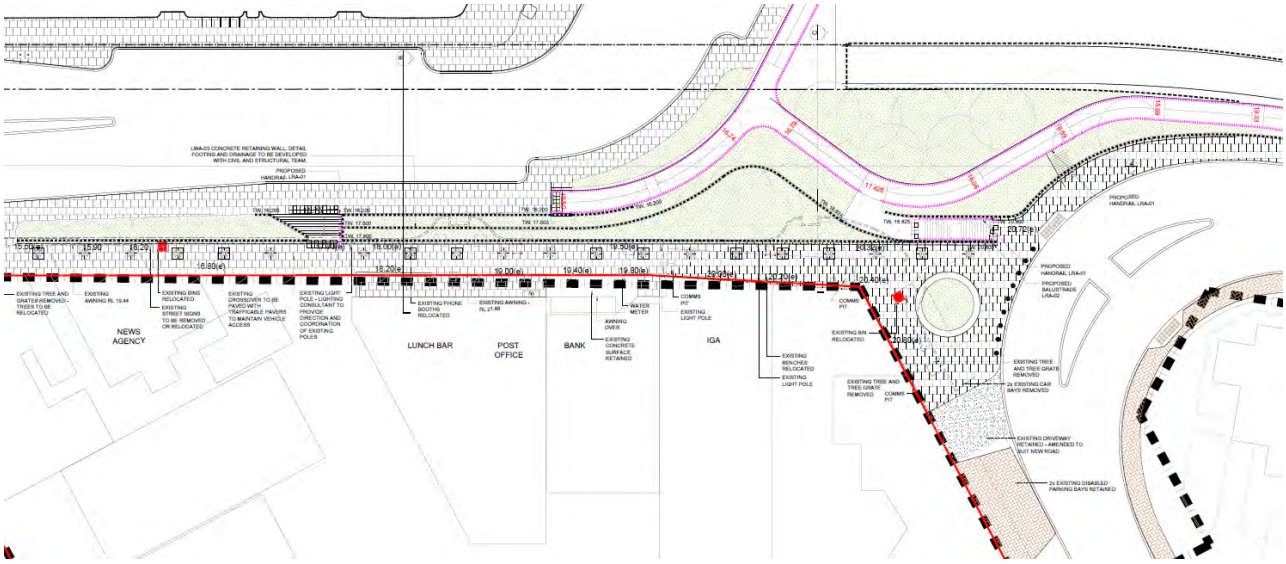


Figure 18.64: Landscape Plan Excerpt

Where the retaining walls need to be installed along the Whatley crescent shop fronts a temporary sheet pile will be required to retain the existing earth to enable the excavation for the installation of the in-situ wall. The sheet piles will be installed once Whatley Crescent is closed and prior to the excavation down to the new Whatley level (approximately 4m lower) to allow for the sheet piling rig to sit on a level surface and eliminate the need for a crane and pile gate configuration for the installation. See staging in the figures below.

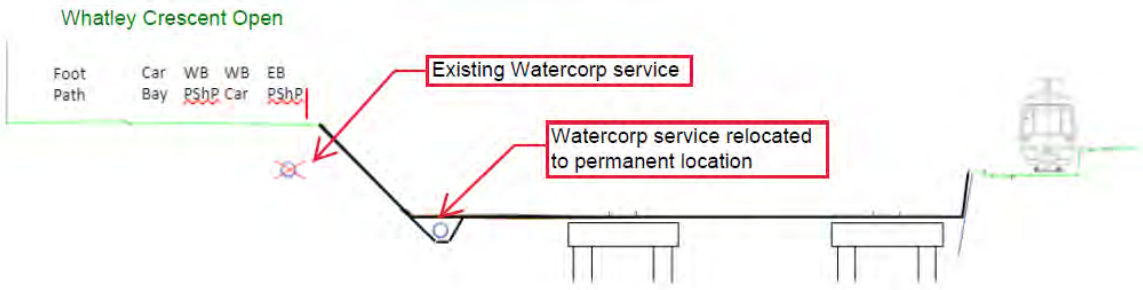


Figure 18.65: Whatley Crescent prior to Installation of Sheet Piles

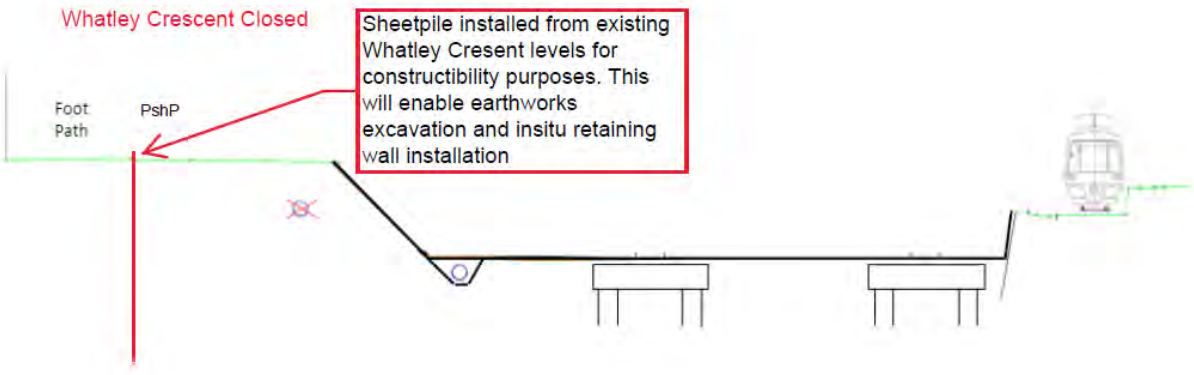


Figure 18.66: Whatley Crescent during Installation of Sheet Piles

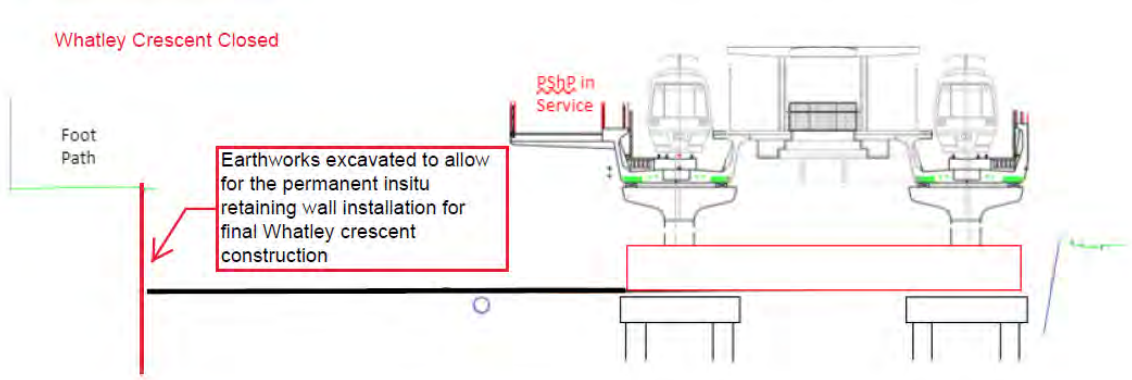


Figure 18.67: Whatley Crescent after Installation of Sheet Piles

17.11 Roadworks

17.11.1 Methodology and Staging

There are five major sections and a number or minor tie-in sections of permanent roadworks to be constructed. The major sections are listed below and described in the following sections.

1. Whatley Crescent and Hamilton Street Intersection
2. Whatley Crescent Link Road Stage 1
3. Whatley Crescent Link Road stage 2
4. Whatley Crescent West of King William Street
5. King William Street between Whatley and Coode Streets
6. Railway Parade between Coode Street and Rose Avenue.

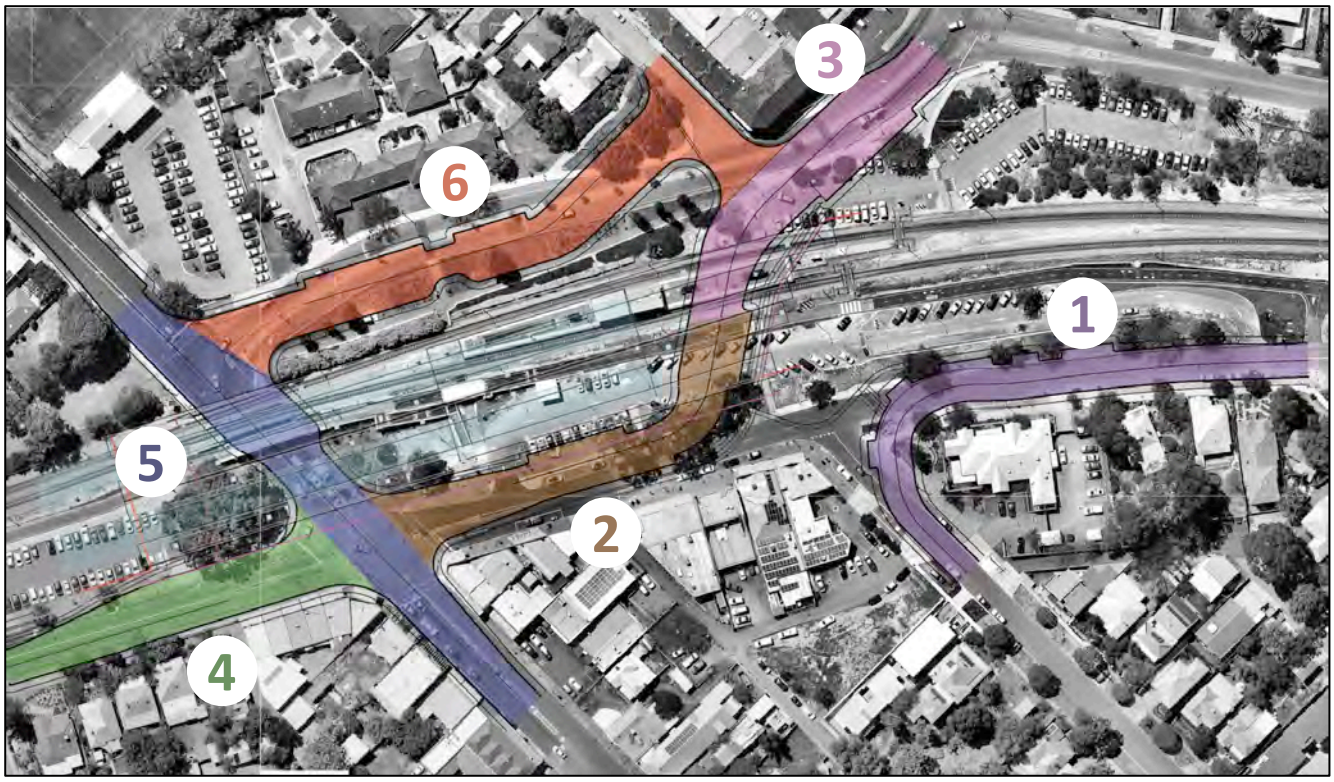


Figure 18.68: Roadworks Methodology

17.11.1.1 Whatley Crescent and Hamilton Street Intersection

This intersection realignment will be completed to coincide with the full closure of section of Whatley Crescent between King William and Hamilton Street to traffic.

The key construction challenges are to maintain vehicle and pedestrian access to the police station and east and west bound PShP bicycle and pedestrian traffic.

This will be achieved by providing temporary detours for pedestrians and bicycles and constructing the new pavements in progressive sections with the intersection closed to vehicles during the works.

17.11.1.2 Whatley Crescent Link Road stage 1

This section of roadworks will be constructed once erection of the southern bridges No 1 and 2 superstructure, PShP path and station platform deck are completed. Its construction will coincide with the construction of the station stage 1 and a moveable site fence will be maintained to separate road construction activities from station building activities. In addition, hard landscaping works will also be required to constructed at the same time with road and landscape pavements being installed simultaneously using the same plant and equipment when practical.

Pavement materials will be delivered preconditioned to avoid having to work the materials in the constrained site.

Where practicable the final layer of asphalt will be installed at the same time as the final layer of asphalt for the Whatley Crescent Link Road Stage 2 so that the surface is not damaged and the colour will be consistent then the road is opened.

17.11.1.3 Whatley Crescent Link Road Stage 2

This section of roadworks as soon as the existing railway formation is removed. Its construction will coincide with the construction of the foundations for northern bridges 3 and 4 and a moveable site fence will be maintained to separate road construction activities from bridge building activities. In addition, hard landscaping works for footpaths will also be required to constructed at the same time with road and landscape pavements being installed simultaneously using the same plant and equipment when practical.

Pavement materials will be delivered preconditioned to avoid having to work the materials in the constrained site.

Pedestrian access for this section will require consideration of additional risks as a result of patrons leaving the hotel at night times. Temporary lighting levels will be especially critical as well as consistent footpath surfaces to reduce the risk of trips and falls.

17.11.1.4 Whatley Crescent West of King William Street

These works will need to be completed to enable the station stage 1 to be completed and the station to enter into service. As this section of road is critical to the performance of the roads during peak hour, these works will have to be performed during off peak hours with lane or carriageway closures

17.11.1.5 King William Street between Whatley and Coode Street

The final level of King William Street at the existing road's lowest point is approximately 1.4m higher than existing as shown by the in the following figure. As a result it is not possible to complete these works until after demolition of the existing rail and PShP bridges.

Figure 18.69: King William Street Roadworks

However as the new station stage 1 will be in service prior to the demolition of the existing rail bridge, it will be necessary to complete some road works prior to the opening including adjustments to kerbs and footpaths at the intersection of King William and Whatley Crescent prior to the station is open.

It is currently planned to complete these works after opening of the new Whatley Crescent Link Road to allow King William Street to be closed to all vehicular and pedestrian traffic.

This will allow the road and footpath works to be completed safely and as quickly as possible to minimise disruption to the public. Preconditioned materials and quick setting pavement materials will also be utilised to reduce the construction duration.

17.11.1.6 Railway Parade between Coode Street and Rose Avenue

This will be the final section of road to be constructed. It will be constructed after the northern bridges 3 and 4 superstructure is erected and whilst the station is being constructed.

Vehicular access to the nursing home in Railway Parade and residences and accommodation in Rose Avenue is required at all times. Consultation will be undertaken with the emergency services to ensure the access is suitable for emergency vehicles.

In addition, full access to adjacent sports ground parking area is also likely to be required during sporting events.

The works will be coordinated with the construction of the landscaping and other features to be installed in the area.

Noise, vibration and dust generation will have to be especially managed in this location due to the proximity of residents.

17.11.2 Plant and Equipment

The plant and equipment to be utilised is typical road construction equipment readily available in Perth via a specialist subcontractor or dry hire. As the sites are relatively constrained, the plant required will include:

- Skid steer loader
- Excavator
- Grader
- 6 wheel tip trucks
- 6 wheel water tanker
- Smooth drum and multi tyre roller
- Bitumen spraying plant

- Asphalt laying plant
- Kerb laying plant
- Line marking plant

17.12 PShP

As discussed in the traffic management section, the existing PShP through the precinct will be closed prior to the commencement of the bridge construction. Commuter bicycles will then be using on-road bicycle lanes in Whatley Crescent to bypass the construction site.

The new elevated section PShP attached to the bridge and bridge abutments, as shown in the following figure, will be constructed as the bridge superstructure is erected.

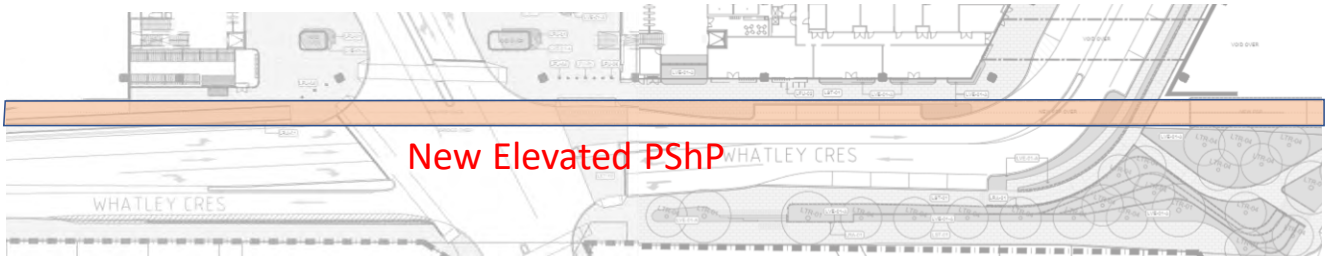


Figure 18.70: PShP Earthworks

In addition the new western and eastern sections of the PShP to complete the PShP will be constructed to allow the PShP to be opened. This will entail earthworks, retaining wall construction, pavement construction, lighting, surfacing and line marking works to be completed including placing a asphalt surface and line marking on the bridge section.

Once the new PShP is opened, traffic control will be utilized to allow construction traffic to enter the rail reserve to cross the PShP safely.

The ramps from the PShP down to the station entry level will be completed as part of the station, new Whatley Crescent and precinct landscaping for opening at the same time as the station.

17.13 Landscaping

17.13.1 General Sequencing of Works

During the completion of roadworks sections as mentioned earlier, adjacent landscaping works will also be done. Irrigation pre-lays for soft landscaping and service works for hard landscaping will be done during earthworks stage. After that pavements and kerbing works will be completed. Hard landscaping will commence after that and will include paving bricks, timber topped concrete bench, bike racks, bins, drinking fountains and bollards. After that plant beds and lawns will be setup, followed on by planting trees and spreading mulch.

Landscaping works will be done in 5 stages and described below.

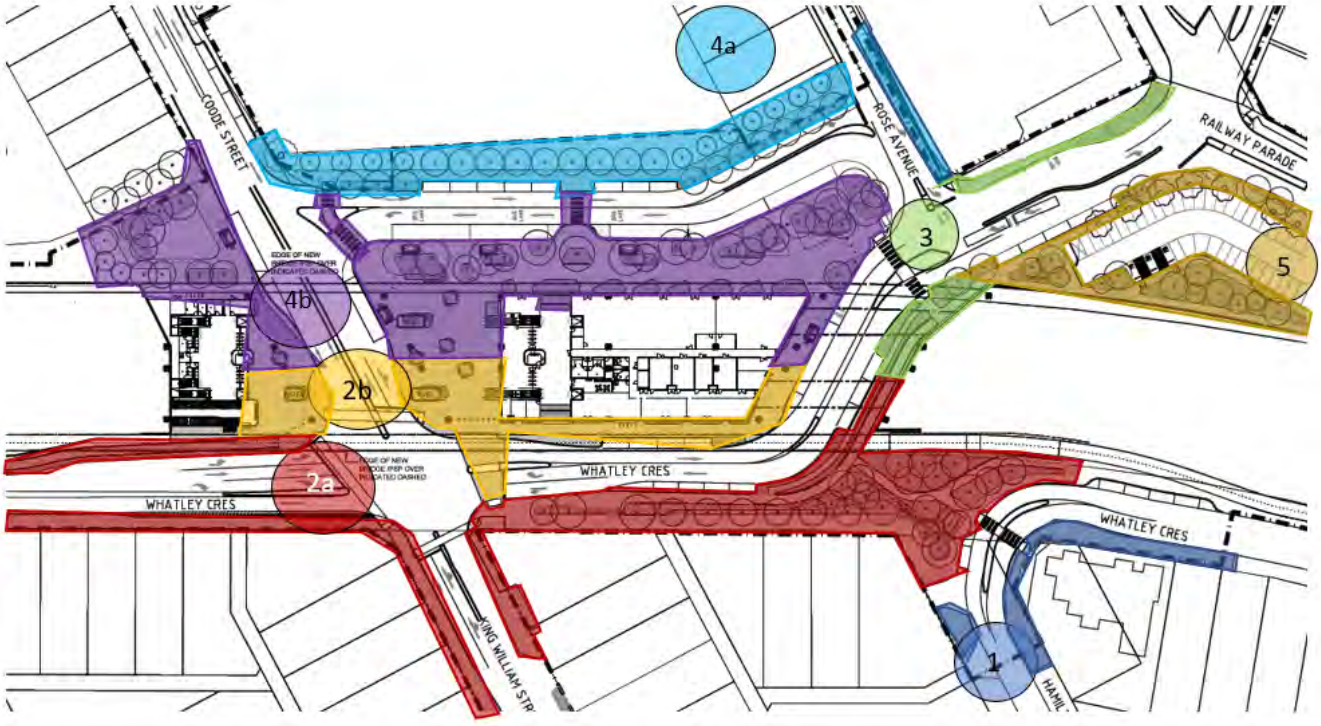


Figure 18.71: Landscape Staging

17.13.1.1 Stage 1

In this section, paving bricks will be installed in conjunction with roadworks at Whatley Crescent and Hamilton Street intersection. In order to provide access to the police station, works will first be conducted on one side of the pedestrian crossing and then on the other.

17.13.1.2 Stage 2

Stages 2a and 2b will start at the same time.

2a: This section will happen in conjunction with Whatley Crescent Link Road Stage 1 works. Firstly, the brick paving works will be completed, and the section will be open for pedestrian use. Following that, soft landscaping will be done progressively, closing off certain parts as required. Work in front of the shops will be done after hours. After completion of new Leake Street Underpass, landscaping works will be done on the adjacent PSHP and will tie in with this section.

2b: For this stage, coordination with the station building team will be required to ensure work proceeds concurrently.

17.13.1.3 Stage 3

This section will be done in conjunction with Whatley Crescent Link Road Stage 2 works. It will tie in with the landscaping works done in stage 2a.

17.13.1.4 Stage 4

Stages 4a and 4b will start at the same time.

4a: Firstly, the paving works will be completed in conjunction with roadworks at Railway Parade between Coode Street and Rose Avenue, and the section will be open for pedestrian use. Following that, soft landscaping will be done progressively, closing off certain parts as required.

4b: For this stage, coordination will the station building team will be required to ensure work proceeds concurrently. This will tie in with the landscaping works completed in stage 2b. Bus shelters and Transperth signage will also be established at this section.

17.13.1.5 Stage 5

The final stage of landscaping works will occur here after site demobilisation.

Appendix P

Operational Waste Management Plan prepared by Evolve Bayswater

PTA

BAYSWATER STATION AND TURNBACK

PTA190037

OPERATIONAL WASTE MANAGEMENT PLAN

BST-EVO-SU-PLN-0000X

AUTHORISED TO USE: _____(ALLIANCE MANAGER), DATE: _____

Submit to Client for Review and Approval where required in the Contract (Client to complete one box only):					
❑	Rejected, resubmit	Name:	Sign:		Date:
❑	Endorsed, with comments to add or change	Name:	Sign:		Date:
❑	Endorsed	Name:	Sign:		Date:
A	24/09/2020	Draft - Issued for Comment	K.O'Mara		
Rev	Date	Reason for Issue	Prepared	Checked	Approval

Table of Contents

Compliance and Obligations Register 4
Abbreviations and Acronyms 5
1.0 Introduction 6
1.1 Bayswater Station and Turnback Project 6
1.2 Location 7
1.3 Structure plan, zoning and land use 7
1.4 Purpose of the Operational Waste Management Plan 11
1.5 Scope of the Plan 11
1.6 Regulatory Requirements and guidelines 11
1.7 Assumptions 12
2.0 Roles and Responsibilities 12
2.1.1 PTA's responsibilities 12
2.1.2 Tenants responsibilities: 13
3.0 Waste Streams 13
3.1 Waste Categories and Types 13
3.2 Reliability of the waste estimates 14
4.0 Goals and Targets 16
5.0 Waste Management System 16
5.1 Principles 16
5.2 Frequency 16
5.3 Waste Facilities 17
5.3.1 Bin Storage Area 17
5.3.2 Platforms and Public Realm 17
5.3.3 PTA Service Areas 17
5.3.4 Toilets 17
5.3.5 Tenancies 17
5.4 Waste Servicing Area 19
5.5 Waste Contractor 19
5.6 Education and Signage 19
5.7 Safety Considerations 19
5.8 Maintenance and Fit Out Waste 20
6.0 Monitoring, Reporting and Review 22
6.1 Waste monitoring and surveillance 22
6.1.1 Data Collection and Analysis 22
6.1.2 Monitoring and Surveillance 22
6.2 Waste Auditing 23
6.2.1 Waste Management Plan Audit 23

6.2.2 Audit 23
6.3 Reporting 23
6.4 Review of the OWMP 23
7.0 References 24

Compliance and Obligations Register

Reference	Description	Section in this Plan
SWTC Book 2: Management Plan Requirements (BST-PTAWA-PM-RPT-00010)		
Section 24.10.1	The Alliance must review with the PTA the key risks and opportunities for maximising sustainable outcomes through procurement as part of developing the Sustainability Plan and sub-plans, including: i. resource efficiency and whole of life improvements for use of energy, water and materials; ii. waste avoidance, recovering and management; iii. use of environmentally labelled products and suppliers; and local content (workforce and businesses).	Whole Plan
Development Approval		
Condition Number 25	Waste management and servicing plan to be submitted and approved	Whole Plan
METRONET Sustainability Strategy 2019 – 2022 (BST-MET-PM-RPT-00001.5.1.IFI)		
Focus Areas and Target Outcomes (Table 1, p25)	Assess project opportunities for: • the use of recycled products and alternatives to basic raw materials • Operational waste initiatives influenced by asset design.	Whole Plan
Focus Areas and Target Outcomes (Table 4, p33)	Operational strategy: • Operational waste management across the precinct integrates with LGA operations to support sustainable waste management set out in the Waste Avoidance and Resource Recovery Strategy 2030. Infrastructure: • Precinct planning identifies the local infrastructure context and a formal engineering assessment is undertaken in early design to identify opportunities for waste management and recycling services, aligned to LGA operations, including community-scale organic waste composting.	Whole Plan
METRONET Bayswater Station and Turnback Owners Project Requirements (BST-MET-SU-SPC-00001)		
Section 4.1.9 Operational Waste	The METRONET Office is undertaking a program-wide Resource Recovery Opportunities Review (completion anticipated late 2020). This will include investigation of the potential for a program-wide waste strategy. When available, the station design teams are expected to review the results and incorporate requirements into the design of the stations and associated infrastructure. The station design teams shall allow for future waste segregation into at least three waste streams, including allowing for safe collation and collection in accordance with best practice guidelines, such as the City of Sydney Guide to Waste Management in New Developments.	Whole Plan Section 5.3
Chapter 5 Tenant Sustainable Design Requirements (p31)	Waste Management; • The stations will be subject to an operational waste management plan. Tenancies are to be designed and operated in accordance with this plan, which includes minimisation of waste to landfill.	Section 5.3.5

Abbreviations and Acronyms

Term	Definition
BST	Bayswater Station and Turnout
GBCA	Green Building Council of Australia
GSAP	Green Star Accredited Professional
LGA / WALGA	Local Government Authority / WA Local Government Association
MNO	METRONET Office
OWMP	Operational Waste Management Plan
PTA	Public Transport Authority

1.0 Introduction

METRONET is the State's vision to integrate transport and land use planning in the State and provide a framework to support sustainable growth of greater metropolitan Perth over the next 50 to 100 years.

Aligned with Commonwealth planning and infrastructure policies and the State's metropolitan growth strategies, *Perth and Peel @ 3.5 million* and *Transport @ 3.5 million*, METRONET Initiatives will deliver around 70 kilometres of new passenger rail and up to 18 new stations.

More than just rail infrastructure works, METRONET recognises the potential for urban intensification in more than 5,000 hectares of land. Planning goes beyond the station forecourts to shape and support development of communities within a walkable distance of 400 metres from a public transport hub.

METRONET Initiatives include approximately 70 kilometres of new heavy passenger rail and 16 new rail stations, which represents the single largest investment in public transport in Perth's history.

The State has prioritised the following METRONET Initiatives:

- Forrestfield – Airport Link;
- Thornlie – Cockburn Link;
- Yanchep Rail Extension;
- Morley – Ellenbrook Line;
- Extension of the Armadale Line to Byford;
- Bayswater Station Upgrade
- New station at Bellevue
- Station upgrade and relocation of Midland Station to Cale Street;
- Extension of the Midland Line to Bellevue; and
- Level crossing removal program.

1.1 Bayswater Station and Turnback Project

The Bayswater Station and Turnback Project as incorporated in the PAA for the Project includes:

- Stage One: The Turnback Works;
- Stage Two: The Bayswater Station Southern Section;
- Stage Three: The Bayswater Station Northern Section;

Stage One: Turnback Works comprises the following:

- New turnback siding between Bayswater and Meltham stations (configured to provide accommodation for 1 x 6 car sets);
- A shunters path (walkway) and a new driver's washroom;
- Relocation of the Leake Street underpass;
- Maintenance of the principle shared path along the southern side of the railway reserve;
- Other Project works including standard station systems, signalling, overhead line electrifications, communications, utility relocations and noise mitigation;

Stage Two: The Bayswater Station Southern Section, comprises the following:

- Two new rail bridges over King William Street, immediately south of the existing railway;
- New station island platform (150m long and 10m wide) complete with associated infrastructure and supported by the railway bridges;
- Provision for the principle shared path on the southern side of the southern railway bridge;
- The first stage of western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts and stairs) and equipment rooms to service railway operations;
- Integrated pedestrian, cyclist, bus and vehicle access into the station and future Bayswater town centre;
- Relocation of the dual gauge tracks and all associated track infrastructure to align with the new platform faces;
- New bus bays and vehicle parking bays;
- Other Project works including standard station systems, signalling, overhead line electrifications, communications, utility relocations and noise mitigation; and
- Landscaping and urban design features within the station precinct.

Stage Three: The Bayswater Station Northern Section comprises the following:

- Demolition of the existing Bayswater station and associated infrastructure.
- A second set of two new rail bridges over King William Street, located immediately north of the first new set of railway bridges delivered as part of Stage One;
- A second island platform (150m long and 10m wide) complete with station infrastructure again supported by the northern pair of railway bridges;
- The second stage of the western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts and stairs) and retail tenancies:
- Additional station infrastructure to meet the needs of the expanded (four line, four platform face) station;
- Landscaping and urban design features within the station precinct;
- Other Project works including standard station systems, signalling, overhead line electrifications, communications, utility relocations and noise mitigation;
- Completion of new bus bays and vehicle parking bays; and
- Landscaping and urban design features within the station precinct.

1.2 Location

The BST project is in the area surrounding the existing Bayswater Station, between Whatley Crescent and Railway Parade, surrounded by the Bayswater Town Centre as shown in Figure 1.

NOTE: Image to be replaced with higher quality in the PDF version when issued as Rev 0

1.3 Structure plan, zoning and land use

The project site is predominantly contained within the railway and road reserves included in the City of Bayswater Local Planning Scheme 24 and forms a portion of the Planning Control Area 135, which includes land required for the BST project and the METRONET transport program, for which Station Approval was granted in 2019.

Either side of the existing rail corridor, there is a mix of landscaped areas and parking facilities, with a principal shared path located adjacent to the corridor on the southern side as shown in Figure 2.

NOTE: Image to be replaced with higher quality in the PDF version when issued as Rev 0

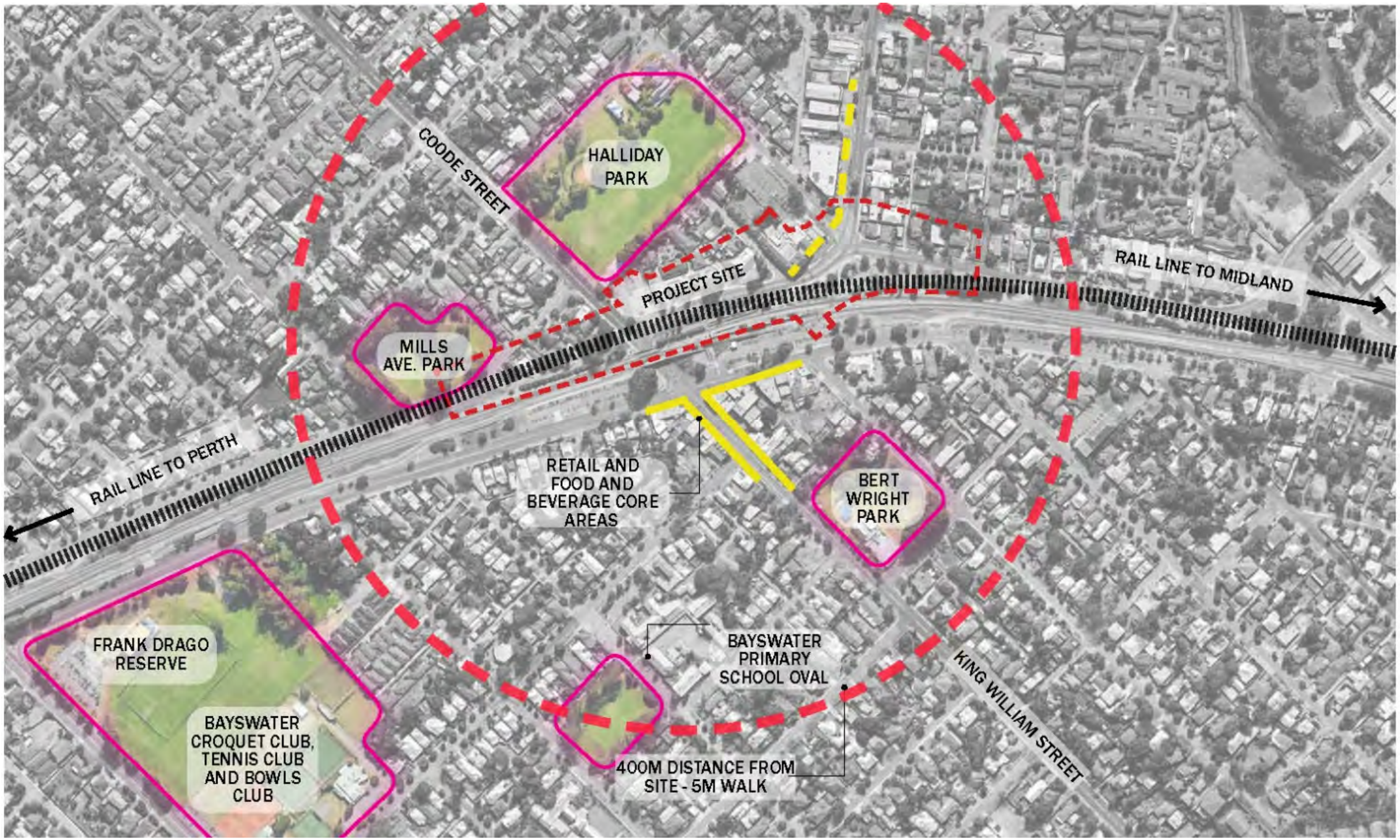


Figure 1 Context

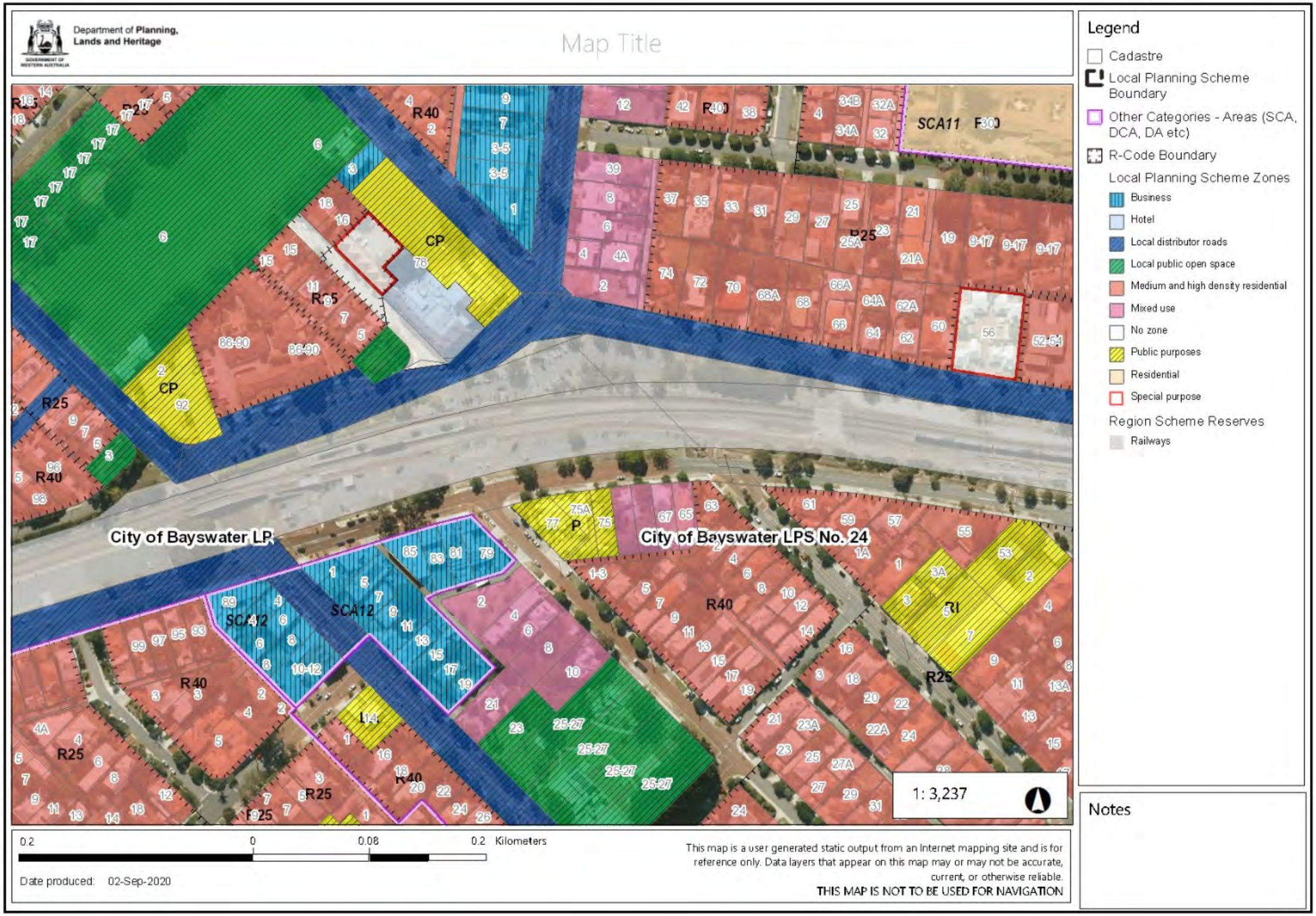


Figure 2 Zoning

1.4 Purpose of the Operational Waste Management Plan

The purpose of this Operational Waste Management Plan (OWMP) is to:

- Document the framework for the management of waste generated at Bayswater Station;
- Identify waste categories and estimated quantities likely to be generated; and
- Provide guidance as to the sizing and placement of bins as well as the servicing requirements for collection vehicles during the design of the Station.

1.5 Scope of the Plan

This OWMP applies to the operational phase of Bayswater Station. This includes:

- Waste management activities for the facilities which are owned or managed by the PTA, including the Station and carparking facilities.
- Consideration of operational practices associated with potential ground floor tenancies, including the fit out and operation.

Exclusions:

- Waste generated from the operation of the areas developed by the BST project but proposed to be managed by the City of Bayswater or third parties.
- Wastes generated during construction activities, not associated with operations at the Station, including fit-out furniture and equipment for the PTA facilities located on the ground floor.

1.6 Regulatory Requirements and guidelines

This OWMP complies with relevant regulatory requirements and guidelines including (but not limited to):

- *Environmental Protection Act 1986*
- *Health Act 1911* and Guidelines
- *Waste Avoidance and Resource Recovery Act 2007* and Regulations 2007
- Environmental Protection (Controlled Waste) Regulations, 2004 and Guidelines
- Landfill Waste Classification and Waste Definitions 1996 (As amended).
- METRONET Bayswater Station and Turnback Owners Project Requirements
- Commercial and Industrial Waste Management Plan Guidelines. (Western Australian Local Government Association (WALGA), n.d.)
- Guidelines for Waste Management in New Developments (City of Sydney, 2018)
- Volumetric to tonnage conversion factors based on those presented in Table 1 (Western Australian Waste Authority, n.d.).

Table 1 Conversion factors

Material	Tonnes per m^3
Uncompacted General Waste	0.3
Co-mingle recycling	0.063
Paper / Cardboard	0.1

1.7 Assumptions

To assist with identifying sources and streams, following assumptions have been used to base the assessment:

- Waste management services for the Station are expected to be serviced by a provider who offers a range of commercial waste management services, engaged by the PTA through a standard procurement approach.
- The impact on both waste quantities and comingle recyclables associated with the WA container deposit scheme (Containers for Change) has not been considered during the preparation of this plan.
- A potential tenancy profile has been developed aligned to the type of premises identified in Appendix 1 of the WALGA Guideline (Western Australian Local Government Association (WALGA), n.d.) and consider the use and tenancy floor area.
- It is expected that no major maintenance activities will be undertaken for the first five years of operation of the Station. Should maintenance, fit out or repair work be required, the responsible party shall consider waste management which is consistent with the intent of this operational plan.
- Construction wastes, including tenancy fit out and end of life replacement of furniture have not been considered, but would be expected to be managed independently of the typical waste requirements for the site and responsibility be embedded into the contractual requirements of tenants.
- Controlled and specialist wastes and recyclables, such as printer toner cartridges, coffee pods, batteries and organics are expected to be disposed of using specialist service providers and are expected to be of non-material volumes.

2.0 Roles and Responsibilities

The management of wastes deposited in the dedicated Bin Areas in the Site which services the Station, including tenancy activities. responsible for ensuring waste management, including appropriate signage, monitoring and review of waste management practices on the Ground Floor is undertaken in accordance with this OWMP.

2.1.1 PTA's responsibilities

The responsibilities of the PTA include, but are not limited to;

- Identification the waste sources, streams and quantities for the different activities expected within the Station;
- Removal of wastes, litter and/or recycling collected in PTA offices and common use areas, including the platform, car park and bus area within the boundary of the BST project;
- Provision of recycling facilities aligned to the waste streams to promote diversion from landfill and working with tenants to promote use of the recycling services;
- Promotion of opportunities to avoid and minimise waste generation by improving the reuse of waste streams as appropriate;
- Identification of management approaches to assist the achievement of the goals and targets set for the Site;
- Monitoring and reporting on the waste generated and diversion from landfill achieved; and
- Continuous improvement its waste management performance through reduced waste generation and improved diversion from landfill.

2.1.2 Tenants responsibilities:

The responsibilities of Tenants include, but are not limited to;

- Seek opportunities to reduce waste volumes and to promote recycling opportunities, including those associated with the container deposit scheme.
- Collection of wastes and recyclable materials generated within the tenancies
- Transportation of waste from the tenancies to the Bin Area
- Appropriate segregation disposed of into the waste and recycling bins appropriate to the waste stream
- Ensure that staff or cleaning service providers have appropriate health, safety and environmental management processes and insurances in place prior to the commencement of services.

3.0 Waste Streams

Waste is expected be generated as a result of station operations, including from PTA staff as well as passengers using the train and bus services. However, most of the waste is expected to be generated from tenancies within the Station. The anticipated waste streams which are expected to be generated in significant quantities include:

- General waste
- Paper and cardboard
- Co-mingle recyclables
- Food and Organics, subject to tenancy profile
- Sanitary wastes

Minor quantities of the following streams are also anticipated during operation and maintenance activities:

- E-Waste
- Printer cartridges
- Batteries
- Confidential paper materials for shredding
- Paint
- Building materials aligned to the fit out of the Station and tenancies

3.1 Waste Categories and Types

Estimates for the quantity of daily and weekly waste generated across the Station are summarised in Table 2.

Table 2 Summary of estimated quantity of waste generated

Waste quantities by type	Daily		Weekly	
	Volume (L)	Mass (kg)	Volume (L)	Mass (kg)
General Waste	655	196	4,582	1,374
Co-mingle	284	28	1,988	199
Paper and Cardboard	184	2	1,104	11
Total	**1,123**	**227**	**4,582**	**1,374**

Considering WALGA waste generation rates, without provision and promotion of recycling the Station is anticipated to divert approximately 33% of waste by volume from landfill as shown in Table 3.

Table 3 Summary of estimated diversion percentage by mass

Source	Percentage by Volume
General Waste	68%
Co-mingle	30%
Paper and Cardboard	16%

3.2 Reliability of the waste estimates

This OWMP has been developed based on waste generation rates which were based on 2012 data which is provided in the WALGA guidelines. Since this time, there has been an increase in both generation rates overall and diversion from landfill.

The waste quantities estimated in Section 3.1 currently indicate that the Station would not be able to achieve the diversion targets set in Section 4.0. However, it is anticipated that the proposed measures identified in this OWMP, including increased provision of recycling services to support both PTA operations and the Tenancies will enable the 75% diversion rate achievable.

Table 4 Waste generation estimate

Waste Categories and Types	Daily Generation Rate (L)	Unit of Measure	Gross Floor Area (m^2)	Number of Units	Daily Volume (L)	Daily Mass (kg)	Generation Rate Source
Retail (non-food) (Tenancy <100m2)							
General Waste	50	L/ 100m2/FA/day	286	-	143	43	WALGA Commercial and Industrial Waste Management Plan Guidelines
Paper and cardboard	12.5	L/ 100m2/FA/day			36	0	
Co-mingle recyclables	12.5	L/ 100m2/FA/day			35.75	4	
Retail (non-food) (Tenancy >100m^2)							
General Waste	50	L/ 100m2/FA/day	570	-	285	86	WALGA Commercial and Industrial Waste Management Plan Guidelines
Paper and cardboard	25	L/ 100m2/FA/day			143	14	
Co-mingle	25	L/ 100m2/FA/day			143	14	
Office							
General Waste	10		115	-	12	3	WALGA Commercial and Industrial Waste Management Plan Guidelines
Organic (food) wastes	0				-	-	
Paper and Cardboard	5				6	1	
Co-mingle	5				6	0	
Washroom wastes							
General Waste	5	L/washroom/day		23	115	35	Estimate based on typical washroom, where waste bins are installed
Sanitary waste	0.7	L/washroom/day		18	13	1	
Maintenance in Tenancies							
Wood and laminates	Minor		971	-	Minor	Minor	Estimate based on typical retail / commercial tenancy rates
Steel							
Toner / fuser cartridges							
E-Waste							
Plastics							
Batteries							
Platforms and Public Realm							
General Waste	60	Per unit		20	100	30	
PTA CSO Specific Wastes							
Printer cartridges	Minor	Per unit		2	Minor	Minor	One per CSO
Batteries		Per unit		2			
Confidential materials for shredding		Per unit		2			

4.0 Goals and Targets

The waste management objectives, goals and targets for the Station as shown in **Table 5**, which consider the operational waste targets set in the BST Owners Project Requirements (METRONET, 2020).

Table 5 Goals and Targets

Waste Stream	Target
General Waste	Reduce general waste mass to landfill by 5% year on year
Paper and Cardboard	Recycle 75% by volume of waste across tenancies.
Co-Mingles	

Collection and reporting against these goals as identified in **Section 6.0**.

5.0 Waste Management System

This section outlines the approaches recommended for the management of wastes across the Station.

5.1 Principles

To achieve the waste management objectives and targets in this OWMP the following waste management initiatives have been adopted:

- Provision and promotion of recycling services for comingle recyclables, paper/cardboard and small volume wastes, including e-waste.
- Implementation of a waste management hierarchy in this order of preference:
  - Avoidance of the creation of waste
  - Re-use and recycling of waste
  - Disposal of waste
- Appropriate and effective collection, segregation, handling, and transport of waste;
- The colour of signage on bins is to be matched to the *AS4123.7 Mobile Waste Containers – Part 7 Colours, Markings and Designation* requirements.
- If lining of co-mingle (yellow) bins is required, clear liners are to be used to facilitate contamination inspection.
- Undertake monitoring and regular reporting; and
- Regular review the OWMP, service frequency and adequacy of bins to contain daily volume of wastes.

5.2 Frequency

Regular scheduled collection of wastes to prevent storage of excessive volumes of waste, reduce odour and discourage pests, which will be implemented once the complex is operational. The frequency of waste collection based on the waste quantities prepared for this OWMP is proposed to be:

- General waste to be emptied twice weekly;
- Co-mingle recyclables to be emptied weekly; and
- Paper/Cardboard to be emptied weekly.

5.3 Waste Facilities

5.3.1 Bin Storage Area

A central bin storage area is proposed for the development for consolidated storage and segregation of wastes generated across the Station, including from tenancies.

Rear lift, 1,100L mobile garbage bins (MGB) have been proposed for use for the central storage of wastes and recycle streams. The design of the Bin Store has taken the sizing of these large, mobile bins into consideration, although the use of a mix of smaller volume bins is also possible for the room size provided.

Bins will require removal from within the secured Bin Area prior to collection by either the PTA or the Waste Contractor. Confirmation of the responsible party for relocation would occur as part of the process to engage the Waste Contractors.

5.3.2 Platforms and Public Realm

Standard stainless-steel PTA bins will be provided throughout the Station. Bins will be located adjacent to all seating provided through the development in accordance with

Designated cigarette bins will also be provided at least 20m away from each of the Station entries.

5.3.3 PTA Service Areas

10L General Waste and 10L Co-mingle Recycling bins are recommended for each of the Customer Service Offices (CSO) at ground level and in each of the Tea Preparation Areas on the platforms.

Standard 240L confidential shredding wheelie bins may also be required for installation in the CSO's. If required, removal and collection of these is anticipated to be subject to a separate waste management contract.

5.3.4 Toilets

Energy efficient air-based hand dryers have been specified for use in the toilets as a waste minimisation measure. As a result, paper wastes are not expected to be generated, although small volume bins (approximately 12L) are recommended for inclusion in washrooms to prevent littering in the public realm.

Sanitary bins will be required in the universal access and female toilets. The provision of sharps bins in public access washrooms is also recommended.

5.3.5 Tenancies

Tenants will be responsible for providing their own waste and recycling bins consistent with the waste and recycling services provided by the PTA and sized to consider the waste and recycling generation of the tenancy.

Where a deep fryer is installed within the tenancies, either on a temporary or permanent basis, the vendor providing food services shall be responsible for directly engaging appropriate waste collection services for cooking oil wastes, with storage of the waste cooking oil drum in the kitchen are in the tenancies.

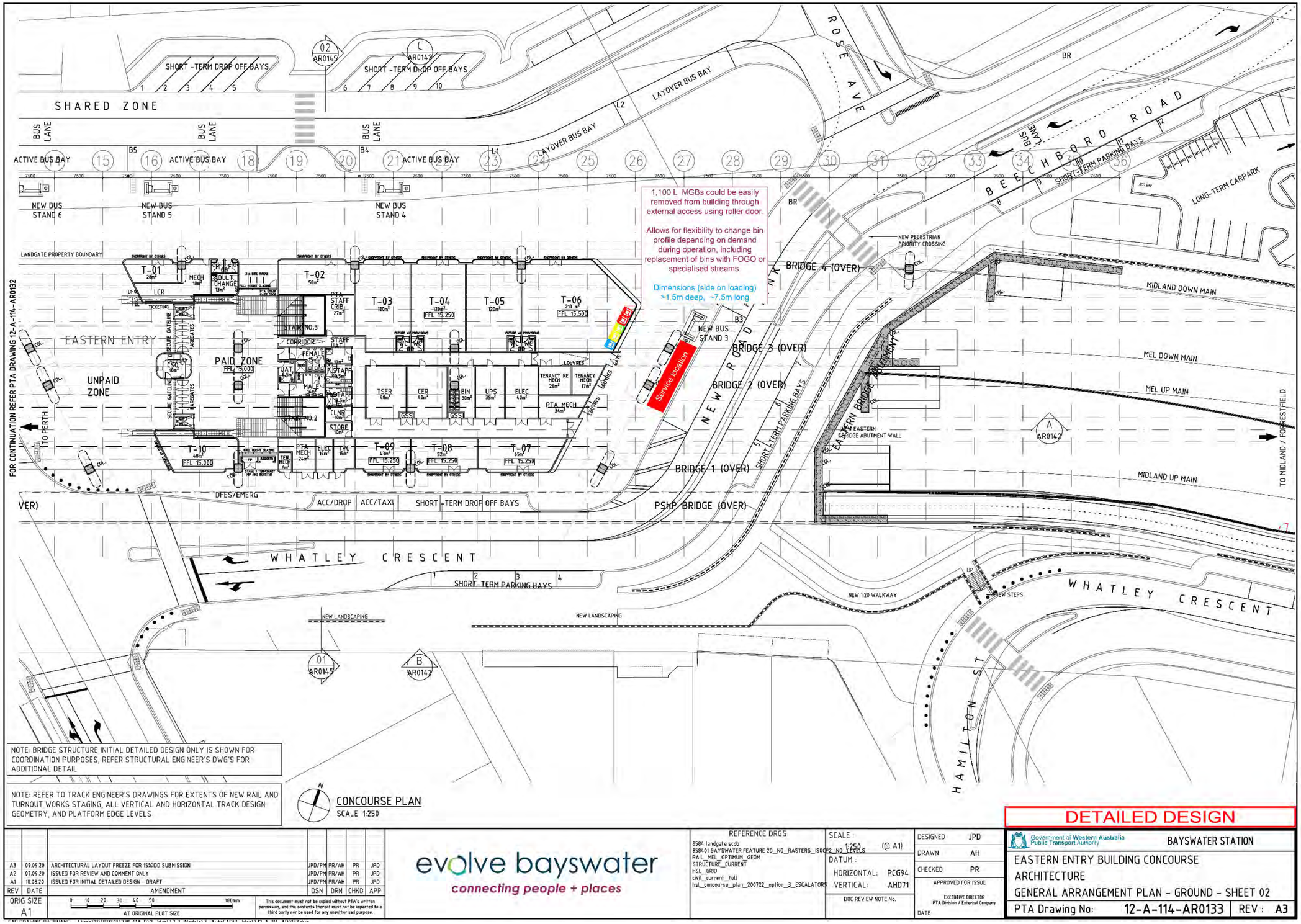


Figure 3 Site Plan

NOTE: Image to be replaced with higher quality in the PDF version when issued as Rev 0

5.4 Waste Servicing Area

Servicing of the general waste and recycling bins will be within the in new bus bay (Stand 3), which is located adjacent to the bin area. Vehicle access to the collection area will be via the new road which links Whatley Crescent to Beechboro Road as shown in burgundy on in Figure 4.

Following the service, the vehicle will drive along the Bus Lane with opportunity for continuation on to Beechboro Road or to continue in the Bus Lane and exit left on to King William Street.

The bins will be removed from the bin area, taken to the collection vehicle and returned to the bin area when emptied. Bins are not to remain outside the bin area before or after the service.

Waste collection services are proposed to be undertaken a designated Servicing Area which has been sized to include additional capacity to cater for unusual generation rates. The location and sizing of the Servicing area has considered:

- Preliminary estimate of volume of waste generated at the Station
- Anticipated collection frequency for each of the waste streams
- Locations where rear lift vehicles could drive in and drive out without turning or reversing
- Positions without disrupting traffic movements on local government roads, Station function or accessibility.

5.5 Waste Contractor

A private waste management contractor will be engaged by the PTA as the Station nears practical completion. It is expected that the selected contractor would use its Standard Operating Procedure to lift the bin to empty it and to exist the Site within the proposed traffic movements in Figure 4.

5.6 Education and Signage

Information for tenants regarding the waste and recycling services available in the complex as well as their responsibilities will be provided as part of the tenancy establishment process.

Signage throughout the Station and Bin Areas, be required to encourage the placement of recyclable materials in the appropriate bin to promote recycling. Bins used by tenants and the public should be fitted with appropriate signage, such as adhered to the front of, or above bins and be coloured as described in **Section** Error! Reference source not found..

5.7 Safety Considerations

All cleaning contractors, including those engaged by PTA, using the Bin Area and Service Area should develop appropriate occupational health and safety management plans (OHSMP) and/or safe work method statements (SWMS) based on the waste receptacles and transportation methods are developed and implemented.

The following guidance and list of hazards is provided to assist with the development of the SWMS and is not intended to be used as substitute for appropriate job hazard analysis. Potential hazards include:

- Interaction with pedestrians and vehicles within the Site
- Manual handling of receptacles, and the emptying of smaller bins or bags into larger bins
- Slips, trips and falls, particularly associated with wet conditions
- Interaction with pests and vermin
- Inappropriate disposal of hazardous wastes (i.e. syringes)
- Cuts and lacerations from broken and damaged waste and recycling materials, especially glass and crockery

- Working around plant and vehicles in both the carpark and the service bay
- Biological hazards (infection and disease)
- Pinch points and falling objects, especially associated with the opening and closing of bin lids and working behind wheelie bins where brakes are not engaged
- Environmental factors (odour, noise and task lighting levels as well as heat and/or cold exposure
- Competency and training
- Fatigue

The dedicated Bin Area should always be left tidy and free from clutter by users of the facilities.

Cleaning contractors are recommended to seek appropriate advice during the development of their safety management guidance, including consulting with WorkSafe WA.

5.8 Maintenance and Fit Out Waste

Where major fit-out at commencement or end of tenancy, or maintenance activities are planned for the Site, or within individual tenancies, it is recommended that larger volume steel or skip bins are sourced, including appropriate recycling skip or steel bins are acquired.

Due to operational constraints, the location of these bins would be expected to be within the Station carpark and as such additional occupational health and safety requirements would be needed to ensure the safe transportation of wastes at the cross walk across the new road between Whatley Crescent and Beechboro Road. Wastes stored in this location are also likely to require padlocks or exclusion from public access to prevent illegal dumping.

Where these bins are required by tenants, permission from the PTA will be required prior to the commencement of maintenance or fit out activities.

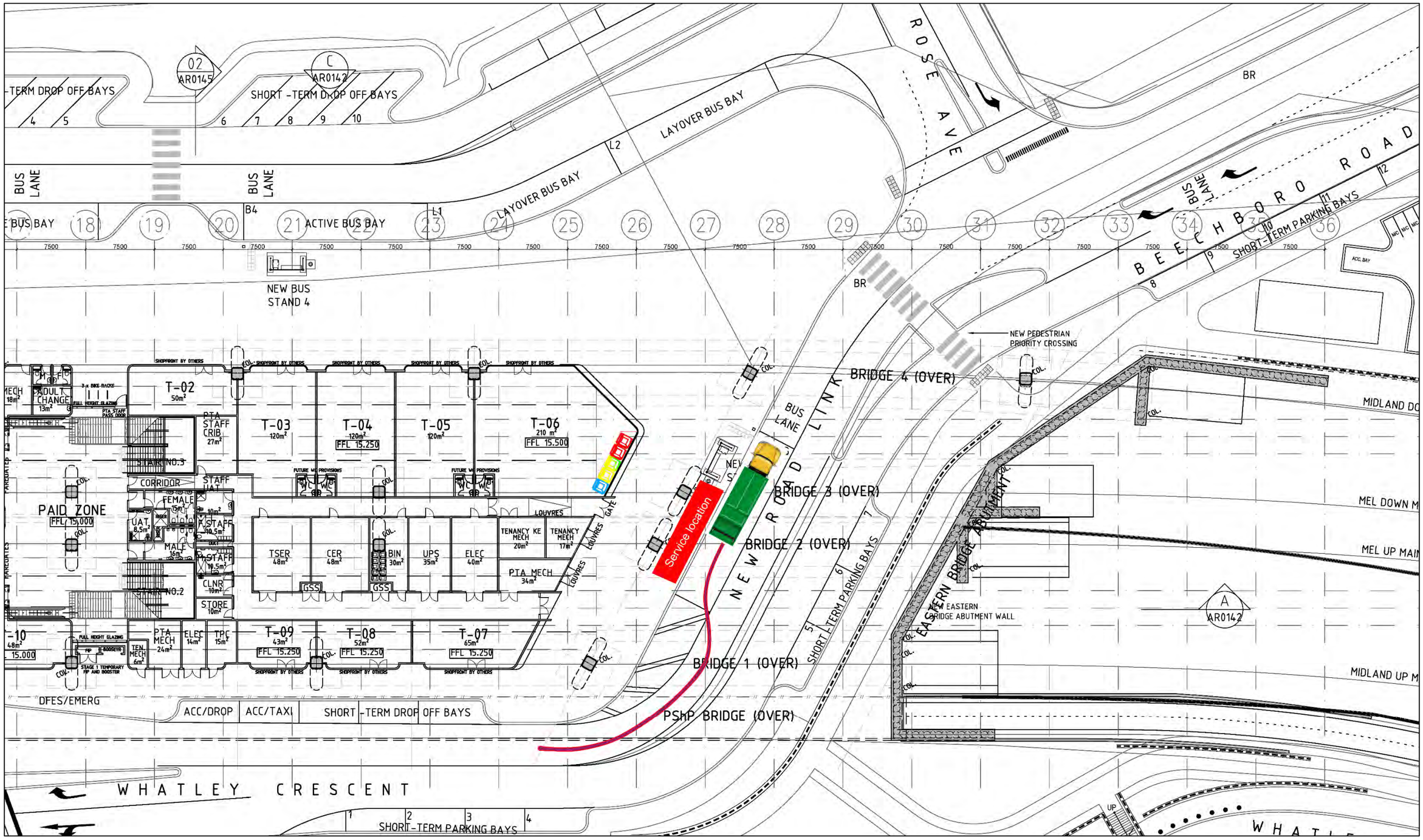


Figure 4 Servicing Area

NOTE: Image to be replaced with higher quality in the PDF version when issued as Rev 0

6.0 Monitoring, Reporting and Review

6.1 Waste monitoring and surveillance

It is recommended that as part of the commissioning and tuning of the Site, waste generation rates specific for the site are compared to those in the sources identified in **Section 1.6** and the OWMP be updated based on actual generation quantities and the effect of the introduction of the WA Container Deposit Scheme on the 1st October 2020.

6.1.1 Data Collection and Analysis

As noted in Section 4.0, the collection of the data and information to support the waste management activities at the Site will be undertaken with the data collection commitments summarised in Table 6.

Table 6 Data collection commitments

Stream	Data Source	Metric	Responsibility	Frequency
General Waste	Waste data supplied by Contractor(s)	Total volume of waste stream	Facility Manager is responsible for requesting, collating and maintaining waste statistics for all zones	Quarterly; commencing once open for business
Co-mingled		Total volume of recycled stream		
Paper and cardboard		Total volume of recycled stream		
All		Percentage diversion from landfill by volume		

6.1.2 Monitoring and Surveillance

Station management or their delegated cleaning contractor will conduct weekly, passive surveillance of the cleanliness of Bin Area as well as appropriate waste segregation, and littering (intentional and windblown) across the Site. If recycling bins within the Bin Area is under-utilised or are subject to contamination such that recycling is not possible, the waste segregation practices and signage associated with the recycling bins should be reviewed. Education and awareness raising activities with tenants should be considered to raise recycling rates should also be considered to increase volume of recyclables.

The following additional monitoring is also recommended:

- A register recording complaints and incidents relating to waste
- Review of waste disposal records including contractor supplied data identified in **Table 6** including:
  - Type of waste
  - Quantity or volume
  - Final destination
  - Date of collection

6.2 Waste Auditing

6.2.1 Waste Management Plan Audit

Annual audits of against this OWMP will be conducted by a suitably qualified professional, with audit and waste management experience as defined in the Green Star Railway Stations Submission Guidelines.

The focus of the audit is to determine compliance with all relevant regulatory and this OWMP requirements.

6.2.2 Audit

Waste Auditing, in accordance with the principles outlined in NABERS Waste for Offices or similar should be undertaken annually, prior to the audit of the OWMP.

The purpose of the waste audit is to define the quantity of waste and recyclables generated and assess changes in the predicted waste categories and quantities to enable improvement to waste management practices.

6.3 Reporting

An annual waste management report shall be prepared and include the following, as appropriate:

- Quantities of waste streams collected for general waste and recycling
- Comparison against estimated quantities, reduction and diversion targets.
- Summary of surveillance, tracking and auditing results.
- Non-conformance and corrective actions arising from activities at the sites, including audits of the waste management processes.
- Any incident or complaints relating to waste management.
- Responses, mitigation measures and/or preventative actions that were undertaken in response to incidents or near misses which have the potential to cause injury to people or environmental damage, opportunities, non-conformations or complains/
- Recommendation for changes to the OWMP as a result of the above items in this list or changes to the tenancy profile changes and recycling opportunities implemented.

6.4 Review of the OWMP

This OWMP will be reviewed on at least an annual basis to ensure that it meets the configuration and operation of the site, including when following occur:

- Six months after practical completion of the Station
- Six months after 80 percent of the gross lettable area has been tenanted and are open for trading.
- When collection of emerging waste streams, such as Food Organics and Garden Organics, are available for commercial and industrial customers.
- Audit recommendation for review; and/or
- Changes to the OWMP are identified in Section 6.3.

7.0 References

City of Sydney. (2018). *Guidelines for Waste Management in New Developments.*

Green Building Council of Australia. (2020). *Green Star Railway Stations Submissions Guideline v1.1.*

METRONET. (2019). *Sustainability Strategy (BST-MET_PM-RPT-00001.5.0).*

METRONET. (2020). *Bayswater Station and Turnback Owners Project Requirements (BST-MET-SU-SPC-00001).*

Western Australian Local Government Association (WALGA). (n.d.). *Commercial and Industrial Waste Management Plan Guidelines.*

Western Australian Waste Authority. (2019). *Waste Avoidance and Resource Recovery Strategy 2030.*

Western Australian Waste Authority. (n.d.). Retrieved from Converting volumes to tonnes: http://www.wasteauthority.wa.gov.au/media/files/documents/GN6VoltoTonnes.pdf

Appendix A WALGA Checklists

NOTE: Completed WALGA Appendix 5A and 5B to inserted when PDF'd

Appendix Q

Tree Survey prepared by Paperbark Technologies

Tree Survey – Bayswater Station and Turnback Project

Prepared for

Evolve Bayswater

Zana Sheary & Luisa Galata

Arboricultural Consultants

Paperbark Technologies Pty Ltd

ISA Certified Arborist - AU0039A

Quantified Tree Risk Assessor, Licensed user 1082 & 6146

Diploma of Horticulture/Arboriculture

PO Box 1116

Scarborough WA 6922

Mobile: 0401 817 551

www.paperbarktechnologies.com.au

zana@paperbarktechnologies.com.au

TABLE OF CONTENTS

Brief	2
Form and approach	2
Botanical name	2
Age Class	2 - 3
Tree health & Tree structure	3 - 4
Tree protection zone - TPZ	4 - 5
Structural root zone – SRZ	5 – 6
Retention & Ecological Values	7
Tree Survey	8 - 42
Summary	43 – 44
Contractor Specification	45 – 46
Limitation of Liability	47
References	47
Site Maps showing tree locations	48 – 57
Photos of each tree	58 – 79

BRIEF:

This consultant has been commissioned by Evolve Bayswater to inspect and submit a report in respect of 172 trees located within the site known as Bayswater Station and Turnback Project which is scheduled to undergo redevelopment works.

The purpose of the survey is to assess selected trees located within the site. Recommendations were made based upon health and structural condition of the inspected trees as to whether or not they are suitable to be retained and to advise of any remedial pruning works.

The survey scope requires:

- Tagging each tree with a numerical tree tag from 1 – 173. (Tag 158 is missing)
- The identification of tree species.
- Measurement of the height & canopy spread of the trees.
- Measurement of trunk diameters.
- A detailed description of each trees current health and structural condition.
- Advice regarding the suitability for retention and if not why.
- Retention value (Low, Medium or High)
- Ecological Value (Low, Medium or High)
- Tree Protection Zone Radius (TPZ) calculation.
- Structural Root Zone Radius (SRZ) calculation.
- Recommended remedial pruning or other works that may be required.

A total of 172 trees located within the site have been inspected, assessed and photographed for this report.

Trees were tagged to facilitate locating individual trees and numbers have been placed upon an aerial image of the site.

A photo of each tree is also included in this report.

This consultant confirms tree inspections were carried out on the 21st, 22nd & 23rd of September 2020.

FORM AND APPROACH:

Below are the definitions for the captured information provided:

Botanical name Information:

Botanical names are listed detailing the generic name followed by the specific epithet. The variety is named where applicable. Only the scientific and botanical names should be accepted to identify an exact tree species.

The botanical name is predominantly used within this report and the common name provided for your reference within the summary.

Tree Age:

Tree age is based on the age of the tree that would be considered typical for the species in the general area. It is not based on the health of the tree.

Young
The tree has recently been planted or self-sown (within the last 3 – 5 years).

Semi mature
The tree has become established in the site and may be approaching its expected mature size. If correctly maintained the specimen will continue to grow to maturity.

Mature
Usually the tree will have reached the expected size for the species in the site.

Post mature
The tree has passed the mature stage of its life and is characterized by both a very slow growth rate and by intolerance to disturbances. The post-mature tree has limited energy reserves to fight invading diseases and insects, especially pruning wounds. Removal of live tissue is something to avoid.

Severe decline
The tree is in its final stages of life, the tree is beginning to lose its ability to defend itself. It is at this stage that the tree becomes susceptible to pests and disease. The tree will be assessed for hazards and may require reduction pruning or removal.

Note
It is important to note that tree age is not directly related to tree health. For example: It is possible for a young tree to have very poor health and a mature tree to have good health.

Tree health:

Good
The tree is demonstrating good or exceptional growth for the species. The tree should exhibit a full canopy of foliage and have only minor pest or diseases problems. Foliage colour, size and density should be typical of a healthy specimen of that species.

Fair
The tree is in reasonable condition and growing well for the species. The tree should exhibit an adequate canopy of foliage. There may be some dead wood present in the crown, some grazing by insects or animals may be evident and/or foliage colour, size or density may be atypical for a healthy specimen of that species.

Poor
The tree is not growing to its full capacity; extension growth of the laterals may be minimal. The canopy may be thinning or sparse. Large amounts of dead wood may be evident throughout the crown. Significant pest and disease problems may be evident or symptoms of stress indicating tree decline.

Very poor
The tree appears to be in a state of decline and the canopy may be very thin and sparse. A significant volume of deadwood may be present in the canopy or pest and disease problems may be causing a severe decline in tree health.

Dead
The tree is dead.

Tree Structure:

Each tree surveyed was examined in detail to ascertain its overall structural condition and then placed into one of five categories:

Good: The tree has a well-defined and balanced crown. Branch unions appear to be strong, with no defects evident in the trunk or the branches. Major limbs are well defined. The tree would be considered a good example of the species. Probability of significant failure is highly unlikely.

Fair: The tree has some minor problems in the structure of the crown. The crown may be slightly out of balance, and some branch unions or branches may be exhibiting minor structural faults. If the tree is single trunked, this may be on a slight lean or be exhibiting minor defects. Probability of significant failure is low.

Poor: The tree may have a poorly structured crown. The crown may be unbalanced or exhibit large gaps. Major limbs may not be well defined. Branches may be rubbing or crossing over. Branch unions may be poor or faulty at the point of attachment. The tree may have suffered major root damage. Probability of significant failure is moderate.

Very Poor: The tree has a poorly structured crown. The crown is unbalanced or exhibits large gaps. Major limbs are not well defined. Branch unions may be poor or faulty at the point of attachment. A section of the tree has failed or is in imminent danger of failure. Active failure may be present or failure is probable in the immediate future.

Has Failed: A significant section of the tree or the whole tree has failed.

TPZ – Tree Protection zone

As per the Australian Standards AS 4970-2009 *Protection of trees on development sites* the tree protection zone (TPZ) is the principal means of protecting trees on sites where development is to occur. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, so that the tree remains viable.

The radius of the TPZ is calculated for each tree by multiplying its DBH x 12.
E.g. DBH is 0.5m x 12 = 6m radius (TPZ = 6m measured from the centre of the trunk at ground level.)

If the proposed encroachment is greater than 10% into the TPZ or SRZ the project Arborist must demonstrate that the tree(s) would remain viable. Once proposed changes or designs of the site are completed the project Arborist may need to re-inspect selected trees to ensure the trees are adequately protected. The purpose of this is to determine the potential impact on trees proposed to be retained.

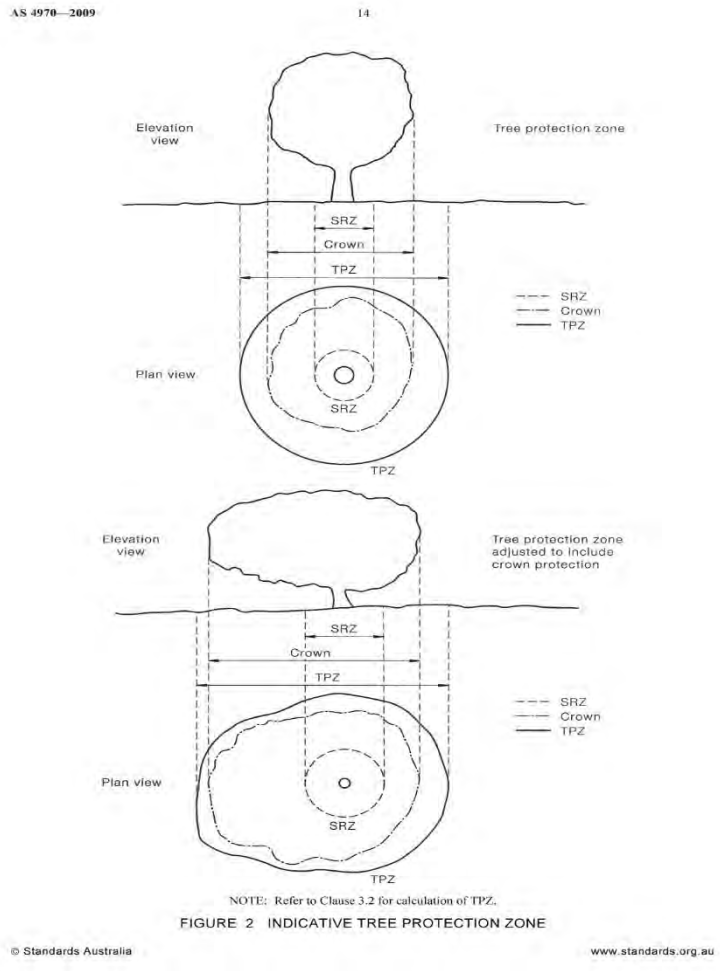
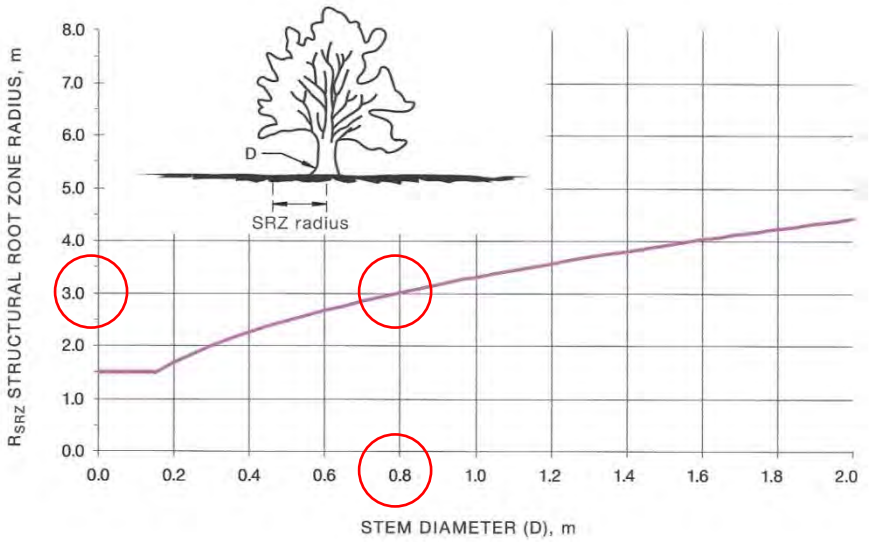


Figure 1 Indicative tree protection zone from AS 4970-2009

SRZ – Structural Root Zone

This consultant advises that a structural root zone area of a tree is required for tree stability. Using Australian Standards AS 4970-2009 *Protection of trees on development sites* the structural root zone area can be calculated when major encroachment into a TPZ is proposed. This zone considers a tree's structural stability only and not the root zone required for a tree's health and long-term viability, which is usually a much larger area. (As cited by AS 4970-2009) An indicative SRZ radius can be determined from the trunk diameter measured immediately above the buttress using the following formula. SRZ radius = $(D \times 50)^{0.42} \times 0.64$ or using the following guide from AS 4970-2009. E.g. Diameter at root flare is 0.8m (red circle) and using the graph below a 3m SRZ radius is required. This is measured from the centre of the trunk at ground level.

All trunk diameters used in TPZ and SRZ calculations were measured directly.



The curve can be expressed by the following formula:
$R_{SRZ} = (D \times 50)^{0.42} \times 0.64$

NOTES:

1 R_{SRZ} is the calculated structural root zone radius (SRZ radius).
2 D is the stem diameter measured immediately above root buttress.
3 The R_{SRZ} for trees less than 0.15 m diameter is 1.5 m.
4 The R_{SRZ} formula and graph do not apply to palms, other monocots, cycads and tree ferns.
5 This does not apply to trees with an asymmetrical root plate.

Figure 2 Displays the Structural Root Zone Calculation from AS 4970-2009 *Protection of trees on development sites* and indicates how to work out the SRZ of each tree.

Retention Value

- High: the tree is well suited to the site and in harmony with the proposed space and structures. The trees in this category are vigorously healthy trees in sound structural condition. In some circumstances a tree may need to be retained for cultural, commemorative and/or historical value.

- Medium: the tree is suited to the site. These trees are predominantly in fair health and/or fair structural condition. This category may contain trees that are juvenile specimens that can potentially be replaced with standard nursery stock or can be transplanted.

- Low: the tree is not very much suited to be retained within the site. These trees are in poor health and/or structural condition. This category may contain trees that are dying/diseased or that are developing within an unsuitable location.

- N/A: trees which should be removed. Dead or structurally dangerous trees, unstable trees, trees with cavities of significant safety concerns.

Ecological Value

- High: locally indigenous species and representative of the original vegetation of the area. They can provide habitat for native wildlife. They might have evidence of nesting (hollows), foraging and they are known food source.

- Medium: planted or self-sown exotic or non-local native trees. They are beneficial for native wildlife.

- Low: weed or environmental pest species or exotic non-local native trees. They do not provide habitat for native wildlife.

- N/A: trees which should be removed.

Tree Survey Details over leaf.

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
1	*Melaleuca quinquenervia*	9.4	5.5	940	940	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation within main trunk and upper limbs. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	11.28	3.22
2	*Melaleuca quinquenervia*	14.4	6	1200	1280	Mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation within main trunk and upper limbs. Suckering growth developing. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	14.4	3.67
3	*Melaleuca quinquenervia*	12.8	6	1150	1150	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple stems. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation within main trunk and upper limbs. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	13.8	3.51
4	*Melaleuca quinquenervia*	12.1	6	1050	1050	Mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by codominant stems. Main union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation within main trunk and upper limbs. Basal bark wound. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	12.6	3.38

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
5	*Melaleuca quinquenervia*	9.3	5	860	920	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branches appear soundly attached at this time with no evidence of cracking, splitting or separation. Moderate borer infestation within main trunk and upper limbs. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	10.32	3.20
6	*Melaleuca quinquenervia*	11.1	5.5	830	900	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by codominant stems. Main union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation within main trunk and upper limbs. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	9.96	3.17
7	*Melaleuca quinquenervia*	12.6	6	850	850	Mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limbs forks appear sound at this time with no evidence of cracking, splitting or separation. Mild borer infestation on main trunk. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	10.2	3.09
8	*Melaleuca quinquenervia*	10.5	6.5	460	530	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Mild borer infestation on main trunk.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	5.52	2.53

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
9	*Eucalyptus todtiana*	9.4	5	410	520	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branches appear well formed and soundly attached at this time with no evidence of cracking, splitting or separation. Previous limb failure and pruning wounds visible on main trunk.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	4.92	2.51
10	*Eucalyptus todtiana*	7.7	11	620	620	Mature	Leaning tree found in fair health and structural condition displaying a satisfactory coverage of foliage supported by main and secondary stems. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. The root plate appears firm with no evidence of root heave or soil displacement.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	7.44	2.71
11	*Eucalyptus todtiana*	10.3	13	570	890	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by twin stems. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Pruning wounds visible on the northern side.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	6.84	3.15
12	*Corymbia ficifolia*	3.8	2.5	160	210	Semi-mature	Good health and fair structural condition displaying a full coverage of foliage supported by codominant stems. Main union appears sound at this time with no evidence of cracking, splitting or separation. Minor deadwood	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	2	1.72
13	*Hakea laurina*	4.3	2	120	230	Semi-mature	Leaning tree found in good health and fair structural condition displaying a full coverage of foliage. The root plate appears firm at this time with no evidence of root heave or soil displacement.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.79

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
14	*Eucalyptus camaldulensis*	17.2	15	860	1030	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by codominant stems. Main union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Previous pruning visible over adjacent roadway and footpath. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	High	High	No works recommended at this time.	10.32	3.35
15	*Eucalyptus torquata*	5.5	2.2	120	160	Semi-mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.53
16	*Eucalyptus camaldulensis*	22.2	18	910	1110	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Major deadwood held in the canopy.	Yes, at this time, depending upon the proposed plans.	High	High	Selectively clean up canopy of deadwood.	10.92	3.46
17	*Hakea laurina*	2.6	3	220	230	Semi-mature	Good health and poor structural condition displaying a full coverage of foliage supported by codominant stems. Main codominant union has split.	No, due to poor structural condition.	N/A	N/A	Remove tree.	2.64	1.79
18	*Eucalyptus torquata*	5.4	4	180	210	Semi-mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2.16	1.72

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
19	*Eucalyptus torquata*	4.6	4.5	220	220	Semi-mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2.64	1.75
20	*Callistemon 'Kings Park Special'*	4.1	2	210	230	Semi-mature	Poor health and fair structural condition displaying a reduced coverage of foliage supported by multiple crown leaders. The canopy is consisting predominantly of epicormic growth. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	High	No works recommended at this time.	2.52	1.79
21	*Melaleuca quinquenervia*	9.6	6.5	530	680	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Main branches appear well formed and soundly attached at this time with no evidence of cracking, splitting or separation. Mild borer infestation within main trunk and upper limbs.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	6.36	2.81
22	*Melaleuca quinquenervia*	11.4	6	600	680	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Mild borer infestation within main trunk and upper limbs.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	7.2	2.81

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
23	*Callistemon 'Kings Park Special'*	6.7	5.5	340	410	Semi-mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Suckering growth developing.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	4.08	2.28
24	*Callistemon 'Kings Park Special'*	8.4	7.5	370	470	Semi-mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Previous pruning visible in the lower canopy. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	4.44	2.41
25	*Brachychiton acerifolius*	9.3	5	400	480	Semi-mature	Very good health and structural condition displaying a full coverage of healthy foliage supported by a tall and upright form. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	4.8	2.43
26	*Corymbia ficifolia*	9.9	6	360	430	Semi-mature	Leaning tree found in good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. The root plate appears firm with no evidence of root heave or soil displacement. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	4.32	2.32
27	*Melia azedarach*	11.5	8	630	860	Mature	Fair health and structural condition displaying a canopy predominantly bare of foliage supported by codominant stems. Main union appears sound at this time with no evidence of cracking, splitting or	Yes, at this time, depending upon the proposed plans.	Medium	Low	No works recommended at this time.	7.56	3.11

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
							separation. Pruning wounds visible on the main trunk.						
28	*Lophostemon confertus*	12.8	11	750	820	Mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	9	3.04
29	*Lophostemon confertus*	11.5	7	650	660	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	7.8	2.78
30	*Corymbia citriodora*	22.7	10	470	500	Mature	Good health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	5.64	2.47
31	*Cupressus macrocarpa 'Gold'*	11.3	7	48	600	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by twin stems. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	Carry out a canopy lift over adjacent footpath.	2	2.67

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
32	*Corymbia ficifolia*	10.8	9	500	670	Mature	Leaning tree found in fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth developing due to previous pruning. The root plate appears firm at this time with no evidence of root heave or soil displacement. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	6	2.80
33	*Hibiscus species x 4*	4.5	4	300	300	Semi-mature	Group of the same species shrubs found in good health and fair structural condition displaying full canopies of healthy foliage supported by multiple stems.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	3.6	2.00
34	*Hibiscus species x 3*	4	3	250	250	Semi-mature	Group of the same species shrubs found in good health and fair structural condition displaying full canopies of healthy foliage supported by multiple stems.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	3	1.85
35	*Lophostemon confertus*	14.8	8	670	670	Mature	Poor health and fair structural condition displaying a reduced coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Canopy die back. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	Medium	Apply Trace Elements to improve health.	8.04	2.80
36	*Lophostemon confertus*	14.7	10	580	710	Mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	Carry out a canopy lift over adjacent footpath.	6.96	2.87

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
37	*Lophostemon confertus*	18.5	14	940	1090	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	Carry out a canopy lift over adjacent footpath.	11.28	3.43
38	*Lophostemon confertus*	17.1	11	690	830	Mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branches appear well formed and soundly attached at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	8.28	3.06
39	*Corymbia ficifolia*	13.1	5	740	800	Mature	Leaning tree found in fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth developing due to previous pruning. The root plate appears firm at this time with no evidence of root heave or soil displacement.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	8.88	3.01
40	*Melaleuca quinquenervia*	7.2	4	950	950	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth developing due to previous pruning.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	11.4	3.24

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
41	*Melaleuca quinquenervia*	6.8	4.5	800	800	Mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth developing due to previous pruning.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	9.6	3.01
42	*Corymbia ficifolia*	5.2	4.5	630	640	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth developing due to previous pruning.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	7.56	2.74
43	*Melaleuca quinquenervia*	6.1	4	790	790	Mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branches appear well formed and soundly attached at this time with no evidence of cracking, splitting or separation. Epicormic growth developing due to previous pruning. Moderate borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	9.48	3.00
44	*Callistemon 'Kings Park Special'*	7.6	4	340	410	Semi-mature	Fair health and poor structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth has developed due to the tree previously lopped. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	High	No works recommended at this time.	4.08	2.28

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
45	*Callistemon 'Kings Park Special'*	7.5	4	360	420	Semi-mature	Fair health and poor structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth has developed due to the tree previously lopped. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	High	No works recommended at this time.	4.32	2.30
46	*Callistemon 'Kings Park Special'*	7.4	4	290	360	Semi-mature	Fair health and poor structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branches appear soundly attached at this time with no evidence of cracking, splitting or separation. Epicormic growth has developed due to the tree previously lopped. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	High	No works recommended at this time.	3.48	2.15
47	*Callistemon 'Kings Park Special'*	7.6	4	380	480	Semi-mature	Fair health and poor structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth has developed due to the tree previously lopped. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	High	No works recommended at this time.	4.56	2.43
48	*Callistemon 'Kings Park Special'*	7.5	4	390	500	Semi-mature	Fair health and poor structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth has developed due to the tree previously lopped. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	High	No works recommended at this time.	4.68	2.47

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
49	*Agonis flexuosa*	4.8	3	390	470	Semi-mature	Poor health and structural condition displaying a reduced coverage of foliage supported by multiple crown leaders. Severe decline. Major deadwood.	No, due to poor health and structural condition.	N/A	N/A	Remove tree.	4.68	2.41
50	*Callistemon 'Kings Park Special'*	6.9	4.5	550	550	Semi-mature	Fair health and poor structural condition displaying a suitable coverage of foliage supported by multiple stems. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth has developed due to the tree be previously lopped. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	High	No works recommended at this time.	6.6	2.57
51	*Callistemon 'Kings Park Special'*	7.1	5	400	510	Semi-mature	Fair health and poor structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth has developed due to the tree previously lopped. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	High	No works recommended at this time.	4.8	2.49
52	*Callistemon 'Kings Park Special'*	2.6	3.5	370	400	Semi-mature	The tree is dead.	No, due to being dead.	N/A	N/A	Remove tree.	4.44	2.25
53	*Callistemon 'Kings Park Special'*	7.2	4.5	380	460	Semi-mature	The tree is dead.	No, due to being dead.	N/A	N/A	Remove tree.	4.56	2.39
54	*Callistemon 'Kings Park Special'*	6.9	4	470	550	Semi-mature	Poor health and structural condition displaying a reduced coverage of foliage supported by multiple crown leaders. Severe canopy decline. Minor deadwood.	No, due to poor health and structural condition.	N/A	N/A	Remove tree.	5.64	2.57
55	*Callistemon 'Kings Park Special'*	7.1	5.5	450	500	Semi-mature	Poor health and structural condition displaying a reduced coverage of foliage supported by multiple crown leaders. Severe canopy decline. Minor deadwood.	No, due to poor health and structural condition.	N/A	N/A	Remove tree.	5.4	2.47

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
56	*Callistemon 'Kings Park Special'*	5.2	3	390	440	Semi-mature	Poor health and structural condition displaying a reduced coverage of foliage supported by multiple crown leaders. Severe canopy decline. Minor deadwood.	No, due to poor health and structural condition.	N/A	N/A	Remove tree.	4.68	2.34
57	*Callistemon 'Kings Park Special'*	7.8	6	390	510	Semi-mature	Poor health and structural condition displaying a reduced coverage of foliage supported by multiple crown leaders. Severe canopy decline. Minor deadwood.	No, due to poor health and structural condition.	N/A	N/A	Remove tree.	4.68	2.49
58	*Lophostemon confertus*	4.9	4	200	230	Semi-mature	Good health and structural condition displaying a full coverage of healthy foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	2.4	1.79
59	*Agonis flexuosa*	7.8	7	790	880	Mature	Good health and fair structural condition displaying a full coverage of healthy foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	9.48	3.14
60	*Ficus macrophylla*	8.4	12	1110	1110	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple stems. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	13.32	3.46
61	*Platanus acerifolia*	6.2	3.5	160	190	Young	Predominantly bare of foliage due to seasonal changes. Appears in good health with a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.65

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
62	*Platanus acerifolia*	7.4	5	180	210	Young	Predominantly bare of foliage due to seasonal changes. Appears in good health with a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2.16	1.72
63	*Agonis flexuosa*	8.9	12.5	1270	1410	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Previous pruning visible. Moderate borer infestation on main trunk. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	15	3.82
64	*Agonis flexuosa*	4.3	4	180	230	Semi-mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2.16	1.79
65	*Agonis flexuosa*	3.5	3	130	200	Young	Good health and condition displaying a full canopy of healthy foliage and a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.68
66	*Agonis flexuosa*	6.3	4.5	230	300	Semi-mature	Good health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	2.76	2.00
67	*Robinia pseudoacacia*	8.1	10.5	730	730	Mature	Fair health and structural condition displaying a canopy predominantly bare of foliage supported by codominant stems. Main union appears sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Low	No works recommended at this time.	8.76	2.90

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
68	*Tipuana tipu*	12.2	17	690	910	Mature	Leaning tree found in fair health and structural condition displaying a canopy predominantly bare of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. The root plate appears firm with no evidence of root heave or soil displacement. Exposed roots. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Low	No works recommended at this time.	8.28	3.18
69	*Brachychiton acerifolius*	9.6	6.5	390	470	Mature	Very good health and structural condition displaying a full coverage of healthy foliage supported by a tall and upright form. Main branches appear soundly attached at this time with no evidence of cracking, splitting or separation. Exposed roots.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	4.68	2.41
70	*Tipuana tipu*	4.7	4.5	180	240	Young	Good health and condition displaying a full canopy of healthy foliage and developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Low	No works recommended at this time.	2.16	1.82
71	*Platanus acerifolia*	15.7	14	510	580	Mature	Good health and structural condition displaying a canopy predominantly bare of foliage supported by a tall and upright form. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	6.12	2.63
72	*Corymbia citriodora*	15.6	10.5	330	440	Semi-mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Previous limb failure.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	3.96	2.34

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
73	*Platanus acerifolia*	14.7	11	370	540	Mature	Good health and structural condition displaying a canopy predominantly bare of foliage supported by a tall and upright form. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	4.44	2.55
74	*Platanus acerifolia*	13.5	10	390	480	Mature	Good health and structural condition displaying a canopy bare of foliage supported by codominant stems. Main union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	4.68	2.43
75	*Pyrus calleryana*	2.2	1	50	70	Young	Bare of foliage due to seasonal changes. Appears to be in good health and poor structural condition. Apical leader has been removed.	Yes, at this time, depending upon the proposed plans.	Low	Medium	No works recommended at this time.	2	1.50
76	*Pyrus calleryana*	3.2	2	100	130	Young	Bare of foliage due to seasonal changes. Appears to be in good health and structural condition with a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.50
77	*Pyrus calleryana*	3.6	2	70	110	Young	Bare of foliage due to seasonal changes. Appears to be in good health and structural condition with a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.50
78	*Pyrus calleryana*	3.7	2	70	100	Young	Bare of foliage due to seasonal changes. Appears to be in good health and structural condition with a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.50
79	*Pyrus calleryana*	4	2	90	130	Young	Bare of foliage due to seasonal changes. Appears to be in good health and structural condition with a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.50

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
80	*Pyrus calleryana*	3.8	2	120	170	Young	Bare of foliage due to seasonal changes. Appears to be in good health and structural condition with a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.57
81	*Pyrus calleryana*	3.4	1.5	80	105	Young	Bare of foliage due to seasonal changes. Appears to be in good health and structural condition with a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.50
82	*Pyrus calleryana*	4.1	2	80	120	Young	Bare of foliage due to seasonal changes. Appears to be in good health and structural condition with a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.50
83	*Cupressus sempervirens*	12.1	3	360	360	Mature	Good health and structural condition displaying a full canopy of foliage supported by a tall and upright form. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	4.32	2.15
84	*Cupressus sempervirens*	10.7	2.5	450	450	Mature	The tree is dead.	No, due to being dead.	N/A	N/A	Remove tree.	5.4	2.37
85	*Cupressus sempervirens*	11.5	4	560	560	Mature	The tree is dead.	No, due to being dead.	N/A	N/A	Remove tree.	6.72	2.59
86	*Cupressus sempervirens*	17.1	8	790	790	Mature	The tree is dead.	No, due to being dead.	N/A	N/A	Remove tree.	9.48	3.00
87	*Cupressus sempervirens*	8.9	3	580	580	Mature	The tree is dead.	No, due to being dead.	N/A	N/A	Remove tree.	6.96	2.63
88	*Cupressus sempervirens*	13.8	3	700	700	Mature	Good health and structural condition displaying a full canopy of foliage supported by a tall and upright form. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	8.4	2.85
89	*Cupressus sempervirens*	9.3	3	610	610	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by a tall and upright form. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	7.32	2.69

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
90	*Pyrus calleryana*	3.6	3.5	100	140	Young	Bare of foliage due to seasonal changes. Appears to be in good health and structural condition with a sound developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.50
91	*Melaleuca quinquenervia*	8.3	9	450	550	Semi-mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Moderate canopy suppression due to close proximity of neighbouring trees. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	5.4	2.57
92	*Melaleuca quinquenervia*	17.5	10	1850	1850	Mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by main and secondary stems. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	15	4.29
93	*Melaleuca quinquenervia*	13.7	11	770	1040	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by main and secondary stems. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Fire damage visible on main stems. Moderate borer infestation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	9.24	3.36

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
94	*Corymbia citriodora*	17.5	13	790	790	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Multiple limb failures visible in the canopy. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	9.48	3.00
95	*Corymbia citriodora*	19.6	9	510	640	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	6.12	2.74
96	*Corymbia citriodora*	12.2	6	320	450	Semi-mature	Fair health and structural condition displaying a suitable coverage of foliage supported by twin stems. Main branches appear soundly attached at this time with no evidence of cracking, splitting or separation. Moderate canopy suppression due to close proximity of neighbouring trees.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	3.84	2.37
97	*Corymbia citriodora*	21.6	10	630	780	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	7.56	2.98

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
98	*Corymbia citriodora*	19.2	9	430	520	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Mild phototropism due to close proximity of neighbouring trees. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	5.16	2.51
99	*Corymbia citriodora*	19.4	10	570	690	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Multiple limb failures visible in the canopy. Major deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	Selectively clean up canopy of deadwood.	6.84	2.83
100	*Eucalyptus torquata*	6.1	5	270	300	Semi-mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	3.24	2.00
101	*Eucalyptus torquata*	6.9	5	310	340	Semi-mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branches appear soundly attached at this time with no evidence of cracking, splitting or separation. Previous limb failure on the eastern side of the canopy. Epicormic growth developing on main trunk. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	3.72	2.10

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
102	*Melia azedarach*	11.5	9	690	750	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Bark wound visible on main trunk displays partial occlusion. Epicormic growth developing throughout the crown.	Yes, at this time, depending upon the proposed plans.	Medium	Low	No works recommended at this time.	8.28	2.93
103	*Agonis flexuosa*	6.3	6	1080	1140	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Previous pruning visible. Epicormic and suckering growth developing. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	12.96	3.50
104	*Agonis flexuosa*	10.1	10	1360	1390	Post-mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Previous pruning visible. Epicormic growth developing in the lower canopy. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	15	3.80
105	*Agonis flexuosa*	8	9	1170	1170	Post-mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branches appear soundly attached at this time with no evidence of cracking, splitting or separation. Previous pruning visible. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	14.04	3.53

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
106	*Agonis flexuosa*	11.3	10	1630	1630	Post-mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Previous major limb removal on the eastern side of the trunk. Major deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	Selectively clean up canopy of deadwood.	15	4.06
107	*Agonis flexuosa*	7.1	6	930	1010	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Suckering growth developing. Major deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	Selectively clean up canopy of deadwood.	11.16	3.32
108	*Agonis flexuosa*	9.2	8.5	2150	2150	Post-mature	Poor health and structural condition displaying a reduced coverage of foliage supported by multiple crown leaders. Severe canopy decline and internal decay visible within main trunk and upper limbs. Major deadwood.	No, due to poor health and structural condition.	N/A	N/A	Remove tree.	15	4.56
109	*Agonis flexuosa*	6.4	7	990	108	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	11.88	1.50
110	*Agonis flexuosa*	6.8	9	980	1190	Mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Previous pruning visible. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	11.76	3.56

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
111	*Agonis flexuosa*	5.6	4	820	870	Mature	The tree is dead.	No, due to being dead.	N/A	N/A	Remove tree.	9.84	3.12
112	*Agonis flexuosa*	9.7	8.5	670	720	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	8.04	2.88
113	*Agonis flexuosa*	8.5	8	1290	1420	Post-mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Major deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	Selectively clean up canopy of deadwood.	15	3.83
114	*Agonis flexuosa*	8.8	8.5	1380	1570	Post-mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Small internal cavity. Suckering growth developing. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	15	4.00
115	*Agonis flexuosa*	6.4	5	840	1050	Mature	The tree is dead.	No, due to being dead.	N/A	N/A	Remove tree.	10.08	3.38
116	*Agonis flexuosa*	4.1	6.5	800	950	Mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branches appear soundly attached at this time with no evidence of cracking, splitting or separation. Vigorous suckering growth. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	Remove suckers.	9.6	3.24

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
117	*Agonis flexuosa*	10.9	8	1340	1480	Post-mature	Poor health and structural condition displaying a reduced coverage of foliage supported by multiple crown leaders. Severe canopy decline. Major deadwood.	No, due to poor health and structural condition.	N/A	N/A	Remove tree.	15	3.90
118	*Agonis flexuosa*	6.5	4.5	500	620	Semi-mature	Poor health and fair structural condition displaying a reduced coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Suckering growth developing. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	Medium	Apply Trace Elements to improve health.	6	2.71
119	*Agonis flexuosa*	4.6	4	680	680	Semi-mature	Poor health and fair structural condition displaying a reduced coverage of foliage supported by multiple stems. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Low	Medium	Apply Trace Elements to improve health.	8.16	2.81
120	*Agonis flexuosa*	5.6	5	340	510	Semi-mature	The tree is dead.	No, due to being dead.	N/A	N/A	Remove tree.	4.08	2.49
121	*Platanus acerifolia x 6*	2.5	1	30	60	Young	Group of the same species trees found in good health and structural condition displaying canopies predominantly bare of foliage and developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.50
122	*Eucalyptus sideroxylon*	18.9	11	650	930	Mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Multiple limb failures visible in the crown. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	7.8	3.21

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
123	*Brachychiton populneus*	6.9	5.5	340	450	Semi-mature	Good health and structural condition displaying a full coverage of healthy foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	4.08	2.37
124	*Corymbia maculata*	22.8	13	630	820	Mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branches appear well formed and soundly attached at this time with no evidence of cracking, splitting or separation. Epicormic growth developing in the lower crown. Previous limb failure. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	7.56	3.04
125	*Brachychiton populneus*	7.2	8	370	480	Semi-mature	Good health and structural condition displaying a full coverage of healthy foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	4.44	2.43
126	*Brachychiton populneus*	7.1	8	390	510	Semi-mature	Good health and structural condition displaying a full coverage of healthy foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Epicormic growth developing due to previous major limb removal on main trunk.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	4.68	2.49
127	*Eucalyptus erythrocorys*	7.1	7	350	350	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple stems. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	4.2	2.13

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
128	*Agonis flexuosa*	5.2	4	210	320	Semi-mature	The tree is dead.	No, due to being dead.	N/A	N/A	Remove tree.	2.52	2.05
129	*Corymbia citriodora*	16.5	12	590	670	Mature	Leaning tree found in good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. The root plate appears firm at this time with no evidence of root heave or soil displacement. Multiple limb failures visible in the crown. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	7.08	2.80
130	*Lophostemon confertus*	6.6	5	420	620	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Previous pruning visible in the lower crown.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	5.04	2.71
131	*Brachychiton populneus*	9.9	12	640	760	Mature	Good health and structural condition displaying a full coverage of healthy foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Pruning wounds on main trunk display complete occlusion.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	7.68	2.95
132	*Lophostemon confertus*	7.5	7	380	440	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branches appear well formed and soundly attached at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	4.56	2.34

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
133	*Liquidambar styraciflua*	8.9	5	310	380	Semi-mature	Good health and fair structural condition displaying a canopy predominantly bare of foliage supported by codominant stems. Main union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	High	Medium	No works recommended at this time.	3.72	2.20
134	*Lophostemon confertus*	7.6	7	370	430	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	4.44	2.32
135	*Callistemon viminallis*	6.6	5	240	330	Semi-mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by codominant stems. Main union appears sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	2.88	2.08
136	*Callistemon viminallis*	6.7	4.5	230	320	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Suckering growth developing.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	2.76	2.05
137	*Jacaranda mimosifolia*	8.1	8.5	440	510	Mature	Fair health and structural condition displaying a canopy predominantly bare of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	5.28	2.49

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
138	*Melia azedarach*	6.8	5	380	380	Semi-mature	Good health and poor structural condition displaying a satisfactory coverage of foliage supported by multiple stems. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Low	Low	No works recommended at this time.	4.56	2.20
139	*Callistemon viminallis*	7.3	5	210	290	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by codominant stems. Main union appears sound at this time with no evidence of cracking, splitting or separation. Mild phototrophic lean due to close proximity of neighbouring tree. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	2.52	1.97
140	*Callistemon viminallis*	7.5	4	200	300	Semi-mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by codominant stems. Main union appears sound at this time with no evidence of cracking, splitting or separation. Mild phototrophic lean due to close proximity of neighbouring trees. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	2.4	2.00
141	*Callistemon viminallis*	7.6	4	210	280	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Mild phototrophic lean due to close proximity of neighbouring trees. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	High	No works recommended at this time.	2.52	1.94

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
142	*Jacaranda mimosifolia*	10.6	9	600	600	Mature	Fair health and structural condition displaying a canopy predominantly bare of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Previous major limb removal visible on main trunk. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	7.2	2.67
143	*Melia azedarach*	6.6	5	340	340	Semi-mature	Good health and poor structural condition displaying a satisfactory coverage of foliage supported by multiple stems. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Low	Low	No works recommended at this time.	4.08	2.10
144	*Melia azedarach*	9.3	9	450	450	Semi-mature	Good health and poor structural condition displaying a satisfactory coverage of foliage supported by multiple stems. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Low	Low	No works recommended at this time.	5.4	2.37
145	*Lophostemon confertus*	4.8	4	280	320	Semi-mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branches appear well formed and soundly attached at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	3.36	2.05
146	*Lophostemon confertus*	2.3	1	30	60	Young	Good health and structural condition displaying a full canopy of healthy foliage and developing branch structure.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.50

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
147	*Lophostemon confertus*	5.7	4	300	370	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	3.6	2.18
148	*Lophostemon confertus*	4.8	5	250	350	Semi-mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	3	2.13
149	*Lophostemon confertus*	6.4	6	390	480	Semi-mature	Good health and fair structural condition displaying a full coverage of foliage supported by codominant stems. Main union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	4.68	2.43
150	*Agonis flexuosa*	9.1	12	1560	1560	Mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	15	3.99
151	*Agonis flexuosa*	8.2	11	1130	1130	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	13.56	3.48

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
152	*Melaleuca quinquenervia*	16.3	8	980	980	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	11.76	3.28
153	*Melaleuca quinquenervia*	15.7	7.5	1750	1750	Mature	Good health and fair structural condition displaying a full coverage of healthy foliage supported by twin stems. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	15	4.19
154	*Melaleuca quinquenervia*	14.1	4	450	580	Semi-mature	Fair health and structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	5.4	2.63
155	*Melaleuca quinquenervia*	12.1	7	800	830	Mature	Good health and fair structural condition displaying a full coverage of healthy foliage supported by codominant stems. Main included union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	9.6	3.06
156	*Melaleuca quinquenervia*	11.7	5	1460	1460	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple stems. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Mild borer infestation. Suckering growth developing.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	15	3.88

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
157	*Melaleuca quinquenervia*	13.1	6	550	620	Mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branches appear soundly attached at this time with no evidence of cracking, splitting or separation. Moderate borer infestation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	6.6	2.71
159	*Melaleuca quinquenervia*	12.9	6	510	600	Mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Mild borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	6.12	2.67
160	*Melaleuca quinquenervia*	11.1	4	430	540	Semi-mature	Good health and fair structural condition displaying a full coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	5.16	2.55
161	*Melaleuca quinquenervia*	5.7	2.5	210	280	Semi-mature	Good health and fair structural condition displaying a full coverage of foliage supported by codominant stems. Main union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2.52	1.94

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
162	*Melaleuca quinquenervia*	8.6	6.5	540	630	Mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by codominant stems. Main union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation within main trunk and upper limbs. Previous pruning visible.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	6.48	2.73
163	*Melaleuca quinquenervia*	8.1	4	330	450	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Bark wound visible on main trunk.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	3.96	2.37
164	*Melaleuca quinquenervia*	9.6	7	530	580	Mature	Fair health and structural condition displaying a suitable coverage of foliage supported by codominant stems. Main union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Mild borer infestation within main trunk and upper limbs. Bark wounds visible on main trunk.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	6.36	2.63
165	*Melaleuca quinquenervia*	8.9	5	360	470	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by codominant stems. Main union and branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation within main trunk and upper limbs.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	4.32	2.41

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
166	*Melaleuca quinquenervia*	7.4	5	320	400	Semi-mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by a tall and upright form. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Moderate borer infestation within main trunk and upper limbs.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	3.84	2.25
167	*Melaleuca quinquenervia*	8.1	5	440	630	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Mild borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	5.28	2.73
168	*Melaleuca quinquenervia*	5.7	4.5	340	470	Semi-mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Mild borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	4.08	2.41
169	*Melaleuca quinquenervia*	7.2	5	370	400	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branches appear well formed and soundly attached at this time with no evidence of cracking, splitting or separation. Mild borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	4.44	2.25
170	*Melaleuca quinquenervia*	5.6	4	340	410	Semi-mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Mild borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	4.08	2.28

Tree No.	Botanical Name	Height (m)	Canopy spread (m)	DBH (mm)	DRF (mm)	Age Class	Health & Condition	Suitable to retain Yes or No (And why no)	Retention value (High, Medium, Low)	Ecological Value (High, Medium, Low)	Recommendations	TPZ (m) radius	SRZ (m) radius
171	*Melaleuca quinquenervia*	5.7	6	440	470	Semi-mature	Good health and fair structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Major limb forks appear sound at this time with no evidence of cracking, splitting or separation. Mild borer infestation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	5.28	2.41
172	*Melaleuca quinquenervia*	5.9	1.5	140	200	Semi-mature	Good health and fair structural condition displaying a suitable coverage of foliage supported by a tall and upright form. Main branches appear soundly attached at this time with no evidence of cracking, splitting or separation.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	2	1.68
173	*Agonis flexuosa*	8.6	9	820	920	Mature	Fair health and structural condition displaying a satisfactory coverage of foliage supported by multiple crown leaders. Main branch attachments appear sound at this time with no evidence of cracking, splitting or separation. Minor deadwood.	Yes, at this time, depending upon the proposed plans.	Medium	Medium	No works recommended at this time.	9.84	3.20

Summary

This consultant confirms that the 172 trees located within the site known as Bayswater Station and Turnback Project were found to be predominantly in good to fair health and predominantly sound structural condition at the time of inspection.

Out of the 172 trees audited 154 trees were found suitable to be retained at this time. This consultant has not seen the proposed plans for redevelopment of the site therefore further tree removal may be required dependent upon future building placement and the proposed scope of works.

The proposed plans for the site are likely to include the removal of existing services and the possible installation of new service pipes. When services are being removed within the Tree protection zone radius of trees, it is recommended that work be done by hand or mini excavator to minimise the impact to tree roots. It is recommended that a project arborist be onsite to oversee the excavation works within the TPZ radius to document what roots are found over 30mm and provide further advice on the day if required.

When installing new services within tree protection zones, it is recommended that under boring to a depth of 1.5m – 2m is the preferred method of installing pipes and services near mature trees. This minimises disturbance to trees root systems as under boring will avoid damage to trees major structural and nutrient feeder root systems.

The proposed planned upgrade of the site may possibly require changes of soil levels around the base of trees. Changing levels around trees, either up or down can have a detrimental effect on the trees root systems sometimes starving the roots of oxygen & water infiltration or causing instability to the tree. When plans are finalised, if level changes are proposed within tree protection zones it is recommended that the project arborist be informed to inspect the amount of level change around a tree in order to make an informed decision as to whether the tree can be retained.

The TPZ and SRZ radius details for each tree are provided in the report. It is recommended that any works proposed around these trees are to be made in accordance using the Australian Standard 4970-2009 Protection of trees on development sites. This Standard is to be used as a guide to assist with the care and protection of trees. This consultant advises that the AS 4970-2009 cannot always be achieved however further investigations of select trees may be required at ground level by way of hand digging to assess visible surface roots to accomplish new works and projects which may be proposed in close proximity to trees.

Trees species List

The following twenty-seven tree species were identified by this consultant within the site:

Botanical name	Common name
Agonis flexuosa	WA Weeping Peppermint
Brachychiton acerifolius	Illawarra Flame Tree
Brachychiton populneus	Kurrajong
Callistemon 'Kings Park Special'	Kings Park Bottlebrush
Callistemon viminallis	Weeping Bottlebrush
Corymbia citriodora	Lemon Scented Gum
Corymbia ficifolia	Red Flowering Gum
Corymbia maculata	Spotted Gum

Cupressus macrocarpa 'Gold'	Monterey Cypress
Cupressus sempervirens	Mediterranean Cypress
Eucalyptus camaldulensis	River Red Gum
Eucalyptus erythrocorys	Illyarrie
Eucalyptus sideroxylon	Red Iron Bark
Eucalyptus todtiana	Coastal Blackbutt
Eucalyptus torquata	Coral Gum
Ficus macrophylla	Moreton Bay Fig
Hakea laurina	Pink Cushion Hakea
Hibiscus species	Rose Mallow
Jacaranda mimosifolia	Jacaranda
Liquidambar styraciflua	American Sweet Gum
Lophostemon confertus	QLD Box Tree
Melaleuca quinquenervia	Paperbark
Melia azedarach	Cape Lilac Tree
Platanus acerifolia	London Plane Tree
Pyrus calleryana	Ornamental Pear
Robinia pseudoacacia	Black locust
Tipuana tipu	Pride of Bolivia

To Summarise, the survey revealed:

- The 172 trees inspected were found to be predominantly in good to fair health and predominantly sound structural condition at this time.
- 154 trees were found to be suitable for retention.
- 18 trees are not recommended for retention due to being found in poor health and/or poor structural condition or being dead.
- 9 trees are recommended for some remedial pruning works which consist predominantly of the removal of deadwood and the reduction of low limbs held over the adjacent roadway/footpath.
- The application of Trace Elements in an attempt to improve health, stimulate new growth and extend the useful life expectancy of 3 trees is recommended.
- 24 trees have been attributed with a High Retention Value due to their size, health, structural condition and/or their location within the site.
- 22 trees have been attributed with a High Ecological Value. These trees are endemic to the area and/or provide habitat for native wildlife. At maturity, *Corymbia* and *Eucalyptus camaldulensis* have the potential to be nesting sites for the local bird population. Also, *Callistemon* have been included in this range due to their flowers be considered food source for nectar eating birds.
- 8 trees have been attributed with a Low Ecological Value due to be considered weeds or environmental pest species.
- Further tree removal is likely and dependent upon when the proposed plans for the site are released and confirmed. The majority of trees are recommended for retention at this stage as intended usage patterns of the site have not, as yet, been determined. Many of these trees will be only suitable to be retained in their current condition or within other areas where disturbance during the development process is limited or where target values will remain relatively low.
- Pruning is to be carried out by a qualified Arborist in a manner consistent with AS 4373-2007 *Pruning of Amenity Trees.*

A works list in excel spreadsheet format accompanies this report.

Contractor Specification

To reduce the effects that a development can have upon the health of retained trees, suitable forms of protection are required together with the steps necessary to limit deterioration of those trees left standing on the development site.

This consultant confirms that there is clear evidence that mature trees are more sensitive to contractor pressure than young and semi-mature specimens, where the younger trees are able to compensate and adapt to new ground conditions by producing new roots. However, although younger trees can exhibit a remarkable tolerance to the adverse effects of building operations and site alterations, this is conditional upon the location and extent of works carried out within the root zone of the tree and therefore the extent of primary root removal.

Trees store vast amounts of carbohydrate in their root system, subsequently when major roots are severed the tree is unable to replenish its depleted energy levels, which gradually results in the decline of the canopy and often the death of the tree, with such symptoms often not evident until some years later.

Therefore, there must be clear recommendations to alleviate detrimental tree damage from the commencement through to the completion of the development, with the recommendations enforced and clearly understood by all contractor staff.

- All trees identified for retention shall be clearly marked and a **Tree Protection Zone (TPZ)** confirmed prior to the commencement of the development. The tree protection zone is the principal means of protecting trees on development sites. The TPZ is a combination of the root area and crown area requiring protection. It is an area isolated from construction disturbance, to ensure the tree remains viable. To determine the radius of the TPZ for each tree, the DBH is multiplied x 12. DBH is the trunk diameter 1.4m above ground level. The radius is measured from the centre of the stem at ground level. E.g. a tree's trunk diameter is 0.3m x 12 = 3.6m, meaning that a 3.6m radius around the tree is the recommended TPZ. As confirmed in the AS 4970-2009 a TPZ should not be less than 2m nor greater than 15m (unless crown protection is required).

- This consultant advises that a **structural root zone** area of a tree is required for tree stability. Using Australian Standards AS 4970-2009 *Protection of trees on development sites* the structural root zone area can be calculated when major encroachment into a TPZ is proposed. This zone considers a tree's structural stability only and not the root zone required for a tree's health and long-term viability, which is usually a much larger area.

- No building materials are to be stored or disposed of within the tree protection zone, with provisions implemented so that building chemicals do not come into contact with the root rhizosphere or the roots themselves.

- Excavated soil shall not be stored or built up around the trunk of retained trees. **Soil levels shall not be changed around the base of trees, either raised or lowered.**

- No filling, trenching or other earthworks shall be carried out closer than the determined structural root zone of the individual tree without written Arborist approval.

- If a bob cat is to be used it is to be driving in a forward and backwards motion within the trees TPZ and no turning or squirreling is to be carried out within the TPZ radius. This is to ensure that the soil is not dug into when turning which will rip and tear surface roots.

- It is a requirement that the mini excavator have a flat edge bucket and is used to reduce the weight and compaction of soil around the tree protection and root zones.

- If soil is to be lowered or grass layer removed a spotter will be required to watch all works and it is preferable to use a mini excavator (Not a bobcat) when carrying out this work. The mini excavator is to lightly scrape the top layer off not gouge deep sections of soil. All works are to be supervised by a spotter for root damage when working in the TPZ radius.

- Approved excavations within the structural root zone shall be undertaken under supervision with the exposed roots having a diameter less than 25mm diameter cleanly severed to initiate occlusion. **Roots above 30mm diameter are not to be cut without authorisation from a qualified Arborist.**

- Any remedial works which requires the removal of lower limbs to facilitate access by large machinery or to alleviate the level of risk to the contract staff shall be carried out by a competent Arborist to the relevant Australian Standards AS 4373-2007 *Pruning of amenity trees.*

- If trees are growing close together any felling and root removal shall be done with care to avoid damage to the retained trees.

- Under boring to a depth of 1.5m – 2m is the preferred method of installing pipes and services near mature trees. This minimises disturbance to trees root systems as the top 1.5m – 2m of soil is where the trees major structural and nutrient feeder root systems are located and this will ensure the future health and condition of the tree is maintained.

- Where the extent of construction works has resulted in a nominated tree becoming structurally unstable or within a location to render the tree a high level of risk to property and persons, the contractor shall inform the works supervisor for further instructions.

- Any damage to the protected tree during the preliminary stages of site clearance or during the construction works shall be reported immediately to the site supervisor with remedial works carried out by a qualified Arborist to the relevant Australian Standard.

- Supplementary watering to retained trees may be required over summer months where works are in proximity of the trees. Watering the trees is required to minimise stress on the trees while works are occurring. It is recommended to water deeply a minimum of once per week for a total of 1000 litres per tree for mature trees and 600 litres for trees less than 8m in height. It is recommended that the water truck have a wetting agent in the tank to assist to get the water through to sandy layer to the trees root system.

- Established trees of good vigour and structure represent an asset to any development site. Trees are living organisms that require certain environmental conditions in order to maintain their value as an asset. Damage must be avoided or minimized during the development process and procedures to ensure the protection of trees must be in place at all stages.

Zana Sheary & Luisa Galata - Arboricultural Consultants
Paperbark Technologies Pty Ltd
PO Box 1116
Scarborough WA 6922
Mob: 0401 817 551
zana@paperbarktechnologies.com.au
www.paperbarktechnologies.com.au
ISA Certified Arborist AU-0039A
Quantified Tree Risk Assessor Lic-1082/6146
Diploma of Horticulture/Arboriculture

Limitation of liability
Trees can be managed, but they cannot be controlled. To live or work near a tree involves a degree of risk.
This report only covers identifiable defects present at the time of inspection. Paperbark Technologies accepts no responsibility and cannot be held liable for any structural defect or unforeseen event/situation or adverse weather conditions that may occur after the time of inspection.
Paperbark Technologies cannot guarantee that the tree/s contained within this report will be structurally sound under all circumstances, and is not able to detect every condition that may possibly lead to the structural failure of a tree. Paperbark Technologies cannot guarantee that the recommendations made will categorically result in the tree being made safe.
Unless specifically mentioned this report will only be concerned with above ground inspections, as such all observations have been visually assessed from ground level. Trees are living organisms and as such cannot be classified as safe under any circumstances. Trees fail in ways that the arboriculture industry does not fully understand.
The recommendations are made on the basis of what can be reasonably identified at the time of inspection therefore Paperbark Technologies accepts no liability for any recommendations made.
All care has been taken to obtain information from reliable sources, however Paperbark Technologies can neither guarantee nor be responsible for the accuracy of information provided by others.
In the event that re-inspection of the tree/s is recommended it is the client's responsibility to make arrangements with Paperbark Technologies.

References

Mattheck, C & Breloer H, (1994) *The body language of trees, a handbook for failure analysis.* London TSO (The Stationery Office)

Lonsdale David, (1999) *Principles of Tree Hazard Assessment and Management.* London TSO (The Stationery Office).

Hayes, Ed (2007) *Evaluating Tree Defects, second edition.* Safetrees Rochester.

Australian Standard 4373-2007 *Pruning of amenity trees.*

Australian Standard 4970-2009 *Protection of trees on development sites.*

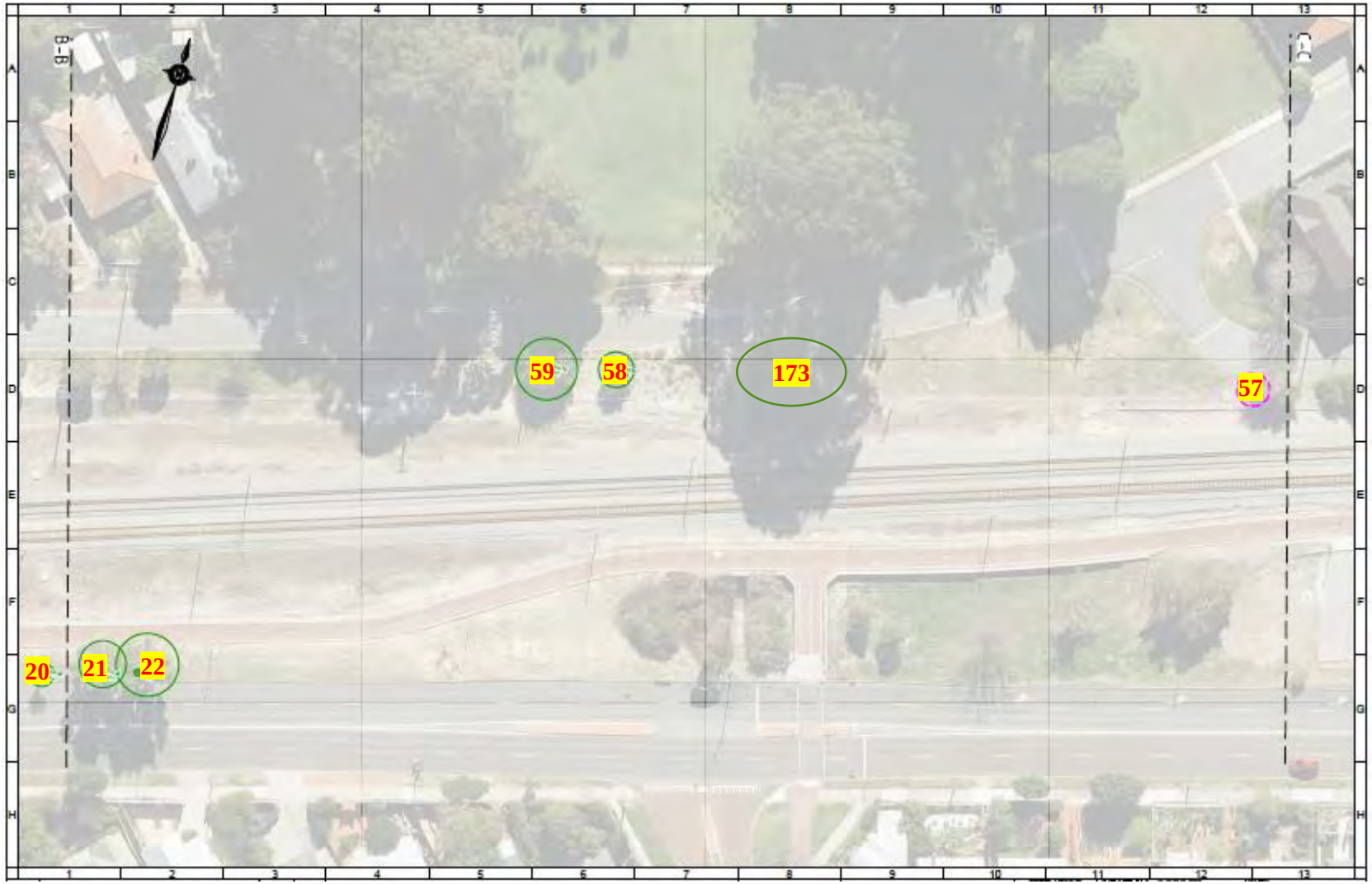
Urban, James (2008) *Up by Roots – Healthy Soils and Trees in the Built Environment* International Society of Arboriculture, Champaign, Illinois U

Overall Map

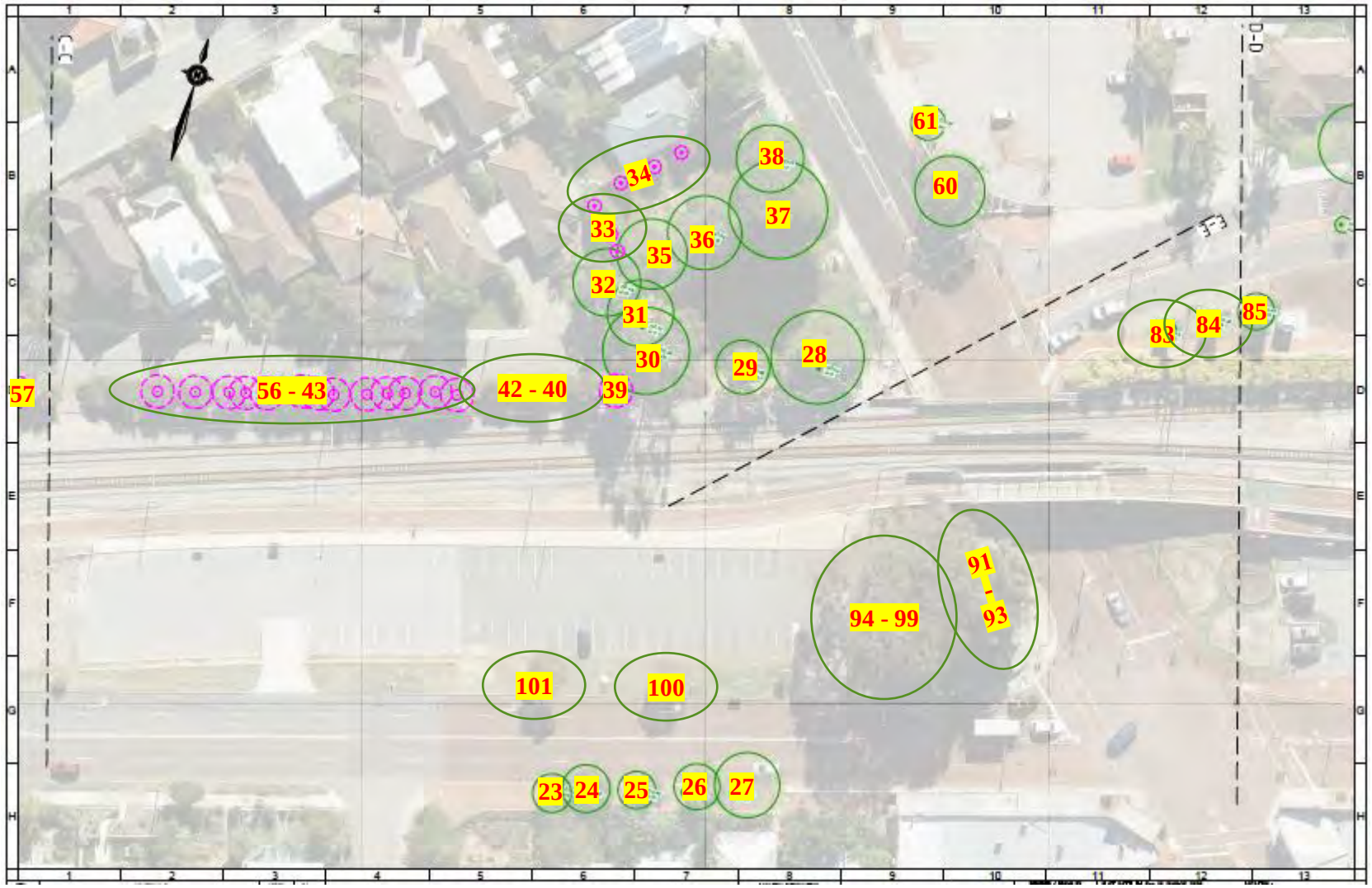
Map 1

Map 2

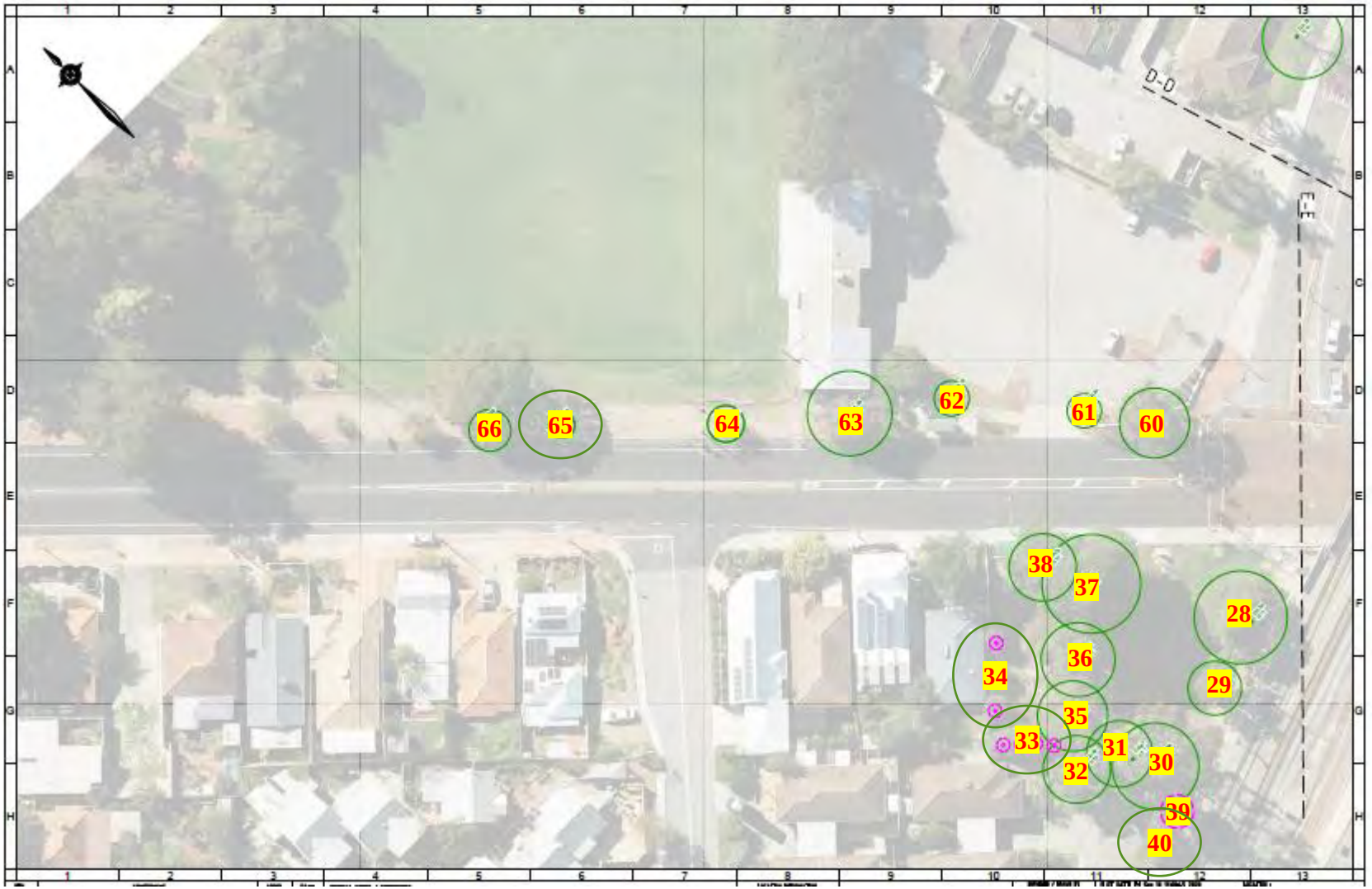
Map 3



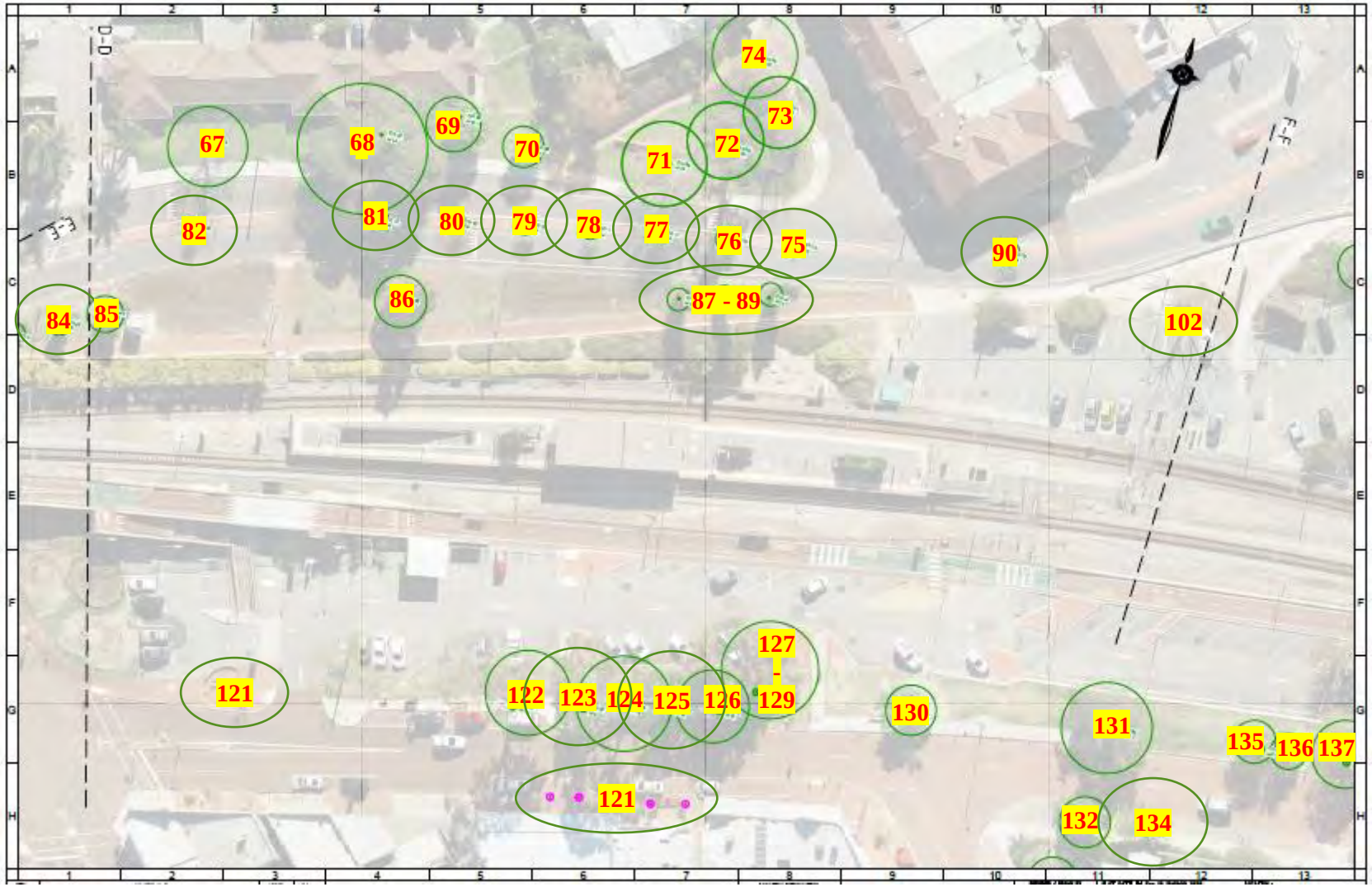
Map 4



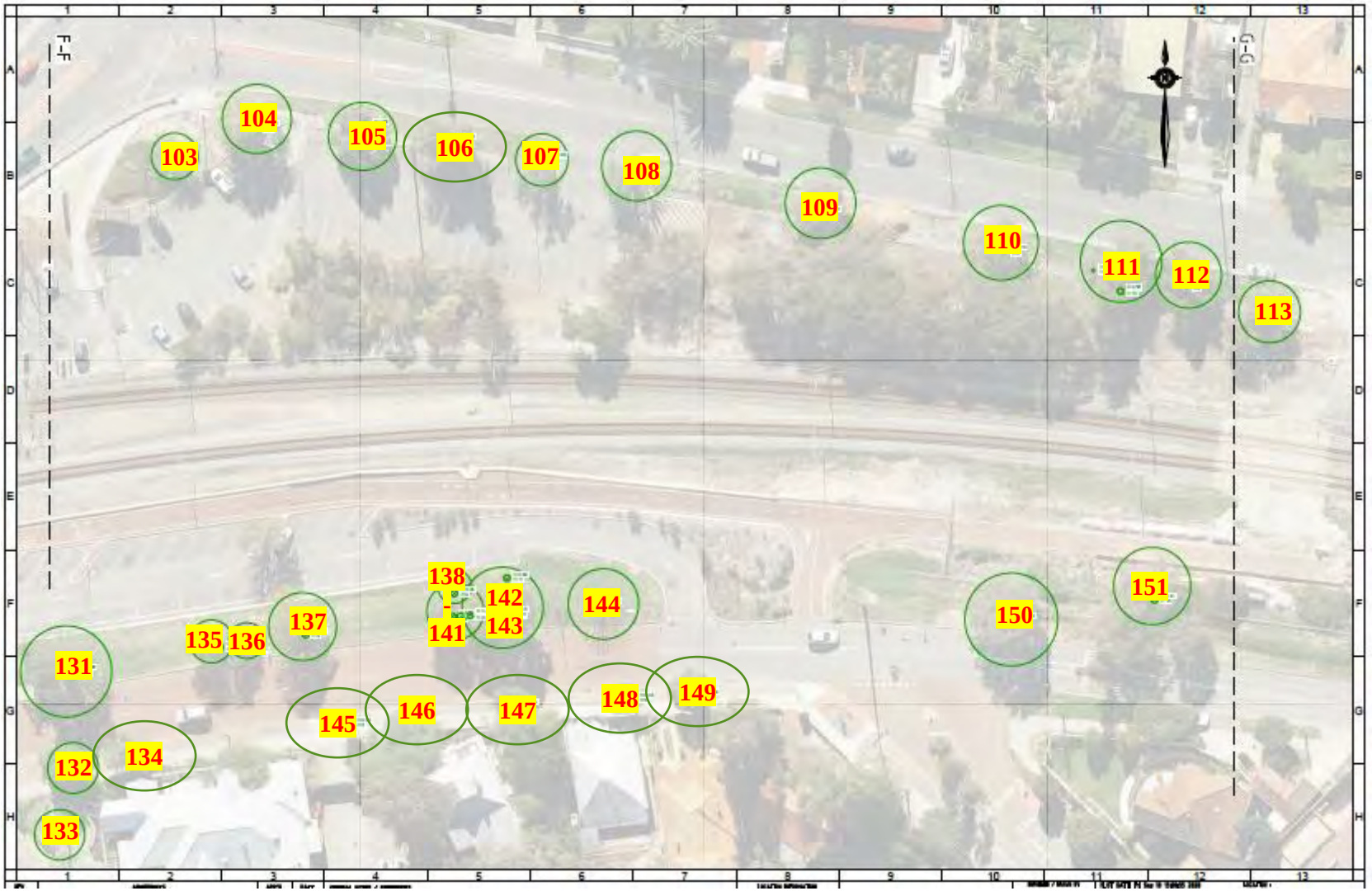
Map 5



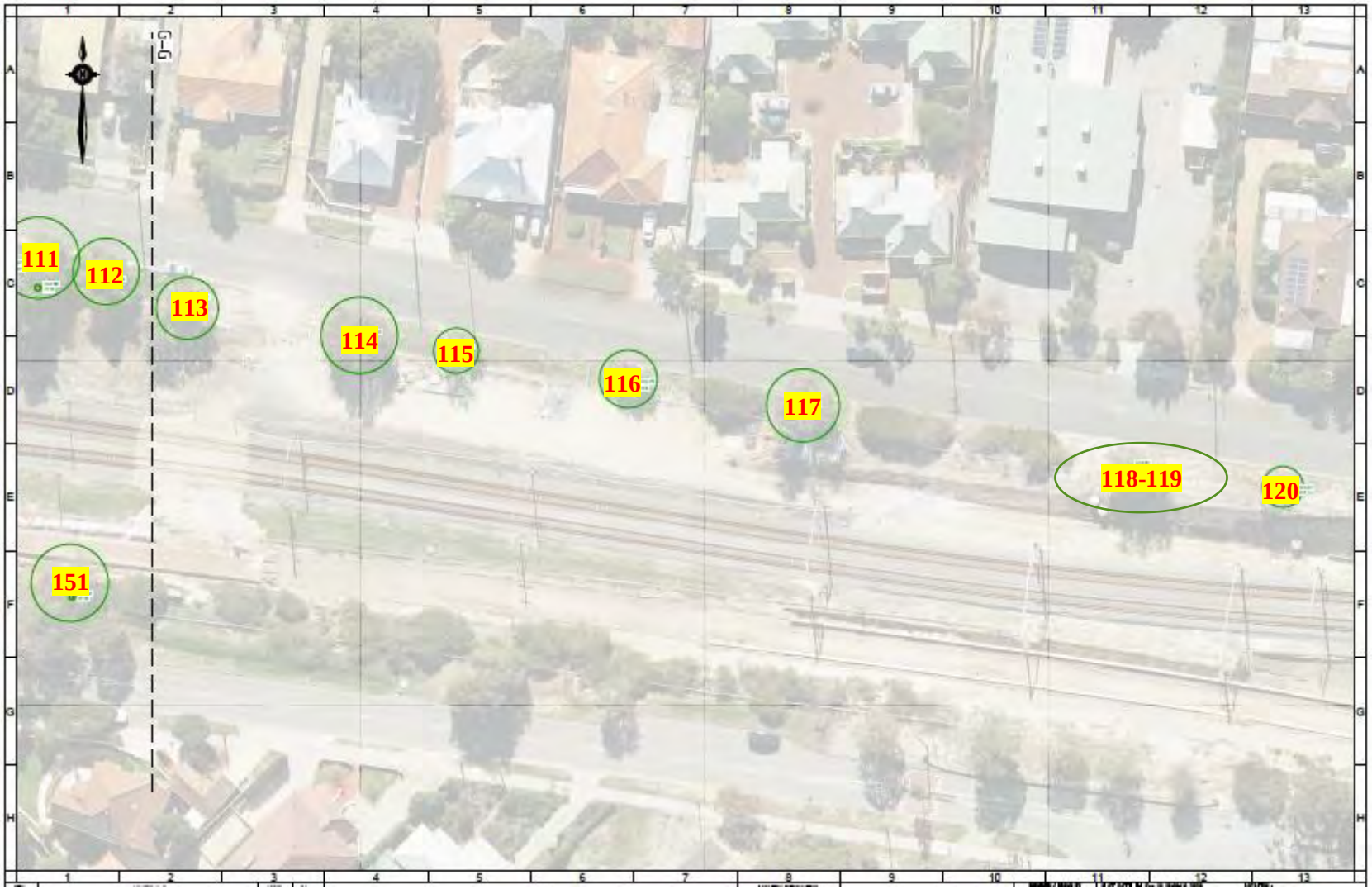
Map 6



Map 7



Map 8



Map 9

Photos

Tree 1

Tree 2

Tree 3

Tree 4

Tree 5

Tree 6

Tree 7

Tree 8

Tree 9

Tree 10

Tree 11

Tree 12

Tree 13

Tree 14

Tree 15

Tree 16

Tree 17

Tree 18

Tree 19

Tree 20

Tree 21

Tree 22

Tree 23

Tree 24

Tree 25

Tree 26

Tree 27

Tree 28

Tree 29

Tree 30

Tree 31

Tree 32

Tree 33

Tree 34

Tree 35

Tree 36

Tree 37

Tree 38

Tree 39

Tree 40

Tree 41

Tree 42

Tree 43

Tree 44

Tree 45

Tree 46

Tree 47

Tree 48

Tree 49

Tree 50

Tree 51

Tree 52

Tree 53

Tree 54

Tree 55

Tree 56

Tree 57

Tree 58

Tree 59

Tree 60

Tree 61

Tree 62

Tree 63

Tree 64

Tree 65

Tree 66

Tree 67

Tree 68

Tree 69

Tree 70

Tree 71

Tree 72

Tree 73

Tree 74

Tree 75

Tree 76

Tree 77

Tree 78

Tree 79

Tree 80

Tree 81

Tree 82

Tree 83

Tree 84

Tree 85

Tree 86

Tree 87

Tree 88

Tree 89

Tree 90

Tree 91

Tree 92

Tree 93

Tree 94

Tree 95

Tree 96

Tree 97

Tree 98

Tree 99

Tree 100

Tree 101

Tree 102

Tree 103

Tree 104

Tree 105

Tree 106

Tree 107

Tree 108

Tree 109

Tree 110

Tree 111

Tree 112

Tree 113

Tree 114

Tree 115

Tree 116

Tree 117

Tree 118

Tree 119

Tree 120

Tree 121

Tree 122

Tree 123

Tree 124

Tree 125

Tree 126

Tree 127

Tree 128

Tree 129

Tree 130

Tree 131

Tree 132

Tree 133

Tree 134

Tree 135

Tree 136

Tree 137

Tree 138

Tree 139

Tree 140

Tree 141

Tree 142

Tree 143

Tree 144

Tree 145

Tree 146

Tree 147

Tree 148

Tree 149

Tree 150

Tree 151

Tree 152

Tree 153

Tree 154

Tree 155

Tree 156

Tree 157

Tree 159

Tree 160

Tree 161


Tree 162


Tree 163


Tree 164


Tree 165


Tree 166

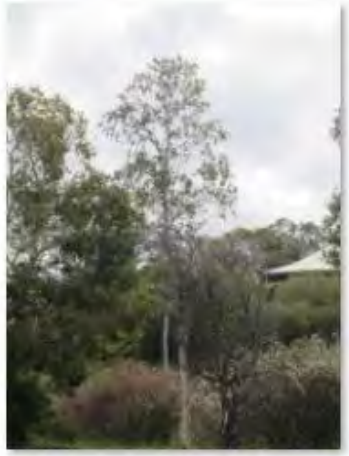

Tree 167


Tree 168


Tree 169

Tree 170

Tree 171



Tree 172

Tree 173

Appendix R

Microsimulation Modelling (Transport Modelling) Report prepared by WSP

EVOLVE BAYSWATER

BAYSWATER STATION MICROSIMULATION MODELLING

FUTURE MODELLING REPORT

OCTOBER 2020

CONFIDENTIAL

Question today
Imagine tomorrow
Create for the future

Bayswater Station Microsimulation Modelling
Future Modelling Report

Evolve Bayswater

WSP
Level 5, 503 Murray Street
Perth WA 6000
PO Box 7181
Cloisters Square WA 6850

Tel: +61 8 9489 9700
Fax: +61 8 9489 9777
wsp.com

REV	DATE	DETAILS
A	2/10/2020	Draft for client comment
B	5/10/2020	Final for DA submission

	NAME	DATE	SIGNATURE
Prepared by:	Roland Salita	2/10/20	
Reviewed by:	Phil Greenwood	2/10/20	
Approved by:	Mark Fowler	5/10/20	

TABLE OF CONTENTS

EXECUTIVE SUMMARY III

1 INTRODUCTION 1

1.1 CONTEXT 1

1.2 REPORT PURPOSE 1

1.3 PREVIOUS STUDIES 2

1.4 REPORT STRUCTURE 2

2 DEMAND DEVELOPMENT 3

2.1 NETWORK GROWTH 3

3 MODEL DEVELOPMENT 4

3.1 SCENARIOS 4

3.2 AIMSUN NETWORK DEVELOPMENT 4

3.2.1 BAYSWATER STATION PRECINCT 5
3.2.2 GUILDFORD ROAD 6
3.2.3 PUBLIC TRANSPORT 7
3.2.4 INTERSECTION SIGNAL TIMINGS 8

4 FUTURE YEAR ASSESSMENT 10

4.1 OVERVIEW 10

4.2 INTERSECTION PERFORMANCE CRITERIA 10

4.3 NETWORK PERFORMANCE 11

4.4 2021 (OPENING YEAR) 13

4.4.1 TRAFFIC FLOWS 13
4.4.2 AVERAGE DELAY 15
4.4.3 INTERSECTION PERFORMANCE 17
4.4.4 TRAVEL TIME 26
4.4.5 RAT-RUNNING 28

4.5 2026 (OPENING YEAR + 5 YEARS) 32

4.5.1 TRAFFIC FLOWS 32
4.5.2 AVERAGE DELAY 34
4.5.3 INTERSECTION PERFORMANCE 36
4.5.4 TRAVEL TIME 41

4.6 2031 (OPENING YEAR + 10 YEARS) 42

4.6.1 TRAFFIC FLOWS 42
4.6.2 AVERAGE DELAY 44
4.6.3 INTERSECTION PERFORMANCE 46
4.6.4 TRAVEL TIME 48

5 CONCLUSION 49

6 LIMITATIONS 50

6.1 PERMITTED PURPOSE 50

6.2 QUALIFICATIONS AND ASSUMPTIONS 50

6.3 USE AND RELIANCE 50

6.4 DISCLAIMER 51

EXECUTIVE SUMMARY

The Bayswater Station Upgrade is expected to bring about exciting change to the area around the existing Bayswater train station, and includes changes to the local road network. Evolve Bayswater commissioned WSP to develop a traffic simulation model to identify and assess the traffic impacts of these changes, which include a reconfiguration of the road network and a potential Development WA (DWA) precinct to the north of the station. The traffic modelling assessed the year of opening as the critical review (i.e. 2021), as well as 5 and 10-year planning horizons for a longer term overview (i.e. 2026 and 2031) over a wider area which extends to Guildford Road, , Garratt Road, Coode Street, Beechboro Road South and Whatley Crescent.

The modelling found that the PM peak is consistently more congested in all the analysis years. It was found that in 2021 (year of opening), the following intersections are major constraints to the modelled networks performance:

- Whatley Crescent / King William Street: This intersection is overcapacity in the PM Peak with heavy demand from both Whatley Crescent and King William Street travelling towards Beechboro Road South. Queueing on King William Street northbound extends back, blocking Murray Street.
- King William Street / Guildford Road: This intersection suffers heavy delays (i.e. LOS F) on the north and south approaches (i.e. King William Street) primarily in the PM peak period, as the signal timings naturally prioritise throughput along Guildford Road. The right-turn traffic from Guildford Road (east) to King William Street (north) also consistently queues back beyond the capacity provided in the turn pocket at the intersection, subsequently blocking the adjacent lane and reducing westbound throughput to a single lane.
- Roberts Street / Guildford Road: This is a three-leg priority-controlled intersection, with a considerable amount of traffic turning right from Guildford Road westbound onto Roberts Street. As these vehicles have to gap seek (which is limited) they queue along Guildford Road and reduce its capacity to a single lane in the westbound direction.

In opening year, impacts to average vehicle travel time along Whatley Crescent, King William Street, and Guildford Road were also considered, as there are deemed the critical routes within the model. These impacts are recorded as a maximum of 30 seconds in the AM peak and one minute in the PM peak. There is a significant saving of over three and a half minutes in travel time for Beechboro Road South / Whatley Crescent westbound in the AM Peak, with marginal increases in the PM Peak

Rat-running routes were identified as connections between either Whatley Crescent or Coode Street to Guildford Road, in order to bypass the signalised intersections on King William Street. These rat runs use the local roads of Slade Street, Murray Street, and Roberts Street. Note that some of these rat-running routes currently occur.

The modelling found that in 2026 (year of opening + 5 year horizon), the issues identified in the 2021 model are made worse. In particular:

- Queueing at the identified intersections extend further back, impacting other local road approaches to King William Street (i.e. Olfe Street).
- Queueing along Guildford Road further constrains east-west throughput.
- General increase in average travel time along all routes as traffic demand generally increases.

The modelling found that in 2031 (year of opening + 10 year horizon):

- Significant latent demand whereby vehicles cannot enter the modelled network occurs(over 1,000 and 2,000 vehicles in the AM and PM peaks respectively).
- Network breakdown in the PM peak due to internal network constraints (i.e. gridlocking) early in the model run, that does not occur in the 2026 and 2021 models. Note, the modelled traffic demands are developed from ROM24 fixed demands. Therefore, these future demands are not changing in response to operational constraints experienced in the microsimulation's study area up to the year 2031, such as route-changing via the wider network or mode-changing via public transport. Thus, the traffic breakdown is an indication of the defined model area's operational constraints and capacity given these fixed long-term demand assumptions.

It should be noted that the increase in demand in the future years (as defined by ROM24) is not all associated with the Bayswater Station Upgrade and is also attributed to general network growth beyond the extent of the area modelled for this project i.e. it is traffic looking to pass through the modelled area.

It is recommended that the issues identified in this report be reviewed and addressed via network capacity enhancements. Areas which should be considered for enhancement are the worst performing intersections but also other intersections which may encourage traffic re-routing away from rat-runs, such as:

- King William Street / Guildford Road
- Roberts Street / Guildford Road
- Guildford Road / Garratt Road
- Some other minor roads on Guildford Road.

It may also be prudent to consider the introduction of measures to discourage regional (passing through) traffic from using local roads to get through the network.

1 INTRODUCTION

1.1 CONTEXT

Evolve Bayswater has appointed WSP to provide traffic engineering services associated with the Bayswater Station Upgrade Development Application.

In October 2018, PTA engaged Arup (via Coniglio Ainsworth Architects) to conduct a traffic and transport assessment on the concept design of the Bayswater Station Upgrade. This assessment is reported on in the *New Bayswater Station Concept Design Transport Report (Coniglio Ainsworth Architects, October 2018)*.

In August 2019, PTA then engaged WSP to conduct additional traffic and transport analysis of the Bayswater Station Upgrade (*PS113592-TAP-REP-004 RevB*), which focused on the latest concept design at that point in time and considered a number of issues which were not addressed during the earlier study by Coniglio Ainsworth Architects. Both of these analyses were based upon static spreadsheet modelling to conduct intersection capacity analysis for the opening year (2021 at time of analysis) of Bayswater Station only.

In September 2019, PTA engaged WSP to develop a microscopic simulation transport model of the area around Bayswater Station to further analyse the impacts of the current (at that time) proposal across a wider study area, and also to consider the future year scenarios.

1.2 REPORT PURPOSE

The purpose of this transport model, which shall be called the Bayswater Station Aimsun Model (BSTAM), is to assess the future year road network performance in 2021, 2026 and 2031 in and around the station and identify impacts associated with network-wide traffic growth, the Bayswater Station Upgrade and potential future developments. A base model was calibrated, validated and reported on in *Bayswater Station Microsimulation Modelling – Base Modelling Report PS113592-TAP-REP-006 RevA, WSP, 2020.* This model and its results were audited by Main Roads WA and endorsed by them. It forms the basis of the further modelling that has been undertaken.

Preliminary modelling for future scenarios was also conducted as reported in *Bayswater Station Microsimulation Modelling – Future Modelling Report PS113592-PAM-REP-007 RevB, WSP, 2020.* This modelling used the road network as detailed in the PTA Concept Plans for the station.

This report documents the future year modelling to the same network extents with the proposed new road and intersection configurations developed in the detailed design of the station development.

1.3 PREVIOUS STUDIES

Key reference documents which have been considered during the undertaking of this study are listed in Table 1.1.

Table 1.1 Previous Studies

REFERENCE NUMBER	TITLE	DATE	AUTHOR
1	New Bayswater Station Concept Design Transport Report	October 2018	Coniglio Ainsworth Architects
2	Future station and road layout drawings	November 2018	PTA
3	Bayswater Station Traffic and Transport Assessment	August 2019	WSP
4	Bayswater Station Microsimulation Modelling – Base Modelling Report	April 2020	WSP
5	Bayswater Station Microsimulation Modelling – Future Modelling Report	June 2020	WSP

1.4 REPORT STRUCTURE

This report documents the methods and process used in the development of the Aimsun microscopic model, based on the previously calibrated and validated base Aimsun model developed. This report outlines the overall methodology and is divided into five chapters, namely:

- Section 1: Introduction, describing the background and purpose of this report
- Section 2: Demand Development, describing the methodology adopted to develop the future scenario demands
- Section 3: Model Development, describing modelling inputs and parameters
- Section 4: Future Scenario Assessment, describing traffic modelling outputs for the future scenarios
- Section 5: Conclusion, summarising the outcomes of this report.
- Section 6: Limitations, describing the limitations of the findings in this report.

2 DEMAND DEVELOPMENT

2.1 NETWORK GROWTH

Future year 2021, 2026 and 2031 ROM24 sub-area forecasts were developed and supplied by Main Roads WA. In association with PTA and Department of Planning, Lands and Heritage, Main Roads WA created future year ROM24 traffic models which included the proposed road network upgrades associated with Bayswater Station Upgrade as well as changes in land use and density around the station in the study area.

The ROM24 models also included all wider network upgrades and land use changes proposed outside the model.

The forecast ROM24 all day matrices were used to calculate future demand matrices for the Aimsun peak hour models, adopting the *"Urban Road Planning (URP)"* method. The following steps set out the process adopted to prepare the future year demand matrices for the future year Aimsun scenario using the outputs from the future year ROM24 all day matrices, as agreed with Main Roads WA:

1. ROM24 2021, 2026 and 2031 was disaggregated to align with the Aimsun zone structure (step completed by Main Roads WA)
2. 24hr ROM24 2016 and 2021 outputs were compared using linear growth to create a 24hr ROM24 2019 matrix
3. These 24hr flow differences were applied to the provided 24hr ROM24 2021 / 2026 / 2031 matrices (at trip-end link level). This created 24hr project 2021 / 2026 / 2031 matrices
4. Peak one-hour factors were calculated for each origin and destination by dividing the total for each origin and destination in the calibrated 2019 AM and PM matrices, by the total all day 24hr ROM24 2019 matrix created in Step 2
5. The identified peak one-hour factors were applied to 24hr project 2021 / 2026 / 2031 matrices to create AM and PM peak project 2021/2026/2031 matrices
6. Using Aimsun, the AM and PM Peak project 2021 / 2026 / 2031 matrices were adjusted using the 2019 calibrated base model – this considered the demands, centroids, zone connectors and adjusted the strategic demands to observed 2019 traffic proportions, using the OD patterns out of the strategic model.

3 MODEL DEVELOPMENT

3.1 SCENARIOS

The following scenarios were modelled in Aimsun with the proposed road network layout of the Bayswater Station Upgrade (as provided by Evolve Bayswater) for both the AM and PM peak hours:

- 2021 (Opening year)
- 2026 (Opening year + 5 years)
- 2031 (Opening year + 10 years).

3.2 AIMSUN NETWORK DEVELOPMENT

While the wider microsimulation modelled network remains unchanged, modifications will be made in the area surrounding Bayswater Station and along Guildford Road. The modelled network is shown in Figure 3.1.

Figure 3.1 BSTAM Future Scenario Modelled Network

The link of Whatley Crescent to Beechboro Road South is proposed to be realigned in order to improve the connectivity for east-west through traffic. Right-turn traffic from Coode Street to Whatley Crescent west is proposed to be removed with traffic currently using this route expected to re-route and make the right turn within the wider network (likely from King William Street or at Guildford Road).

3.2.1 BAYSWATER STATION PRECINCT

The proposed modification to the area surrounding Bayswater Station is shown in Figure 3.2. Key aspects include:

- Realignment of Beechboro Road South / Railway Parade to connect to Whatley Crescent / King William Street
- Whatley Crescent reduced to single lanes from Garratt Road to the town centre, including a reconfiguration of turn lanes at the Whatley Crescent and Garratt Road signalised intersection
- The existing Railway Parade section (Coode Street and Rose Avenue) converted to a shared zone with new bus stands, a reduced speed limit (10km/hr), and priority intersections on both ends
- The existing Coode Street / King William Street section (Burnside Street and Olfe Street) and Whatley Crescent / Beechboro Road South section (Roberts Street and Foyle Road) converted to a 40 km/hr speed zone
- Railway Parade / Coode Street to operate as a left-in / left-out (bus only)
- Removal of right turns from Coode Street to Whatley Crescent
- No right turn lane from Whatley Crescent east to Coode Street northbound
- Whatley Crescent east truncated to the west of Hamilton Road
- Removal of right turn pocket along Beechboro Road South to Drake Street
- Removal of the two Transperth car parks on Whatley Crescent (the removal of these parking bays is expected to be supplemented by new parking bays at Meltham and Ashfield stations)
- Signalised pedestrian crossing across the new link road, providing access between the station and the eastern carpark.

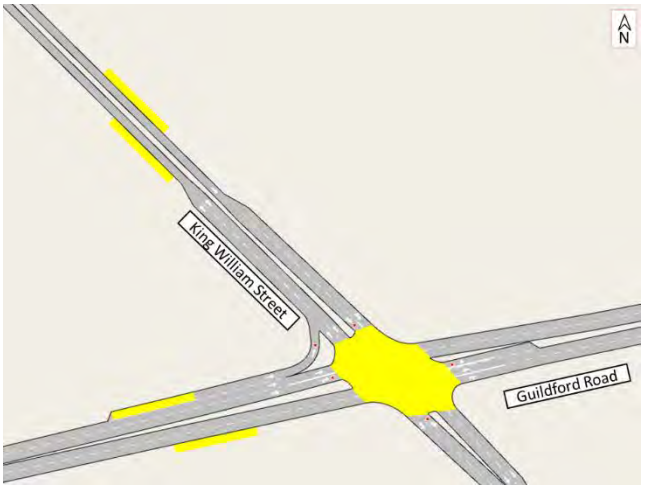
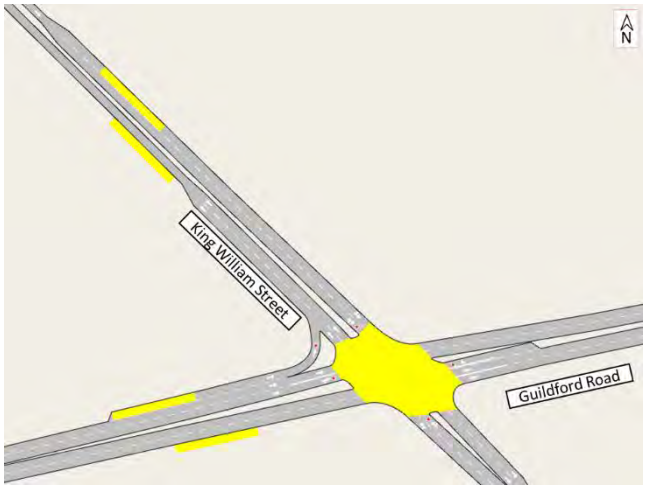
Figure 3.2 Bayswater Station proposed layout

3.2.2 GUILDFORD ROAD

Modifications proposed by Main Roads WA along Guildford Road are at the signalised intersections with King William Street and Garratt Road.

Modifications for the Guildford Road / King William Street intersection consist of the narrowing of the painted median to allow for two approach lanes for 150m and the provision of leading right turn signal phases / signal aspects for the right turn from King William Street onto Guildford Road west. These modifications are illustrated in Table 3.1 below, and are only proposed at this stage (but likely to proceed).

Table 3.1 Modifications to Guildford Road / King William Street

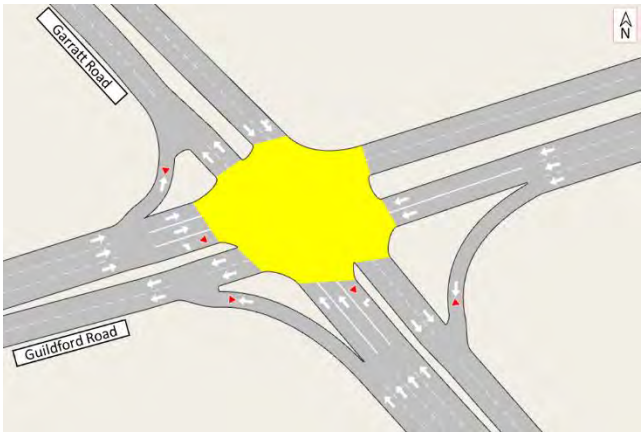
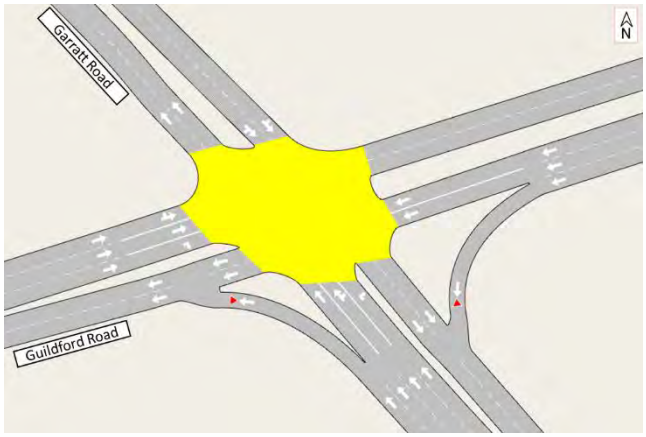
BEFORE	AFTER
	

Modifications for the Guildford Road / Garratt Road intersection consist of:

- the introduction of a right turn movement from Garratt Road north to Guildford Road east
- the lane reconfiguration of the southern approach to a through, shared through and right, and right turn only
- the removal of the western approach left turn slip lane
- the conversion of the phasing arrangement to split phasing thus removing the eastbound right turn filter movement.

These modifications are illustrated in Table 3.2, and are currently under construction.

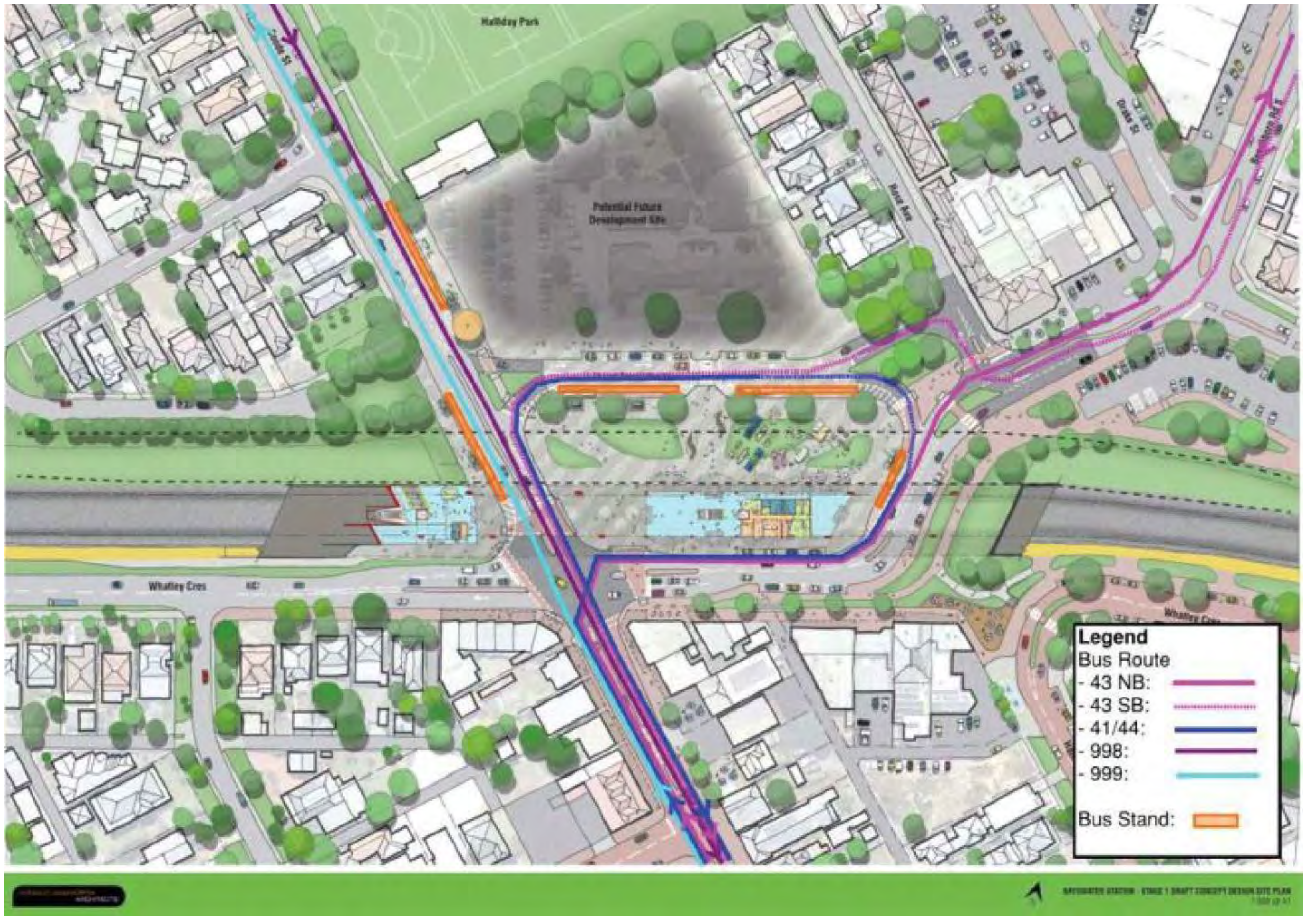
Table 3.2 Modifications to Guildford Road / Garratt Road

BEFORE	AFTER
	

3.2.3 PUBLIC TRANSPORT

The future public transport plans in the study area were identified in the *New Bayswater Station Concept Design Report, Coniglio Ainsworth Architects, 2018* with the proposed routes and movement around the new Bayswater Station shown in Figure 3.3. The existing route 998 and route 999 will remain as is, with route 48 being discontinued.

New bus routes 41, 43, and 44 will be introduced, with all buses operating at a six buses per hour frequency during peak hours, and thus in the models.



Source: New Bayswater final concept design report (Coniglio Ainsworth Architects, Oct 2018)

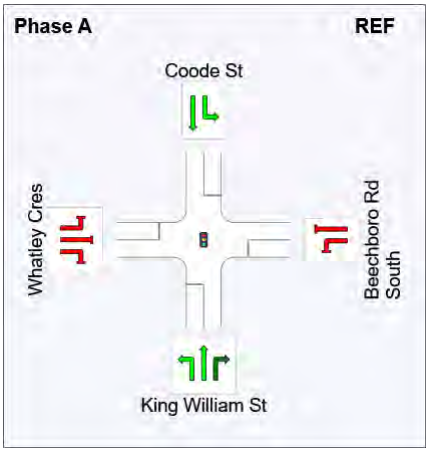
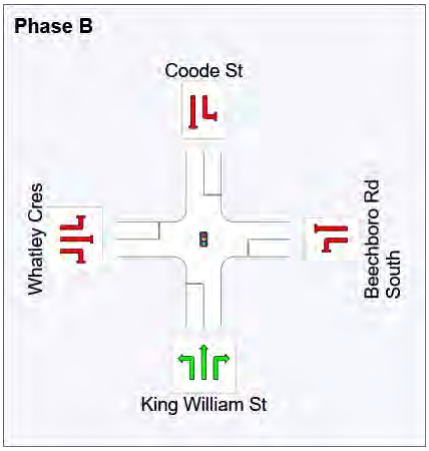
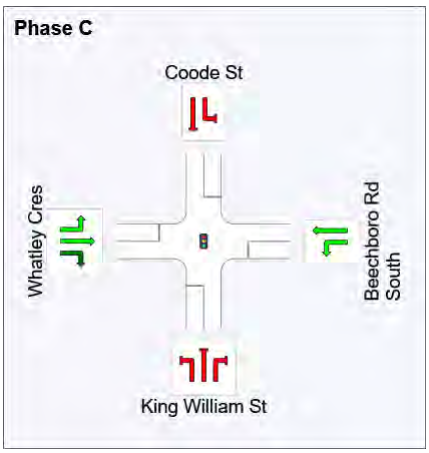
Figure 3.3 Future year bus routes

3.2.4 INTERSECTION SIGNAL TIMINGS

All intersection signal plans and timings were maintained from the endorsed base model, with the exception of those at King William Street / Whatley Crescent, whose signals were developed based on the *Bayswater Station Traffic and Transport Assessment PS113592-TAP-REP-004 RevB, WSP, 2019,* whereby initial SIDRA intersection analysis was performed.

Then, using traffic volume outputs from the Aimsun model and at the reuest of Main Roads WA (Network Operations) these initial signal plans and timings were optimised over several iterations between Aimsun and LinSig as per the *Proposed King William Street / Whatley Crescent Linsig Model Report, PS113592-PAM-REP-008, WSP, 2020.* These optimised signal timings and phasing plans were then input into the Aimsun model for its use in the operational assessment of the network. The final signal phase plans and timings used in the Aimsun modelling are found in Table 3.3 below.

Table 3.3 Signal phasing and timing for King William Street / Whatley Crescent

PHASE NAME	PHASE DIAGRAM	PHASE TIME (AM)	PHASE TIME (PM)
A		64	36
B		15	18
C		37	59
Cycle Time		116	113

Note that start loss was applied to the left and right turns to account for opposing pedestrian movements.

4 FUTURE YEAR ASSESSMENT

The future year models were developed based on the validated base model (as endorsed by Main Roads WA) with future year flows and the proposed road layout. The future model outputs are discussed in this section along with details of any major traffic impacts.

4.1 OVERVIEW

The overall network statistics show that as expected, as traffic volumes increase, delay on the network increases and average speed within the network decreases. The overall network statistics also highlight that by the year 2031, the network breaks down due to congestion with all the forecast demand being unable to enter the network within the modelled hours in either peak.

The traffic flows are tidal across all modelled years with the largest volume of traffic travelling westbound on Guildford Road in the AM peak and eastbound in the PM peak. In addition to this, tidal flows are also evident immediately adjacent to Bayswater Station, shown to be southbound on Coode Street in the AM peak hour and eastbound on Whatley Crescent in the PM peak hour with some additional eastbound traffic on Guildford Road using Garratt Road to travel northbound from Guildford Road to Whatley Crescent.

4.2 INTERSECTION PERFORMANCE CRITERIA

Intersection performance of future year scenarios were assessed in terms of delay-based levels of service (LOS) and queue spill-over. Delay-based LOS describes the varying quality of traffic flow that road users are willing to accept. It is categorised in six levels between LOS 'A' (i.e. minimal to no delay) to LOS 'F' (i.e. excessive delay), relative to the type of intersection being considered (i.e. signalised or priority-controlled). The general limit of acceptable operation adopted for this assessment is LOS 'D'.

Some intersections may already be operating beyond this threshold in the existing network and so future year analysis would be based on their further detriments to performance. The range of delay-based LOS criteria for signalised and priority-controlled intersections are presented in Table 4.1.

Table 4.1 Delay-based level of service criteria

LOS	Signalised	Priority-controlled
	Delay (sec)	
A	0 to 10	0 to 10
B	11 to 20	11 to 15
C	21 to 35	16 to 25
D	36 to 55	26 to 35
E	56 to 80	36 to 50
F	81 or greater	51 or greater

Queueing is considered where queues are observed to spill over their allocated turn pocket lengths such that adjacent traffic movements are impeded.

4.3 NETWORK PERFORMANCE

General network statistics are shown in Table 4.2 to provide a high-level assessment of the network performance across the three future years, for both AM and PM peak periods.

Table 4.2 Network statistics

Network Statistics	AM			PM		
	2021	2026	2031	2021	2026	2031
Modelled Flow (veh/hr)	7,141	7,884	8,374	8,190	8,547	8,563
Total Latent Demand (veh)	2	108	932	45	393	1,948
Vehicle Kilometres Travelled (km)	12,734	14,102	14,513	14,726	15,028	14,755
Vehicle Hours Travelled (hr)	434	691	870	594	906	1,163
Average Speed (km/hr)	32	25	22	29	24	19
Average Delay Time (sec/km)	62	115	165	83	146	216
Average Travel Time (sec/km)	128	181	231	150	212	282
Average Vehicles in Queue (veh)	103	235	360	187	437	688

The results show that with the increase in demand in future years there is also:

- A reduction in average speed
- An increase in average delay time and travel time
- An increase in vehicles queuing and latent demand.

The increase in demand in the future years (as defined by ROM24) is not all associated with the Bayswater Station Upgrade and is attributed to general network growth beyond the extent of the area modelled for this project i.e. it is traffic looking to pass through the modelled area.

The latent demand (vehicles that cannot enter the modelled network) statistic shows that by the year 2031, around 10% and 20% of the traffic demand is unable to be accommodated by the network in the AM and PM peak respectively. The modelling shows network breakdown in the 2031 PM peak as evidenced by the decrease in vehicle kilometres travelled (VKT) to below 2026 levels.

Further investigation in the 2031 PM peak microsimulation shows that this network breakdown is caused by the existing right turn facilities along Guildford Road westbound operating above capacity and impeding the major westbound through movements as shown in Figure 4.1 and Figure 4.2. At King William Street, vehicles queue and spill over the short right turn pocket and block the adjacent through lane. Similarly, at Roberts Street, vehicles stop and queue along the median lane, thereby blocking it, as they filter through the busy Guildford Road eastbound movement. While these constraints exist in the 2021 model, they significantly worsen through to 2026 such that the PM peak begins to show network breakdown. This is evidenced by the sharp increase in latent demand, stagnant modelled flow, and decrease in VKT, between the 2026 and 2031 model years.

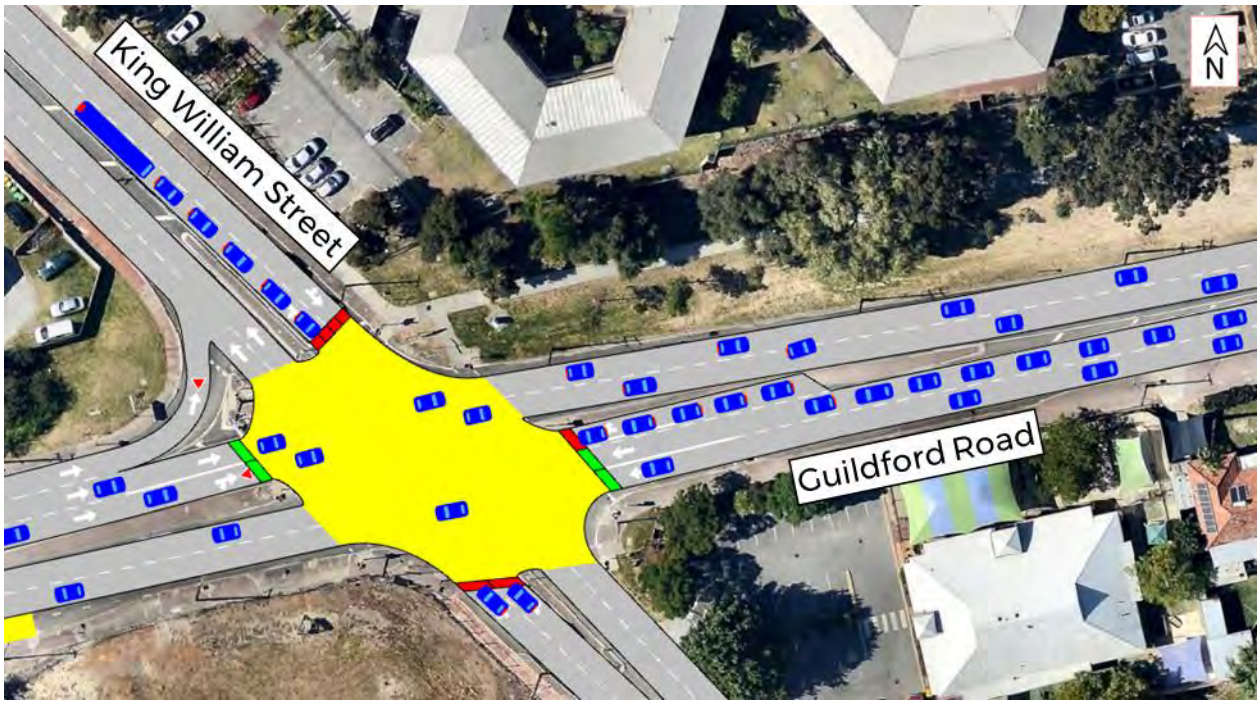


Figure 4.1 Modelled outcome of Guildford Road westbound constraints at King William Street

Figure 4.2 Modelled outcome Guildford Road westbound constraints at Roberts Street

It should be noted that the future demand inputs into microsimulation modelling are developed from ROM24 fixed demands. Therefore, these future demands are not changing in response to operational constraints experienced in the microsimulations study area up to the year 2031, such as peak spreading, route-changing outside of the modelled network or mode-changing via public transport. Thus, the latent demand and traffic breakdown is an indication of the networks operational constraints given these long-term fixed demand assumptions.

4.4 2021 (OPENING YEAR)

The following section identifies the 2021 microsimulation modelling results.

4.4.1 TRAFFIC FLOWS

The projected 2021 traffic flows for the AM and PM peak hours are represented in Figure 4.3 and Figure 4.4 respectively. The traffic flows are tidal with the largest volume of traffic travelling westbound on Guildford Road in the AM peak and eastbound in the PM peak.

Traffic volumes in the 1,000 vehicles per hour (veh/hr) range are forecast southbound on Coode Street in the AM peak hour, with these volumes being experienced eastbound on Whatley Crescent in the PM peak hour.

Figure 4.3 Traffic flows (veh/hr) in the AM peak in the year 2021

Figure 4.4 Traffic flows (veh/hr) in the PM peak in the year 2021

4.4.2 AVERAGE DELAY

The projected 2021 average vehicle delay for the AM and PM peak hours are shown in Figure 4.5 and Figure 4.6 respectively. These figures illustrate locations where delays are estimated to be significant due to road network constraints. In the delay plot, road links highlighted in red demonstrate an average vehicle delay of more than 60 seconds.

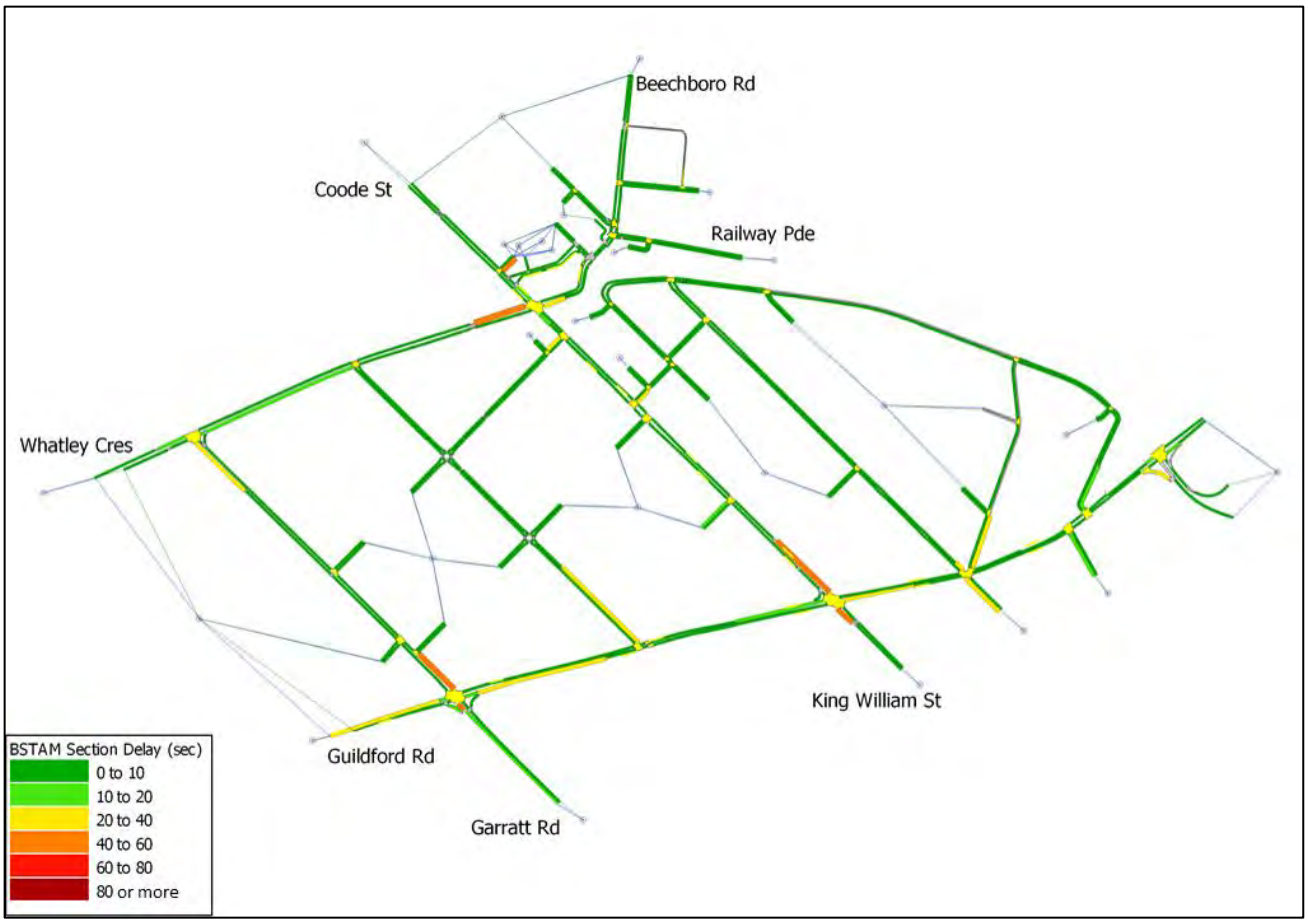


Figure 4.5 Delay in the AM peak in the year 2021

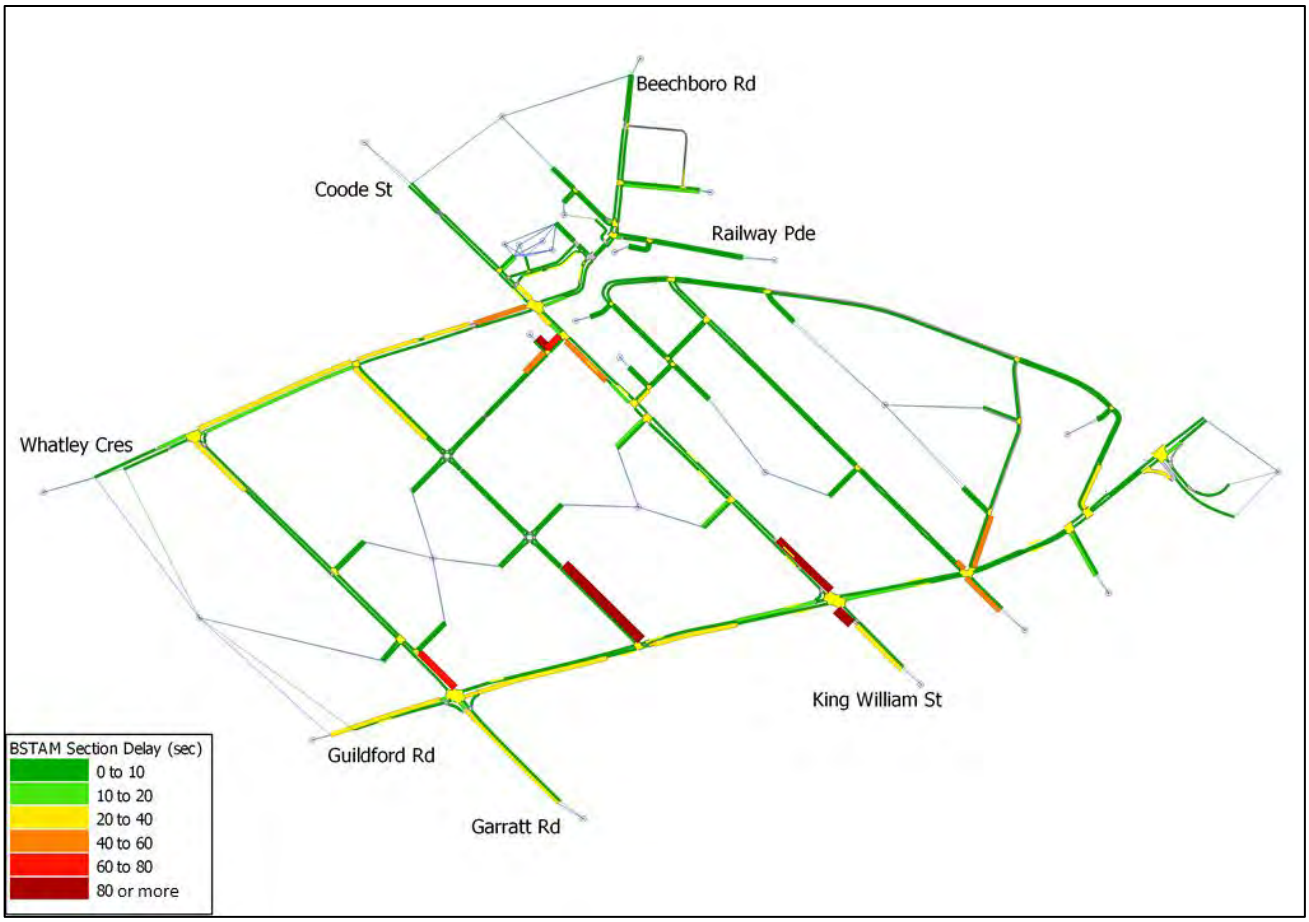


Figure 4.6 Delay in the PM peak in the year 2021

In the AM peak, the heaviest delays fall below 60 seconds and are forecast to be experienced at

- the northern approaches to Guildford Road (King William Street and Garratt Road)
- the western approach to Coode Street / King William Street (Whatley Crescent)
- the eastern approach to Coode Street (Railway Parade).

In the PM peak, the heaviest delays are more pronounced than the AM peak, with delays reaching above 60 seconds. These are forecast to be experienced at:

- both the northern and southern approaches to Guildford Road (King William Street, Garratt Road, Roberts Street)
- the western approach to King William Street (from Murray Street).

The delays at King William Street / Guildford Road and Garratt Road / Guildford Road are due to traffic signals prioritising throughput along Guildford Road and so traffic queues back and waits for more than one cycle before passing through the intersection. This priority is however to be expected due to the importance of Guildford Road and the volume of traffic which uses it. The delays at Roberts Street / Guildford Road are due to traffic turning right at these priority-controlled intersections, so having to gap seek within the two-way traffic flow on the busy Guildford Road.

The forecasted delays at Whatley Crescent / King William Street / Coode Street are due to heavy competing demands between the Whatley Crescent and King William Street approaches. This is because compared to existing, the proposed road network shows these approaches with reduced posted speeds and number of lanes, constraining the capacity of the intersection.

The delays at the Railway Parade / Coode Street and Murray Street / King William Street and are due to traffic queues from the nearby signalised intersection at Whatley Crescent extending back and blocking the intersections. Note the

performance of Murray Street / King William Street is further detailed in Section 4.4.3, with rat-running investigated in Section 4.4.5.

4.4.3 INTERSECTION PERFORMANCE

Delay and Level of Service (LOS) were assessed for each movement of each intersection within the modelled area. Any intersection which is forecast to have movements / approaches operating at a LOS worse than D in the year 2021 are detailed below. The other intersections which do not meet this threshold are considered to be working satisfactorily. Full LOS and delay results for all movements for all intersections are provided in Appendix A.

4.4.3.1 KING WILLIAM STREET / WHATLEY CRESCENT

The proposed layout of the King William Street / Whatley Crescent intersection is shown in Figure 4.7, as extracted from the model.

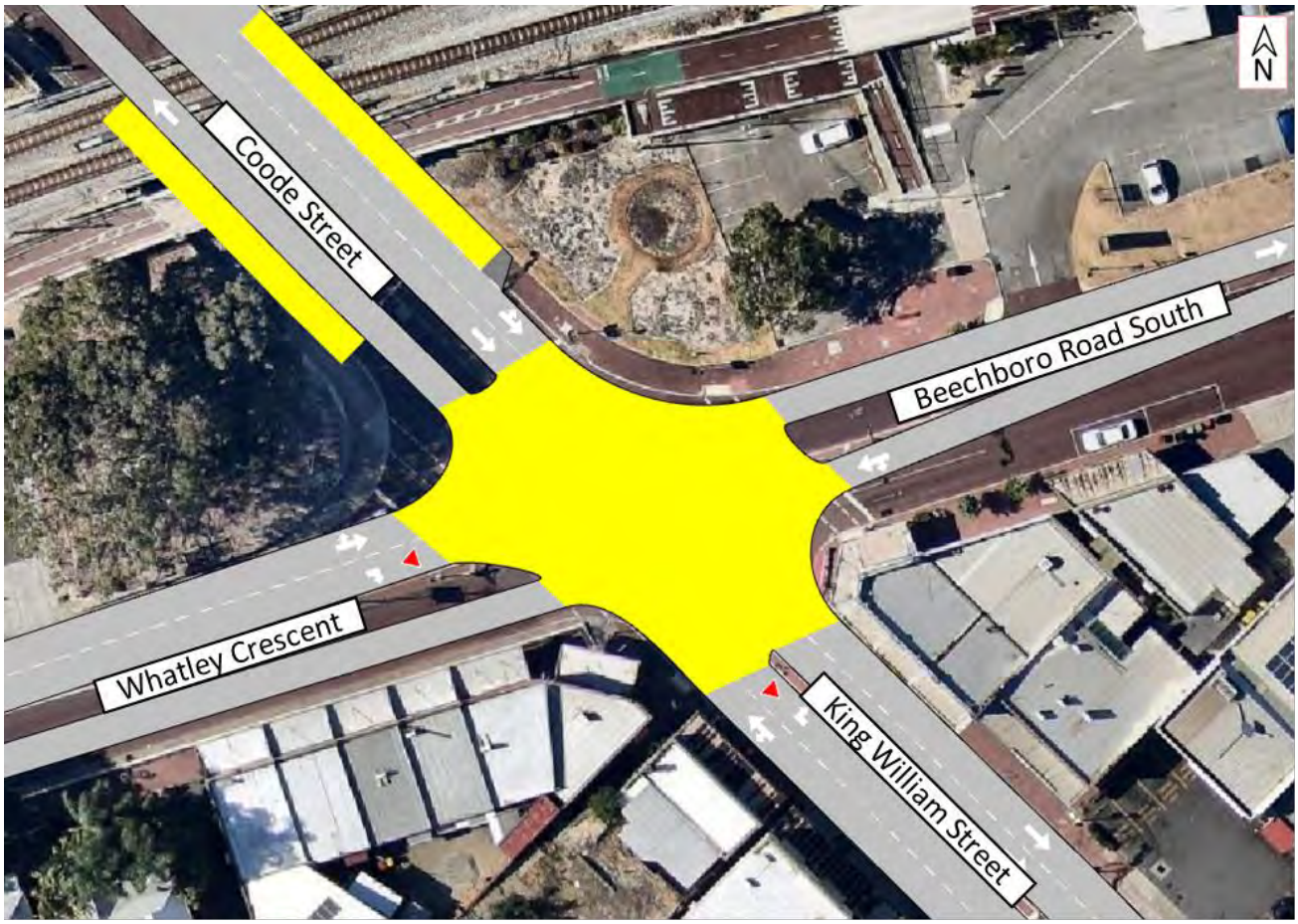


Figure 4.7 King William Street / Whatley Crescent proposed intersection layout

The road network is proposed to change significantly in this area between the years 2019 and 2021 and therefore a direct comparison of performance with the existing intersection at this location is not appropriate.

The modelling found that the southern and western approaches and movements of the proposed intersection layout would operate below LOS D in both the AM and PM peak. Table 4.3 and Table 4.4 show the approaches and movements which are forecast to operate at a LOS worse than D, noting that heavy demand exists towards Beechboro Road South from both King William Street and Whatley Crescent.

Table 4.3 AM King William Street / Whatley Crescent LOS results (where LOS is worse than D)

Road	Approach	Movement	2021
Whatley Crescent	West	Left Turn Through Right Turn	E E E
King William Street	South	Right Turn	E

Table 4.4 PM King William Street / Whatley Crescent LOS results (where LOS is worse than D)

Road	Approach	Movement	2021
Whatley Crescent	West	Left Turn Through Right Turn	F F F
King William Street	South	Left Turn Through Right Turn	F F F

The traffic modelling shows that several turning movements of the proposed intersection design of King William Street and Whatley Crescent would perform at LOS F in the PM peak of the year 2021. This indicates that the intersections capacity is insufficient in accommodating all the traffic demand within the peak period, resulting in heavy queueing and delay as shown in Figure 4.8. Furthermore, this would have upstream impacts to the operation of nearby intersections such as at Murray Street / King William Street.

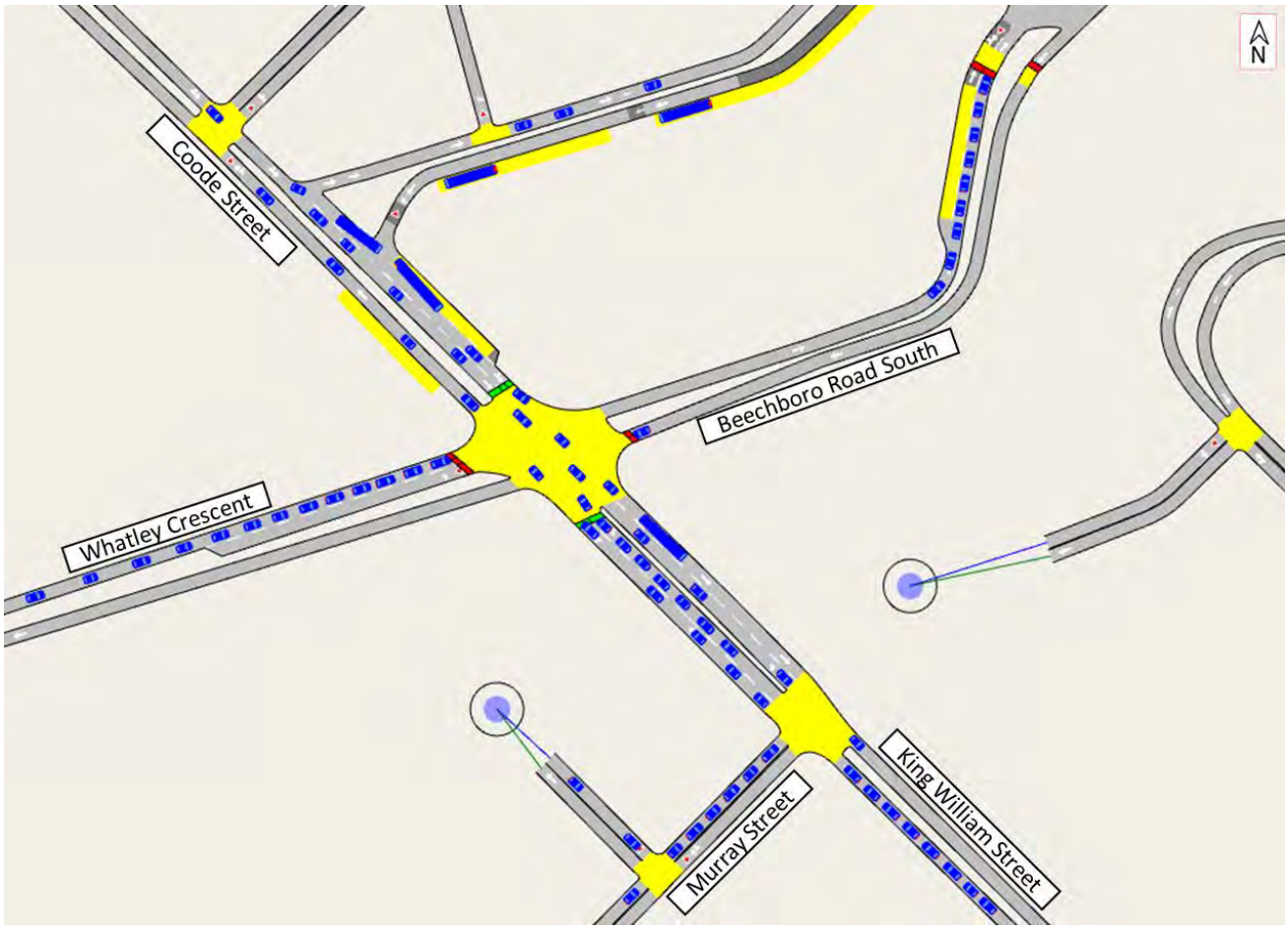


Figure 4.8 Queuing at King William Street / Whatley Crescent in the PM peak

To improve these LOS to an acceptable level, it would be typical to revise the intersection layout and traffic signal design to add more capacity for the western and northern approaches. However, given the station development and existing property boundaries, it is not feasible to expand lane capacity on these legs of the intersection further than has been achieved, and the traffic signals have been optimised in the context of the modelled demand.

As such, wider network interventions could be made where regional traffic is diverted away from the Bayswater Station Precinct and towards higher-order roads.

4.4.3.2 KING WILLIAM STREET / MURRAY STREET

The intersection layout of King William Street / Murray Street as modelled is shown in Figure 4.9.

Figure 4.9 King William Street / Murray Street intersection layout

Table 4.5 and Table 4.6 show the approaches and movements which are forecast to operate at a LOS worse than D in the AM and PM peaks respectively.

Table 4.5 AM King William Street / Murray Street LOS results (where LOS is worse than D)

Road	Approach	Movement	2019	2021
Murray Street	West	Right Turn	E	F

In the AM peak, traffic from Murray Street is forecast to have difficulty in turning right on to King William Street due to being unable to find gaps in the heavy traffic flow on King William Street and inbound demand from King William Street to Murray Street. This is the case in the existing scenario, but this effect is compounded by the increase in traffic and change in traffic distribution on the network in the proposed 2021 scenario, as a result of the removal of the right turn from Coode Street to Whately Crescent.

Table 4.6 PM King William Street / Murray Street LOS results (where LOS is worse than D)

Road	Approach	Movement	2019	2021
Murray Street	West	Left Turn Right Turn	C D	F F

In the PM peak, queuing from the downstream intersection of King William Street / Whatley Crescent is forecast to result in the left turn movement from Murray Street to King William Street (north) to experience delay and therefore operate at LOS F. As the Murray Street approach has both turning movements sharing a single lane, this would also impact the right turn movement which is expected to operate at LOS F.

To improve these LOS the addition of "Keep Clear" markings on King William Street could be considered to assist traffic exiting Murray Street. If possible, greater improvements could be achieved by providing an additional lane on Murray Street through widening at the intersection, in conjunction with the additional road markings.

4.4.3.3 GUILDFORD ROAD / KING WILLIAM STREET

The intersection layout of Guildford Road / King William Street is shown in Figure 4.10. Note the proposed road network includes lane widening and revised leading right turn phases on the northern approach, as discussed in Section 3.2.2.

Figure 4.10 Guildford Road / King William Street intersection layout

Table 4.7 and

Table 4.8 show the approaches and movements which are forecast to operate at a LOS worse than D in the AM and PM peaks respectively.

Table 4.7 AM Guildford Road / King William Street LOS results (where LOS is worse than D)

Road	Approach	Movement	2019	2021
King William Street	North	Right Turn	E	E
King William Street	South	Right Turn	F	E

Table 4.8 PM Guildford Road / King William Street LOS results (where LOS is worse than D)

Road	Approach	Movement	2019	2021
King William Street	North	Through Right Turn	D E	E F
Guildford Road	East	Right Turn	E	F
King William Street	South	Left Turn Through Right Turn	D D F	F F F

In the AM peak, the right turn movement of the northern approach is forecast to operate similar to existing, while the right turn movement of the southern approach operates slightly better, but still below LOS D. In the PM peak, the northern and southern approaches are worse off, falling to LOS F on several turn movements.

In both the AM and PM peaks, the traffic signals at Guildford Road / King William Street prioritise through traffic on Guildford Road. As demand increases in 2021, this results in excessive queuing and delay occuring on King William Street leading to a poor LOS despite the revised lane widening and signal phasing for the northern approach.

Furthermore, queueing on the right pocket of Guildford Road (east) is also shown to spill over its allocated road length, thereby reducing capacity of Guildford Road westbound as it blocks upstream through traffic. In the year 2021, due to the increase in traffic as well as the change in traffic distribution, this effect is compounded.

Figure 4.12 and Figure 4.11 show the queue lengths at the Guildford Road / King William Street intersection.

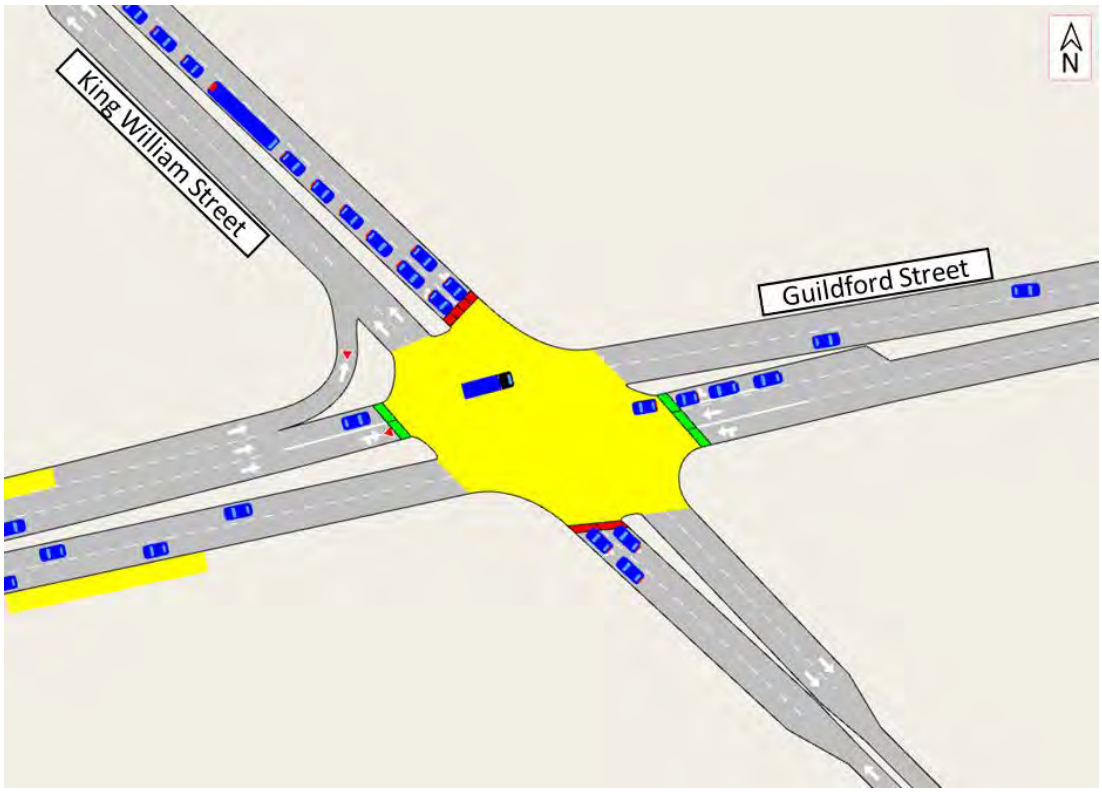


Figure 4.11 Delay and queueing on King William Street (north) at Guildford Road / King William Street in the AM peak

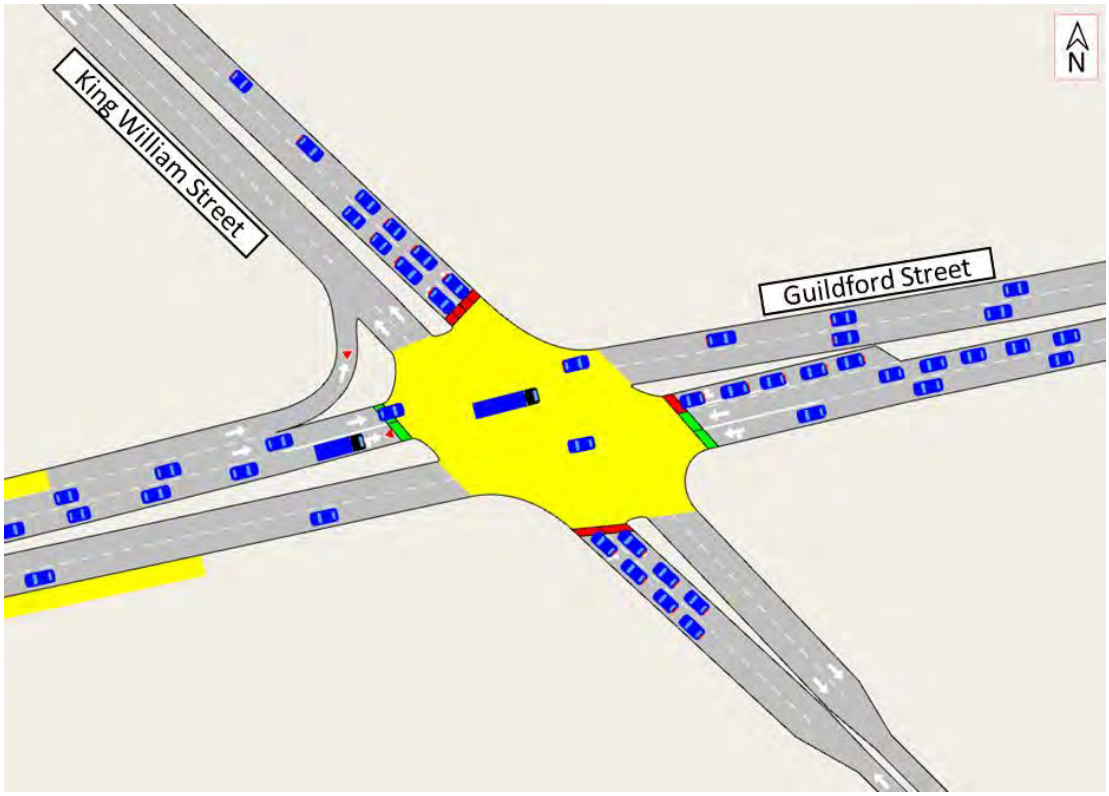


Figure 4.12 Delay and queueing on Guildford Road (east) at Guildford Road / King William Street in the PM peak

It is recommended to consider providing additional capacity to the northern and southern approaches, particularly for their right turn movements. This may be in the form of additional turn lanes and associated signal phasing changes (i.e. split phasing). Note that doing so would require coordination with other signalised intersections along Guildford Road such that overall throughput is not negatively impacted. It is also recommended to consider providing additional capacity to the right turn facility on Guildford Road westbound into King William Street. This may be in the form of additional turn pocket length, green time, or capacity in other areas of the road network to accommodate this demand.

4.4.3.4 GUILDFORD ROAD / SLADE STREET / ANZAC STREET

The intersection layout of Guildford Road / Slade Street / Anzac Street is shown in Figure 4.13.

Figure 4.13 Guildford Road / Slade Street / Anzac Street intersection layout

Table 4.9 and Table 4.10 show the approaches and movements which are forecast to operate at a LOS worse than D in the AM and PM peaks respectively.

Table 4.9 AM Guildford Road / Slade Street / Anzac Street LOS results (where LOS is worse than D)

Road	Approach	Movement	2019	2021
Slade Street	North	Left Turn Through Right Turn	E F F	D A E
Slade Street	South	Left Turn Through Right	E F E	D F E
Anzac Street	North-east	Right Turn	E	E

Table 4.10 PM Guildford Road / Slade Street / Anzac Street LOS results (where LOS is worse than D)

Road	Approach	Movement	2019	2021
Slade Street	North	Left Turn Through Right Turn	E F E	E D F
Slade Street	South	Left Turn Through Right	D E F	E F E
Anzac Street	North-east	Left Turn Right Turn	E E	E E

The Guildford Road / Slade Street / Anzac Street intersection currently operates at a poor LOS in both peak hours and is forecast to remain operating at similar levels in the year 2021. Note that some turn movements deteriorate, while some improve particularly in the AM peak. In the 2021 AM peak, less traffic accesses Guildford Road via Slade Street compared to 2019, due to local traffic redistributions stemming from the truncation of Whatley Crescent and Hamilton Road.

Figure 4.14 shows the queuing at the intersection which is compounded by traffic turning right from Guildford Road in both directions causing delay to the through movements on Guildford Road.

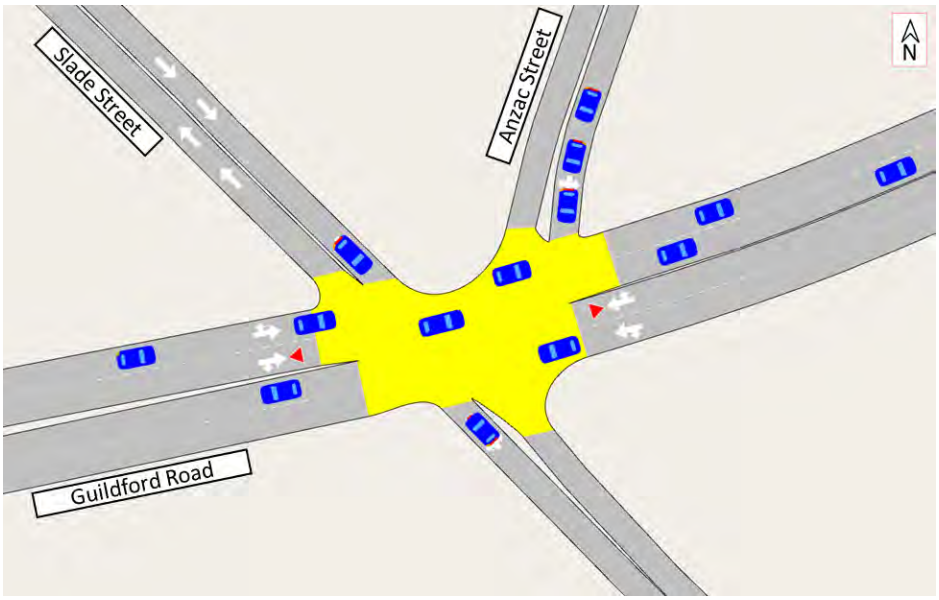


Figure 4.14 Delay and queuing at Guildford Road / Slade Street / Anzac Street in the AM Peak

4.4.4 TRAVEL TIME

The travel time outputs, especially for travel time routes through the King William Street / Whatley Crescent intersection, are important to assess the impact on the network as a result of the proposed changes. As in the 2019 base model, the following travel time routes were assessed to allow comparisons:

- Red: Whatley Crescent, Coode Street, Beechboro Road (eastbound and westbound)
- Blue: Coode Street, Guildford Road (northbound and southbound)
- Green: Guildford Road (eastbound and westbound)

These routes are illustrated in Figure 4.15 below.

Figure 4.15 Travel time routes assessed

The travel time results for each route are shown in Table 4.11.

Table 4.11 Travel time results and comparison to 2019 base model travel times

Travel Time	AM			PM		
Route	2019	2021	Difference	2019	2021	Difference
Green (EB)	2 min 55 sec	2 min 42 sec	-13 sec	2 min 42 sec	3 min 6 sec	+24 sec
Green (WB)	2 min 33 sec	2 min 43 sec	+10 sec	2 min 22 sec	3 min 23 sec	+1 min 1 sec
Blue (NB)	1 min 35 sec	1 min 34 sec	-1 sec	2 min 4 sec	3 min 2 sec	+58 sec
Blue (SB)	2 min 10 sec	2 min 26 sec	+16 sec	2 min 24 sec	3 min 22 sec	+58 sec
Red (EB)	1 min 45 sec	2 min 19 sec	+34 sec	2 min 32 sec	3 min 29 sec	+57 sec
Red (WB)	6 min 41 sec	3 min	-3 min 41 sec	2 min 35 sec	2 min 41 sec	+6 sec
TOTALS			-2 min 56 sec			+4 min 22 sec

In the AM peak, travel times on most routes are forecast to remain similar to existing with the exception of the westbound route from Beechboro Road South to Whatley Crescent (red). Currently traffic undertaking this route has to turn left at a signalised intersection, travel 40m, before turning right at another signalised intersection at King William Street / Whatley Crescent. In the proposed scenario, this is changed to being a through movement at the King William Street / Whatley Crescent intersection without any need to stop at signals. As a result of the proposed network reconfiguration, the travel time on this route is forecast to benefit by over three and a half minutes in the AM peak.

In the PM Peak, the westbound route from Beechboro Road to Whatley Crescent (red) shows marginal changes, while other routes experience increased travel times of up to a minute. The eastbound route from Whatley Crescent to Beechboro Road South (red) and the northbound route from Guildford Road to Whatley Crescent (blue) are forecast to experience an additional minute in travel time. This is due the heavy competing demands between the adjacent approaches, and the constrained capacity (i.e. reduced posted speeds and number of lanes) through this area of the model compared to 2019. The southbound route from Whatley Crescent to Beechboro Road (blue) is also forecast to experience an additional minute in travel time due to increased demand and downstream signals prioritising Guildford Road throughput. Lastly, the westbound route from Guildford Road west to Guildford Road east is forecast to experience a travel time impact of under 30 seconds due to increased demand.

4.4.5 RAT-RUNNING

Path assignment link analyses were performed to identify instances of rat-running during the AM and PM peak periods, particularly in relation to the project's network changes at King William Street / Whatley Crescent. The analyses have identified the following potential instances of rat-running which are discussed below:

- Slade Street
- Murray Street
- Roberts Street.

4.4.5.1 SLADE STREET

Rat-running via Slade Street currently occurs in 2019, as it is an attractive alternative to travelling on King William Street between Guildford Road and Whatley Crescent, as it connects closely to Bayswater Station and bypasses the signalised intersection of Guildford Road and King William Street. This is particularly attractive for vehicles travelling to and from Guildford Road east. Note that this rat-running in 2019 occurs in the southbound direction in the AM peak and in the northbound direction in the PM peak, in line with the network's tidal flows.

As Whatley Crescent and Hamilton Street are truncated in the proposed 2021 road network, the attractiveness of this route is reduced such that rat-running does not occur at all in the AM peak. However, congestion stemming from Guildford Road / King William Street during the PM peak is severe enough that it does occur in the PM peak, via Olfe Street. Note that the most severe rat-running occurs in the southbound direction in the PM peak where 67% of vehicles on Slade Street are rat-running.

The number and percentage of rat-running vehicles along Slade Street is summarised in Table 4.12, while the most severe case is illustrated in Figure 4.16 below.

Table 4.12 Rat-running vehicles via Slade Street (Percentage of total vehicles)

	AM		PM	
	2019	2021	2019	2021
Northbound	0 (0%)	0 (0%)	27 (46%)	12 (31%)
Southbound	35 (40%)	0 (0%)	0 (0%)	47 (67%)

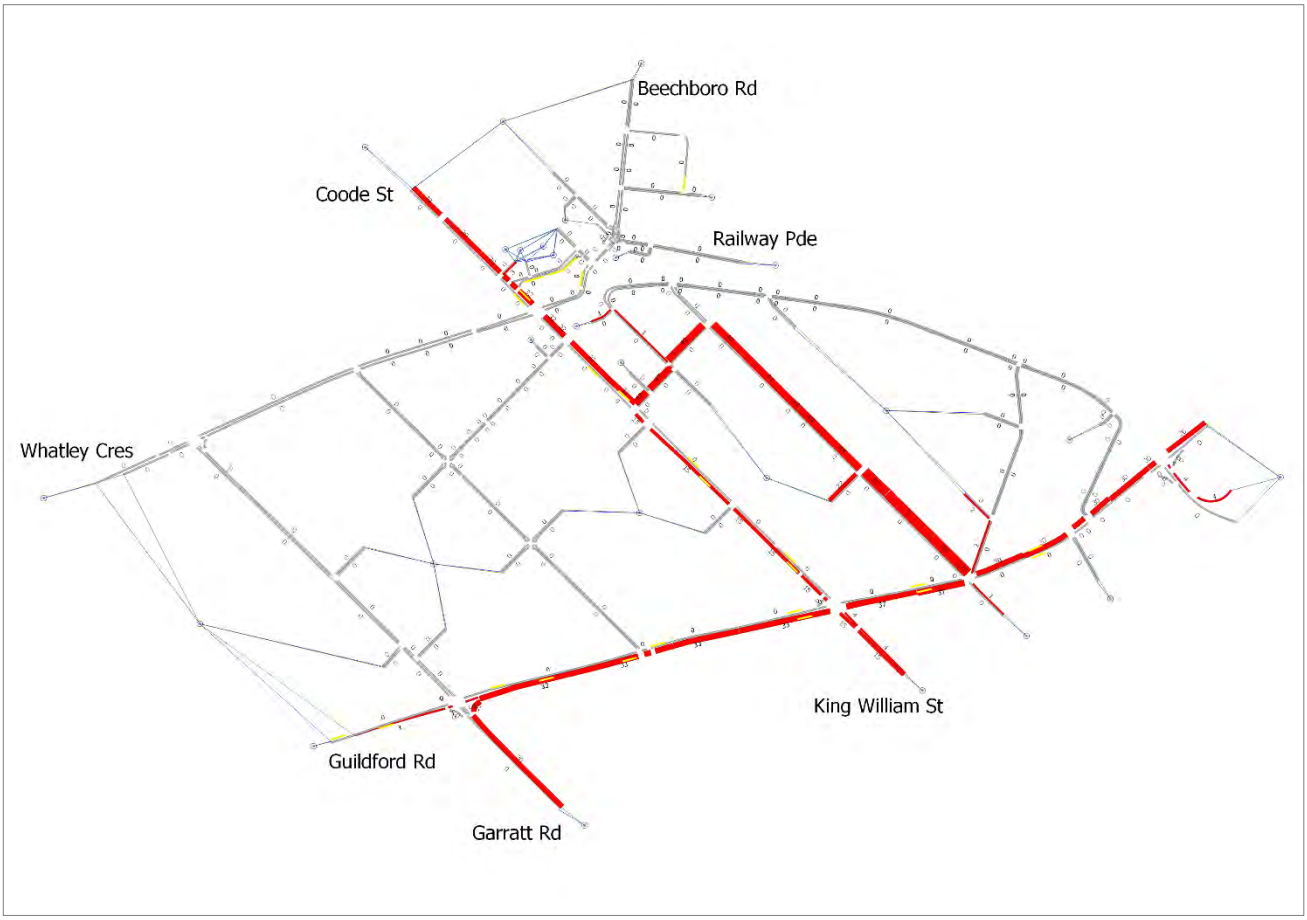


Figure 4.16 Rat-running vehicles via Slade Street (Southbound, 2021 PM Peak)

4.4.5.2 MURRAY STREET

Rat-running via Murray Street is not currently an issue in the year 2019. As the right turn movement from Coode Street into Whatley Crescent is banned in the proposed 2021 road network, the right-turning traffic would divert towards alternative roads such as Murray Street (westbound). Furthermore, congestion stemming from the Whatley Crescent / King William Street intersection in 2021 may drive vehicles to seek alternative routes that would bypass this intersection (i.e. Murray Street eastbound). The 2021 model shows that rat-running occurs in both AM and PM peaks, with the most severe case being in the westbound direction during the AM peak, where 34% of westbound traffic are rat-running.

The number and percentage of rat-running vehicles along Murray Street is summarised in Table 4.13, while the most severe case is illustrated in Figure 4.17 below.

Table 4.13 Rat-running vehicles via Murray Street (Percentage of total vehicles)

	AM		PM	
	2019	2021	2019	2021
Eastbound	0 (0%)	23 (10%)	0 (0%)	48 (14%)
Westbound	1 (1%)	234 (34%)	0 (0%)	74 (27%)

Figure 4.17 Rat-running vehicles via Murray Street (Westbound, 2021 AM Peak)

4.4.5.3 ROBERTS STREET

Rat-running via Roberts Street currently occurs in 2019. Like Slade Street, it is an attractive alternative to travelling on King William Street between Guildford Road and Whatley Crescent, as this route bypasses the two signalised intersections along King William Street. This is particularly attractive to vehicles travelling from Guildford Road east to Whatley Crescent.

As the signalised intersections of Whatley Crescent / King William Street and Guildford Road / King William Street grow increasingly congested in 2021, rat-running in the northbound direction intensifies in both the AM and PM peak. Rat-running continues to occur in the southbound direction, but to a lesser degree even compared to 2019 levels due to the introduction of a right-turn movement from Garratt Road north onto Guildford Road west. The number and percentage of rat-running vehicles along Murray Street is summarised in Table 4.14, while the most severe case is illustrated in Figure 4.18 below.

Table 4.14 Rat-running vehicles via Roberts Street (Percentage of total vehicles)

	AM		PM	
	2019	2021	2019	2021
Northbound	35 (20%)	80 (34%)	149 (47%)	220 (57%)
Southbound	61 (35%)	17 (23%)	17 (17%)	15 (22%)

Figure 4.18 Rat-running vehicles via Roberts Street (Northbound, 2021 PM Peak)

4.5 2026 (OPENING YEAR + 5 YEARS)

4.5.1 TRAFFIC FLOWS

The projected 2026 traffic flows for the AM and PM peak hours are shown in Figure 4.19 and Figure 4.20 respectively.

Figure 4.19 Traffic flows (veh/hr) in the AM peak in the year 2026

Figure 4.20 Traffic flows (veh/hr) in the PM peak in the year 2026

The traffic flows are again forecast to be tidal in the year 2026 with the largest volume of traffic travelling westbound on Guildford Road in the AM peak and eastbound in the PM peak with these volumes being around 2,000 veh/hr in both peak hours. Traffic in the counter-peak direction on Guildford Road is forecast to increase by the year 2026 compared to 2021 with these volumes being around 1,250 veh/hr in both peak hours.

Traffic volumes around the 1,000 veh/hr range are forecast southbound on Coode Street in the AM peak hour, with these volumes being experienced eastbound on Whatley Crescent in the PM peak hour.

4.5.2 AVERAGE DELAY

The projected 2026 average vehicle delay for the AM and PM peak hours are shown in Figure 4.21 and Figure 4.22 respectively. These figures illustrate locations where delays are estimated to be significant due to network constraints. In the delay plot, road links highlighted in red demonstrates an average vehicle delay of more than 60 seconds.

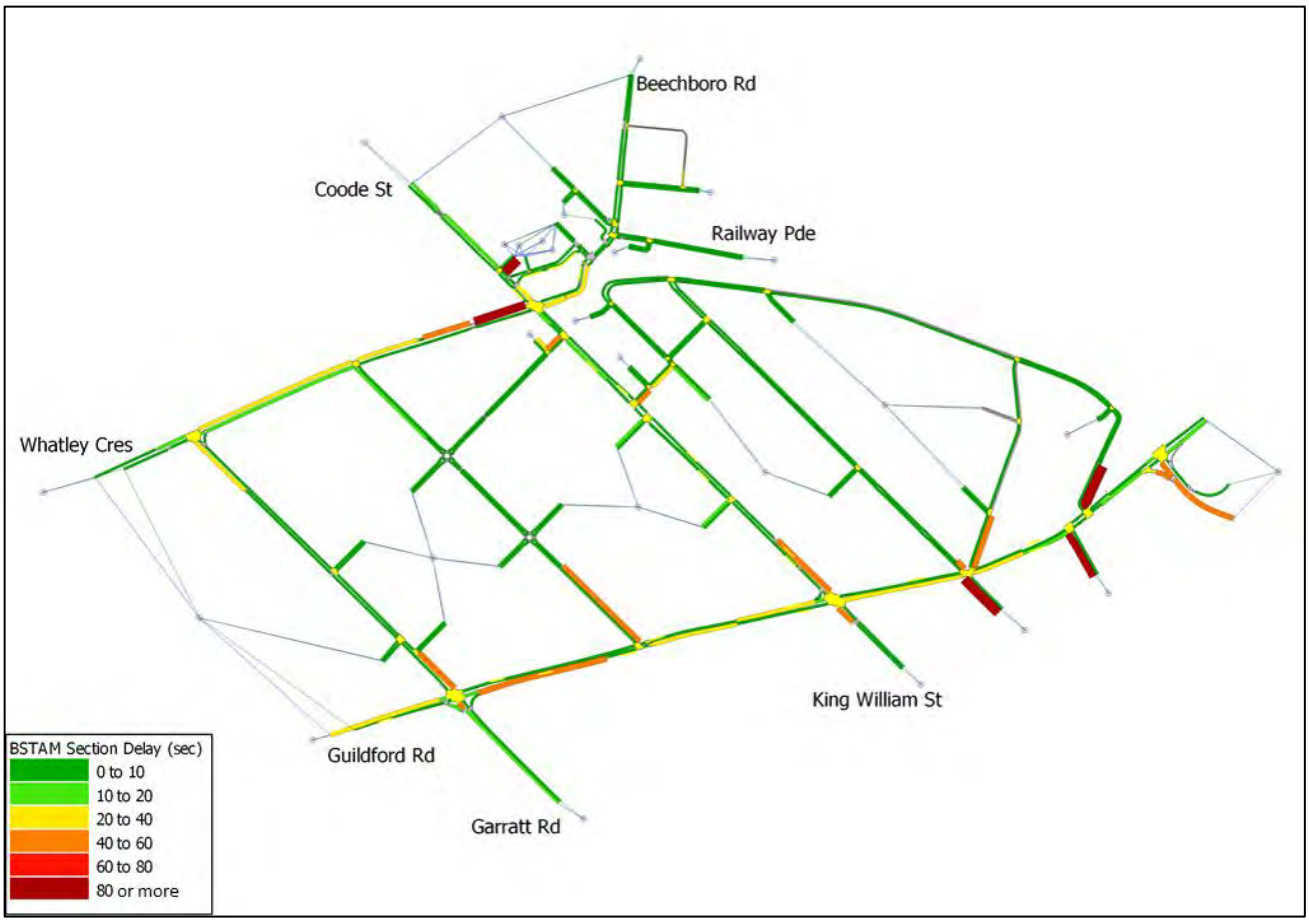


Figure 4.21 Delay in the AM peak in the year 2026

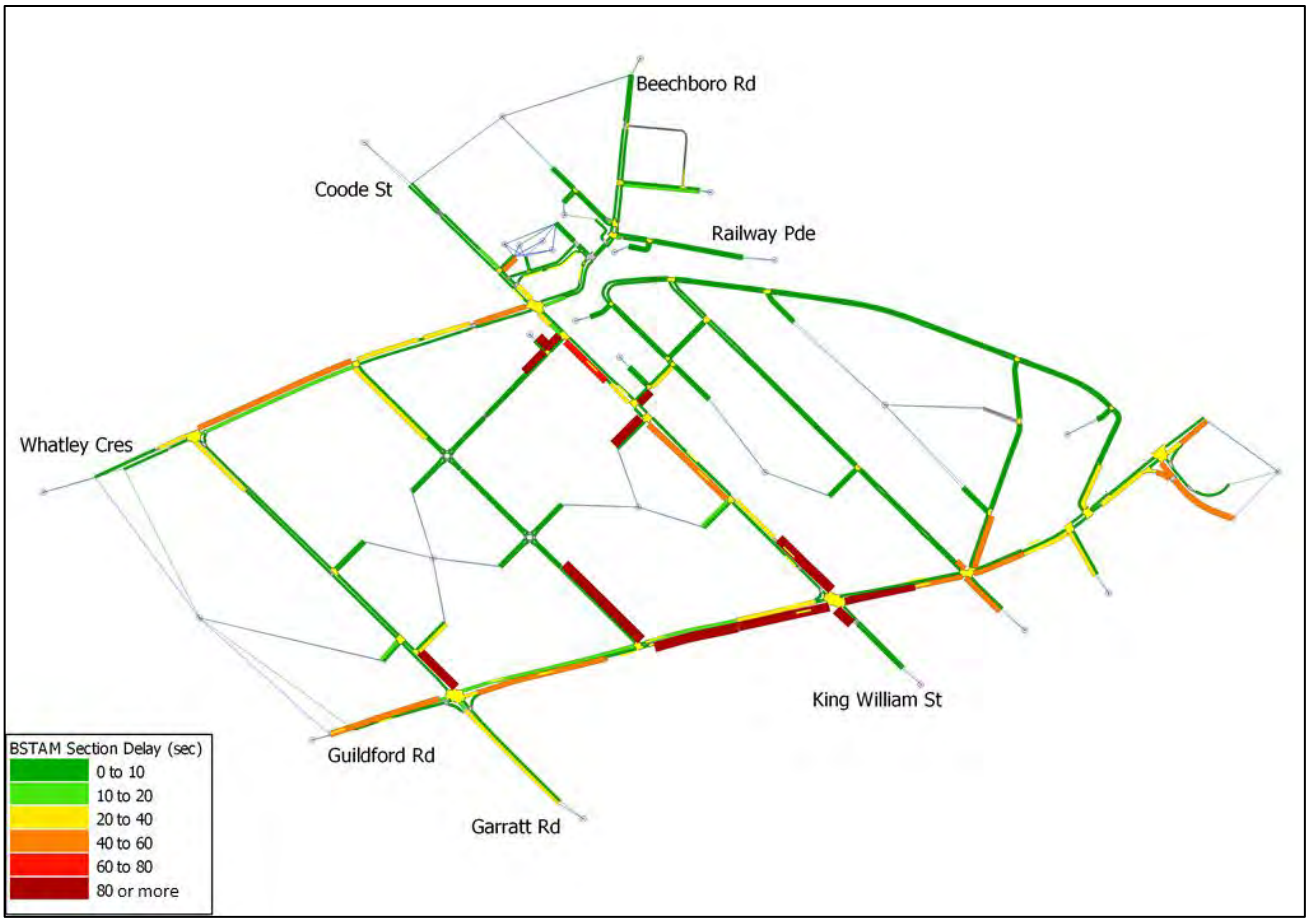


Figure 4.22 Delay in the PM peak in the year 2026

In the AM peak, heavy delays are forecast to be experienced on several approaches to Guildford Road, with the heaviest delays (i.e. greater than 80 seconds) experienced at Slade Street south, Newton Road north, and Newton Road south. This is due to traffic from these roads attempting to enter a congested Guildford Road. Furthermore, the delays on the approaches to Coode Street (from Whatley Crescent and Railway Parade) observed in 2021 worsen in 2026, with congestion propagating upstream on Whatley Crescent.

In the PM peak, heavy delays are similarly forecast to be experienced on approaches to Guildford Road as east-west throughput is prioritised. As discussed in Section 4.3, right turn facilities along Guildford Road westbound operate above capacity, and begin to significantly impede the westbound through movement. This results in heavy delays and queueing along Guildford Road, with congestion propagating east towards Tonkin Highway.

Delays on western and southern approaches of the Whatley Crescent / King William Street intersection observed in 2021 worsen in 2026, with congestion impacting the minor road approaches of Murray Street, Olfe Street, Almondbury Street, and Railway Parade.

4.5.3 INTERSECTION PERFORMANCE

In general, the intersection statistics and results discussed for 2021 are exacerbated in the 2026 microsimulation model. Therefore, only the intersections which exceed the performance threshold on 2026 that did not in 2021 are reported on.

4.5.3.1 KING WILLIAM STREET / OLFE STREET

The intersection layout of King William Street / Olfe Street is shown in Figure 4.23.

Figure 4.23 King William Street / Olfe Street intersection layout

Table 4.15and Table 4.16 show the approaches and movements which are forecast to operate at a LOS worse than D in the PM peak.

Table 4.15 AM King William Street / Olfe Street LOS results (where LOS is worse than D)

Road	Approach	Movement	2026
Olfe Street	East	Right Turn	E

Table 4.16 PM King William Street / Olfe Street LOS results (where LOS is worse than D)

Road	Approach	Movement	2026
Olfe Street	East	Left Turn Right Turn	F F

In the 2026 AM and PM peaks, the queuing from the downstream intersection of King William Street / Whatley Crescent observed in 2021 becomes worse such that it impacts minor road approaches further back along King William Street. As such, the right turn from Olfe Street to King William Street (north) is expected to operate at LOS E and F respectively. In the PM peak, this causes delay for the left turn from Olfe Street to King William Street (south) as left turning traffic is queued behind right turning traffic on Olfe Street which only has a one-lane approach to King William Street.

4.5.3.2 GUILDFORD ROAD / NEWTON STREET SOUTH

The intersection layout of Guildford Road / Newton Street (south) is shown in Figure 4.24.

Figure 4.24 Layout of the Guildford Road / Newton Street (south) intersection

Table 4.17 and Table 4.18 shows the approach and movement which is forecast to operate at an LOS worse than D in each peak.

Table 4.17 AM Guildford Road / Newton Street (south) LOS results (where LOS is worse than D)

Road	Approach	Movement	2026
Newton Street	South	Left Turn Right Turn	F F

Table 4.18 PM Guildford Road / Newton Street (south) LOS results (where LOS is worse than D)

Road	Approach	Movement	2026
Newton Street	South	Right Turn	E

The Newton Street (south) approach to Guildford Road operates at LOS F in the AM peak and LOS E in the PM peak. The queuing on Newton Street (south), shown in Figure 4.25, is due to traffic being unable to find gaps to enter Guildford Road.

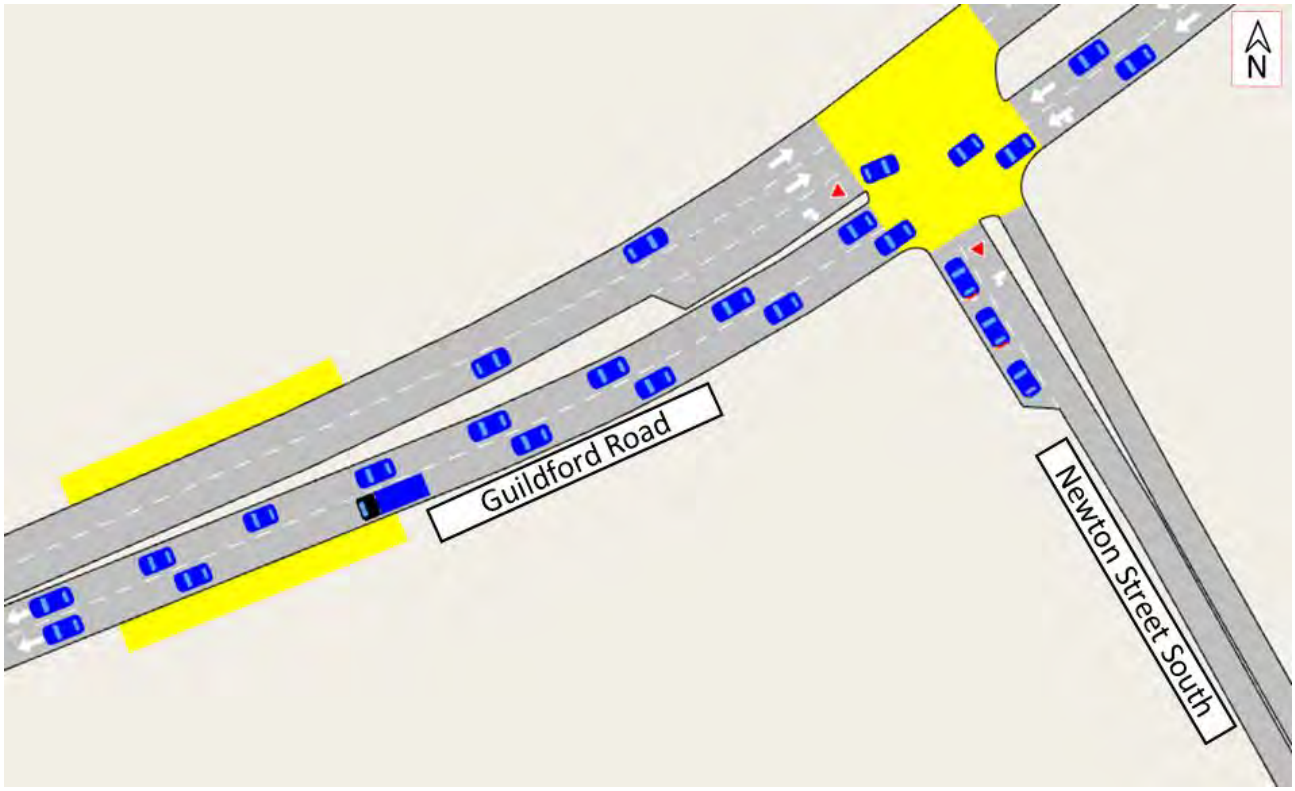


Figure 4.25 Delay and queuing at Newton Street (south) in the AM peak

4.5.3.3 GUILDFORD ROAD / NEWTON STREET NORTH

The intersection layout of Guildford Road / Newton Street (north) is shown in Figure 4.26.

Figure 4.26 Guildford Road / Newton Street (north) intersection layout

Table 4.19 and Table 4.20 show the approach and movement which is forecast to operate at a LOS worse than D in each peak.

Table 4.19 AM Guildford Road / Newton Street (north) LOS results (where LOS is worse than D)

Road	Approach	Movement	2026
Newton Street	North	Left Turn Right Turn	F F

Table 4.20 PM Guildford Road / Newton Street (north) LOS results (where LOS is worse than D)

Road	Approach	Movement	2026
Newton Street	North	Right Turn	F

The right turn from Newton Street (north) is a two-stage crossing with relatively low traffic volumes which currently operates at LOS D and is forecast to remain operating at LOS F in the year 2026, with a carry on effect to the left turn movement that would queue behind right turners as Newton Street North is a single lane shared road. This is illustrated in Figure 4.27.

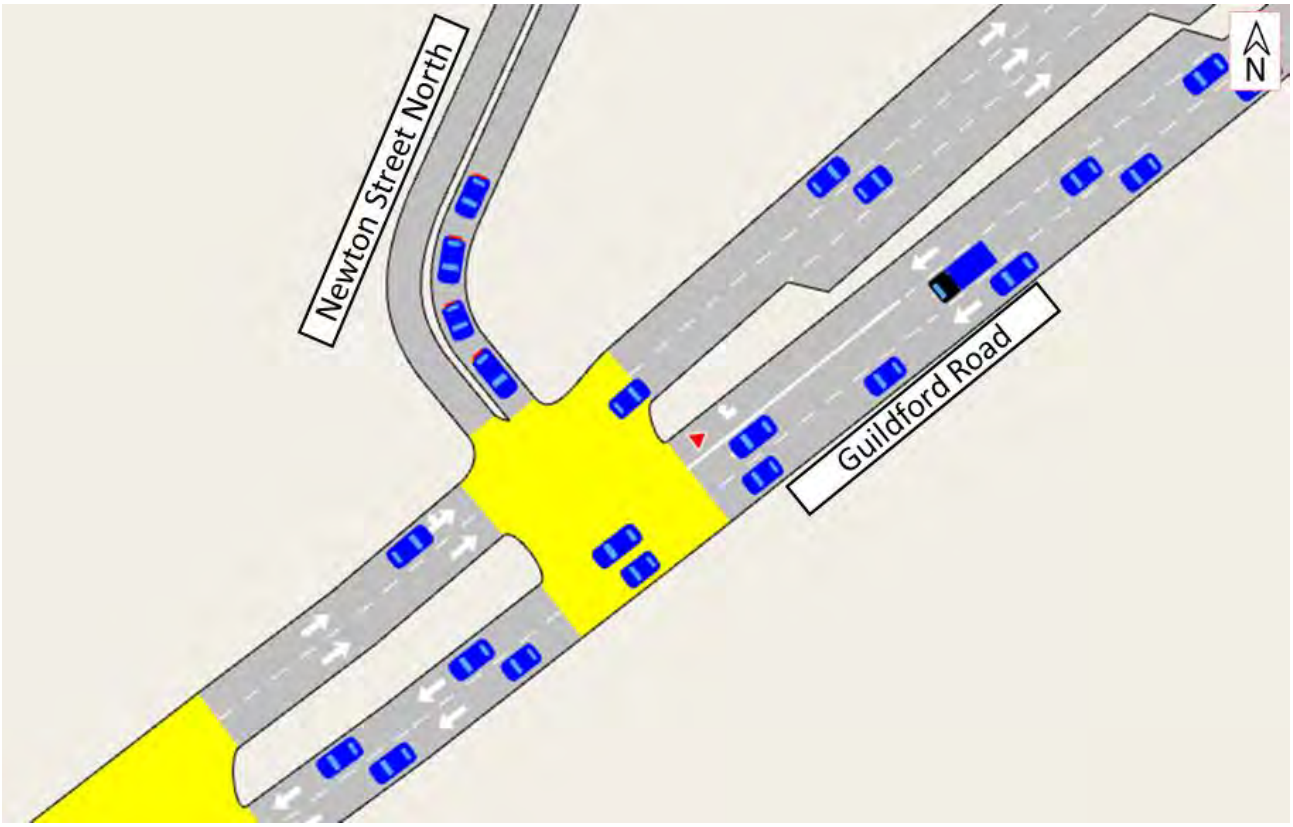


Figure 4.27 Delay at Guildford Road / Newton Street (north) in the PM peak

Given the relatively small demand, it is suggested no mitigation is required here.

4.5.4 TRAVEL TIME

The travel time results for each route in the year 2026 are shown in Table 4.21.

Table 4.21 Travel time results and comparison to 2021 model travel times

Travel Time	AM			PM		
Route	2021	2026	Difference	2021	2026	Difference
Green (EB)	2 min 42 sec	2 min 55 sec	+13 sec	3 min 6 sec	3 min 59 sec	+53 sec
Green (WB)	2 min 43 sec	5 min 13 sec	+2 min 30 sec	3 min 23 sec	10 min 33 sec	+7 min 10 sec
Blue (NB)	1 min 34 sec	2 min 7 sec	+33 sec	3 min 2 sec	5 min 16 sec	+2 min 14 sec
Blue (SB)	2 min 26 sec	2 min 39 sec	+13 sec	3 min 22 sec	5 min 24 sec	+2 min 2 sec
Red (EB)	2 min 19 sec	4 min 35 sec	+2 min 16 sec	3 min 29 sec	4 min 25 sec	+56 sec
Red (WB)	3 min	3 min 35 sec	+35 sec	2 min 41 sec	2 min 43 sec	+2 sec
TOTALS			+6 min 21 sec			+13 min 18 sec

As in the year 2021, the westbound Beechboro Road South to Whatley Crescent (red) route is forecast to benefit the most in the year 2026 with the proposed option in place, although no real additional time savings are achieved from 2021 to 2026, the real benefit occurs when the change is implemented.

In the AM Peak, average travel times are generally forecast to increase between 2021 and the 2026 project case, most notably for the westbound Guildford Road (green) route and the eastbound Whatley Crescent to Beechboro Road (red) route, both of which increase by over two minutes. This is due to the unresolved congestion stemming from the right turn facilities along Guildford Road westbound and the Whatley Crescent / King William Street intersection operating over capacity, as previously flagged in the 2021 model assessment.

In the PM peak, average travel times on all routes increase, with the westbound Guildford Road (green) route being the most impacted as average travel times increase by over seven minutes, while the King William Street route (both directions) increases by over two minutes. This is again due to unresolved congestion along Guildford Road westbound, propagating upstream to the King William Street / Guildford Road signalised intersection, and the Whatley Crescent / King William Street intersection operating above capacity.

In both peaks, the increase in travel time was generally a result of capacity constraints of the right turn movement facilities along Guildford Road westbound and the intersection of Whatley Crescent and King William Street.

4.6 2031 (OPENING YEAR + 10 YEARS)

4.6.1 TRAFFIC FLOWS

The projected 2031 traffic flows for the AM and PM peak hours are shown in Figure 4.28 and Figure 4.29 respectively.

Figure 4.28 Traffic flows (veh/hr) in the AM peak in the year 2031

Figure 4.29 Traffic flows (veh/hr) in the PM peak in the year 2031

The traffic flows are again forecast to be tidal in the year 2031 with the largest volume of traffic travelling westbound on Guildford Road in the AM peak and eastbound in the PM peak with these volumes being up to 2,000 veh/hr in both peak hours. Note that the flows along Guildford Road stagnate at 2026 levels due to a breakdown in traffic as a result of unresolved congestion.

Therefore, all of the demand for the network is unable to enter the modelled area within the peak hours. This has flow on effect on other links within the network in both peak hours in the year 2031, and so results should be interpreted with caution.

4.6.2 AVERAGE DELAY

The projected 2031 average vehicle delay for the AM and PM peak hours are shown in Figure 4.30 and Figure 4.31 respectively. These figures illustrate locations where delays are estimated to be significant due to network constraints. In the delay plot, road links highlighted in red demonstrates an average vehicle delay of more than 60 seconds.

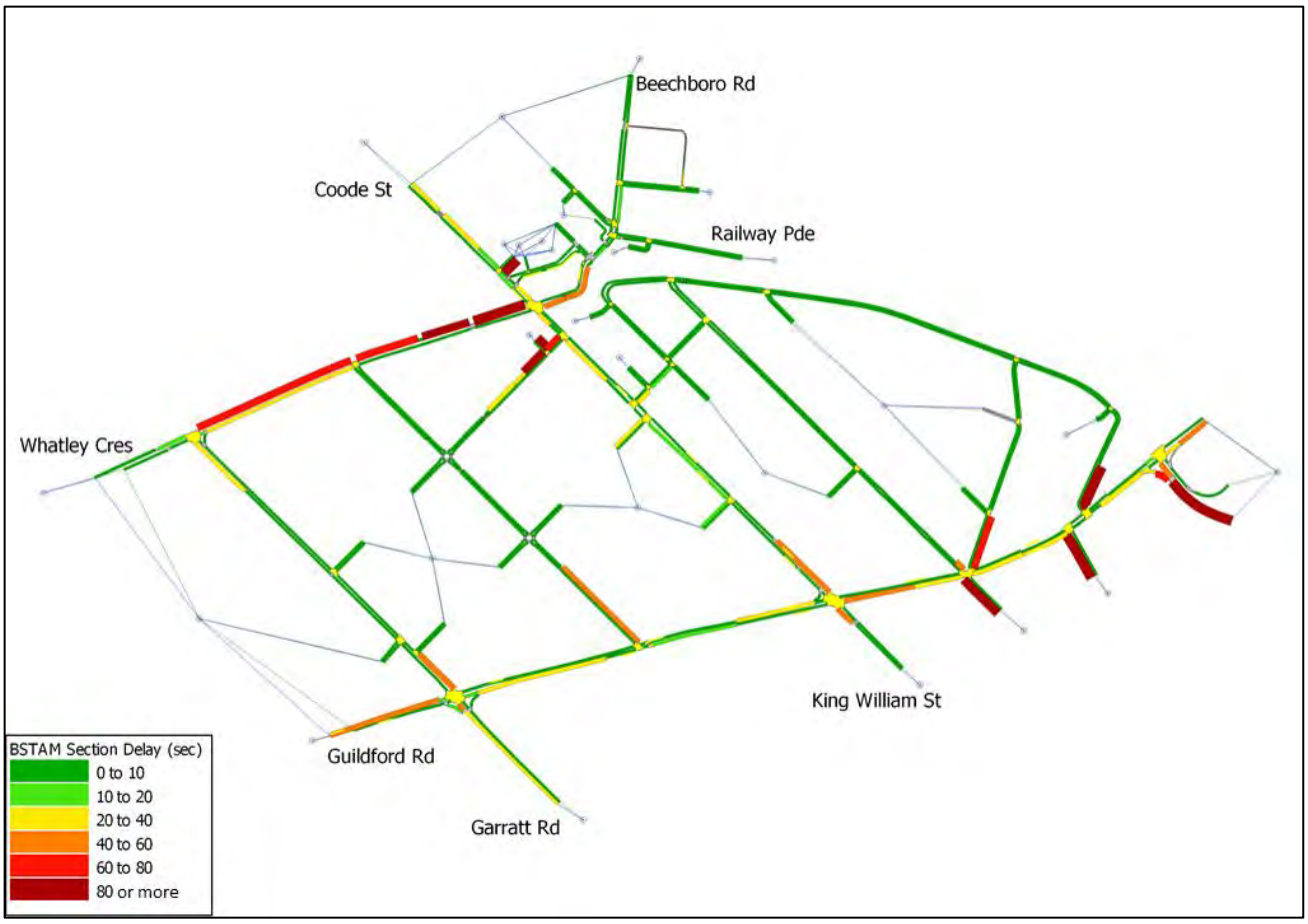


Figure 4.30 Delay in the AM peak in the year 2031

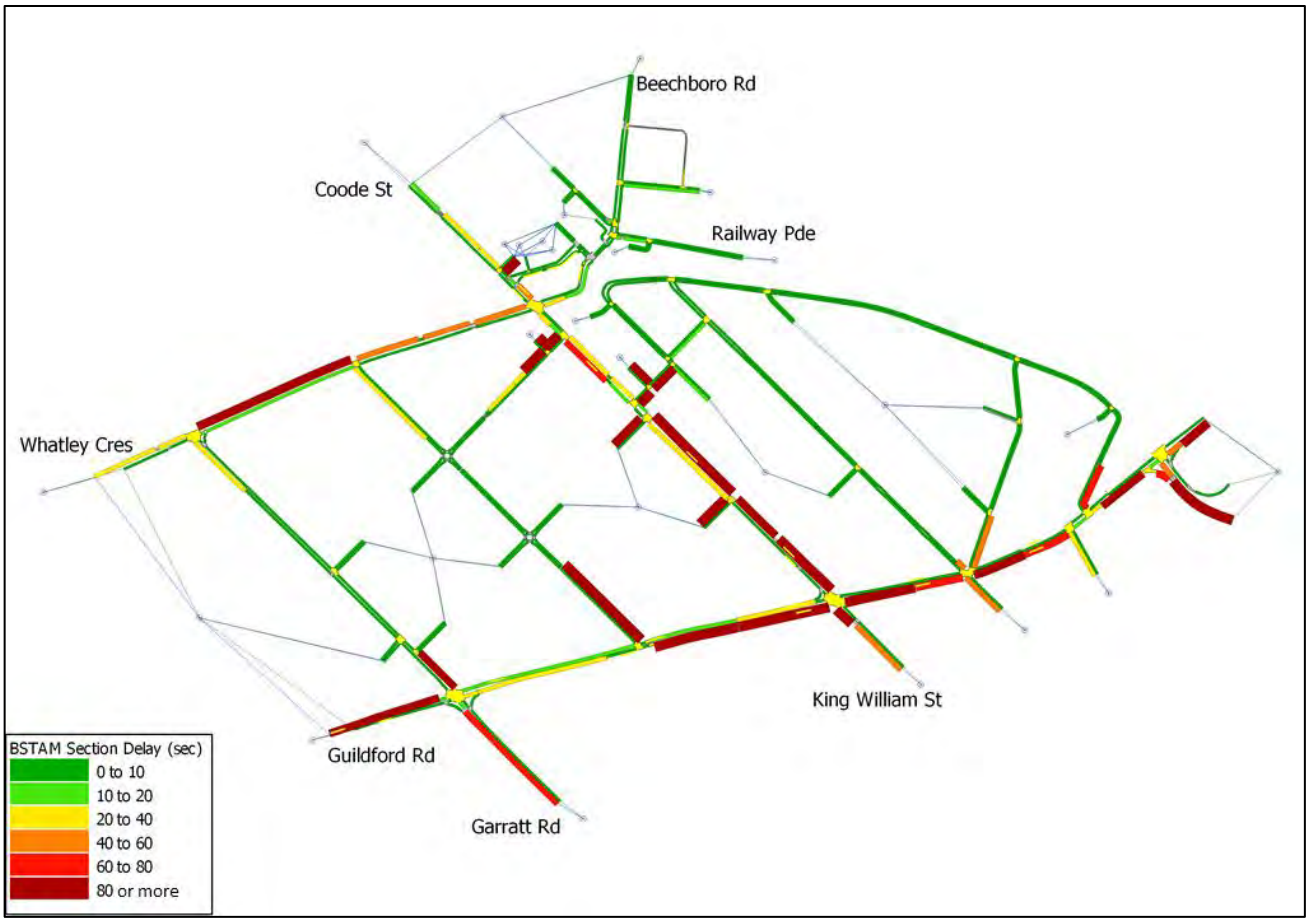


Figure 4.31 Delay in the PM peak in the year 2031

The delays in both the AM and PM peaks in the year 2031 are generally in the same pattern as those observed in the 2021 and 2026 model, only aggravated.

In the AM peak, the highest delays are forecast to be experienced on several minor and major approaches to Guildford Road. This is due to heavy traffic flow along Guildford Road itself which reaches capacity. Congestion on Whatley Crescent eastbound extends towards Garratt Road, with congestion on Murray Street also worsening due to the induced rat-running.

In the PM peak, the congestion along Guildford Road westbound has worsened such that network breakdown occurs, with 20% of the demand unable to enter the modelled area within the modelled time period, with the latent demand primarily originating from Guildford Road east. Other points of latent demand occur at the model entry points of Guildford Road west, Garratt Road south, and Whatley Crescent west. As traffic flow on Guildford Road breaks down, heavy congestion and queues propagate north along King William Street, impacting the intersecting minor roads from accessing the main road as well as the signalised intersection with Whatley Crescent.

4.6.3 INTERSECTION PERFORMANCE

In general, the intersection statistics and results discussed for 2021 and 2026 are exacerbated in the 2031 microsimulation model. Therefore, only the intersections which exceed the performance threshold in 2031 that did not in 2021 or 2026 are reported on.

4.6.3.1 RAILWAY PARADE / BEECHBORO ROAD

The intersection layout of Railway Parade / Beechboro Road South is shown in Figure 4.32.

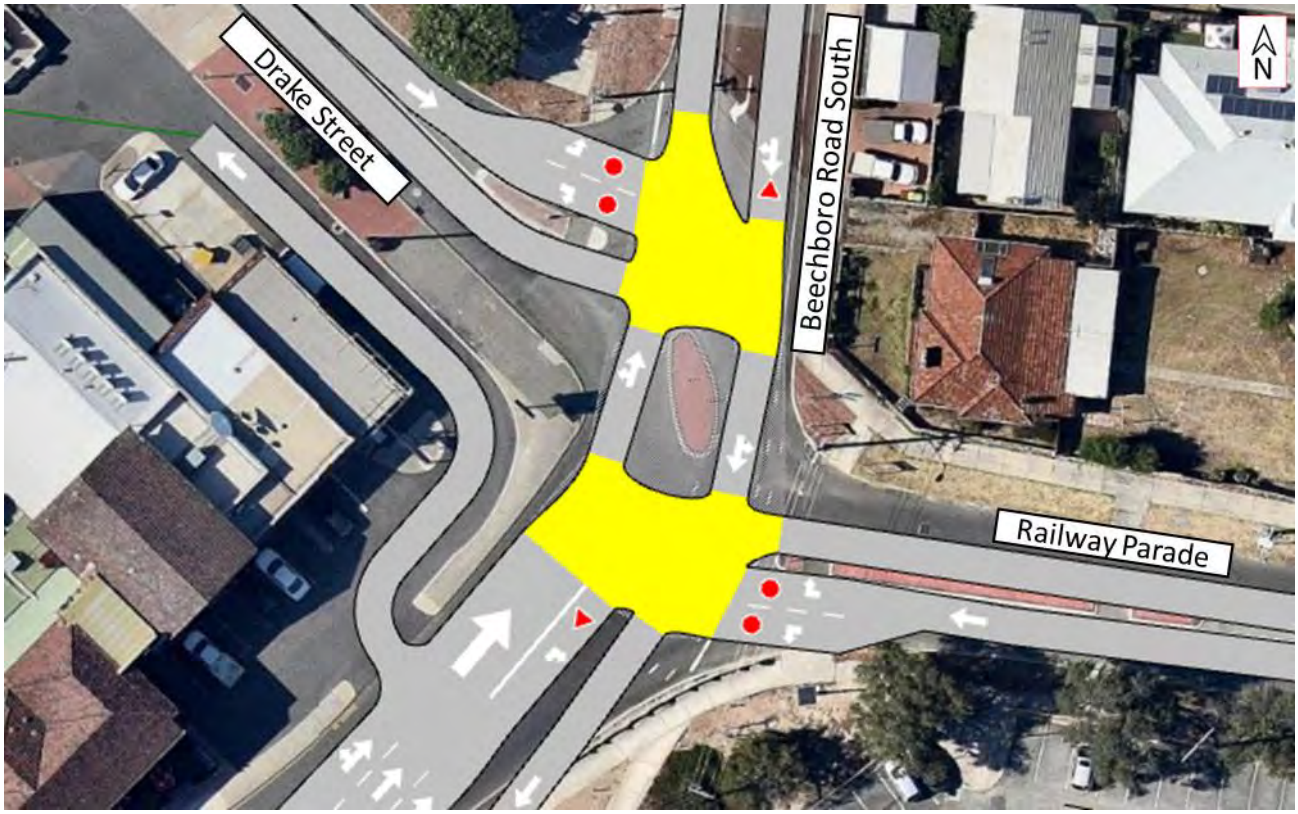


Figure 4.32 Railway Parade / Beechboro Road intersection layout

Table 4.22 and Table 4.23 show the approaches and movements which are forecast to operate at a LOS worse than D in the PM peak.

Table 4.22 PM Railway Parade / Beechboro Road LOS results (where LOS is worse than D)

Road	Approach	Movement	2031
Drake Street	West	Right Turn	E

Table 4.23 PM Railway Parade / Beechboro Road LOS results (where LOS is worse than D)

Road	Approach	Movement	2031
Railway Parade	East	Through Right Turn	E F

Turn movement from the Drake Street and Railway Parade approaches are forecast to operate at LOS E and F for the AM and PM peaks respectively. This is due to downstream blocking on Beechboro Road South from the King William Street / Whatley Crescent intersection. As a result, traffic from these approaches is unable to enter Beechboro Road South, as shown in Figure 4.33 below.

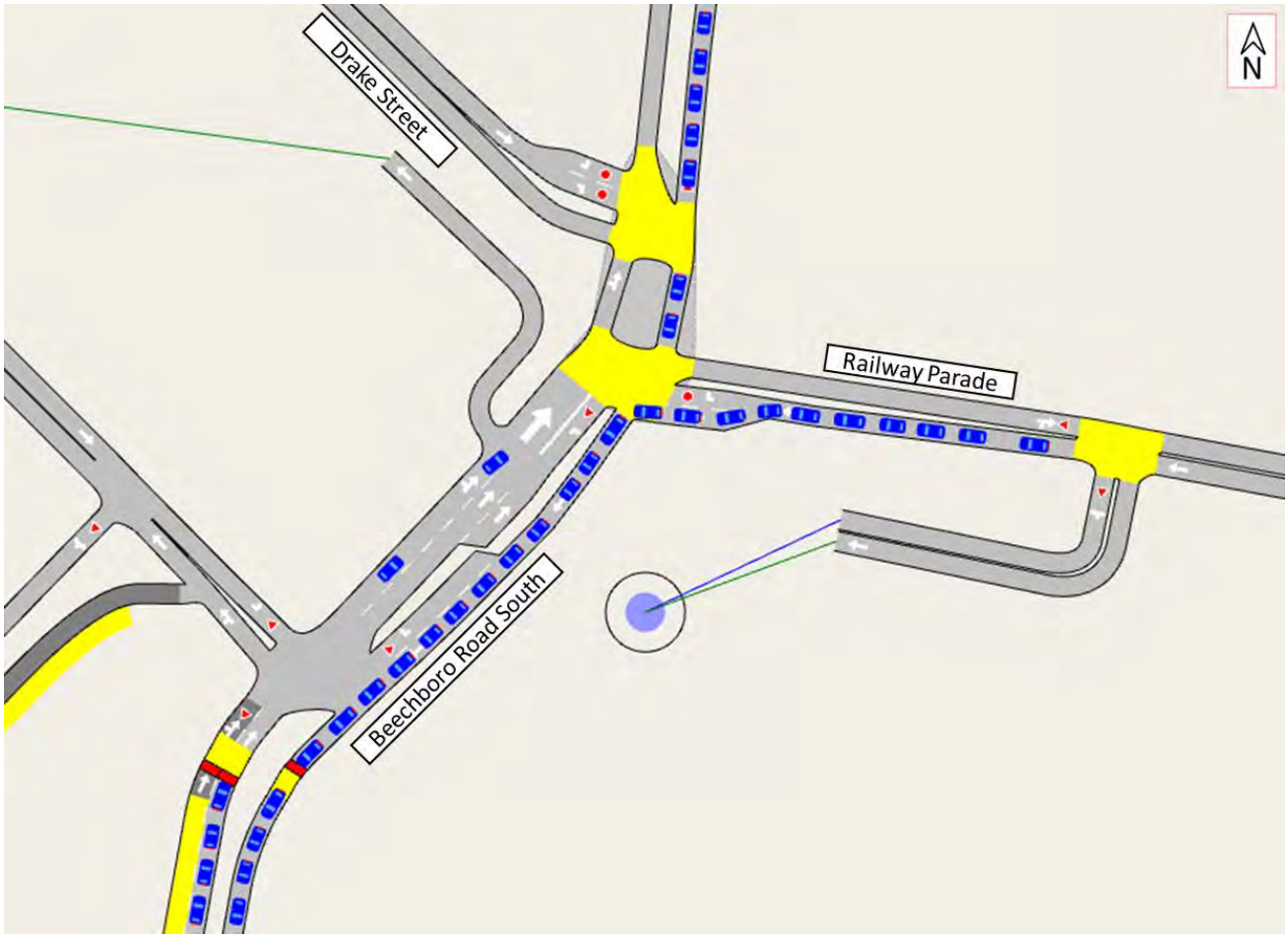


Figure 4.33 Queuing at the Railway Parade / Beechboro Road South intersection in the PM peak

4.6.4 TRAVEL TIME

The travel time results for each route in the year 2031 are shown in Table 4.24.

Table 4.24 Travel time results and comparison to 2026 base model travel times

Travel Time	AM			PM		
Route	2026	2031	Difference	2019	2031	Difference
Green (EB)	2 min 55 sec	3 min 5 sec	+10 sec	3 min 59 sec	4 min 45 sec	+46 sec
Green (WB)	5 min 13 sec	5 min 34 sec	+21 sec	10 min 33 sec	15 min 38 sec	+5 min 5 sec
Blue (NB)	2 min 7 sec	2 min 32 sec	+25 sec	5 min 16 sec	4 min 10 sec	-1 min 6 sec
Blue (SB)	2 min 39 sec	2 min 42 sec	+3 sec	5 min 24 sec	12 min 41 sec	+7 min 17 sec
Red (EB)	4 min 35 sec	7 min 31 sec	+2 min 56 sec	4 min 25 sec	6 min 21 sec	+1 min 56 sec
Red (WB)	3 min 35 sec	4 min 51 sec	+1 min 16 sec	2 min 43 sec	3 min 5 sec	+22 sec
TOTALS			+5 min 11 sec			+14 min 19 sec

In the AM Peak, average travel times are generally forecast to increase between the 2026 and the 2031 project case. Average travel times along Whatley Crescent and Beechboro Road (red) increase by over one minute, due to increased demand in 2031. Average travel times for Guildford Road (green) and King William Street (blue) show marginal increases as these roads are already heavily congested in 2026 such that the increased demand in 2031 does not impact travel much greater than its previous levels in 2026. However, note that increased demand in 2031 is still reflected in the model as latent demand, as shown in Section 4.3.

In the PM peak, average travel times are also generally forecast to increase, except most notably for the northbound Guildford Road to Whatley Crescent (blue) route, which decreases by over a minute. This is due to traffic flow breakdown in the network such that vehicles that intend to travel northbound along King William Street are being held back from doing so or are kept outside of the model. This results in the perceived improvement of travel time on isolated sections of the network, as the improvement only pertains to travel time along a defined road length and not the overall journey time and its impacts to local roads. This is evidenced by increased VHT and rat-running.

In both peaks, the increase in travel time was generally a result of capacity constraints of the right turn movement facilities along Guildford Road westbound and the intersection of Whatley Crescent and King William Street.

5 CONCLUSION

Evolve Bayswater has appointed WSP to provide traffic modelling services associated with the Bayswater Station Upgrade Development Application. This report considers the development of a microscopic simulation transport model of the area around Bayswater Station to analyse the impacts of the proposal across a wider study area, and also to consider the future year scenarios.

The purpose of this transport model is to assess the future year road network performance in 2021, 2026 and 2031 in and around the station and identify impacts associated with network-wide traffic growth, the Bayswater Station Upgrade and potential future developments. A base model was calibrated, validated and reported on in *Bayswater Station Microsimulation Modelling – Base Modelling Report PS113592-TAP-REP-006 RevA, WSP, 2020.* Preliminary modelling for future scenarios was also conducted as reported in *Bayswater Station Microsimulation Modelling – Future Modelling Report PS113592-PAM-REP-007 RevB, WSP, 2020.*

This report documents the future year modelling to the same network extents with the proposed new road and intersection configurations developed in the detailed design of the station development, which is the subject of the Development Application.

The overall network statistics show that as expected, as traffic volumes increase, delay on the network increases and average speed within the network decreases. The overall network statistics also highlight that by the year 2031, the network breaks down due to congestion with all of the demand not being able to enter the network within the modelled hours in either peak.

The integration of the upgraded railway station into the Bayswater Town Centre restricts the space available for road and intersection expansion and therefore the ability to improve the capacity of the road network through the area. In addition, the expansion of the 40km/hr speed zoning through the Town Centre increases the occurrence of rat-running with drivers seeking alternate, faster routes away from the primary routes through the area.

As identified throughout the report, in the future years there exists too much demand to be appropriately accommodated in the network as proposed (including the project and minor Main Roads WA roan network changes). As a consequence, management of the traffic capacity of the modelled network will need to focus on improvements to traffic capacities within the wider network rather than changes to the project road designs.

It is recommended that the issues identified in this report are reviewed and addressed in the next stages of the Bayswater Station Upgrade project, with all key stakeholders including City of Bayswater, Public Transport Authority and Main Roads WA coming together to agree a satisfactory route forward and define what would be an acceptable outcome for the community.

6 LIMITATIONS

This Report is provided by WSP Australia Pty Limited (*WSP*) for Evolve Bayswater (*Client*) in response to specific instructions from the Client and in accordance with WSP's proposal dated 21 August 2020 and agreement with the Client dated 9 September 2020 (*Agreement*).

6.1 PERMITTED PURPOSE

This Report is provided by WSP for the purpose described in the Agreement and no responsibility is accepted by WSP for the use of the Report in whole or in part, for any other purpose (*Permitted Purpose*).

6.2 QUALIFICATIONS AND ASSUMPTIONS

The services undertaken by WSP in preparing this Report were limited to those specifically detailed in the Report and are subject to the scope, qualifications, assumptions and limitations set out in the Report or otherwise communicated to the Client.

Except as otherwise stated in the Report and to the extent that statements, opinions, facts, conclusion and / or recommendations in the Report (*Conclusions*) are based in whole or in part on information provided by the Client and other parties identified in the report (*Information)*, those Conclusions are based on assumptions by WSP of the reliability, adequacy, accuracy and completeness of the Information and have not been verified. WSP accepts no responsibility for the Information.

WSP has prepared the Report without regard to any special interest of any person other than the Client when undertaking the services described in the Agreement or in preparing the Report.

6.3 USE AND RELIANCE

This Report should be read in its entirety and must not be copied, distributed or referred to in part only. The Report must not be reproduced without the written approval of WSP. WSP will not be responsible for interpretations or conclusions drawn by the reader. This Report (or sections of the Report) should not be used as part of a specification for a project or for incorporation into any other document without the prior agreement of WSP.

WSP is not (and will not be) obliged to provide an update of this Report to include any event, circumstance, revised Information or any matter coming to WSP's attention after the date of this Report. Data reported and Conclusions drawn are based solely on information made available to WSP at the time of preparing the Report. The passage of time; unexpected variations in ground conditions; manifestations of latent conditions; or the impact of future events (including (without limitation) changes in policy, legislation, guidelines, scientific knowledge; and changes in interpretation of policy by statutory authorities); may require further investigation or subsequent re-evaluation of the Conclusions.

This Report can only be relied upon for the Permitted Purpose and may not be relied upon for any other purpose. The Report does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise. It is the responsibility of the Client to accept (if the Client so chooses) any Conclusions contained within the Report and implement them in an appropriate, suitable and timely manner.

In the absence of express written consent of WSP, no responsibility is accepted by WSP for the use of the Report in whole or in part by any party other than the Client for any purpose whatsoever. Without the express written consent of WSP, any use which a third party makes of this Report or any reliance on (or decisions to be made) based on this Report is at the sole risk of those third parties without recourse to WSP. Third parties should make their own enquiries and obtain independent advice in relation to any matter dealt with or Conclusions expressed in the Report.

6.4 DISCLAIMER

No warranty, undertaking or guarantee whether expressed or implied, is made with respect to the data reported or the Conclusions drawn. To the fullest extent permitted at law, WSP, its related bodies corporate and its officers, employees and agents assumes no responsibility and will not be liable to any third party for, or in relation to any losses, damages or expenses (including any indirect, consequential or punitive losses or damages or any amounts for loss of profit, loss of revenue, loss of opportunity to earn profit, loss of production, loss of contract, increased operational costs, loss of business opportunity, site depredation costs, business interruption or economic loss) of any kind whatsoever, suffered on incurred by a third party.

APPENDIX A

FUTURE MODELLING OUTPUTS

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS
01 King William St - Murray St	King William St	North	LT				1938	10	N/A
			TH	689	2	A			
			RT	454	20	C			
			Approach	1144	9	A			
			Departure	677					
	King William St	South	LT	100	6	A			
			TH	499	6	A			
			RT						
			Approach	598	6	A			
			Departure	707					
	Murray St	West	LT	178	26	D			
			TH						
			RT	17	53	F			
			Approach	196	27	D			
			Departure	554					
02 Railway Pde - Beechboro Rd S	Beechboro Rd	North	LT	30	1	A	984	1	N/A
			TH	275	1	A			
			RT	24	3	A			
			Approach	340	1	A			
			Departure	343					
	Railway Pde	East	LT	75	6	A			
			TH	13	11	B			
			RT	19	13	B			
			Approach	123	7	A			
			Departure	216					
	Railway Pde	South	LT	15	0	A			
			TH	269	0	A			
			RT	171	1	A			
			Approach	456	0	A			
			Departure	374					
	Drake St	West	LT	0	3	A			
			TH	3	10	A			
			RT	4	12	B			
			Approach	65	9	A			
			Departure	53					
03 Coode St - Railway Pde	Coode St	North	LT	2	-1	A	30	-34	A
			TH	1020	-1	A			
			RT						
			Approach	0	-1	A			
			Departure	0					
	Railway Pde	East	LT	0	-1	A			
			TH						
			RT						
			Approach	30	-1	A			
			Departure	2					
	Coode St	South	LT						
			TH	0	1	A			
			RT	0	1	A			
			Approach	0	1	A			
			Departure	0					
04 King William St - Whatley Crs	Coode St	North	LT	111	17	B	2504	31	C
			TH	939	20	B			
			RT	0	0	A			
			Approach	1050	19	B			
			Departure	451					
	Whatley Crs	East	LT	185	33	C			
			TH	174	33	C			
			RT	0	0	A			
			Approach	359	33	C			
			Departure	577					
	King William St	South	LT	157	18	B			
			TH	357	20	B			
			RT	165	57	E			
			Approach	678	27	C			
			Departure	1145					
	Whatley Crs	West	LT	94	60	E			
			TH	302	62	E			
			RT	21	60	E			
			Approach	417	62	E			
			Departure	330					

NETWORK		
Total Travel Time (hr)	Total Travel Distance (km)	Average Vehicle Speed (km/hr)
434	12,734	32

Delay-based LOS for Signals		
A	Excellent	d ≤ 10
B	Very Good	10 < d ≤ 20
C	Good	20 < d ≤ 35
D	Fair	35 < d ≤ 55
E	Poor	55 < d ≤ 80
F	Very Poor	80 < d

N/A

Intersection LOS values are Not Applicable for priority controlled intersections since average delay is not a good LOS measure due to low delays associated with major road movements

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
05 Guildford Rd - King William St 	King William St	North	LT	291	34	C						
			TH	102	47	D						
			RT	267	69	E						
			Approach	661	50	D						
			Departure	497								
	Guildford Rd	East	LT	51	20	C						
			TH	1505	20	C						
			RT	319	54	D						
			Approach	1876	26	C						
			Departure	1249								
	King William St	South	LT	8	38	D	3680	32	C			
			TH	71	36	D						
			RT	40	67	E						
			Approach	118	47	D						
			Departure	159								
	Guildford Rd	West	LT	107	19	B						
			TH	918	30	C						
			RT	5	34	C						
			Approach	1026	30	C						
			Departure	1780								
06 King William St - Olfe St 	King William St	North	LT	36	5	A						
			TH	670	6	A						
			RT									
			Approach	706	6	A						
			Departure	594								
	Olfe St	East	LT	16	17	C						
			TH									
			RT	86	24	C						
							1332	6	N/A			
			Approach	102	23	C						
			Departure	53								
	King William St	South	LT									
			TH	507	3	A						
			RT	17	2	A						
			Approach	524	3	A						
			Departure	687								
07 Guildford Rd - Slade St 	Slade St	North	LT	14	25	D						
			TH	0	-1	A						
			RT	8	42	E						
			Approach	22	31	D						
			Departure	13								
	Guildford Rd	East	LT	10	0	A						
			TH	1835	2	A						
			RT	11	10	B						
		(to Anzac)	RT	5	12	B						
			Approach	1855	2	A						
			Departure	1245								
	Slade St	South	LT	29	34	D						
			TH	1	70	F						
			RT	13	40	E						
							3195	3	N/A			
			Approach	44	37	E						
			Departure	20								
	Guildford Rd	West	LT	1	8	A						
			TH	1218	2	A						
			RT	11	20	C						
		(to Anzac)	LT	15	0	A						
			Approach	1245	3	A						
			Departure	1884								
	Anzac St	North	LT	14	23	C						
		East	TH									
			RT	15	37	E						
			Approach	29	30	D						
			Departure	20								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
09A Guildford Rd - Newton St S 	Guildford Rd	East	LT	16	1	A	3164	1	N/A			
			TH	1780	0	A						
			RT									
			Approach	1796	0	A						
			Departure	1245								
	Newton St	South	LT	83	15	C						
			TH									
			RT	27	19	C						
			Approach	110	16	C						
			Departure	56								
	Guildford Rd	West	LT									
			TH	1218	1	A						
			RT	39	5	A						
			Approach	1258	1	A						
			Departure	1863								
09B Guildford Rd - Newton St N 	Newton St	North	LT	9	7	A	3050	1	N/A			
			TH									
			RT	26	22	C						
			Approach	35	18	C						
			Departure	11								
	Guildford Rd	East	LT									
			TH	1770	1	A						
			RT	1	1	A						
			Approach	1771	1	A						
			Departure	1243								
	Guildford Rd	West	LT	10	0	A						
			TH	1234	0	A						
			RT									
			Approach	1244	0	A						
			Departure	1796								
10 Railway Pde - Rose Ave 	Rose Ave	North	LT	17	0	A	967	5	N/A			
			TH									
			RT									
			Approach	17	0	A						
			Departure	127								
	Railway Pde	East	LT	0	0	A						
			TH	362	1	A						
			RT	11	3	A						
			Approach	373	1	A						
			Departure	478								
	Railway Pde	West	LT	116	6	A						
			TH	462	8	A						
			RT	0	0	A						
			Approach	578	7	A						
			Departure	361								
11 Whatley Crs - Hamilton St 	Whatley Crs	East	LT	0	-1	A	0	#####	N/A			
			TH	0	-1	A						
			RT									
			Approach	0	-1	A						
			Departure	0								
	Hamilton St	South	LT	0	-1	A						
			TH									
			RT	0	-1	A						
			Approach	0	-1	A						
			Departure	0								
	Whatley Crs	West	LT									
			TH	0	0	A						
			RT	0	0	A						
			Approach	0	0	A						
			Departure	0								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
12 Guildford Rd - Garratt Rd 	Garratt Rd	North	LT	54	52	D	4239	41	D			
			TH	290	53	D						
			RT									
			Approach	421	53	D						
			Departure	263								
	Guildford Rd	East	LT	266	28	C						
			TH	1429	44	D						
			RT									
			Approach	1698	44	D						
			Departure	1112								
	Garratt Rd	South	LT	622	26	C						
			TH	258	67	E						
			RT	172	62	E						
			Approach	1050	65	E						
			Departure	729								
	Guildford Rd	West	LT	5	17	B						
			TH	897	19	B						
			RT	171	132	F						
			Approach	1071	37	D						
			Departure	2120								
13 Whatley Cres - Garratt Rd 	Whatley Crs	East	LT	8	21	C	1724	21	C			
			TH	664	29	C						
			RT									
			Approach	672	29	C						
			Departure	450								
	Garratt Rd	South	LT	218	21	C						
			TH									
			RT	44	53	D						
			Approach	261	26	C						
			Departure	392								
	Whatley Crs	West	LT									
			TH	407	7	A						
			RT	384	19	B						
			Approach	791	13	B						
			Departure	882								
14 Guildford Rd - Roberts St 	Roberts St	North	LT	23	25	D	2974	3	N/A			
			TH									
			RT	52	30	D						
			Approach	74	29	D						
			Departure	227								
	Guildford Rd	East	LT									
			TH	1677	1	A						
			RT	111	10	A						
			Approach	1788	1	A						
			Departure	1018								
	Guildford Rd	West	LT	115	8	A						
			TH	996	4	A						
			RT									
			Approach	1112	4	A						
			Departure	1698								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS
01 King William St - Murray St	King William St	North	LT				1512	47	N/A
			TH	528	2	A			
			RT	211	14	B			
			Approach	739	6	A			
			Departure	723					
	King William St	South	LT	23	62	F			
			TH	522	63	F			
			RT						
			Approach	546	63	F			
			Departure	555					
	Murray St	West	LT	200	144	F			
			TH						
			RT	28	143	F			
			Approach	228	144	F			
			Departure	235					
02 Railway Pde - Beechboro Rd S	Beechboro Rd	North	LT	5	1	A	1454	0	N/A
			TH	14	1	A			
			RT	4	7	A			
			Approach	256	2	A			
			Departure	868					
	Railway Pde	East	LT	8	13	B			
			TH	5	32	D			
			RT	3	31	D			
			Approach	224	20	C			
			Departure	171					
	Railway Pde	South	LT	4	1	A			
			TH	15	0	A			
			RT	9	0	A			
			Approach	929	0	A			
			Departure	348					
	Drake St	West	LT	0	-1	A			
			TH	1	15	C			
			RT	1	18	C			
			Approach	45	13	B			
			Departure	66					
03 Coode St - Railway Pde	Coode St	North	LT	69	-1	A	30	-24	A
			TH	639	-1	A			
			RT						
			Approach	0	-1	A			
			Departure	0					
	Railway Pde	East	LT	0	-1	A			
			TH						
			RT						
			Approach	30	-1	A			
			Departure	69					
	Coode St	South	LT						
			TH	0	1	A			
			RT	0	1	A			
			Approach	0	1	A			
			Departure	0					
04 King William St - Whatley Crs	Coode St	North	LT	67	34	C	2539	74	E
			TH	601	35	D			
			RT	0	0	A			
			Approach	669	35	D			
			Departure	655					
	Whatley Crs	East	LT	108	15	B			
			TH	227	14	B			
			RT	0	0	A			
			Approach	335	15	B			
			Departure	875					
	King William St	South	LT	42	111	F			
			TH	434	97	F			
			RT	246	136	F			
			Approach	722	114	F			
			Departure	739					
	Whatley Crs	West	LT	221	98	F			
			TH	562	95	F			
			RT	30	103	F			
			Approach	814	96	F			
			Departure	269					

NETWORK		
Total Travel Time (hr)	Total Travel Distance (km)	Average Vehicle Speed (km/hr)
594	14,726	29

Delay-based LOS for Signals		
A	Excellent	d ≤ 10
B	Very Good	10 < d ≤ 20
C	Good	20 < d ≤ 35
D	Fair	35 < d ≤ 55
E	Poor	55 < d ≤ 80
F	Very Poor	80 < d

N/A

Intersection LOS values are Not Applicable for priority controlled intersections since average delay is not a good LOS measure due to low delays associated with major road movements

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
05 Guildford Rd - King William St 	King William St	North	LT	215	50	D	3912	38	D			
			TH	76	69	E						
			RT	146	144	F						
			Approach	437	85	F						
			Departure	513								
	Guildford Rd	East	LT	69	10	A						
			TH	1106	11	B						
			RT	220	81	F						
			Approach	1396	22	C						
			Departure	1983								
	King William St	South	LT	14	153	F						
			TH	130	150	F						
			RT	30	253	F						
			Approach	174	168	F						
			Departure	149								
	Guildford Rd	West	LT	163	22	C						
			TH	1737	29	C						
			RT	5	31	C						
			Approach	1905	29	C						
			Departure	1257								
06 King William St - Olfe St 	King William St	North	LT	102	4	A	1148	9	N/A			
			TH	453	3	A						
			RT									
			Approach	555	3	A						
			Departure	541								
	Olfe St	East	LT	12	10	B						
			TH									
			RT	43	24	C						
			Approach	54	21	C						
			Departure	143								
	King William St	South	LT									
			TH	498	14	B						
			RT	41	11	B						
			Approach	539	13	B						
			Departure	465								
07 Guildford Rd - Slade St 	Slade St	North	LT	23	41	E	3473	4	N/A			
			TH	0	32	D						
			RT	18	52	F						
			Approach	42	46	E						
			Departure	39								
	Guildford Rd	East	LT	3	0	A						
			TH	1368	2	A						
			RT	18	24	C						
		(to Anzac)	RT	4	22	C						
			Approach	1393	3	A						
			Departure	1931								
	Slade St	South	LT	17	36	E						
			TH	1	76	F						
			RT	12	45	E						
			Approach	30	41	E						
			Departure	26								
	Guildford Rd	West	LT	19	9	A						
			TH	1880	4	A						
			RT	20	14	B						
		(to Anzac)	LT	63	0	A						
			Approach	1983	4	A						
			Departure	1407								
	Anzac St	North	LT	16	38	E						
		East	TH									
			RT	7	48	E						
			Approach	24	41	E						
			Departure	68								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
09A Guildford Rd - Newton St S 	Guildford Rd	East	LT	23	0	A	3371	1	N/A			
			TH	1336	0	A						
			RT									
			Approach	1359	0	A						
			Departure	1877								
	Newton St	South	LT	58	10	A						
			TH									
			RT	22	20	C						
			Approach	80	13	B						
			Departure	100								
	Guildford Rd	West	LT									
			TH	1855	2	A						
			RT	77	6	A						
			Approach	1932	2	A						
			Departure	1394								
09B Guildford Rd - Newton St N 	Newton St	North	LT	37	23	C	3289	1	N/A			
			TH									
			RT	6	24	C						
			Approach	44	23	C						
			Departure	28								
	Guildford Rd	East	LT									
			TH	1353	1	A						
			RT	14	1	A						
			Approach	1368	1	A						
			Departure	1901								
	Guildford Rd	West	LT	14	0	A						
			TH	1864	0	A						
			RT									
			Approach	1878	0	A						
			Departure	1359								
10 Railway Pde - Rose Ave 	Rose Ave	North	LT	181	6	A	1402	6	N/A			
			TH									
			RT									
			Approach	181	6	A						
			Departure	112								
	Railway Pde	East	LT	0	0	A						
			TH	335	1	A						
			RT	13	5	A						
			Approach	348	2	A						
			Departure	954								
	Railway Pde	West	LT	99	6	A						
			TH	774	8	A						
			RT	0	0	A						
			Approach	873	8	A						
			Departure	335								
11 Whatley Crs - Hamilton St 	Whatley Crs	East	LT	0	-1	A	0	#####	N/A			
			TH	0	-1	A						
			RT									
			Approach	0	-1	A						
			Departure	0								
	Hamilton St	South	LT	0	-1	A						
			TH									
			RT	0	-1	A						
			Approach	0	-1	A						
			Departure	0								
	Whatley Crs	West	LT									
			TH	0	0	A						
			RT	0	0	A						
			Approach	0	0	A						
			Departure	0								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
12 Guildford Rd - Garratt Rd 	Garratt Rd	North	LT	172	90	F	5061	48	D			
			TH	158	62	E						
			RT									
			Approach	370	76	E						
			Departure	858								
	Guildford Rd	East	LT	214	28	C						
			TH	861	66	E						
			RT									
			Approach	1074	66	E						
			Departure	1993								
	Garratt Rd	South	LT	767	22	C						
			TH	851	54	D						
			RT	460	51	D						
			Approach	2084	53	D						
			Departure	515								
	Guildford Rd	West	LT	7	48	D						
			TH	1386	38	D						
			RT	142	102	F						
			Approach	1532	44	D						
			Departure	1659								
13 Whatley Cres - Garratt Rd 	Whatley Crs	East	LT	56	20	B	2308	31	C			
			TH	424	34	C						
			RT									
			Approach	480	34	C						
			Departure	885								
	Garratt Rd	South	LT	571	29	C						
			TH									
			RT	297	52	D						
			Approach	867	37	D						
			Departure	421								
	Whatley Crs	West	LT									
			TH	593	22	C						
			RT	366	32	C						
			Approach	960	26	C						
			Departure	995								
14 Guildford Rd - Roberts St 	Roberts St	North	LT	23	95	F	3303	8	N/A			
			TH									
			RT	39	133	F						
			Approach	63	119	F						
			Departure	321								
	Guildford Rd	East	LT									
			TH	1048	1	A						
			RT	201	23	C						
			Approach	1248	4	A						
			Departure	1894								
	Guildford Rd	West	LT	120	12	B						
			TH	1873	7	A						
			RT									
			Approach	1993	7	A						
			Departure	1074								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS
01 King William St - Murray St	King William St	North	LT				2067	21	N/A
			TH	657	2	A			
			RT	496	27	D			
			Approach	1153	13	B			
			Departure	778					
	King William St	South	LT	118	21	C			
			TH	572	23	C			
			RT						
			Approach	690	23	C			
			Departure	673					
	Murray St	West	LT	206	51	F			
			TH						
			RT	17	78	F			
			Approach	223	51	F			
			Departure	613					
02 Railway Pde - Beechboro Rd S	Beechboro Rd	North	LT	30	4	A	1053	3	N/A
			TH	300	5	A			
			RT	21	7	A			
			Approach	362	4	A			
			Departure	378					
	Railway Pde	East	LT	83	8	A			
			TH	15	14	B			
			RT	20	13	B			
			Approach	137	9	A			
			Departure	204					
	Railway Pde	South	LT	21	0	A			
			TH	298	0	A			
			RT	164	1	A			
			Approach	483	0	A			
			Departure	412					
	Drake St	West	LT	1	10	A			
			TH	1	9	A			
			RT	4	13	B			
			Approach	71	11	B			
			Departure	57					
03 Coode St - Railway Pde	Coode St	North	LT	6	-1	A	29	-35	A
			TH	1015	-1	A			
			RT						
			Approach	0	-1	A			
			Departure	0					
	Railway Pde	East	LT	0	-1	A			
			TH						
			RT						
			Approach	29	-1	A			
			Departure	6					
	Coode St	South	LT						
			TH	0	3	A			
			RT	0	3	A			
			Approach	0	3	A			
			Departure	0					
04 King William St - Whatley Crs	Coode St	North	LT	105	19	B	2670	58	E
			TH	936	24	C			
			RT	0	0	A			
			Approach	1040	24	C			
			Departure	504					
	Whatley Crs	East	LT	193	39	D			
			TH	205	40	D			
			RT	0	0	A			
			Approach	398	39	D			
			Departure	608					
	King William St	South	LT	197	36	D			
			TH	405	39	D			
			RT	178	87	F			
			Approach	780	48	D			
			Departure	1153					
	Whatley Crs	West	LT	99	168	F			
			TH	327	171	F			
			RT	25	175	F			
			Approach	452	170	F			
			Departure	402					

NETWORK		
Total Travel Time (hr)	Total Travel Distance (km)	Average Vehicle Speed (km/hr)
691	14,102	25

Delay-based LOS for Signals		
A	Excellent	d ≤ 10
B	Very Good	10 < d ≤ 20
C	Good	20 < d ≤ 35
D	Fair	35 < d ≤ 55
E	Poor	55 < d ≤ 80
F	Very Poor	80 < d

N/A

Intersection LOS values are Not Applicable for priority controlled intersections since average delay is not a good LOS measure due to low delays associated with major road movements

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
05 Guildford Rd - King William St 	King William St	North	LT	267	35	D	4035	52	D			
			TH	109	52	D						
			RT	251	74	E						
			Approach	627	54	D						
			Departure	584								
	Guildford Rd	East	LT	55	47	D						
			TH	1681	51	D						
			RT	381	105	F						
			Approach	2117	61	E						
			Departure	1340								
	King William St	South	LT	12	37	D						
			TH	81	36	D						
			RT	39	67	E						
			Approach	132	45	D						
			Departure	171								
	Guildford Rd	West	LT	123	24	C						
			TH	1035	38	D						
			RT	7	49	D						
			Approach	1160	38	D						
			Departure	1944								
06 King William St - Olfe St 	King William St	North	LT	38	5	A	1394	11	N/A			
			TH	635	5	A						
			RT									
			Approach	673	5	A						
			Departure	687								
	Olfe St	East	LT	16	32	D						
			TH									
			RT	92	44	E						
			Approach	107	42	E						
			Departure	58								
	King William St	South	LT									
			TH	594	13	B						
			RT	20	14	B						
			Approach	613	13	B						
			Departure	651								
07 Guildford Rd - Slade St 	Slade St	North	LT	12	38	E	3538	31	N/A			
			TH	1	37	E						
			RT	27	64	F						
			Approach	41	55	F						
			Departure	16								
	Guildford Rd	East	LT	14	0	A						
			TH	2053	45	E						
			RT	11	75	F						
		(to Anzac)	RT	3	61	F						
			Approach	2078	45	E						
			Departure	1328								
	Slade St	South	LT	28	111	F						
			TH	2	121	F						
			RT	13	133	F						
			Approach	43	118	F						
			Departure	30								
	Guildford Rd	West	LT	4	9	A						
			TH	1302	5	A						
			RT	15	54	F						
		(to Anzac)	LT	18	0	A						
			Approach	1339	6	A						
			Departure	2126								
	Anzac St	North East	LT	14	43	E						
			TH									
			RT	24	60	F						
			Approach	38	54	F						
			Departure	22								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
09A Guildford Rd - Newton St S 	Guildford Rd	East	LT	21	4	A	3497	7	N/A			
			TH	2001	6	A						
			RT									
			Approach	2024	6	A						
			Departure	1327								
	Newton St	South	LT	102	78	F						
			TH									
			RT	30	93	F						
			Approach	133	82	F						
			Departure	63								
	Guildford Rd	West	LT									
			TH	1297	1	A						
			RT	42	10	B						
			Approach	1340	1	A						
			Departure	2093								
09B Guildford Rd - Newton St N 	Newton St	North	LT	8	122	F	3362	15	N/A			
			TH									
			RT	26	165	F						
			Approach	35	155	F						
			Departure	11								
	Guildford Rd	East	LT									
			TH	2000	22	C						
			RT	0	21	C						
			Approach	2001	22	C						
			Departure	1324								
	Guildford Rd	West	LT	10	0	A						
			TH	1316	0	A						
			RT									
			Approach	1327	0	A						
			Departure	2026								
10 Railway Pde - Rose Ave 	Rose Ave	North	LT	22	0	A	1043	7	N/A			
			TH									
			RT									
			Approach	22	0	A						
			Departure	132								
	Railway Pde	East	LT	0	0	A						
			TH	402	6	A						
			RT	10	4	A						
			Approach	412	6	A						
			Departure	509								
	Railway Pde	West	LT	122	7	A						
			TH	486	8	A						
			RT	0	0	A						
			Approach	608	8	A						
			Departure	402								
11 Whatley Crs - Hamilton St 	Whatley Crs	East	LT	0	-1	A	0	#####	N/A			
			TH	0	-1	A						
			RT									
			Approach	0	-1	A						
			Departure	0								
	Hamilton St	South	LT	0	-1	A						
			TH									
			RT	0	-1	A						
			Approach	0	-1	A						
			Departure	0								
	Whatley Crs	West	LT									
			TH	0	0	A						
			RT	0	0	A						
			Approach	0	0	A						
			Departure	0								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
12 Guildford Rd - Garratt Rd 	Garratt Rd	North	LT	64	60	E	4645	54	D			
			TH	339	55	E						
			RT									
			Approach	501	56	E						
			Departure	272								
	Guildford Rd	East	LT	260	52	D						
			TH	1568	72	E						
			RT									
			Approach	1831	72	E						
			Departure	1251								
	Garratt Rd	South	LT	667	33	C						
			TH	264	68	E						
			RT	169	62	E						
			Approach	1095	65	E						
			Departure	778								
	Guildford Rd	West	LT	7	24	C						
			TH	1032	22	C						
			RT	178	167	F						
			Approach	1218	43	D						
			Departure	2328								
13 Whatley Cres - Garratt Rd 	Whatley Crs	East	LT	37	24	C	1911	23	C			
			TH	702	32	C						
			RT									
			Approach	740	32	C						
			Departure	508								
	Garratt Rd	South	LT	223	22	C						
			TH									
			RT	43	53	D						
			Approach	266	27	C						
			Departure	472								
	Whatley Crs	West	LT									
			TH	470	8	A						
			RT	435	21	C						
			Approach	906	15	B						
			Departure	927								
14 Guildford Rd - Roberts St 	Roberts St	North	LT	22	30	D	3283	4	N/A			
			TH									
			RT	53	52	F						
			Approach	75	46	E						
			Departure	253								
	Guildford Rd	East	LT									
			TH	1831	1	A						
			RT	126	12	B						
			Approach	1956	2	A						
			Departure	1146								
	Guildford Rd	West	LT	127	9	A						
			TH	1124	5	A						
			RT									
			Approach	1251	5	A						
			Departure	1831								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS
01 King William St - Murray St	King William St	North	LT				1513	65	N/A
			TH	503	2	A			
			RT	258	16	C			
			Approach	761	6	A			
			Departure	705					
	King William St	South	LT	21	94	F			
			TH	526	95	F			
			RT						
			Approach	547	95	F			
			Departure	527					
	Murray St	West	LT	180	206	F			
			TH						
			RT	24	180	F			
			Approach	204	201	F			
			Departure	279					
02 Railway Pde - Beechboro Rd S	Beechboro Rd	North	LT	4	1	A	1516	1	N/A
			TH	6	2	A			
			RT	6	7	A			
			Approach	270	2	A			
			Departure	913					
	Railway Pde	East	LT	13	16	C			
			TH	3	35	D			
			RT	10	35	D			
			Approach	214	22	C			
			Departure	178					
	Railway Pde	South	LT	6	0	A			
			TH	20	1	A			
			RT	11	0	A			
			Approach	981	0	A			
			Departure	353					
	Drake St	West	LT	1	19	C			
			TH	2	23	C			
			RT	1	19	C			
			Approach	51	19	C			
			Departure	72					
03 Coode St - Railway Pde	Coode St	North	LT	48	-1	A	26	-29	A
			TH	718	-1	A			
			RT						
			Approach	0	-1	A			
			Departure	0					
	Railway Pde	East	LT	0	-1	A			
			TH						
			RT						
			Approach	26	-1	A			
			Departure	48					
	Coode St	South	LT						
			TH	0	1	A			
			RT	0	1	A			
			Approach	0	1	A			
			Departure	0					
04 King William St - Whatley Crs	Coode St	North	LT	115	42	D	2599	88	F
			TH	623	38	D			
			RT	0	0	A			
			Approach	738	38	D			
			Departure	648					
	Whatley Crs	East	LT	100	16	B			
			TH	240	15	B			
			RT	0	0	A			
			Approach	340	15	B			
			Departure	917					
	King William St	South	LT	30	119	F			
			TH	429	133	F			
			RT	245	177	F			
			Approach	704	151	F			
			Departure	761					
	Whatley Crs	West	LT	220	114	F			
			TH	557	110	F			
			RT	38	115	F			
			Approach	816	112	F			
			Departure	270					

NETWORK		
Total Travel Time (hr)	Total Travel Distance (km)	Average Vehicle Speed (km/hr)
906	15,028	24

Delay-based LOS for Signals		
A	Excellent	d ≤ 10
B	Very Good	10 < d ≤ 20
C	Good	20 < d ≤ 35
D	Fair	35 < d ≤ 55
E	Poor	55 < d ≤ 80
F	Very Poor	80 < d

N/A

Intersection LOS values are Not Applicable for priority controlled intersections since average delay is not a good LOS measure due to low delays associated with major road movements

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
05 Guildford Rd - King William St 	King William St	North	LT	184	92	F	3878	88	F			
			TH	76	111	F						
			RT	104	296	F						
			Approach	364	154	F						
			Departure	543								
	Guildford Rd	East	LT	54	98	F						
			TH	995	111	F						
			RT	188	187	F						
			Approach	1237	122	F						
			Departure	2090								
	King William St	South	LT	7	152	F						
			TH	137	132	F						
			RT	34	208	F						
			Approach	177	147	F						
			Departure	137								
	Guildford Rd	West	LT	221	48	D						
			TH	1872	53	D						
			RT	7	46	D						
			Approach	2100	53	D						
			Departure	1077								
06 King William St - Olfe St 	King William St	North	LT	113	3	A	1132	43	N/A			
			TH	414	3	A						
			RT									
			Approach	527	3	A						
			Departure	549								
	Olfe St	East	LT	11	61	F						
			TH									
			RT	49	95	F						
			Approach	59	89	F						
			Departure	158								
	King William St	South	LT									
			TH	500	77	F						
			RT	45	63	F						
			Approach	546	76	F						
			Departure	425								
07 Guildford Rd - Slade St 	Slade St	North	LT	38	50	E	3471	34	N/A			
			TH	1	101	F						
			RT	6	47	E						
			Approach	46	51	F						
			Departure	30								
	Guildford Rd	East	LT	3	0	A						
			TH	1252	79	F						
			RT	12	129	F						
		(to Anzac)	RT	4	127	F						
			Approach	1270	80	F						
			Departure	2057								
	Slade St	South	LT	21	37	E						
			TH	4	64	F						
			RT	14	66	F						
			Approach	39	51	F						
			Departure	30								
	Guildford Rd	West	LT	15	9	A						
			TH	1985	6	A						
			RT	24	23	C						
		(to Anzac)	LT	64	0	A						
			Approach	2087	6	A						
			Departure	1264								
	Anzac St	North	LT	19	48	E						
		East	TH									
			RT	7	75	F						
			Approach	27	56	F						
			Departure	69								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
09A Guildford Rd - Newton St S 	Guildford Rd	East	LT	19	10	B	3419	6	N/A			
			TH	1242	11	B						
			RT									
			Approach	1261	11	B						
			Departure	1984								
	Newton St	South	LT	79	17	C						
			TH									
			RT	22	41	E						
			Approach	101	22	C						
			Departure	113								
	Guildford Rd	West	LT									
			TH	1963	2	A						
			RT	94	8	A						
			Approach	2057	2	A						
			Departure	1303								
09B Guildford Rd - Newton St N 	Newton St	North	LT	39	28	D	3303	18	N/A			
			TH									
			RT	7	54	F						
			Approach	45	32	D						
			Departure	28								
	Guildford Rd	East	LT									
			TH	1260	45	E						
			RT	13	32	D						
			Approach	1274	45	E						
			Departure	2007								
	Guildford Rd	West	LT	16	0	A						
			TH	1968	0	A						
			RT									
			Approach	1984	0	A						
			Departure	1265								
10 Railway Pde - Rose Ave 	Rose Ave	North	LT	203	7	A	1473	6	N/A			
			TH									
			RT									
			Approach	203	7	A						
			Departure	118								
	Railway Pde	East	LT	0	0	A						
			TH	341	1	A						
			RT	12	5	A						
			Approach	353	1	A						
			Departure	1014								
	Railway Pde	West	LT	106	8	A						
			TH	810	8	A						
			RT	0	0	A						
			Approach	917	8	A						
			Departure	341								
11 Whatley Crs - Hamilton St 	Whatley Crs	East	LT	0	-1	A	0	#####	N/A			
			TH	0	-1	A						
			RT									
			Approach	0	-1	A						
			Departure	0								
	Hamilton St	South	LT	0	-1	A						
			TH									
			RT	0	-1	A						
			Approach	0	-1	A						
			Departure	0								
	Whatley Crs	West	LT									
			TH	0	0	A						
			RT	0	0	A						
			Approach	0	0	A						
			Departure	0								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
12 Guildford Rd - Garratt Rd 	Garratt Rd	North	LT	179	133	F	5268	61	E			
			TH	199	89	F						
			RT									
			Approach	440	109	F						
			Departure	859								
	Guildford Rd	East	LT	146	35	D						
			TH	768	79	E						
			RT									
			Approach	909	79	E						
			Departure	2213								
	Garratt Rd	South	LT	830	24	C						
			TH	851	57	E						
			RT	478	56	E						
			Approach	2164	56	E						
			Departure	512								
	Guildford Rd	West	LT	7	64	E						
			TH	1585	61	E						
			RT	164	133	F						
			Approach	1755	68	E						
			Departure	1651								
13 Whatley Cres - Garratt Rd 	Whatley Crs	East	LT	110	21	C	2442	32	C			
			TH	422	36	D						
			RT									
			Approach	531	36	D						
			Departure	893								
	Garratt Rd	South	LT	622	31	C						
			TH									
			RT	250	43	D						
			Approach	872	34	C						
			Departure	491								
	Whatley Crs	West	LT									
			TH	660	25	C						
			RT	380	37	D						
			Approach	1039	29	C						
			Departure	1044								
14 Guildford Rd - Roberts St 	Roberts St	North	LT	23	193	F	3322	14	N/A			
			TH									
			RT	19	205	F						
			Approach	41	198	F						
			Departure	296								
	Guildford Rd	East	LT									
			TH	892	1	A						
			RT	176	32	D						
			Approach	1068	6	A						
			Departure	2112								
	Guildford Rd	West	LT	121	21	C						
			TH	2092	15	B						
			RT									
			Approach	2213	15	B						
			Departure	909								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS
01 King William St - Murray St	King William St	North	LT				2111	45	N/A
			TH	650	3	A			
			RT	518	27	D			
			Approach	1167	14	B			
			Departure	777					
	King William St	South	LT	143	27	D			
			TH	552	31	D			
			RT						
			Approach	696	30	D			
			Departure	671					
	Murray St	West	LT	225	238	F			
			TH						
			RT	23	198	F			
			Approach	248	234	F			
			Departure	661					
02 Railway Pde - Beechboro Rd S	Beechboro Rd	North	LT	35	14	B	1112	8	N/A
			TH	330	17	C			
			RT	27	13	B			
			Approach	407	13	B			
			Departure	377					
	Railway Pde	East	LT	82	12	B			
			TH	18	19	C			
			RT	22	16	C			
			Approach	145	13	B			
			Departure	228					
	Railway Pde	South	LT	19	1	A			
			TH	280	0	A			
			RT	178	1	A			
			Approach	477	1	A			
			Departure	438					
	Drake St	West	LT	1	11	B			
			TH	2	10	B			
			RT	6	48	E			
			Approach	83	23	C			
			Departure	65					
03 Coode St - Railway Pde	Coode St	North	LT	9	-1	A	26	-39	A
			TH	1020	-1	A			
			RT						
			Approach	0	-1	A			
			Departure	0					
	Railway Pde	East	LT	0	-1	A			
			TH						
			RT						
			Approach	26	-1	A			
			Departure	9					
	Coode St	South	LT						
			TH	0	5	A			
			RT	0	5	A			
			Approach	0	5	A			
			Departure	0					
04 King William St - Whatley Crs	Coode St	North	LT	113	21	C	2679	84	F
			TH	934	25	C			
			RT	0	0	A			
			Approach	1047	25	C			
			Departure	483					
	Whatley Crs	East	LT	200	47	D			
			TH	216	48	D			
			RT	0	0	A			
			Approach	416	48	D			
			Departure	603					
	King William St	South	LT	211	50	D			
			TH	364	47	D			
			RT	201	102	F			
			Approach	776	60	E			
			Departure	1168					
	Whatley Crs	West	LT	116	302	F			
			TH	290	293	F			
			RT	35	325	F			
			Approach	440	298	F			
			Departure	427					

NETWORK		
Total Travel Time (hr)	Total Travel Distance (km)	Average Vehicle Speed (km/hr)
870	14,513	22

Delay-based LOS for Signals		
A	Excellent	d ≤ 10
B	Very Good	10 < d ≤ 20
C	Good	20 < d ≤ 35
D	Fair	35 < d ≤ 55
E	Poor	55 < d ≤ 80
F	Very Poor	80 < d

N/A

Intersection LOS values are Not Applicable for priority controlled intersections since average delay is not a good LOS measure due to low delays associated with major road movements

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
05 Guildford Rd - King William St 	King William St	North	LT	283	32	C	3968	60	E			
			TH	108	47	D						
			RT	238	75	E						
			Approach	628	51	D						
			Departure	623								
	Guildford Rd	East	LT	48	50	D						
			TH	1494	61	E						
			RT	396	140	F						
			Approach	1938	77	E						
			Departure	1444								
	King William St	South	LT	11	36	D						
			TH	89	36	D						
			RT	42	73	E						
			Approach	141	47	D						
			Departure	161								
	Guildford Rd	West	LT	138	24	C						
			TH	1119	41	D						
			RT	6	39	D						
			Approach	1260	41	D						
			Departure	1744								
06 King William St - Olfe St 	King William St	North	LT	45	4	A	1414	15	N/A			
			TH	625	5	A						
			RT									
			Approach	670	5	A						
			Departure	698								
	Olfe St	East	LT	19	35	D						
			TH									
			RT	78	39	E						
			Approach	97	38	E						
			Departure	70								
	King William St	South	LT									
			TH	621	22	C						
			RT	25	25	C						
			Approach	647	22	C						
			Departure	643								
07 Guildford Rd - Slade St 	Slade St	North	LT	10	45	E	3456	44	N/A			
			TH	2	56	F						
			RT	52	62	F						
			Approach	64	59	F						
			Departure	11								
	Guildford Rd	East	LT	14	0	A						
			TH	1812	72	F						
			RT	6	110	F						
		(to Anzac)	RT	2	132	F						
			Approach	1833	72	F						
			Departure	1443								
	Slade St	South	LT	35	102	F						
			TH	3	152	F						
			RT	18	110	F						
			Approach	57	107	F						
			Departure	27								
	Guildford Rd	West	LT	2	9	A						
			TH	1414	5	A						
			RT	11	66	F						
		(to Anzac)	LT	16	0	A						
			Approach	1443	5	A						
			Departure	1941								
	Anzac St	North	LT	16	58	F						
		East	TH									
			RT	43	78	F						
			Approach	59	73	F						
			Departure	19								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
09A Guildford Rd - Newton St S 	Guildford Rd	East	LT	23	9	A	3378	14	N/A			
			TH	1715	11	B						
			RT									
			Approach	1738	11	B						
			Departure	1468								
	Newton St	South	LT	120	120	F						
			TH									
			RT	63	177	F						
			Approach	183	140	F						
			Departure	75								
	Guildford Rd	West	LT									
			TH	1405	1	A						
			RT	52	13	B						
			Approach	1457	2	A						
			Departure	1835								
09B Guildford Rd - Newton St N 	Newton St	North	LT	9	371	F	3221	31	N/A			
			TH									
			RT	33	369	F						
			Approach	43	369	F						
			Departure	44								
	Guildford Rd	East	LT									
			TH	1705	49	E						
			RT	6	39	E						
			Approach	1711	49	E						
			Departure	1439								
	Guildford Rd	West	LT	38	2	A						
			TH	1429	0	A						
			RT									
			Approach	1468	0	A						
			Departure	1738								
10 Railway Pde - Rose Ave 	Rose Ave	North	LT	27	0	A	1066	12	N/A			
			TH									
			RT									
			Approach	27	0	A						
			Departure	142								
	Railway Pde	East	LT	0	0	A						
			TH	422	18	C						
			RT	12	11	B						
			Approach	435	18	C						
			Departure	501								
	Railway Pde	West	LT	130	6	A						
			TH	474	8	A						
			RT	0	0	A						
			Approach	604	7	A						
			Departure	420								
11 Whatley Crs - Hamilton St 	Whatley Crs	East	LT	0	-1	A	0	#####	N/A			
			TH	0	-1	A						
			RT									
			Approach	0	-1	A						
			Departure	0								
	Hamilton St	South	LT	0	-1	A						
			TH									
			RT	0	-1	A						
			Approach	0	-1	A						
			Departure	0								
	Whatley Crs	West	LT									
			TH	0	0	A						
			RT	0	0	A						
			Approach	0	0	A						
			Departure	0								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
12 Guildford Rd - Garratt Rd 	Garratt Rd	North	LT	68	60	E	4845	50	D			
			TH	389	56	E						
			RT									
			Approach	560	57	E						
			Departure	317								
	Guildford Rd	East	LT	297	30	C						
			TH	1398	45	D						
			RT									
			Approach	1697	45	D						
			Departure	1372								
	Garratt Rd	South	LT	771	40	D						
			TH	311	75	E						
			RT	202	70	E						
			Approach	1281	73	E						
			Departure	866								
	Guildford Rd	West	LT	6	15	B						
			TH	1121	29	C						
			RT	179	245	F						
			Approach	1307	59	E						
			Departure	2268								
13 Whatley Cres - Garratt Rd 	Whatley Crs	East	LT	44	27	C	2016	31	C			
			TH	690	35	D						
			RT									
			Approach	732	35	D						
			Departure	546								
	Garratt Rd	South	LT	264	23	C						
			TH									
			RT	49	68	E						
			Approach	313	30	C						
			Departure	510								
	Whatley Crs	West	LT									
			TH	504	23	C						
			RT	467	36	D						
			Approach	970	29	C						
			Departure	956								
14 Guildford Rd - Roberts St 	Roberts St	North	LT	31	38	E	3231	5	N/A			
			TH									
			RT	72	45	E						
			Approach	103	43	E						
			Departure	268								
	Guildford Rd	East	LT									
			TH	1641	1	A						
			RT	116	15	C						
			Approach	1756	2	A						
			Departure	1251								
	Guildford Rd	West	LT	151	9	A						
			TH	1220	5	A						
			RT									
			Approach	1372	6	A						
			Departure	1697								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS
01 King William St - Murray St	King William St	North	LT				1474	76	N/A
			TH	515	16	C			
			RT	219	24	C			
			Approach	734	18	C			
			Departure	688					
	King William St	South	LT	30	84	F			
			TH	557	84	F			
			RT						
			Approach	588	84	F			
			Departure	526					
	Murray St	West	LT	132	326	F			
			TH						
			RT	20	342	F			
			Approach	152	329	F			
			Departure	250					
02 Railway Pde - Beechboro Rd S	Beechboro Rd	North	LT	4	6	A	1640	1	N/A
			TH	16	6	A			
			RT	5	12	B			
			Approach	307	5	A			
			Departure	989					
	Railway Pde	East	LT	11	34	D			
			TH	5	48	E			
			RT	5	53	F			
			Approach	250	41	E			
			Departure	179					
	Railway Pde	South	LT	6	1	A			
			TH	28	1	A			
			RT	15	1	A			
			Approach	1021	0	A			
			Departure	396					
	Drake St	West	LT	0	7	A			
			TH	1	22	C			
			RT	1	31	D			
			Approach	62	16	C			
			Departure	74					
03 Coode St - Railway Pde	Coode St	North	LT	58	-1	A	22	-31	A
			TH	625	-1	A			
			RT						
			Approach	0	-1	A			
			Departure	0					
	Railway Pde	East	LT	0	-1	A			
			TH						
			RT						
			Approach	22	-1	A			
			Departure	58					
	Coode St	South	LT						
			TH	0	3	A			
			RT	0	3	A			
			Approach	0	3	A			
			Departure	0					
04 King William St - Whatley Crs	Coode St	North	LT	82	51	D	2507	102	F
			TH	564	53	D			
			RT	0	0	A			
			Approach	646	53	D			
			Departure	575					
	Whatley Crs	East	LT	132	27	C			
			TH	248	22	C			
			RT	0	0	A			
			Approach	380	23	C			
			Departure	928					
	King William St	South	LT	18	122	F			
			TH	395	124	F			
			RT	273	160	F			
			Approach	686	140	F			
			Departure	736					
	Whatley Crs	West	LT	180	152	F			
			TH	574	149	F			
			RT	41	151	F			
			Approach	795	149	F			
			Departure	265					

NETWORK		
Total Travel Time (hr)	Total Travel Distance (km)	Average Vehicle Speed (km/hr)
1,163	14,755	19

Delay-based LOS for Signals		
A	Excellent	d ≤ 10
B	Very Good	10 < d ≤ 20
C	Good	20 < d ≤ 35
D	Fair	35 < d ≤ 55
E	Poor	55 < d ≤ 80
F	Very Poor	80 < d

N/A

Intersection LOS values are Not Applicable for priority controlled intersections since average delay is not a good LOS measure due to low delays associated with major road movements

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
05 Guildford Rd - King William St 	King William St	North	LT	167	208	F	3782	137	F			
			TH	66	243	F						
			RT	107	686	F						
			Approach	340	365	F						
			Departure	555								
	Guildford Rd	East	LT	50	151	F						
			TH	823	192	F						
			RT	156	307	F						
			Approach	1030	207	F						
			Departure	2163								
	King William St	South	LT	11	251	F						
			TH	138	233	F						
			RT	37	316	F						
			Approach	187	251	F						
			Departure	121								
	Guildford Rd	West	LT	263	55	E						
			TH	1958	60	E						
			RT	5	66	E						
			Approach	2225	60	E						
			Departure	943								
06 King William St - Olfe St 	King William St	North	LT	108	80	F	1184	61	N/A			
			TH	411	58	F						
			RT									
			Approach	520	63	F						
			Departure	593								
	Olfe St	East	LT	12	165	F						
			TH									
			RT	51	143	F						
			Approach	63	147	F						
			Departure	165								
	King William St	South	LT									
			TH	545	49	E						
			RT	57	51	F						
			Approach	602	50	E						
			Departure	422								
07 Guildford Rd - Slade St 	Slade St	North	LT	45	61	F	3301	59	N/A			
			TH	1	97	F						
			RT	11	80	F						
			Approach	58	66	F						
			Departure	28								
	Guildford Rd	East	LT	3	0	A						
			TH	991	172	F						
			RT	7	241	F						
		(to Anzac)	RT	3	287	F						
			Approach	1004	172	F						
			Departure	2133								
	Slade St	South	LT	23	37	E						
			TH	4	93	F						
			RT	20	53	F						
			Approach	49	49	E						
			Departure	29								
	Guildford Rd	West	LT	17	9	A						
			TH	2056	6	A						
			RT	24	23	C						
		(to Anzac)	LT	67	0	A						
			Approach	2163	6	A						
			Departure	1032								
	Anzac St	North	LT	14	44	E						
		East	TH									
			RT	13	60	F						
			Approach	27	52	F						
			Departure	72								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
09A Guildford Rd - Newton St S 	Guildford Rd	East	LT	19	17	C	3223	10	N/A			
			TH	939	26	D						
			RT									
			Approach	958	26	D						
			Departure	2065								
	Newton St	South	LT	91	23	C						
			TH									
			RT	40	45	E						
			Approach	132	29	D						
			Departure	127								
	Guildford Rd	West	LT									
			TH	2025	2	A						
			RT	108	8	A						
			Approach	2133	2	A						
			Departure	1021								
09B Guildford Rd - Newton St N 	Newton St	North	LT	46	53	F	3089	35	N/A			
			TH									
			RT	7	143	F						
			Approach	53	65	F						
			Departure	39								
	Guildford Rd	East	LT									
			TH	953	107	F						
			RT	18	71	F						
			Approach	971	107	F						
			Departure	2090								
	Guildford Rd	West	LT	21	1	A						
			TH	2044	0	A						
			RT									
			Approach	2065	0	A						
			Departure	960								
10 Railway Pde - Rose Ave 	Rose Ave	North	LT	213	8	A	1537	8	N/A			
			TH									
			RT									
			Approach	213	8	A						
			Departure	109								
	Railway Pde	East	LT	0	0	A						
			TH	380	5	A						
			RT	17	7	A						
			Approach	396	6	A						
			Departure	1049								
	Railway Pde	West	LT	92	8	A						
			TH	836	8	A						
			RT	0	0	A						
			Approach	928	8	A						
			Departure	380								
11 Whatley Crs - Hamilton St 	Whatley Crs	East	LT	0	-1	A	0	#####	N/A			
			TH	0	-1	A						
			RT									
			Approach	0	-1	A						
			Departure	0								
	Hamilton St	South	LT	0	-1	A						
			TH									
			RT	0	-1	A						
			Approach	0	-1	A						
			Departure	0								
	Whatley Crs	West	LT									
			TH	0	0	A						
			RT	0	0	A						
			Approach	0	0	A						
			Departure	0								

Intersection	Road	Approach	Movement	Modelled Flow (veh/hr)	Delay (s)	LOS	Intersection Modelled Flow (veh/hr)	Intersection Delay (s)	Intersection LOS	NETWORK Total Travel Time (hr)	NETWORK Total Travel Distance (km)	NETWORK Average Vehicle Speed (km/hr)
12 Guildford Rd - Garratt Rd 	Garratt Rd	North	LT	164	96	F	5330	81	F			
			TH	178	70	E						
			RT									
			Approach	395	82	F						
			Departure	846								
	Guildford Rd	East	LT	174	25	C						
			TH	637	61	E						
			RT									
			Approach	809	61	E						
			Departure	2351								
	Garratt Rd	South	LT	889	51	D						
			TH	836	99	F						
			RT	600	108	F						
			Approach	2334	102	F						
			Departure	523								
	Guildford Rd	West	LT	9	85	F						
			TH	1613	88	F						
			RT	172	159	F						
			Approach	1793	95	F						
			Departure	1571								
13 Whatley Cres - Garratt Rd 	Whatley Crs	East	LT	77	18	B	2341	46	D			
			TH	392	32	C						
			RT									
			Approach	469	32	C						
			Departure	852								
	Garratt Rd	South	LT	637	32	C						
			TH									
			RT	215	61	E						
			Approach	852	39	D						
			Departure	445								
	Whatley Crs	West	LT									
			TH	653	58	E						
			RT	368	62	E						
			Approach	1020	59	E						
			Departure	1029								
14 Guildford Rd - Roberts St 	Roberts St	North	LT	28	291	F	3344	19	N/A			
			TH									
			RT	20	322	F						
			Approach	48	304	F						
			Departure	298								
	Guildford Rd	East	LT									
			TH	791	1	A						
			RT	153	37	E						
			Approach	944	7	A						
			Departure	2231								
	Guildford Rd	West	LT	147	24	C						
			TH	2205	17	C						
			RT									
			Approach	2351	17	C						
			Departure	809								

Appendix S

Water Management Plan prepared by Evolve Bayswater

PTA

BAYSWATER STATION AND TURNBACK

PTA190037

WATER MANAGEMENT PLAN

BST-EVO-SU-PLN-00003

AUTHORISED TO USE: _____(ALLIANCE MANAGER), DATE: _____

Submit to Client for Review and Approval where required in the Contract (Client to complete one box only):					
❑	Rejected, resubmit	Name:	Sign:		Date:
❑	Endorsed, with comments to add or change	Name:	Sign:		Date:
❑	Endorsed	Name:	Sign:		Date:
A	04/10/2020	Draft - Issued for Comment	K.O'Mara		
Rev	Date	Reason for Issue	Prepared	Checked	Approval

Table of Contents

Compliance and Obligations Register 3
Abbreviations and Acronyms 4
1.0 Introduction 5
1.1 Bayswater Station and Turnback Project 5
1.2 Location 6
1.3 Structure plan, zoning and land use 6
1.4 Purpose of the Water Management Plan 9
1.5 Scope of the Plan 9
2.0 Existing Environment and Site Characteristics 10
2.1.1 Climate 11
2.1.2 Topography 12
2.1.3 Surface Water 12
2.1.4 Geotechnical conditions 12
2.1.5 Groundwater 13
2.1.6 Acid sulphate soils 13
3.0 Design criteria and objectives 13
4.0 Estimated water consumption 14
5.0 Water supply and water conservation and efficiency 14
5.1.1 Options Assessment 15
5.1.1.1 Opportunity Identification 15
5.1.1.2 Decision Making Process 15
5.1.1.3 Design decisions 16
5.1.2 Water efficiency measures 16
5.1.3 Non-potable water measures 16
5.1.4 On-site capture measures 17
6.0 Stormwater and Surface Water Management 17
6.1 Protect ecology: 18
6.2 Protection from flooding: 18
7.0 Groundwater management 18
8.0 Urban amenity, liveability and health 19
9.0 Management of Works 19
10.0 Monitoring Plan 19
11.0 Maintenance Plan 19
12.0 Implementation Plan 20
13.0 Finalisation and Approval of the Plan 20
14.0 References 20

Compliance and Obligations Register

Reference	Description	Section in this Plan
SWTC Book 2: Management Plan Requirements (BST-PTAWA-PM-RPT-00010)		
Section 24.9	The Alliance must utilise information provided by the PTA, and work with the PTA to finalise the following items during Reference Design to the PTA's satisfaction: iv water management strategy options assessment, including considering options for water sensitive urban design, water efficiency and reduced potable water use.	
SWTC Book 3: Part A – Scope of Works (BST-PTAWA-PM-RPT-00013)		
Section 1.4 Table 3, page 44	Water Management Strategy Options Assessment. Required with Reference Design.	
Development Approval		
Condition Number 18	Prior to the commencement of drainage works, a Water Management plan, including compliance with water sensitive urban design principles, must be submitted and approved to the satisfaction of the Western Australian Planning Commission, on the advice of the City of Bayswater and the Department of Water and Environmental Regulation. Once approved, the plan is to be implemented in its entirety thereafter.	
Water Management Plan for METRONET Transport Infrastructure and Stations (PRO-MNO-MET-EN-SOW-0001_0 IFU)		
Whole Document	Definition of the Scope of Work for Water Management Plans for METRONET Transport Infrastructure and Stations	Refer to Appendix XXX

Abbreviations and Acronyms

Term	Definition
AMT	Alliance Management Team
BST	Bayswater Station and Turnout
EnvMgr	Environment Manager
FTE	Full time equivalent
GBCA	Green Building Council of Australia
GSAP	Green Star Accredited Professional
LGA / WALGA	Local Government Authority / WA Local Government Association
MNO	METRONET Office
Mgr	Manager
PTA	Public Transport Authority
SuMgr	Sustainability Manager
SuMP	Sustainability Management Plan
UD Lead	Urban Design Lead

1.0 Introduction

METRONET is the State's vision to integrate transport and land use planning in the State and provide a framework to support sustainable growth of greater metropolitan Perth over the next 50 to 100 years.

Aligned with Commonwealth planning and infrastructure policies and the State's metropolitan growth strategies, *Perth and Peel @ 3.5 million* and *Transport @ 3.5 million*, METRONET Initiatives will deliver around 70 kilometres of new passenger rail and up to 18 new stations.

More than just rail infrastructure works, METRONET recognises the potential for urban intensification in more than 5,000 hectares of land. Planning goes beyond the station forecourts to shape and support development of communities within a walkable distance of 400 metres from a public transport hub.

METRONET Initiatives include approximately 70 kilometres of new heavy passenger rail and 16 new rail stations, which represents the single largest investment in public transport in Perth's history.

The State has prioritised the following METRONET Initiatives:

- Forrestfield – Airport Link;
- Thornlie – Cockburn Link;
- Yanchep Rail Extension;
- Morley – Ellenbrook Line;
- Extension of the Armadale Line to Byford;
- Bayswater Station Upgrade
- New station at Bellevue
- Station upgrade and relocation of Midland Station to Cale Street;
- Extension of the Midland Line to Bellevue; and
- Level crossing removal program.

1.1 Bayswater Station and Turnback Project

The Bayswater Station and Turnback Project as incorporated in the PAA for the Project includes:

- Stage One: The Turnback Works;
- Stage Two: The Bayswater Station Southern Section;
- Stage Three: The Bayswater Station Northern Section;

Stage One: Turnback Works comprises the following:

- New turnback siding between Bayswater and Meltham stations (configured to provide accommodation for 1 x 6 car sets);
- A shunters path (walkway) and a new driver's washroom;
- Relocation of the Leake Street underpass;
- Maintenance of the principle shared path along the southern side of the railway reserve;
- Other Project works including standard station systems, signalling, overhead line electrifications, communications, utility relocations and noise mitigation;

Stage Two: The Bayswater Station Southern Section, comprises the following:

- Two new rail bridges over King William Street, immediately south of the existing railway;
- New station island platform (150m long and 10m wide) complete with associated infrastructure and supported by the railway bridges;
- Provision for the principle shared path on the southern side of the southern railway bridge;
- The first stage of western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts and stairs) and equipment rooms to service railway operations;
- Integrated pedestrian, cyclist, bus and vehicle access into the station and future Bayswater town centre;
- Relocation of the dual gauge tracks and all associated track infrastructure to align with the new platform faces;
- New bus bays and vehicle parking bays;
- Other Project works including standard station systems, signalling, overhead line electrifications, communications, utility relocations and noise mitigation; and
- Landscaping and urban design features within the station precinct.

Stage Three: The Bayswater Station Northern Section comprises the following:

- Demolition of the existing Bayswater station and associated infrastructure.
- A second set of two new rail bridges over King William Street, located immediately north of the first new set of railway bridges delivered as part of Stage One;
- A second island platform (150m long and 10m wide) complete with station infrastructure again supported by the northern pair of railway bridges;
- The second stage of the western and eastern entry buildings complete with fare gates, commuter access to the platforms (lifts and stairs) and retail tenancies:
- Additional station infrastructure to meet the needs of the expanded (four line, four platform face) station;
- Landscaping and urban design features within the station precinct;
- Other Project works including standard station systems, signalling, overhead line electrifications, communications, utility relocations and noise mitigation;
- Completion of new bus bays and vehicle parking bays; and
- Landscaping and urban design features within the station precinct.

1.2 Location

The BST project is in the area surrounding the existing Bayswater Station, between Whatley Crescent and Railway Parade, surrounded by the Bayswater Town Centre as shown in Figure 1.

NOTE: Image to be replaced with higher quality in the PDF version when issued as Rev 0

1.3 Structure plan, zoning and land use

The project site is predominantly contained within the railway and road reserves included in the City of Bayswater Local Planning Scheme 24 and forms a portion of the Planning Control Area 135, which includes land required for the BST project and the METRONET transport program, for which Development Approval was granted in 2019.

Either side of the existing rail corridor, there is a mix of landscaped areas and parking facilities, with a principal shared path located adjacent to the corridor on the southern side as shown in Figure 2. NOTE: Image to be replaced with higher quality in Rev 0

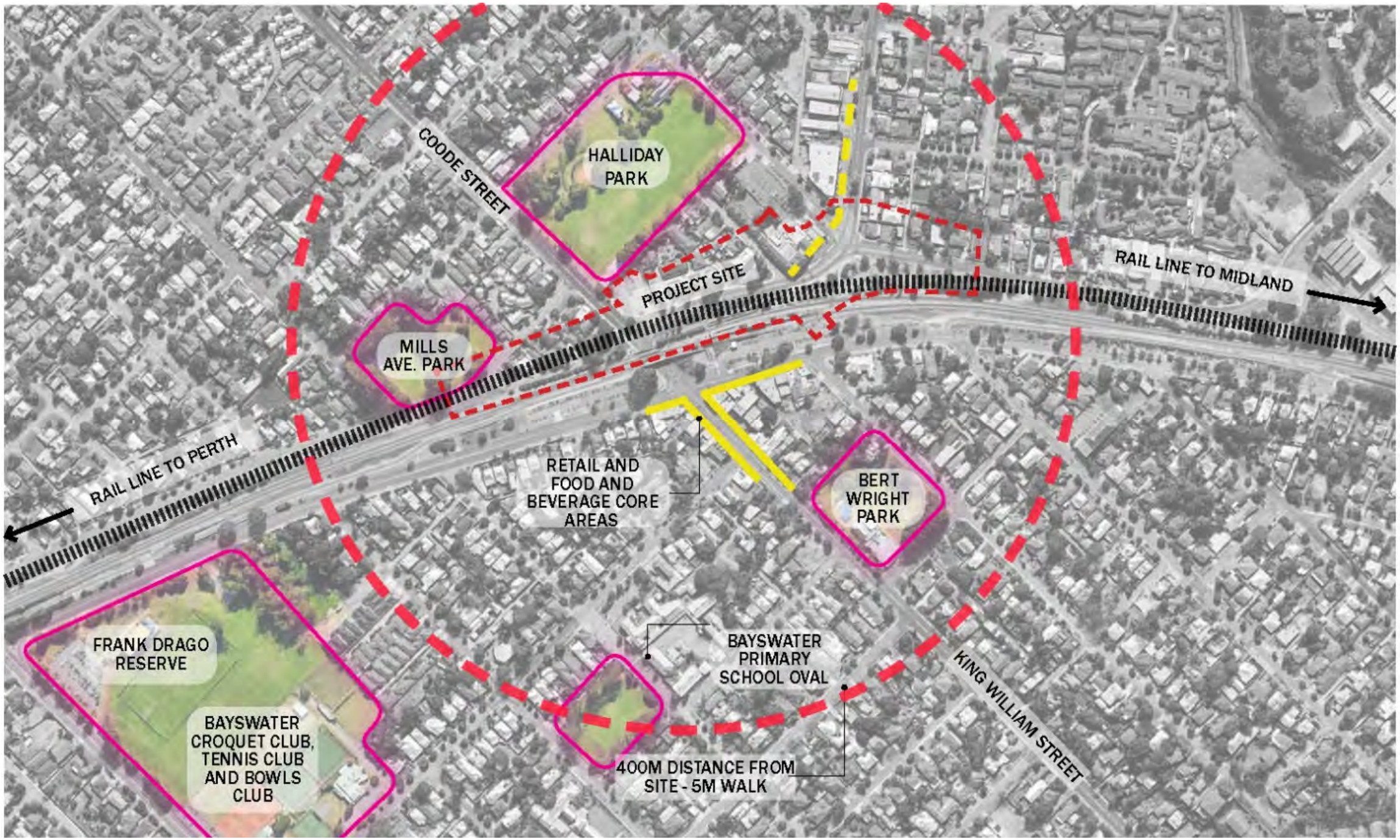


Figure 1 Context

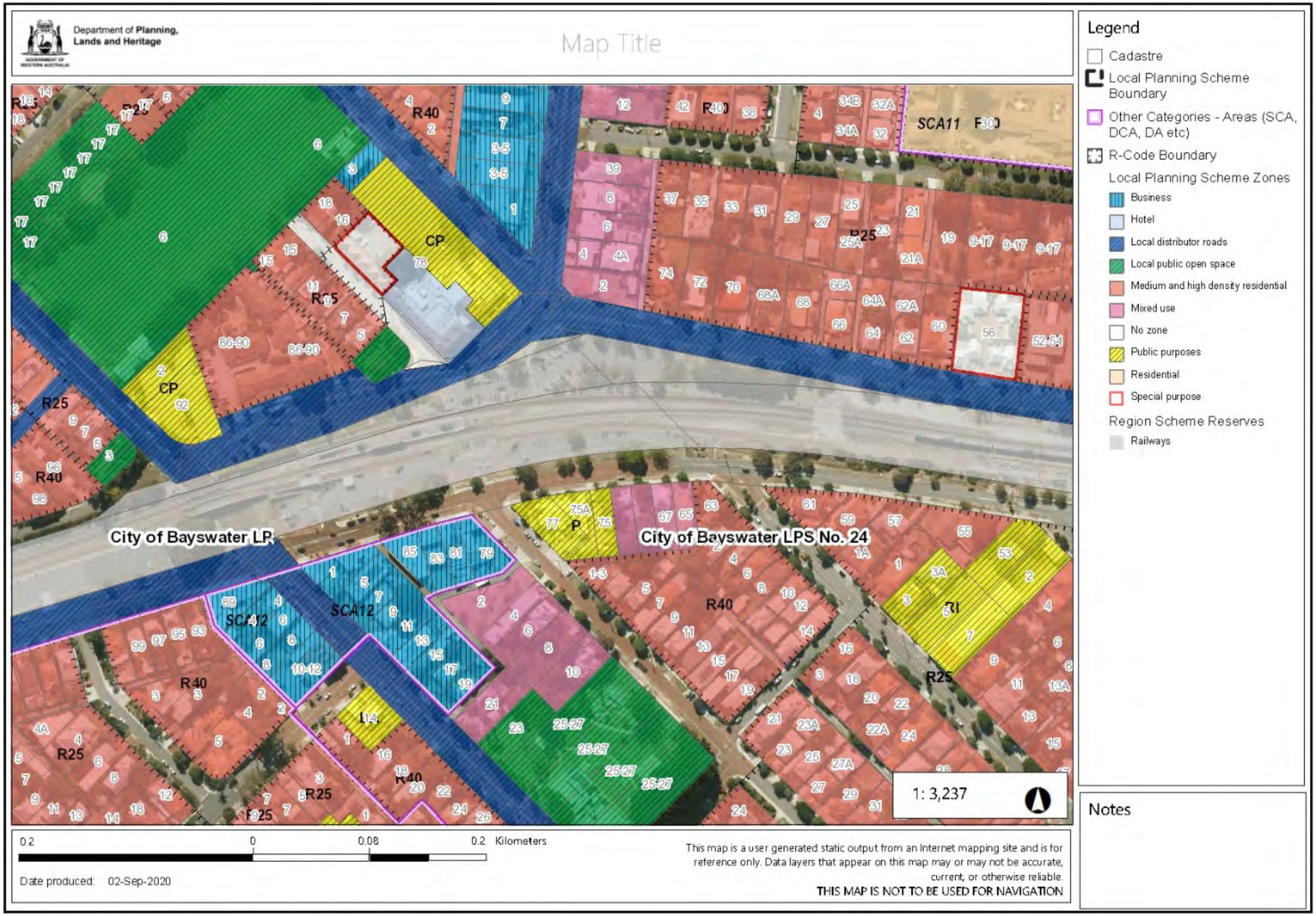


Figure 2 Zoning

1.4 Purpose of the Water Management Plan

The purpose of this plan is to detail the consideration and management of water resources operation of the Bayswater Station as described in **Section 1.1**.

It seeks to identify water consuming activities for spaces managed and operated by the PTA, including the station, the public spaces and facilities as well as tenancy fixtures installed as part of the project for use in operation and .guide the identification and implementation of opportunities in design and operation to:

- Promote water efficiency in the fit out and operation of PTA and tenancy areas.
- Reduce operational water use
- Replace potable water demand with non-potable sources where feasible.

The WMP also includes include:

- Estimates of business as usual operational water consumption by source for scheme, other potable, groundwater and other non-potable water;
- Targets for reducing the annual operational water consumption and for promoting the use of non-potable water beyond business as usual;
- Approach for assessing water management decisions which considers sustainability impact
- Process for monitoring, reporting and tracking performance of initiatives which are implemented during operation; and

1.5 Scope of the Plan

This Water Management Plan is applicable to all areas of land and facilities owned by the PTA, including Tenancies, public realm within the Station and Station carpark.

This plan does not address:

- Water consumed on land owned by, or under the operational control of an entity other than the PTA.
- Water consumed during construction activities which are covered by the Construction Resource Efficiency and Waste Management Plan

2.0 Existing Environment and Site Characteristics

Prior to European Settlement of the Swan River Colony, the land north of Derbarl Yerrigan (Swan River) was Mooro Country, with Yellagonga the elder of the Mooro Clan (Hughes-Hallett, 2010). Following European Settlement, the land including Bayswater Station was part of the land grants established by the settlers and likely to be located on the border between land grants T and U as mapped by Arrowsmith (1842).

A railway station has existed at Bayswater since the mid 1890's[1], with the original location located to the south east of the current station, which was constructed in 1969.

Hold – historical figure of Bayswater Station appropriate source/reference needed: not located in Battye / SLO collection

Figure 3 Bayswater Station circa (Invaderofthethone (aka dekrest-blog-blog))

[1] It is commonly thought that the station was constructed in 1896, but newspaper advertising back as far as April 1894 include reference to the Bayswater railway station along the Perth Guildford line [Bunbury Herald, 1894 http://nla.gov.au/nla.news-article87103900]. Employees of the locomotive workshop were transported to Bayswater in March of 1894, suggesting that some form of Station or siding may have been present. No Station existed as early as March 1893, where a letter to the Editor of the Inquirer and Commercial News commented on the lack of a station at Bayswater http://nla.gov.au/nla.news-page6583368.

2.1.1 Climate

Bayswater Station is located approximately 4km from the Bureau of Meteorology's official Perth Metro Station (Latitude: 31.92 °S, Longitude: 115.87 °E) which is located in the neighbouring suburb of Mount Lawley. Perth has a Mediterranean climate described as having dry summers and wet winters.

The Whadjuk people of the Noongar nation use six seasons to describe the climate of the Perth which provides a more descriptive approach to the climatic changes observed throughout the year as shown in Figure 4.

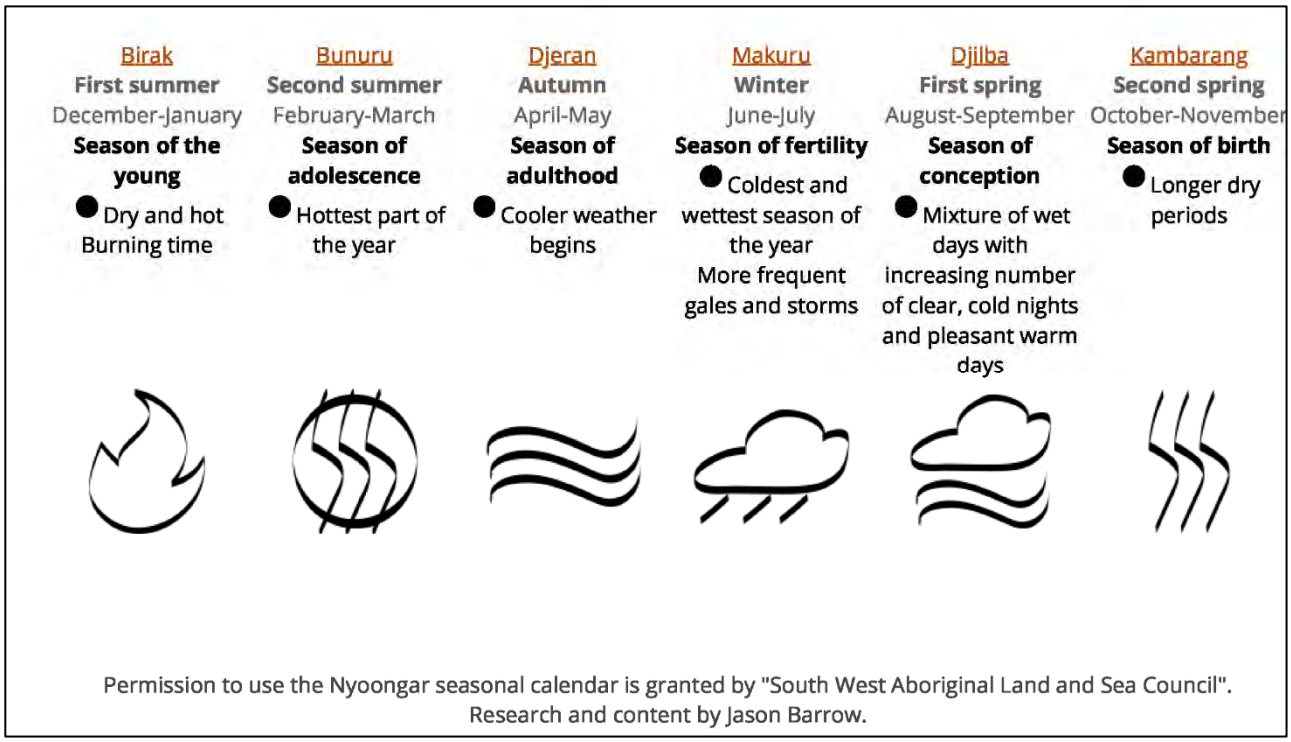


Figure 4 Noongar Calendar (Bureau of Meteorology, n.d.)

Perth has been experiencing a drying climate, with more hot days and changing rainfall which in turn has reduced flows into Water Corporation dams as shown in Figure 5

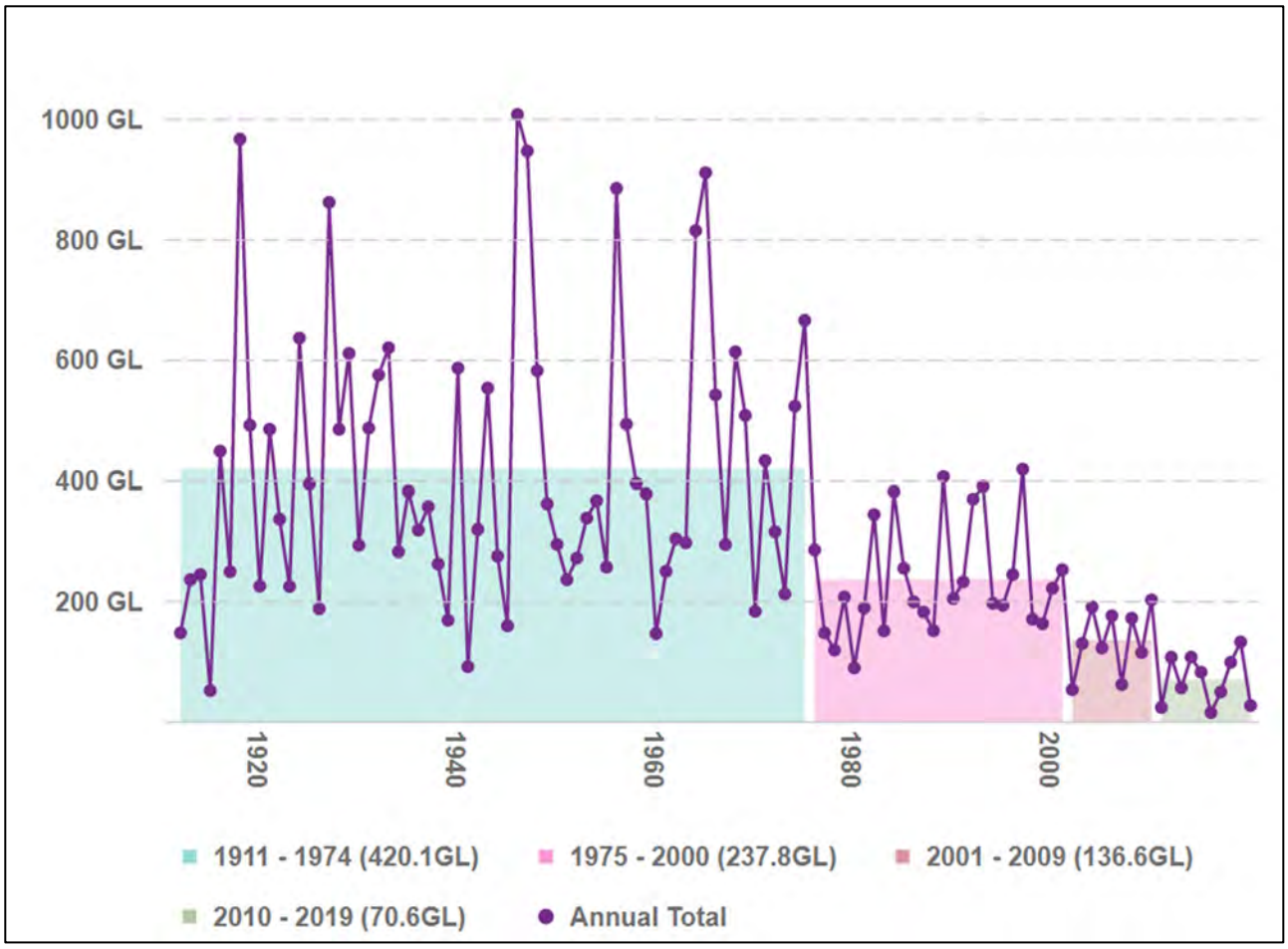


Figure 5 South West of Western Australia streamflow (Water Corporation, n.d.)

2.1.2 Topography

The rail corridor is generally flat although the roads along the southern side of the alignment are also south west of Veitch Street and north east of Hamilton Street where there are highpoints, although there is low point at the location of the intersection of Whatley Crescent and King William Street and into the King William Street Underpass, commonly known as the 'Baysie Bridge'. Railway Parade is lower than the rail corridor until the intersection with Rose Avenue where the Bayswater Hotel is located.

2.1.3 Surface Water

Bayswater Station is not located near any surface water bodies or water dependent ecosystems and is approximately 1.4 km from the Swan River and 1.2km from the 100-year flood fringe area associated with the Eric Singleton Bird Sanctuary and Riverside Gardens. The Bayswater Main Drain is located approximately 1 km to the east of the Station.

2.1.4 Geotechnical conditions

The site is predominantly Bassendean Sands with topsoil, although pockets of peaty clay may be present along Railway Parade although these have not been identified during geotechnical

investigations of the site to date (Golder Associates Pty Ltd, 2019). Bassendean Sands are known to have a high permeability and are generally easy to excavate.

2.1.5 Groundwater

Groundwater within the site is generally of a good quality, slightly acidic to neutral pH, brackish water. No contaminants were identified in ground investigations, although the concentrations of aluminium, iron and total nitrogen are above the regulatory requirements for water released into the environment. As a result, dewatering water may require treatment prior to discharge (Golder Associates Pty Ltd, 2019).

Groundwater levels in the project and surrounding area have lowered as a result of the installation of drains during development of the surrounding area, with more than 1m of change in levels recorded across the project area from late 1950s until the early 1970's as shown in Figure 6 (Golder Associates Pty Ltd, 2019). The 120 year groundwater level for the project has been set at between 13.7 and 16.1 m AHD, which could result in groundwater encroaching the surface in the vicinity of Railway Parade near the turnback (Golder Associates Pty Ltd, 2019).

HOLD – Figure 4 Golders report in PDF version to be included in Rev0

Figure 6 Historical groundwater levels

Groundwater levels are changes in rainfall, with stormwater infiltration significantly influenced by rainfall events as shown in Figure 7

HOLD – Figure 4 Golders report in PDF version to be included in Rev0

Figure 7 Recent groundwater levels

Drains provide an important water management strategy during rainfall events, so it is unlikely that drains will be removed. As such groundwater levels in the long term are unlikely to be at the levels recorded prior to the installation of drains in the 1950's and 1960's. (Golder Associates Pty Ltd, 2019)

2.1.6 Acid sulphate soils

Most of the Site is mapped as Risk Class 2 ‘Moderate to Low Risk’ of Acid Sulfate Soils (ASS) occurring within 3m of natural soil surface but high to moderate risk of ASS beyond 3m of natural soil surface. Some areas at the eastern end of the Site are mapped as Risk Class 1 ‘High to moderate risk’ of ASS occurring within 3m of natural soil surface (DWER, 2018).

3.0 Design criteria and objectives

DRAFT Criteria and Objectives

The BST project is committed to adopting the METRONET Sustainability Strategy (2019) targets of:

- Implementation of water sensitive urban design, conservation measures and reduction in potable water use;
- Monitoring of water consumption across the BST;

- Use of non-potable water for irrigation and phasing out use of irrigation after 2 years; and
- Meeting stakeholder and regulatory requirements in relation to the use and impacts on Stormwater and Groundwater.

4.0 Estimated water consumption

Hold - Pending finalisation of the design and confirmation of irrigation approach.

5.0 Water supply and water conservation and efficiency

HOLD – Pending finalisation of the design and confirmation of irrigation approach.
To include consideration of:

Fit for purpose water use.

Non-potable water demand and supply (Groundwater supply or rainwater harvesting).

Water conservation measures (water efficient fixtures and appliances, waterwise gardens, vegetation retention).

Options confirmed.

Alternative supply schematic and plan (if any) – not likely to be applicable.

Questions

1. Has the station identified the water demand and uses that could be supplemented with non-potable water?
2. Are there irrigation requirements for the station/precinct and how will these be met?
3. Has the potential for rainwater harvest been investigated? Is the investigation documented?
4. If the investigation indicated water harvest is possible, has it been incorporated into the design? To what extent has the potential water harvesting been taken up in design? – limited potential opportunity for rainwater harvesting, but opportunity is still under evaluation.
5. If water harvesting is possible and has not been taken up, has a rationale for its exclusion been developed/provided?
6. Has harvest of greywater been considered? Is it technically possible and has the investigation been documented?
7. Does (or can) the station include the highest Water Efficiency Labelling Standard (WELS) rated fittings and appliances? – *included in design*
8. Are there water quality treatment measures required for the non- potable water supply?
9. Has a waterwise/water efficient approach been taken to any proposed landscaping? If so, has this been documented?

10. Does the station design/landscape incorporate signage to increase public awareness on water conservation and efficiency?

5.1.1 Options Assessment

5.1.1.1 Opportunity Identification

During the design development and construction planning process, a number of sustainability initiatives are expected to be identified by the project team, including through the value management workshops and during the development of the design.

Opportunities will be assessed based on a process and methodology discussed in Section 5.1.1.2.

5.1.1.2 Decision Making Process

In line with the Risk Management Plan (BSTPR-EVO-RI-PLN-00002), Evolve Bayswater's approach to decision making considers the complexity and scope of the decision. This process is summarized in Figure 8, with the minimum decision-making documentation identified along the left hand side.

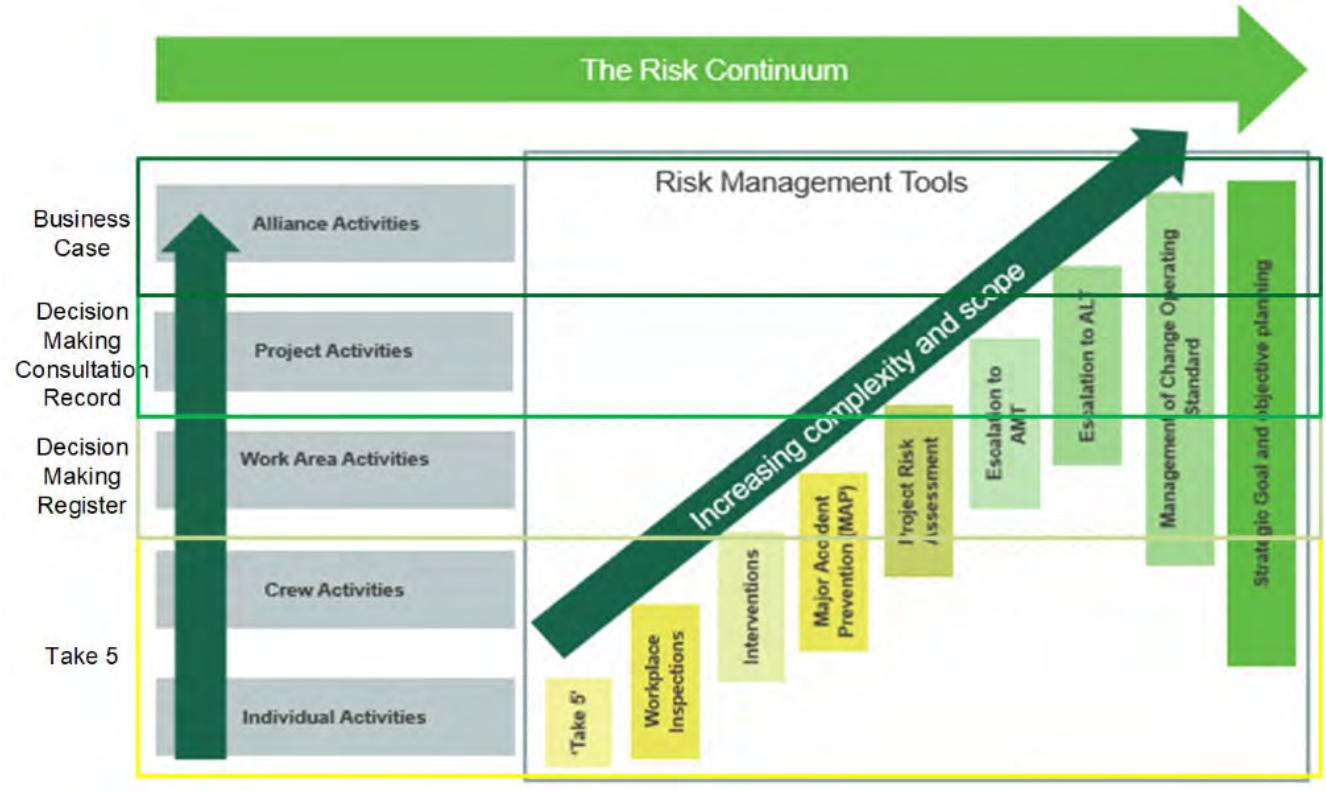


Figure 8 Decision making and risk management interaction

For simple decisions that do not require consultation beyond the crew activities, a Take 5 process can be used to record that safety, quality, environment, community and sustainability factors have been considered as part of the process.

Simple decisions which:

- can be approved by the work area lead must be documented in a Take 5, in correspondence or minutes of meetings.
- require consultation outside of the work area, must be recorded in the Decision-Making Register and need to include comments by the area(s) who need to be consulted with as part of the decision making process.

As the complexity of the decision involves increased complexity or scope or requires at least informing other disciplines then the minimum level of consultation, approval requirements and record keeping associated with the decision increases.

Key decisions which:

- informs the design must be recorded in the Key Decision Making Register and have completed the Decision Making Consultation Record as discussed in Section 5.1.1.3
- requires consultation across areas, or require approval of the AMT lead for the area or the PTA, must be recorded in the Key Decision Making Register and have completed the Decision Making Consultation Record
- requires ALT or PTA approval must be recorded in the Key Decision Making Register and either a Decision Making Consultation Record or a Business Case where there are budget, resourcing or schedule implications.

5.1.1.3 Design decisions

Design decisions which impact the whole of life water footprint for the project, including significant changes to the:

- quantity or type of high impact materials
- construction duration
- maintainability or service life
- operational consumption of energy
- water and materials

must be documented in the Design Decision Register and considered against the Reference Design using an MCA or similar process which assesses both financial and non-financial criteria across the whole of life of the asset.

Where the decision is associated with a water management opportunity or initiative, consultation with the relevant PTA Stakeholders, an MCA process must be undertaken which assesses both financial and non-financial criteria across the whole of life of the asset.

5.1.2 Water efficiency measures

Pending finalisation of the design and confirmation of irrigation approach.

5.1.3 Non-potable water measures

Pending finalisation of the design and confirmation of irrigation approach.

5.1.4 On-site capture measures

Pending finalisation of the design and confirmation of irrigation approach.

6.0 Stormwater and Surface Water Management

HOLD – Pending finalisation of the design. To include consideration of:

1. Does Station and associated areas manage runoff from different size of rainfall events (e.g. small/very frequent/frequent, minor and major) generated within the development area and associated catchment (if any) with detailed design?
2. Have water quality treatment measures been adopted either at source or close to source?
3. Do the water quality treatment measures integrate into the landscape/station design? (e.g. inclusion of appropriately designed tree pits, biofilters, median vegetated swales or vegetated swales in car parks of the stations to treat stormwater runoff before discharging to receiving environments or downstream drainage systems).
4. Have the water quality treatment measures been designed in consideration of Adoption guidelines for stormwater biofiltration systems published by CRC for Water Sensitives Cities and the Stormwater Management Manual for WA?
5. Have any WSUD measures been designed in consideration of the site context and surrounding environment (and local government design standards)? For example, if treatment and infiltration performance of treatment systems is likely to be impacted by high groundwater table, treatment systems to be designed with an appropriate impermeable liner which works as a barrier to elevated groundwater table. And sub-soil drainage or low flow outlets will be required to drain treated runoff from treatment systems.
6. If there is any offsite discharge of stormwater runoff, has an assessment of the capacity of the surrounding area and infrastructure been undertaken?
7. If there is any offsite discharge of stormwater runoff to the surrounding area/ infrastructure has the capacity of both the upstream and downstream system been undertaken to confirm that sufficient capacity exists?
8. Has the detailed design investigated/adopted surface-based (overland flow) conveyance approaches in preference to traditional pit and piped runoff conveyance? If so, has this investigation been documented?
9. Has the ongoing management of the site as a catchment and of any WSUD features been considered?
10. Have the responsibilities for the required catchment/WSUD management/maintenance been documented (and accepted by those responsible).

6.1 Protect ecology:

HOLD – Pending finalisation of the design. To include consideration of:

Management (retention/detention and/or treatment) areas for small rainfall events including their indicative locations; agreed structural and non-structural best management practices and treatment trains; and protection of waterways, groundwater, wetlands (and their buffers), remnant vegetation and ecological linkages (where applicable).

Small event management plan.

Long-section and typical cross- sections.

Manage serviceability, amenity and road safety: Stormwater management systems required for the critical 20/10%AEP storm events (or as specified by service providers/infrastructure managers).

Waterways/wetland maps/plans – N/A.

Minor event management plan.

Long-section and typical cross- sections

.

6.2 Protection from flooding:

HOLD – Pending finalisation of the design. To include consideration of:

Pre-and post-development maximum flood level, peak flow rates and storage volumes for 1% and 1 in 500 AEP events at control points; 1% and 1 in 500 AEP events flow paths and inundation areas; separation of habitable floor level to maximum flood level provided.

1% AEP event management plan.

Long sections and cross-sections of critical flow paths and points.

7.0 Groundwater management

HOLD – Pending finalisation of the design. To include consideration of:

Pre-and Post-development groundwater levels including maximum groundwater levels and control groundwater levels; fill requirements; outlet controls; treatment systems; and subsoils areas.

Groundwater/sub-soil drainage network plan including cross-sections.

1. Is the proximity and quality of groundwater beneath the site known, measured and documented? – addressed in Section 2.1.5
2. Does the site have potential to mobilise polluted groundwater? If so, is the design includes an appropriate treatment measure before discharging to receiving environments? – addressed in Section 2.1.5
3. Does the site have a potential to infiltrate runoff into groundwater?
4. Will quality of runoff be appropriately treated prior to or as a part of infiltration?
5. Are there any landscaped areas and if so, do they adopt a waterwise and low nutrient

approach?

8.0 Urban amenity, liveability and health

HOLD – subject to progression of landscape design
15% design includes consideration of amenity, water sensitive urban design and urban heat island.

To address:

Urban form and vegetation coverage with appropriate tree canopy and vegetated swale/biofilters at station's car parks, access roads and other constructed impervious surfaces of the stations.

Detailed landscape plan - Do landscape features provide/achieve multiple outcomes of water quality treatment, water use reduction, urban amenity, provision of shade/reduction of urban heat island effect?

9.0 Management of Works

Construction Environmental Management Plan (BST-EVO-EN-PLN-00003, CEMP) has been prepared for the project, informed by the Groundwater and Dewatering Assessment prepared by Golders (2019) and includes:

- Dewatering is discussed in Section 18.0
- Acid sulfate soils in Section 15.2
- Dust in Section 22.0.

10.0 Monitoring Plan

The monitoring of stormwater and surface water, including erosion control is addressed in detail in Section 19.0 of the CEMP.

If dewatering is required, these will be monitored in accordance with Section 18.2 of the CEMP.

HOLD – Subject to finalisation of the design and water services. To include:

Monitoring plan including timing, frequency, locations and parameters, together with arrangements for ongoing actions consistent with the DWER monitoring guideline.

Monitoring plan or reference to the separate monitoring plan.

11.0 Maintenance Plan

A Maintenance Plan (BST-EVO-XX-PLN-XXXX) will be prepared by Evolve Bayswater in collaboration with the PTA will include all water services installed as part of the BST project. This includes hydraulic services for the Station and water services installed in the public realm and operated by the PTA, including irrigation.

12.0 Implementation Plan

Measures which are to be implemented into the design of the Bayswater Station and Turnback projects and works being undertaken by Evolve Bayswater as part of the delivery of the BST project are the responsibility of, and funded by, the Alliance.

Where measures are associated with the operation of the Station or PTA owned land, PTA Network and Infrastructure will be responsible for implementation. For third party land, including land owned by the City of Bayswater, responsibility for implementation of measures will be agreed prior to handover of assets.

13.0 Finalisation and Approval of the Plan

Prior to the commencement of drainage works, this water management plan, including compliance with water sensitive urban design principles, will be submitted for approval to the satisfaction of the Western Australian Planning Commission, on the advice of the City of Bayswater and the Department of Water and Environmental Regulation in accordance with the Development Approval Condition 18. Once approved, the plan is to be implemented in its entirety thereafter.

14.0 References

Arrowsmith, J. (1842). *The colony of Western Australia [cartographic material] 1842.* Retrieved from National Library of Australia: http://nla.gov.au/nla.map-rm1994

Bureau of Meteorology. (n.d.). *Indigenous Weather Knowledge: Nyoongar Calendar*. Retrieved from Bureau of Meteorology: http://www.bom.gov.au/iwk/calendars/nyoongar.shtml

Golder Associates Pty Ltd. (2019). *METRONET FAL Bayswater Station and Turnback Project [181004444-001-R-Rev0].*

Government of Western Australia. (2019). *METRONET Sustainability Strategy.*

Green Building Council of Australia. (2020). *Green Star Railway Stations Submissions Guideline v1.1*.

Green Building Council of Australia. (2020). *Green Star Volume Certification Agreement.*

Hughes-Hallett, D. (2010). *Indigenous history of the Swan and Canning Rivers [compilation].* Perth: Swan River Trust.

Invaderofthethone (aka dekrest-blog-blog). (n.d.). *Tumblr .* Retrieved from Bayswater Railway Station - Western Australia 1900: https://dekrest-blog-blog.tumblr.com/post/6657870121

METRONET Program. (2020). *Climate Change Network Vulnerability and Risk Assessment.*

PTA. (2020). *Bayswater Station and Turnback Owners Project Requirements.*

PTA. (2020). *Water Management Pland for METRONET Transport Infrastructure and Stations.*

State Design Review Panel. (2020). *METRONET Implementation Strategy.*

Water Corporation. (n.d.). *Streamflow*. Retrieved from Water Corporation: https://www.watercorporation.com.au/Our-water/Rainfall-and-dams/Streamflow

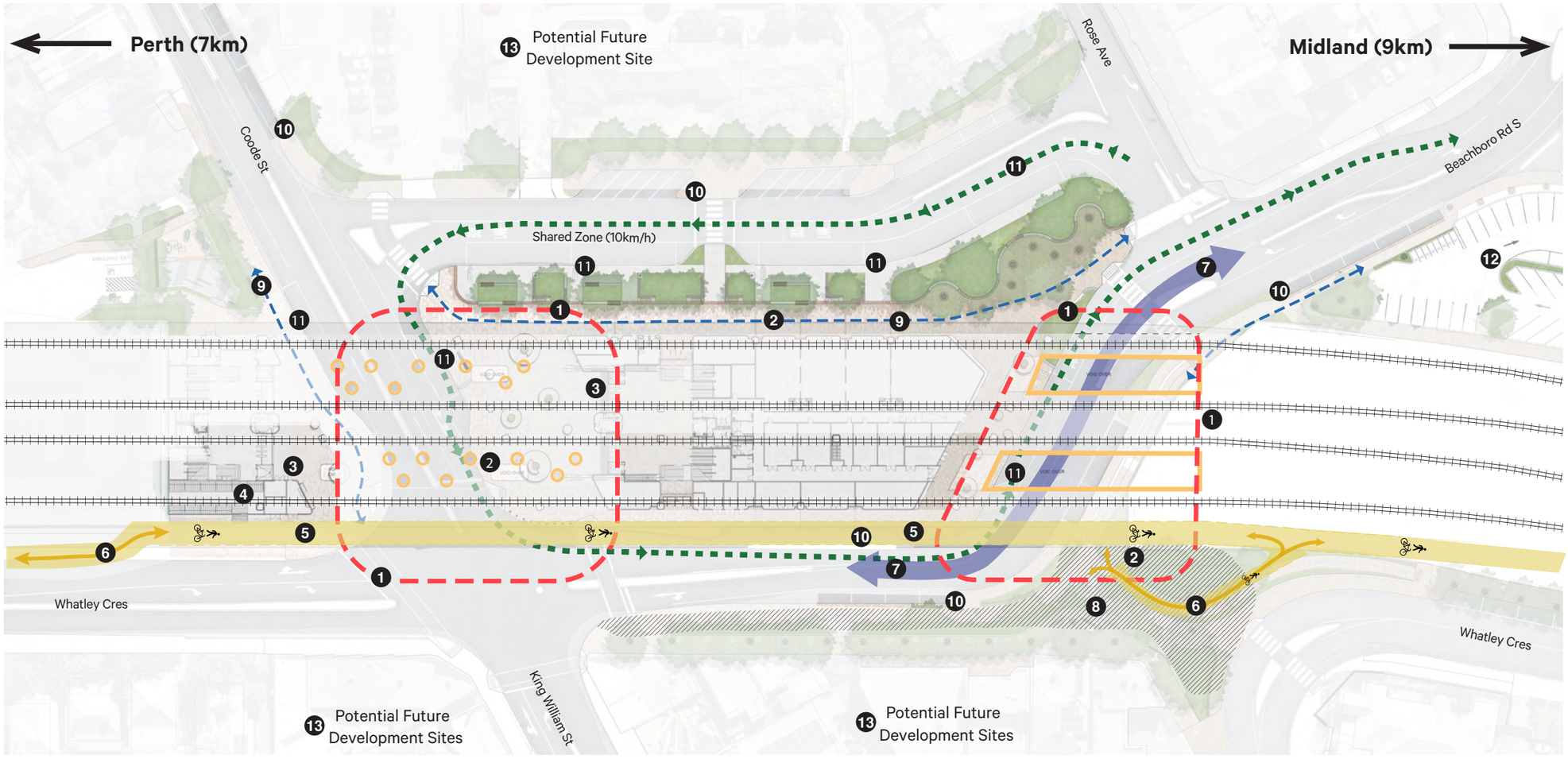
Western Australian Waste Authority. (2019). *Waste Avoidance and Resource Recovery Strategy 2030.*

World Commission on Environment and Development. (1987). *Our Common Future.* Oxford University Press.

Appendix

Appendix T

Design Principles Plan prepared by element in conjunction with Hassell



Guiding Principles

1	Elevate rail line and reduce station footprint • Rail line elevated to 4.8m above road levels • Avoids dangerous vehicle collisions with bridge structure • Earth batters removed extended bridge structures to increase visual connections and reconnect the two sides of the rail line through the site • Enhanced CPTED outcomes through light well structures providing openness, natural light and clear view lines linking public spaces
2	Deliver new public plazas • Pedestrianised environment for informal activity and community events space. • Facilitates safe and direct access between bus services and the station. • Curated space offering multiple opportunities for active and passive use
3	Ensure dual station entries • Improved pedestrian connections to adjoining catchments and integration with bus services
4	Provide integrated secure bicycle storage • Convenient accessible location providing direct access to the station
5	Provide elevated cycle path • Separated from vehicle and pedestrian movements for enhanced safety and efficiency for users
6	Improve cycling connections • Convenient cycle path connections provided to both station entrances
7	Create new road connections in centre • Simplifies movement between northern and southern portions of the town centre • Enables integration of bus services • Improved intersection geometry and through traffic connections, slow vehicle speeds and maintain essential through route
8	Hamilton Street level change • New high quality public space incorporating terraces • Accessible pathway between the station precinct and Hamilton Street
9	Widened footpaths • Improve pedestrian amenity and create opportunities for street level activation
10	Include short term on-street car parking • High turnover to support local businesses and allows for pick up and drop off
11	Integrate bus services on street • Safe uninterrupted access to station
12	Retain open at-grade facilities
13	Protect development site opportunities • Project delivery to ensure opportunities for redevelopment are protected

- Existing rail line will be relocated toward Whatley Crescent to allow construction of four new rail lines. This will accommodate the Midland Line, Forrestfield Airport Link and Morley-Ellenbrook Line. Bayswater will evolve into one of Perth's best connected stations.
- Bridge structures required to reduce station footprint and enable an open high quality design.
- King William Street and Coode Street are to be at same level to improve the public realm, disabled access and drainage. Intersections are to be designed for safe pedestrian use.
- Urban landscape and paving upgrades shall be required to integrate treatments across town centre promoting a consistent theme and connectivity on a precinct wide basis.
- Strong focus on tree planting, shade and seating is required to support micro tenancies, markets and food trucks for community events.
- Station and bridges are to be designed to reduce the visual scale of the infrastructure with strong consideration to emerging sense of place and scale of precinct development opportunities.
- Sustainable design considered for the station and integration with precinct wide initiatives.
- Public art and landscape opportunities to be used to further enhance Aboriginal and European heritage connections in Bayswater.
- Pedestrians shall be prioritised throughout town centre.

Guiding Principles Plan provided to support explanation of the proposal and as a guide to detail design. The plan may be refined as part of the proposed Place Making Plan.

Guiding Design Principles Plan (based on SPP7)

Bayswater Station

Date: 05 Oct 2020 Scale: NTS @A3 Drawing No. **20-362** Staff: LS/TG/DW Checked: MC

element.

Level 18, 191 St Georges Terrace, Perth Western Australia 6000.
PO Box 7375 Cloisters Square, Perth Western Australia 6850.
T. +61 8 9289 8300 | **E.** hello@elementwa.com.au **elementwa.com.au**

element.

the art and science of place

Level 18, 191 St Georges Tce, Perth WA 6000

T. (08) 9289 8300 – **E.** hello@elementwa.com.au

elementwa.com.au