Technical Paper

Contamination

Preliminary Site Investigation

7

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Sydney Metro West - Rail infrastructure, stations, precincts and operations

Technical Paper 7: Contamination - Preliminary Site Investigation

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Glossary and terms of abbreviations

Term	Definition
A	
ACM	Asbestos containing material
AEI	Area of environmental interest
AFFF	Aqueous film forming foam
AHD	Australian height datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ANZAST	Australian and New Zealand and Australian State and Territory Governments
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 2013
AASS	Actual ASS
ASS	Acid sulfate soil
ASSMAC	Acid Sulfate Soils Management Advisory Committee
ASSMP	Acid sulfate soil management plan
AST	Above ground storage tank
B	
bgl	Below ground level
BTEX	Benzene, toluene, ethylbenzene and xylenes
C	
CEMF	Construction environmental management framework
CEMP	Construction environmental management plan
CLM Act	*Contaminated Land Management Act 1997*
CoPC	Contaminant of potential concern
CSM	Conceptual site model
D	
DECC	Former NSW Department of Environment and Climate Change (now OEH)
DECCW	NSW Department of Environment, Climate Change and Water (formerly DECC, but now OEH)
DP	Deposited plan
DUAP	NSW Department of Urban Affairs and Planning
E	
EC	Electrical conductivity
EIL/ESL	Ecological investigation and screening levels
ENM	Excavated natural material
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPA	Environment Protection Authority (NSW Government)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPL	Environment protection licence
G	
GIL	Groundwater investigation level
H	
HEPA	Heads of EPAs Australia and New Zealand
HIL	Health investigation level
HSL	Health screening level

Term	Definition
K	
kL/day	Kilolitres per day
km	Kilometres
L	
LAA	Licensed asbestos assessor
L/s/km	Litres per second per kilometre
LEP	Local environmental plan
LGA	Local government area
LNAPL	Light non aqueous phase liquid
LOR	Limit of reporting
LTEMP	Long Term Environmental Management Plan
M	
m/day	Metres per day
mg/L	Milligrams per litre
mg/kg	Milligrams per kilogram
µg/L	Micrograms per litre
µS/cm	Micro siemens per centimetre
N	
NEPC	National Environment Protection Council
NEMP	National Environmental Management Plan
NEPM	National Environment Protection Measure
O	
OCPs	Organochlorine pesticides
OEMP	Operational environmental management plan
OPPs	Organophosphorus pesticides
P	
PAHs	Polycyclic aromatic hydrocarbons
PASS	Potential ASS
PCBs	Polychlorinated biphenyls
PFAS	Per- and poly- fluoroalkyl substances
PFHxS	Perfluorohexanesulfonic acid
PFOS	Perfluorooctanesulfonic acid
PFOS + PFHxS	The sum of perfluorooctanesulfonic acid and perfluorohexanesulphonic acid
POEO Act	*Protection of the Environment Operations Act 1997* (NSW)
PR	Pathways and receptors
PSI	Preliminary site investigation
R	
RAP	Remedial Action Plan
S	
SAR	Site Audit Report
SAS	Site Audit Statement
SAQP	Sampling, analysis and quality plan
SE	Severity and extent
SEARs	Secretary's environmental assessment requirements
SEPP 55	State Environment Planning Policy No. 55 – Remediation of Land
SVOC	Semi-volatile organic compounds
SWL	Standing water level

Term	Definition
SWMP	Soil and water management plan
T	
TPH	Total petroleum hydrocarbon
TRH	Total recoverable hydrocarbon
U	
UPSS	Underground petroleum storage systems
UST	Underground storage tank
V	
VENM	Virgin excavated natural material
VHC	Volatile halogenated compounds
VOC	Volatile organic compounds

Executive Summary

Sydney Metro West is a new 24-kilometre metro line that will connect Greater Parramatta with the Sydney CBD. Confirmed stations include Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Hunter Street (Sydney CBD).

The project is being assessed as a staged infrastructure application under section 5.20 of the *Environmental Planning & Assessment Act 1979* (EP&A Act). The previous Sydney Metro West planning applications included:

- The Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process, application number SSI-10038), was approved by the Minister for Planning and Public Places on 11 March 2021
- Stage 2 of the planning approval process includes all major civil construction between The Bays and Sydney CBD. An Environmental Impact Statement for major civil construction between The Bays and Sydney CBD was exhibited between 3 November 2021 and 15 December 2021.

Stage 3 of the planning approval process is seeking planning approval to enable the approved Concept to be realised by undertaking the tunnel fit-out, construction of stations, ancillary facilities and station precincts, and operation and maintenance of the Sydney Metro West line (this proposal).

Major civil construction including station excavation and tunnelling work associated with the previous Sydney Metro West planning applications does not form part of this proposal. This proposal includes the activities required to complete construction ready for operations of Sydney Metro West.

This technical paper, Technical Paper 7: Contamination is one of a number of technical papers that form part of the Environmental Impact Statement. The purpose of this technical paper is to identify and assess the potential impacts of this proposal in relation to contamination. It responds directly to the Secretary's environmental assessment requirements.

The study area for this technical paper comprises:

- The construction footprint for this proposal including land within 1 kilometre of the construction footprint
- The tunnel alignment including land within 500 metres of the tunnel alignment.

The construction footprint required for this proposal is the same as the construction footprints required for the previous Sydney Metro West planning applications (Stage 1 and Stage 2), with the exception of additional footprint areas at the following construction sites:

- Westmead metro station
- Sydney Olympic Park
- North Strathfield metro station
- The Bays Station.

The following methodology was conducted for the investigation of contaminated land in the study area:

- A desktop review of available information relevant to the study area was conducted to understand the site history, existing environment and potential risk from existing contamination. The desktop review also considered proposed construction and operational activities to identify potential sources of new contamination, which is defined as contamination that could arise from construction or operation activities carried out as part of this proposal.
- Development of a preliminary conceptual site model for areas of environmental interest (AEIs) identified from the desktop review to assess potential human and/or ecological health risks in the context of this proposal. The conceptual site model was developed assuming no mitigation and based on the proposed construction works for a particular location, which provides a conservative assessment of exposures, enabling a consistent decision on appropriate mitigation measures to be adopted.

- Ranking of the risks by (1) identifying if a pathway between a source and receptor would likely be complete, assuming no mitigation measures other than standard industry construction practices; (2) assessing the severity and extent of the contamination likely or known to be present; and (3) estimating the risk category (very low, low, moderate, high or very high) based on the pathway and receptor completeness and contamination severity and extent.

Development of mitigation measures for AEIs based on the risk ranking for those areas and in consideration of the mitigation measures being implemented as part of the previous Sydney Metro West planning applications. This technical paper has identified and assessed the potential impacts of this proposal in relation to soil and groundwater contamination, acid sulfate soils and salinity . It responds directly to the Secretary's environmental assessment requirements outlined in Section 1.3.1.

The assessment has ranked AEI's at each construction site to address existing contamination and appropriate mitigation measures have been assigned to each construction site to reduce the risk of adverse impacts during construction and operation. The potential impacts from construction and operation activities to acid sulfate soils and salinity were also assessed for each construction site and appropriate mitigation measures assigned.

Uncertainty associated with this proposal includes the actual nature and extent of residual contamination following completion of the works associated with the previous Sydney Metro West planning applications. The additional contaminated land investigations that are to occur during works associated with the previous Sydney Metro West planning applications are expected to address remaining data gaps and provide an adequate understanding of contamination requiring remediation/management during those previous applications. Remediation of contamination, if present, is expected to be managed by previous Sydney Metro West planning applications. Remediation delivered under the previous Sydney Metro West planning applications will ensure protection of human health and the environment during construction and comply with the requirements of the relevant Construction Environmental Management Plan, associated sub-plans and, where applicable, the Remediation Action Plan(s) and requirements of the Site Auditor.

An additional review of residual contaminant concentrations (if present) and groundwater inflow rates is recommended during implementation of this proposal to determine whether additional remediation/management of residual contamination is warranted. The additional review would ensure that any differences between the previous remediation scope and the requirements of this assessment are identified and addressed. It is noted that depending on the nature and extent of residual contamination following completion of the works associated with the previous Sydney Metro West planning applications, the risk ranking of the individual AEIs may change.

The approach to management and mitigation of contamination for this proposal would follow the same process established for the previous Sydney Metro West planning applications, including the relevant conditions of approval (conditions D71 to D78) of SSI-10038. These processes would ensure that residual contamination does not pose a risk to Sydney Metro customers or staff and that the land is suitable for the intended future land use.

Table ES-1 Summary of findings, conclusions and recommendations

Site	Summary of Findings	Conclusions
Westmead metro station	• Five of six AEIs ranked low risk, one ranked moderate risk. • There is low risk for the presence of acid sulfate soils. • Groundwater contamination within the area is expected to be localised and the risk to workers and ecological receptors is considered to be low. Extracted groundwater would be treated to the required discharge quality. • Construction works would also occur within the existing Westmead Station, rail corridor and embankment work.	• For the majority of the site, existing contamination, if present, is expected to be managed by previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • If contamination present in rail corridor and embankment (additional construction footprint associated with this proposal), protection of human health and environment would be managed by standard construction practices as disturbance would be minimal under this proposal.
Parramatta metro station	• Three of four AEIs ranked moderate risk, one ranked low risk. • There is a low probability of potential acid sulfate soils at depths greater than two metres below ground level. Investigations will be undertaken prior to work carried out under the previous Sydney Metro West planning application to inform an acid sulfate soil management plan for construction. • Groundwater contamination within the area is expected to be localised and the risk to workers and ecological receptors is considered to be low. Extracted groundwater would be treated to the required discharge quality. • Subsurface residual soil and groundwater contamination could remain which will be further assessed in accordance with the requirements of the previous Sydney Metro West planning application prior to construction of this proposal.	• Existing contamination, if present, is expected to be managed by previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • There is no additional construction footprint associated with this proposal.
Sydney Olympic Park metro station	• All four AEIs ranked low risk. • There is a high potential for acid sulfate soils in the area. • Excavation required as part of this proposal is not likely to intersect groundwater. • Construction and operation dewatering could potentially impact on the existing gas and leachate control measures for the nearby landfills. • Detailed contamination and groundwater investigations will be undertaken during the work carried out under the previous Sydney Metro West planning application and inform management measures for this proposal.	• No on-site sources of soil or groundwater contamination were identified. • Further investigation of off-site sources will be conducted in accordance with previous Sydney Metro West planning application prior to work under this proposal. • Residual groundwater contamination could remain. • The impact from the operation of Sydney Olympic Park metro station is considered to be low once mitigation measures are implemented.
North Strathfield metro station	• Two of seven AEIs ranked low risk, five ranked moderate risk. • There is low risk for the presence of acid sulfate soils although there is a mapped Class 2 acid sulfate soil risk located 260 metres to the west. • Potentially contaminated groundwater would be extracted during dewatering of the untanked station during construction and operation. This would result in localised changes to groundwater flow and groundwater drawdown. • Investigations will be undertaken during the work carried out under the previous Sydney Metro West planning application to assess the potential impacts and inform if specific mitigation measures are required.	• For the majority of the site. existing contamination, if present, is expected to be managed by previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • There is a potential for ongoing management of contamination of groundwater and vapour (if present) during construction and into operation due to untanked station box. • The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the North Strathfield metro station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant.
Burwood North Station	• One of five AEIs ranked a very low risk, four ranked moderate risk. • There is low risk for the presence of acid sulfate soils although there is a mapped Class 2 acid sulfate soil risk located within 240 metres of the site. • Residual groundwater contamination could remain following the work carried out under the previous Sydney Metro West planning application.	• Existing contamination, if present, is expected to be managed by previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • There is a potential for ongoing management of contaminated groundwater (if present) during construction and into operation. • The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the proposed Burwood North Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant. • There is no additional construction footprint associated with this proposal.
Five Dock Station	• One of five AEIs ranked a very low risk, two ranked low risk and two ranked moderate risk. • There is an extremely low probability of occurrence of acid sulfate soil within the construction site and the immediate surrounds. • Potentially contaminated groundwater would be extracted during dewatering of the untanked shafts during construction.	• Existing contamination, if present, is expected to be investigated and remediated during the previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • There are no anticipated impacts to the operation of Five Dock Station from existing contamination. • The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the proposed Five Dock Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant. • There is no additional construction footprint associated with this proposal.

Site	Summary of Findings	Conclusions
The Bays Station	• Three of six AEIs ranked low risk and three ranked high risk. • The construction site is mapped as disturbed terrain and low probability of occurrence of acid sulfate soils. • Light non aqueous phase liquid was reported in groundwater to the west of the site.	• The station box would be tanked at the completion of construction of this proposal, therefore groundwater drawdown would cease to occur and potential contamination would not impact operation. • Contaminated groundwater encountered during construction would require management during works associated with the previous Sydney Metro West planning applications.
Pyrmont Station	• One of six AEIs ranked a very low risk, four ranked low risk, one ranked moderate risk. • Potential acid sulfate soils could be located within and to the north of the Pyrmont Station eastern site. • Groundwater drawdown could result in potentially contaminated groundwater being drawn towards the Pyrmont Station sites. • The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during the work carried out under the previous Sydney Metro West planning application.	• Off-site sources of groundwater contamination will remain following work carried out under the previous Sydney Metro West planning application. • The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the Pyrmont Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant. • There is no additional construction footprint associated with this proposal.
Hunter Street Station (Sydney CBD)	• All four AEIs ranked low risk. • There is low risk for the presence of acid sulfate soils although there is a mapped Class 2 acid sulfate soil risk located within 200 metres north and 300 metres west of the site. • The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during work carried out under the previous Sydney Metro West planning application.	• Off-site sources of groundwater contamination would remain following the work carried out under the previous Sydney Metro West planning application. Groundwater would continue to be dewatered during construction and operation within the shafts. • The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the Hunter Street (Sydney CBD) Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant. • There is no additional construction footprint associated with this proposal.
Clyde stabling and maintenance facility and Rosehill services facility	• Five of eight relevant AEIs ranked low risk, three ranked moderate risk. • The Clyde stabling and maintenance construction site is mapped as Class 4 acid sulfate soils risk, with a high probability of potential acid sulfate soils at depths greater than two metres below ground level. • The tunnel and dive structures will be tanked within the soil profile and untanked within bedrock.	• Soil and/or groundwater contamination, where present, is expected to be investigated and remediated during the previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • There would likely be a requirement for a long-term environmental management plan to be developed to manage residual soil and monitor groundwater contamination, particularly if the remediation approach includes capping in-situ for contamination encountered during the work carried out under the previous Sydney Metro West planning application. • There is no additional construction footprint associated with this proposal.

1.0 Introduction

1.1 Background

Greater Sydney is expanding and the NSW Government is working hard to deliver an integrated transport system that meets the needs of customers now and in the future. Sydney Metro is Australia's biggest public transport program.

Sydney Metro West is a new 24-kilometre metro line that will connect Greater Parramatta with the Sydney CBD. Stations include Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Hunter Street (Sydney CBD). This infrastructure investment will double the rail capacity of the Greater Parramatta to Sydney CBD corridor with a travel time target between the two centres of about 20 minutes.

The delivery of Sydney Metro West is critical to keeping Sydney moving and is identified in a number of key strategic planning documents including the Greater Sydney Region Plan: A Metropolis of Three Cities – connecting people (Greater Sydney Commission, 2018a), Building Momentum: State Infrastructure Strategy 2018-2038 (Infrastructure NSW, 2018) and Future Transport Strategy 2056 (Transport for NSW, 2018).

Sydney Metro West is being assessed as a staged infrastructure application under section 5.20 of the *Environmental Planning & Assessment Act 1979* (EP&A Act). The previous Sydney Metro West planning applications included:

- The Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process, application number SSI-10038), was approved by the Minister for Planning and Public Places on 11 March 2021.
- Stage 2 of the planning approval process includes all major civil construction between The Bays and Sydney CBD. An Environmental Impact Statement for major civil construction between The Bays and Sydney CBD was exhibited between 3 November 2021 and 15 December 2021.

Stage 3 of the planning approval process is seeking planning approval to enable the approved Concept to be realised by carrying out the tunnel fit-out, construction of stations, ancillary facilities and station precincts, and operation and maintenance of the Sydney Metro West line (this proposal).

Major civil construction including station excavation and tunnelling work associated with the previous Sydney Metro West planning applications does not form part of this proposal. This proposal includes the activities required to complete construction ready for operations of Sydney Metro West.

The main elements of Sydney Metro West are shown in Figure 1-1.

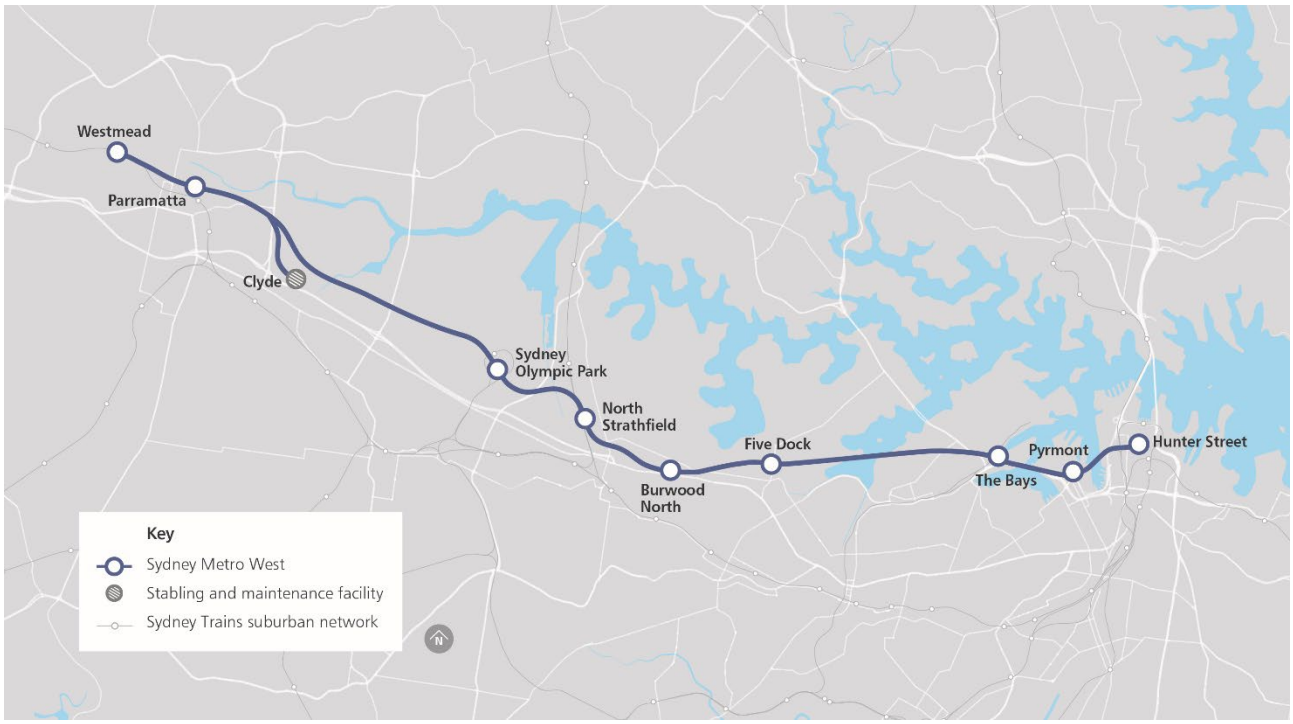

Figure 1-1 Sydney Metro West

1.2 Key features of this proposal

This proposal would involve:

- Fit-out of tunnels including systems for metro train operations
- Construction, fit-out and operation of:
  - Metro station buildings and the surrounding metro precincts
  - A services facility and traction substations
  - A control centre, test track and stabling and maintenance facility at Clyde
- Space for non-station uses at metro stations (e.g. retail, commercial and/or community facilities)
- Provisions for over and/or adjacent developments within metro precincts
- Rail interchange support works, including work to the existing T1 Western Line at Westmead and T9 Northern Line at North Strathfield
- Transport network modifications such as new interchange facilities and changes to public transport networks to serve metro stations
- Subdivision of sites
- Operation and maintenance of the Sydney Metro West line.

Components of this proposal are subject to further design development, and changes may be made during the ongoing design which consider the outcomes of community and stakeholder engagement and environmental investigations.

Further details of this proposal are provided in Chapter 5 (Proposal description – operation) and Chapter 6 (Proposal description – construction) of the Environmental Impact Statement.

1.3 Objectives and scope of this report

This technical paper, Technical Paper 7: Contamination is one of a number of technical papers that form part of the Environmental Impact Statement. The purpose of this technical paper is to identify and assess the potential impacts of this proposal in relation to soil and groundwater contamination, acid sulfate soils and salinity . It responds directly to the Secretary's environmental assessment requirements outlined in Section 1.3.1.

1.3.1 Secretary's environmental assessment requirements

The Secretary's environmental assessment requirements for this proposal were issued on 16 August 2021. The requirements specific to contamination, and where these requirements are addressed in this technical paper, are outlined Table 1-1.

The Secretary's environmental assessment requirements also refers to the Sydney Metro West Scoping Report – Rail infrastructure, stations, precincts and operations (Sydney Metro, 2021), which identified the proposed scope of investigations and assessment. How this technical paper addresses these matters is outlined in Table-1-2.

Table 1-1 Secretary's environmental assessment requirements – soils, contamination and groundwater

Secretary's environmental assessment requirements	Where addressed
An assessment of the following issues must be undertaken in accordance with the commitments in Section 5 of Sydney Metro West Scoping Report – Rail infrastructure, stations, precincts, and operations (Sydney Metro, June 2021): (g) Soils, contamination, and groundwater.	See Table-1-2

Table-1-2 Scoping Report investigations and assessment – soil, contamination and groundwater

Scoping report investigations and assessment	Where addressed
Consideration of the relevant regulatory framework and guidelines, and publicly available data.	Addressed in Section 2.0 and Appendix A
Identification of the existing soil landscapes and a review of previous contamination assessments and publicly available data (web-based information searches).	Addressed in the following sections in Appendix B: Westmead metro station – Section B.B.1 Parramatta metro station – Section B.B.2 Sydney Olympic Park metro station – Section B.B.3 North Strathfield metro station – Section B.B.4 Burwood North Station – Section B.B.5 Five Dock Station – Section B.B.6 The Bays Station – Section B.B.7 Pyrmont Station – Section B.B.8 Hunter Street Station – Section B.B.9 Clyde stabling and maintenance facility and Rosehill services facility - Section B.B.10
An assessment of potential contamination risks based on the previous contamination assessments undertaken, potential impacts to existing contamination and exposure risks to environmental and human health receptors. This would consider any remediation carried out which is subject to preceding Sydney Metro West planning applications.	Addressed in the following sections: Westmead metro station – Section 4.3 Parramatta metro station – Section 5.3 Sydney Olympic Park metro station – Section 6.3 North Strathfield metro station – Section 7.3 Burwood North Station – Section 8.3 Five Dock Station – Section 9.3 The Bays Station – Section 10.3 Pyrmont Station – Section 11.3 Hunter Street Station – Section 12.3 Clyde stabling and maintenance facility and Rosehill services facility – Section 13.3

Scoping report investigations and assessment	Where addressed
Identification of low, medium, and high-risk sites including recommendations for additional investigations and/or management based on the site risk rating and with consideration to the intended land use/future exposure scenarios at the relevant location.	Addressed in the following sections: Westmead metro station – Section 4.4.1 Parramatta metro station – Section 5.4.1 Sydney Olympic Park metro station – Section 6.4.1 North Strathfield metro station – Section 7.4.1 Burwood North Station – Section 8.4.1 Five Dock Station – Section 9.4.1 The Bays Station – Section 10.4.1 Pyrmont Station – Section 11.4.1 Hunter Street Station – Section 12.4.1 Clyde stabling and maintenance facility and Rosehill services facility – Section 13.4.1
Identification of the potential to disturb acid sulfate soils and the associated impacts during construction.	In the following sections: Westmead metro station – Section 4.4.3 Parramatta metro station – Section 5.4.3 Sydney Olympic Park metro station – Section 6.4.3 North Strathfield metro station – Section 7.4.3 Burwood North Station – Section 8.4.3 Five Dock Station – Section 9.4.3 The Bays Station – Section 10.4.3 Pyrmont Station – Section 11.4.3 Hunter Street Station – Section 12.4.3 Clyde stabling and maintenance facility and Rosehill services facility – Section 13.4.3

1.4 Structure of this report

This technical paper is structured as follows:

- Section 1 (this section) provides the context, background, objectives and key features of this proposal
- Section 2 outlines the legislation and policy context for the management of contaminated land, acid sulfate soils and salinity in NSW
- Section 3 describes the methodology undertaken for this assessment
- Section 4 to Section 13 summarises the construction and operation, baseline environment and construction and operation impact assessment for each station site and associated Sydney Metro West infrastructure
- Section 14 summarises the construction and operation, baseline environment and construction and operation impact assessment for the tunnels
- Section 15 describes and identifies the cumulative impacts from the proposal and surrounding projects
- Section 16 describes the environmental management and mitigation measures for potential contamination impacts during construction and operation
- Section 17 lists the reports and guidelines referenced in the contamination technical paper
- Appendix A provides the overview of relevant legislation and policy for this assessment
- Appendix B provides the detailed environmental setting, site history review and preliminary conceptual site model for each station and ancillary infrastructure.

1.5 Study area identification

The study area for this technical paper comprises:

- The construction footprint for this proposal including land within 1 kilometre of the construction footprint
- The tunnel alignment including land within 500 metres of the tunnel alignment.

In this report the study area has been referred to when describing the baseline environment. Specific construction sites within the study area referred to are shown in Figure 4-1 to Figure 13-1. The construction footprint required for this proposal is the same as the construction footprints assessed for the previous

Sydney Metro West planning applications, except for additional footprint areas at the following construction sites:

- Westmead metro station – additional areas within the rail corridor on either side of Hawkesbury Road and a cavern under Alexandra Avenue
- North Strathfield metro station – additional areas within the rail corridor
- Sydney Olympic Park metro station – an additional small area in south-western corner of the construction footprint
- The Bays Station – additional areas in the southern and western parts of the construction footprint.

The additional footprint areas related to this proposal are detailed in Figure 4-3, Figure 6-1, Figure 7-3 and Figure 10-3.

As noted above, the proposal provides for over and/or adjacent station development at the following locations:

- Westmead metro station
- Parramatta metro station
- Sydney Olympic Park metro station
- Burwood North Station
- The Bays Station
- Pyrmont Station
- Hunter Street (Sydney CBD) Station.

2.0 Legislative and policy context

The relevant legislation, policies and guidelines for contaminated land matters that have been considered during the preparation of this report are listed in Table 2-1 and described in Appendix A.

Table 2-1 Legislation, policies and guidelines

Legislation, regulation or policy		Guidelines applicable to this paper
STATE	• *Environmental Planning and Assessment Act 1979* • *State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55)* • *Contaminated Land Management Act 1997*	• Australian and New Zealand and Australian State and Territory Governments (ANZAST), 2018, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* • Heads of EPAs Australia and New Zealand (HEPA), 2020. *PFAS National Environmental Management Plan 2.0.* • NSW Acid Sulfate Soils Management Advisory Committee (ASSMAC) 1998, *Acid Sulfate Soils Assessment Guidelines.* August 1998 • NSW Department of Land and Water Conservation 2002, *Site Investigation for Urban Salinity* • National Environment Protection Council (NEPC) 1999, *National Environment Protection (Assessment of Site Contamination) Measure 2013* (the ASC NEPM) • NSW DUAP and NSW EPA, 1998. Managing Land Contamination Planning Guidelines SEPP 55 – Remediation of Land. • NSW EPA 2015, *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* • NSW EPA 2017, *Guidelines for the NSW Site Auditor Scheme (3rd edition)* • NSW EPA 2019, *Assessment and management of hazardous ground gases: Contaminated Land Guidelines.* • NSW Department of Environment and Conservation (DEC) 2007, *Guidelines for the Assessment and Management of Groundwater Contamination* • NSW DEC 2005. *Guidelines for Assessing Former Orchards and Market Gardens* • NSW Department of Environment and Climate Change (DECC) 2009, *Guidelines for Implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008* • NSW Department of Environment, Climate Change and Water (DECCW) 2010*, UPSS Technical Note: Decommissioning, Abandonment and Removal of UPSS.* • NSW DECCW 2010, *UPSS Technical Note: Site Validation Reporting* • NSW Department of Urban Affairs and Planning (DUAP) and NSW EPA 1998, *Managing Land Contamination, Planning Guidelines SEPP 55-Remediation of Land* • NSW EPA, 2020, *Guidelines for Consultants Reporting on Contaminated Sites*

Legislation, regulation or policy		Guidelines applicable to this paper
	• *Protection of the Environment Operations Act 1997 (POEO Act)* • *The POEO (Waste) Regulation 2014*	• NSW EPA, 2014. *Waste Classification Guidelines Part 1 to 4* • NSW EPA (2016) *Addendum to the Waste Classification Guidelines* (20410 Part 1: Classifying Waste) • NSW EPA, 2018. *Guidelines on resource recovery orders and exemptions for the land application of waste materials as fill* • NSW EPA 2016, *Environmental Guidelines: Solid Waste Landfills*, Second Edition.
LOCAL	• *Cumberland Local Environmental Plan 2021* • *Parramatta Local Environmental Plan 2011* • *Strathfield Local Environmental Plan 2012* • *Burwood Local Environment Plan 2012* • *Canada Bay Local Environment Plan 2013* • *Leichhardt Local Environmental Plan 2013* • *State Environmental Planning Policy (State Significant Precincts) 2005* • *Sydney Regional Environment Plan No.24 - Homebush Bay Area* • *Sydney Regional Environment Plan No.26 - City West* • *Sydney Local Environment Plan 2012* • *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005*	-

3.0 Scope of work and methodology

The contamination assessment comprised a desktop review, conceptual site model (CSM) update, risk ranking and assessment of mitigation measures, as detailed in the following sections.

3.1 Desktop review

A desktop review of available information relevant to the study area was conducted to understand the site history, existing environment, and potential risk from existing contamination. The following was reviewed for all areas of the study area:

Published geology, soils, salinity, and acid sulfate soil risk maps

- Current land use by review of current aerial photography, current maps, businesses, and Local Environmental Plan (LEP) zones
- Registered groundwater wells, groundwater dependent ecosystems and existing hydrogeology reports
- Review of areas of environmental interest (AEIs) from the contamination technical reports prepared as part of the previous Sydney Metro West planning applications
- Review of construction and remediation works planned to be completed as part of the work carried out under the previous Sydney Metro West planning applications, prior to the commencement of the construction works for this proposal
- Review of additional contamination reports prepared since the previous Sydney Metro West planning application, including identification of additional AEIs based on any new information in these reports.

The following was undertaken for additional footprint areas which were not assessed as part of the previous Sydney Metro West planning applications:

- A review of historical aerial photographs, historical business records, NSW EPA registers (under *the Contaminated Land Management Act 1997* and the *Protection of the Environment Operations Act 1997*) and other NSW EPA lists (former gasworks, PFAS investigation sites, and sites affected by asbestos filling or loose-fill asbestos) from Lotsearch Pty Ltd (Lotsearch) EnviroPro reports (Lotsearch 2021a and 2021b)
- Review of contamination investigation and remediation reports and data provided by other Government departments and those available through public sources
- Identification of AEIs in the additional footprint areas.

The previous reports reviewed included:

- Sydney Metro, 2020a, Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD Technical Paper 8 – Contamination
- Sydney Metro, 2021, Sydney Metro West Environmental Impact Statement – The Bays to Sydney CBD Technical Paper 8 – Contamination
- GHD Pty Ltd (GHD), 2021, 1 Tennyson Street – Stockpile cost estimate. 16 March 2021.
- A.D. Envirotech Australia Pty Ltd (ADE), 2015, Environmental Management Plan, Gate NS1, Sydney Trains Rail Corridor, CH13+286 to CH13+350, Queen Street, North Strathfield, NSW. 27 July 2015.
- ADE, 2015, Environmental Management Plan, Sydney Trains Rail Corridor, Site from CH13+420 to CH13+520 (Up-Main), Queen St, North Strathfield. 31 July 2015.
- Golder-Douglas, 2021a, Factual Contamination Assessment Report, 00013/11180 Sydney Metro West Geotechnical Investigation. 18 March 2021.
- Golder-Douglas, 2021b, Groundwater Monitoring Report – Stage 2 Locations, Sydney Metro West Geotechnical Investigation. 28 February 2021.
- Golder-Douglas, 2021c, 00013/11180 Sydney Metro West Geotechnical Investigation, Groundwater Monitoring Report Stage 3 Locations. 23 June 2021.
- Senversa Pty Ltd (Senversa), 2021, Factual Contamination Investigation Report – The Bays, Sydney Metro West, White Bay Site Investigations, 21 May 2021.

- Zizina Pty Ltd (Zizina), 2021, Acid Sulfate Soil Assessment, Port Access Road, Balmain, NSW, 19 January 2021.

The Sydney Metro (2020a) Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD Technical Paper 8 – Contamination included:

- a review of the data from the Sydney Metro West geotechnical investigation and groundwater monitoring completed at the time of the report, which included 24 boreholes and 57 groundwater wells
- review of the following reports:
  - Department of Defence, 2016, Lancer Barracks, Parramatta, New South Wales.
  - SMEC, 2014, WestConnex M4 Widening, Pitt Street, Parramatta to Homebush Bay Drive, Homebush.
  - NSW Government, 2015, WestConnex, M4 East Environmental Impact Statement, Appendix P.
  - Trace Environmental, 2016, Preliminary Site Investigation and Limited Detailed Site Investigation, 15-19 Berry Street, Clyde, NSW.
  - Golder, 2015a, Camellia Precinct, Contamination Study – Part 1 – High Level Contamination Review.
  - Golder, 2015b, Camellia Precinct, Contamination and Remediation Study – Stage 2.
  - AECOM, 2013, Clyde Terminal Conversion Project, Chapter 17.
  - AECOM, 2019, Viva Energy Clyde Western Area Remediation Project. Appendix C: Conceptual Remedial Action Plan.
  - Coffey, 2017, Transport for NSW, Parramatta Light Rail, Stage 1 Contaminated Land Technical Paper.
  - DECCW, 2010, Regulation Project. James Hardie Asbestos Waste Contamination Legacy. Summary Project Report (DECCW, April 2010)
  - Cardno, 2008, Parramatta River Estuary, Data Compilation and Review Study
  - Sydney Olympic Park Authority, 2014a, Fact Sheet – Remediation
  - Sydney Olympic Park Authority, 2014b, Sydney Olympic Park Authority, 2014b, Environmental Management: Remediated Lands Management Policy
  - NSW Government, 2018, Transport Access Program, North Strathfield Station Upgrade, Review of Environmental Factors
  - Lotsearch 2016, Environmental Risk and Planning Report
  - Alliance Geotechnical, 2014, Preliminary Environmental Investigation 1 Cook Avenue, Canada Bay.
  - Consara, 2015, Addendum to Remedial Action Plan, Part Lot 6643 DP 1137663 Leichhardt Park, Mary Street Lilyfield NSW (Consara, 2015).
  - Roads and Maritime Services, 2016, Rozelle Rail Yards – Site Management Works, Review of Environmental Factors.
  - Douglas Partners, 2016, Phase 1 Contamination Assessment, 469-483 Balmain Road, Lilyfield NSW.
  - JBS&G, 2015, Urban Growth NSW. Site Wide Remedial Concept Plan. The Bays Precinct Urban Transformation Area.

A desktop review was undertaken of the proposed construction and operational activities to identify potential sources of new contamination. In this technical paper, new contamination is considered as contamination that could arise from construction or operation activities carried out as part of this proposal.

Due to public health orders and restrictions issued by the NSW state government for the COVID-19 pandemic, site inspections could not be completed to verify the condition of the construction sites and surrounding study area at the time of this report. As the previous assessments of the study area were completed within the past two years, changes in land use that could have resulted in new contamination sources is unlikely and not considered to have a material impact on the outcome of the assessment of this proposal. Additionally, access to the sites was a constraint due to current ownership and existing

infrastructure on the sites. Consideration should be given to conducting proposal-wide site inspections as part of the next phase of work to confirm site condition have not significantly changed in the intervening timeframe.

3.2 Preliminary conceptual site model

AEIs identified from the desktop review were assessed for potential human and/or ecological health risks in the context of this proposal. Where an AEI was identified, a CSM was then developed. A CSM is a representation of how human and ecological receptors may be exposed to contamination and is an essential part of all contamination site assessments. The CSM considers the different exposure pathways between a contamination source and receptor in either the present or future.

The CSM was developed assuming no mitigation and based on the proposed construction works for a particular location. This approach provides a conservative assessment of exposures and enables a consistent decision on appropriate mitigation measures to be adopted.

3.3 Risk ranking

For consistency, the approach used for identifying contamination risk for this proposal is consistent with the approach carried out for Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) and Sydney Metro West Environmental Impact Statement –The Bays to Sydney CBD (Sydney Metro,2021), and involved ranking the risks by identifying the consequence of the impact and the likelihood of a complete pathway occurring.

The first step in the risk analysis involved identifying if a pathway exists between a source and a potential receptor. This was undertaken assuming no mitigation measures other than standard industry construction practices. The second step involved assessing the severity and extent of the contamination likely or known to be present and potential for contamination to be intersected by the proposal and be a complete exposure pathway. The risk rating was then determined by combining the potential pathway and contamination severity and extent to identify the level of risk as shown in the matrix in Table 3-1.

Table 3-1 Risk ranking matrix

		Contamination severity and extent (SE)				
		SE1 Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	**SE2** Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	**SE3** Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread	**SE4** Known contamination present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	**SE5** Known contamination present in the media of concern at concentrations above the relevant assessment criteria and widespread
Pathways and receptors (PR)	**PR1** Media of concern is unlikely to coincide with or otherwise impact on the construction scope AND/OR No or unlikely exposure pathway for human or ecological receptor's during construction or operation	**Very Low**	**Low**	**Low**	**Moderate**	**Moderate**
	PR2 Media of concern may intersect the construction scope. AND Exposure pathway for human or ecological receptors could be present and complete during construction or operation	**Low**	**Moderate**	**Moderate**	**High**	**High**
	PR3 Media of concern would intersect the construction scope AND Exposure pathway for human or ecological receptors could be present and complete during construction or operation	**Moderate**	**Moderate**	**High**	**High**	**Very High**

3.4 Mitigation measures

Mitigation measures have been applied for AEIs based on consideration of the risk ranking for those areas and in consideration of the mitigation measures being implemented as part of the preceding Sydney Metro West planning applications. Generally, sites were assigned a mitigation measure based on risk as follows:

- Very low and low risk construction sites could be mitigated through implementation of a Soil and Water Management Plan, where contamination would be managed via standard construction processes
- Moderate or high to very high-risk construction sites:
  - Would have further data review undertaken prior to construction and then where required due to insufficient pre-existing information a detailed site investigation (DSI) would be undertaken to assess whether remediation is required (only applicable to areas not assessed as part of preceding Sydney Metro planning applications)
  - Would be remediated where remediation is assessed as being required following data review and/or DSI, and where remediation hasn't been completed during the work carried out under the previous Sydney Metro West planning applications.

A full description of mitigation measures, including requirements for site audit statements and on-going management and monitoring is provided in Section 16.0.

4.0 Westmead metro station

Westmead metro station would be located to the east of Hawkesbury Road, between Railway Parade in the north, Bailey Street in the south and Hassall Street in the east to provide a direct interchange with the T1 Western Line and the T5 Cumberland Line. The existing Westmead Station is located immediately to the north.

The locality around Westmead metro station generally contains a mix of land uses, including the Westmead town centre, and medium- and low-density residential buildings, as well as specialised health, education and recreational areas. Immediately to the north, the Westmead health and education precinct and its redevelopment is planned to transform Westmead into a world-class innovation district.

4.1 Construction description

The Westmead metro station construction site for this proposal would comprise:

- The approved construction site which will be established as part of work carried out under the previous Sydney Metro West planning application
- An area within the existing rail corridor at the existing Westmead Station, bound by Railway Parade in the north and the Hawkesbury Road bridge in the west
- An area within the existing rail corridor to the west of the Hawkesbury Road bridge
- Additional construction site areas within the rail corridor to support within-corridor construction activities, the location of which may vary during the construction period depending on specific activities being carried out
- Areas within existing roads around the proposed station.

Key construction work at the Westmead metro station construction site would include:

- Enabling and site establishment work (including set up of construction site facilities, laydown areas, environmental and safety controls, and hoardings)
- Construction of the station and structures for non-station uses
- Station fit-out
- Construction of station precinct and interchange facilities
- Work within the existing rail corridor to enable integration of this proposal with the existing Sydney Trains suburban network, including:
    - Construction and fit-out of a new aerial concourse above the existing rail corridor to the east of the Hawkesbury Road overbridge
    - Upgrade work to the western side of the Hawkesbury Road overbridge
    - Demolition of the aerial concourse at the existing Westmead Station
    - Track slewing in the vicinity of the existing Westmead Station
    - Lengthening and widening of Platform 1 and Platform 4 at the existing Westmead Station
    - Localised excavations of the existing platforms to allow for vertical transport (lifts and escalators) from the proposed underground concourse
    - Adjusting the embankment (to the south of the rail tracks) within the existing rail corridor and west of the Hawkesbury Road bridge to support track slewing
- Provision for adjacent station development
- Finishing work, testing and commissioning.

The construction works are likely to comprise shallow earthworks associated with road construction, services and building footings. Localised deeper excavations may occur where deeper pilings are required for the aerial concourse and works within the public domain areas. Excavation would also be required for the new underground concourse connecting from the metro station box beneath the existing Westmead Station. Groundwater dewatering will occur for the station box during work carried out under the previous Sydney Metro West planning application and during the construction of this proposal. The cross-over cavern

structure will be tanked as part of the work carried out under the previous Sydney Metro West planning application.

The location and indicative layout of the Westmead metro station construction site is shown on Figure 4-1.

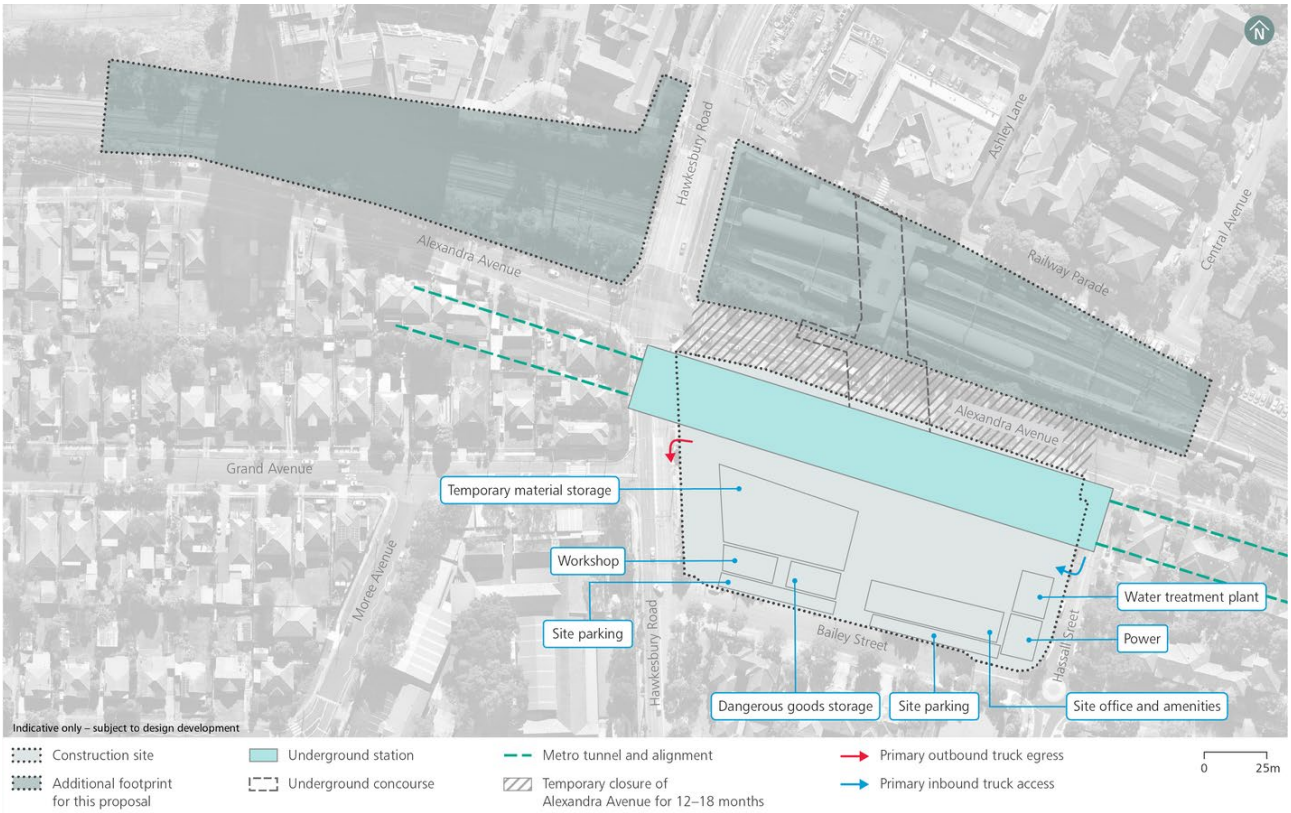

Figure 4-1 Westmead metro station indicative construction site layout

4.2 Operation description

Westmead metro station would be comprised of an underground station and above ground public precinct including open space and future commercial land use. The Westmead metro station would require ongoing groundwater dewatering during operation as the station box and the underground concourse would be untanked at completion of construction. The operational indicative layout and key design elements are shown on Figure 4-2.

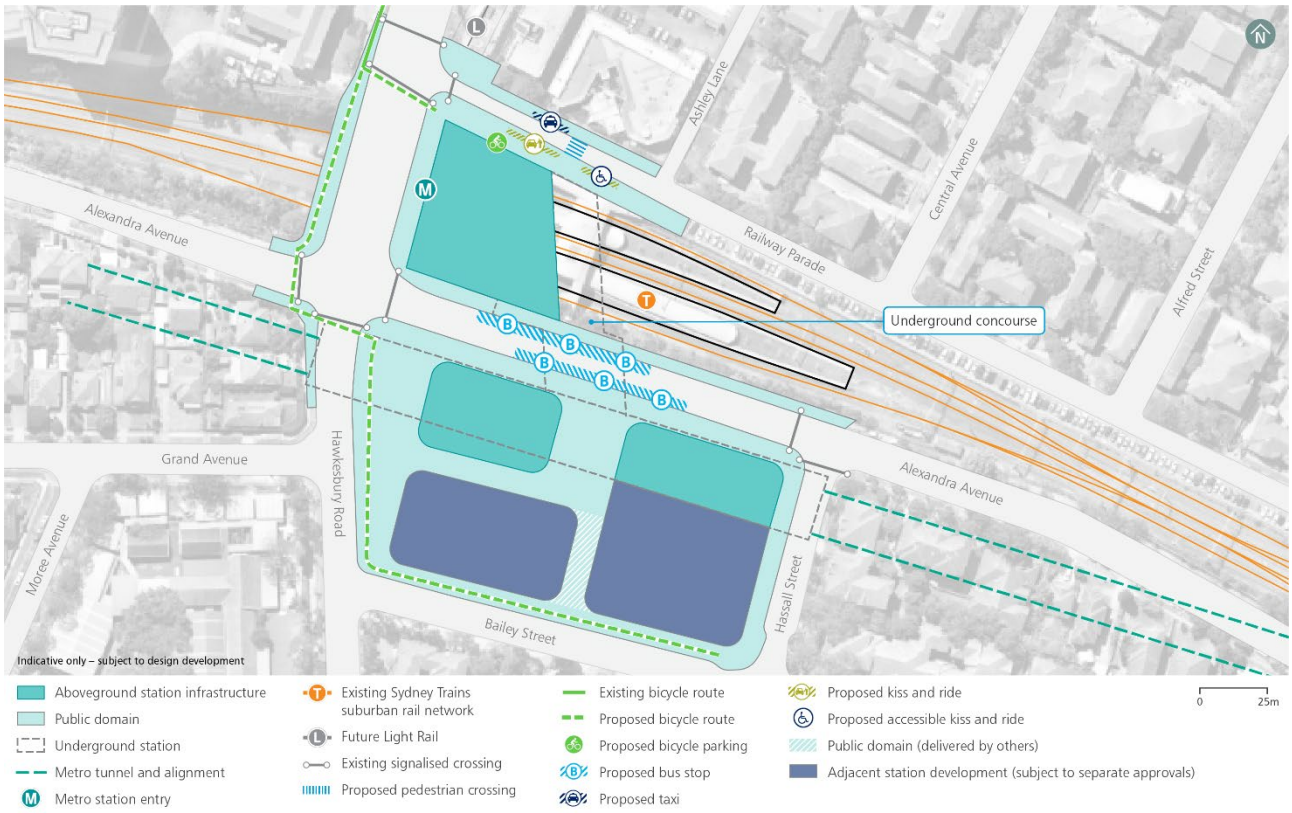

Figure 4-2 Westmead metro station indicative layout and key design elements

4.3 Baseline environment

The construction site for this proposal and its surrounds currently comprises of the existing station and rail corridor, low, moderate and high-density residential properties along with a mechanical workshop on the corner of Hassall Street and businesses along Railway Parade. Prior to commencement of construction for this proposal, all buildings in the block bound by Alexandra Avenue, Hawkesbury Road, Bailey Street and Hassell Street will be demolished as part of the work carried out under the previous Sydney Metro West planning application and used as a construction compound. The deep station box excavation will be located in the northern part of the block in the location of Alexandra Avenue. The detailed site description, environmental setting and site history review for the Westmead metro station is described in Appendix B.

AEIs identified within the Westmead metro station construction site in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) (refer to Appendix B) and this assessment, are summarised in Table 4-1. The AEIs that were assessed as moderate or higher risk are shown on Figure 4-3.

Table 4-1 Westmead metro station – summary of baseline environment

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 1 – Railway activities	**Very low** Could be source of soil contamination from use of hazardous building materials and railway activities including lead, asbestos, polychlorinated biphenyl's (PCBs), petroleum hydrocarbons and pesticides.	**Moderate** AEI 1 was previously assessed as very low risk and outside of the construction site required for work carried out under the previous Sydney Metro West planning application. This proposal would require earthworks within the rail corridor and is therefore assessed as moderate risk as potential contamination would be intercepted during construction of this proposal.

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 1(a) – Roads (new AEI)	Not identified as AEI in the Stage 1 planning approval.	**Low** Uncontrolled and potentially contaminated fill could be used during road construction.
AEI 2 – Mechanical workshop/service station (corner of Alexandra Avenue and Hassall Street)	**Moderate** Could be a source of soil and groundwater contamination from petroleum hydrocarbons, volatile halogenated compounds (degreasers) and heavy metals.	**Low** AEI 2 will require a DSI and remediation (if required) during the work carried out under the previous Sydney Metro West planning application. There could be residual groundwater contamination remaining following remediation that may potentially require ongoing management during and post construction activities for this proposal.
AEI 3, **AEI 4** and **AEI 5** – Hazardous building materials and dumping of construction waste/ former demolition (Residential properties and businesses along Hawkesbury Road, Grand Avenue, Bailey Street, Hassall Street, Alexandra Avenue and Railway Parade)	**Moderate (AEI 3 & 5) and very low (AEI 4)** Could be sources of soil contamination from historic uses of hazardous building materials, including lead, asbestos, PCBs potentially from old electrical equipment and pesticides, and dumping of construction waste within a vacant property on Alexandra Avenue.	**Low** Contamination from AEI 3, AEI 4 and AEI 5 would be expected to be confined to surface soils which would be managed during the work carried out under the previous Sydney Metro West planning application. It is unlikely residual contamination remaining in surface soil would require management during construction of this proposal.

Note: (a) Denotes new AEI identified from the assessment of the additional construction footprint for this proposal - to differentiate from AEIs from the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a)

Figure 4-3 Westmead metro station – moderate or higher risk areas of environmental interest

4.4 Construction impact assessment

4.4.1 Existing contamination

The CSM and risk ranking for the proposed Westmead metro station is detailed in Appendix B. Based on the assessment, all AEIs were ranked as low risk, with the exception of AEI 1 which has been elevated to a moderate risk as works would be required to disturb soils which could have been contaminated from historical railway activities. AEI 1 was originally assessed as very low risk in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a), as the AEI was outside the construction footprint and no disturbance of soil was proposed.

Soil contamination within the remainder of the construction site is likely to be remediated or managed during the work carried out under the previous Sydney Metro West planning application prior to construction commencing for this proposal and residual contamination, if present, is likely to be minor and isolated. There is the potential for residual groundwater contamination to require an ongoing environmental management plan.

4.4.2 New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be detailed in the respective construction environmental management plans.

4.4.3 Acid sulfate soils

A search for the likely presence of acid sulfate soil on the construction site was carried out through a review of the website maintained by the Australian Soil Resource Information Service (ASRIS). Acid sulfate soils are typically encountered at elevations of less than five metres AHD. According to the ASRIS there is an extremely low probability (type C4) of occurrence of acid sulfate soils and the construction site is within land mapped as Class 5 in the Parramatta LEP 2012 acid sulfate soil risk maps. There are no Class 1 to Class 4 mapped areas within 500 metres of the construction site.

The groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) assessed that groundwater drawdown would not extend into areas of potential acid sulfate soils.

As there is low risk of acid sulfate soils, there are no impacts related to disturbance of acid sulfate soils anticipated from construction.

4.4.4 Salinity

The groundwater salinity typically ranges between about 2,000 milligrams per litre and 20,000 milligrams per litre as total dissolved solids. The NSW Natural Resources Atlas sourcing information from the Salinity Hazard Map of NSW (DIPNR, 2018) does not indicate a soil salinity hazard at this site. Previous studies do not indicate soil salinity being an issue at this site. The groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) assessed there was no risk of saline water intrusion. There are no impacts anticipated related to soil or groundwater salinity related to the construction of Westmead metro station.

4.4.5 Groundwater

Groundwater is understood to be at about three metres below ground level within the Westmead metro station construction site. The Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) assessed that groundwater may be impacted by heavy metals, hydrocarbons, and volatile organic compounds (VOCs).

Excavations for this proposal would most likely not reach this depth, except for the embankment widening works within the rail corridor, localised piling to support station construction and excavation of the underground concourse. If groundwater contamination is present at concentrations above the relevant assessment criteria, the likely nature and extent of potential residual contamination in the construction site is expected to be limited (see Section 4.3.1).

Potential migration of contaminated groundwater into localised road, services, and footing excavations, poses an overall potential low exposure risk to construction workers and ecological receptors (Domain Creek and Parramatta River). The station box constructed during the work carried out under the previous Sydney Metro West planning application will be untanked and therefore groundwater inflow into the station box is anticipated and would require dewatering and possibly treatment before discharging. As groundwater contamination within the area is expected to be localised, the risk to workers and ecological receptors is considered to be low.

4.5 Operational impact assessment

4.5.1 Existing contamination

Soil and/or groundwater contamination within the construction footprint, if present, is expected to be investigated and remediated during construction. There are therefore not expected to be impacts from existing contamination during operation, except for potential residual groundwater contamination outside of the construction site, which could require a long-term environmental management plan.

4.5.2 New contamination

Westmead metro station would include limited use and storage of chemicals, oils, or fuels. There are no significant sources of contamination or impacts anticipated from the operation of the station, roads or public domain.

4.5.3 Acid sulfate soils

Acid sulfate soils have not been identified within or within 500 metres of the Westmead metro station site and there are no impacts anticipated related to the operation of the station, roads and public domain.

4.5.4 Salinity

The operation of the station, roads and public domain are not anticipated to have impacts on local soil or groundwater salinity.

4.5.5 Groundwater

Groundwater dewatering would be required for the station box throughout operation. All groundwater extracted from dewatering of the station box would be pumped to the operational water treatment plant at the Clyde stabling and maintenance facility. The risk of encountering existing groundwater contamination during operation is considered to be low as groundwater contamination in the Westmead metro station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant.

5.0 Parramatta metro station

Parramatta metro station would be located in the heart of the Central River City (Parramatta CBD) between George Street to the north, Smith Street to the east, Macquarie Street to the south and Church Street to the west. Parramatta metro station would be located to the north of the existing Parramatta Station, within the commercial core of Parramatta CBD.

The Parramatta metro station precinct is characterised by a diverse mix of commercial and retail with some residential apartments and community facilities. There are also a number of heritage listed buildings and potential archaeological resources in the vicinity of the site.

5.1 Construction description

The Parramatta metro station construction site for this proposal would comprise the approved construction site which will be established as part of the work carried out under the previous Sydney Metro West planning application. The construction works for the Parramatta metro station for this proposal would include:

- Enabling and site establishment work, including:
  - installation of an acoustic shed (or other acoustic measures) over the rail systems fit-out shaft at the western end of the station box
  - installation or retention of protection around heritage structures including Kia Ora and heritage-listed shop at 45 George Street
- Construction of the station and structures for non-station use
- Station fit-out
- Excavation for basement structures for over station and adjacent station development
- Construction of station precinct and interchange facilities, including public domain works for the Civic Link within the footprint of the construction site
- Provision for over and adjacent station development
- Access for tunnel fit-out and rail systems work
- Finishing work, testing and commissioning.

There would be bulk excavation works for the basements to the north and south of the station box. Other earthworks would be associated with construction of building footings and pilings and trenches for underground services. The cut and cover station box would be tanked within the soil profile and untanked within bedrock during the work carried out under the previous Sydney Metro West planning application and this proposal. The basements would be untanked during construction. Groundwater dewatering would therefore occur during construction until the structures are tanked at completion.

The location and indicative layout of the Parramatta metro station construction site is shown on Figure 5-1.

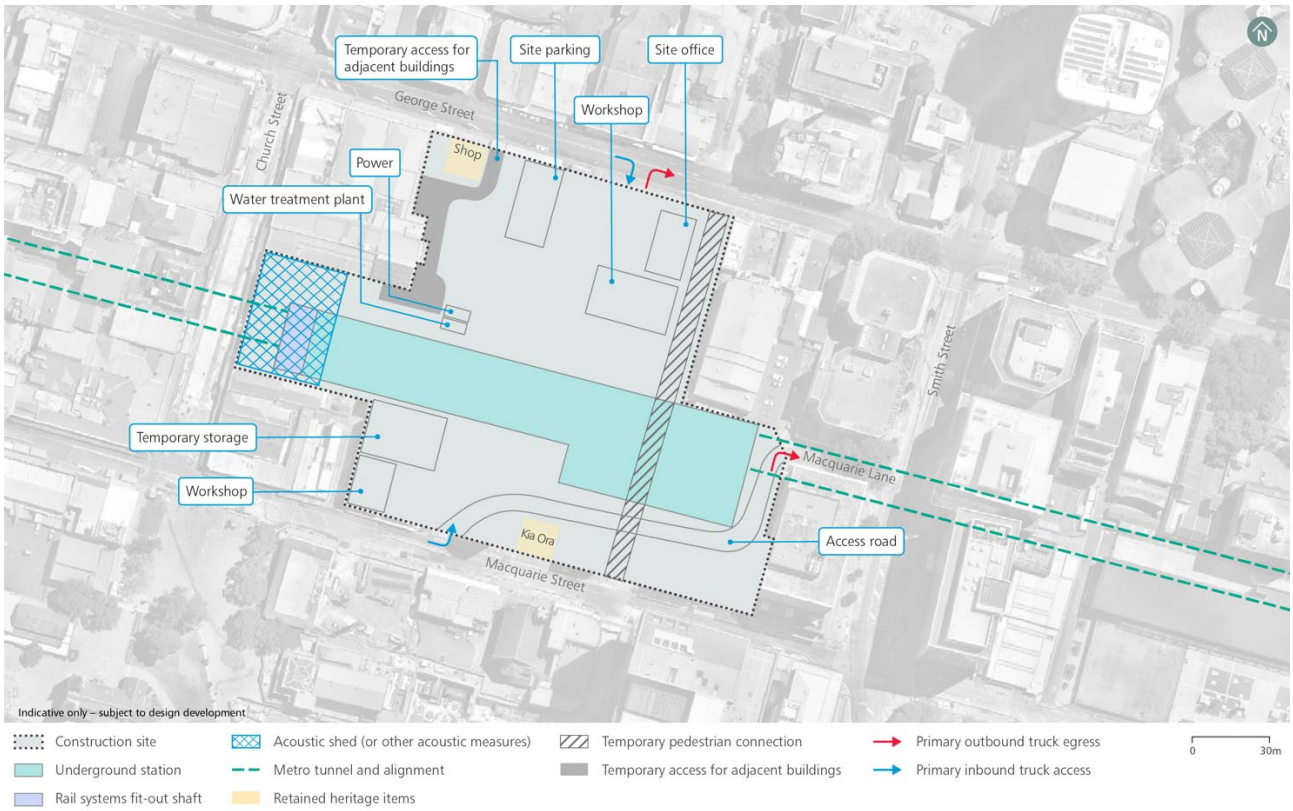

Figure 5-1 Parramatta metro station indicative construction site layout

5.2 Operation description

This proposal would include precinct works and station transport interchanges, such as kiss and ride and bus stops, station access walkways including the Civic Link, a realigned Horwood Place and intersection treatments. Provision would be made for future land uses such as retail, commercial and community facilities to activate the station precinct (subject to separate approval where required).

There is anticipated to be limited chemical, oil or fuel storage at Parramatta metro station during operation. The station box and basements would be tanked during operation. The operational indicative layout and key design elements are shown on Figure 5-2.

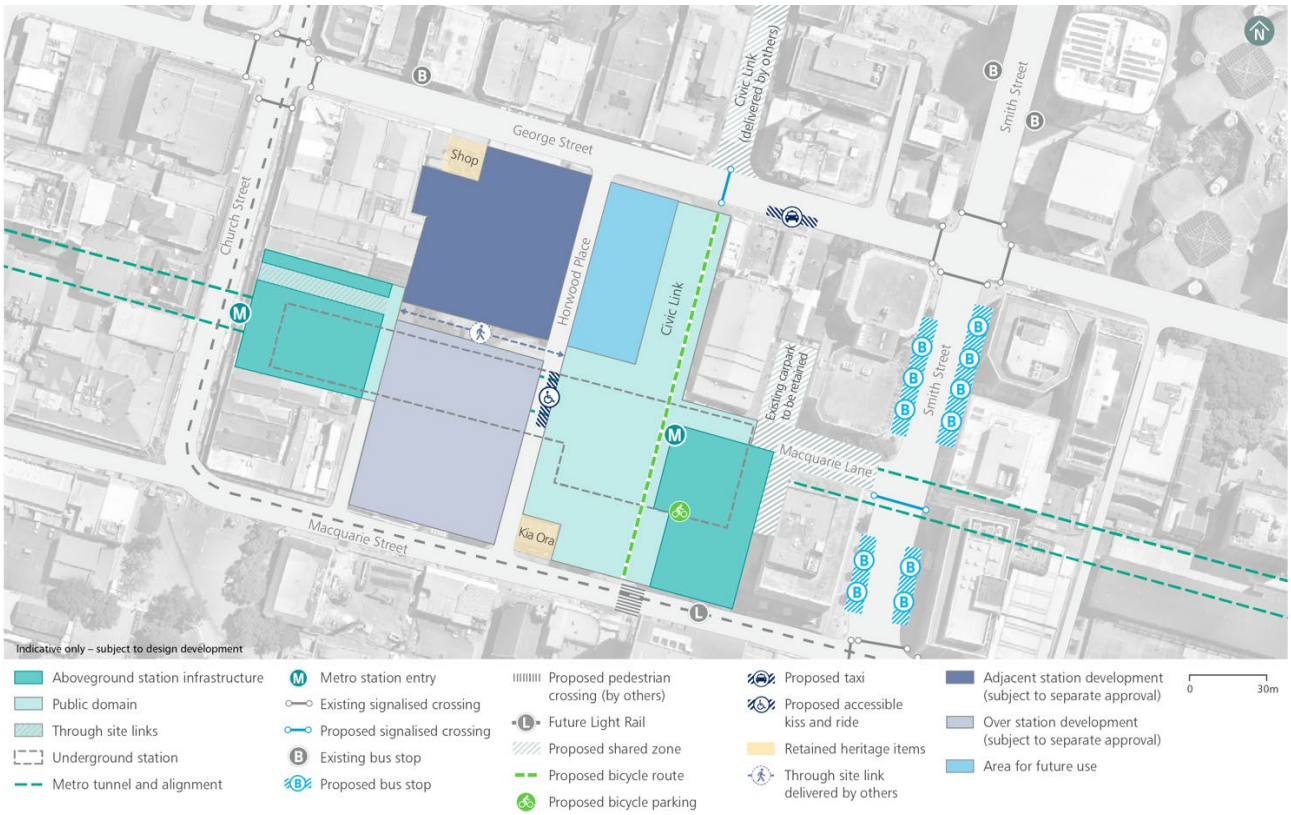

Figure 5-2 Parramatta metro station indicative layout and key design elements

5.3 Baseline environment

The Parramatta metro station construction site currently comprises a mixture of retail, commercial office buildings and a carpark. Prior to the commencement of the proposed construction, all structures except for two heritage buildings will be demolished within the construction site. The demolition works will be completed during work carried out under the previous Sydney Metro West planning application which includes the bulk excavation works for the station box. The detailed site description, environmental setting and site history review for Parramatta metro station is described in Appendix B.

AEIs identified within the Parramatta metro station construction site in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) (refer to Appendix B) are listed in Table 5-1 . The AEIs that were assessed as moderate or higher risk are shown on Figure 5-3.

Table 5-1 Parramatta metro station – summary of baseline environment

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 6 – Former and existing structures with hazardous building materials	**Moderate (soil)** Former and existing structures which could contain hazardous building materials within or from on-site buildings and structures and demolition wastes, resulting in soil contamination.	**Low** The work carried out under the previous Sydney Metro West planning application would include demolition and the bulk excavation of the station box. The remainder of the construction site will be made suitable for construction. Based on this, surface soil contamination from hazardous building materials would be investigated and remediated (if required) prior to construction of this proposal.

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 7 – Dry cleaners (56-67 George Street)	**Moderate (groundwater) and very low (soil)** Dry cleaning activities could result in contamination from inappropriate disposal of solvents and leaks from underground tanks	**Moderate** The work carried out under the previous Sydney Metro West planning application will include demolition and the bulk excavation of the station box. The remainder of the construction site will be made suitable for construction. Based on this, subsurface residual soil and groundwater contamination could remain which will be further assessed in accordance with the requirements of the planning approvals for work carried out under the previous Sydney Metro West planning application prior to construction of this proposal.
AEI 8 – General historical commercial and industrial land use	**Moderate (soil and groundwater)** Could have resulted in contamination from inappropriate chemical storage and use, industrial operations, waste disposal and management.	
AEI 9 – General historical commercial and industrial land use (off-site surrounding land use)	**Moderate (groundwater) and very low (soil)** Could have resulted in contamination from inappropriate chemical storage and use, industrial operations, waste disposal and management	

Figure 5-3 Parramatta metro station – moderate or higher risk areas of environmental interest

5.4 Construction impact assessment

5.4.1 Existing contamination

The CSM and risk ranking for Parramatta metro station is detailed in Appendix B. Based on the assessment all AEIs were ranked as moderate risk for the construction works except for AEI 6 which was low risk. Soil and groundwater contamination within the station box would be excavated during the work carried out under the previous Sydney Metro West planning application. Soil and groundwater contamination within the basement areas would be excavated during construction of this proposal. In the remainder of the construction site, shallow soils are likely to be remediated if required to make the site suitable for use as a construction site prior to construction of this proposal. Deeper residual soil and groundwater contamination could remain in the rest of the construction site that may require remediation during the construction of this proposal. This would depend on the findings of investigations undertaken during the work carried out under the previous Sydney Metro West planning application and detailed construction plans for this proposal.

5.4.2 New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be detailed in the respective construction environmental management plans.

5.4.3 Acid sulfate soils

The Paramatta metro station construction site is mapped as Class 4 acid sulfate soils risk, with a low probability of potential acid sulfate soils at depths greater than two metres below ground level (see Appendix B). Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) assessed that up to 23 metres of groundwater drawdown was estimated which could expose potential acid sulfate soils beneath and surrounding the construction site to oxidation.

Further assessment would be undertaken to inform an acid sulfate soil management plan (ASSMP) for the construction works within the Parramatta metro station construction site, as excavation of soils will occur. The investigations will be undertaken prior to work carried out under the previous Sydney Metro West planning application. An ASSMP will be implemented during those works and updated as required for the construction of this proposal. In accordance with conditions of approval (D122) for the work carried out under the previous Sydney Metro West planning application. The revised Groundwater Modelling Report prepared for those works would assess impacts from groundwater drawdown. Specific mitigation and monitoring recommended in this report, where required, would be continued during construction of this proposal.

5.4.4 Salinity

Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) assessed that groundwater drawdown during construction could result in saline water intrusion from the Parramatta River. The assessment concluded that saltwater intrusion was not likely to impact the environmental value of the aquifer, as groundwater dependent ecosystems in the area are tolerant to saline water and groundwater is not beneficially used in the area.

5.4.5 Groundwater

Groundwater is expected approximately six metres below ground level within the Parramatta metro station construction site. The Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) stated that contamination could be present in groundwater at concentrations above the relevant assessment criteria and is likely to be limited in extent. In accordance with conditions of approval (D122) for the work carried out under the previous Sydney Metro West planning application. The revised Groundwater Modelling Report would assess impacts from groundwater drawdown. Specific mitigation and monitoring where required would be continued during construction of this proposal. The underground station and basements would be untanked within bedrock during construction and dewatering would occur. As the groundwater contamination is likely localised in extent and the groundwater would be treated to the required discharge quality, the risk is considered low.

5.5 Operational impact assessment

5.5.1 Existing contamination

Soil and/or groundwater contamination, if present, is expected to be investigated and remediated during construction. There are no anticipated impacts to the operation of Parramatta metro station from existing contamination during operation.

5.5.2 New contamination

Parramatta metro station would include limited use and storage of chemicals, oils or fuels during operation. There are no significant sources of contamination or impacts anticipated from the operation of the station or public domain.

5.5.3 Acid sulfate soils

The operation of the Parramatta metro station is not expected to have any impacts from acid sulfate soils as there would be no excavation or groundwater dewatering after completion of construction.

5.5.4 Salinity

The operation of Parramatta metro station is not expected to have any impacts from soil or groundwater salinity as the structure would be tanked meaning there would be no groundwater dewatering after completion of construction.

5.5.5 Groundwater

The operation of Parramatta metro station is not expected to have impacts on groundwater quality as the structure would be tanked meaning there would be no groundwater dewatering after completion of construction.

6.0 Sydney Olympic Park metro station

Sydney Olympic Park metro station would be located close to Olympic Boulevard and between Herb Elliott Avenue and Figtree Drive, and in close proximity to the Heritage Abattoir Precinct to the north.

The Sydney Olympic Park metro station precinct is characterised by mainly commercial properties – typically being office or retail, as well as educational facilities. High-density residential areas are also located nearby.

The broader Sydney Olympic Park metro station precinct is proposed to be a thriving urban centre with a vibrant mix of homes and jobs, as well as a premier destination for cultural, entertainment, recreational and sporting events.

6.1 Construction description

The Olympic Park metro station construction site for this proposal would comprise the approved construction site which will be established as part of the work carried out under the previous Sydney Metro West planning application, and an additional small area to the south-west of the site. Construction works for the Sydney Olympic Park metro station for this proposal would include:

- Enabling and site establishment work
- Earthworks to level the site with the surrounding road network
- Construction of the station and structures for non-station use
- Station fit out
- Construction of station precinct and interchange facilities
- Provision for over and adjacent station development
- Finishing work, testing and commissioning.

There is anticipated to be some earthworks (levelling of the site) associated with the construction works for this proposal. Groundwater dewatering works would be carried out during construction as the proposed Sydney Olympic Park metro station would be untanked. The location and indicative layout of the Sydney Olympic Park metro station construction site is shown on Figure 6-1.

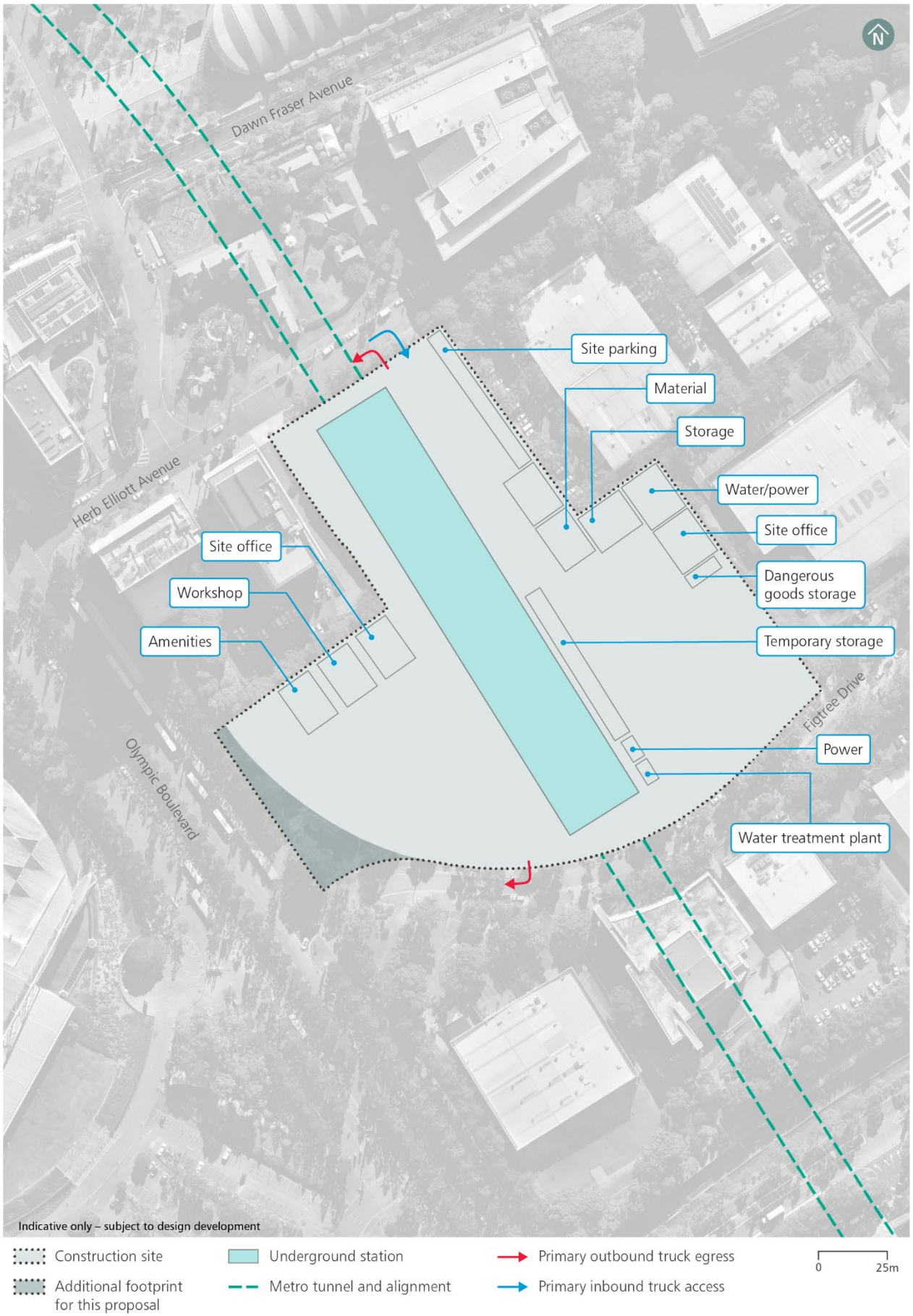

Figure 6-1 Sydney Olympic Park metro station indicative construction site layout

6.2 Operation description

The operation of Sydney Olympic Park metro station and surrounding station precinct would include public domain area and provision for commercial and retail uses (subject to separate approval where required). Groundwater dewatering works would be carried out during operation as the proposed Sydney Olympic Park metro station would be untanked. Groundwater inflows would be captured and directed to the operational water treatment plant at Clyde stabling and maintenance facility. The operational indicative layout and key design elements are shown on Figure 6-2.

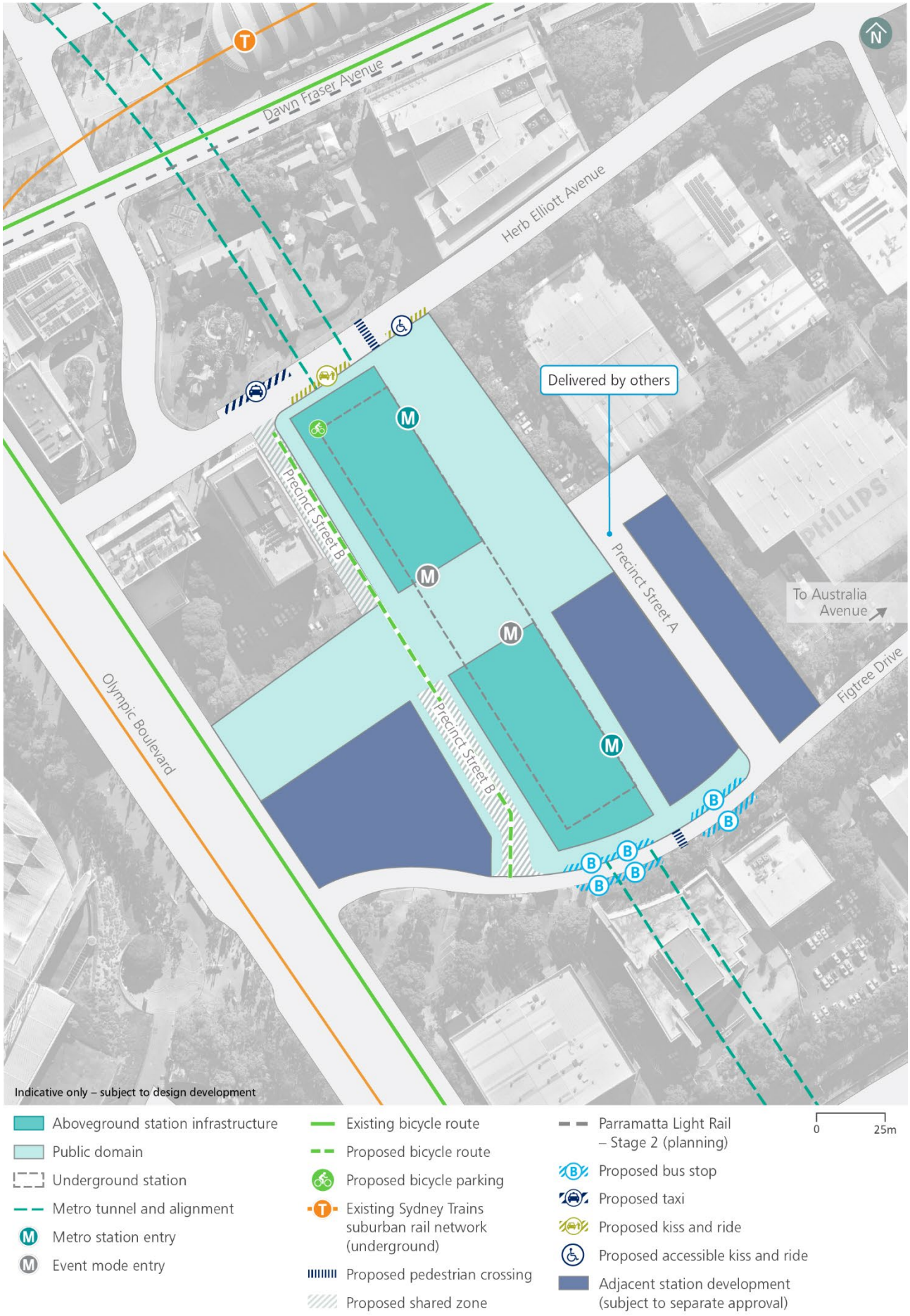

Figure 6-2 Sydney Olympic Park metro station indicative layout and key design elements

6.3 Baseline environment

The Sydney Olympic Park metro station construction site currently comprises of large commercial buildings with large, tree-bound carparking areas. The area to the northwest of the construction site comprises of sporting stadiums and large paved areas. As part of the work carried out under the previous Sydney Metro West planning application, buildings within the construction site will be demolished and the station box excavated. The detailed site description, environmental setting and site history review for Sydney Olympic Park metro station is described in Appendix B.

AEIs identified within the Sydney Olympic Park construction site in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) (refer to Appendix B) and this assessment are summarised in Table 6-1.

Table 6-1 Sydney Olympic Park metro station – summary of baseline environment

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion work carried out under the previous Sydney Metro West planning application
AEI 30 – Golf Driving Range Landfill (off-site source)	**High (groundwater) and moderate (vapour)** Leachate from purpose-built landfill cells containing former uncontrolled waste burial in Sydney Olympic Park could migrate into the construction site during dewatering.	**Low** The off-site sources of contamination will not be remediated during the work carried out under the previous Sydney Metro West planning application and will remain. Further investigation and assessment would be undertaken in accordance with the planning approval work carried out under the previous Sydney Metro West planning application prior to this proposal. Residual groundwater contamination could remain. No on-site sources of soil or groundwater contamination were identified. The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during the work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation.
AEI 31 – Aquatic Centre Landfill (off-site source)		
AEI 32 – Bicentennial Park Landfill (off-site source)		
AEI 33 – Former abattoir (off-site source)	**Moderate (groundwater)** The former abattoir could be a source of contamination from inappropriate chemical storage and use, waste disposal and burials. Groundwater could migrate into the construction site during dewatering.	

6.4 Construction impact assessment

6.4.1 Existing contamination

The CSM and risk ranking for Sydney Olympic Park metro station is detailed in Appendix B. Based on the assessment, the AEIs 30 to 33 were rated as low risk for this proposal as the ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation undertaken during the work carried out under the previous Sydney Metro West planning application. Groundwater would continue to be dewatered due to the untanked cut and cover structure and off-site sources which are a source of groundwater, and vapour/landfill gas will remain following the work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation.

Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) predicts groundwater drawdown of two to four metres would occur within the Golf Driving Range landfill (AEI 30) to the southeast. A lowered groundwater/leachate level within the landfill could potentially result in increased landfill gas generation as the unsaturated volume in the landfill is increased. The drawdown could impact on the existing leachate control measures for the landfills. Further investigation would be undertaken during the work carried out under the previous Sydney

Metro West planning application to assess the impacts and specific mitigation measures which would also require implementation during the construction of this proposal.

As identified in Section 9.6.3 of Chapter 9 (Sydney Olympic Park metro station) of the Environmental Impact Statement, construction work for this proposal at Sydney Olympic Park metro station would not involve major sources of vibration generating equipment. As such, the potential for vibration to impact landfill waste containment cells in the area is anticipated to be negligible.

6.4.2 New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be detailed in the respective construction environmental management plans.

6.4.3 Acid sulfate soils

There is a high potential for acid sulfate soils in the area (see Appendix B). Soil mapped as Class 2 acid sulfate soil risk are located about 320 metres north of the construction site and disturbed terrain 200 metres to the east. As the station box would be untanked during construction, dewatering resulting in localised lowering of the groundwater table will occur. Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) predicts groundwater drawdown of two to four metres in mapped disturbed soils to the east. In accordance with conditions of approval (D122) for the work carried out under the previous Sydney Metro West planning application, a revised Groundwater Modelling Report will assess impacts from groundwater drawdown. Specific mitigation and monitoring recommended in this report, where required, would be continued during construction of this proposal.

6.4.4 Salinity

The Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) assessed the potential impacts from groundwater dewatering and resultant drawdown on groundwater salinity. Drawdown during the construction of this proposal could also result in continued saltwater intrusion from Powells Creek and the Bicentennial Park Wetlands. Potential environmental impacts from saline water intrusion were not identified, due to the absence of freshwater groundwater dependant ecosystems.

6.4.5 Groundwater

The groundwater is understood to be at about 12 metres below ground level within the Sydney Olympic Park metro station construction site. The Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) assessed that groundwater may be impacted by nutrients, heavy metals, hydrocarbons, methane, and VOCs.

Excavation required as part of this proposal is not likely to reach this depth. If contamination is present in groundwater at concentrations above the relevant assessment criteria, it is not likely to be significantly above the criteria based on the likely nature and extent of potential residual contamination in the construction site (see Section 8.3.1).

Groundwater dewatering required during construction could result in contact with contaminated groundwater by construction workers and groundwater which would require treatment prior to discharge. In accordance with conditions of approval (D122 and C17) and mitigation measure GW4 for the work carried out under the previous Sydney Metro West planning application, further detailed site investigations will be carried out as part of these works to assess if specific mitigation measures are required. These specific mitigation measures (if required) would be implemented for the construction of this proposal.

6.5 Operational impact assessment

6.5.1 Existing contamination

Soil and/or groundwater contamination, if present, are expected to be investigated and remediated during construction within the construction site. The station box would be untanked during operation, requiring ongoing dewatering which would result in groundwater drawdown. Groundwater inflows would be captured and directed to the operational water treatment plant at Clyde stabling and maintenance facility. As described in Section 6.4.1 there are potential impacts to the adjacent landfill beneath the Golf Driving Range from groundwater drawdown that could result in increased landfill gas generation. Further investigation will be undertaken during the work carried out under the previous Sydney Metro West planning application to assess the impacts and specific mitigation measures which may also require implementation during the operation of this proposal.

6.5.2 New contamination

Sydney Olympic Park metro station would include limited use and storage of chemicals, oils or fuels. There are no significant sources of contamination or impacts anticipated from the operation of the station or public domain. An operational environmental management plan would be implemented to prevent future soil or groundwater contamination.

6.5.3 Acid sulfate soils

The station box would be untanked during operation and as per Section 6.4.3 acid sulfate soil investigations within the zone of groundwater drawdown would be required to assess potential impacts and decide whether an ASSMP is required for operation.

6.5.4 Salinity

As per Section 6.4.4 the operation of Sydney Olympic Park metro station is not expected to have any negative environmental impacts from saltwater intrusion.

6.5.5 Groundwater

Groundwater from the station box would be pumped to the water treatment plant at the Clyde stabling and maintenance facility for treatment to the required discharge quality. Detailed contamination and groundwater investigations undertaken during the work carried out under the previous Sydney Metro West planning application would inform management measures for this proposal. The impact from the operation of Sydney Olympic Park metro station is considered to be low once mitigation measures are implemented.

7.0 North Strathfield metro station

North Strathfield metro station would be located immediately adjacent to the existing North Strathfield Station and would provide direct interchange with the T9 Northern Line.

The metro station would be located parallel and to the west of Queen Street, bounded to the north by Pomeroy Street, to the east by Queen Street, and to the south by the existing North Strathfield Station entry.

The area surrounding North Strathfield is characterised by single storey detached residential properties and low-rise residential apartments, townhouse buildings and a mix of schools and commercial uses. The North Strathfield local centre is located nearby on the opposite side of Queen Street, with retail and offices at street level and some residences above.

7.1 Construction description

The North Strathfield metro station construction site for this proposal would comprise:

- The approved construction site which will be established as part of the work carried out under the previous Sydney Metro West planning application
- Additional footprint areas within the existing rail corridor at and around the existing North Strathfield Station as shown in Figure 7-1

Construction of the proposed North Strathfield metro station would include:

- Enabling and site establishment work
- Relocation of utilities, including:
  - fibre optic cable within the rail corridor
  - signals and communication routes at Platform 3
  - overhead wiring structures
- Access to and use of the existing rail corridor between Rhodes Station to the north and Strathfield Station to the south to support work within the rail corridor
- Construction and fit-out of a new aerial footbridge (to the north of the existing footbridge) to enable integration of this proposal with the existing Sydney Trains suburban network and to provide access to the existing station and the North Strathfield metro station from the west of the rail corridor. This would include modification such as localised widening of Platform 3
- Construction of the station and structures for non-station use
- Station fit-out, including tie-in work to the existing aerial footbridge on the eastern side of the rail corridor
- Construction of station precinct and interchange facilities
- Finishing work, testing, and commissioning.

The construction works are likely to comprise of shallow earthworks associated with the construction of the station building. Localised deeper excavations may occur where deeper foundations are required for the aerial concourses. Groundwater dewatering works would occur as the metro station is to be untanked during construction.

The location and indicative layout of the North Strathfield metro station construction site is shown on Figure 7-1.

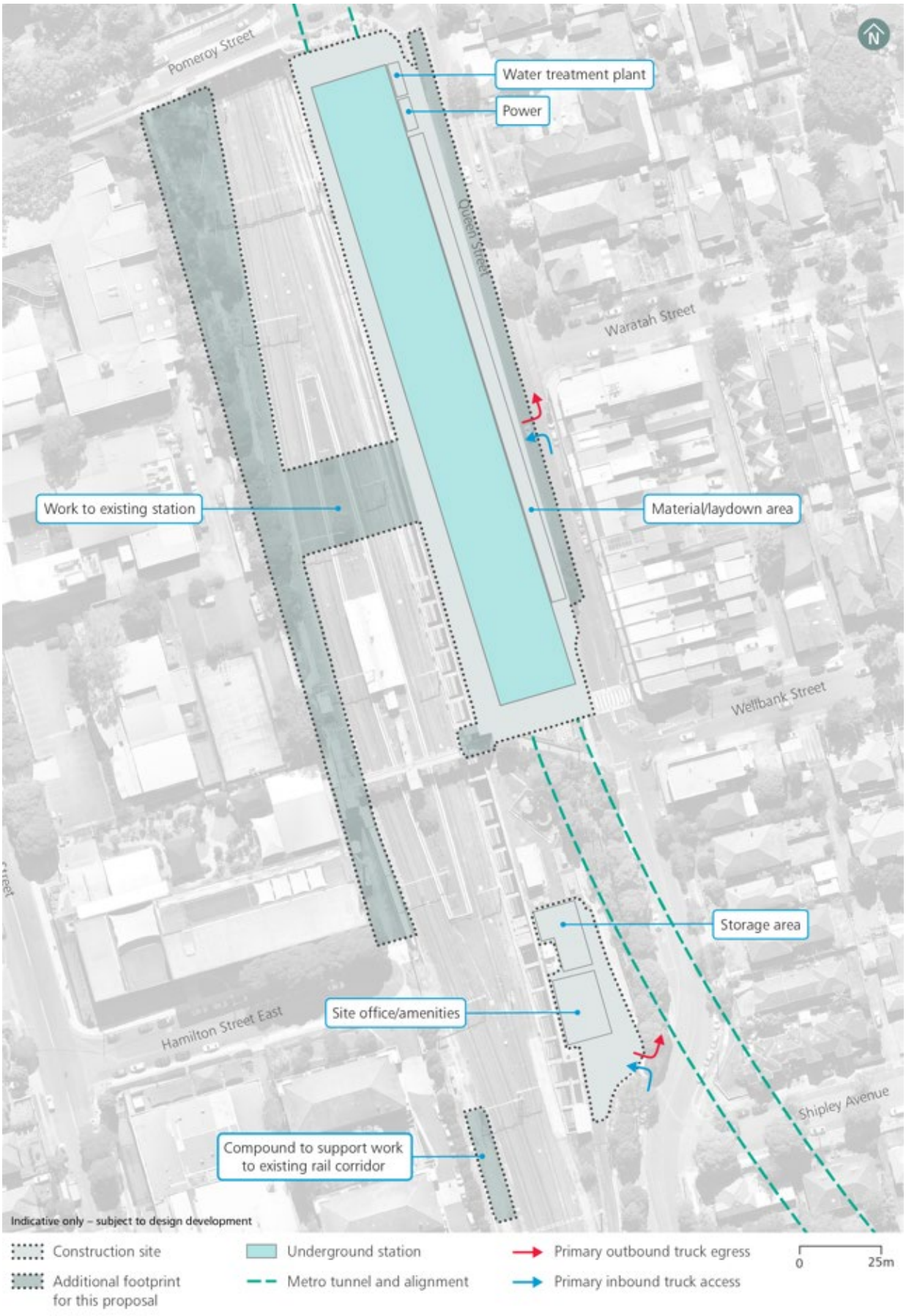

Figure 7-1 North Strathfield metro station indicative construction site layout

7.2 Operation description

North Strathfield metro station would be comprised of an underground station and above ground public domain which would include open space and spaces for future uses (subject to separate approval where required). The metro station would be untanked during operation and would therefore require ongoing groundwater dewatering. Groundwater inflows would be captured and directed to the operational water treatment plant at Clyde stabling and maintenance facility. The operational indicative layout and key design elements are shown on Figure 7-2.

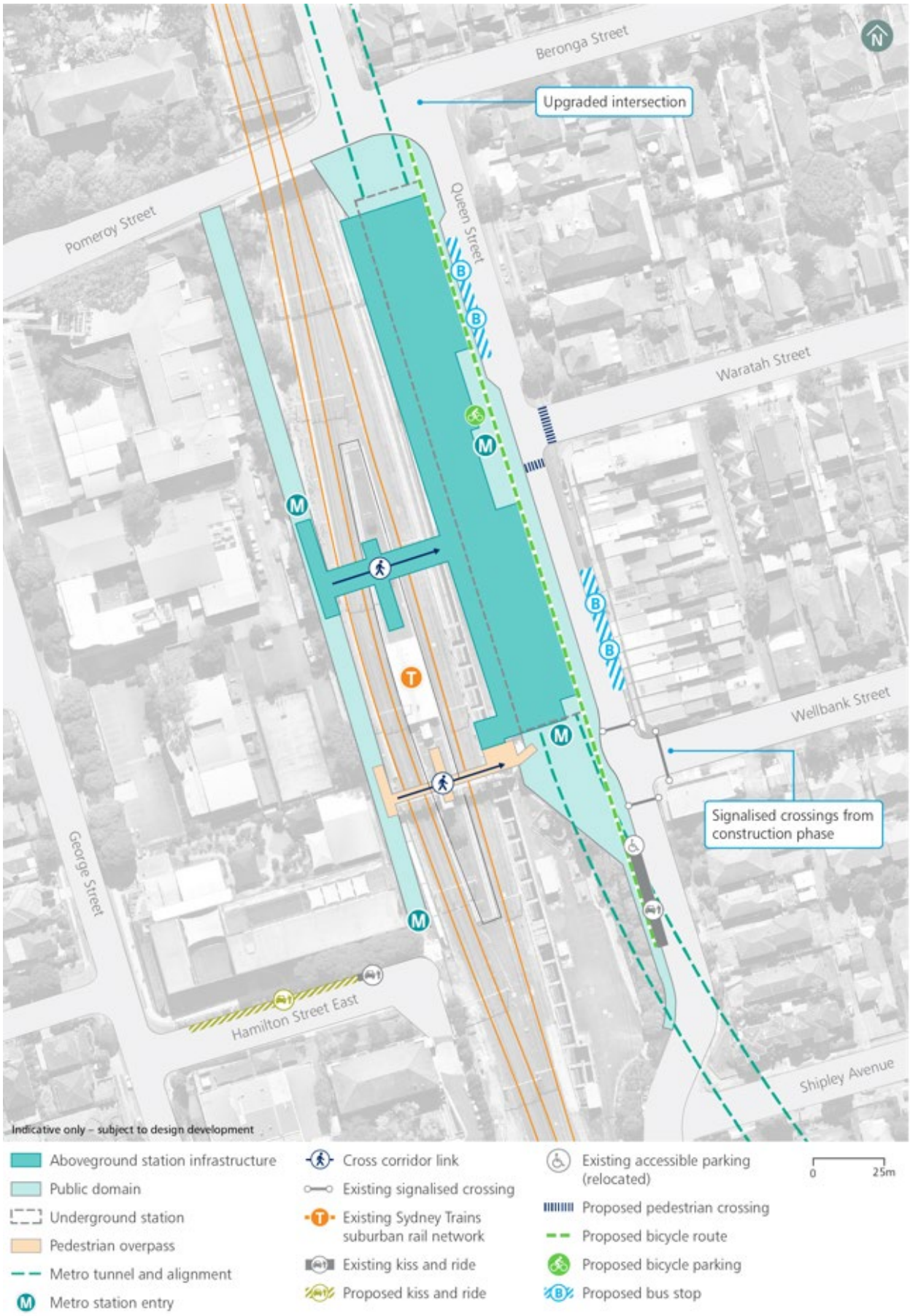

Figure 7-2 North Strathfield metro station indicative layout and key design features

7.3 Baseline environment

The construction site and surrounds comprise of low-density residential housing with moderate vegetation. To the west of the construction site is the existing North Strathfield Station and the existing rail corridor. Further west, the land uses comprise of education facilities, carparking, childcare, gym, café and low-density residential housing. Commercial properties are located to the east along part of Queen Street. The detailed site description, environmental setting and site history review for the North Strathfield metro station is described in Appendix B.

AEIs identified within the North Strathfield metro station construction site in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) (refer to Appendix B) and this assessment are summarised in Table 7-1. The AEIs assessed as a moderate or higher risk are shown on Figure 7-3.

Table 7-1 North Strathfield metro station – summary of baseline environment

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 35 – Historical railway activities	**Very low** Residuals from historical and current railway use, potential soil contamination (the construction boundary established as part of the previous Sydney Metro West planning application is outside AEI35)	**Moderate** Construction for this proposal would be within AEI 35, as such potentially contaminated soil would be disturbed during construction.
AEI 36 – Embalming chemicals (funeral home located off-site)	**Moderate** Use of embalming chemicals, potential off-site groundwater source	**Moderate** Off-site groundwater contamination sources would not be remediated during the work carried out under the previous Sydney Metro West planning application, therefore residual groundwater contamination would remain. The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation.
AEI 37 – Dry cleaning (off-site dry cleaners)	**Moderate** Use of solvents, potential off-site groundwater source	
AEI 38 – Hazardous building materials/demolition wastes	**Moderate** Former demolition of hazardous building materials potentially causing contamination to surface soils	**Low** (within the construction footprint of work carried out under the previous Sydney Metro West planning application) Surface soil within AEI 38 would be remediated during the work carried out under the previous Sydney Metro West planning application, therefore residual soil contamination would not remain.
AEI 38(a) – Hazardous building materials/demolition wastes	Not identified as AEI in the previous Sydney Metro West planning application.	**Moderate** Former demolition of hazardous building materials potentially causing contamination to surface soils may be present within the additional footprint which would not be remediated during the work carried out under the previous Sydney Metro West planning application.

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 39 – Historical commercial and industrial land use in surrounding locality (off-site)	**Moderate** Historical commercial and industrial land use in surrounding areas – potential off-site groundwater contamination source	**Moderate** Off-site groundwater contamination sources would not be remediated during the work carried out under the previous Sydney Metro West planning application, therefore residual groundwater contamination could remain. The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during the work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation.
AEI 40 – Potential firefighting activities (Switch yard located off-site)	**Moderate** Potential use of firefighting foam, potential off-site groundwater contamination source	**Low** Potentially ongoing management of contamination of groundwater and vapour (if present) during construction and operation of this proposal.

Note: (a) Denotes new AEI identified from the assessment of the additional construction footprint for this proposal - to differentiate from AEIs from the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a)

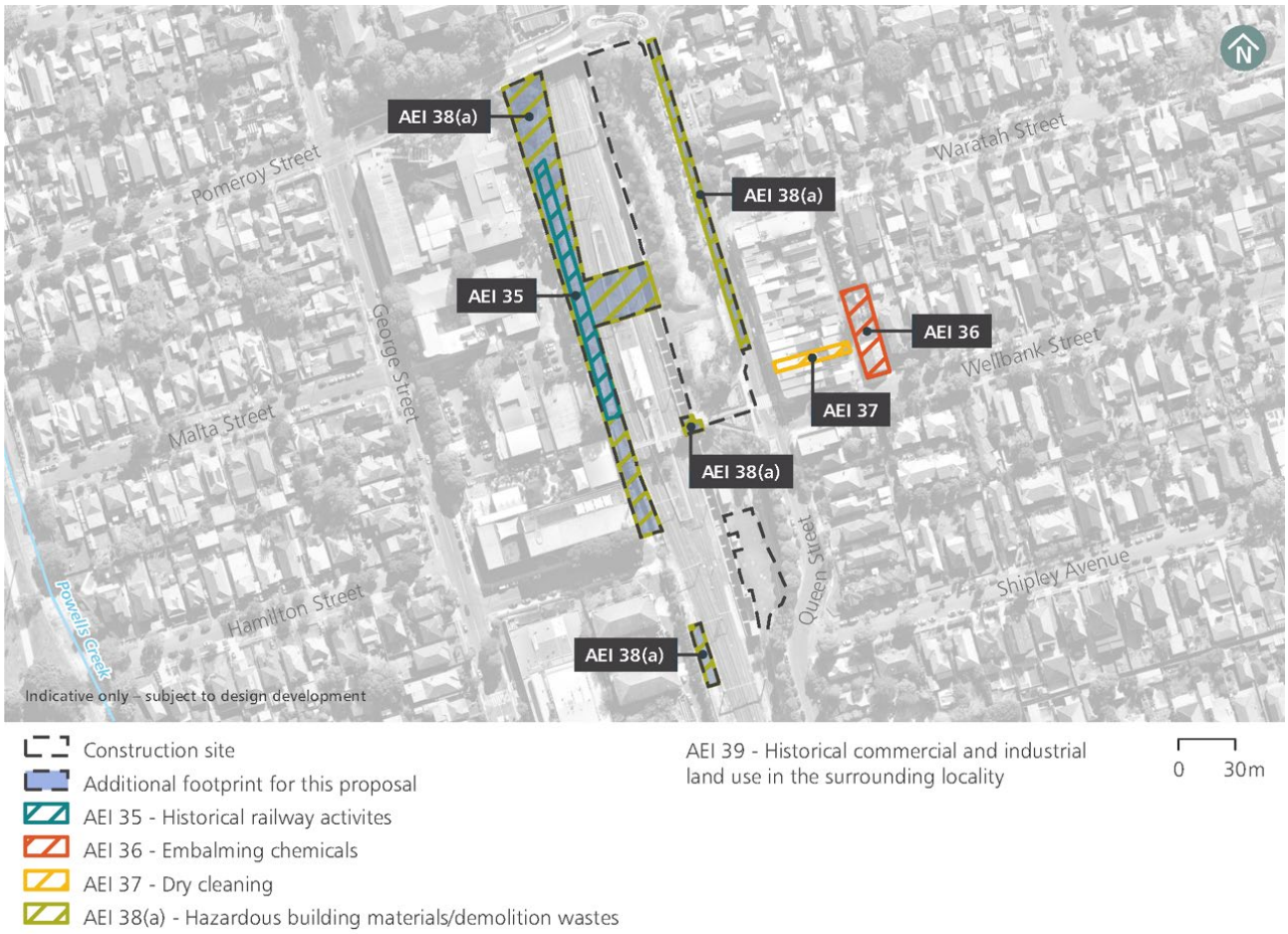

Figure 7-3 North Strathfield metro station – moderate risk areas of environmental interest

7.4 Construction impact assessment

7.4.1 Existing contamination

The CSM and risk ranking for North Strathfield metro station is detailed in Appendix B. Based on the assessment, all AEIs were all ranked as moderate risk except for AEI 40. Soil contamination within the construction site is likely to be remediated prior to the commencement of construction for this proposal and any residual contamination is likely to be minor and isolated. There are areas outside the construction site for the work carried out under the previous Sydney Metro West planning application that would require shallow and localised soil disturbance during this proposal. These additional construction areas are within AEI 35 and AEI 38. The additional area is shown on Figure 7-1.

Groundwater dewatering would continue during this proposal as the station would be untanked. As the groundwater contamination sources are off-site sources, the risk of contamination remains moderate for AEI 36 through to AEI 40.

7.4.2 New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be detailed in the respective construction environmental management plans.

7.4.3 Acid sulfate soils

The construction site is located within an area mapped as Class 5 acid sulfate risk and therefore acid sulfate soils are not expected to be encountered during excavation works. An area mapped as Class 2 acid sulfate soil risk is located 260 metres west of North Strathfield metro station. Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD

(Sydney Metro, 2020a) predicts a groundwater drawdown of two metres within areas mapped as disturbed soil to the west. In accordance with conditions of approval (D122) for the work carried out under the previous Sydney Metro West planning application, a revised Groundwater Modelling Report will assess impacts from groundwater drawdown. Specific mitigation and monitoring recommended in this report, where required, would be continued during construction of this proposal.

7.4.4 Salinity

The NSW Natural Resources Atlas sourcing information from the Salinity Hazard Map of NSW (DIPNR, 2018) does not indicate a soil salinity hazard at this site. Previous studies do not indicate soil salinity being an issue at this site. Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) predicted potential saltwater intrusion from Powells Creek due to groundwater drawdown. No negative environmental impacts were identified from the saltwater intrusion due to saline water tolerant groundwater dependant ecosystems and no use of groundwater for beneficial use in the affected area.

7.4.5 Groundwater

Potentially contaminated groundwater would be extracted during dewatering of the untanked station during construction. This would result in localised changes to groundwater flow and groundwater drawdown. There could be potential impacts to receptors including construction workers and to the receiving environment of extracted groundwater. Investigations will be undertaken during the work carried out under the previous Sydney Metro West planning application to assess the potential impacts and inform if specific mitigation measures are required in accordance with the conditions of approval (D122 and C17) and mitigation measure GW4. If required, this mitigation measure would continue to be implemented during the construction of this proposal.

7.5 Operational impact assessment

7.5.1 Existing contamination

Soil and/or groundwater contamination, if present, is expected to be investigated and remediated to the extent possible during construction. Groundwater would be continued to be extracted from the untanked underground metro station during operation and require treatment prior to discharge.

7.5.2 New contamination

North Strathfield metro station would include limited use and storage of chemicals, oils or fuels. There are no significant sources of contamination or impacts anticipated from the operation of the station or public domain. An operational environmental management plan would be implemented to prevent future soil or groundwater contamination.

7.5.3 Acid sulfate soils

The station box would be untanked during operation, requiring ongoing dewatering which would result in groundwater drawdown. As per Section 7.4.3 specific mitigation and monitoring where required would be continued during operation of this proposal.

7.5.4 Salinity

The station box would be untanked during operation, requiring ongoing dewatering which would result in groundwater drawdown. As per Section 7.4.3 the operation of North Strathfield metro station is not expected to have any negative environmental impacts from saltwater intrusion.

7.5.5 Groundwater

Sources of contaminants from the operation of the station would be negligible and not anticipated to have an impact on groundwater quality. Potentially contaminated groundwater will be extracted during dewatering of the untanked station during operation. This would result in localised changes to groundwater flow and groundwater drawdown. All groundwater extracted from dewatering of the station box would be captured and pumped to the operational water treatment plant at the Clyde stabling and maintenance facility. The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the North Strathfield metro station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant.

8.0 Burwood North Station

Burwood North Station would be located around the intersection of Parramatta Road and Burwood Road across two sites. The Burwood North Station northern site would be located between Burwood Road and Loftus Street on the northern side of Parramatta Road and the Burwood North Station southern site would be located between Burwood Road and Esher Lane on the southern side of Parramatta Road.

The Burwood North Station precinct is characterised by a variety of retail, commercial, light industrial, low- and medium-density development and open space uses. Concord Oval, located on the corner of Loftus Street and Parramatta Road, is an important regional sporting facility and is in the process of being redeveloped into a state-of-the-art sporting, recreation and community facility. The Burwood Strategic Centre is developed around the existing Burwood Station (to the south of Burwood North), with the Burwood shopping precinct located nearby.

8.1 Construction description

The Burwood North Station construction site for this proposal would comprise the approved construction site which will be established as part of the work carried out under the previous Sydney Metro West planning application. Construction works for this proposal would include:

- Enabling and site establishment work, including installation of an acoustic shed (or other acoustic measures) over the rail systems fit-out shaft at the Burwood North northern construction site
- Construction of the station and structures for non-station use
- Station fit-out, including fit-out of an underground pedestrian link below Parramatta Road providing a permanent connection between two station entrances to the north and south of Parramatta Road
- Construction of station precinct and interchange facilities
- Provision for adjacent station development
- Access for tunnel fit-out and rail systems work
- Finishing work, testing, and commissioning.

There are anticipated to be very minor earthworks, limited to shallow excavations and trenches for footings and services. Groundwater dewatering would occur during construction of this proposal as the shaft and station box excavated as part of the work carried out under the previous Sydney Metro West planning application will be untanked. The crossover cavern would be tanked.

The location and indicative layout of the Burwood North Station construction site is shown on Figure 8-1.

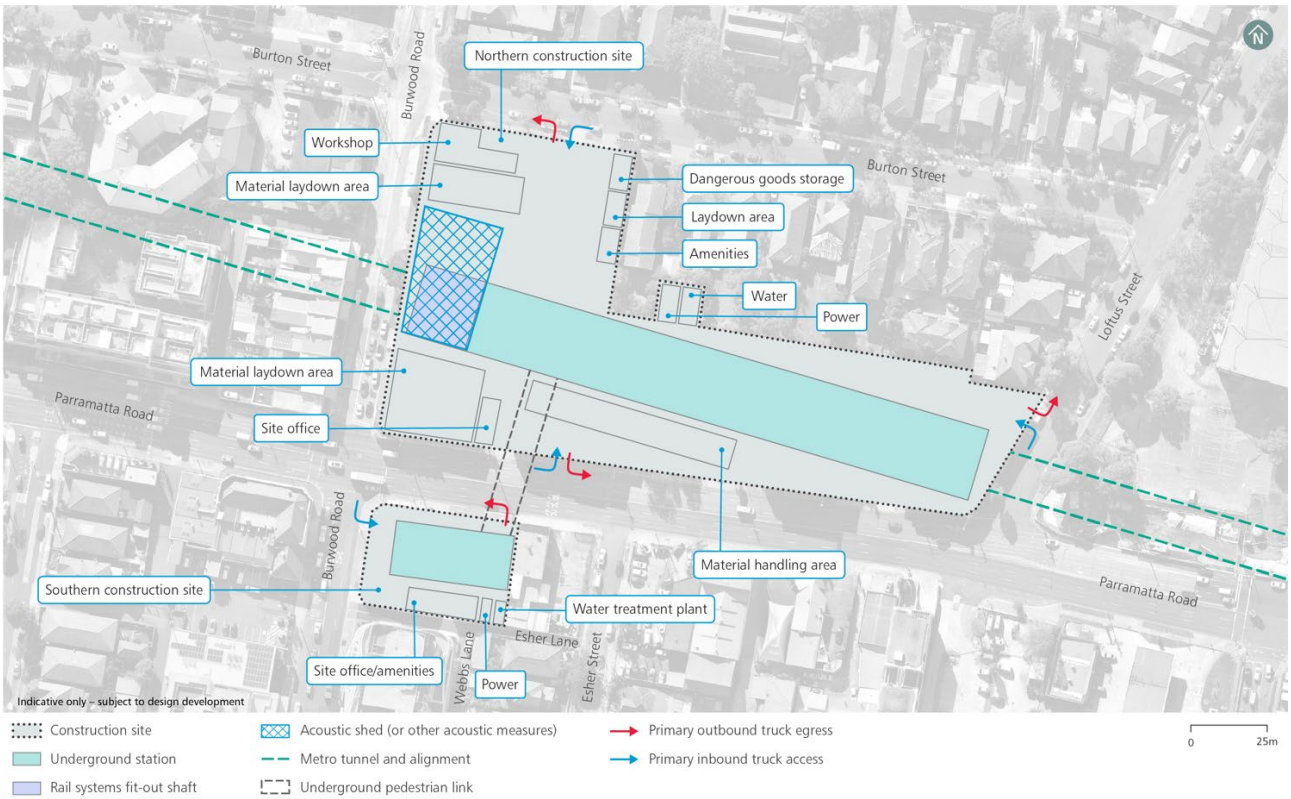

Figure 8-1 Burwood North station indicative construction site layout

8.2 Operation description

Burwood North Station would include some operation and maintenance activity for station services and operation of a public domain area and provision for commercial and retail uses (subject to separate approval where required). There is anticipated to be limited chemical oil or fuel storage at the Burwood North Station. The shaft and station box would be untanked during operation and would require ongoing groundwater dewatering. Groundwater would be captured and directed to the operational water treatment plant at the Clyde maintenance and stabling facility. The operational indicative layout and key design elements are shown on Figure 8-2.

Figure 8-2 Burwood North station indicative layout and key design elements

8.3 Baseline environment

The Burwood North Station construction site currently comprises of commercial/industrial facilities and some low-density residential housing. The commercial/industrial facilities consist of a variety of uses including car mechanics, vacant buildings and an automotive dealership which was present along Parramatta Road. Within the northern site are medium-density residential properties, located on Burwood Road between Burton Street and Parramatta Road. The southern site is occupied by commercial/industrial facilities which consist of a variety of uses including car mechanics and vacant buildings. This infrastructure will be removed as part of the work carried out under the previous Sydney Metro West planning application and the sites would be cleared at commencement of construction work associated with this proposal. The detailed site description, environmental setting and site history review for the Burwood North Station is described in Appendix B.

AEIs identified within the Burwood North Station construction site in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) (refer to Appendix B) and this assessment are summarised in Table 8-1. The AEIs that were assessed as moderate or higher risk are shown on Figure 8-3.

Table 8-1 Burwood North Station – summary of baseline environment

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 41 – Leaks and spills from automotive dealer	**Moderate** Could be sources of heavy metals, hydrocarbons (TRH, BTEX, PAH) and asbestos.	**Moderate** Residual groundwater contamination could remain following the work carried out under the previous Sydney Metro

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 42 – Chemical and wax use (Crown car wash on 13 Parramatta Road)	**Very low (soil) and moderate (groundwater)** Could be a source of contamination including heavy metals, hydrocarbons, surfactants and PFAS.	West planning application. The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during the work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation.
AEI 43 – Hazardous building materials	**Moderate** Associated potential hazardous building materials within or from buildings which could be sources of heavy metals, hydrocarbons (TRH, PAH), pesticides and asbestos to surface soils.	**Very low** Surface soils will be excavated or remediated during the work carried out under the previous Sydney Metro West planning application.
AEI 44 – Vehicle particulate deposition (from historical traffic flow on Paramatta Road)	**Moderate** Could be sources of hydrocarbons and lead from particulate matter deposition.	
AEI 45 – Historical commercial and industrial use in surrounding locality (off-site sources)	**Very low (soil) and moderate (groundwater)** Historical commercial/industrial use within locality which could be sources of heavy metals, hydrocarbons (TRH. BTEX, PAH) and VOCs.	**Moderate** Off-site sources of contamination would not be remediated during the work carried out under the previous Sydney Metro West planning application, therefore residual groundwater contamination could remain. The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during the work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation.

Figure 8-3 Burwood North Station – moderate or higher risk areas of environmental interest

8.4 Construction impact assessment

8.4.1 Existing contamination

The CSM and risk ranking for Burwood North Station is detailed in Appendix B. Based on the assessment, all AEIs were ranked as moderate risk except for AEI 43 and AEI 44 which were ranked as very low risk. Soil and groundwater contamination within the site is likely to be investigated as part of the work carried out under the previous Sydney Metro West planning application. Shallow soils and soils within the station box will be excavated or remediated as required prior to commencement of construction for this proposal. Residual groundwater contamination could remain as off-site sources of contamination would not be remediated.

8.4.2 New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be detailed in the respective construction environmental management plans.

8.4.3 Acid sulfate soils

There is a low potential for acid sulfate soils in the area (see Appendix B). Soils mapped as Class 2 are located within 240 metres of the construction site. Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) predicts a groundwater drawdown of two to 14 metres within areas mapped as disturbed soil and Class 2 acid sulfate soil risk to the north, north west and north east. In accordance with conditions of approval (D122) for the work carried out under the previous Sydney Metro West planning application, a revised Groundwater Modelling Report will assess impacts from groundwater drawdown. Specific mitigation and monitoring recommended in this report, where required, would be continued during construction of this proposal.

8.4.4 Salinity

Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) predicted potential minimal saltwater intrusion from Canada Bay from groundwater drawdown. No negative environmental impacts were identified from the saltwater intrusion due to the limited distance of intrusion of about 50 metres.

8.4.5 Groundwater

Potentially contaminated groundwater would be extracted during dewatering of the untanked station box and shaft during construction. This would result in localised changes to groundwater flow and groundwater drawdown. Groundwater investigations will be undertaken during the work carried out under the previous Sydney Metro West planning application to assess the requirements for specific mitigation measures in accordance with the conditions of approval (D122 and C17) and mitigation measure GW4. If required, these mitigation measures would continue to be implemented during the construction of this proposal.

8.5 Operational impact assessment

8.5.1 Existing contamination

Soil and/or groundwater contamination, if present, is expected to be investigated and remediated during construction. There are no anticipated impacts to the operation of Burwood North Station from existing contamination, with the exception of ongoing treatment of extracted groundwater.

8.5.2 New contamination

Burwood North Station would include limited use and storage of chemicals, oils or fuels. There are no significant sources of contamination or impacts anticipated from the operation of the station or public domain. An operational environmental management plan would be implemented to prevent future soil or groundwater contamination.

8.5.3 Acid sulfate soils

As per Section 8.4.3 a revised Groundwater Modelling Report will assess impacts from groundwater drawdown. Specific mitigation and monitoring recommended in this report , where required, would be continued during operation of this proposal.

8.5.4 Salinity

As per Section 8.4.4 the operation of Burwood North Station is not expected to have any negative environmental impacts from saltwater intrusion.

8.5.5 Groundwater

Sources of contaminants from the operation of the Burwood North Station would be negligible and not anticipated to have an impact on groundwater quality. Potentially contaminated groundwater would be extracted during dewatering of the untanked station during operation. This would result in localised changes to groundwater flow and groundwater drawdown. All groundwater extracted from dewatering of the station box and shaft will be pumped to the operational water treatment plant at the Clyde stabling and maintenance facility. The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the proposed Burwood North Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant.

9.0 Five Dock Station

Five Dock Station would be located in Five Dock town centre, off Great North Road.

The Five Dock Station precinct is characterised by its vibrant town centre, which includes a mix of commercial, retail, community, residential and civic open space uses. Fred Kelly Place is a focal point of the community. The town centre is surrounded by low-rise detached residential properties, apartments and townhouse buildings together with a mix of schools, including the Five Dock Public School. Great North Road is the primary north-south spine through the locality leading from Parramatta Road to the peninsula suburbs of Abbotsford and Drummoyne.

9.1 Construction description

The Five Dock Station construction site for this proposal would comprise the approved construction site which will be established as part of the work carried out under the previous Sydney Metro West planning application. Construction works for this proposal would include:

- Enabling and site establishment work
- Minor excavation for the station building
- construction of the station and structures for non-station use
- station fit-out
- Construction of station precinct and interchange facilities
- Finishing work, testing, and commissioning.

There are anticipated to be limited earthworks associated with the construction works. As the station access shafts will be untanked structures, groundwater dewatering would continue throughout construction and operation. The station cavern will be tanked prior to construction of this proposal.

The location and indicative layout of the Five Dock Station construction site is shown on Figure 9-1.

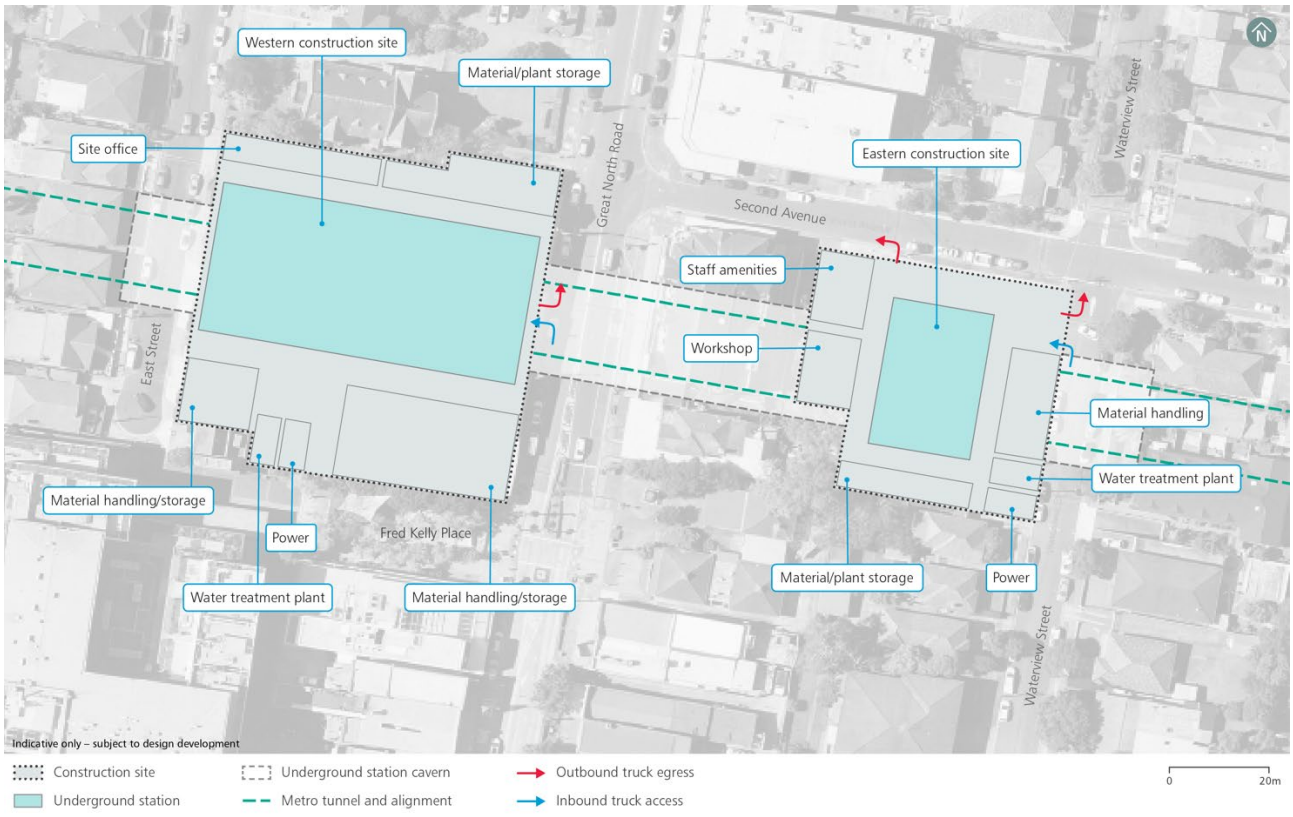

Figure 9-1 Five Dock Station indicative construction site layout

9.2 Operation description

The operation of the metro station will include two laneways and a public concourse area and provision for commercial and retail uses (subject to separate approval where required). There is anticipated to be limited chemical, oil or fuel storage at Five Dock Station. The operational indicative layout and key design elements are shown on Figure 9-2.

Figure 9-2 Five Dock Station indicative layout and key design elements

9.3 Baseline environment

The Five Dock Station western site is occupied by commercial premises with external car parking areas. Some vegetation was present comprising grassed areas and tree-lined streets. The eastern site is occupied by low-density residential properties and an external carpark.

During the work carried out under the previous Sydney Metro West planning application, the buildings within the sites would be demolished and bulk excavation would occur for the construction of the underground station cavern. The detailed site description, environmental setting and site history review for Five Dock Station is described in Appendix B.

AEIs identified within the Five Dock Station construction site in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) (refer to Appendix B) and this assessment are summarised in Table 9-1. The AEIs which were assessed as moderate or higher risk are shown on Figure 9-3.

Table 9-1 Five Dock Station – summary of baseline environment

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 46 – Embalming chemicals (two off-site nearby funeral homes)	**Moderate** Off-site potential source of groundwater contamination from embalming fluids	**Moderate** Off-site sources of contamination would not be remediated during the work carried out under the previous Sydney Metro West planning application, therefore residual groundwater contamination could remain. The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation.
AEI 47 – Hazardous building materials	**Moderate** Potential surface soil contamination from hazardous building materials within or from on-site buildings / structures or demolition wastes.	**Low** Surface soils will be excavated or remediated during the work carried out under the previous Sydney Metro West planning application.
AEI 48 – Adjacent Chamber Substation (off-site source)	**Very low** Potential source of soil contamination from PCB containing oil leaks.	**Very low** As per AEI 47 above.
AEI 49 – Former service station (off-site source)	**Low** Potential groundwater contamination from leaks and spills from underground petroleum storage infrastructure.	**Low** Off-site sources of contamination would not be remediated during work carried out under the previous Sydney Metro West planning application, therefore residual groundwater contamination could remain. The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during the work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation.
AEI 50 – Surrounding historical industrial and commercial land uses (off-site sources)	**Moderate** Surrounding historical industrial and commercial land uses which could be a source of groundwater contamination.	**Moderate** As per AEI 49 above.

Figure 9-3 Five Dock Station – moderate or higher risk areas of environmental interest

9.4 Construction impact assessment

9.4.1 Existing contamination

The CSM and risk ranking for Five Dock Station is detailed in Appendix B. Based on the assessment:

- AEIs 47 and 48 were likely to be remediated during the work carried out under the previous Sydney Metro West planning application and are not anticipated to present a risk during the construction of this proposal
- AEIs 46 and 50 remained moderate risk and AEI 49 remained low risk as off-site groundwater sources will continue to remain a potential issue due to groundwater dewatering continuing through construction.

9.4.2 New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be detailed in the respective construction environmental management plans.

9.4.3 Acid sulfate soils

There is an extremely low probability of occurrence of acid sulfate soil within the construction site and the immediate surrounds and the construction site is mapped as Class 5 acid sulfate soil risk in the *Burwood Local Environment Plan 2012*. Soils mapped as low probability of occurrence and Class 2 risk are mapped 360 metres to the north.

Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) predicts a groundwater drawdown of up to nine metres within areas mapped as disturbed soil to the north, north west and east. In accordance with conditions of approval (D122) for the work carried out under the previous Sydney Metro West planning application a revised Groundwater Modelling Report will assess impacts from groundwater drawdown. Specific mitigation and monitoring recommended in this report, where required, would be continued during construction of this the proposal.

9.4.4 Salinity

Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) predicted minimal potential saltwater intrusion from Canada Bay due groundwater drawdown. No negative environmental impacts were identified from the saltwater intrusion due to the minimal intrusion distance of around 50 metres

9.4.5 Groundwater

Potentially contaminated groundwater would be extracted during dewatering of the untanked shaft during construction. This would result in localised changes to groundwater flow and groundwater drawdown. Groundwater investigations will be undertaken during the previous Sydney Metro West planning application to assess the requirements for specific mitigation measures in accordance with the conditions of approval (D122 and C17) and mitigation measure GW4.

9.5 Operational impact assessment

9.5.1 Existing contamination

Soil and/or groundwater contamination within the construction site, if present, is expected to be investigated and remediated during the previous Sydney Metro West planning application. There are no anticipated impacts to the operation of Five Dock Station from existing contamination.

9.5.2 New contamination

Five Dock Station would include limited use and storage of chemicals, oils or fuels. There are no significant sources of contamination or impacts anticipated from the operation of the station or public domain. An operational environmental management plan would be implemented to prevent future soil or groundwater contamination.

9.5.3 Acid sulfate soils

The station shafts would be untanked during operation, requiring ongoing dewatering which would result in groundwater drawdown. As per Section 9.4.3 a revised Groundwater Modelling Report will assess impacts from groundwater drawdown. Specific mitigation and monitoring recommended in this report, where required, would be continued during operation of this proposal.

9.5.4 Salinity

The shaft would be untanked during operation, requiring ongoing dewatering which would result in groundwater drawdown. As per Section 9.4.3 the operation of the proposal is not expected to have any negative environmental impacts from saltwater intrusion.

9.5.5 Groundwater

Sources of contaminants from the operation of the station would be negligible and not anticipated to have an impact on groundwater quality. Potentially contaminated groundwater would be extracted during dewatering of the untanked shafts during operation. This would result in localised changes to groundwater flow and groundwater drawdown. All groundwater extracted from dewatering of the shafts would be captured and pumped to the operational water treatment plant at the Clyde stabling and maintenance facility. The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the proposed Five Dock Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant.

10.0 The Bays Station

The Bays Station would be located at White Bay between Glebe Island and the former White Bay Power Station. The station would have direct access to the future Bays Waterfront Promenade, which would run north-south along White Bay. Port Access Road, Sommerville Road and Solomons Way provide access to the White Bay Cruise Terminal and other port operations located in the Glebe Island and White Bay destinations.

The Bays Station precinct is framed by the residential suburbs of Rozelle, Balmain and Balmain East, located to the north and west. There are several significant landmarks in proximity including the former White Bay Power Station, the Glebe Island Silos, and Anzac Bridge.

Land use near the proposed site is largely maritime-related commercial and industrial. The land within The Bays has been identified as a State Significant Precinct and Growth Centre by the NSW Government.

Sydney Metro has developed a precinct plan to inform the concept design for the station precinct in consultation with the NSW Department of Planning and Environment. The Bays Station precinct, including the provision for adjacent station development and public domain, would be subject to the NSW Department of Planning and Environment master plan.

10.1 Construction description

The Bays Station construction site for this proposal would comprise:

- The approved construction site which will be established as part of the work carried out under the previous Sydney Metro West planning application
- The Bays tunnel and launch construction site which would be used as part of the work carried out under the previous Sydney Metro West planning application. This site is located within the approved construction site which will be established as part of the works carried out under the previous Sydney Metro West planning application
- Additional areas to the north and south of the White Bay Power Station for precinct works and the traction substation.

Construction works for this proposal at The Bays would include:

- Enabling and site establishment work, including acoustic sheds (or other acoustic measures) over the rail systems fit-out shafts
- construction of the station and structures for non-station use
- station fit-out
- Construction of station precinct and interchange facilities
- Provision of infrastructure such as trunk utilities as well as public domain and landscape works to service the station precinct and future adjacent station development (subject to separate approvals)
- Construction and fit-out of the traction substation
- Access for tunnel fit-out and rail systems work
- Provision for adjacent station development
- Finishing work, testing, and commissioning.

The location and indicative layout of The Bays Station construction site is shown on Figure 10-1.

The cut and cover station box would be tanked in soil and untanked in bedrock during construction of this proposal. Shallow earthworks and localised deep excavations would be required in The Bays Station construction site for the construction of the public domain areas for this proposal.

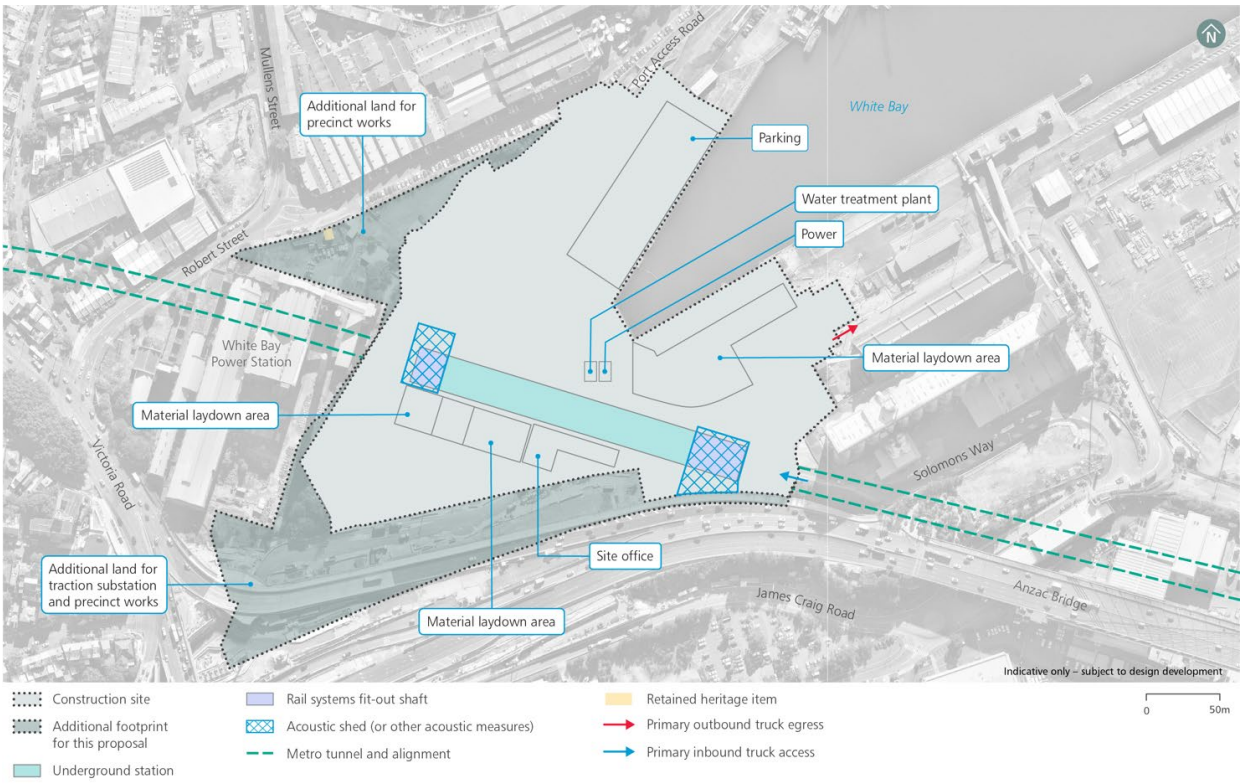

Figure 10-1 The Bays Station indicative construction site layout

10.2 Operation description

The operation of the metro station will include public domain area, precinct roads and transport interchange facilities, and provision for commercial and retail uses (subject to separate approval where required). There is anticipated to be limited chemical, oil or fuel storage at The Bays Station. The station box would be tanked during operation. The operational indicative layout and key design elements are shown on Figure 10-2.

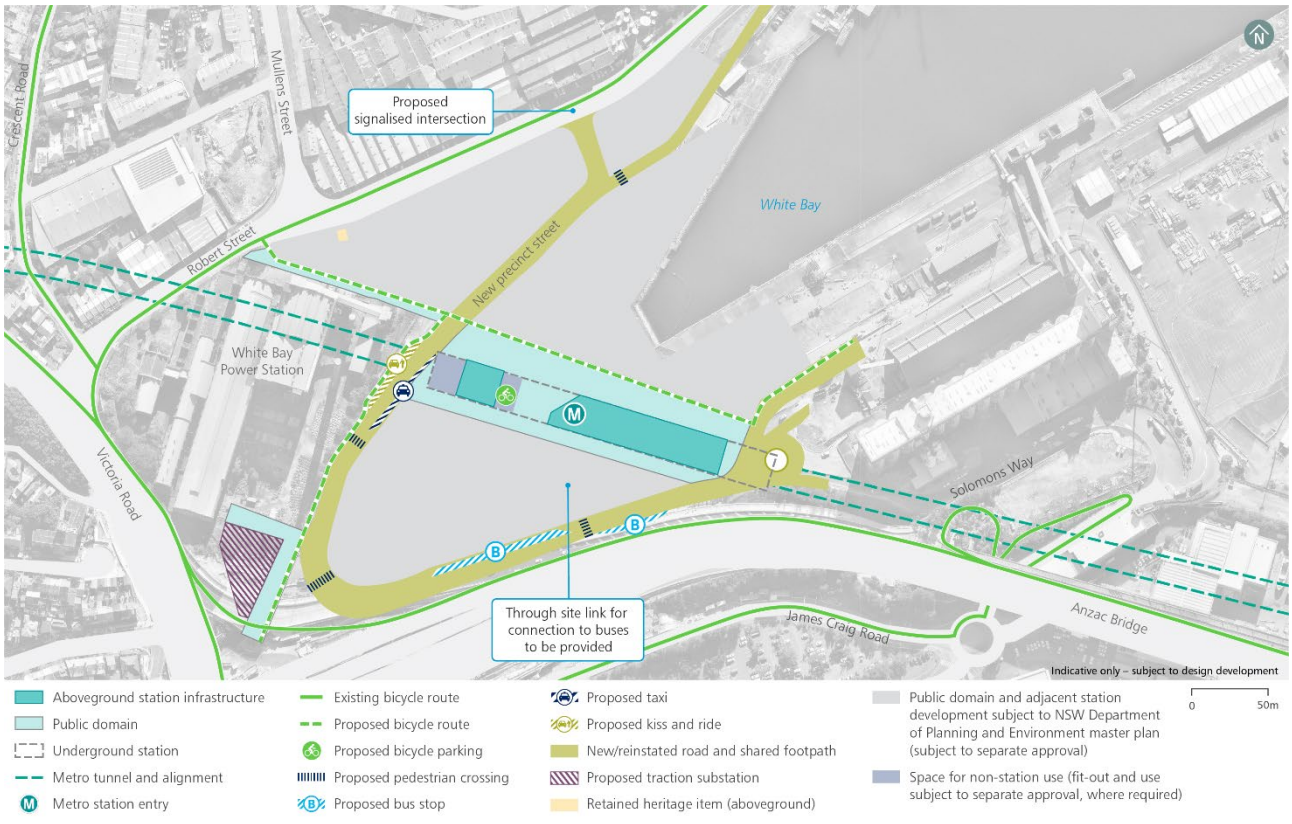

Figure 10-2 The Bays Station indicative layout and key design elements

10.3 Baseline environment

The Bays Station construction site currently comprises vacant port land in White Bay. Bulk excavation for the station box will have been completed during the work carried out under the previous Sydney Metro West planning application prior to the commencement of construction for this proposal. The detailed site description, environmental setting and site history review for The Bays Station is described in Appendix B.

AEIs identified within The Bays Station construction site in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) and Sydney Metro West Environmental Impact Statement – The Bays to Sydney CBD (Sydney Metro, 2021) (refer to Appendix B) are summarised in Table 10-1. The AEIs with a moderate or higher risk are shown on Figure 10-3.

Following approval of work carried out under the previous Sydney Metro West planning application, a Factual Contamination Investigation Report – The Bays, Sydney Metro West, White Bay Site Investigations (Senversa, 2021) was undertaken for The Bays Station construction site. The report is discussed in Appendix B and summarised below:

- Asbestos was detected in five fill samples, with one sample exceeding the adopted assessment criteria for friable asbestos and asbestos fines
- Lead and benzene concentrations exceeded the adopted human health assessment criteria in one fill sample
- Concentrations of heavy metals (arsenic, cobalt, copper, manganese, nickel and zinc) and ammonia in groundwater exceeded the adopted ecological assessment criteria across the construction site
- TRH > C16-C34 concentration in one well in the southwest portion of the construction site exceeded the adopted ecological assessment criteria.
- Perfluorooctanesulfonic acid (PFOS) concentrations in groundwater exceeded the adopted ecological assessment criteria in wells in the southwest portion of the construction site
- The sum of PFOS and perfluorohexanesulfonic acid (PFHxS) (PFOS+PFHxS) concentrations in one well in the southwest portion of the construction site exceeded the adopted human health (recreational) criteria
- Light non aqueous phase liquid (LNAPL) was measured in two up-gradient off-site wells located within the former White Bay Power Station.

Table 10-1 The Bays Station – summary of baseline environment

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 2(2) - Former Ampol terminal (off-site source)	**Low** Adjacent off-site known heavy metals and hydrocarbon contamination. The soil remediation was completed prior to 1994, with potential for remaining contamination above current guideline levels unknown	**Low** The cut and cover station box would be untanked in bedrock during construction of this proposal, and groundwater would be dewatered and treated prior to discharge to White Bay. The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during works carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation. The permanent station box will be tanked.

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 4(2) – Former Unilever Sulphonation Plant (off-site source)	**Low** Off-site source of contamination from past chemical and potential fuel storage and use, potential spills, manufacturing processes, inappropriate demolition/waste disposal.	**Low** As per AEI 2(2) above.
AEI 52 – Mechanical workshop (off-site source in Robert Street, Rozelle)	**Moderate (groundwater)** and **very low (soil)** Adjacent off-site mechanical workshop located adjacent to the construction site in Robert Street.	**Low** As per AEI 2(2).
AEI 53/AEI 8(2) – White Bay Power Station	**AEI 53 -Moderate/AEI 8(2) Low** The former White Bay Power Station activities, structures and potential firefighting activities within and adjacent to the construction site	**High** As per AEI 2(2).
AEI 54/ AEI 9(2) – Land reclamation	**AEI 54 -Moderate /AEI 9(2) - Low** Historical land reclamation using potentially contaminated fill within the construction site.	**High** Soil and contaminated groundwater will be removed from the cut and cover station excavation during the work carried out under the previous Sydney Metro West planning application, and would remain in-situ in the remainder of the construction site. Based on extensive investigation results, asbestos is present in the fill and there are likely localised areas of soil contamination exceeding commercial/industrial land use criteria that will require remediation (remediation action plan [RAP] development but unlikely additional significant investigation). Shallow and localised deep excavation would be required during construction of this proposal.
AEI 55/11(2) – Historical industrial land use (off-site sources)	**AEI 55 - Moderate (groundwater) and very low (soil)/** **AEI 11(2) – Low** Surrounding historical and commercial land use surrounding the construction site.	**High** As per AEI 2(2).

Note: "(2)" Denotes AEI from the Sydney Metro West Environmental Impact Statement – The Bays to Sydney CBD (Sydney Metro, 2021) to differentiate from AEIs with the same number from the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a)

Figure 10-3 The Bays Station – moderate or higher risk areas of environmental interest

10.4 Construction impact assessment

10.4.1 Existing contamination

The CSM and risk ranking for The Bays Station is detailed in Appendix B. Based on the assessment, all AEIs were ranked as high risk, with the exception of AEI 52, AEI 2(2) and AEI 4(2) which was low risk. Earthworks would be required to disturb soils which have been found to contain asbestos waste which present a risk to construction workers. Groundwater dewatering would be required during construction as the station box would be untanked which could alter existing contaminated groundwater migration. Groundwater extracted would be treated prior to discharge.

10.4.2 New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be detailed in the respective construction environmental management plans.

10.4.3 Acid sulfate soils

The construction site is mapped as disturbed terrain and low probability of occurrence of acid sulfate soils (no acid sulfate soil class mapped). The Factual Contamination Investigation Report – The Bays, Sydney Metro West, White Bay Site Investigations (Senversa, 2021), identified acid sulfate soils were present beneath the fill across The Bays Station construction site. The Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) modelled that up to 28 metres of groundwater level drawdown would occur.

It is therefore possible that oxidation of acid sulfate soils could occur during construction. In accordance with conditions of approval (D122) for the work carried out under the previous Sydney Metro West planning application, a revised Groundwater Modelling Report will assess impacts from groundwater drawdown.

Specific mitigation and monitoring recommended in this report, where required, would be continued during construction of this proposal.

10.4.4 Salinity

The Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) concluded that saltwater intrusion from groundwater drawdown would likely occur due to the close proximity to White Bay. No groundwater dependant ecosystems were identified, and structures are expected to be designed for saline conditions. Based on this, environmental impacts from increased salinity are not expected during construction.

10.4.5 Groundwater

Light non aqueous phase liquid was detected in groundwater to the west of the construction site. The groundwater drawdown could cause the contamination to migrate towards the direction of the station box excavation during construction that could present a risk to construction workers and require further assessment. Heavy metals, ammonia, TRH and PFAS were found to exceed adopted ecological and recreational (PFAS only) assessment criteria. Groundwater encountered during construction would be treated prior to discharge so the risk to sensitive receptors in White Bay is low.

10.5 Operational impact assessment

10.5.1 Existing contamination

Soil and groundwater contamination where present would be investigated and remediated (where required) during construction. There would likely be a requirement for a long-term environmental management to manage residual soil and monitor groundwater contamination.

10.5.2 New contamination

The Bays Station would include limited use and storage of chemicals, oils, or fuels during operation with the exception of the substation. An operational environmental management plan would be implemented to prevent future soil or groundwater contamination. There are no significant sources of contamination or impacts anticipated from the operation of the station or public domain.

10.5.3 Acid sulfate soils

The station box would be tanked at the completion of construction, as such groundwater drawdown would no longer occur, and groundwater levels would return to pre-construction levels. There would be no anticipated impacts from operation on acid sulfate soils.

10.5.4 Salinity

The station box would be tanked at the completion of construction, as such groundwater drawdown would no longer occur, and saltwater intrusion would no longer occur. Operation is not anticipated to have a negative impact on groundwater salinity.

10.5.5 Groundwater

The station box would be tanked at the completion of construction of this proposal, as such groundwater drawdown would no longer occur. Operation is not anticipated to have a negative impact on groundwater quality.

11.0 Pyrmont Station

Pyrmont Station would be located at the centre of the Pyrmont peninsula, across a western and eastern site. The Pyrmont Station western site would be located between Paternoster Row and Pyrmont Street, immediately north of Pyrmont Bridge Road, and the Pyrmont Station eastern site would be located between Edward Street, Union Street and Pyrmont Bridge Road.

The area surrounding the Pyrmont Station western site includes low- and medium-rise character terrace buildings, former warehouse buildings and local hotels at prominent corner sites. There are some remnant buildings that exhibit a heritage character. The Pyrmont Station eastern site is located near The Star Sydney, a casino that is subject to a proposed redevelopment application. There are also several heritage buildings in the vicinity of this site.

Pyrmont Station would be located on the western fringe of the Sydney CBD, containing commercial, residential and retail development, and extensive foreshore areas with parks and waterside boardwalks.

11.1 Construction description

The Pyrmont Station construction site for this proposal comprises the construction site which would be established as part of the work carried out under the previous Sydney Metro West planning application. The construction works for this proposal would include:

- Enabling and site establishment work
- Construction of the station and structures for non-station use
- Station fit-out
- Construction of station precinct and interchange facilities
- Provision for over station development
- Finishing work, testing, and commissioning.

The station cavern and shaft excavation would occur during the work carried out under the previous Sydney Metro West planning application. The station cavern will be tanked prior to construction and the shafts will be untanked during construction of this proposal.

The location and indicative layout of the Pyrmont Station construction site is shown on Figure 11-1and the operational indicative layout and key design elements are shown on Figure 11-2.

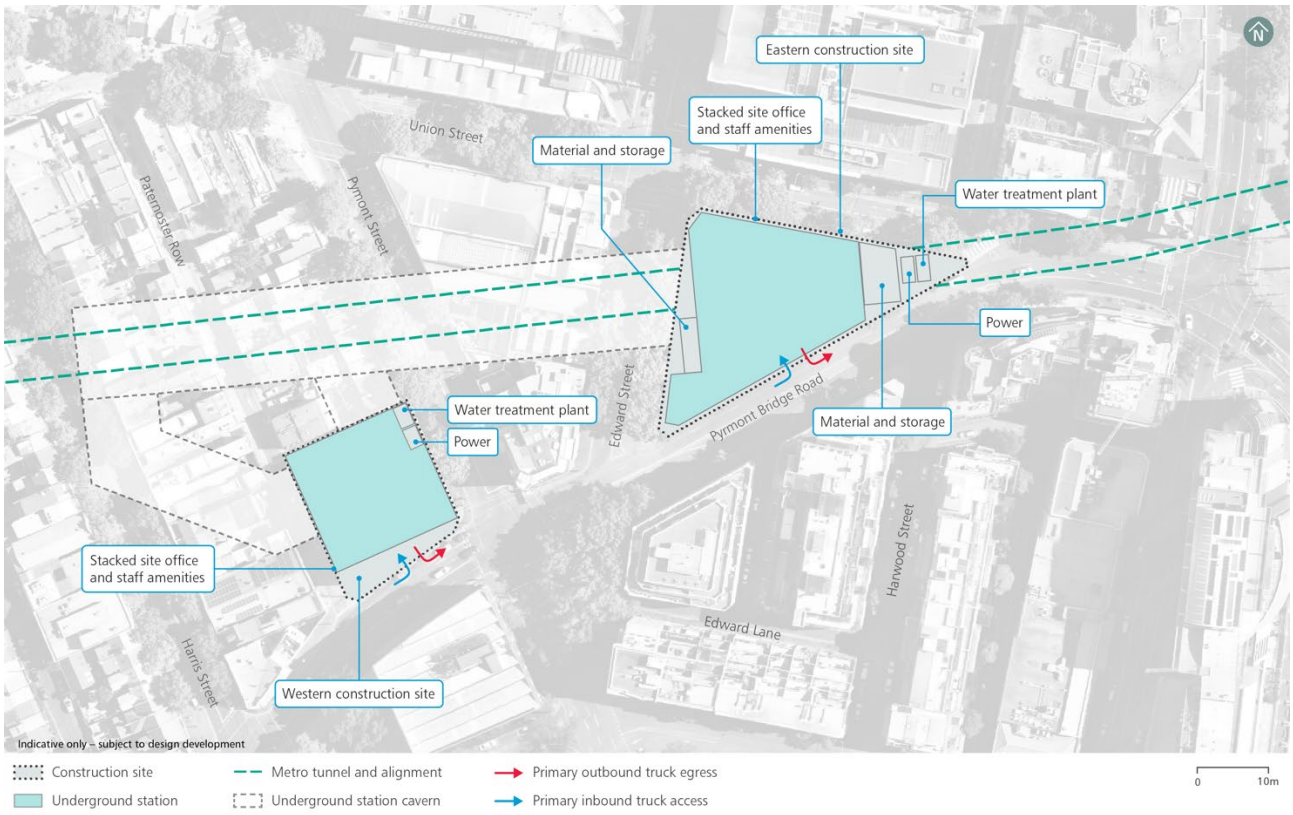

Figure 11-1 Pyrmont Station indicative construction site layout

11.2 Operation description

The operation of the metro station will include public domain area, transport interchange facilities, and provision for commercial and retail uses (subject to separate approval where required). There is anticipated to be limited chemical, oil or fuel storage at Pyrmont Station. The shaft may be tanked or untanked during operation. For the purposes of this assessment, the shafts have been assumed to be untanked to provide a conservative worst-case scenario. The operational indicative layout and key design elements are shown on Figure 11-2.

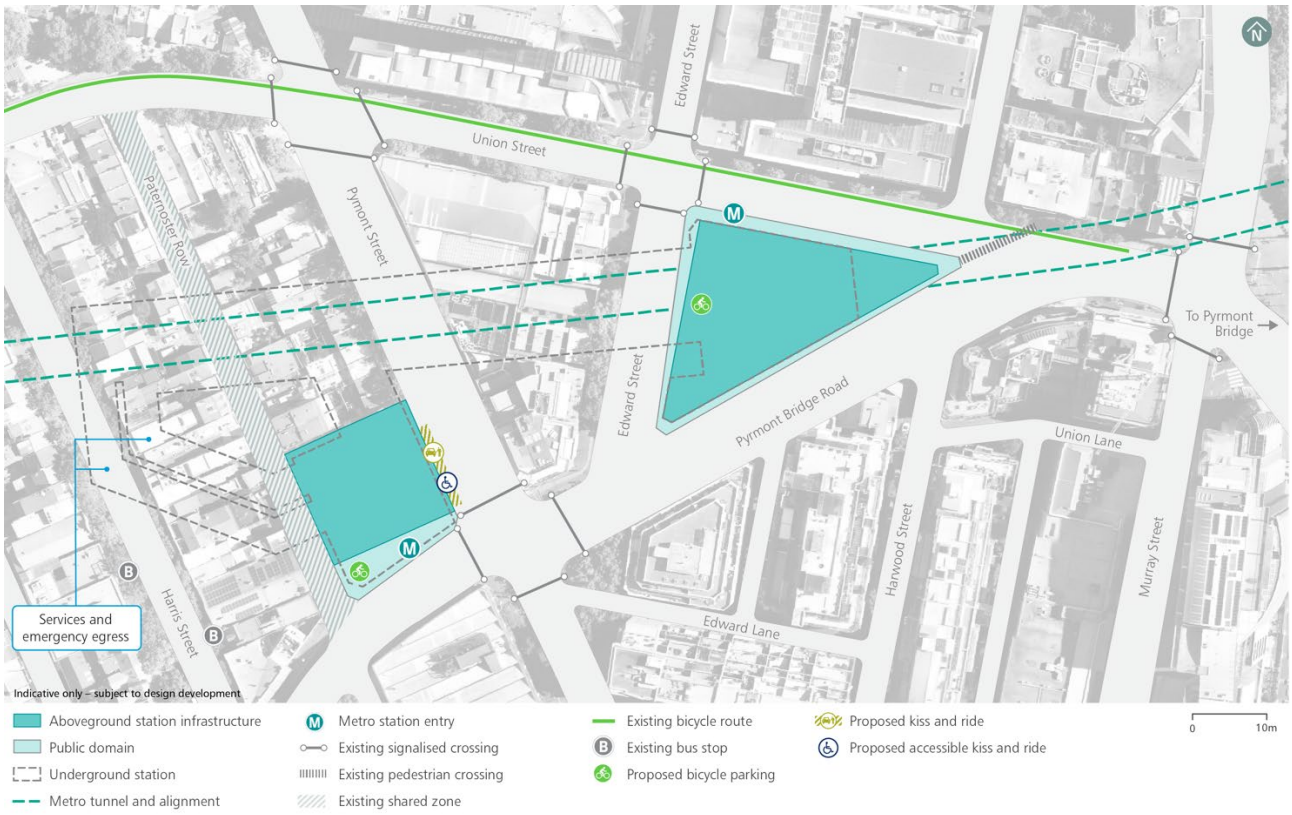

Figure 11-2 Pyrmont Station indicative layout and key design features

11.3 Baseline environment

The Pyrmont Station construction site is occupied by commercial buildings occupied as offices and retail. The surrounding land uses are a mixture of commercial and residential land use, with the Darling Harbour precinct to the east.

During the work carried out under the previous Sydney Metro West planning application, the buildings within the site would be demolished and bulk excavation would occur for the construction of the shafts and underground station cavern. The detailed site description, environmental setting and site history review for Pyrmont Station is described in Appendix B.

AEIs identified within the Pyrmont Station construction site in Sydney Metro West Environmental Impact Statement - The Bays to Sydney CBD Technical Paper 8 – Contamination (Sydney Metro, 2021) (refer to Appendix B) and this assessment are summarised in Table 11-1.

Table 11-1 Pyrmont Station – summary of baseline environment

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 1(2) – Former Pyrmont Power Station (off-site)	**Low** Potential off-site source of soil and groundwater contamination from substation and structures (including potential firefighting activities and demolition).	**Low** Off-site sources of groundwater contamination would remain following the work carried out under the previous Sydney Metro West planning application. The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during the work carried out under the previous Sydney
AEI 3(2) – Above ground bulk fuel storage site (off-site)	**Low** Potential off-site source of soil and groundwater contamination.	

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 7(2) – Former Pyrmont incinerator (off-site)	**Low** Potential off-site source of soil and groundwater contamination from bulk fuel storage.	Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation.
AEI 10(2) – Historical land reclamation (off-site)	**Very low (soil) to low (groundwater)** Potential off-site source of soil and groundwater contamination from use of potential contaminated fill.	
AEI 11(2) – General historical commercial / industrial use (off-site)	**Low (soil) and Moderate (groundwater)** Potential off-site source of soil and groundwater contamination from historical industrial land use (chemical use and storage)	**Moderate (groundwater)** As above.
AEI 13(2) – Dry cleaning and laundry facilities (off-site - 149 and 204 Harris Street, Pyrmont)	**Very low** Potential off-site source of soil and groundwater contamination from storage and use of solvents.	**Very low** As above.

Note: "(2)" Denotes AEI from the Sydney Metro West Environmental Impact Statement The Bays to Sydney CBD (Sydney Metro, 2021) to differentiate from AEIs with the same number in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a)

Figure 11-3 Pyrmont Station – moderate risk area of environmental interest

11.4 Construction impact assessment

11.4.1 Existing contamination

The CSM and risk ranking for Pyrmont Station is detailed in Appendix B. Based on the assessment, all AEIs were ranked as low risk, except for AEI 11(2) which was moderate risk for groundwater. Groundwater dewatering would be required during construction which could draw potential contaminated groundwater from off-site sources into the construction site. Groundwater extracted would be treated prior to discharge.

11.4.2 New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be detailed in the respective construction environmental management plans.

11.4.3 Acid sulfate soils

The construction site is mapped as low probability of acid sulfate soils occurrence and disturbed terrain. The construction site is mapped as Class 5 on acid sulfate risk maps except for the northern half of the eastern construction site which is mapped as Class 1. Potential acid sulfate soils could be located within and to the north of the Pyrmont Station eastern construction site.

Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – The Bays to Sydney CBD (Sydney Metro, 2021) predicts a drawdown of between 15 and 25 metres within the site and grading to 0.5 metres near the Darling Harbour foreshore. The drawdown could potentially expose acid sulfate soils to oxidation adjacent to the Pyrmont Station construction site. This could cause adverse impacts from acidification of soil and groundwater and leaching of heavy metals into groundwater.

11.4.4 Salinity

Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – The Bays to Sydney CBD (Sydney Metro, 2021) predicts an up-coning of the saline water interface after two years of dewatering. It was recommended that further modelling would be required to assess whether saltwater intrusion during the construction phase could occur. As the shaft would remain untanked during construction of this proposal, the saltwater intrusion would remain. Due to the developed nature of the area there are no terrestrial ecosystems that would be impacted. Impacts to the built environment however could occur. The service shafts would likely need to be tanked during operation.

11.4.5 Groundwater

Groundwater drawdown could result in potentially contaminated groundwater being drawn towards the Pyrmont Station construction sites. The groundwater encountered during construction would be treated prior to discharge so the risk to sensitive receptors in Darling Harbour is low.

11.5 Operational impact assessment

11.5.1 Existing contamination

Soil and groundwater contamination where present would be investigated and remediated (where required) during construction. There could be a requirement for a long-term environmental management to manage residual groundwater contamination.

11.5.2 New contamination

Pyrmont Station would include limited use and storage of chemicals, oils, or fuels during operation. There are no significant sources of contamination or impacts anticipated from the operation of the station or public domain.

11.5.3 Acid sulfate soils

Groundwater dewatering would continue during operation as the shafts at Pyrmont Station may remain untanked. As described in Section 11.4.3. further assessment is required to inform an acid sulfate soil management plan which would be required to prevent ecological and aesthetic impacts during operation if the shafts are untanked.

11.5.4 Salinity

As per Section 11.4.4 saltwater intrusion could occur due to ongoing dewatering of the untanked shafts at Pyrmont Station during operation. Further groundwater modelling is required to assess whether saltwater

intrusion during the operation phase could occur. It is likely that the service shafts would be tanked during operation.

11.5.5 Groundwater

Sources of contaminants from the operation of the station would be negligible and not anticipated to have an impact on groundwater quality. Potentially contaminated groundwater would be extracted during dewatering of the untanked shafts during operation. This would result in localised changes to groundwater flow and groundwater drawdown. All groundwater extracted from dewatering of the shafts would be captured and pumped to the operational water treatment plant at the Clyde stabling and maintenance facility. The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the Pyrmont Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant.

12.0 Hunter Street Station (Sydney CBD)

The Hunter Street Station (Sydney CBD) precinct is situated in the heart of the Sydney CBD, near to the commercial core and is one of the busiest precincts of the Sydney CBD. The Hunter Street Station (Sydney CBD) western site would be located on the corner of Hunter Street and George Street and the Hunter Street Station (Sydney CBD) eastern site would be located adjacent to Richard Johnson Square at the corner of Hunter Street, O'Connell Street and Bligh Street.

The precinct surrounding Hunter Street Station (Sydney CBD) is characterised by a broad mix of uses including offices, retail, hotels, entertainment and night-life, as well as open space such as The Royal Botanic Garden, the Domain and Hyde Park.

12.1 Construction description

The Hunter Street Station (Sydney CBD) construction site for this proposal comprises the construction site which would be established as part of the work carried out under the previous Sydney Metro West planning application. The construction works for this proposal would include:

- Enabling and site establishment work
- Construction of the station and structures for non-station use
- Station fit-out
- Construction of station precinct and interchange facilities
- Provision for over station development
- Finishing work, testing, and commissioning.

The cavern would be tanked and the shafts would be untanked during construction.

The location and indicative layout of the Hunter Street Station (Sydney CBD) construction site is shown on Figure 12-1 and the operational indicative layout and key design elements are shown on Figure 12-2.

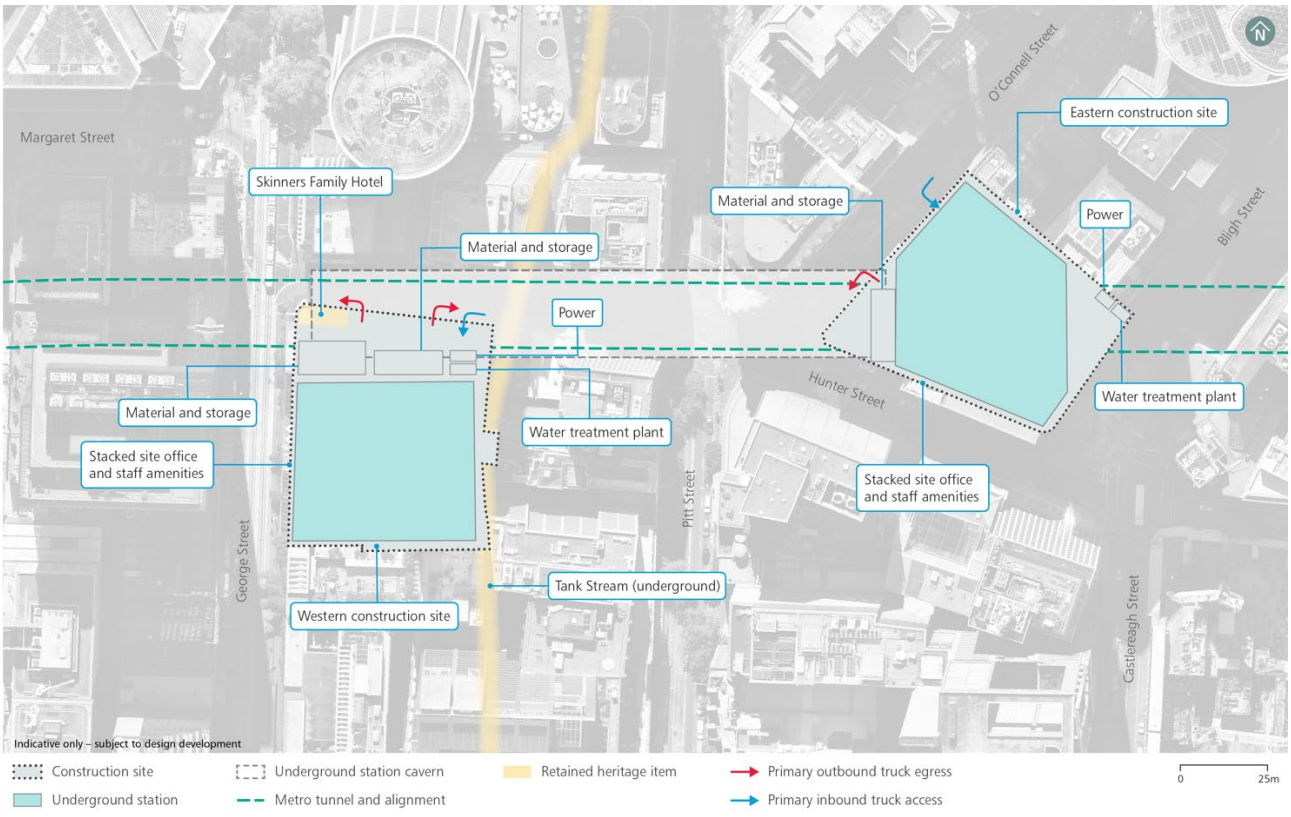

Figure 12-1 Hunter Street Station (Sydney CBD) indicative construction site layout

12.2 Operation description

The operation of the metro station would include public domain area, transport interchange facilities, and provision for commercial and retail uses (subject to separate approval where required). There is anticipated to be limited chemical, oil or fuel storage at Hunter Street Station (Sydney CBD). The cavern would be tanked and the shafts would be untanked during operation. The operational indicative layout and key design elements are shown on Figure 12-2.

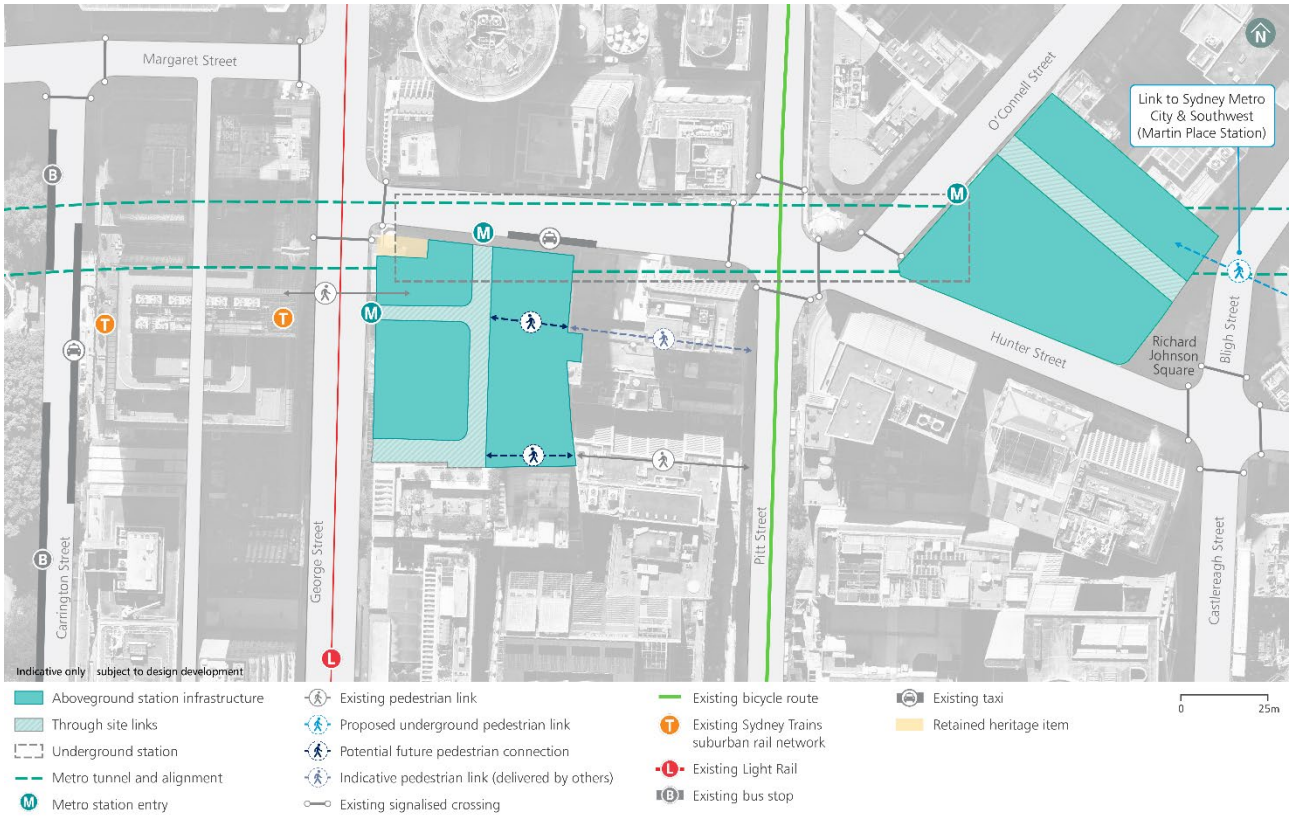

Figure 12-2 Hunter Street (Sydney CBD) Station indicative layout and key design elements

12.3 Baseline environment

The Hunter Street Station (Sydney CBD) construction site is occupied by commercial buildings occupied as offices and retail. The surrounding land use is mainly commercial office and retail.

During the work carried out under the previous Sydney Metro West planning application, the buildings within the site would be demolished and bulk excavation would occur for the shafts and underground station cavern. The detailed site description, environmental setting and site history review for Hunter Street (Sydney CBD) Station is described in Appendix B.

AEIs identified within the Hunter Street (Sydney CBD) Station construction site in Sydney Metro West Environmental Impact Statement - The Bays to Sydney CBD Technical Paper 8 – Contamination (Sydney Metro, 2021) (refer to Appendix B) and this assessment are summarised in Table 12-1.

Table 12-1 Hunter Street (Sydney CBD) Station – summary of baseline environment

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 5(2) – Dry cleaning businesses in surrounding area (including 447 Kent Street) (off-site)	**Low (groundwater) to very low (soil)** Potential off-site source of soil and groundwater contamination from storage and use of solvents.	**Low** Off-site sources of groundwater contamination would remain following the work carried out under the previous Sydney Metro West planning application. Groundwater would continue to be

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 6(2) – Former gasworks at Millers Point (off-site)	**Low** Potential off-site source of groundwater contamination from historical gasworks.	dewatered during construction and operation within the shafts. The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during work carried out under the previous Sydney Metro West planning application. An additional review of residual contaminant concentrations and rates of inflow would be required during implementation of this proposal to determine the need for additional groundwater remediation.
AEI 12(2) – Current and historical storage of diesel for backup power supply generators within commercial buildings	**Very low (soil) to low (groundwater)** Potential on-site source of soil and groundwater contamination from diesel spill or leaks.	**Low** The majority of the soil and bedrock would be excavated on-site during the work carried out under the previous Sydney Metro West planning application, prior to the commencement of construction of this proposal.
AEI 10(2) – Current dry cleaners (within western construction site)	**Very low (soil) to low (groundwater and vapour)** Potential on-site source of soil and groundwater contamination from storage and use of solvents.	

Note: "(2)" Denotes AEI from the Sydney Metro West Environmental Impact Statement – The Bays to Sydney CBD (Sydney Metro, 2021) to differentiate from AEIs with the same number from the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a).

12.4 Construction impact assessment

12.4.1 Existing contamination

The CSM and risk ranking for Hunter Street (Sydney CBD) Station is detailed in Appendix B. Based on the assessment, all AEIs were ranked as low risk. Groundwater dewatering would be required during construction which could draw potential contaminated groundwater from off-site sources into the construction site. Groundwater extracted would be treated prior to discharge.

12.4.2 New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be detailed in the respective construction environmental management plans.

12.4.3 Acid sulfate soils

The construction site is mapped as low probability of acid sulfate soils occurrence with very low confidence. The construction site is mapped as Class 5 on acid sulfate risk maps. Class 2 mapped soils are located 200 metres north near Circular Quay and 300 metres west of the construction site on the eastern side of Darling Harbour there is an extremely low probability of acid sulfate soil occurrence, with very low confidence.

Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – The Bays to Sydney CBD (Sydney Metro, 2021) predicts a drawdown of 0.5 to two metres within the area of potential acid sulfate soils to the north and 0.5 to 1.5 in the area of potential acid sulfate soils. The impacts from acid sulfate soils was assessed as very low risk due to recharge of groundwater from the harbour and already disturbed nature of the area.

12.4.4 Salinity

The Sydney Metro West Environmental Impact Statement – The Bays to Sydney CBD (Sydney Metro, 2021) concluded that saltwater intrusion from groundwater drawdown was unlikely to reach the Hunter Street Station (Sydney CBD) during construction. It was recommended that further modelling would be required as part of work under the previous Sydney Metro West planning application to assess whether saltwater intrusion could occur. If required, mitigation or monitoring measures developed based on this assessment would be implemented for this proposal.

12.4.5 Groundwater

Groundwater drawdown could result in potentially contaminated groundwater being drawn towards the Hunter Street Station (Sydney CBD) construction sites. The groundwater would be treated prior to discharge so the risk to sensitive receptors in Sydney Harbour is low.

12.5 Operational impact assessment

12.5.1 Existing contamination

Soil and groundwater contamination where present would be investigated and remediated (where required) during construction. There could be a requirement for a long-term environmental management to manage residual groundwater contamination.

12.5.2 New contamination

The Hunter Street Station (Sydney CBD) would include limited use and storage of chemicals, oils, or fuels during operation. There are no significant sources of contamination or impacts anticipated from the operation of the station or public domain.

12.5.3 Acid sulfate soils

The shafts would be untanked during operation, requiring ongoing dewatering which would result in groundwater drawdown. As per Section12.4.3 the risk posed from groundwater drawdown within acid sulfate soils located off-site was assessed as very low.

12.5.4 Salinity

The shafts would be untanked during operation, requiring ongoing dewatering which would result in groundwater drawdown which could potentially cause saltwater intrusion. As stated in Section 12.4.4, it was recommended that further modelling would be required as part of work under the previous Sydney Metro West planning application to assess whether saltwater intrusion during the operation phase could occur. If required, mitigation or monitoring measures developed based on this assessment would be implemented for this proposal.

12.5.5 Groundwater

Sources of contaminants from the operation of the station would be negligible and not anticipated to have an impact on groundwater quality. Potentially contaminated groundwater would be extracted during dewatering of the untanked station during operation. This would result in localised changes to groundwater flow and groundwater drawdown. All groundwater extracted from dewatering of the shafts would be pumped to the operational water treatment plant at the Clyde stabling and maintenance facility. The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the Hunter Street (Sydney CBD) Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant.

13.0 Clyde stabling and maintenance facility and Rosehill services facility

Clyde stabling and maintenance facility would be located in the Clyde industrial area, to the north of the M4 Western Motorway and to the east of James Ruse Drive. Duck Creek sits north and east of the site. Rosehill services facility would be located to the north of Duck Creek and the stabling and maintenance facility, and south of Rosehill Gardens racecourse. Unwin Street is located to the north of the services facility and Shirley Street is located to the east.

In addition to the Rosehill Gardens racecourse, the area around Clyde stabling and maintenance facility and Rosehill services facility is generally made up of industrial uses.

13.1 Construction description

The Clyde stabling and maintenance facility construction site and Rosehill services facility for this proposal comprises the approved construction site which will be established as part of the work carried out under the previous Sydney Metro West planning application. The construction works for the Clyde stabling and maintenance facility for this proposal would include:

- Enabling and site establishment work
- Placement of select material to final design levels
- Construction of access roads and car parking, including kerb and guttering, localised drainage work, surfacing including asphalt, concrete or pavers, line marking, signage, and other finishes
- Building and facility construction and fit-out, including maintenance buildings, the operations control centre, administration, cleaning facilities, security and fire control buildings, a train wash facility, and an operational water treatment plant
- Construction and fit-out of the stabling yard to accommodate the stabling of trains, including:
  - Construction of rail entry/exit structures to the facility from the mainline tunnels
  - Surface rail track installation
  - Electrical fit-out
  - Signalling and communications works
- Rehabilitation and revegetation work within the Duck Creek and A'Beckett's Creek riparian zone
- Finishing work, testing, and commissioning.

The construction works for the Rosehill services facility for this proposal would include:

- Enabling and site establishment work including:
  - Delivery of tunnel ventilation fans, substation transformers, precast concrete elements, and structural steel
  - Temporary installation of an acoustic shed (or other acoustic measures) above the services facility
- Construction of aboveground and below ground structures for the services facility
- Access for tunnel fit-out and rail systems work
- Construction and fit-out of a traction substation
- Finishing work, testing and commissioning.

The bulk earthworks and excavation of the shaft for the services facility will be undertaken during work carried out under the previous Sydney Metro West planning application. The construction works would include relatively shallow and localised excavations associated with building footing and services installations. The Clyde stabling and maintenance facility tunnel portal structure and Rosehill services facility shaft would be tanked in soil and untanked in rock during construction.

The location and indicative layout of the Clyde stabling and maintenance facility and Rosehill services facility construction site is shown on Figure 13-1.

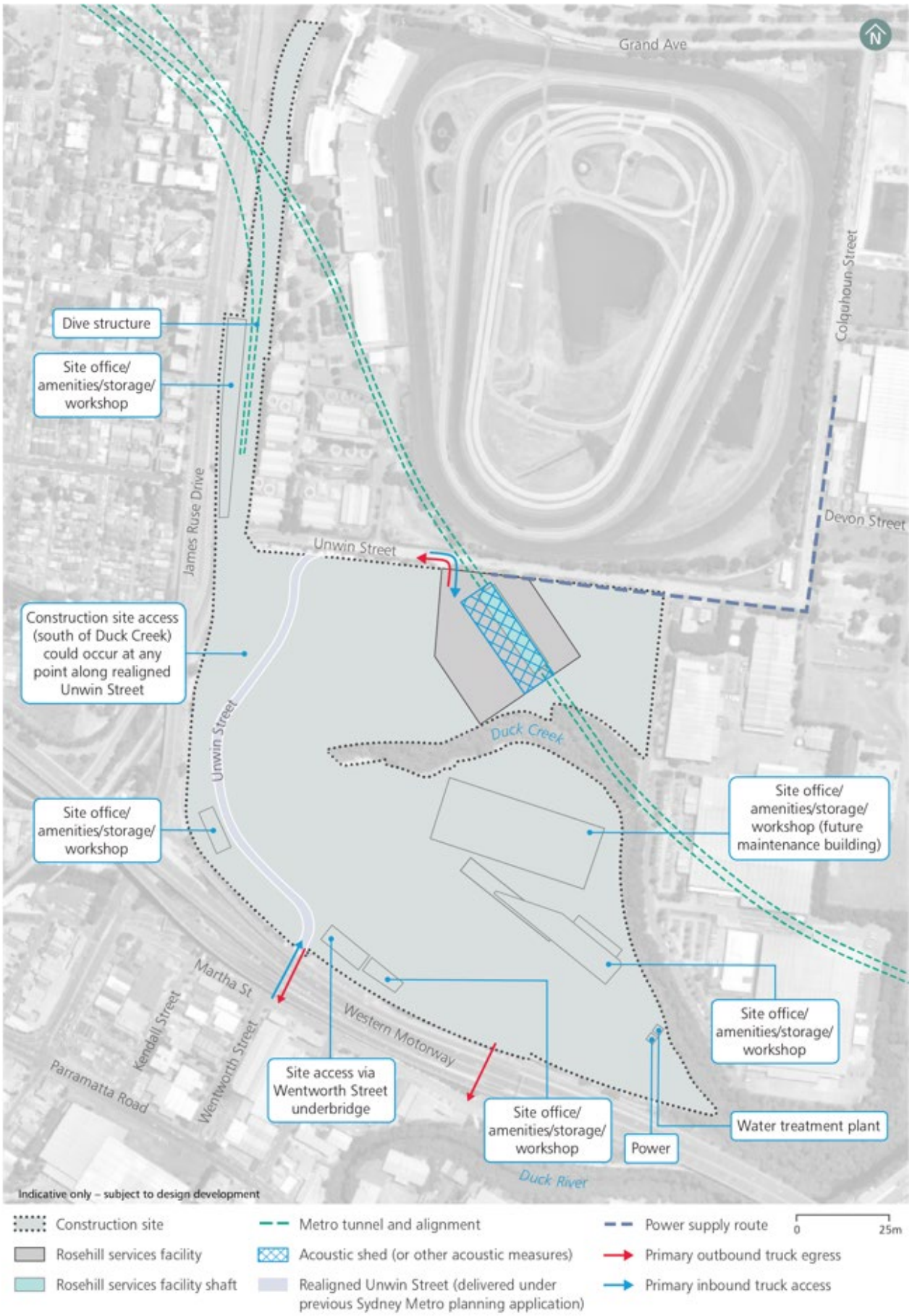

Figure 13-1 Clyde stabling and maintenance facility and Rosehill service facility indicative construction site layout

13.2 Operation description

Operation of the Clyde stabling and maintenance facility would include train maintenance works, a train wash and the operational water treatment plant. The facility would include the storage and use of chemicals, oils, and fuels. The Clyde stabling and maintenance facility tunnel portal structure and Rosehill services facility shaft would be tanked in soil and untanked in rock during operation. The Rosehill services facility would provide fresh air ventilation, emergency egress and a traction substation. The remainder of the construction site would be residual land and landscaped areas. The operational indicative layout and key design elements are shown on Figure 13-2.

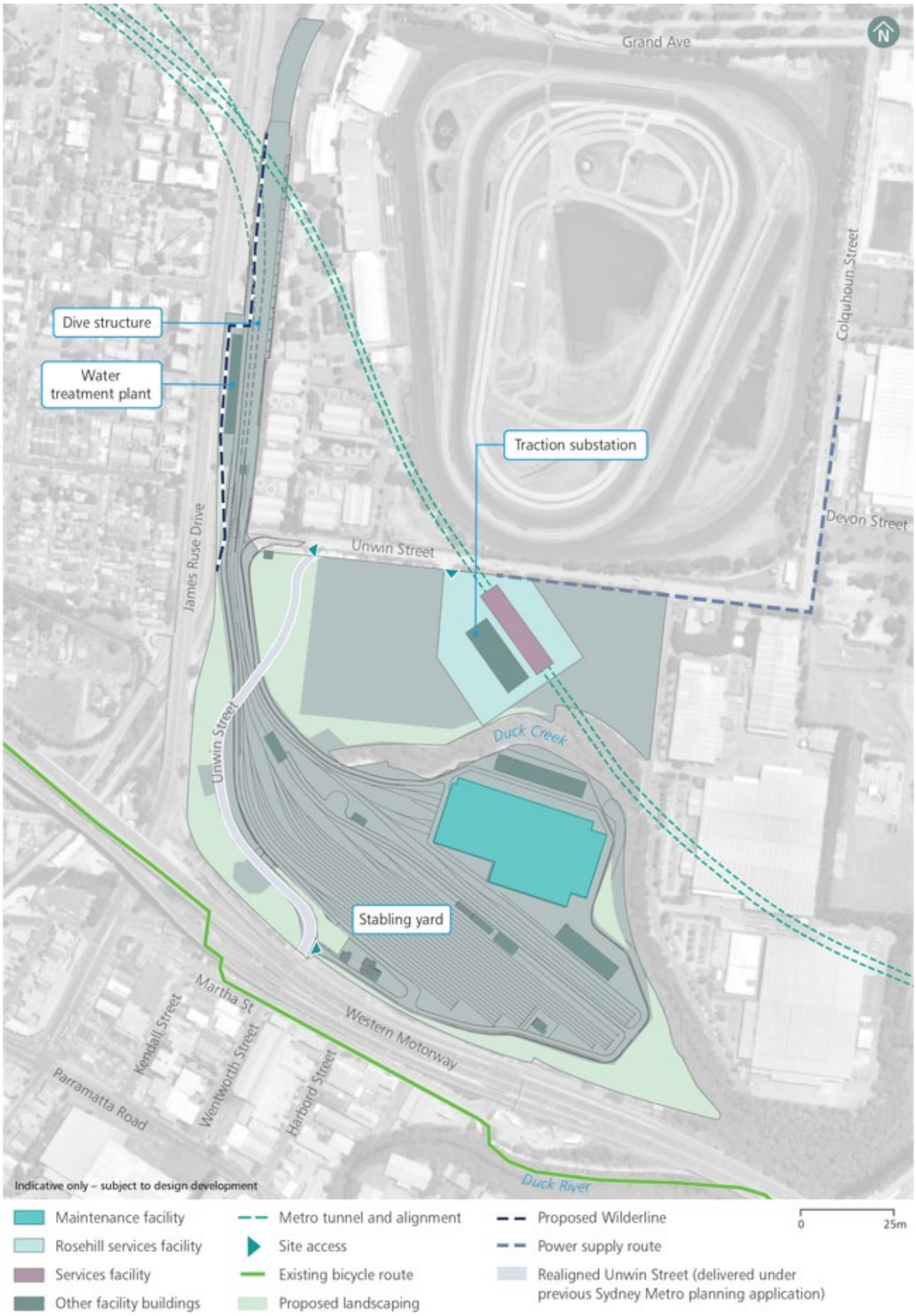

Figure 13-2 Clyde stabling and maintenance facility and Rosehill service facility indicative layout and key features

13.3 Baseline environment

The Clyde stabling and maintenance facility and Rosehill services facility construction site currently comprises a mixture of industrial, commercial, and private recreational land uses. All structures and buildings will be demolished within the construction site during work carried out under the previous Sydney Metro West planning application prior to the commencement of construction for this proposal. The detailed site description, environmental setting and site history review for the Clyde stabling and maintenance facility and Rosehill services facility is described in Appendix B.

Areas of environmental interest (AEI) identified within the Clyde stabling and maintenance facility construction site in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) (refer to Appendix B) and this assessment are summarised in Table 13-1. The AEIs assessed as moderate risk or above are shown on Figure 13-3.

Table 13-1 Clyde stabling and maintenance facility and Rosehill services facility – summary of baseline environment

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 10 – Former James Hardie factory [1 Grand Avenue, Camellia (off-site source)]	**Very low (soil) and low (groundwater)** Known soil and groundwater contamination from historical manufacture of asbestos cement products.	**Not applicable** Not considered a likely source of contamination to the construction site due to being topographically down-gradient of the construction site.
AEI 11 – Rosehill Gardens racecourse [Equestrian related activities (off-site source)]	**Very low** Potential source of soil contamination from pesticide, disinfectant, and nutrients. Unlikely to be a source of contamination to the construction site.	**Not applicable** Not considered a likely or significant source of contamination to the construction site, due to being topographically down-gradient of the construction site and minor surface source of contamination.
AEI 12 – Sydney Speedway	**Moderate** Potential source of hydrocarbon contamination to soils from motor sports.	**Low** AEI 12 is within the area of the preceding the previous Sydney Metro West planning application and would be investigated prior to construction works for this proposal. Ongoing monitoring and management may be required if capped in-situ.
AEI 13 – Hazardous building materials	**Moderate** Potential source of asbestos, PCB, heavy metal and pesticide contamination to surface soils.	**Low** Shallow surface soil contamination from construction or demolition of past hazardous building materials would be removed during the work carried out under the previous Sydney Metro West planning application.
AEI 14 – Industrial use (former Shell Clyde Refinery – Durham Street, Rosehill) – Known groundwater contamination (off-site source)	**Moderate** Potential off-site source of hydrocarbon and PFAS contamination to the east.	**Low** Residual groundwater contamination may remain in areas outside the work area of the previous Sydney Metro West planning application that are not subject to remediation or that are subject to an environmental management plan.

AEI	Risk identified in previous Sydney Metro West planning application	Residual issues following completion of work carried out under the previous Sydney Metro West planning application
AEI 15 – Industrial land use (on-site)	**Moderate** Numerous potential historical and current industrial land uses which could have resulted in soil and groundwater contamination with a wide range of contaminants including heavy metals, hydrocarbons, pesticides, PCBs and PFAS.	**Moderate** Residual soil and groundwater contamination may remain in areas outside the work area of the previous Sydney Metro West planning application that are not subject to remediation. Residual groundwater contamination may remain that is subject to an environmental management plan.
AEI 16 – Industrial land use (off-site)	**Moderate (groundwater), low (soil)** Numerous potential historical and current industrial land uses which could have resulted in soil and groundwater contamination with a wide range of contaminants including heavy metals, hydrocarbons, pesticides, PCBs and PFAS.	**Moderate** Residual groundwater contamination may remain in areas outside the work area of the previous Sydney Metro West planning application that are not subject to remediation or that are subject to an environmental management plan.
AEI 17 – Historical filling	**Moderate** The construction site and surrounds has historically been filled for land reclamation. Fill could be contaminated with a wide range of contaminants including heavy metals, asbestos, hydrocarbons, PCBs and pesticides.	**Moderate** Residual soil and groundwater contamination may remain in areas outside the work area of the previous Sydney Metro West planning application that are not subject to remediation. Residual groundwater contamination may remain that is subject to an environmental management plan.
AEI 18 – Parramatta heliport	**Moderate** Historical heliport operations had the potential to cause soil and groundwater contamination from storage and use of fuels and oils and firefighting foam storage which could result in hydrocarbon and PFAS contamination.	**Low** AEI 18 and 19 are within the area of the previous Sydney Metro West planning application' and would be investigated and remediated if required prior to construction works as part of this proposal. Residual groundwater contamination or capped fill may remain that is subject to an environmental management plan.
AEI 19 – Rapid Oil Distributors	**Moderate** Underground fuel storage and distribution could have resulted in soil and groundwater contamination from leaks or spills. Potential for hydrocarbon contamination.	

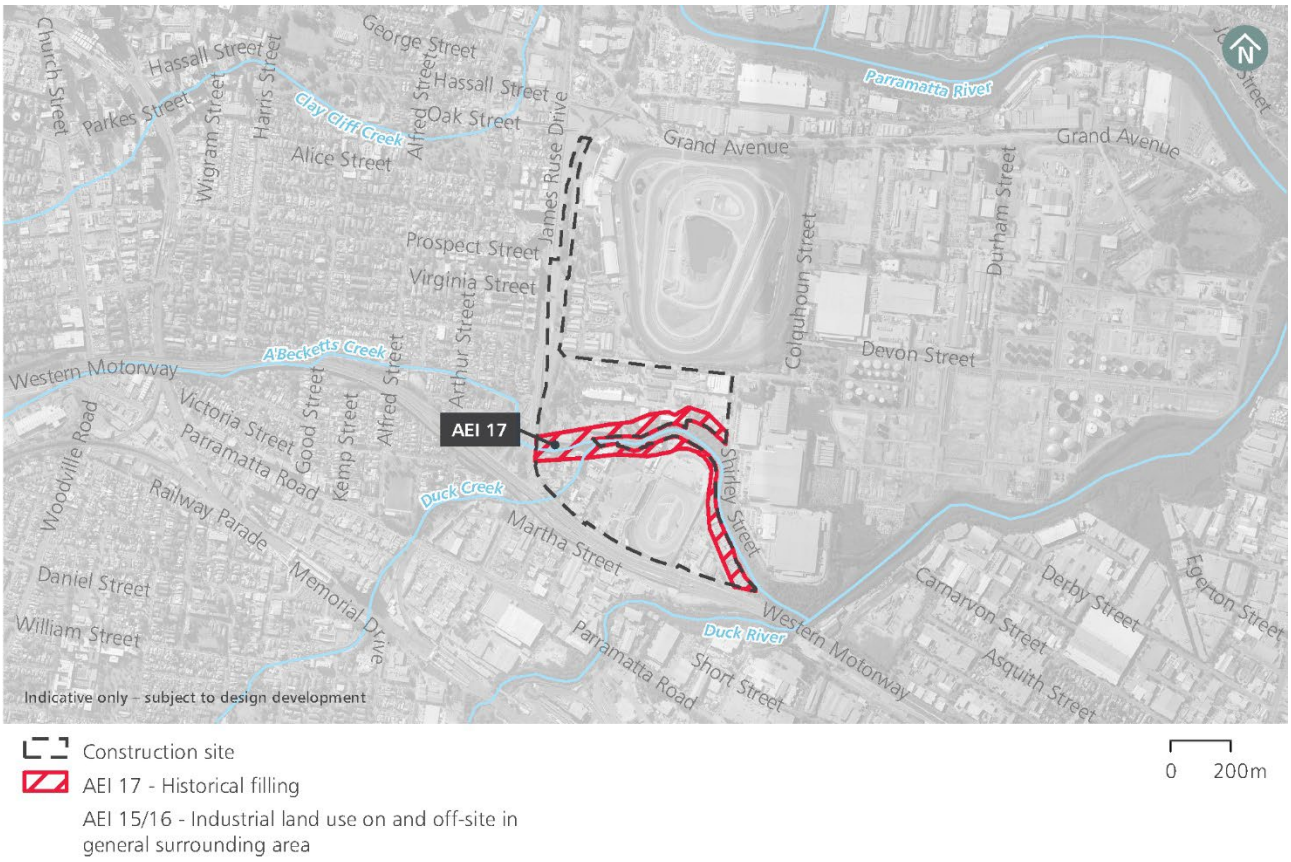

Figure 13-3 Clyde stabling and maintenance facility and Rosehill services facility – moderate or higher risk areas of environmental interest

13.4 Construction impact assessment

13.4.1 Existing contamination

The CSM and risk ranking for the Clyde stabling and maintenance facility and Rosehill services facility is detailed in Appendix B. Based on the assessment, all AEI were ranked as moderate risk for the construction works for this proposal, except for AEI 12, 13, 14, 18 and 19 which were ranked as a low risk.

13.4.2 New contamination

With the exception of the use and storage of chemicals associated with construction activities (e.g. fuels and oils associated with the operation of plant and equipment), the construction activities associated with this proposal are unlikely to represent a significant source of contamination. Management measures associated with the use and storage of chemicals during construction activities would be detailed in the respective construction environmental management plans.

13.4.3 Acid sulfate soils

The Clyde stabling and maintenance construction site is mapped as Class 4 acid sulfate soils risk, with a high probability of potential acid sulfate soils at depths greater than two metres below ground level (see Appendix B). Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) assessed that up to 25 metres of groundwater level drawdown is estimated in the area where disturbed soils and potential acid sulfate soils exist. The drawdown would occur due to dewatering of the shaft for the Rosehill services facility and the tunnel portal. An acid sulfate soil management plan (ASSMP) will be required for the construction works within the Clyde stabling and maintenance construction site, for where excavation of soils would occur. The investigations will be undertaken prior to the work carried out under the previous Sydney Metro West planning application and the ASSMP implemented during those works (as per mitigation measure SSWQ1) and updated as required for the construction of this proposal.

13.4.4 Salinity

The tunnel and dive structure will be constructed during the work carried out under the previous Sydney Metro West planning application. The structures will be tanked within the soil profile and untanked within bedrock. Groundwater modelling undertaken in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020a) assessed that saline water intrusion from Duck Creek could occur although no likely environmental impacts were identified due to groundwater dependant ecosystems in the area being tolerant to saline water and groundwater is not beneficially used in the area.

13.4.5 Groundwater

The tunnel and dive structure will be constructed during the work carried out under the previous Sydney Metro West planning application. The structures will be tanked within the soil profile and untanked within bedrock. Potentially contaminated groundwater would be dewatered and require treatment prior to discharge.

13.4.6 Power supply route to Rosehill services facility

The operational power supply route from the Camellia substation to the Rosehill services facility would be constructed by trenching within the road reserve. Excavation work for the power supply route could encounter contamination associated with:

- Industrial wastes that may have been used in the construction of roadways. If present, this contamination would be exposed by the work and represents a moderate risk
- Historical industrial use in the area. This contamination is unlikely to be exposed by the work and represents a low risk.

13.5 Operational impact assessment

13.5.1 Existing contamination

Soil and/or groundwater contamination where present would be investigated and remediated during construction. There would likely be a requirement for a long-term environmental management to manage residual soil and monitor groundwater contamination, particularly if the remediation approach includes capping in-situ for any contamination encountered during the work carried out under the previous Sydney Metro West planning application.

13.5.2 New contamination

Operation of the Clyde stabling and maintenance facility and Rosehill services facility would include train maintenance works, a train wash, the operational water treatment plant and a traction substation. The facility would include the storage and use of chemicals, oils and fuels. An operational environmental management plan would be implemented to prevent future soil or groundwater contamination.

13.5.3 Acid sulfate soils

With the exception of groundwater dewatering as the result of the untanked structure, further disturbance of acid sulfate soils during operation is unlikely. A long-term environmental management plan would be required to manage impacts from acid sulfate soils related to localised dewatering impacts.

13.5.4 Salinity

The tunnel and dive structure will be untanked within bedrock. As with construction there are not likely to be environmental impacts from saline water intrusion.

13.5.5 Groundwater

The tunnel and dive structure will be untanked within bedrock. As groundwater dewatering would occur, contaminated groundwater would be treated prior to discharge. All groundwater extracted from dewatering of the tunnel portal and shaft would be pumped to the operational water treatment plant at the Clyde stabling and maintenance facility. As groundwater would be treated prior to discharge the risk to receptors is low. A long-term environmental management plan may be required for residual groundwater contamination during operation within the Clyde stabling and maintenance facility, Rosehill services facility and associated residual land.

14.0 Tunnels

The tunnelling excavation including the tanking of the tunnels will be undertaken during the work carried out under the previous Sydney Metro West planning application prior to construction commencing for this proposal. As the tunnels will be tanked there would be no dewatering required during construction or operation of this proposal. As a result, there are not anticipated to be any impacts to or from soil or groundwater contamination.

15.0 Cumulative impacts

There is the potential for cumulative contamination impacts from this proposal and other proposed developments surrounding the proposal. The projects that have the potential to have a cumulative impact with this proposal were considered and screened in Chapter 19 (Cumulative impacts) of the Environmental Impact Statement. The projects considered to be relevant for the contamination assessment include:

- Sydney Metro West – Major civil construction work between Westmead and the Bays
- Parramatta Leagues Club Hotel
- Clyde Terminal Conversion Project
- Site 43/44, Sydney Olympic Park – Stage 1 and 2 (6 Australia Avenue and 2 Herb Elliot Avenue)
- Western Harbour Tunnel and Warringah Freeway Upgrade
- Sydney Metro West – Major civil construction between Pyrmont and Sydney CBD
- The new Sydney Fish Market
- Cockle Bay Wharf mixed use development
- Sydney Metro City & Southwest (Chatswood to Sydenham)
- 301 and 305 Kent Street Concept Hotel Development
- 50-52 Phillip Street New Hotel (SSD)
- One Sydney Harbour
- Sydney Metro – Martin Place Over Station Development.

A brief description of these projects and qualitative assessment of associated potential cumulative impacts during construction and operation is included below. Management of contamination, where required, could indirectly contribute to cumulative impacts related to traffic, noise and vibration during construction. Assessment of cumulative impacts for these aspects are addressed in Chapter 19 (Cumulative impacts) of the Environmental Impact Statement, as well as Technical Paper 1 (Operational Transport), Technical Paper 2 (Construction transport), Technical Paper 3 (Operational Noise and Vibration) and Technical Paper 4 (Construction Noise and Vibration).

15.1 Construction

The cumulative assessment for construction of this proposal with the listed projects is summarised in the following sections. The assessment is for the station construction sites and not the tunnel alignment as the excavation and tanking of all the tunnels would occur prior to this proposal during the work carried out under the previous Sydney Metro West planning application . There would not be cumulative impacts from works completed within the tunnels as part of this proposal from existing contamination.

Sydney Metro West - Major civil construction work between Westmead and the Bays

The previous Sydney Metro West planning application coincides with all construction sites for this proposal between Westmead metro station and The Bays Station. This work would be substantially completed prior to the commencement of construction works as part of this proposal. However, in some locations there could be some minor overlap of construction activities.

Construction works would occur within the same footprint and directly adjacent. Groundwater dewatering could be undertaken concurrently for both the proposal and the work carried out under the previous Sydney Metro West planning application for the same shared structures potentially changing the flow of contaminated groundwater and potential for the oxidation of acid sulfate soils (at relevant sites).

Mitigation measures implemented for the work carried out under the previous Sydney Metro West planning application would carry through to the management of acid sulfate soil and contamination for construction of this proposal. The outcomes of investigations and remediation (where required) undertaken during the work carried out under the previous Sydney Metro West planning application would influence decisions on the management measures required for construction of this proposal.

Parramatta Leagues Club Hotel

The proposed Parramatta Leagues Club Hotel is located about 800 metres northwest of the Parramatta metro station construction site, on the opposite side of the Parramatta River. The Parramatta Leagues Club Hotel proposal involves the demolition of existing buildings and the construction of a 17-storey hotel building (plus a single level basement for services).

Douglas Partners (2018b) prepared a Remedial Action Plan for the remediation of friable asbestos in soils and on-site treatment of acid sulfate soils at the proposed Parramatta Leagues Club Hotel development site. The remediation method comprises excavation and off-site disposal of all fill contaminated with asbestos, on-site treatment of acid sulfate soils and on-site detention of leachate/wastewater from the acid sulfate soil treatment prior to licensed discharge or off-site disposal to liquid waste facility.

The Douglas Partners (2018b) Remedial Action Plan indicates that if leachate from acid sulfate soil treatment at Parramatta Leagues Club Hotel development site is discharged to stormwater and ultimately the Parramatta River, it would be treated and analysed to assess it meets the discharge criteria. Given the distance from the proposal there are not expected to be any interfaces or cumulative impacts with the development in relation to remediation of asbestos in soil.

Clyde Terminal Conversion Project

The Clyde Terminal is located approximately 300 metres east of the Clyde stabling and maintenance facility and Rosehill services facility. The Clyde Terminal Conversion Project involves the removal of redundant crude oil refinery and import facilities at the Clyde Terminal and upgrade of existing facilities to allow for the receipt, storage and distribution of finished petroleum products. The project would result in a reduced operational footprint for the terminal. The project involves the following components:

- Demolition of existing oil refinery processing units, surplus storage tanks and other redundant infrastructure
- Upgrade of existing storage tanks and supporting infrastructure and utilities to be retained.

The Clyde Terminal Conversion Project commenced in 2015 and is anticipated to be complete in 2025. According to details in the AECOM (2013) Clyde Terminal Conversion Project Environmental Impact Statement, the project involves shallow excavations and areas of the Clyde Terminal ranging between 0.3 and one metre below ground level. No groundwater dewatering was anticipated to be required.

Currently, soil and groundwater conditions at the Clyde Terminal are regulated by Condition U1 of Environment Protection Licence No.570 which references the need for the Soil and Groundwater Management Plan (SGMP) and an associated annual report. The ongoing operations also continue to be regulated by the requirements of the *Protection of the Environment Operation Act* and *Contaminated Land Manangement Act 1997*. An Erosion and Sediment Control Plan (ESCP) was also required to be completed for the Clyde Terminal Conversion Project. If contaminated soils are discovered during excavations, they would be separated and managed in accordance with Shell's existing waste management system. Acid sulfate soil would be managed according to an ASSMP which would be incorporated into the existing SGMP. Based on the information reviewed there are not likely to be any interfaces with contamination management between the Clyde Terminal Conversion Project and this proposal.

Sites 2A and 2B Sydney Olympic Park, Australia Avenue

The Sites 2A and 2B proposed development is located approximately 65 metres southeast of the Sydney Olympic Park metro station construction site and comprises a State significant development application (SSD-21356591) for the site, including:

- Site preparation works including tree removal and excavation
- The construction of two buildings including a tower (approximately 45 storeys in height) that provides serviced apartments, plus a podium on Site 2A and a commercial building (approximately 12 storeys in height) on Site 2B
- Six levels of basement accommodating car and bicycle parking
- Construction of an extension to Dawn Fraser Avenue and a service lane

- Construction of a large activate public domain located in the frontage area between the proposed buildings and Australia Avenue.

While the timeframe for the project is unknown, the project application exhibition ended on 27 January 2022. The construction would require bulk excavation and dewatering. Douglas Partners (2018a) undertook a contamination investigation of Site 2, which comprised review of previous reports and additional soil and groundwater sampling. The investigation found that the potential for significant contamination to be present within Sites 2A and 2B was low and could be made suitable for the proposed development provided further round of sampling to assess TRH, BTEX and VOC vapour risk from groundwater. The report also recommended completion of waste classification and development of an unexpected finds protocol prior to bulk excavation. Douglas Partners (2021) provided a brief contamination update based on a proposed modification and concluded that the findings of Douglas Partners (2018a) did not change.

Based on the information reviewed there are not likely to be any interfaces with contamination management between the Sites 2A and 2B project and this proposal, with the exception of groundwater dewatering. As the dewatering for the basement construction for this proposal is likely to only occur for a proportion of the construction period, the cumulative impact of lowering of local groundwater levels is likely to be short term. Further modelling undertaken during work carried out under the previous Sydney Metro West planning application prior to construction of this proposal would consider potential cumulative impacts of surrounding dewatering projects.

Site 43/44, 2 Australia Avenue, Sydney Olympic Park

The Site 43/44 proposed development is located approximately 100 metres northeast of the Sydney Olympic Park metro station construction site and comprises a major project development application (MP10_0168) for the site, including:

- Removal of existing trees and vegetation
- Relocation of 30 at-grade car spaces into the proposed basement carpark levels
- Construction of an eight storey commercial building with two levels of basement car parking.

Environmental Investigation Services (EIS 2010) conducted a Phase 1 Preliminary Environmental Site Assessment which included review of previous reports and limited soil sampling, including waste characterisation. The results of the soil investigation indicated that concentrations of contaminants of potential concern were less than the site assessment criteria in all samples analysed. EIS (2010) concluded that the potential of significant widespread soil contamination was relatively low. EIS (2010) did not investigate groundwater.

Geotechnique (2010) conducted additional drilling at Site 43/44, which encountered limited groundwater seepage at approximately 2.6 metres below ground level in one of eight locations. No additional information on groundwater or dewatering during construction was provided.

Based on the information reviewed there are not likely to be any interfaces with contamination management between the Site 43/44 project and this proposal. Given the shallow depth of the proposed basement, groundwater dewatering would be expected to be minimal based on Geotechnique (2010) observations. As the dewatering for the excavation for this proposal is likely to only occur for a proportion of the construction period, the cumulative impact of lowering of local groundwater levels is likely to be short term. Further modelling undertaken during work carried out under the previous Sydney Metro West planning application prior to construction of this proposal would consider potential cumulative impacts of surrounding dewatering projects.

Western Harbour Tunnel and Warringah Freeway Upgrade

The Western Harbour Tunnel will be located 600 metres northwest and 400 metres southwest of The Bays Station construction site. The Western Harbour Tunnel and Warringah Freeway Upgrade project forms part of the Western Harbour Tunnel and Beaches Link Program, and comprise a new motorway tunnel connection across Sydney Harbour, and an upgrade of the Warringah Freeway to integrate the new motorway infrastructure with the existing road network, with a connection to the Beaches Link and Gore Hill Freeway Connection project. Construction would coincide with this proposal activities at White Bay.

One of the construction compounds for the Western Harbour Tunnel (referred to as WHT3) is located adjacent to The Bays Station construction site for this proposal and is located on both sides of White Bay. The eastern side of WHT3 would be used for casting, fit out and loading of immersed tunnel tubes onto barges in White Bay and the western side for handling and treatment of dredged sediments requiring on-land disposal. No earthworks will be undertaken in the WHT3 construction compound during the Western Harbour Tunnel construction period.

The Western Harbour Tunnel and Warringah Freeway Upgrade Environmental Impact Statement (TfNSW, 2020) estimated a groundwater drawdown of up to 33 metres beneath the Western Harbour Tunnel and one to seven metres within the White Bay area.

The changes due to groundwater drawdown of both the Western Harbour Tunnel and this proposal could have impacts to the migration of existing groundwater contamination and potential oxidation of acid sulfate soils in the same area of White Bay. Both projects would require detailed soil and groundwater investigations, an acid sulfate soil management plan and groundwater monitoring plan to monitor and prevent environmental impacts.

Sydney Metro West - Major civil construction works between The Bays and Sydney CBD

The proposal would involve major civil construction between The Bays and Sydney CBD, at the proposed The Bays Station tunnel launch site, Pyrmont Station and Hunter Street Station (Sydney CBD). The work carried out under the previous Sydney Metro West planning application are expected to be substantially complete prior to construction works for this proposal commencing. There may be some concurrent works between the two proposals at The Bays Station construction site for a short period of time.

There could be cumulative impacts from this proposal and the work carried out under the previous Sydney Metro West planning application from ongoing groundwater dewatering causing changes to the flow of potentially contaminated groundwater and potential for the oxidation of acid sulfate soils.

Mitigation measures for the management of acid sulfate soil and contamination implemented for the work carried out under the previous Sydney Metro West planning application would carry through to the construction of this proposal. The outcomes of investigations and remediation (where required) undertaken during the work carried out under the previous Sydney Metro West planning application would influence decisions on the management measures required for construction of this proposal.

The new Sydney Fish Market

The new Sydney Fish Market site is located at the head of Blackwattle Bay between Pyrmont Peninsula and Glebe Peninsula, one kilometre to the southeast of The Bays Station and 500 metres to the southwest of Pyrmont Station. The project involves building a new Sydney Fish Market which will be set within an improved public domain including the creation of a waterfront promenade.

JBS&G prepared a Remedial Action Plan for the construction of the new Sydney Fish Market (JBS&G, 2019). The construction would include excavation for basement and foundations on land and a coffer dam over water for the pilings of the overwater structure. Contamination issues include reclaimed land with potential contaminated soils and contaminated sediments in Blackwattle Bay. The Remedial Action Plan includes environmental management measures for the excavation and off-site disposal of potentially contaminated soil and contaminated sediments.

There are not expected to be any interfaces between the new Sydney Fish Market and this proposal in relation to contamination management during construction.

Cockle Bay Wharf mixed use development

The proposed Cockle Bay Wharf mixed use development is located about 500 metres east of the Pyrmont Station construction site and 700 metres south west of the Hunter Street Station (Sydney CBD) construction site. A SSDA was approved by the NSW Independent Planning Commission on 13 May 2019 for the Cockle Bay Wharf mixed use development Concept Proposal and Stage 1 works which include demolition works. The current development would include:

- Construction of a land bridge across part of the Western Distributor
- The design, construction and use of a 43-storey mixed-use development
- At least 6500 m^2 of publicly accessible open space
- Site interface works and subdivision.

A Preliminary Site Contamination Assessment was prepared by Coffey as part of the JBA (2016) Environmental Impact Statement for the Concept Proposal and Stage 1 works. The assessment found that as the future development would involve little or no excavation, the development site could be made suitable for the continued commercial and retail uses. Based on this information, no potential cumulative impacts from management of contamination have been identified.

Sydney Metro City & Southwest (Chatswood to Sydenham)

The Chatswood to Sydenham component of Sydney Metro City & Southwest project involves the construction and operation of a 15.5 kilometre metro line from Chatswood, under Sydney Harbour and through Sydney's CBD to Sydenham. Components of the project relevant to this assessment include the White Bay truck marshalling yard and tunnelling/construction of stations at Barangaroo and Martin Place.

Martin Place metro station is under construction as part of the Chatswood to Sydenham component of Sydney Metro City & Southwest project and will be 50 metres from Hunter Street Station (Sydney CBD). Martin Place metro station will be a tanked cavern structure with an untanked shafts at completion.

The Sydney Metro (2016) Chatswood to Sydenham Environmental Impact Statement found that groundwater drawdown would occur in the vicinity of Martin Place Station by greater than four metres. No areas of environmental interest were identified in the vicinity of the Martin Place Station in the contamination assessment.

Barangaroo Station is over 300 metres from the proposal and there are not expected to be any interfaces relating to contamination and this proposal. The White Bay truck marshalling yard was located adjacent to The Bays Station construction site but did not include works which would result in the disturbance of existing contamination.

301 and 305 Kent Street Concept Hotel Development

The proposed 301 and 305 Kent Street redevelopment site is located 300 metres south west of the Hunter Street Station (Sydney CBD) construction site. The proposal is a Concept SSDA submitted in accordance with Section 4.22 of the EP&A Act. The Concept SSDA seeks consent for:

- The establishment of a building envelope up to a height of 96.2 metres
- Use of the site as a hotel (with ancillary uses)
- Pedestrian and vehicular access arrangements
- The provision of on-site bicycle and car parking.

A future detailed SSDA (Stage 2 SSDA) will be lodged for the detailed design and construction of the development. The construction would include bulk excavation and dewatering for a five-level basement.

Architectus (2019) completed an Environmental Impact Statement for the Concept SSDA and included an assessment of contamination in a Detailed Site Investigation (DSI) Report was prepared by Aargus Pty Ltd (2019). The DSI concluded that the risks to human health associated with soil contamination were negligible and the that the site was suitable for the proposed development. Based on this information no potential cumulative impacts from management of contamination have been identified.

50-52 Phillip Street New Hotel

The proposed 50-52 Phillip Street New Hotel development is located about 250 metres northwest of the Hunter Street Station (Sydney CBD) construction site. The proposal at 50-52 Phillip Street Sydney involves the delivery of a new landmark hotel building in Sydney's CBD. The proposal will deliver approximately 331 new rooms throughout the 47 storey hotel development.

Golder Pty Ltd (2020) completed a Geotechnical and Contamination Desktop Study for the proposed redevelopment of 50-52 Phillip Street Sydney. The assessment concluded there was no evidence of significant contamination within the site and no contaminated land was known to be within the vicinity of the site. Groundwater dewatering would be required during construction of the basement. There are not expected to be any interfaces between the proposal at 50-52 Phillip Street Sydney and this proposal in relation to contamination management during construction.

One Sydney Harbour

One Sydney Harbour is a skyscraper complex under construction in Sydney which includes 808 apartments in three towers. The project is part of the major urban renewal precinct of Barangaroo. The site is within former reclaimed land and located adjacent to the former Millers Point gas works. The construction works include the bulk excavation of a basement for the skyscraper.

A Remedial Action Plan was prepared for the proposed development by AECOM (2013) to remediate and manage contamination associated with contaminated fill, soil and groundwater historically impacted by coal tar from the Millers Point gasworks.

One Sydney Harbour is located about 500 metres northwest of the Hunter Street Station (Sydney CBD) construction site. Given the distance between this proposal and the One Sydney Harbour development, there are not expected to be any interfaces between projects in relation to contamination management during construction.

Sydney Metro - Martin Place Over Station Development

The Sydney Metro Martin Place Over Station Development will be 50 metres from Hunter Street Station (Sydney CBD). The project includes two over station development commercial towers above the northern and southern entrances of the under construction Martin Place Station. The Concept proposal is intended to be delivered as a single, integrated project along with the delivery of rail, station, concourse infrastructure and public domain works associated with the Martin Place Station. The construction of the different elements is likely to be staged so as not to interrupt the metro station construction program.

Contamination (if any) would be managed during the construction of the underground station [refer to Sydney Metro City & Southwest (Chatswood to Sydenham)] and there are not expected to be any interfaces between the proposal Martin Place Over Station Development and this proposal in relation to contamination management during construction.

15.2 Operation

None of the proposed developments are likely to be significant sources of soil or groundwater contamination following completion. The developments could have small volumes of chemical and fuel storage related to on-site maintenance and backup generators where spills could have the potential for localised contamination. Where groundwater dewatering is required long-term of untanked structures, extracted groundwater is required to be treated prior to discharge. The developments are required to meet the regulations of the *Protection of the Environment Operations Act* 1997 to prevent environmental pollution. The potential for cumulative impacts from contamination during operation is therefore considered to be negligible.

16.0 Environmental management and mitigation

16.1 Construction

This section provides a summary of the mitigation and management measures that would be required to minimise, avoid or mitigate the impacts of the proposal on contamination. The approach to management and mitigation of contamination would follow the same process established for the work carried out under the previous Sydney Metro West planning applications, including the relevant conditions of the Stage 1 planning approval (conditions D71 to D78).

The Sydney Metro Construction Environmental Management Framework (CEMF) (Appendix F of the Environmental Impact Statement) describes the approach to environmental management, monitoring and reporting during construction. Specifically, it lists the requirements to be addressed by construction contractors in developing the Construction Environmental Management Plan (CEMP)s, sub-plans, and other supporting documentation for each specific environmental aspect.

The CEMF contains a number of 'standard mitigation measures' related to management of contamination and soils during construction and would be applied at all construction sites to minimise and manage the impacts from the work as far as practicable and where feasible and reasonable. In relation to soils, this includes measures to manage potential disturbance of acid sulfate soils and saline soils.

In relation to contamination, the CEMF provides mitigation measures to be applied based on consideration of the risk ranking for each area. For this proposal, measures implemented as part work under the previous Sydney Metro West planning applications also need to be considered. Generally, this involves:

- Very low and low risk construction sites would be mitigated through implementation of a Soil and Water Management Plan, where contamination would be managed via standard construction processes. In these areas, a Detailed Site Investigation or Remediation Action Plan would not be required.
- Moderate or high to very high-risk construction sites:
  - Would have further data review undertaken prior to construction. This will generally have been undertaken as part of works under the previous Sydney Metro West planning applications; however further data review may be required for the additional footprint areas at Westmead metro station, North Strathfield metro station and The Bays Station.
  - Where required due to insufficient pre-existing information a Detailed Site Investigation (DSI) would be undertaken to assess whether remediation is required. DSIs will generally have been undertaken as part of works under the previous Sydney Metro West planning applications; however this may be required for the additional footprint areas at Westmead metro station, North Strathfield metro station and The Bays Station.
  - Where the additional data review or DSI confirms that contamination would have a moderate, high or very high risk, and remediation is required to make the site suitable for its proposed use, a Remediation Action Plan would be developed for the area of the relevant area of the construction site(s). This would be applicable to all sites where moderate to very high-risk contamination exists, remediation is required and has not completed during work carried out under the previous Sydney Metro West planning application.
  - Where contamination is highly complex, such as significant groundwater contamination; contamination associated with vapour; contamination that requires specialised remediation techniques; or contamination that requires ongoing active management during and beyond construction, an accredited Site Auditor would review and approve the Remediation Action Plan, and would develop a Site Audit Statement and Site Audit Report upon completion of remediation. The locations this is required would depend on the outcome of the Remediation Action Plan and where remediation work is not completed as part of work carried out under the previous Sydney Metro West planning application.

The CEMF also includes measures in relation to ongoing management and monitoring measures where residual contamination remains following construction, and the potential migration of contaminated groundwater into the construction footprint from groundwater drawdown.

16.2 Operation

Environmental performance during operation of the proposal would be managed by the implementation of an operational environmental management plan or system.

16.3 Performance outcomes

Performance outcomes for Sydney Metro West were established as part of the concept assessment in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020). The performance outcomes related to contamination are:

- Operation:
  - Residual contamination does not pose a risk to Sydney Metro customers or staff
- Construction:
  - Contamination risks to human health and ecological receivers are minimised through effective management of existing contaminated land
  - Contaminated land is remediated to be suitable for the intended future land use.

Further details regarding how this proposal would achieve the performance outcomes is provided in Chapter 20 (Synthesis) of the Environmental Impact Statement.

17.0 Conclusion

This technical paper has identified and assessed the potential impacts of this proposal in relation to soil and groundwater contamination, acid sulfate soils and salinity. It responds directly to the Secretary's environmental assessment requirements outlined in Section 1.3.1.

The assessment undertaken in this technical paper is a preliminary site investigation based on desktop review only. Due to public health orders and restrictions issued by the NSW state government for the COVID-19 pandemic, site inspections could not be completed to verify the condition of the construction sites and surrounding study area at the time of this report. As the previous assessments of the study area were completed within the past two years, changes in land use that could have resulted in new contamination sources is unlikely and not considered to have a material impact on the outcome of the assessment of this proposal. Additionally, access to the sites was a constraint due to current ownership and existing infrastructure on the sites. Consideration should be given to conducting a proposal-wide site inspection as part of the next phase of work to confirm site conditions have not significantly changed in the intervening timeframe. It is also noted that additional investigations recommended as part of the previous Sydney Metro West planning applications have not yet been conducted.

The assessment has ranked AEI's at each construction site to address existing contamination and appropriate mitigation measures have been assigned to each construction site to reduce the risk of adverse impacts. The potential impacts from construction activities to acid sulfate soils and salinity were also assessed for each construction site and appropriate mitigation measures assigned.

Contaminated land, where present, would be investigated and remediated/managed during construction. The potential for ongoing management of off-site contaminated groundwater in the operational phase would be managed through appropriate design and treatment at the operational water treatment plant.

Works carried out under the previous Sydney Metro West planning applications would seek to avoid or minimise potential interaction with known contaminated sites and appropriately manage and remediate contamination if present and requiring management. For all sites (except for Westmead metro station), an additional review of residual contaminant concentrations and inflow rates would be required during implementation of this proposal to determine the need for groundwater remediation. In addition, the need for a long-term environmental management plan for the Clyde stabling and maintenance facility would be confirmed following remediation conducted during the work carried out under the previous Sydney Metro West planning application and construction activities carried out as part of this proposal.

Uncertainty associated with this proposal includes the actual nature and extent of residual contamination following completion of the works associated with the previous Sydney Metro West planning applications. The additional contaminated land investigations that are to occur during works associated with the previous Sydney Metro West planning applications are expected to address remaining data gaps and provide an adequate understanding of contamination requiring remediation/management during those previous applications. Remediation of contamination, if present, is expected to be managed by previous Sydney Metro West planning applications. Remediation delivered under the previous Sydney Metro West planning applications will ensure the protection of human health and the environment during construction and comply with the requirements of the relevant Construction Environmental Management Plan, associated sub-plans and, where applicable, the Remediation Action Plan(s) and requirements of the Site Auditor.

An additional review of residual contaminant concentrations (if present) and groundwater inflow rates is recommended during implementation of this proposal to determine whether additional remediation/management of residual contamination is warranted. The additional review would ensure that any differences between the previous remediation scope and the requirements of this assessment are identified and addressed It is noted that depending on the nature and extent of residual contamination following completion of the works associated with the previous Sydney Metro West planning applications, the risk ranking of the individual AEIs may change.

The approach to management and mitigation of contamination for this proposal would follow the same process established for the previous Sydney Metro West planning applications, including the relevant conditions of approval (conditions D71 to D78) of SSI-10038. These processes would ensure that residual contamination does not pose a risk to Sydney Metro customers or staff and that the land is suitable for the intended future land use.

Table 17-1 provides a summary of findings and conclusions for each of the construction sites.

Table 17-1 Summary of findings, conclusions and recommendations

Site	Summary of Findings	Conclusions
Westmead metro station	• Five of six AEIs ranked low risk, one ranked moderate risk. • There is low risk for the presence of acid sulfate soils. • Groundwater contamination within the area is expected to be localised and the risk to workers and ecological receptors is considered to be low. Extracted groundwater would be treated to the required discharge quality. • Construction works would also occur within the existing Westmead Station, rail corridor and embankment work.	• For the majority of the site, existing contamination, if present, is expected to be managed by previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • If contamination present in rail corridor and embankment (additional construction footprint associated with this proposal), protection of human health and environment would be managed by standard construction practices as disturbance would be minimal under this proposal.
Parramatta metro station	• Three of four AEIs ranked moderate risk, one ranked low risk. • There is a low probability of potential acid sulfate soils at depths greater than two metres below ground level. Investigations will be undertaken prior to work carried out under the previous Sydney Metro West planning application to inform an acid sulfate soil management plan for construction. • Groundwater contamination within the area is expected to be localised and the risk to workers and ecological receptors is considered to be low. Extracted groundwater would be treated to the required discharge quality. • Subsurface residual soil and groundwater contamination could remain which will be further assessed in accordance with the requirements of the previous Sydney Metro West planning application prior to construction of this proposal.	• Existing contamination, if present, is expected to be managed by previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • There is no additional construction footprint associated with this proposal.
Sydney Olympic Park metro station	• All four AEIs ranked low risk. • There is a high potential for acid sulfate soils in the area. • Excavation required as part of this proposal is not likely to intersect groundwater. • Construction and operation dewatering could potentially impact on the existing gas and leachate control measures for the nearby landfills. • Detailed contamination and groundwater investigations will be undertaken during the work carried out under the previous Sydney Metro West planning application and inform management measures for this proposal.	• No on-site sources of soil or groundwater contamination were identified. • Further investigation of off-site sources will be conducted in accordance with previous Sydney Metro West planning application prior to work under this proposal. • Residual groundwater contamination could remain. • The impact from the operation of Sydney Olympic Park metro station is considered to be low once mitigation measures are implemented.
North Strathfield metro station	• Two of seven AEIs ranked low risk, five ranked moderate risk. • There is low risk for the presence of acid sulfate soils although there is a mapped Class 2 acid sulfate soil risk located 260 metres to the west. • Potentially contaminated groundwater would be extracted during dewatering of the untanked station during construction and operation. This would result in localised changes to groundwater flow and groundwater drawdown. • Investigations will be undertaken during the work carried out under the previous Sydney Metro West planning application to assess the potential impacts and inform if specific mitigation measures are required.	• For the majority of the site, existing contamination, if present, is expected to be managed by previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • There is a potential for ongoing management of contamination of groundwater and vapour (if present) during construction and into operation due to untanked station box. • The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the North Strathfield metro station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant.
Burwood North Station	• One of five AEIs ranked a very low risk, four ranked moderate risk. • There is low risk for the presence of acid sulfate soils although there is a mapped Class 2 acid sulfate soil risk located within 240 metres of the site. • Residual groundwater contamination could remain following the work carried out under the previous Sydney Metro West planning application.	• Existing contamination, if present, is expected to be managed by previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • There is a potential for ongoing management of contaminated groundwater (if present) during construction and into operation. • The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the proposed Burwood North Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant. • There is no additional construction footprint associated with this proposal.
Five Dock Station	• One of five AEIs ranked a very low risk, two ranked low risk and two ranked moderate risk. • There is an extremely low probability of occurrence of acid sulfate soil within the construction site and the immediate surrounds. • Potentially contaminated groundwater would be extracted during dewatering of the untanked shafts during construction.	• Existing contamination, if present, is expected to be investigated and remediated during the previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • There are no anticipated impacts to the operation of Five Dock Station from existing contamination. • The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the proposed Five Dock Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant. • There is no additional construction footprint associated with this proposal.

Site	Summary of Findings	Conclusions
The Bays Station	• Three of six AEIs ranked low risk and three ranked high risk. • The construction site is mapped as disturbed terrain and low probability of occurrence of acid sulfate soils. • Light non aqueous phase liquid was reported in groundwater to the west of the site.	• The station box would be tanked at the completion of construction of this proposal, therefore groundwater drawdown would cease to occur and potential contamination would not impact operation. • Contaminated groundwater encountered during construction would require management during works associated with the previous Sydney Metro West planning applications.
Pyrmont Station	• One of six AEIs ranked a very low risk, four ranked low risk, one ranked moderate risk. • Potential acid sulfate soils could be located within and to the north of the Pyrmont Station eastern site. • Groundwater drawdown could result in potentially contaminated groundwater being drawn towards the Pyrmont Station sites. • The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during the work carried out under the previous Sydney Metro West planning application.	• Off-site sources of groundwater contamination will remain following work carried out under the previous Sydney Metro West planning application. • The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the Pyrmont Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant. • There is no additional construction footprint associated with this proposal.
Hunter Street Station (Sydney CBD)	• All four AEIs ranked low risk. • There is low risk for the presence of acid sulfate soils although there is a mapped Class 2 acid sulfate soil risk located within 200 metres north and 300 metres west of the site. • The ingress of contaminated groundwater to sub-surface infrastructure is expected to be partially or fully mitigated through remediation performed during work carried out under the previous Sydney Metro West planning application.	• Off-site sources of groundwater contamination would remain following the work carried out under the previous Sydney Metro West planning application. Groundwater would continue to be dewatered during construction and operation within the shafts. • The risk of existing groundwater contamination during operation is considered to be low as groundwater contamination in the Hunter Street (Sydney CBD) Station area is likely localised and extracted groundwater would be treated to the required discharge quality at the water treatment plant. • There is no additional construction footprint associated with this proposal.
Clyde stabling and maintenance facility and Rosehill services facility	• Five of eight relevant AEIs ranked low risk, three ranked moderate risk. • The Clyde stabling and maintenance construction site is mapped as Class 4 acid sulfate soils risk, with a high probability of potential acid sulfate soils at depths greater than two metres below ground level. • The tunnel and dive structures will be tanked within the soil profile and untanked within bedrock.	• Soil and/or groundwater contamination, where present, is expected to be investigated and remediated during the previous Sydney Metro West planning applications to ensure the protection of human health and the environment during construction. • There would likely be a requirement for a long-term environmental management plan to be developed to manage residual soil and monitor groundwater contamination, particularly if the remediation approach includes capping in-situ for contamination encountered during the work carried out under the previous Sydney Metro West planning application. • There is no additional construction footprint associated with this proposal.

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Appendix A

Legislation and policy context

A. Legislation and policy context

A.1 Commonwealth policy

A.1.1 National Environment Protection (Assessment of Contamination) Measure 1999 as amended in 2013 (ASC NEPM)

National Environment Protection Measures (NEPMs) are developed by the National Environmental Protection Council (NEPC) to protect or manage particular factors of the environment. The National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended 2013 (the ASC NEPM) is made under the *National Environment Protection Council Act 1994* (Cth).

The ASC NEPM establishes a nationally consistent approach to the assessment of site contamination to provide sound environmental management practices. The *National Environment Protection Measures (Implementation) Act 1998* (the Implementation Act) gives the Australian Government the power to implement NEPMs on its own land and for its own activities.

A.2 State legislation and policy

A.2.1 Environmental Planning and Assessment Act 1979

The *Environmental Planning and Assessment Act 1979* (EP&A Act) and the EP&A Regulation are the primary pieces of legislation regulating land use planning and development assessment in NSW. This legislation is supported by a range of environmental planning instruments including State environmental planning policies (SEPPs) and LEPs

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) provides a State-wide approach to the remediation of contaminated land for the purpose of minimising the risk of harm to the health of humans and the environment. In accordance with Clause 7(1) of SEPP 55, a consent authority must not consent to the carrying out of development on any land unless:

- It has considered whether the land is contaminated
- If the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or would be suitable, after remediation) for the purpose for which the development is proposed to be carried out
- If the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land would be remediated before the land is used for that purpose.

A.2.2 Contaminated Land Management Act 1997

The Contaminated Land Management Act 1997 (CLM Act) provides for the management of contaminated land in NSW by the Environment Protection Authority (EPA). The objects of this Act are to establish a process for investigating and (where appropriate) remediating land areas where contamination presents a risk of harm to human health or some factor of the environment.

The EPA is the primary environmental regulator in NSW and has powers to respond to contamination if it is significant enough to warrant regulation. The EPA can make or approve guidelines under section 105 of the *CLM Act*.

A.2.3 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) is administered by the NSW EPA. It prohibits any person from causing pollution of land, waters, or air and provides penalties for air, water, and noise pollution offences. The Act enables the NSW EPA to set out protection of the environment policies (PEPs) and adopt more innovative approaches to reducing pollution.

The disposal of waste is also regulated under the POEO Act. *The POEO (Waste) Regulation 2014* requires that all excavated material that is defined as waste must be classified prior to disposal to a landfill or waste treatment facility with the required Environmental Protection Licence (EPL) to accept the waste type. Under Section 91 and 92 of the *POEO (Waste) Regulation 2014* there are resource recovery orders (RRO) and resource recovery exemptions (RRE) that provide provisions for excavated material that do not meet the requirements of virgin excavated natural materials (VENM) to be re-used.

An application can be made to the NSW EPA to apply for a RRO and RRE if there is no current order and exemption for the planned re-use of waste. The applications for an RRO and RRE for re-use of material as fill must address the requirements of the NSW EPA (2018) *Guidelines on resource recovery orders and exemptions for the land application of waste materials as fill*.

A.3 Local legislation and policy

As the proposal is State Significant Infrastructure, local environment plans (LEP) and development control plans (DCP) are not applicable. Relevant planning controls are however considered for consistency, and local government is involved through stakeholder consultation.

Appendix B

Environmental setting, site history review and preliminary conceptual site model

B Environmental setting, site history review and preliminary conceptual site model

B.1 Westmead metro station

B.1.1 Identification and description

The Westmead metro station construction site comprises low and medium density residential, medical, commercial and rail infrastructure land uses. Westmead Station is bound by Railway Parade to the north, along which a barber, Desi Barber, a bakery and a tavern are located. Hawkesbury Road runs north to south and overpasses the existing Westmead Station to the east. Residential properties are situated along the construction footprint of this road, along with two businesses – Westmead Hair Salon and Yoel Clothing at the corner of Hawkesbury Road and Alexandra Avenue. A mechanic with a disused service station and an adjacent vacant retail store is located on the corner of Hassall Street and Alexandra Avenue. The remainder of the construction site, along Bailey Street, Hassall Avenue and Grand Avenue comprises of low-density residential properties and tree lined pavements. The identification and property description of the Westmead metro station construction site is outlined in Table B-1.

Table B-1 Westmead metro station construction site description

Item	Description		
Suburb	Westmead		
LGA	City of Parramatta (north of rail line) and Cumberland Council (south of rail line)		
Property details	**Address**	**Lot and DP**	**Current land use**
	131 Hawkesbury Road	Lot 11 to 13 DP1409	Residential
	133 Hawkesbury Road	Lot 9 and 10 DP4036	Commercial - vacant
	135 Hawkesbury Road	Lot 7 and 8 DP4036	Residential
	139 Hawkesbury Road	SP1871	Residential
	141 to 143 Hawkesbury Road	Lot 1 and 2 DP1409	Commercial – medical practice and hair salon
	49 Alexandra Avenue	Lot 49 to 51 DP1409	Vacant
	24-27 Alexandra Avenue	Lot 42 to 48 DP 4036	Residential
	20-22 Alexandra Avenue	SP67282	Residential
	3 Hassall Street	Lot 35 to 37 DP4036	Commercial – mechanics and former service station
	9-11 Hassall Street	Lot 1 DP949987	Commercial – vacant retail store
	15-19 Hassall Street	SP61570	Residential
	21 Hassall Street	Lot 26 to 27 DP4036	Residential
	Railway Parade	Part Lot 3 in DP1002926 and Lot 1 in Dp565420	Westmead Station and rail line
	Parts of Alexandra Avenue	Road reserve	Road
	Part of Grand Avenue	Road reserve	Road
	Hawkesbury Road	Road reserve	Road

Item	Description		
	Bailey Street	Road reserve	Road
	Part of Hassall Street	Road reserve	Road
	Part of Railway Parade	Road reserve	Road
	Part of Ashly Parade	Road reserve	Road

B.1.2 Environmental setting

The environmental setting for the Westmead metro station construction site is described in Table B-2.

Table B-2 Westmead metro station environmental setting

Aspect	Description
Land uses	The land uses comprise low and medium residential, medical, commercial and rail infrastructure Surrounding land use includes: • North: several major institutions, including the Western Sydney University Westmead campus and the Westmead health and medical research precinct, commercial and medium density residential • South: medium and low density residential • East: medium and low density residential, then Parramatta Park • West: low density residential and Westmead Public School (southwest)
Zoning	The zoning within the construction site comprises: • B4- Mixed Use • R2- Low Density Residential • R4- High Density Residential • SP2- Infrastructure (rail)
Topography	There is a slight decline to the east across the construction site, with an embarkment cutting down to the rail corridor along either side of Westmead Station.
Drainage	The nearest receiving water body is Domain Creek about 300 metres to the east, which drains into the Parramatta River a further 900 metres downstream.
Geology	The geology within the construction site comprises: • Alluvial/residual clay (0 to 2 m bgl) • Ashfield shale (2 to 45 m bgl) • Hawkesbury Sandstone (+45 m bgl)
Soil Landscapes	The soil within the construction site is mapped as the Birrong soil landscape. Alluvial/fluvial soils are associated with the Birrong soil landscape. They are found on level to gently undulating alluvial floodplain draining Wianamatta Group shale, with slopes less than three per cent. Broad valley flats and extensively cleared tall open forest and woodland. Limitations include localised flooding, high soil erosion hazard, saline subsoils.
Hydrogeology	Groundwater is typically 33 metres AHD and 3 metres bgl in the vicinity of the construction site.
Salinity	Groundwater is brackish to saline within and surrounding the construction site. Soil salinity
Acid sulfate soils	The construction site is mapped as a low probability of occurrence of acid sulfate soils and mapped as Class 5 in the Parramatta LEP 2011 acid sulfate soil risk maps.

B.1.3 Site history review

Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020)

The findings of the Sydney Metro West Environmental Impact Statement - Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) for the Westmead metro station included:

- Historical aerial photography showed that the construction site has had low density residential land uses since at least 1955, with scattered trees and vegetation. This land use has remained largely unchanged, with a number of extensions and subdivisions to properties within the construction site and widening of Alexandra Avenue in the 1960s
- Land uses in the area surrounding the construction site since the 1950s included low density residential development, commercial and industrial premises, large areas of open space including parks and ovals, and the existing Westmead Station. Former commercial and industrial premises may be associated with higher contamination risks. Key developments since the 1950s include the development of local schools in the 1970s and the development of Westmead Hospital
- Soils and groundwater within and beneath the Westmead metro station construction site and above the alignment were assigned a moderate potential contamination impact associated with the historical activities carried out on and/or adjacent to the footprint including mechanical workshop activities, dumping of construction wastes and the possible inappropriate management (during demolition) and/or degradation of hazardous building materials within current and former on-site structures.

Golder-Douglas (2021a) Factual Contamination Assessment Report, 00013/11180 Sydney Metro West Geotechnical Investigation

The results of two boreholes sampled and drilled within the proposed Westmead metro station construction site are summarised in Table B-3. The samples were analysed for TRH/TPH, PAHs, 8 heavy metals, OCPs, OPPs, PCBs, asbestos (absence/presence), VOC, field acid sulfate soil test, total phenolics and PFAS. The results indicated minor exceedances of the adopted ecological criteria contamination that would not likely require remediation at the locations sampled.

Table B-3 Golder-Douglas (2021a) – Borehole results - Westmead metro station

Location	Geology	Soil results
SMW_BH700 (Alexandra Ave west of Hawkesbury Road)	• Asphalt: 0.2 m • Fill: 0.2 - 0.4 m • Silty Clay: 0.4- 2.8 m • Bedrock: 2.8 - 70.69 m	• No observations of contamination recorded • Sample from 26.2 m exceeded adopted ecological criteria for zinc at a concentration of 128 mg/kg.
SMW_BH701 (Alexandra Ave north of workshop/former service station)	• Asphalt: 0 - 0.31 • Fill: 0.31 - 1.4 m • Clay: 1.4 – 4.8 m • Bedrock: 4.8 – 28.19 m	• No observations of contamination recorded • Sample from 0.5 m exceeded adopted ecological criteria for nickel at a concentration of 59 mg/kg.

Golder-Douglas (2021b) Groundwater Monitoring Report – Stage 2 Locations, Sydney Metro West Geotechnical Investigation and Golder-Douglas (2021c) 00013/11180 Sydney Metro West Geotechnical Investigation, Groundwater Monitoring Report Stage 3 Locations

One groundwater monitoring well was sampled within the construction site and one downgradient of the construction site. Samples were analysed for the following analytes:

- Golder-Douglas (2021b): EC, TDS, pH, major ions, 11 heavy metals[1] and nutrients[2]
- Golder- Douglas (2021c): EC, TDS, pH, major ions, 11 heavy metals, TRH/TPH, BTEXN, SVOCs, VOCs, hexavalent chromium, PFAS and nutrients

The results are summarised in Table B-4 and indicate that groundwater would likely require treatment prior to discharge to surface water due to concentrations of ammonia and some heavy metals exceeding the adopted ecological criteria.

Table B-4 Golder-Douglas (2021b/c) – Groundwater results - Westmead metro station

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_BH008 (Golder-Douglas, 2021b)	200 m east and down-gradient of the construction site	14-17	5.15	7.3	17,400	• Nitrite: 20 µg/L (DWG – 3 µg/L) • Ammonia: 3380 µg/L (ANZG – 910 µg/L) • Iron: 1240 µg/L (LTI – 200 µg/L)
SMW_BH701 (Golder-Douglas, 2021c)	Within construction site (Alexandra Ave north of workshop/former service station)	6.0-9.0	4.37	7.56	8,410	• Iron: 0.55 mg/L (LTI – 0.2 mg/L) • Sodium: 1580 mg/L (LTI – 0.2 mg/L) • Chloride: 1840 mg/L (LTI – 0.2 mg/L) • Fluoride: 2.4 mg/L (LTI – 1 mg/L, DWG – 1.5 mg/L) • Cobalt: 5 µg/L (ANZG – 1 µg/L) • Manganese: 165 µg/L (ANZG – 80 µg/L) • Chromium: 5 µg/L (ANZG – 4.4 µg/L) • Copper: 12 (µg/L ANZG – 1.3 µg/L) • Zinc: 19 µg/L (ANZG – 15 µg/L)

Notes: ANZG – 95% level of protection for marine environments (Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, 2018); DWG – drinking water criteria (Australian Drinking Water Guidelines. National Health and Medical Research Council and Natural Resource Management Ministerial Council, 2011); LTI – Irrigation water long term trigger values as outlined in ANZECC/ARMCANZ (2000); SWL – standing water level (m btoc); Screen – screened interval (m bgl); EC – electrical conductivity (µS/cm).

Desktop review

A site history review of the Lotsearch Enviro Professional report of Westmead metro station (Lotsearch, 2021a) was undertaken for the additional construction footprint for this proposal. The review findings are summarised in Table B-5.

[1] Arsenic, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel and zinc
[2] Ammonia, nitrate, nitrite, total nitrogen, total phosphorus and phosphate

Table B-5 Site history review – Westmead metro station additional footprint

Item	Description
Historical aerial photograph review	1930: Railway Avenue, Hawkesbury Road, Alexandra Avenue, Grand Avenue, Bailey Street, Hassel Street and Westmead Station were visible. There were no houses along the west side of Hawkesbury Road south of the railway bridge crossing. 1943: Additional houses present, station platforms appear to be better developed and continued commercial development to the southwest. 1949: Footbridge across station in place and continued commercial development to the southwest. 1951: No major changes. 1956: First appearance of mechanical workshop (AEI 2). 1961: No major changes. 1965: No major changes. 1970: No major changes. 1978: The Hawkesbury Road bridge crossing the railway appeared to be under reconstruction. 1982: The Hawkesbury Road bridge crossing the railway now complete, shopping centre immediately north of the station in place. 1986: No major changes. 1991: Large carpark under construction in the northwest. 1994: Large carpark completed in the northwest.
Historical business records	There was a former BP service station listed on Hawkesbury Road (1971 and 1972) and a motor garage on Bailey Street (1950 to 1962), the street numbers were not known. No service stations were visible within aerial photographs. No other businesses that could be potential sources of contamination were listed within close proximity of the construction site.
Historical lands titles	Not obtained
Section 10.7 planning certificates	Not obtained
NSW EPA notified sites	Parramatta Park Toilet Block Demolition, 580m east Coleman Oval Embankment, 655m northeast
NSW EPA regulated sites	None
Sites licenced or formerly licensed under POEO Act 1997	A search of the NSW EPA public register of licences and penalty notices issued under the *Protection of the Environment Operations Act 1997* (POEO Act) for premises within 1 km of the Site was undertaken. The following licences were listed within the construction site in the rail corridor: • EPL 12208: Sydney trains – railway systems and activities • EPL 21247: Metro Trains Sydney Pty Ltd – railway system activities • EPL 21347: CPB Contractors Pty Limited – railway infrastructure construction
NSW EPA lists (former gasworks, PFAS investigation sites, and sites affected by asbestos filling or loose-fill asbestos)	None

B.1.4 Conceptual site model and risk ranking

The CSM and risk ranking for Westmead metro station is presented in Table B-6.

Table B-6 Westmead metro station – Conceptual site model and risk ranking

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source, CoPC and Media**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Risk Rating**
AEI 1	Railway activities	**Source:** Hazardous building materials within or from on-site buildings/structures **CoPC:** Heavy metals, hydrocarbons, asbestos **Media:** Soil	Very low	Direct contact, ingestion or inhalation, dust and surface water runoff	Construction workers, nearby site users and future rail workers	**Construction:** Yes **Operation:** No	PR3	SE2	Construction works would occur within the existing Westmead Station, rail corridor and embankment work.	Moderate
AEI 1(a)	Roads (Hawkesbury Road, Grand Avenue, Bailey Street, Hassall Street, Alexandra Avenue and Railway Parade)	**Source:** Uncontrolled filling from past road and underground service construction **CoPC:** Heavy metals, PAHs, TRH/BTEX, pesticides and asbestos	NA	Direct contact, ingestion or inhalation, dust and surface water runoff	Construction workers, nearby site users and future intrusive maintenance workers	**Construction**: Yes **Operation:** No	PR2	SE1	Shallow earthworks required during this proposal construction	Low
AEI 2	Mechanical workshop/service station [3 Hassall St, Westmead (Iman Auto Mechanic)]	**Source:** Leaks and spills from underground petroleum storage infrastructure/automotive repair work **CoPC:** Hydrocarbons, heavy metals, solvents **Media**: Soil and groundwater	Moderate	Direct contact, ingestion or inhalation, dust, vapour intrusion, surface water runoff	Construction workers and future site users	**Construction:** Yes **Operation:** Yes	PR1	SE2	Potentially ongoing management of contamination in groundwater (if present) during construction and into operations	Low

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source, CoPC and Media**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Risk Rating**
AEI 3	Dumping of construction waste (29 Alexandra Avenue, Westmead)	**Source:** Dumping of Construction waste **CoPC:** Heavy metals, hydrocarbons (TRH, PAH), pesticides, asbestos **Media:** Surface soils	Moderate	Direct contact, ingestion, inhalation, with contaminated soils and dust (namely asbestos).	Construction workers and adjacent site users	**Construction:** Yes **Operation**: No	PR2	SE1	Previously dumped construction waste is expected to be transported off-site or managed appropriately during the work carried out under the previous Sydney Metro West planning application	Low
AEI 4	Hazardous building materials and dumping of construction waste/former demolition (Blocks between Alexandra Avenue, Hassall Street, Bailey Street and Hawkesbury Road)	**Source**: dumping of construction waste and demolition of former structures **CoPC:** heavy metals, hydrocarbons (TRH< PAH), pesticides, asbestos **Media:** surface soils	Moderate	Direct contact, ingestion, inhalation, with contaminated soils and dust (namely asbestos).	Construction workers and adjacent site users	**Construction**: Yes **Operation:** No	PR2	SE1	Previously dumped construction waste is expected to be remediated or managed prior to this proposal construction	Low
AEI 5		**Source**: Hazardous building materials within or from buildings (impacts to soil from demolition/construction) CoPC: Heavy metals, pesticides, asbestos Media: Soil	Moderate	Direct contact, ingestion or inhalation, dust and surface water runoff	Construction workers, nearby site users and future site users	**Construction:** Yes **Operation:** No	PR2	SE1	Impacted shallow soils expected to be remediated or managed prior to this proposal construction	Low

Note: (a) Denotes new AEI identified from the assessment of the additional construction footprint for this proposal - to differentiate from AEI's from the Sydney Metro West Environmental Impact Statement - Westmead to The Bays and Sydney CBD (Sydney Metro, 2020).

B.2 Parramatta metro station

B.2.1 Identification and description

The property description for the Parramatta metro station is detailed in Table B-7 below.

Table B-7 Parramatta metro station construction site description

Item	Description		
Suburb	Parramatta		
LGA	City of Parramatta		
Property details	**Address**	**Lot and DP**	**Land use**
	41-59 George Street Parramatta 2150	10 DP858392	Commercial – shop and retail
	61B George Street Parramatta 2150	1 DP607181	Commercial – shop and retail
	71 George Street Parramatta 2150	100 DP607789	Car Park
	238 Church Street Parramatta 2150	2 DP591454	Commercial – shop and retail
	236 Church Street Parramatta 2150	1 DP128437	Commercial – shop and retail
	232 Church Street Parramatta 2150	1 DP651992	Commercial – shop and retail
	222 Church Street Parramatta 2150	1 DP702291	Commercial
	220 Church Street Parramatta 2150	1 DP1041242	Commercial – shop and retail, medical and consulting
	48 Macquarie Street Parramatta 2150	B DP394050	Commercial – leased office
	58-60 Macquarie Street Parramatta 2150	1 DP399104	Commercial – office space
	62-64 Macquarie Street Parramatta 2150	AY DP400258	Commercial – office space
	68 Macquarie Street Parramatta 2150	1 DP711982	Medical - dental
	70 Macquarie Street Parramatta 2150	E DP402952	Commercial – office space
	72 Macquarie Street Parramatta 2150	3 DP218510	Commercial – office space
	74 Macquarie Street Parramatta 2150	H DP405846	Commercial – retail

B.2.2 Environmental setting

The environmental setting for the Parramatta metro station construction site is described in Table B-8.

Table B-8 Parramatta metro station environmental setting

Aspect	Description
Land uses	The construction site consists of commercial land uses. The area comprises of multiple buildings used for a variety of activities including, but not limited to, food, beauty, clothing, car parking, chemists, banks, convenience stores, offices, education buildings, dry cleaners. Surrounding land use includes: • North: commercial buildings and adjacent roads • South: commercial buildings and adjacent roads • East: commercial buildings and adjacent roads • West: commercial buildings and adjacent roads
Zoning	The zoning within the construction site comprises: • B3- Commercial Core • B4- Mixed Use
Topography	Largely flat area with slight decline north towards Parramatta River
Drainage	The construction site is expected to drain into local stormwater network which discharges to the Parramatta River located 350 metres to the north.
Geology	The geology within the construction site comprises: • Alluvial/residual clay and fluvial sand (0 to 16 m bgl) • Ashfield Shale (16 to 19 m bgl) • Hawkesbury Sandstone (+19 m bgl)
Soil Landscapes	The soil within the construction site is mapped as Birrong soil landscape.
Hydrogeology	Groundwater is expected to be at 6 m bgl, at about 4 metres AHD. Groundwater is expected to flow in a north to north-easterly direction towards the Parramatta River.
Salinity	Groundwater is expected to be fresh to brackish in the shallow alluvial aquifer and brackish to saline within the underlaying Ashfield Shale aquifer.
Acid sulfate soils	The construction site is mapped as low probability of acid sulfate soils, disturbed terrain and as Class 4 in the Parramatta LEP 2011 acid sulfate soil risk maps.

B.2.3 Site history review

Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020)

The contamination findings of the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) for the Parramatta metro station included:

- The historical aerial review identified that the since 1943, the land within the construction site appears to have consisted of multiple large commercial/industrial buildings and associated yard that have been extended and modified over the years.
- Three AEIs were identified within the construction site which comprised:
  - AEI 6: Former and existing structures – Hazardous building materials within or from on-site buildings / structures, demolition wastes
  - AEI 7: Dry cleaners at 56-67 George Street – Residuals from current dry-cleaning activities. inappropriate disposal of solvents, depth distribution associated with potential underground tanks
  - AEI 8: Historical commercial / industrial use within locality – Inappropriate chemical storage and use, industrial operations, waste disposal and management etc.

- Soils, groundwater and vapour within / beneath the construction site were assigned a moderate potential contamination impact associated with the current and historical activities carried out on and/or adjacent to the site including possible commercial/industrial land use, dry cleaning operation and the possible inappropriate management (during demolition) and/or degradation of hazardous building materials within current and former on-site structures
- The Sydney Metro West Geotechnical Investigation was described in the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020). The investigation included sampling of boreholes within the Parramatta metro station construction footprint. BH003 at a depth of 0.5 metres (fill) recorded concentrations of zinc above the adopted ecological guidelines.

A factsheet for Lancer Barracks at Parramatta was prepared by the Department of Defence (Department of Defence, 2016). Lancer Barracks is located approximately 300 metres south-east of Parramatta metro station construction site and the alignment. The Fact Sheet indicated a Stage 1 investigation had been carried out at the site, with no intrusive works completed to date. It stated that the Lancer Barracks is considered low risk to human health and the environment, based on previous and current land use.

Golder-Douglas (2021b) Groundwater Monitoring Report – Stage 2 Locations, Sydney Metro West Geotechnical Investigation and Golder-Douglas

Two shallow and two deep groundwater monitoring wells were sampled downgradient of the construction site and one downgradient of the proposed Parramatta metro station construction site. Samples were collected and analysed for EC, TDS, pH, major ions, 11 heavy metals, TRH, BTEXN, PAHs, PFAS and nutrients.

The results are summarised in Table B-9 and indicate that groundwater downgradient of the site has concentrations of heavy metals and nutrients exceeding the adopted ecological and human health based assessment criteria respectively.

Table B-9 Golder-Douglas (2021b) – Groundwater results – Parramatta metro station

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_ BH04A (BH004S)	120 m north and down-gradient of the construction site	6.5-11.5	5.75	6.79	339	• Nitrate: 1420 ug/L (R/DC – 500 µg/L) • Nitrite: 20 ug/L (DWG – 3 µg/L) • Total phosphorus: 140 ug/L (LTI – 50 µg/L) • Cobalt: 13 ug/L (ANZG – 1 µg/L) • Iron: 2150 ug/L (LTI – 200 µg/L) • Zinc: 26 ug/L (ANZG – 15 µg/L)
SMW_ BH004		20.6-23.6	12.1	7.83	3960	• Nitrate: 160 ug/L (DWG – 50 µg/L) • Total phosphorus: 90 ug/L (LTI – 50 µg/L) • Nickel: 182 ug/L (ANZG – 70 µg/L)
SMW_ BH048_S	160 m north and down-gradient of the construction site	4.5-7.5	4.32	7.19	502	• Total phosphorus: 200 ug/L (LTI – 50 µg/L) • Cobalt: 5 µg/L (ANZG – 1 µg/L) • Iron: 3780 µg/L (LTI – 200 µg/L) • Manganese: 165 µg/L (ANZG – 80 µg/L) • Zinc: 16 µg/L (ANZG – 15 µg/L)

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_ BH048		16.9-22.6	9.31	7.67	1590	• Iron: 630 µg/L (LTI – 200 µg/L) • Manganese: 173 µg/L (ANZG – 80 µg/L)

Notes: ANZG – 95% level of protection for marine ecosystems (Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, 2018); DWG – drinking water criteria (Australian Drinking Water Guidelines. National Health and Medical Research Council and Natural Resource Management Ministerial Council, 2011); LTI – Irrigation water long term trigger values as outlined in ANZECC/ARMCANZ (2000); R/DC – recreational/direct contact criteria (DWG criteria x 10); SWL – standing water level (m btoc); Screen – screened interval (m bgl); EC – electrical conductivity (µS/cm).

B.2.4 Conceptual site model and risk ranking

The CSM and risk ranking for the Parramatta metro station is presented in Table B-10.

Table B-10 Parramatta metro station – Conceptual site model and risk ranking

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Risk Rating**
AEI 6	Former and existing structures with hazardous building materials	Source: Hazardous building materials within or from on-site buildings / structures CoPC: Heavy, metals, hydrocarbons, pesticides, PCBs, asbestos Media: Soil	Moderate	Direct contact, ingestion or inhalation, dust and surface water runoff	Construction workers, nearby site users, future site users and ecological receptors including the Parramatta River	Construction: Yes Operation: No	PR2	SE1	Previously dumped construction waste is expected to be transported off-site or managed appropriately during the work carried out under the previous Sydney Metro West planning application	Low
AEI 7	Dry cleaners	Source: Dry cleaning solvents CoPC: VHCs, BTEX and TRH Media: Soil, groundwater and vapour	Very low (surface soil) Moderate (groundwater)	Direct contact, ingestion or inhalation, vapour intrusion, dust and surface water runoff	Construction workers, nearby site users, future site users and ecological receptors including the Parramatta River	Construction: Yes Operation: Yes	PR3	SE2	Potentially ongoing management of contamination of groundwater and vapours (if present during construction and operation of this proposal). Soils are not expected to be contaminated, as it is assumed that surface soils will be removed during work carried out under the previous Sydney Metro West planning application.	Moderate

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Risk Rating**
AEI 8 and AEI 9	General historical commercial and industrial land use (AEI 8 – on-site and AEI – 9 off-site)	Source: Inappropriate chemical storage and use, industrial operations, waste disposal and management within (AEI 8) and outside footprint (AEI 9) CoPC: Heavy metals, TRH, BTEX, PAH and VOCs Media: Soil and groundwater	AEI 8: Moderate AEI 9: Very low (soil) Moderate (groundwater)	Direct contact, ingestion or inhalation, dust and surface water runoff	Construction workers, nearby site users, future site users and ecological receptors including the Paramatta River	Construction: Yes Operation: No	PR3	SE2	Potentially ongoing management of contamination of groundwater and vapours (if present during construction and operation of this proposal). Soils are not expected to be contaminated, as it is assumed that surface soils will be removed during work carried out under the previous Sydney Metro West planning application.	Moderate

B.3 Sydney Olympic Park metro station

B.3.1 Identification and description

The environmental setting for the Sydney Olympic Park metro station construction site is described in Table B-11.

Table B-11 Sydney Olympic Park metro station construction site - description

Item	Description		
Suburb	Sydney Olympic Park		
LGA	City of Parramatta		
Property details	**Address**	**Lot and DP**	**Land use**
	13 Olympic Boulevard Sydney Olympic Park 2127	2 DP1256423	Residential
	8 Herb Elliott Avenue Sydney Olympic Park 2127	132 DP1189734	Mixed Commercial and Retail
	7 Figtree Drive Sydney Olympic Park 2127	59 DP786296	Mixed Commercial and Retail
	5 Figtree Drive Sydney Olympic Park 2127	58 DP786296	Mixed Commercial and Retail
	Figtree Drive Sydney Olympic Park 2127	20 DP1228905	Road

B.3.2 Environmental setting

The environmental setting for the Sydney Olympic Park metro station construction site is described in Table B-12

Table B-12 Sydney Olympic Park metro station – environmental setting

Aspect	Description
Land uses	The construction site is occupied by large commercial buildings (offices or businesses), with large, tree-bound carparking areas. Surrounding land use includes: • North: commercial buildings and restaurants, existing Olympic Park Station, Olympic Park exhibition halls • South: commercial buildings, then multi-level carparking and sports facilities • East: commercial buildings, then Bicentennial Park • West: sporting facilities (aquatic centre and stadiums)
Zoning	The zoning of the construction site is B4- Mixed Use
Topography	The construction site has a south-easterly decline towards Bicentennial Park.
Drainage	The closest water bodies are: • Lake Belvedere 200 metres east • Bicentennial Park wetlands (Bennelong Pond) 300 metres northeast • Haslams Creek 900 metres northwest • Homebush Bay 1 km north
Geology	The geology beneath the construction site is: • Fill/alluvial/residual clay (0 to 2 m bgl) • Ashfield Shale (2 to 45 m bgl) • Hawkesbury Sandstone (+45 m bgl) • Inferred fault

Aspect	Description
Soil Landscapes	The soil landscape of the construction site is Disturbed alluvial/fluvial soils- found on a variety of landscapes ranging from level plain to hummocky terrain that has been extensively disturbed by human activity. Slopes are typically less than five per cent and local reliefs of less than 10 metres The original soil has been completely disturbed, removed, or buried. Landfill may include soil, rock, building and waste material with a cap of sandy loam. Soil may by strongly acidic to strongly alkaline
Hydrogeology	12 metres AHD, 12 m bgl
Salinity	Brackish to saline
Acid sulfate soils	The construction site is mapped as low probability/confidence unknown occurrence of acid sulfate soils. Mapped disturbed terrain with high probability of occurrence is located 300 metres south and east of the construction site.

B.3.3 Site history review

Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020)

The contamination findings of the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) for the Sydney Olympic Park metro station included:

- Landfilled wastes may contain levels of metals, hydrocarbons (TRH, BTEX, PAH), VOC, PFAS and asbestos. Increased potential for impact is likely to be associated with the removal of potentially contaminated surface soils to facilitate the construction of the station box and the handling/management of materials within spoil storage areas (i.e. where potentially contaminated materials need to be disturbed and handled during construction). Significant excavation of existing surface soils and potentially waste materials is unlikely to occur across other areas of the construction site. However, disturbance of surface soils and waste materials associated with site preparation and general construction activities could increase the potential for impact
- Groundwater and landfill gas within / beneath the construction site and above the alignment have been assigned a high potential contamination impact associated with historical burial of waste materials and potential firefighting activities adjacent to the site
- Landfill gas from the biological breakdown of organic wastes could contain methane and hydrogen sulphide and wastes could contain VOC. Increased potential for impact is likely to be associated with the ingress and accumulation of vapour into excavation voids during the construction of the station box, tunnel and associated below ground services.

The Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) included review of the following reports:

- Sydney Metro West Geotechnical Investigation: One borehole (BH032) at a depth of 0.6 metres (fill) and 1.0 metres (fill) recorded concentrations of benzo(a)pyrene above the adopted ecological guidelines
- WestConnex, M4 East Environmental Impact Statement, Appendix P (NSW Government, 2015): Fill was identified from 0 to 1.8 metres below ground level, underlain by natural soils from 0.2 to 3.5 metres below ground level between Homebush Drive and Pomeroy Street. Asbestos containing material was identified in fill soils along the Western Motorway between Sydney Olympic Park and North Strathfield metro station construction sites
- Factsheet – Remediation (Sydney Olympic Park Authority, 2014a): Relevant information included:
  - Numerous areas of landfilling exist within Sydney Olympic Park precinct. Closest known areas of landfilling to the Sydney Olympic Park metro station construction site are approximately 150 metres to the south and south west. The alignment of the tunnel is overlain by (The Pyramid Marker, former Golf Driving Range and Bicentennial Park) and adjacent to (Kronos Hill, Aquatic Centre Carpark) a number or areas of landfilling
  - Sydney Olympic Park Authority outlined the long-term management of ten engineered landfills constructed at Sydney Olympic Park between 1983 and 2001

- A combination of legal and illegal landfilling operations occurred over several decades at Sydney Olympic Park. In the early 1990s, soil and groundwater samples were collected from generally 1.6 metres deep boreholes installed on a 50-metre grid across the site. Waste was identified across the site consisting of power station ash, demolition rubble, asbestos, industrial hydrocarbons, domestic garbage, and dredging material from the Parramatta River
- Between 1992 and 2000, the area underwent an auditor remediation program consisting of recovery, consolidation, and containment of approximately nine million cubic meters of waste. Acid sulfate soils were detected in the areas of parklands at Sydney Olympic Park. The areas contained acid sulfate soils were either excavated, consolidated in deep pits or used as landfill mounds
- Areas of designed containment cells of acid sulfate soils are known to produce some leachate. A leachate transfer system transports the majority of this liquid to a nearby commercial treatment location, whilst some is contained in constructed evaporative ponds.

Golder-Douglas (2021a) Factual Contamination Assessment Report, 00013/11180 Sydney Metro West Geotechnical Investigation

The results of three boreholes sampled drilled outside the boundary of the proposed Sydney Olympic Park metro station construction site are summarised in Table B-13. The samples were analysed for TRH/TPH, PAHs, 8 heavy metals, OCPs, OPPs, PCBs, asbestos (absence/presence), VOC, field acid sulfate soil test, total phenolics and PFAS. The results indicated minor exceedances of the adopted ecological criteria contamination that would not likely require remediation at the location sampled.

Table B-13 Golder-Douglas (2021a) – Borehole results – Sydney Olympic Park metro station

Location	Geology	Soil results
SMW_ENV712/712S (Herb Elliot Avenue)	• Asphalt: 0-0.14 m • Fill: 0.14-0.4 m • Silty Clay: 0.4-2.3 m • Clay: 2.3-2.5 m • Bedrock: 2.5-55.5 m	• All results less than adopted assessment criteria
SMW_ENV713/713S (Sarah Durack Ave)	• Concrete: 0 -0.1 m • Fill: 0.1 – 0.8 m • Silty Clay: 0.8-1.7 m • Bedrock: 1.7 – 35.05 m •	• All results less than adopted assessment criteria
SMW_ENV714/714S (Olympic Boulevard)	• Asphalt/concrete: 0-0.22 m • Fill: 0.22 – 0.8 m • Silty Clay: 0.8 – 1.6 m • Bedrock: 3.08 – 30.65 m	• The following samples exceeded adopted ecological criteria for zinc: - 0.5 m: 160-213 mg/kg - 1.7 m:276 mg/kg - 24.42 m: 120 mg/kg - 27.4 m: 130 mg/kg

Golder-Douglas (2021b) Groundwater Monitoring Report – Stage 2 Locations, Sydney Metro West Geotechnical Investigation and Golder-Douglas (2021c) 00013/11180 Sydney Metro West Geotechnical Investigation, Groundwater Monitoring Report Stage 3 Locations

Seven groundwater monitoring wells were installed and sampled in the vicinity of the proposed Sydney Olympic Park metro station construction site. Groundwater samples were analysed for EC, TDS, pH, major ions, 11 heavy metals, TRH/TPH, BTEXN, PAH, VOCs, SVOCs, hexavalent chromium, PFAS, nutrients and dissolved methane.

The results are summarised in Table B-14. Some heavy metals and ammonia exceeded the adopted ecological and human health based screening criteria. Groundwater results within the Golf Driving Range Landfill to the east of the construction site were typical of leachate with high concentrations of nutrients and dissolved methane and slightly elevated petroleum hydrocarbon, PFAS and heavy metal concentrations.

Table B-14 Golder-Douglas (2021b/c) – Groundwater results – Sydney Olympic Park metro station

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_BH120 (Douglas - Golder, 2021b)	50 m north of the construction site within Showground Road	22.5-25.5	17.18	6.98	16,400	• Ammonia: 1640 µg/L (ANZG – 910 µg/L) • Cobalt: 10 µg/L (ANZG – 1 µg/L) • Copper: 6 µg/L (ANZG – 1.3 µg/L) • Iron: 1120 µg/L (LTI – 200 µg/L) • Manganese: 441 µg/L (ANZG – 80 µg/L, LTI– 200 µg/L) • Nickel: 67 ug/L (DWG – 20 µg/L) • Zinc: 73 µg/L (ANZG – 15 µg/L)
SMW_BH126 (Douglas - Golder, 2021b)	260 m south east of the construction site (Golf Driving Range Landfill)	9.2-12.2 (screened across fill and bedrock)	4.17	7.61	12,900	• Fluoride: 1.3 mg/L (LTI – 1 mg/L) • Ammonia: 267,000 µg/L (ANZG – 910 µg/L) • Total Nitrogen: 312,000 µg/L (LTI – 5000 µg/L) • Total Phosphorus: 440 µg/L (LTI – 50 µg/L) • Cobalt: 11 µg/L (ANZG – 1 µg/L) • Iron: 300 µg/L (LTI – 200 µg/L) • Nickel: 26 µg/L (DWG – 20 µg/L) • Dissolved methane: 9460 µg/L (DWG-1600 µg/L) • TRH F2 fraction: 420 µg/L (DWG – 100 µg/L) • Benzene: 61 µg/L (R/DC – 10 µg/L) • PFHXS+PFOA: 0.34 µg/L (DWG – 0.07 µg/L) • PFOA: 0.14 µg/L (ANZG – 0.13 µg/L)

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_BH069 (Douglas - Golder, 2021b)	490 m southeast of the construction site	19.4-22.4	6.04	7.63	15,700	• Ammonia: 2220 µg/L (ANZG – 910 µg/L) • Cobalt: 10 µg/L (ANZG – 1 µg/L) • Manganese: 406 µg/L (ANZG – 80 µg/L, LTI– 200 µg/L) • Zinc: 58 µg/L (ANZG – 15 µg/L)
SMW_ENV712S (Douglas - Golder, 2021c)	Herb Elliott Ave, north of construction site	13.5-16.5	3.76	-	-	-
SMW_ENV712 (Douglas - Golder, 2021c)		21.04-27.04	1.85	-	-	-
SMW_ENV713 (Douglas - Golder, 2021c)	140 m southeast of Sarah Durack Ave, south of construction site	11.5-20.5	6.11	7.54	7820	• Sodium: 1430 mg/L (LTI – 115 mg/L) • Chloride: 1780 mg/L (LTI – 175 mg/L) • Nitrate: 2.42 mg/L (R/DC – 0.5 mg/L) • Fluoride: 1.4 mg/L (LTI – 1 mg/L) • Total phosphorus: 0.06 µg/L (LTI – 0.05 µg/L) • Cobalt: 43 µg/L (ANZG – 1 µg/L) • Manganese: 272 µg/L (ANZG – 80 µg/L, LTI– 200 µg/L) • Copper: 89 µg/L (ANZG – 1.3 µg/L) • Nickel: 81 ug/L (DWG – 20 µg/L) • Zinc: 91 µg/L (ANZG – 15 µg/L)
SMW_ENV714	Olympic Boulevard, west of construction site	11.5-20.5	3.98	-	-	-

Notes: SMW_ENV712S, SMW_ENV712 and SMW_ENV714 were noted as analytical results pending; ANZG – 95% level of protection for marine ecosystems (Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, 2018); DWG – drinking water criteria (Australian Drinking Water Guidelines. National Health and Medical Research Council and Natural Resource Management Ministerial Council, 2011); LTI – Irrigation water long term trigger values as outlined in ANZECC/ARMCANZ (2000); R/DC – recreational/direct contact criteria (DWG criteria x 10); SWL – standing water level (m btoc); Screen – screened interval (m bgl); EC – electrical conductivity (µS/cm).

B.3.4 Conceptual site model and risk ranking

The CSM and risk ranking for the Sydney Olympic Park metro station is presented in Table B-15.

Table B-15 Sydney Olympic Park – Conceptual site model and risk ranking

Area of environmental concern			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potentially applicable to this proposal**	**Revised risk rating**
AEI 30	Golf Driving Range Landfill (Sarah Durack Avenue, Sydney Olympic Park)	Media: Groundwater and ground gas/vapour Source: Known areas of waste and groundwater contamination CoPC: Heavy metals, hydrocarbons, VOCs, PFAS, asbestos	High (groundwater) Moderate (vapour)	Direct contact, ingestion and inhalation of contaminated groundwater Inhalation and explosive risk of landfill gases. Discharge of extracted groundwater.	Construction workers, adjacent site users and ecological receptors including Homebush Bay	Construction: Yes Operation: Yes	PR1	SE2	Potentially ongoing management of contamination of groundwater and vapour (if present) during construction and into operation (untanked station)	Low
AEI 31	Aquatic Centre Landfill (Shane Gould Avenue, Sydney Olympic Park)	Media: Groundwater and ground gas/vapour Source: Known areas of waste and groundwater contamination CoPC: Heavy metals, hydrocarbons, VOCs, PFAS, asbestos	High (groundwater) Moderate (vapour)	Direct contact, ingestion and inhalation of contaminated groundwater Inhalation and explosive risk of landfill gases. Discharge of extracted groundwater.	Construction workers, adjacent site users and ecological receptors including Homebush Bay	Construction: Yes Operation: Yes	PR1	SE2	Potentially ongoing management of contamination of groundwater and vapour (if present) during construction and into operation (untanked station)	Low

Area of environmental concern			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potentially applicable to this proposal**	**Revised risk rating**
AEI 32	Bicentennial Park Landfill (Bicentennial Drive, Sydney Olympic Park)	Media: Groundwater and ground gas/vapour Source: Known landfill CoPC: Heavy metals, hydrocarbons, VOCs, PFAS, asbestos	High (groundwater) Moderate (vapour)	Direct contact, ingestion and inhalation of contaminated groundwater Inhalation and explosive risk of landfill gases. Discharge of extracted groundwater.	Construction workers, adjacent site users and ecological receptors including Homebush Bay	Construction: Yes Operation: Yes	PR1	SE2	Potentially ongoing management of contamination of groundwater and vapour (if present) during construction and into operation. (untanked station)	Low
AEI 33	Former abattoir	Media: Groundwater Source: Inappropriate chemical storage and use, waste disposal and burial CoPC: Pathogens and nutrients	Moderate (groundwater)	Direct contact, ingestion and inhalation of contaminated groundwater Discharge of extracted groundwater.	Construction workers, adjacent site users and ecological receptors including Homebush Bay	Construction: Yes Operation: Yes	PR1	SE2	Potentially ongoing management of contamination of groundwater and vapour (if present) during construction and into operation (untanked station)	Low

B.4 North Strathfield metro station

B.4.1 Identification and description

The property description of the North Strathfield metro station construction site is detailed in Table B-16.

Table B-16 North Strathfield metro station construction site - description

Item	Description		
Suburb	North Strathfield		
LGA	City of Canada Bay		
Property details	**Address**	**Lot and DP**	**Land use**
	2G Queen St, North Strathfield 2137	50 DP1219136	Rail corridor

B.4.2 Environmental setting

The environmental setting for the North Strathfield metro station construction site is described in Table B-17.

Table B-17 North Strathfield metro station - environmental setting

Aspect	Description
Land uses	Land uses to the north of the construction site comprise of low-density residential housing with moderate vegetation. Surrounding land use includes: • North: Pomeroy Street overbridge • South: low-density residential housing and moderate vegetation • East: low residential housing areas with moderate vegetation, with a small strip of commercial buildings further south along Queen Street includes a dry cleaner • West: existing North Strathfield Station, then education facilities, carparking, childcare, gym, café and low-density residential housing, concrete drainage channel (Powells Creek) adjacent to an open grass covered, treelined area
Zoning	The construction site is zoned SP2- Infrastructure
Topography	Flat land with little to no incline or decline
Drainage	The closest receiving water body is Powells Creek 300 metres to the west.
Geology	The geology beneath the construction site is: • Alluvial/residual clay (0 to 2 m BGL) • Ashfield Shale (2 to 34 m BGL) • Hawkesbury Sandstone (+34 m BGL) • Possible dyke
Soil Landscapes	The soil landscape within the construction site is the Birrong soil landscape which comprises alluvial/fluvial soils.
Hydrogeology	Groundwater within the construction site is expected at 15 metres AHD and 0.9 to 5.55 m bgl (NSW Government, 2015)
Salinity	Groundwater in the area is expected to be brackish to saline within the Ashfield Shale and fresh to brackish within the alluvial aquifer.
Acid sulfate soils	The construction site and immediate surrounds are mapped as extremely low probability of acid sulfate soil occurrence and Class 5 in the Strathfield LEP 2012 acid sulfate soil risk maps. An area of mapped Class 2 and low probability of occurrence/low confidence soils are located approximately 240 metres west of the construction site.

B.4.3 Site history review

Previous reports prepared for the site comprising the North Strathfield metro station construction site are summarised in the following sub-sections.

Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020)

The Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) had the following findings for the North Strathfield metro station construction site and alignment:

- Soils within the construction site or above the alignment have were assigned a moderate potential contamination impact associated with the current and historical activities carried out on and/or adjacent to the site including the possible inappropriate management (during demolition) and/or degradation of hazardous building materials within current and former on-site structures and potential firefighting activities adjacent to the site
- Contamination could be present in groundwater at concentrations above the relevant assessment criteria and is likely to be limited in extent. Contaminated groundwater may intersect the major civil construction work for Sydney Metro West between Westmead and The Bays and result in complete pathways for ecological and human receptors.
- There was potential for contaminated groundwater to migrate into the station excavation.

The Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) included the review of the following reports:

- Sydney Metro West Geotechnical Investigation: a geotechnical, groundwater and contamination investigation was undertaken within and in vicinity of the North Strathfield metro station. In one borehole (BH009) at a depth of 0.1 metre (fill) concentrations were recorded above adopted ecological guidelines. Acid sulfate soil was detected at another location at BH038
- WestConnex, M4 East Environmental Impact Statement, Appendix P (NSW Government, 2015): ACM was identified in fill soils along the Western Motorway between Sydney Olympic Park and North Strathfield metro station construction sites
- Transport Access Program, North Strathfield Station Upgrade, Review of Environmental Factors (NSW Government, 2018), contamination assessment identified the following:
    - Historic activities resulting in ground modifications included excavations, earth fillings, railroad activities, and construction of buildings and associated underground infrastructure
    - The probability of acid sulfate soils was considered extremely low
    - Contamination associated with railroad activities included; fuel spills, leaks, ash spills, operation activities, filling activities.
    - Land to the west of the existing rail corridor was previously used for industrial activities, much of which has developed into residential land use. Asbestos is also likely to be present in buildings surrounding or on the station
    - A total of ten groundwater monitoring wells were identified within 500 metres radius of the station. The nearest bore located 460 meters from the station, recorded groundwater at 1.4 metres below ground level.

Sydney Trains Rail Corridor, Site from CH13+420 to CH13+520 (Up-Main), Queen St, North Strathfield NSW (ADE, 2015a) and Sydney Trains Rail Corridor, Site from CH13+420 to CH13+350, Queen St, North Strathfield NSW (ADE, 2015b)

ADE prepared an Environmental Management Plan (EMPs) for asbestos contaminated fill capped within two areas within a battered slope that are within the proposed North Starfield metro station construction footprint. During construction of the North Strathfield Rail Underpass (NSRU) project, fill from other areas of the NSRU project was used to construct a batter within the northeast and south east portion of the proposed North Strathfield metro station construction site. Bonded asbestos fragments were identified in the fill material at concentrations below the adopted assessment criteria. Areas of friable asbestos identified were identified and a cap of clean fill of 150 mm to 500 mm thickness was installed across the impacted area. The EMPs detail controls for the long-term management of the soil to prevent exposure of construction and site workers to asbestos.

Golder-Douglas (2021a) Factual Contamination Assessment Report, 00013/11180 Sydney Metro West Geotechnical Investigation

The results of one boreholes sampled drilled within the proposed North Strathfield construction site is summarised in Table B -18. The soil samples were analysed for TRH/TPH, PAHs, 8 heavy metals, OCPs, OPPs, PCBs, asbestos (absence/presence), VOC, field acid sulfate soil test, total phenolics and PFAS. Fill was encountered to a depth of 2.7 m bgl at the drilling location and there were no assessment criteria exceedances in the soil samples analysed.

Table B -18 Golder-Douglas (2021a) – Borehole results – North Strathfield metro station

Location	Geology	Soil results
SMW_BH711/711S (within eastern portion construction site)	• Fill: 0 to 2.7 m • Clay: 2.7 - 4.3 m • Bedrock: 4.3 – 26.17 m	All less than adopted assessment criteria

Golder-Douglas (2021b) Groundwater Monitoring Report – Stage 2 Locations, Sydney Metro West Geotechnical Investigation and Golder-Douglas (2021c) 00013/11180 Sydney Metro West Geotechnical Investigation, Groundwater Monitoring Report Stage 3 Locations

Two deep and one shallow groundwater monitoring wells were sampled within the proposed North Strathfield construction site. The groundwater samples were analysed for EC, TDS, pH, major ions, 11 heavy metals, TRH/TPH, BTEXN, PAH, VOCs, SVOCs, hexavalent chromium, PFAS and nutrients.

The results are summarised in Table B-19 and indicate that groundwater would likely require treatment prior to discharge to surface water due to the exceedance of adopted ecological and human health based assessment criteria.

Table B-19 Golder-Douglas (2021b/c) – Groundwater results – North Strathfield metro station

Well	Proximity	Screened interval (m)	SWL (m BTOC)	pH	EC (µS/cm)	Criteria exceedances
SMW_BH073 (Golder-Douglas, 2021b)	Within construction site (centre)	10.2-13.2	8.7	6.81	5500	• Fluoride: 1.2 mg/L (LTI – 1 mg/L) • Total phosphorus: 120 µg/L (LTI – 50 µg/L) • Iron: 1540 µg/L (LTI – 200 µg/L) • Manganese:5620 µg/L (ANZG – 80 µg/L, R/DC– 200 µg/L)
SMW_BH711S (Golder-Douglas, 2021c)	Within construction site (centre)	4-6.9	6.37	6.62	4720	• Iron: 4.94 mg/L (LTI – 0.2 mg/L) • Sodium: 1000 mg/L (LTI – 115 mg/L) • Chloride: 824 mg/L (LTI – 175 mg/L) • Total phosphorus: 120 µg/L (LTI – 50 µg/L) • Cobalt: 152 µg/L (ANZG – 1 µg/L, LTI -50 µg/L) • Manganese: 11,500 µg/L (ANZG – 80 µg/L, R/DC – 5000 µg/L) • Copper: 7 µg/L (ANZG – 1.3 µg/L) • Nickel: 92 µg/L(ANZG – 70 µg/L) • Zinc:130 µg/L (ANZG – 15 µg/L)

Well	Proximity	Screened interval (m)	SWL (m BTOC)	pH	EC (µS/cm)	Criteria exceedances
SMW_BH711 (Golder-Douglas, 2021c)		11.15-14.15	11.36	7.02	9140	• Iron: 0.84 mg/L (LTI – 0.2 mg/L) • Sodium: 1390 mg/L (LTI – 115 mg/L) • Chloride: 2670 mg/L (LTI – 175 mg/L) • Total phosphorus: 360 µg/L (LTI – 50 µg/L) • Cobalt: 39 µg/L (ANZG – 1 µg/L, LTI -50 µg/L) • Manganese: 752 µg/L (ANZG – 80 µg/L, R/DC – 5000 µg/L) • Copper: 3 µg/L (ANZG – 1.3 µg/L) • Nickel: 42 µg/L(DWG – 20 µg/L) • Zinc:23 µg/L (ANZG – 15 µg/L)

Notes: ANZG – 95% level of protection for marine ecosystems (Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, 2018); DWG – drinking water criteria (Australian Drinking Water Guidelines. National Health and Medical Research Council and Natural Resource Management Ministerial Council, 2011); LTI – Irrigation water long term trigger values as outlined in ANZECC/ARMCANZ (2000); R/DC – recreational/direct contact criteria (DWG criteria x 10); SWL – standing water level (m btoc); Screen – screened interval (m bgl); EC – electrical conductivity (µS/cm).

Desktop review

A site history review of the Lotsearch Enviro Professional report of North Strathfield metro station (Lotsearch, 2021b) was undertaken for the additional construction footprint for this proposal. The review findings are summarised in Table B-20.

Table B-20 Site history review – North Strathfield metro station additional construction footprint

Item	Description
Historical aerial photograph review	1930: Majority of area immediately surrounding the station is under development, with residential land use beyond. 1943: Further development immediately to the west of the station (The McDonald College and Our Lady of the Assumption primary school site). Station footbridge appears to have been constructed. 1949: No major changes (poor quality photograph). 1951: Additional buildings developed to the immediate southwest (White Rose Flour site). 1955: Additional building developed to the immediate southwest. No other major changes. 1961: Additional buildings developed to the immediate southwest – appear to be silos. No other major changes. 1965: Additional buildings developed to the immediate west and southwest. 1970: Pomeroy Street overpass appears to have been widened. Continued development to the immediate west and southwest. 1978: Continued development to the immediate west and southwest. 1982: No major changes. 1986: New small buildings to the immediate east and south east of the station. No other major changes 1991: New large building in the northern portion of the McDonald College site. 1994: No major changes. 2000: No major changes. 2005: Site to the immediate southwest has been redeveloped to missed medium density residential and commercial.

Item	Description
	2011: No major changes. 2016: Carpark constructed adjacent to/southeast of the station. 2021: No major changes.
Historical business records	Dry cleaners at 91 Queen St., North Strathfield (AEI 37
Historical lands titles	Not obtained
Section 10.7 planning certificates	Not obtained
NSW EPA notified sites	Two contaminated sites were identified through a search in 2021 of the public registers of notices issues by NSW EPA under the Contaminated Land Management Act 1997. These were the Budget service station on 143 Concord Road (400m east from North Strathfield Train station), and the former Caltex service station on 92a Concord Road (500 metres south east of North Strathfield Train Station).
NSW EPA regulated sites	There were no sites listed on the NSW EPA records of notices for sites regulated under Section 58 of the *Contaminated Land Management Act 1997*(CLM Act) within 1 km of the Site.
Sites licenced or formerly licensed under POEO Act 1997	A search of the NSW EPA public register of licences and penalty notices issued under the *Protection of the Environment Operations Act 1997* (POEO Act) for premises within 1 km of the site was undertaken. One site was identified at 500 metres from the alignment at 25-27 Pomeroy Street, Homebush. The site is owned by Ausgrid Operator Partnership and is used as a waste storage facility for hazardous restricted solid, liquid, clinical and related waste and asbestos waste.
NSW EPA lists (former gasworks, PFAS investigation sites, and sites affected by asbestos filling or loose-fill asbestos)	There were no sites under investigation by the NSW government PFAS investigation program within 1 km of the Site. However, 1955 aerial imagery (Jacobs, 2020) suggests that a Switchyard was present on Underwood road approximately 500 m west of the construction site. This switchyard has been identified as having taken part in firefighting activities.

B.4.4 Conceptual site model and risk ranking

The CSM and risk ranking for the North Strathfield metro station is presented in Table B-21.

Table B-21 North Strathfield metro station – Conceptual site model and risk ranking

Area of environmental concern			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potentially applicable to this proposal**	**Revised risk rating**
AEI 35	Historical railway activities	Media: Surface soil Source: Residuals from historical and current railway use CoPC: Heavy metals, hydrocarbons, pesticides and asbestos	Very low	Direct contact, inhalation, ingestion	Construction workers, adjacent site users	Construction: Yes Operation: No	PR2	SE3	Minor soil disturbance as part of footbridge construction.	Moderate
AEI 36	Embalming chemicals (Funeral Home) (off-site source)	Media: Groundwater Source: Embalming chemicals CoPC: Hydrocarbons, solvents	Moderate	Direct contact, ingestion, inhalation Discharge of extracted groundwater.	Construction workers, ecological receptors including Powells Creek	Construction: Yes Operation: Yes	PR2	SE2	Potentially ongoing management of contamination of groundwater and vapour (if present) during construction and into operation due to untanked station box.	Moderate
AEI 37	Dry Cleaning (off-site source)	Media: Groundwater Source: Residuals from dry cleaning CoPC: VOCs	Moderate	Direct contact, ingestion, inhalation Discharge of extracted groundwater.	Construction workers, ecological receptors including Powells Creek	Construction: Yes Operation: Yes	PR2	SE2	Potentially ongoing management of contamination of groundwater and vapour (if present) during construction and into operation due to untanked station box.	Moderate

Area of environmental concern			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potentially applicable to this proposal**	**Revised risk rating**
AEI 38	Hazardous building materials/demolition wastes	Media: Surface soil Source: Hazardous building materials/maintenance chemicals CoPC: Heavy metals, hydrocarbons, pesticides and asbestos	Moderate	Direct contact, ingestion, inhalation	Construction workers, adjacent site users	Construction: Yes Operation: No	PR2	SE1	Shallow soil likely removed during work carried out under the previous Sydney Metro West planning application	Low
AEI 38(a)	Hazardous building materials/demolition wastes	Media: Surface soil Source: Hazardous building materials/maintenance chemicals CoPC: Heavy metals, hydrocarbons, pesticides and asbestos	NA	Direct contact, ingestion, inhalation	Construction workers, adjacent site users	Construction: Yes Operation: No	PR2	SE2	Former demolition of hazardous building materials potentially causing contamination to surface soils exposed during construction works in the additional footprint areas for this proposal.	Moderate
AEI 39	Historical commercial and industrial land use in surrounding locality (off-site source)	Media: Groundwater Source: Hazardous building materials/maintenance chemicals CoPC: Heavy metals, hydrocarbons, pesticides, and asbestos	Moderate	Direct contact, ingestion, inhalation Discharge of extracted groundwater.	Construction workers, ecological receptors including Powells Creek	Construction: Yes Operation: Yes	PR2	SE2	Potentially ongoing management of contamination of groundwater and vapour (if present) during construction and into operation due to untanked station box	Moderate

Area of environmental concern			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potentially applicable to this proposal**	**Revised risk rating**
AEI 40	Potential firefighting activities (Switch Yard at Underwood Road, North Strathfield) (off-site source)	Media: Groundwater Source: Potential firefighting activities CoPC: PFAS	Moderate	Direct contact, ingestion, inhalation Discharge of extracted groundwater.	Construction workers, adjacent site users, ecological receptors including Powells Creek	Construction: Yes Operation: Yes	PR2	SE1	Potentially ongoing management of contamination of groundwater during construction and operation of this proposal.	Low

B.5 Burwood North Station

B.5.1 Identification and description

The property description for the Burwood North Station construction site is detailed in Table B-22.

Table B-22 Burwood North Station construction site description

Item	Description		
Suburb	Concord		
LGA	Canada Bay		
Property details	**Address**	**Lot and DP**	**Land use**
	26 Burton St, Concord NSW 2137	15 DP10926	Residential
	20 Burton St, Concord NSW 2137	Null SP73535	Residential
	19 Parramatta Rd, Concord NSW 2137	B- DP344400 C- DP344400 A- DP340812	Motel
	21 Parramatta Rd, Concord NSW 2137	28 DP10928	Commercial
	13 Parramatta Rd, Concord NSW 2137	1 DP839095	Carwash
	3 Parramatta Rd, Concord NSW 2137	100 DP1154740	Commercial - Retail
	1 Parramatta Rd, Concord NSW 2137	4 DP333924	Commercial – Car mechanic
	13 Burwood Rd, Concord NSW 2137	19-20 DP10928	Residential
	11 Burwood Rd, Concord NSW 2137	21-22 DP10928	Residential
	9 Burwood Rd, Concord NSW 2137	23 DP10928	Residential
	7 Burwood Rd, Concord NSW 2137	24 DP10928	Residential
	3 Burwood Rd, Concord NSW 2137	25-26 DP10928	Commercial – Dance studio
	1 Burwood Rd, Concord NSW 2137	27 DP10928	Commercial – real estate
	7 Parramatta Rd, Concord NSW 2137	1 DP1027871	Commercial – car dealership
	2 Burwood Rd. Concord NSW 2137	14 DP1217020	Commercial - retail
	344-336B/366C Parramatta Rd NSW 2137	15-19 DP1217020	Commercial - retail

B.5.3 Environmental setting

The environmental setting for the Burwood North Station construction site is described in Table B-23.

Table B-23 Burwood North Station - environmental setting

Aspect	Description
Land uses	Burwood North Station northern construction site: • The northern construction site is occupied by commercial/industrial facilities and some low-density residential housing • The commercial/industrial facilities consist of a variety of uses including car mechanics, vacant buildings and an automotive dealership which was present along Parramatta Road. • Within the northern construction site are medium-density residential properties, located on Burwood Road between Burton Street and Parramatta Road. Burwood North Station southern construction site: • The southern construction site is occupied by commercial/industrial facilities. The commercial/industrial facilities consist of a variety of uses including car mechanics and vacant buildings. • Parramatta Road is located between the north and south construction sites. Burwood Road is located adjacent to the northern construction site. Surrounding land use includes: • North: low density residential • South: Parramatta Road, then commercial followed by medium and low density residential • East: Concord Oval • West: commercial
Zoning	The zoning of the Burwood North Station construction site is: • B6- Enterprise Corridor • SP2- Infrastructure (road) • B4- Mixed Use • R3-Medium Density Residential • R2-Low Density Residential • RE1- Public Recreation
Topography	The topography within the construction site and surrounds is an easterly decline
Geology	The geology beneath the Burwood North Station construction site: • Alluvial/residual clay (0 to 2 m BGL) • Ashfield Shale (2 to 22 m BGL) • Hawkesbury Sandstone (+22 m BGL) • Inferred fault
Soil Landscapes	The soil landscapes within and surrounding the Burwood North Station construction site are: • Gymea soil landscape associated with Hawkesbury Sandstone – soils are shallow to moderately deep (30cm to 100cm) with localised steep slopes, high soil erosion hazards, shallow highly permeable soil • Hawkesbury soil landscape – soils are usually shallow (less than 50 centimetres) discontinuous lithosol /siliceous sands associated with rock outcrops, with earthy sands and some yellow podzolic soils on the inside of benches and along rock joints and fractures. This soil landscape is usually coupled with extreme soil erosion hazard, mass movement hazard, steep slopes, high permeability soil and low soil fertility
Hydrogeology	Groundwater is expected at about 4 metres AHD and 1.5-1.6 m bgl.
Salinity	Groundwater is expected to be brackish to saline in the Ashfield Shale, shallow or perched groundwater within fill/alluvial soils would be expected to be fresh.
Acid sulfate soils	There is an extremely low probability of/very low confidence of occurrence of acid sulfate soil and the land is Class 5 mapped acid sulfate soil risk within the construction footprint. Class 2 mapped soils are located about 230 metres to the east of the construction site.

Aspect	Description
Other	Groundwater bore GW0305646 is being used for the water supply in the vicinity of Burwood North Station construction site. This bore is located over 1 km north east of the construction site and alignment and is being used for private use.

B.5.4 Site history review

Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020)

The findings of the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) for the Burwood North Station indicated:

- Contamination could be present in groundwater at concentrations above the relevant assessment criteria and is likely to be limited in extent. Contaminated groundwater may intersect major civil construction work for Sydney Metro West between Westmead and The Bays, and the exposure pathways for human or ecological receptors could be present and fully reached during construction
- Potential migration of contaminated groundwater towards, and into, station excavation, poses a potential exposure risk to site users/workers and adjacent site users, and could potentially reduce the beneficial use of the aquifer
- Soils and groundwater within / beneath the construction site and above the alignment have been assigned a moderate potential contamination impact associated with the current and historical activities carried out on and/or adjacent to the site including mechanical workshop activities and the possible inappropriate management (during demolition) and/or degradation of hazardous building materials within current and former on-site structures.

The Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) included the review if the following reports:

- Environmental Risk and Planning Report (Lotsearch, 2016):
  - A list of businesses in the area between 1950 to 1991 included but not limited to; motor car dealer, motor tuning specialists, motor garages, fuel merchants, metal workers, welders, tool makers, dry cleaners, cafés, garden suppliers, bakers, furniture manufactures, building supplies, and construction equipment hiring services.
  - Registered groundwater wells within a one-kilometre radius of the site describe soil as sandy clays from 0 to 0.8 metres bgl, underlain by clays to approximately 2.0 metres bgl, underlain by shale. Standing water levels are documented at 1.5 to 1.6 metres bgl.
- Preliminary Environmental Investigation 1 Cook Avenue, Canada Bay (Alliance Geotechnical, 2014):
  - The location of the site subject of the report is located approximately 500 metres north of the alignment.
  - The report identified current and historic activities which had/have the potential to cause soil and groundwater contamination at this site. The main environmental issues for the site include the former industrial use of the site, current site buildings and origin of potential fill material.
  - Research indicated that the area had no evidence of acid sulfate soils, and that they were unlikely to exist. No underground or aboveground storage tanks were identified.

Golder-Douglas (2021a) Factual Contamination Assessment Report, 00013/11180 Sydney Metro West Geotechnical Investigation

The results of one boreholes sampled drilled within the proposed North Strathfield construction site is summarised in Table B-24. Around 2.7 metres of fill was encountered at the drilling location and there were no assessment criteria exceedances in the soil samples analysed.

Table B-24 Golder-Douglas (2021a) – Borehole results – Burwood North Station

Location	Geology	Soil results
SMW_BH713/S	• Concrete: 0-0.1 m • Fill: 0-0.8 m • Silty clay: 0.8-1.7 m • Bedrock: 1.7- 35.05 m	• The following samples exceeded adopted ecological criteria for zinc: - 1.5 m: 120 mg/kg - 17.05 m:156 mg/kg - 18.46 m: 180 mg/kg - 20.62 m: 137 mg/kg

Golder-Douglas (2021b) Groundwater Monitoring Report – Stage 2 Locations, Sydney Metro West Geotechnical Investigation

Four deep and three shallow groundwater monitoring wells were sampled within and around the boundary of the proposed Burwood North Station construction site. The groundwater samples were analysed for EC, TDS, pH, major ions, 11 heavy metals, TRH/TPH, BTEXN, PAH, VOCs, SVOCs, hexavalent chromium, PFAS and nutrients.

The results are summarised in Table B-25 and indicate that groundwater would likely require treatment prior to discharge to surface water due to the heavy metal concentrations exceeding adopted ecological and human health based assessment criteria.

Table B-25 Golder-Douglas (2021b) – Groundwater results – Burwood North Station

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_BH712	Neichs Lane, west of construction site	1.3-5.8	1.85	6.66	105	• Total phosphorus: 0.16 mg/L (LTI – 0.05 mg/L)
SMW_BH713S	Within western portion of the construction site	2.0-7.0	5.89	5.98	752	• Sodium: 139 mg/L (LTI – 115 mg/L) • Total phosphorus: 0.09 mg/L (LTI – 0.05 mg/L) • Cobalt: 7 µg/L (ANZG – 1 µg/L) • Manganese: 253 µg/L (LTI– 200 µg/L, ANZG – 80 µg/L) • Copper: 7 µg/L (ANZG - 1.3 µg/L) • Zinc: 52 µg/L (ANZG – 15 µg/L)
SMW_BH713		13.9-16.9	5.69	7.73	13,300	• Iron: 1.16 mg/L (LTI – 0.2 mg/L) • Sodium: 2400 mg/L (LTI – 115 mg/L) • Chloride: 824 mg/L (LTI – 175 mg/L) • Cobalt: 2 µg/L (ANZG – 1 µg/L) • Manganese: 449 µg/L (LTI– 200 µg/L, ANZG – 80 µg/L)

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_BH714S	Sothern boundary of the construction site on Parramatta Road	2.2-7.2	Not recorded	7.06	782	• Sodium: 159 mg/L (LTI – 115 mg/L) • Fluoride1.4 mg/L (LTI – 1 mg/L) • Total phosphorus: 0.15 mg/L (LTI – 0.05 mg/L) • Cobalt: 41 µg/L (ANZG – 1 µg/L) • Manganese: 648 µg/L (LTI– 200 µg/L, ANZG – 80 µg/L, DWG– 500 µg/L) • Copper: 2 µg/L (1.3 µg/L) • Nickel: 40 µg/L (DWG – 20 µg/L) • Zinc: 44 µg/L (ANZG – 15 µg/L)
SMW_BH714		10.5-16.5	Dry	7.17	6940	• Sodium: 1240 mg/L (LTI – 0.2 mg/L) • Chloride: 1560 mg/L (LTI – 0.2 mg/L) • Fluoride: 2.1 mg/L (LTI – 1 mg/L) • Cobalt: 12 µg/L (ANZG – 1 µg/L) • Manganese: 919 µg/L (LTI– 200 µg/L, ANZG – 80 µg/L, DWG– 500 µg/L) • Copper: 4 µg/L (1.3 µg/L)
SMW_BH715S	Northern boundary of the construction site	2.0-7.0	2.58	7.69	6000	• Iron: 2.84 (LTI – 0.2 mg/L) • Sodium: 860 mg/L (LTI – 0.2 mg/L) • Chloride: 1120 mg/L (LTI – 0.2 mg/L) • Total phosphorus: 0.23 mg/L (LTI – 0.05 mg/L) • Cobalt: 19 µg/L (ANZG – 1 µg/L) • Manganese: 899 µg/L (LTI– 200 µg/L, ANZG – 80 µg/L, DWG– 500 µg/L) • Nickel: 22 µg/L (DWG – 20 µg/L) • Zinc: 67 µg/L (ANZG – 15 µg/L)

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_BH715		7.0-10.0	2.56			• Sodium: 783 mg/L (LTI – 0.2 mg/L) • Chloride: 1330 mg/L (LTI – 0.2 mg/L) • Total phosphorus: 0.13 mg/L (LTI – 0.05 mg/L) • Cobalt: 4 µg/L (ANZG – 1 µg/L) • Chromium: 21 µg/L (ANZG – 0.7 µg/L) • Copper: 2 µg/L (ANZG - 1.3 µg/L) • Lead: 7 µg/L (ANZG- 4.4 µg/L)

Notes: ANZG – 95% level of protection for marine ecosystems (Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, 2018); DWG – drinking water criteria (Australian Drinking Water Guidelines. National Health and Medical Research Council and Natural Resource Management Ministerial Council, 2011); LTI – Irrigation water long term trigger values as outlined in ANZECC/ARMCANZ (2000); R/DC – recreational/direct contact criteria (DWG criteria x 10); SWL – standing water level (m btoc); Screen – screened interval (m bgl); EC – electrical conductivity (µS/cm).

B.5.5 Conceptual site model and risk ranking

The CSM and risk ranking for the Burwood North Station is presented in Table B-26.

Table B-26 Burwood North Station– Conceptual site model and risk ranking

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potentially applicable to this proposal**	**Revised risk ranting**
AEI 41	Leaks and spills from automotive dealer	Source: Mechanical workshop – Leaks and spills from automotive facilities, car dealerships and bus depot CoPC: Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOCs, asbestos Media: surface soil, groundwater	Moderate	Direct contact, ingestion, inhalation, ecological receptors including Hen and Chicken Bay	Construction workers and Hen and Chicken Bay	Construction: Yes Operation: Yes	PR2	SE2	Potentially ongoing management of contaminated groundwater (if present) during construction and into operations It is assumed that surface soils will be removed or appropriately managed during work carried out under the previous Sydney Metro West planning application.	Moderate
AEI 42	Chemical and wax use (Crown car wash, 13 Paramatta Road)	Source: Chemical use and waxes associated with car wash and detailing CoPC: Heavy metals, hydrocarbons, surfactants, PFAS Media: Soil and groundwater	Very Low (surface soil) Moderate (groundwater)	Direct contact, ingestion, inhalation, ecological receptors including Hen and Chicken Bay	Construction workers and Hen and Chicken Bay	Construction: No Operation: Yes	PR2	SE2	Potentially ongoing management of contaminated groundwater (if present) during construction and into operations It is assumed that surface soils will be removed or appropriately managed during work carried out under the previous Sydney Metro West planning application.	Moderate

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potentially applicable to this proposal**	**Revised risk ranting**
AEI 43	Hazardous building materials	Source: Former and existing structures – Hazardous building materials within or from on-site buildings / structures, demolition wastes CoPC: Heavy metals, hydrocarbons (TRH, PAH), pesticides, asbestos Media: Surface soil	Moderate	Direct contact, ingestion, inhalation of contaminated soils and dust	Construction workers and adjacent site users	Construction: No Operation: No	PR1	SE1	It is assumed that surface soils will be removed or appropriately managed during work carried out under the previous Sydney Metro West planning application.	Very low
AEI 44	Vehicle particulate deposition	Source: Historical vehicle deposition of particulate matter CoPC: Hydrocarbons, lead, asbestos Media: Surface soil	Moderate	Direct contact, inhalation	Construction workers, site users	Construction: No Operation: No	PR1	SE1	It is assumed that surface soils will be removed or appropriately managed during work carried out under the previous Sydney Metro West planning application.	Very low

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potentially applicable to this proposal**	**Revised risk ranting**
AEI 45	Historical commercial and industrial land use in surrounding locality	Source: Historical commercial / industrial use within locality- Inappropriate chemical storage and use, industrial operations, waste disposal and management CoPC: Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOCs Media: Surface soils and groundwater	Very low (surface soil) Moderate (groundwater)	Direct contact, inhalation, ingestion, ecological receptors including Hen and Chicken Bay	Construction workers	Construction: No Operation: Yes	PR2	SE2	Potentially ongoing management of contaminated groundwater (if present) during construction and operation of this proposal. It is assumed that surface soils will be removed or appropriately managed during work carried out under the previous Sydney Metro West planning application.	Moderate

B.6 Five Dock Station

B.6.1 Identification and description

The property identification details for the Five Dock Station construction site is described in Table B-27.

Table B-27 Five Dock Station construction site description

Item	Description		
Suburb	Five Dock		
LGA	City of Canada Bay		
Property details	**Address**	**Lot and DP**	**Land use**
	169 Great North Road Five Dock	10 DP1170170	Commercial - Retail
	169 Great North Road Five Dock	E DP1170170	Commercial - Retail
	169 Great North Road Five Dock	B DP961640	Commercial - Retail
	27 Waterview Street, Five Dock	15 DP884 SEC 5	Residential
	25 Waterview Street, Five Dock	2 DP962509	Residential
	23 Waterview Street, Five Dock	2 DP962509	Residential
	3 Second Avenue, Five Dock	2 DP537010	Residential
	31 Waterview Street, Five Dock	A DP961640	Residential
	29 Waterview Street, Five Dock	B DP961640	Residential
	27 Waterview Street, Five Dock	15 DP884 SEC 5	Residential
	25 Waterview Street, Five Dock	2 DP962509	Residential
	23 Waterview Street, Five Dock	2 DP962509	Residential

B.6.2 Environmental setting

The environmental setting for the Five Dock Station construction site is described in Table B-28.

Table B-28 Five Dock Station - environmental setting

Aspect	Description
Land uses	Five Dock Station western construction site: • The construction site is occupied by commercial premises with external car parking areas. • Some vegetation was present comprising grassed areas and tree-lined streets. Five Dock Station eastern construction site: • The construction site is occupied by low-density residential properties and an external carpark. Surrounding land use includes: • North: commercial (town centre) • South: commercial (town centre) • East: medium and low density residential • West: low density residential, then Five Dock Public School

Aspect	Description
Zoning	The zoning within and surrounding the construction site is: • B4- Mixed Use • R3- Medium Density Residential • R2- Low Density Residential • RE1- Public Recreation
Topography	The Five Dock Station construction site has a northerly decline in topography.
Drainage	The closest water bodies are: • Iron Cove 1 km to the east • Hen and Chicken Bay 630 metres to the northwest
Geology	The geology below the construction site and surrounds are: • Alluvial/residual clay (0 to 4 m bgl) • Ashfield Shale (4 to 13 m bgl) • Hawkesbury Sandstone (+13 m bgl)
Soil Landscapes	The soil landscapes below and surrounding the construction site are: • Gymea soil landscape associated with Hawkesbury Sandstone – soils are shallow to moderately deep (30cm to 100cm) with localised steep slopes, high soil erosion hazards, shallow highly permeable soil • Hawkesbury soil landscape – soils are usually shallow (less than 50 centimetres) discontinuous lithosol/siliceous sands associated with rock outcrops, with earthy sands and some yellow podzolic soils on the inside of benches and along rock joints and fractures. This soil landscape is usually coupled with extreme soil erosion hazard, mass movement hazard, steep slopes, high permeability soil and low soil fertility
Hydrogeology	Groundwater is anticipated to be about 16 to 18 metres AHD and 2 m bgl
Salinity	Groundwater is expected to be brackish to saline in Ashfield Shale and fresh to brackish in the overlaying fill and alluvial aquifer.
Acid sulfate soils	There is an extremely low probability/very low confidence of occurrence of acid sulfate soil within the construction site and immediate surrounds and is mapped as Class 5 acid sulfate soil risk in the Burwood Local Environment Plan 2012, with Class 2/low probability of occurrence mapped soil 360 metres to the north.

B.6.3 Site history review

Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020)

The findings from the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) for Five Dock Station included:

- Some groundwater contamination sources could be in the vicinity of major civil construction work for Sydney Metro West between Westmead and The Bays but are unlikely to significantly impact upon construction. Contamination (from other sources in the vicinity of major civil construction work for Sydney Metro West between Westmead and The Bays) could be present in groundwater at concentrations above the relevant assessment criteria and is likely to be limited in extent. Contaminated groundwater may intersect major civil construction work for Sydney Metro West between Westmead and The Bays, and the exposure pathways for human or ecological receptors could be present and fully reached during construction
- Potential migration of contaminated groundwater towards, and into, station excavation, poses a potential exposure risk to site users/workers and adjacent site users, and could potentially reduce the beneficial use of the aquifer
- Soils within / beneath the construction site and above the alignment have been assigned a moderate potential contamination impact associated with the current and historical activities carried out on and/or adjacent to the site including the operation of funeral homes and the possible inappropriate management (during demolition) and/or degradation of hazardous building materials within current and former on-site structures.

Golder-Douglas (2021a) Factual Contamination Assessment Report, 00013/11180 Sydney Metro West Geotechnical Investigation

The results of one borehole drilled and sampled on the western boundary of the Five Dock Station construction site are summarised in Table B-29. The soil samples were analysed for TRH/TPH, PAHs, 8 heavy metals, OCPs, OPPs, PCBs, asbestos (absence/presence), VOC, field acid sulfate soil test, total phenolics and PFAS. The results indicated minor exceedances of the adopted ecological criteria contamination that would not likely require remediation at the locations sampled.

Table B-29 Golder-Douglas (2021a) – Borehole results – Five Dock Station

Location	Geology	Soil results
SMW_BH718	• Asphalt: 0- 0.1 m • Fill: 0.1- 0.75 m • Clay: 0.75- 2 m • Bedrock: 2- 34.98 m	Mild hydrocarbon odour in fill All less than adopted assessment criteria.

Golder-Douglas (2021b) Groundwater Monitoring Report – Stage 2 Locations, Sydney Metro West Geotechnical Investigation and Golder-Douglas (2021c) 00013/11180 Sydney Metro West Geotechnical Investigation, Groundwater Monitoring Report Stage 3 Locations

Three deep groundwater monitoring wells were sampled around the boundary of the proposed Five Dock Station construction site. The groundwater samples were analysed for EC, TDS, pH, major ions, 11 heavy metals, TRH/TPH, BTEXN, PAH, VOCs, SVOCs, hexavalent chromium (SMW_BH082 not analysed), PFAS and nutrients.

The results are summarised in Table B-30 and indicate that groundwater would likely require treatment prior to discharge to surface water due to some heavy metals exceeding the adopted ecological criteria. Minor petroleum hydrocarbon impact exceeding the adopted human health (direct contact/recreational) based criteria was recorded on the western boundary at the same location where a hydrocarbon odour was noted in the shallow fill in the Golder-Douglas (2021a) report. Further investigation may be needed to identify the source and delineate the impacts.

Table B-30 Golder-Douglas (2021b/c) – Groundwater results - Five Dock Station

Well	Proximity	Screened interval (m)	SWL (m BTOC)	pH	EC (µS/cm)	Criteria exceedances
SMW_BH082 (Golder Douglas, 2021b)	Centre of the construction site within Great North Road	9.3-12.3	-	7.57	8870	• Fluoride: 2.1 mg/L (LTI – 1 mg/L) • Cobalt: 16 µg/L (ANZG – 1 µg/L) • Iron: 2950 µg/L (LTI – 200 µg/L) • Manganese: 1800 µg/L (ANZG – 80 µg/L, DWG – 500 µg/L)
SMW_BH718 (Golder Douglas, 2021c)	Western boundary of the construction site	12-15	3.89	7.62	11,700	• Iron: 1.18 mg/L (LTI – 0.2 mg/L) • Sodium: 2030 mg/L (LTI – 115 mg/L) • Chloride: 3360 mg/L (LTI – 175 mg/L) • Fluoride: 1.2 µg/L (LTI – 1 µg/L) • Total phosphorus: 0.09 mg/L (LTI – 0.05 mg/L) • TRH >C10-C16: 0.12 mg/L (R/DC – 0.1 mg/L) • Manganese: 894 µg/L (ANZG – 80 µg/L, R/DC – 500 µg/L)

Well	Proximity	Screened interval (m)	SWL (m BTOC)	pH	EC (µS/cm)	Criteria exceedances
SMW_BH719 (Golder Douglas, 2021c)	Eastern boundary of the construction site	28.15-34.15	18.8	8.02	6600	• Iron: 14.4 mg/L (LTI – 0.2 mg/L) • Sodium: 1060 mg/L (LTI – 115 mg/L) • Chloride: 1950 mg/L (LTI – 175 mg/L) • Cobalt: 33 µg/L (ANZG – 1 µg/L) • Manganese: 1070 µg/L (ANZG – 80 µg/L, DWG – 500 µg/L) • Nickel: 29 µg/L (DWG – 20 µg/L)

Notes: ANZG – 95% level of protection for marine ecosystems (Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, 2018); DWG – drinking water criteria (Australian Drinking Water Guidelines. National Health and Medical Research Council and Natural Resource Management Ministerial Council, 2011); LTI – Irrigation water long term trigger values as outlined in ANZECC/ARMCANZ (2000); R/DC – recreational/direct contact criteria (DWG criteria x 10); SWL – standing water level (m btoc); Screen – screened interval (m bgl); EC – electrical conductivity (µS/cm).

B.6.4 Conceptual site model and risk ranking

The CSM and risk ranking for the Five Dock Station is presented in Table B-31.

Table B-31 Five Dock Station – Conceptual site model and risk ranking

Area of environmental concern			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potentially applicable to proposal**	**Revised risk rating**
AEI 46	Embalming chemicals (off-site source from two nearby funeral homes)	Media: Groundwater Source: Embalming chemicals CoPC: Hydrocarbons and solvents	Moderate	Direct contact, ingestion, inhalation Discharge of extracted groundwater	Construction workers, ecological receptors including Iron Cove	Construction: Yes Operation: Yes	PR2	SE2	Potential ongoing management of groundwater contamination (if present) during construction and into operations (for untanked station shafts only)	Moderate
AEI 47	Hazardous building materials	Media: Surface soil Source: Hazardous building materials CoPC: Heavy metals, hydrocarbons, pesticides, asbestos	Moderate	Direct contact, ingestion, inhalation	Construction workers, adjacent site workers	Construction: No Operation: No	PR2	SE1	All hazardous materials and potentially impacted surface soil anticipated to be excavated or remediated during work carried out under the previous Sydney Metro West planning application.	Low
AEI 48	Chamber Substation (off-site)	Media: Surface soil Source: Operational substation CoPC: PCBs	Very Low	Direct contact, ingestion, inhalation	Construction workers, adjacent site workers	Construction: No Operation: No	PR1	SE1	All hazardous materials and potentially impacted surface soil anticipated to be excavated or remediated during work carried out under the previous Sydney Metro West	Very low

Area of environmental concern			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potentially applicable to proposal**	**Revised risk rating**
									planning application.	
AEI 49	Former service station (off-site)	Media: Groundwater Source: Leaks and spills from underground storage tanks CoPC: Hydrocarbons	Low	Direct contact, ingestion, inhalation Discharge of extracted groundwater	Construction workers, ecological receptors including Iron Cove	Construction: Yes Operation: Yes	PR2	SE1	Potentially ongoing management of contamination of groundwater and vapour (if present) during construction and into operations (for untanked station shafts only)	Low
AEI 50	Surrounding historical commercial industrial land uses (off-site source)	Media: Groundwater Source: Chemical storage and use, industrial operations, waste disposal and management CoPC: Heavy metals, hydrocarbons and VOCs	Moderate	Direct contact, ingestion, inhalation Discharge of extracted groundwater	Construction workers, ecological receptors including Iron Cove	Construction: Yes Operation: Yes	PR	SE2	Potentially ongoing management of contamination of groundwater and vapour (if present) during construction and into operations (for untanked station shafts only)	Moderate

B.7 The Bays Station

B.7.1 Identification and description

The property description for The Bays Station construction site is detailed in Table B-32.

Table B-32 The Bays Station construction site - description

Item	Description		
Suburb	Rozelle		
LGA	Inner west		
Property details	**Address**	**Lot and DP**	**Land use**
	Sommerville Rd, Rozelle	Part Lot 10 DP1170710	Vacant port land
	Robert St, Rozelle	Part Lot 5 DP1063454	Car park and vacant port
	Robert St, Rozelle	Part Lot 6 DP1063454	Vacant port land
	165 Victoria Road, Rozelle	Part Lot 10 DP1166179	Decommissioned White Bay Power Station
	Robert Street Rozelle	Lot 2 DP258200	Sydney Water sewerage pump station
	Robert Street Rozelle	Lot 1, 3, 5 and 6 DP258200	Robert Street
	Robert Street Rozelle	Lot 1 DP531412	Robert Street
	Robert Street Rozelle	Lot 1 DP 556377	Robert Street
	Robert Street Rozelle	Lot 4 DP1063454	Car park

B.7.2 Environmental setting

The environmental setting for The Bays Station construction site is described in Table B-33.

Table B-33 The Bays Station - environmental setting

Aspect	Description
Land uses	The majority of the construction site is non-operational vacant port land. Surrounding land use includes: • North: commercial, then low density residential • South: Anzac Bridge access roadway, then marine commercial/industrial docks and Rozelle Bay • East: White Bay and Darling Harbour • West: White Bay Power Station and commercial/industrial
Zoning	The construction site is zoned: • Port and Employment • IN2 – Light Industrial • W1 – Maritime Waters
Topography	The topography is flat with little to no incline or decline around White Bay. Steep incline north-west towards Balmain
Drainage	The construction site would drain into White Bay directly adjacent to the north and east of the construction site.
Geology	The geology below the construction site and surrounds are: • Fill/alluvial/residual clay (0 to 4 m bgl) • Ashfield Shale (2 to 45 m bgl) • Hawkesbury Sandstone (+45 m bgl)
Soil Landscapes	The soil landscape comprises disturbed terrain and Gymea soil landscapes.

Aspect	Description
Hydrogeology	The typical groundwater level within the construction site is 2 metres AHD and 2 m bgl.
Salinity	Groundwater is expected to be brackish to saline.
Acid sulfate soils	The construction site is mapped as disturbed terrain and low probability/confidence unknown of occurrence of acid sulfate soils. Investigations have identified acid sulfate soil within the construction site.

B.7.3 Site history review

Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020)

The contamination findings of the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020) report for The Bays Station included:

- A property on the north side of the construction site in Robert Street was formerly regulated by the NSW EPA for asbestos and PCB contamination
- The White Bay Power Station formerly operated in the western portion of the construction site until the early 1980s
- Large warehouse/factory buildings within the construction site were demolished in the 1950s.
- Two areas of environmental interest were identified within the construction site which comprised:
  - AEI 53: former White Bay Power Station activities, structures and potential firefighting activities
  - AEI 54: historical land reclamation using potentially contaminated fill.
- Two areas of environmental interest were identified outside the construction site which comprised:
  - AEI 52: mechanical workshop located adjacent to the construction site in Robert Street
  - AEI 55: historical and commercial land use surrounding the construction site
  - AEI 56: switch yard (Manning Street Rozelle) 300 metres north, potential firefighting activities.

Sydney Metro West Environmental Impact Statement - The Bays to Sydney CBD Technical Paper 8 – Contamination (Sydney Metro, 2021)

The contamination findings of the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2021) report for The Bays tunnel and launch support site included:

- Two areas of environmental interest were identified within the Bays Station site which comprised:
  - AEI 8 (same as AEI 53): Former White Bay Power Station including substation and structures (including potential firefighting activities and demolition). Environmentally Hazardous Chemicals (EHC) Act Revocation Notice (asbestos and PCB contamination)
  - AEI 9 (same as AEI 54): Land reclamation – Historical use of potentially contaminated fill adjacent to waterways.
- Three areas of environmental interest were identified outside The Bays Station site which comprised:
  - AEI 2: Former Ampol terminal EHC Act Revocation Notice (Former) located 400 metres north west. Known heavy metals and hydrocarbon contamination. Soil remediation completed prior to 1994, potential for remaining contamination above current guideline levels unknown
  - AEI 4: Former Unilever Sulphonation Plant Chemical and potential fuel storage and use, potential spills, manufacturing processes, inappropriate demolition/waste disposal practices located 400 metres north west. EHC Act Revocation Notice issued. Remediation completed prior to 1997. Contaminated soil deeper than 0.5 metre remains
  - AEI 11 (same as AEI 55): General historical commercial / industrial use including rail yards – Inappropriate chemical storage and use, industrial operations, waste disposal and management etc adjacent to the construction site.

Senversa (2021) Factual Contamination Investigation Report – The Bays, Sydney Metro West, White Bay Site Investigations

Senversa undertook a contamination investigation within and upgradient of The Bays Station construction site comprising:

- Excavation and sampling of soil from 14 test pits (maximum depth of 3.1 m bgl) and drilling and sampling of soil of 56 boreholes (maximum depth of 30.7 m bgl)
- Installation of 10 new groundwater monitoring wells and gauging of 31 new and existing groundwater monitoring wells and sampling of 27 groundwater monitoring wells
- Analysis of selected soil samples for heavy metals, TRH, BTEX, PAH, OCP, PCB, VOCs, phenols, herbicides, PFAS, asbestos, SPOCAS, EC, pH, sulfate, chloride and TCLP (heavy metals, benzo(a)pyrene and PFAS)
- Analysis of groundwater samples for dissolved heavy metals, TRH, VOCs, PAH, PFAS, TDS, major cations and anions, nitrate, ammonia, OCP, PCB, phenols, phosphate.

The results of the investigation are summarised below:

- Groundwater levels in shallow monitoring wells ranged from 0.0396 to 3.58 metres BTOC and 0.260 metres AHD to 2.330 metres AHD
- LNAPL was measured in two monitoring wells at thicknesses of 0.527 (A25) and 0.110 metres (MWB1)
- Odours in groundwater noted during gauging included a hydrocarbon odour in monitoring wells C65, S54 and SMW_ENV026, a chemical odour in MW02 and sulfurous odour in C66, S02_d, SMW_ENV020_d and WB8
- Groundwater conductivity ranged from 342 to 48,270 µS/cm, pH 5.9 to 10.3, ORP -67 to 284 mV and dissolved oxygen <0.05 to 5.17 mg/L
- Soil and groundwater analytical results exceeding the adopted assessment criteria are summarised in Table B -34 and Table B -35 respectively and exceedance locations are shown on **Figure B-1** and Figure B-**2** respectively.

Table B-34 The Bays Station – summary of soil criteria exceedances from Senversa (2021)

CoPC exceeding criteria	Adopted criteria		Exceedances		
	Type	Value	Max. result (mg/kg)	No. of samples	Samples with exceedances
Lead	Human health[1]	1500 mg/kg	2520 mg/kg	1	S31_1.8-2.2
Benzene	Human health[2]	3 mg/kg	3.4 mg/kg	1	S31_1.8-2.2
Asbestos fines and fibrous asbestos	Human health[1]	0.001 %	0.12%	1	S19_0.4-0.5
Asbestos	N/A	>LOR	-	2	S10_0.5-0.6 – asbestos sheeting S27_0.9-1.0 – many fibre bundles
Asbestos	N/A	<LOR	-	2	S25_0.9-1.1 – two loose asbestos fibre bundles S62_2.2-2.5 – one asbestos fibre bundle

CoPC exceeding criteria	Adopted criteria		Exceedances		
	Type	Value	Max. result (mg/kg)	No. of samples	Samples with exceedances
pH FOX (screening field test)	Ecological[4]	<3 pH units	1.9 pH units (min.)	26	S02_3.2-3.5, S03_3.8-4.1, S04_3.2-3.5, S04_4.5-4.8, S06_4.0-4.2, S07_4.0-4.4, S08_3.2-3.4, S29_1.8-2.2, S32_4.0-4.2, S34_2.8-3.2, S40_3.8-4.2, S42_2.0-2.3, S50_5-5.2, S51_4.8-5.2, S54_3.1-.3.3, S54_5.8-6.0, S55_5.0-5.2, S55_6.0-6.1, S58_11-11.3, S59_12.2-12.5, S59_4.6-4.8, S60_6.0-6.2, S62_9.0-9.2, S65_5-5.2, S67_3.0-3.1, S67_4.0-4.1
Peroxide Oxidisable Sulfur	Ecological[3]	0.03	0.730%	19	S01_4.5-4.9, S02_5.5-5.8, S03_3.8-4.1, S04_5.8-6.2 –S05_5.5-5.9, S06_5.8-6.0 –S09_5.8-6.2, S29_5.8-6.2 –S31_4.8-5.2, S32_6.0-6.2 –S34_5.8-6.2, S38_7.0-7.2 –S40_4.8-5.2, S42_4.7-5.1 – S43_4.8-5.2, S45_4.8-5.2 – S52_7.0-7.2, S53_4.5-5.2 , S61_5.8-6.2

Notes: 1. NEPM (2013) HIL D 2. NEPM (2013) HSL D (Sand, 1- <2m), 3. ASSMAC (1998) screening value for acid sulfate field test 4. ASSMAC (1998) action criteria for >1000 tonnes disturbed (coarse soils)

Table B-35 The Bays Station – summary of groundwater criteria exceedances from Senversa (2021)

CoPC exceeding criteria	Adopted criteria		Exceedances		
	Type	Value (µg/L)	Max. result (µg/L)	No. of wells	Wells with exceedances
Ammonia	Ecological[1]	0.91	8.42	7	C64, S02_s, S40_d, S58_d, SMW_ENV034, WB4, WB8
Arsenic	Ecological[1]	0.0023	0.091	9	A17, C65, MW02, S02_s, S51, S58_d, SMW_ENV034, WB4, WB8
Cobalt	Ecological[1]	0.001	0.035	5	C65, S40_d, S58_s, S58_d, WB4
Copper	Ecological[1]	0.0013	0.007	3	E63, S40_s, WB4
Manganese	Ecological[1]	0.08	3.41	19	C64, C65, E60, MW02, MW107, S02_s, S06, S40_d, S40_s, S51, S54, S58_s, S58_d, SMW_ENV020_s, SMW_ENV020_d, SMWENV21s, SMW_ENV026, SMW_ENV034, WB4
Nickel	Ecological[1]	0.007	0.033	3	S40d, S58_s, S58_d
Zinc	Ecological[1]	0.015	0.368	8	E62, MW107, S40_s, S40_d, S58_s, S58_d, SMW_020_s, WB4
TRH > C16-C34	Ecological[3]	640	780	1	C65
PFOS	Ecological[1]	0.13	1.57	4	C64, C66, MW02, S06
	Ecological[2]	0.00023	1.57	9	A17, C64, C65, C66, MW02, S06, SMW_ENV021s, SMW_ENV021d, WB8
PFOS + PFHxS	Human Health[4]	2	2.52	1	C64

Notes: 1. ANZECC (2000) 95% marine water trigger values 2. ANZECC (2000) 99% marine water trigger values 3. Californian Water Board (2019) ecological value for diesel (C8-C21) mixture 4. PFAS NEPM 2.0 health recreational water quality guideline.

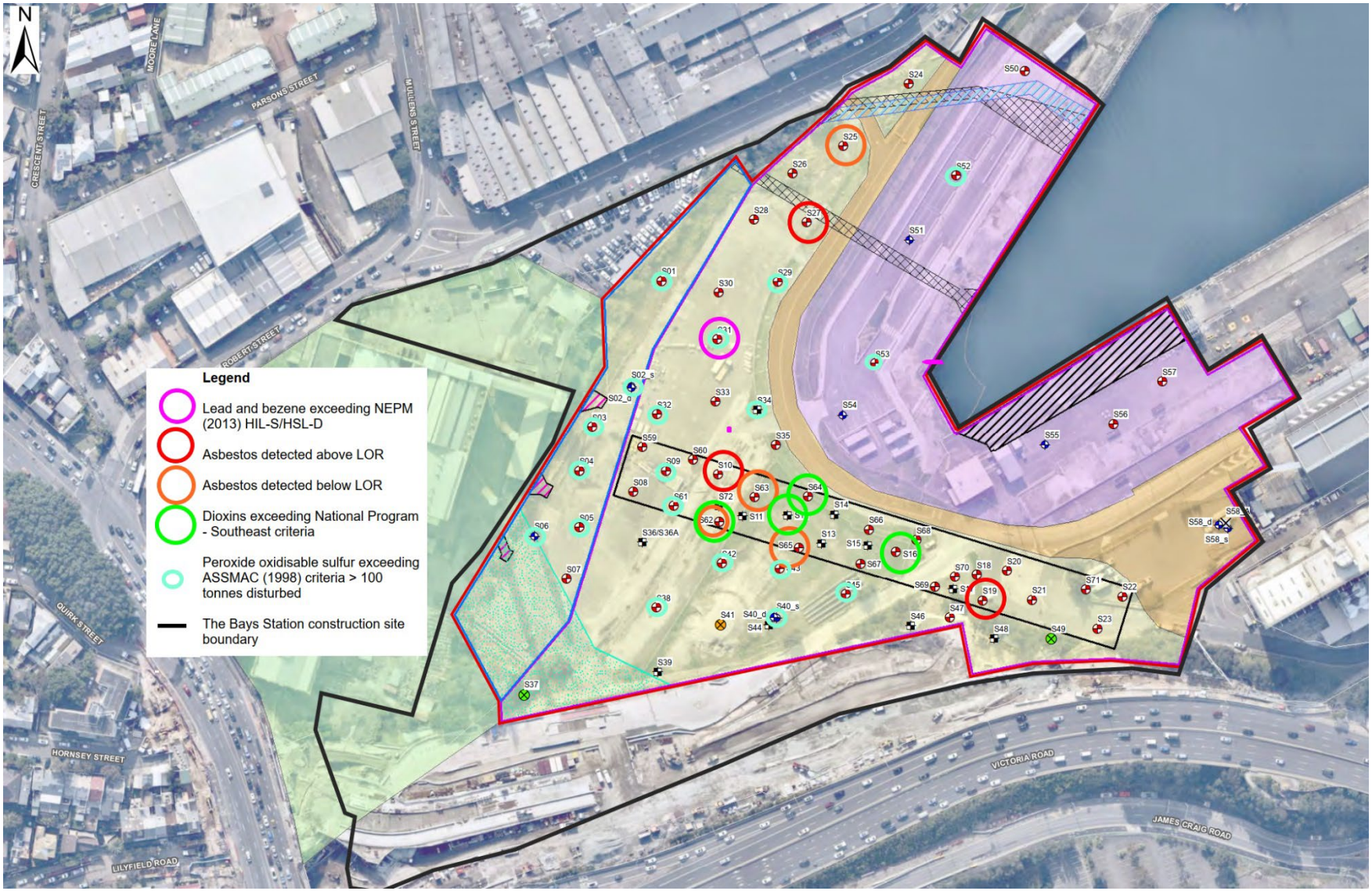

Figure B-1 Senversa (2021) borehole and testpit sampling locations and soil criteria exceedances within The Bays Station construction site [figure extracted and modified from Figure 3Senversa (2021)]

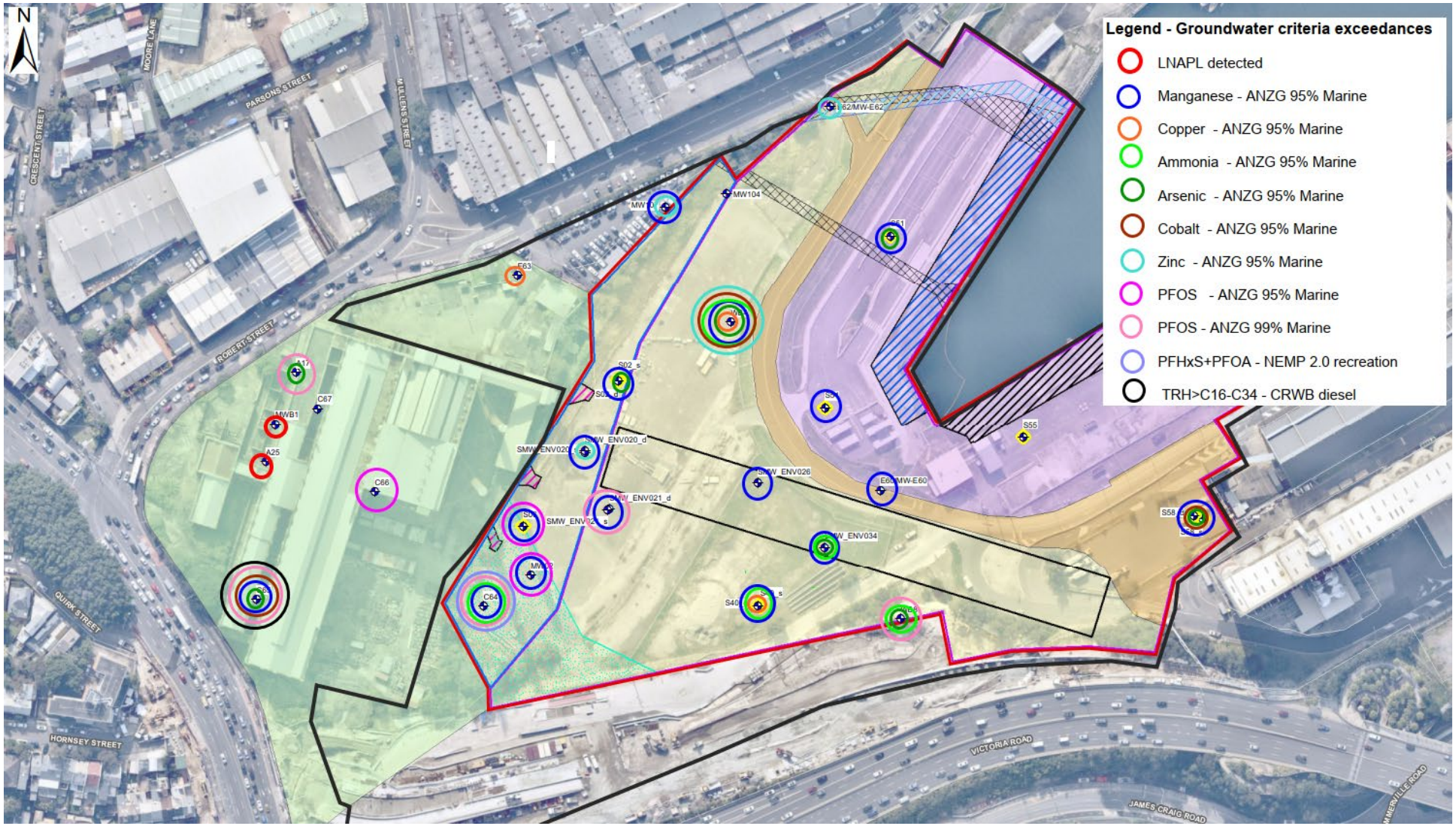

Figure B-2 Senversa (2021) groundwater monitoring well sampling locations and criteria exceedances within The Bays Station construction site [figure extracted and modified from Figure 4 - Senversa (2021)]

Golder-Douglas (2021b) Groundwater Monitoring Report – Stage 2 Locations, Sydney Metro West Geotechnical Investigation and Golder-Douglas (2021c) 00013/11180 Sydney Metro West Geotechnical Investigation, Groundwater Monitoring Report Stage 3 Locations

Four shallow and five deep groundwater monitoring wells were sampled within The Bays Station construction site, within the vicinity of the station box. The groundwater samples were analysed for EC, TDS, pH, major ions, 11 heavy metals, TRH/TPH, BTEXN, PAH, VOCs, SVOCs, hexavalent chromium, PFAS and nutrients. The results are summarised in Table B -36 and were generally consistent with the Senversa (2021) groundwater investigation results.

Table B-36 Golder-Douglas (2021b/c) – Groundwater results – The Bays Station

Well	Proximity	Screened interval (m)	SWL (m BTOC)	pH	EC (µS/cm)	Criteria exceedances
SMW_ENV020_S (Golder-Douglas, 2021b)	Within The Bays construction site	2.5-5.5	2.00	7.15	948	• Nitrite: 40 ug/L (R/DC – 30 µg/L) • Total phosphorus: 440 µg/L (LTI – 50 µg/L) • Arsenic: 190 µg/L (ANZG – 13 µg/L, R/DC – 100 µg/L) • Iron: 9400 µg/L (LTI – 50 µg/L) • Manganese: 280 µg/L (ANZG – 80 µg/L, LTI– 200 µg/L) • Zinc: 180 µg/L (ANZG – 15 µg/L)
SMW_ENV020 (Golder-Douglas, 2021b)		9.0-15.0	-	6.05	10,000	• Total phosphorus: 120 µg/L (LTI – 50 µg/L) • Arsenic: 54 µg/L (ANZG – 13 µg/L, R/DC – 100 µg/L) • Iron: 8260 µg/L (LTI – 200 µg/L) • Manganese: 176 µg/L (ANZG - 80 µg/L)
SMW_ENV021 (Golder-Douglas, 2021b)		9.90-14.40	2.20	7.22	1530	• Total phosphorus: 170 µg/L (LTI – 50 µg/L) • Arsenic: 55 µg/L (ANZG - 13 µg/L)
SMW_ENV021_S (Golder-Douglas, 2021b)		2.20-4.60	2.145	7.36	14,300	• Ammonia: 3790 µg/L (ANZG – 910 µg/L) • Total phosphorus: 890 µg/L (LTI – 50 µg/L) • Arsenic: 12 µg/L (DWG – 10 µg/L) • Iron: 12,900 µg/L (LTI – 200 µg/L) • Manganese: 298 µg/L (ANZG – 80 µg/L, LTI– 200 µg/L) • PFHXS+PFOA: 0.41 µg/L (DWG – 0.07 µg/L)

Well	Proximity	Screened interval (m)	SWL (m BTOC)	pH	EC (µS/cm)	Criteria exceedances
SMW_ENV026 (Golder-Douglas, 2021b)		3.5-6.5	3.55	7.64	2510	• Strong hydrocarbon odour • Ammonia: 7700 µg/L (ANZG – 910 µg/L) • Total nitrogen: 7500 µg/L (LTI – 5000 µg/L) • Total phosphorus: 420 µg/L (LTI – 50 µg/L) • Iron: 1500 µg/L (LTI – 200 µg/L)
SMW_ENV027 (Golder-Douglas, 2021b)		2.0-5.0	2.77	7.18	1160	• Ammonia: 4240 µg/L (ANZG – 910 µg/L) • Total Nitrogen: 1000 µg/L (LTI – 5000 µg/L) • Iron: 9560 µg/L (LTI – 50 µg/L) • Manganese: 394 µg/L (ANZG – 80 µg/L, LTI - 200 µg/L) • TRH >C10-C16: 150 µg/L (DWG – 100 µg/L) • TRH C6-C10: 1840 µg/L (DWG – 100 µg/L) • Isopropylbenzene: 50 µg/L (ANZG – 30 µg/L)
SMW_ENV034 (Golder-Douglas, 2021b)		7.9-9.3	2.57	7.8	11,100	• Fluoride: 1.5 mg/L (LTI – 1 mg/L) • Ammonia: 3560 µg/L (ANZG – 910 µg/L) • Iron: 1950 µg/L (LTI – 200 µg/L)
SMW_BH724S (Golder-Douglas, 2021c)	Within White Bay Power Station west 50 m west of the construction site	21.4-27.4	0.87	5.63	2490	• Iron: 94 mg/L (LTI – 0.2 mg/L) • Sodium: 278 mg/L (LTI – 115 mg/L) • Chloride: 756 mg/L (LTI – 175 mg/L) • Manganese: 2900 µg/L (ANZG – 80 µg/L, R/DC - 500 µg/L)

Well	Proximity	Screened interval (m)	SWL (m BTOC)	pH	EC (µS/cm)	Criteria exceedances
SMW_BH725S (Golder-Douglas, 2021c)	On western boundary of the construction site	21.4-27.4	0.81	6.19	2810	• Iron: 94 mg/L (LTI – 0.2 mg/L) • Sodium: 314 mg/L (LTI – 115 mg/L) • Chloride: 951 mg/L (LTI – 175 mg/L) • Cobalt: 3 µg/L (ANZG – 1 µg/L) • Manganese: 3190 µg/L (ANZG – 80 µg/L, DWG – 500 µg/L)

Notes: ANZG – 95% level of protection for marine ecosystems (Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, 2018); DWG – drinking water criteria (Australian Drinking Water Guidelines. National Health and Medical Research Council and Natural Resource Management Ministerial Council, 2011); LTI – Irrigation water long term trigger values as outlined in ANZECC/ARMCANZ (2000); R/DC – recreational/direct contact criteria (DWG criteria x 10); SWL – standing water level (m btoc); Screen – screened interval (m bgl); EC – electrical conductivity (µS/cm).

B.7.4 Conceptual site model and risk ranking

The CSM and risk ranking for The Bays Station site is presented in Table B -37.

Table B-37 The Bays Station – Conceptual site model and risk ranking

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020 and 2021) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Risk Rating**
AEI 2(2)	Former Ampol terminal (off-site source)	Media: Groundwater Source: Known heavy metals and hydrocarbon contamination CoPC: Heavy metals, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, PFAS	Low	Direct contact, ingestion, inhalation. Discharge of extracted groundwater.	Construction workers, future intrusive maintenance workers, ecological receptors including White Bay	Construction: Yes Operation: Yes	PR1	SE2	Ongoing groundwater dewatering of cut and cover box will be required during construction (bedrock untanked). Minor earth works for construction would occur during proposal construction.	Low
AEI 4 (2)	Former Unilever Sulphonation Plant Chemical (off-site)	Media: Groundwater Source: Chemical and potential fuel storage and use, potential spills, manufacturing processes, inappropriate demolition/waste disposal practices CoPC: Heavy metals, polycyclic	Low	Direct contact, ingestion, inhalation. Discharge of extracted groundwater.	Construction workers, future intrusive maintenance workers, ecological receptors including White Bay	Construction: Yes Operation: Yes	PR1	SE2		Low

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020 and 2021) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Risk Rating**
		aromatic hydrocarbons, linear alkylbenzene and linear alkylbenzene sulphonate compounds								
AEI 52	Mechanical workshop in Roberts Street (off-site)	Media: Groundwater Source: fuel/oil storage and use CoPC: hydrocarbons, VOCs	Moderate	Direct contact, ingestion, inhalation Discharge of extracted groundwater	Construction workers, future intrusive maintenance workers, ecological receptors including White Bay	Construction: Yes Operation: Yes	PR1	SE2		Low
AEI 53/ AEI 8(2)	Former White Bay Power Station activities	Media: Soil and groundwater Source: fuel/oil storage use, combustion, hazardous building materials, use of PCB oils CoPC: PCBs, hydrocarbons, heavy metals, asbestos	Moderate (Sydney Metro 2020) Low (Sydney Metro 2021)	Direct contact, ingestion, inhalation Discharge of extracted groundwater	Construction workers, future intrusive maintenance workers, ecological receptors including White Bay	Construction: Yes Operation: Yes	PR3	SE3	Ongoing groundwater dewatering of cut and cover box will be required during construction (bedrock untanked). Minor earth works for construction would occur during proposal construction. Contamination likely to require ongoing	High

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020 and 2021) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Risk Rating**
									management during operation.	
AEI 54/ AEI 9(2)	Historical use of potentially contaminated fill	Media: Soil and groundwater Source: uncontrolled filing with potentially contaminated soil CoPC: asbestos, hydrocarbons, heavy metals, PCBs, pesticides, asbestos	Moderate (Sydney Metro 2020) Low (Sydney Metro 2021)	Direct contact, ingestion, inhalation Discharge of extracted groundwater	Construction workers, future intrusive maintenance workers, ecological receptors including White Bay	Construction: Yes Operation: Yes	PR3	SE3	Ongoing groundwater dewatering of cut and cover box will be required during construction (bedrock untanked). Minor earth works for construction would occur during proposal construction. Contamination likely to require ongoing management during operation.	High
AEI 55 /AEI 11(2)	Historical industrial land use in surrounding locality (off-site sources)	Media: groundwater Source: chemical, fuel and oil spills and leaks CoPC: heavy metals, hydrocarbons, VOCs and PFAS	Moderate (Sydney Metro 2020) Low (Sydney Metro 2021)	Direct contact, ingestion, inhalation Discharge of extracted groundwater	Construction workers, future intrusive maintenance workers, ecological receptors including White Bay	Construction: Yes Operation: Yes	PR3	SE3	Ongoing groundwater dewatering of cut and cover box will be required during construction (bedrock untanked). Minor earth works for construction would occur during proposal construction. Contamination likely to require	High

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020 and 2021) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Risk Rating**
									ongoing management during operation.	

Note: “(2)” Denotes AEI from the Sydney Metro West Environmental Impact Statement – The Bays to Sydney CBD (Sydney Metro, 2021) to differentiate from AEIs with the same number from Sydney Metro West Environmental Impact Statement – Westmead to The Bays to Sydney CBD (Sydney Metro, 2020).

B.8 Pyrmont Station

B.8.1 Identification and description

The property description for the Pyrmont Station construction site is detailed in Table B -38. The property comprises two separated land parcels.

Table B-38 Pyrmont Station construction site - description

Item	Description		
Suburb	Pyrmont		
LGA	City of Sydney		
Property details	**Address**	**Lot and DP**	**Land use**
	26-32 Pyrmont Bridge Rd, Pyrmont (west site)	Lot 10 DP1028280	Commercial – offices/retail
	37-69 Union St, Pyrmont (east site)	Lot 1 DP620352	Commercial – offices/retail
		Lot 1 DP657429	

B.8.2 Environmental setting

The environmental setting for the Pyrmont Station construction footprint is described in Table B -39.

Table B-39 Pyrmont Station - environmental setting

Aspect	Description
Land uses	The land use within the construction site comprises offices.. Surrounding land use includes: • North: mixed commercial and high/medium density residential • South: mixed commercial and high/medium density residential • East: mixed commercial and high/medium density residential • West: mixed commercial and high/medium density residential
Zoning	The zoning within the construction site is: • B2 – Local Centre • B3 - Commercial Core • B4 - Mixed Use • R1 - General Residential • RE1 - Public Recreation • SP2 - Infrastructure (Railways, classified road) • Port and Employment • W1 - Maritime Waters
Topography	Topography slopes gently to the east from approximately 18 to 13 m AHD.
Drainage	The construction site drains to Darling Harbour 200 metres to the east.
Geology	The construction site is within land mapped as Hawkesbury Sandstone.
Soil Landscapes	The construction site is mapped as Gymea soil landscape and disturbed terrain.
Hydrogeology	Groundwater bores for beneficial use were not located within 1 km of the construction site. Groundwater has been previously measured at -2.4 m AHD in the vicinity of the construction site.
Salinity	Soil and groundwater salinity may occur in the northern half of the eastern site due to the presence of potential acid sulfate soils.
Acid sulfate soils	The construction site is mapped as low probability of acid sulfate soils occurrence with very low confidence and disturbed terrain. The construction site is mapped as Class 5 on acid sulfate risk maps except for the northern half of the eastern construction site which is mapped as Class 1.

B.8.3 Site history review

Sydney Metro West Environmental Impact Statement - The Bays to Sydney CBD Environmental Impact Statement (Sydney Metro, 2021)

A desktop contamination assessment was undertaken in the Sydney Metro West Environmental Impact Statement - The Bays to Sydney CBD Technical Paper 8 – Contamination (Sydney Metro, 2021). The assessment did not identify any areas of environmental interest within the Pyrmont Station construction site. The following potential off-site sources of contamination were identified:

- AEI 1 – former Pyrmont Power Station regulated under EHC Act Revocation Notice for hydrocarbons, PCBs, chemical storage of waste and asbestos, located 100 metres north of the Pyrmont Station construction site. Potential source of PFAS, hydrocarbons, PCBs, VOCs, and asbestos
- AEI 3 – above ground bulk fuel storage site located 500 metres north west of the Pyrmont Station construction. Potential source of hydrocarbons and PFAS.
- AEI 7 – former Pyrmont incinerator located 500 metres north west of the Pyrmont Station construction site. Potential source of heavy metals, hydrocarbons, pesticides, PCB, asbestos
- AEI 9 – historical land reclamation 50 to 100 metres to the north and east. Potential source of heavy metals, hydrocarbons, pesticides, PCB, asbestos.
- AEI 10 – dry cleaning and laundry facilities (149 and 204 Harris Street, Pyrmont) adjacent to the construction sites. Potential sources of VOCs including chlorinated hydrocarbons.
- AEI 11 - general historical commercial / industrial use including rail yards in surrounding area. Potential source of heavy metals, hydrocarbons, TRH, BTEX, PAH, VOC and PFAS.

Groundwater beneath the Pyrmont Station construction sites was assigned a moderate potential impact associated with general historical activities carried out in the surrounding area (industrial land use including an incinerator, power station, land reclamation, bulk fuel storage, potential firefighting) and reported elevated concentrations of metals in groundwater from previous investigations. Surface soils at the Pyrmont Station eastern construction site were assigned a moderate potential impact associated with likely potential acid sulfate and saline soils.

B.8.4 Conceptual site model and risk ranking

The CSM and risk ranking for the Pyrmont Station is presented in Table B -40.

Table B-40 Pyrmont Station – Conceptual site model and risk ranking

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2021) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Revised Risk Rating**
AEI 1 (2)	Former Pyrmont Power Station (off-site)	Media: Groundwater Source: fuel/oil storage and use, firefighting activities CoPC: PFAS, hydrocarbons, PCBs, VOCs	Very Low (vapour) to Low	Direct contact or ingestion, of groundwater. Discharge of extracted groundwater.	Construction workers, future maintenance workers, discharge receiving environment	Construction: Yes Operation: Yes (untanked shaft) Construction: Yes	PR2	SE1	Off-site sources of groundwater contamination will remain following work carried out under the previous Sydney Metro West planning application. Groundwater would continue to be dewatered during construction and operation within the shafts	Low
AEI 3 (2)	Above ground bulk fuel storage site (off-site)	Media: Groundwater Source: Fuel/oil spills or leaks and firefighting activities CoPC: Hydrocarbons and PFAS.	Low				PR1	SE3		Low
AEI 7 (2)	Former Pyrmont incinerator (off-site)	Media: Groundwater Source: waste incineration, fuel use and storage CoPC: heavy metals,	Low				PR1	SE2		Low

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2021) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Revised Risk Rating**
		hydrocarbons, pesticides, PCB, asbestos								
AEI 10 (2)	Historical land reclamation (off-site)	Media: Groundwater Source: uncontrolled potentially contaminated fill CoPC: heavy metals, hydrocarbons, TRH, BTEX, PAH, VOC and PFAS	Very low (soil) to Low (groundwater)				PR1	SE3		Low
AEI 11 (2)	General historical commercial / industrial in surrounding locality (off-site)	Media: Groundwater Source: spills and leaks from chemical and fuel use and storage CoPC: heavy metals, hydrocarbons, TRH, BTEX, PAH, VOC and PFAS	Low (soil) Moderate (groundwater)				PR2	SE3		Moderate

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2021) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Revised Risk Rating**
AEI 13 (2)	Dry cleaning and laundry facilities (off-site - 149 and 204 Harris Street, Pyrmont)	Media: Groundwater Source: Spills and leaks of dry-cleaning solvents CoPC: VOCs including chlorinated hydrocarbons	Very low			Construction: Yes	PR1	SE1		Very low

Note: (2) Denotes AEI from the Sydney Metro West Environmental Impact Statement - The Bays to Sydney CBD (Sydney Metro, 2021) to differentiate from AEI's with the same number from the Sydney Metro West Environmental Impact Statement – Westmead and The Bays and Sydney CBD (Sydney Metro, 2020).

B.9 Hunter Street Station (Sydney CBD)

B.9.1 Identification and description

The property description for the Harris Street Station (Sydney CBD) construction site is detailed in Table B -41.

Table B-41 Hunter Street Station (Sydney CBD) construction site - description

Item	Description		
Suburb	Sydney		
LGA	City of Sydney		
Property details	**Address**	**Lot and DP**	**Land use**
Hunter Street East Entry	28-34 O'Connell St, Sydney 2000	Lot 1 DP1107981	Commercial – office towers with retail
		Lot 1 DP217112	
		Lot 1 DP536538	
	44-48 Hunter St, Sydney	Lot 1 DP59871	
		Lot 2 217112	
	50-58 Hunter St, Sydney	SP58859	
	20-26 O'Connell St, Sydney	Lot 1 DP626651	Current Sydney Metro construction site
Hunter Street West Entry	9 Hunter St, Sydney	SP50276	Commercial – office towers and retail including a dry-cleaning business
	9 Hunter St, Sydney	Lot 2 DP850895	
	314-318 George St, Sydney	Lot 13 DP622968	
	312 George St, Sydney	Lot 1 DP211120	
	5010 De Mestre Place, Sydney	Lot 1 DP1003818	
	304-308 George St, Sydney	SP71068	
	5 Hunter St, Sydney	SP65054	
	298-302 George St, Sydney	SP596	
	296 George St, Sydney	Lot 1 DP438188	

B.9.2 Environmental setting

The environmental setting for the Hunter Street Station (Sydney CBD) construction site is described in Table B -42.

Table B-42 Hunter Street Station (Sydney CBD) - environmental setting

Aspect	Description
Land uses	The land uses within the construction site comprise commercial (retail and offices), including one dry cleaning business. Surrounding land use includes: • North: commercial and high density residential • South: commercial and high density residential • East: commercial and high density residential • West: commercial and high density residential Three dry cleaning businesses are located within 50 metres of the construction site: • TLC Dry Cleaners - 20 Hunter Street • Lucy Dry Cleaning and Alteration – 7 Hunter Street • Maurice Dry Cleaners – 26 Hunter Street
Zoning	The zoning of the construction site is: • B8 - Metropolitan Centre • RE1 - Public Recreation • SP2 - Infrastructure (Railways, classified road, boating facilities) • W1 - Maritime Waters
Topography	Topography is generally flat at around 15 metres AHD.
Drainage	The construction site drains to Circular Quay 480 metres to the north
Geology	The construction site is within land mapped as Hawkesbury Sandstone.
Soil Landscapes	The construction site is mapped as Gymea soil landscape.
Hydrogeology	Groundwater bores for beneficial use were not located within 1 km of the construction site. Groundwater has been previously measured at 2.97 to -5.56 metres AHD in the vicinity of the construction site.
Salinity	Soil and groundwater salinity are not known to exist within the construction site.
Acid sulfate soils	The construction site is mapped as low probability of acid sulfate soils occurrence with very low confidence. The construction site is mapped as Class 5 on acid sulfate risk maps. Class 2 mapped soils are located 200 metres north near Circular Quay and 300 metres west of the construction site on the eastern side of Darling Harbour there is an extremely low probability of acid sulfate soil occurrence, with very low confidence

B.9.3 Site history review

Sydney Metro West Environmental Impact Statement - The Bays to Sydney CBD (Sydney Metro, 2021)

A desktop contamination assessment was undertaken in the Sydney Metro West Environmental Impact Statement - The Bays to Sydney CBD Technical Paper 8 – Contamination (Sydney Metro, 2021). The assessment did not identify any areas of environmental interest within the Hunter Street Station (Sydney CBD) construction site.

Potential on-site sources of contamination identified were:

- AEI 10 - dry cleaning facilities within 7 Hunter Street. Potential sources of VOCs including chlorinated hydrocarbons
- AEI 12 - Current and historical storage of diesel for backup power supply generators within commercial buildings. Potential source of hydrocarbons (both on and off-site sources).

The following potential off-site sources of groundwater contamination were identified:

- AEI 5 - Dry cleaning business (447 Kent Street) located 500 metres south of the construction site and potentially other locations in the Sydney CBD. Potential sources of VOCs including chlorinated hydrocarbons
- AEI 6 - Former gasworks at Millers Point located 300 metres west. Potential source of hydrocarbons, ammonia, phenol, and cyanide.

The assessment found that:

- Groundwater may be impacted by heavy metals, cyanide, phenols, petroleum hydrocarbons, polycyclic aromatic hydrocarbons or volatile organic compounds within the station construction areas as a result of off-site sources of groundwater contamination migrating towards the site based on the modelled groundwater drawdown zone of influence and groundwater monitoring conducted as part of the Sydney Metro City & Southwest project. Increased potential for impact was considered likely to be associated with the ingress of contaminated groundwater into excavation voids and management of dewatering during construction
- Due to the potential presence of volatile compounds in groundwater at depth, construction may be impacted by vapours. Increased potential for impact is likely to be associated with the ingress and accumulation of vapour into excavation voids during the construction of the station.

Additional to the Sydney Metro (2021) assessment, one dry cleaner is located within the western construction site and three dry cleaners within 50 metres of the construction sites.

B.9.4 Conceptual site model and risk ranking

The CSM and risk ranking for the Hunter Street Station (Sydney CBD) is presented in Table B -43.

Table B-43 Hunter Street Station (Sydney CBD) – Conceptual site model and risk ranking

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2021) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Risk Rating**
AEI 5 (2)	Dry cleaning business (447 Kent Street) (off-site)	Media: Groundwater Source: Spills and leaks of dry-cleaning solvents CoPC: VOCs including chlorinated hydrocarbons	Low (groundwater) to very low	Direct contact or ingestion, of groundwater. Discharge of extracted groundwater.	Construction workers, future maintenance workers, discharge receiving environment	Construction: Yes Operation: Yes (untanked shaft)	PR2	SE1	Off-site sources of groundwater contamination will remain following work carried out under the previous Sydney Metro West planning application. Groundwater would continue to be dewatered during construction and operation within the shafts	Low
AEI 6 (2)	Former gasworks at Millers Point (off-site)	Media: Groundwater Source: Historical coal tar contamination CoPC: Hydrocarbons, ammonia, phenol and cyanide	Low				PR1	SE2		Low
AEI 12 (2)	Current and historical storage of diesel for backup power supply generators within commercial buildings	Media: Soil and groundwater Source: Diesel leaks CoPC: Hydrocarbons	Very low	Direct contact or ingestion of soil or groundwater. Discharge of extracted groundwater.	Construction workers, nearby site users, discharge receiving environment	Construction: No Operation: No	N/A	N/A	Contamination source will be excavated and removed during work carried out under the previous Sydney Metro West planning application.	N/A

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2021) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE**	**Potential applicability to this proposal**	**Risk Rating**
AEI 10 (2)	Current dry cleaners within western construction footprint (7 Hunter Street)	Media: Soil, groundwater and vapour Source: Spills and leaks of dry-cleaning solvents CoPC: VOCs including chlorinated hydrocarbons	Very low (soil) to low	Direct contact or ingestion of soil or groundwater. Discharge of extracted groundwater.	Construction workers, nearby site users, discharge receiving environment	Construction: Yes Operation: Yes (untanked shaft)	PR2	SE1	On-site contamination sources will be excavated and removed during work carried out under the previous Sydney Metro West planning application. If contamination migrated off-site residual contamination could remain but likely to be insignificant given the small size of the source.	Low

Note: “(2)” Denotes AEI from the Sydney Metro West Environmental Impact Statement – The Bays to Sydney CBD (Sydney Metro, 2021) to differentiate from AEI’s with the same number from the Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD (Sydney Metro, 2020).

B.10 Clyde services and maintenance facility and Rosehill services facility

B.10.1 Identification and description

The environmental setting for the Clyde services and maintenance facility and Rosehill services facility construction site is described in Table B -44.

Table B-44 Clyde services and maintenance facility and Rosehill services facility construction site description

Item	Description		
Suburb	Rosehill and Clyde		
LGA	City of Parramatta		
Property	**Address**	**Lot and DP**	**Land use**
Clyde services and maintenance facility and Rosehill services facility	1A Unwin Street Rosehill	Lot 21 DP817742	Industrial – asphalt plant, plant yard and workshop
	1 Unwin Street Clyde	Lot 50 DP791656	Industrial – civil yard and stockpiling site
	6 Shirley Street Rosehill	Lot 11 DP1242950	Industrial – concrete plant
	5 Unwin Street Rosehill	Lot 202 DP870298	Industrial – plant hire yard and workshop
Clyde services and maintenance facility	101 James Ruse Drive Rosehill	Part Lot 10 DP1151784	Clyde-Carlingford Railway
	James Ruse Drive Rosehill	Lot 11 DP1271374	Vacant land (adjacent to Clyde-Carlingford Railway)
	James Ruse Drive Rosehill	Lot 11 DP630649	Road
	Unwin Street Rosehill	Lot 9 DP263940	Clyde-Carlingford Railway
	James Ruse Drive Rosehill	Lot 1 DP115004	Road
	1B Unwin Street Rosehill	Lot 201 DP870298	Industrial – scaffolding and pallet storage yards
	8 Shirley Street Rosehill	Lot 10 DP1242950	Industrial - formwork
	2 Shirley Street Rosehill	Lot 1 DP520478	Industrial – civil plant yard and stockpiling site
	4 Kay Street Clyde	Lot 6 DP263068	Industrial – metal fabricators
	2 Kay Street Clyde 2142	Lot B, C and D DP344102	Industrial – civil yard and stockpiling site
		Lot 10 DP263068	
	50-54 Wentworth Street Clyde	Lot 1 DP1180007	Commercial – food distributer Industrial – metal fabricators
	Wentworth Street Clyde	Lot 1 DP568177	Riparian easement - Duck Creek
	Wentworth Street Clyde	Lot 11 DP814837	Riparian easement - Duck Creek
	60 Wentworth Street Clyde	Lot 2 DP567736	Commercial – mechanical workshop
	9 Kay Street Clyde	Lot 7 DP263068	Industrial – civil yard and stockpiling site
	7 Kay Street Clyde	Lot 3 DP805263	
	5 Kay Street Clyde	Lot 4 DP805263 Lot 9 DP263068	Industrial – civil yard and offices
	Kay Street Clyde	Lot 70 DP800279	Riparian easement - Duck Creek

Item	Description		
	32 Wentworth Street Clyde	Lot 71 DP800279	Commercial – amusement ride equipment yard
	1 Kay Street Clyde	Lot 1 DP1160433 Lot 7 DP 701596	Industrial – plant mechanical workshop
	48 Wentworth Street Clyde	Lot 4 DP701596	Commercial – electrical contractor
	46 Wentworth Street Clyde	Lot 50 DP777202	Commercial - furniture warehouse
	38-40 Wentworth Street Clyde	Lot 26/2 and 25/2 DP5944	Commercial – offices and mechanical workshop
	34-36 Wentworth Street Clyde	Lot 24/2 and 23/2 DP5944	Commercial – warehouse and printing
	21 Wentworth Street Clyde	Lot 4 DP1116474	Parramatta Granville Sportsground Reserve Trust and Sydney Speedway
	2 Deniehy Street Clyde	Lot 1 and 2 DP612308	
	23 Wentworth Street Clyde	Lot 1 and 2 DP1116474	Parramatta heliport
	Wentworth Street Clyde	Lot 5 DP1116474	Road reserve
		Lot 6 DP1116474	
	1 Tennyson Street Clyde 2142	Lot 58/6 DP6944	Industrial – civil and stockpile site
		Lot A DP385416	
	3 Tennyson Street Clyde	Lot B DP385416	Industrial – plant yard and engineering workshop
		Lot 56/6, 54/6, 53/6 and 55/6 DP5944	
	3A Tennyson Street Clyde	Lot 51/6 and Lot 52/6 DP5944	
	7 Tennyson Street Clyde	Lot 10 DP712049	Commercial – warehouses and offices
	9 Tennyson Street Clyde	Lot 47/6 and 48/6 DP5944	Industrial – plant storage yard (concrete mixer machinery) and stockpiling
	11-13 Tennyson Street Clyde	Lot 44 to 46 DP855702 Lot 9 DP242917	
	8 Tennyson Street Clyde	Lot 23 DP733500	
	1 Deniehy Street Clyde	Lot 101 DP739030	Industrial – auto wreckers and metal recyclers
	6 Tennyson Street Clyde	SP35152	Commercial - warehouses
	4 Tennyson Street Clyde	Lot 1 DP594218	Vacant lot
	3 Deniehy Street Clyde	Lot 9/6 DP5944	Industrial – plant yard and workshop
	4 Deniehy Street Clyde	Lot 10/6 to 11/6 DP5944	Commercial – food distributers
	2 Tennyson Street Clyde	Lot 1 DP128287	Industrial – petrol station
		Lot 12/6 to 13/6 DP5944	

B.10.2 Environmental setting

The environmental setting for the Clyde services and maintenance facility and Rosehill services facility construction site is described in Table B -45.

Table B-45 Clyde services and maintenance facility and Rosehill services facility - environmental setting

Aspect	Description
Land uses	The land uses comprise a mixture of industrial and commercial properties, the Sydney Speedway, Parramatta Heliport, a section of the closed Clyde-Carlingford railway, sections of A'Becketts and Duck Creek, Kay Street, Deniehy Street, Tennyson Street and part of Wentworth Street. Surrounding land use includes: • North: Rosehill Gardens racecourse • South: M4 Western Motorway and on-ramp, commercial and Duck River • East: industrial and Duck River • West: James Ruse Drive, then mixed commercial and residential
Zoning	The zoning within the construction site comprises: • IN3 – Heavy industrial • IN1 – General industrial • RE2 – Private recreation • W1 – Natural waterways • SP2 – Infrastructure • B5 – business development
Topography	The topography is flat with little to no incline or decline.
Drainage	A'Becketts Creek and Duck Creek merge in the south-west portion of the construction site and flows in an easterly to south-easterly direction through the construction footprint before discharging into the Duck River.
Geology	The geology within the construction site comprises: • Fill (0 to 1 m bgl) • Alluvial/residual clay and fluvial sand (1 to 13 m bgl) • Ashfield shale (13 to 28 m bgl) • Hawkesbury Sandstone (+28 m bgl)
Soil Landscapes	The soil within the construction site is mapped as Birrong soil landscape.
Hydrogeology	Groundwater is typically 3 to 7 metres AHD and 3 to 5 m bgl in the vicinity of the construction site.
Salinity	Groundwater is brackish to saline within and surrounding the construction site. Soil salinity
Acid sulfate soils	The construction site is mapped as a high probability of occurrence of acid sulfate soils/confidence unknown, disturbed terrain and mapped as Class 4 in the Parramatta LEP 2011 acid sulfate soil risk maps.

B.10.3 Site history review

Previous reports prepared for the site comprising the Clyde services and maintenance facility and Rosehill services facility construction footprint are summarised in the following sub-sections.

Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD Technical Paper 8 Contamination (Sydney Metro, 2020)

The contamination findings of the Sydney Metro (2020) report for the Clyde services and maintenance facility included:

- Significant portions of the Clyde services and maintenance facility construction site were subject to historical uncontrolled filling. This included burial of chrome waste and asbestos waste from former operations of James Hardie Industries in properties within Tennyson Street and within the Speedway

- A wide range of industrial land use occurred within the construction site and surrounding area including railroad works, oil refinery, meat works, tannery, lumber yard, asbestos manufacturing, manufacturing (chemical, tyres, plastic, paint, ceramics and pharmaceuticals), bitumen plant and fuel distribution
- Contaminants previously identified within the construction site and surrounds included asbestos, hexavalent chromium, petroleum hydrocarbons, chlorinate hydrocarbon and arsenic.

Six areas of environmental interest were identified within the construction site which comprised:

- AEI 12: Sydney Speedway – leaks and spills from vehicle maintenance and use – heavy metals, petroleum hydrocarbons and VOCs
- AEI 13: Former and existing structures – Hazardous building materials within or from on-site buildings and structures and use of pesticides – heavy metals, PCBs, pesticides and asbestos
- AEI 15: Current and historical commercial / industrial use within locality – Inappropriate chemical storage and use, industrial operations, waste disposal (e.g. James Hardie asbestos disposal sites) – heavy metals, petroleum hydrocarbons and asbestos
- AEI 17: Land reclamation – Historical use of potentially contaminated fill within former waterways – heavy metals, petroleum hydrocarbons, pesticides, PCBs and asbestos
- AEI 18: Rosehill Helipad (Wentworth Street, Rosehill) – Leaks and spills from petroleum storage infrastructure, maintenance and refuelling, PFAS from hydraulic fluids and current EPL – petroleum hydrocarbons, VOC and PFAS
- AEI 19: Rapid Oil Distributors (Deniehy Street, Rosehill) – Leaks and spills from petroleum storage infrastructure – petroleum hydrocarbons

Five areas of environmental interest were identified outside the construction site which were considered potential sources of groundwater contamination to the construction site:

- AEI 10: Historical industrial use (former James Hardie factory – 1 Grand Avenue, Camellia) – known contamination in the fill material and groundwater – asbestos and arsenic
- AEI 11: Rosehill Gardens racecourse – use of pesticide, nutrients and disinfectants
- AEI 14: Historical industrial use (former Shell Clyde Refinery – Durham Street, Rosehill) - known groundwater contamination – petroleum hydrocarbons, lead, chromium and PFAS
- AEI 16: Current commercial / industrial use within locality – Inappropriate chemical storage and use, industrial operations, waste disposal and management – petroleum hydrocarbons and heavy metals
- AEI 20: Landfill (Carnavon Road Silverwater) – PFAS containing waste materials – PFAS.

GHD (2021) 1 Tennyson Street – Stockpile cost estimate

GHD undertook a cost estimate for two stockpiles located on Lot A in DP 385416 and Lot 58 of Section 6 in DP 5944 within the Clyde services and maintenance facility. One of the stockpiles was demolition waste and the other was soil. The origin of the soil stockpile was unknown and was observed to contain demolition waste and potential fragments of asbestos containing materials. The report did not include sampling and analysis of the stockpile. The stockpile was estimated to be 2,020m^3.

Golder-Douglas (2021b) Groundwater Monitoring Report – Stage 2 Locations, Sydney Metro West Geotechnical Investigation

The results of 22 groundwater wells installed within or adjacent to the proposed Clyde stabling and maintenance facility and Rosehill services facility construction site are summarised in Table B -46. The groundwater samples were analysed for EC, TDS, pH, major ions, 11 heavy metals, TRH/TPH, BTEXN, PAH, VOCs, SVOCs, hexavalent chromium, PFAS, nutrients and dissolved methane.

The results indicate that the concentrations of ammonia and some heavy metals (mainly cobalt, copper, manganese, arsenic and zinc) exceed the adopted ecological based criteria across the construction site. Dissolved methane, PFAS and benzene were also detected at concentrations above the adopted human health based assessment criteria in some areas of the construction site. A low pH of 3.84 was also measured in groundwater at the northern end of Deniehy Street which corresponded with elevated ammonia, PFAS and heavy metals, including lead and cadmium.

Table B-46 Golder-Douglas (2021b) – Groundwater results – Clyde stabling and maintenance facility and Rosehill services facility

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_ ENV145	Eastern boundary of the construction site in Shirley Street	11.0-14.0	1.52	6.96	25,400	• Ammonia: 1370 µg/L (ANZG – 910 µg/L) • Cobalt: 4 µg/L (ANZG – 1 µg/L) • Copper: 2 µg/L (ANZG – 1.3 µg/L) • Iron: 9020 µg/L (LTI – 200 µg/L) • Manganese: 151 µg/L (ANZG – 80 µg/L) • Zinc: 18 µg/L (ANZG – 15 µg/L)
SMW_ BH010	Within construction site near Shirley Street and Duck Creek	23.5-26.5	1.39	7.12	1020	• Ammonia: 5660 µg/L (ANZG – 910 µg/L) • Total Nitrogen: 6100 µg/L (LTI – 5000 µg/L) • Iron: 1270 µg/L (LTI – 200 µg/L) • Manganese: 384 µg/L (DWG – 500 µg/L)
SMW_ ENV042		7.4-10.4	2.26	6.27	24,100	• Nitrate: 3640 (R/DC– 500 µg/L) • Copper: 2 µg/L (ANZG – 1.3 µg/L) • Iron: 990 µg/L (LTI – 200 µg/L) • Zinc: 24 µg/L (ANZG – 15 µg/L)
SMW_ BH057	Northern boundary of the construction in Rosehill Racecourse carpark near Grand Avenue/James Ruse Drive	23.3-26.3	1.72	7.25	11600	• Ammonia: 2300 µg/L (ANZG – 910 µg/L) • Arsenic: 17 µg/L (ANZG – 13/24 µg/L) • Cobalt: 4 µg/L (ANZG - 1 µg/L) • Iron: 4000 µg/L (LTI – 200 µg/L) • Manganese: 658 µg/L (DWG – 500 µg/L)
SMW_ BH057S		1.5-5.3	2.065	6.98	588	• Nitrate: 100 (DWG – 50 µg/L) • Total phosphorus: 90 (LTI – 50 µg/L) • Cobalt: 3 µg/L (ANZG – 1 µg/L) • Iron: 330 µg/L (LTI – 200 µg/L) • Manganese: 495 µg/L (LTI – 200 µg/L)

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_ ENV009		2.7-7.3	2.02	7.43	1210	• Ammonia: 6350 µg/L (ANZG – 910 µg/L) • Total Nitrogen: 7900 µg/L (LTI – 5000 µg/L) • Total Phosphorus: 640 µg/L (LTI – 50 µg/L) • Iron: 20,900 µg/L (LTI – 200 µg/L) • Manganese: 830 µg/L (DWG – 500 µg/L) • Dissolved methane: 5290 µg/L (DWG - 1600 µg/L)
SMW_ ENV010		3.2-6.6	2.04	7.12	1020	• Ammonia: 5800 µg/L (ANZG – 910 µg/L) • Total Nitrogen: 6600 µg/L (LTI – 5000 µg/L) • Total Phosphorus: 140 µg/L (LTI – 50 µg/L) • Arsenic: 49 µg/L (ANZG – 13/24 µg/L) • Iron: 42,700 µg/L (LTI – 200 µg/L) • Manganese: 359 µg/L (LTI – 200 µg/L)
SMW_ ENV011		3.0-7.0	1.94	6.46	1340	• Ammonia: 3320 µg/L (ANZG – 910 µg/L) • Total Nitrogen: 5100 µg/L (LTI – 5000 µg/L) • Arsenic: 13 µg/L (ANZG – 13/24 µg/L) • Cobalt: 14 µg/L (ANZG – 1 µg/L) • Iron: 40,300 µg/L (LTI – 200 µg/L) • Manganese: 1190 µg/L (DWG – 500 µg/L)
SMW_ BH043	Within construction site east of Rosehill racecourse	6.5-12.5	8.59	7.55	2550	• Nitrate: 100 (R/DC – 500 µg/L) • Manganese: 658 µg/L (DWG – 500 µg/L)
SMW_ BH064	Within construction site east of Rosehill racecourse	5.9-8.9	6.150	6.17	6810	• Cobalt: 70 µg/L (ANZG -1 µg/L) • Iron: 14,100 µg/L (LTI – 200 µg/L) • Manganese: 376 µg/L (LTI – 200 µg/L) • Nickel: 49 ug/L (ADG – 20 µg/L) • Zinc: 278 µg/L (ANZG – 15 µg/L)

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_ ENV077	Within construction site east of Rosehill racecourse	6.0-9.0	4.04	6.73	19,200	• Cobalt: 11 µg/L (ANZG -1 µg/L) • Iron: 450 µg/L (LTI – 50 µg/L) • Manganese: 143 µg/L (ANZG – 80 µg/L) • Zinc: 18 µg/L (ANZG – 15 µg/L)
SMW_ ENV078	Within construction site east of Rosehill racecourse	8.5-14.5	5.64	7.3	21,200	• Ammonia: 1130 (ANZG – 910 µg/L) • Total Phosphorus: 90 µg/L (LTI – 50 µg/L) • Cobalt: 12 µg/L (ANZG -1 µg/L) • Iron: 1560 µg/L (LTI – 200 µg/L) • Manganese: 849 µg/L (ADG - 500 µg/L)
SMW_ ENV044	Within the construction site – northern end of Deniehy Street	6.8-12.8	1.01	7.18	25,200	• Nitrite: 20 ug/L (DWG – 3 µg/L) • Ammonia: 3570 µg/L (ANZG – 910 µg/L) • Iron: 2990 µg/L (LTI – 200 µg/L) • Manganese: 1220 µg/L (DWG – 500 µg/L) • Zinc: 16 µg/L (ANZG – 15 µg/L) • Dissolved methane: 10,900 µg/L (DWG - 1600 µg/L)
SMW_ ENV045	Within construction site in northern part of Wentworth Street	9.5-12.5	2.63	7.13	26900	• Ammonia: 1690 µg/L (ANZG – 910 µg/L) • Cobalt: 14 µg/L (ANZG – 1 µg/L) • Copper: 3 µg/L (ANZG – 1.3 µg/L) • Iron: 9020 µg/L (LTI – 200 µg/L) • Manganese: 151 µg/L (ANZG – 80 µg/L) • Zinc: 18 µg/L (ANZG – 15 µg/L)
SMW_ ENV076	Within construction site in Unwin Street	6.0-10.0	4.49	7.58	21,200	• Ammonia: 1070 µg/L (ANZG – 910 µg/L) • Cobalt: 6 µg/L (ANZG – 1 µg/L) • Copper: 2 µg/L (ANZG – 1.3 µg/L) • Iron: 3010 µg/L (LTI – 200 µg/L) • Manganese: 618 µg/L (DWG – 500 µg/L) • Benzene: 117 µg/L (R/DC – 10 µg/L)

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_ ENV151	Within the construction site – western part of Kay Street	3.2-6.2	1.96	7.64	21,600	• Cobalt: 2 µg/L (ANZG -1 µg/L) • PFHXS+PFOA: 0.1 µg/L (DWG – 0.07 µg/L)
SMW_ ENV146	Within the construction site – eastern part of Kay Street	3.3-6.3	1.30	6.96	37,800	• Cobalt: 14 µg/L (ANZG -1 µg/L) • Manganese: 600 µg/L (ADG - 500 µg/L)
SMW_ ENV144	Within the construction site – northern end of Tennyson Street	9.5-12.5	1.39	7.83	25,400	• Ammonia: 1270 µg/L (ANZG – 910 µg/L) • Cobalt: 16 µg/L (ANZG – 1 µg/L) • Copper: 3 µg/L (ANZG – 1 µg/L) • Iron: 14600 µg/L (LTI – 200 µg/L) • Manganese: 416 µg/L (ANZG – 80 µg/L) • Zinc: 26 µg/L (ANZG – 15 µg/L)
SMW_ ENV148	Within the construction site – southern end of Tennyson Street	3.1-6.1	2.13	7.14	29,200	• Cobalt: 26 µg/L (ANZG – 1 µg/L) • Copper: 2 µg/L (ANZG – 1 µg/L) • Iron: 880 µg/L (LTI – 200 µg/L) • Manganese: 511 µg/L (ADG – 500 µg/L)
SMW_ ENV149	Within the construction site – northern end of Tennyson Street	6.0-9.0	1.30	7.07	25,200	• Cobalt: 38 µg/L (ANZG -1 µg/L) • Iron: 21,000 µg/L (LTI – 200 µg/L) • Manganese: 323 µg/L (LTI - 200 µg/L) • Zinc: 16 µg/L (ANZG – 15 µg/L

Well	Proximity	Screen	SWL	pH	EC	Criteria exceedances
SMW_ ENV150_S	Within the construction site – northern end of Deniehy Street	0.4-1.0	0.4	3.84	30,400	• pH: 3.84 µg/L (LTI – 6-8.5) • Nitrate: 440 ug/L (ADG – 50 µg/L) • Ammonia: 8100 µg/L (ANZG – 910 µg/L) • Total nitrogen: 7400 µg/L (LTI – 5000 µg/L) • Arsenic:69 µg/L (ANZG – 13/24 µg/L) • Cadmium: 8.4 µg/L (ANZG – 5.5 µg/L) • Cobalt: 637 µg/L (LTI – 50 µg/L) • Copper: 51 µg/L (ANZG – 1.3 µg/L) • Iron: 550,000 µg/L (LTI – 200 µg/L) • Lead: 172 µg/L (R/DC – 100 µg/L) • Manganese: 24,800 µg/L (R/DC – 5000 µg/L) • Nickel: 1110 ug/L (R/DC – 200 µg/L) • Zinc: 3380 µg/L (LTI – 2000 µg/L) • PFHXS+PFOA: 0.08 (DWG – 0.07 µg/L)
SMW_ ENV150		3.0-6.0	0.77	7.53	59,000	• Nitrate: 270ug/L (DWG – 50 µg/L) • Nitrite: 680 ug/L (R/DC – 30 µg/L) • Total phosphorus: 80 ug/L (LTI – 50 µg/L)

Notes: ANZG – 95% level of protection for marine ecosystems (Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, 2018); DWG – drinking water criteria (Australian Drinking Water Guidelines. National Health and Medical Research Council and Natural Resource Management Ministerial Council, 2011); LTI – Irrigation water long term trigger values as outlined in ANZECC/ARMCANZ (2000); R/DC – recreational/direct contact criteria (DWG criteria x 10); SWL – standing water level (m btoc); Screen – screened interval (m bgl); EC – electrical conductivity (µS/cm).

B.10.4 Conceptual site model and risk ranking

The CSM and risk ranking for the Clyde stabling and maintenance facility and Rosehill services facility is presented in Table B -47.

Table B-47 Clyde stabling and maintenance facility and Rosehill services facility – Conceptual site model and risk ranking

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE2**	**Potential applicability to this proposal**	**Risk Rating**
AEI 10	Former James Hardie factory (1 Grand Avenue, Camellia) (off-site source)	Source: Known contamination in the fill material and groundwater CoPC: Arsenic, zinc, phenol, PAH, asbestos Media: Soil and groundwater	Very low (soil) Low (ground-water)	No likely pathway	n/a	n/a	n/a	n/a	n/a	n/a
AEI 11	Rosehill Gardens Racecourse (off-site source)	Source: Use of pesticides and disinfectants, wastes CoPC: Pesticides and nutrients Media: Surface soil	Very low	No likely pathway	n/a	n/a	n/a	n/a	n/a	n/a
AEI 12	Sydney Speedway	Source: Leaks and spills from vehicle maintenance and use CoPC: Heavy metals, Hydrocarbons, VOC	Moderate	Direct contact, ingestion or inhalation, dust and surface water runoff	Construction workers, nearby site users, future site users and ecological receptors including Duck Creek and River	Construction: Yes Operation: Yes	PR2	SE1	Soils are expected to be remediated during work carried out under the previous Sydney Metro West planning application. Residual soil and groundwater contamination may remain at depth that	Low

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE2**	**Potential applicability to this proposal**	**Risk Rating**
		Media: Soil, groundwater							could require localised disturbance and may be subject to an environmental monitoring plan for construction and operation of this proposal.	
AEI 13	Hazardous building materials	Source: Hazardous building materials within or from on-site buildings / structures, demolition wastes CoPC: Heavy metals, hydrocarbons pesticides, asbestos, PCBs Media: Surface soil	Moderate	Direct contact, ingestion or inhalation, dust and surface water runoff	Construction workers, nearby site users, future site users and ecological receptors including Duck Creek and River	Construction: Yes Operation: Yes	PR2	SE1	Surface soils are expected to be fully remediated during work carried out under the previous Sydney Metro West planning application across the construction site.	Low

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE2**	**Potential applicability to this proposal**	**Risk Rating**
AEI 14	Clyde fuel terminal (off-site source)	Source: Groundwater Light non-aqueous phase liquid, CoPC: hydrocarbons (TPH, BTEX, PAH), lead, chromium and PFAS. Media: Groundwater	Moderate	Direct contact, ingestion or inhalation and groundwater discharge	Construction workers, nearby site users, future site users and ecological receptors including Duck Creek and River	Construction: Yes Operation: Yes	PR1	SE2	Residual groundwater contamination may remain in parts of the construction footprint following the work carried out under the previous Sydney Metro West planning application. Potential requirement for ongoing management during operation.	Low
AEI 15/16	Industrial land use (AEI 15 – on-site and AEI 16 – off-site)	Source: Inappropriate chemical storage and use, industrial operations, waste disposal CoPC: Heavy metals, hydrocarbons and asbestos Media: Soil and groundwater	Moderate	Direct contact, ingestion or inhalation, dust and surface water runoff	Construction workers, nearby site users, future site users and ecological receptors including Duck Creek and River	Construction: Yes Operation: Yes	PR2	SE2	Soils are expected to be remediated during work carried out under the previous Sydney Metro West planning applications in the bulk earth works area. Areas of subsurface contaminated soil and groundwater could remain in parts of the construction footprint requiring remediation or management during construction. Potential requirement for ongoing management during operation.	Moderate
AEI 17	Historical filling	Source: Historical use of potentially contaminated fill								

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE2**	**Potential applicability to this proposal**	**Risk Rating**
		CoPC: Heavy metals, pesticides, PCB and asbestos Media: Soil and groundwater								
AEI 18	Parramatta heliport	Source: Leaks and spills from petroleum storage infrastructure, maintenance and refuelling and fire-fighting foam storage CoPC: Hydrocarbons, VOC, PFAS Media: Soil	Moderate	Direct contact, ingestion or inhalation, dust and surface water runoff	Construction workers, nearby site users, future site users and ecological receptors including Duck Creek and River	Construction: Yes Operation: Yes	PR1	SE2	Soils are expected to be remediated work carried out under the previous Sydney Metro West planning application. Residual soil and groundwater contamination may remain at depth that could require localised disturbance and may be subject to an environmental monitoring plan for construction and operation.	Low

Area of environmental interest (AEI)			Risk identification				Risk analysis for this proposal			
AEI	**AEI name**	**Source and CoPC**	**Sydney Metro (2020) major civil works**	**Pathway**	**Receptor**	**Potentially complete SPR**	**PR**	**SE2**	**Potential applicability to this proposal**	**Risk Rating**
AEI 19	Rapid Oil Distributors	Source: Spills and leaks CoPC: Hydrocarbons Media: Soil and groundwater	Moderate	Direct contact, ingestion or inhalation, dust and surface water runoff	Construction workers, nearby site users, future site users and ecological receptors including Duck Creek and River	Construction: Yes Operation: Yes	PR1	SE2	Soils are expected to be remediated during work carried out under the previous Sydney Metro West planning application. Residual soil and groundwater contamination may remain at depth that could require localised disturbance and may be subject to an environmental monitoring plan for construction and operation.	Low