NSW GOVERNMENT | sydney METRO

West

Major civil construction between The Bays and Sydney CBD

Environmental Impact Statement 2021

Technical Paper 8

Contamination

Sydney Metro West

Technical Paper 8 – Contamination

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Contents

Executive summary

Sydney Metro West will double rail capacity between Greater Parramatta and the Sydney CBD, transforming Sydney for generations to come. 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).

The once-in-a-century infrastructure investment will have a target travel time of about 20 minutes between Parramatta and the Sydney CBD, link new communities to rail services and support employment growth and housing supply.

Stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Hunter Street (Sydney CBD).

The planning process for Sydney Metro West is being assessed as a staged infrastructure application under section 5.20 of the *Environment Planning and Assessment Act 1979* (EP&A Act).

Stage 2 of the planning approval process (this proposal) includes all major civil construction work including station excavation and tunnelling between The Bays and Sydney CBD.

This contamination Technical Paper is one of a number of Technical Papers that form part of the Environmental Impact Statement for major civil construction work between The Bays and Sydney CBD. The purpose of this Technical Paper is to identify and assess the potential impacts of the proposal in relation to contamination and other specific geological conditions.

The objectives of this Technical Paper include:

- Understanding the potential impacts (with respect to contamination) associated with potentially historical and current contaminating activities and/or operations carried out on or surrounding the proposal
- Understanding specific geological conditions (i.e. acid sulfate soils, salinity and erosion potential) within or surrounding the proposal
- Assessing potential cumulative impacts with respect to contamination
- Identifying mitigation measures to manage the identified potential contamination and specific geological condition impacts.

The methodology for this contamination Technical Paper has included:

- Desktop review of available information sources, including publicly available sources and information from investigations carried out by Sydney Metro, and observations from site inspections to understand the existing environment, specific geological conditions (i.e. acid sulfate soils, salinity and erosion potential) and potential for contamination to exist within the study area
- A high level prioritisation exercise including identification of areas of environmental interest (with respect to contamination or specific geological conditions) and assessment of potential impacts (assuming no mitigation measures) in the context of proposed construction activities
- Identification of appropriate mitigation and management responses for contamination or specific geological conditions, or where further investigation or remediation may be required.

Based on the findings of the desktop review and site inspections, a number of known and potential contamination sources (areas of environmental interest – AEIs) or areas of specific geological conditions have been identified within and/or adjacent to the proposal. Following an assessment of the potential for the proposal to interact with these AEIs, the majority of these AEIs would represent a very low or low potential for contamination to impact on receptors as a result of the proposal.

Potential groundwater contamination in the vicinity of the Pyrmont Station construction sites as a result of 'general industrial use' (AEI11) is considered to have a moderate risk of resulting in potential impacts to receptors during construction. This AEI does not correspond to a specific geographic location, rather relates to evidence of a long history of industrial land use in Pyrmont including historic railyards, factories, bulk fuel storage and warehousing. This captures various sites in the area identified in historic aerial imagery and during the site inspection that are not recorded in public databases as specific source sites of potential or actual contamination (e.g. on EPA databases).

In addition, potential acid sulfate soils have been identified as representing a moderate potential impact for the eastern construction site. Saline soils may also be present within the same extent as potential acid sulfate soils.

The process for applying mitigation measures would be tiered, where mitigation measures are applied commensurate with the level of risk associated with the potential impact. Initially, additional information would need to be obtained and reviewed (such as site-specific data) in order to determine the most appropriate site-specific responses or controls, which may include remediation. Mitigation measures would be implemented to manage potential contamination, acid sulfate risks, unexpected finds and spill prevention for the proposal. Where required, additional data review will be undertaken to inform these measures . Where there is insufficient data available, detailed site investigations may be required. Where contamination is identified to present a moderate or higher risk to receptors, a Remediation Action Plan or other management plan will be implemented as required.

TERMINOLOGY

Term	Definition
AEIs	Areas of environmental interest
AHD	Australian height datum
ASS	Acid sulfate soil
ASSMAC	Acid Sulfate Soil Management Advisory Committee
BTEX	Benzene, toluene, ethylbenzene, xylenes
CLM Act	*Contaminated Land Management Act 1997*
CSIRO	Commonwealth Scientific and Industrial Research Organisation
der	Dermal
DIPNR	Department of Infrastructure, Planning and Natural Resources
DPI	Department of Primary Industries
EIL	Ecological Investigation Level
EMP	Environmental Management Plan
EPA	Environment Protection Authority
EPL	Environmental protection licence
GDE	Groundwater dependent ecosystem
HEPA	Heads of EPAs
ing	Ingestion
inh	Inhalation
ISCA	Infrastructure Sustainability Council of Australia
ISQG	Interim Sediment Quality Guidelines
LEP	Local Environmental Plan
LNAPL	Light Non-Aqueous Phase Liquid
NAGD	National Assessment Guidelines for Dredging
NEMP	National Environmental Management Plan
NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999, as revised 2013

Term	Definition
OCP	Organochlorine pesticides
OPP	Organophosphate pesticides
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
PFAS	Per- and poly-fluoroalkyl substances
PID	Photoionisation detector
PPE	Personnel protective equipment
REF	Review of environmental factors
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State environmental planning policy
TCLP	Toxicity characteristic leaching procedure
TfNSW	Transport for New South Wales
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
VOC	Volatile organic compounds

1 Introduction

1.1 Sydney Metro West

Sydney Metro West will double rail capacity between Greater Parramatta and the Sydney CBD, transforming Sydney for generations to come. 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).

The once-in-a-century infrastructure investment will have a target travel time of about 20 minutes between Parramatta and the Sydney CBD, link new communities to rail services and support employment growth and housing supply.

Stations have been confirmed at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock, The Bays, Pyrmont and Hunter Street (Sydney CBD). The main elements of Sydney Metro West are shown in Figure 1-1.

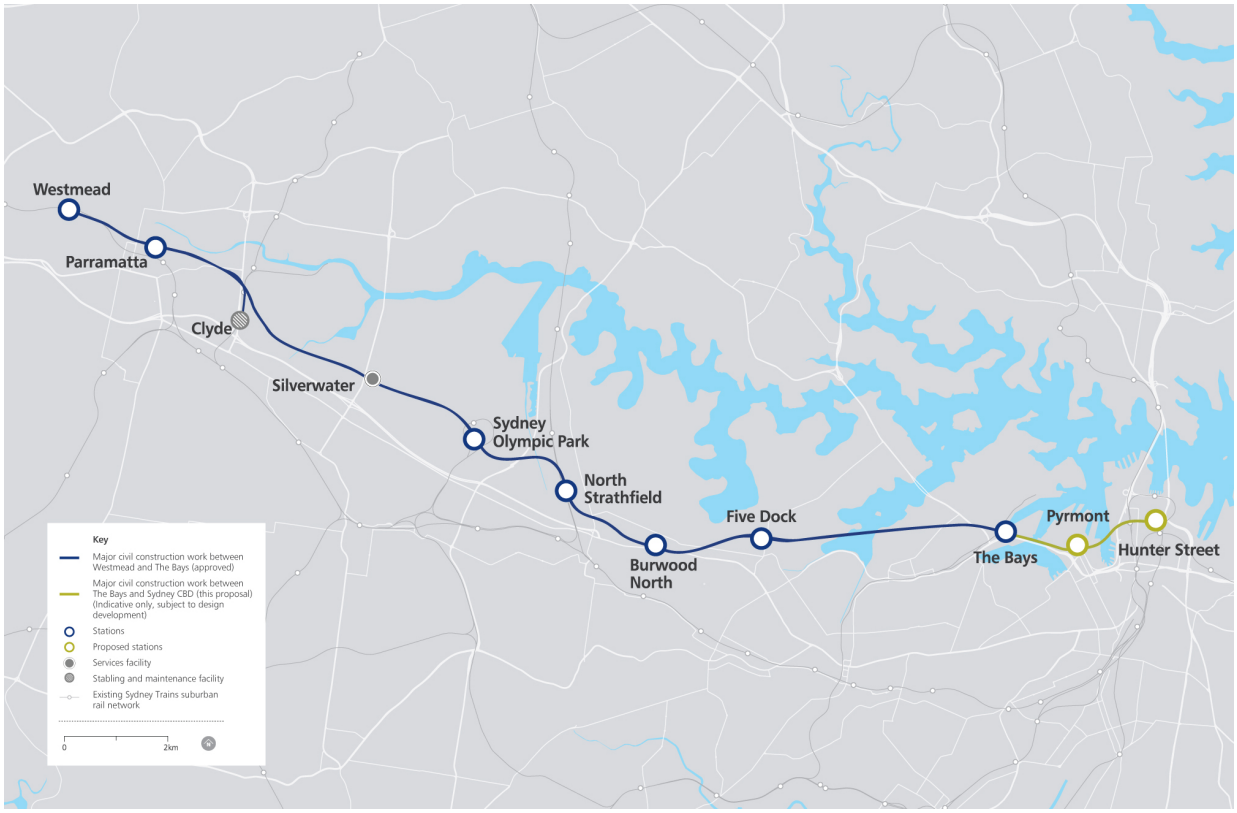

Figure 1-1 Sydney Metro West

The planning process for Sydney Metro West is being assessed as a staged infrastructure application under section 5.20 of the *Environment Planning and Assessment Act 1979* (EP&A Act).

The Sydney Metro West Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process for Sydney Metro West), application number SSI-10038, were approved on 11 March 2021.

The Concept is described in Chapter 6 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) and includes:

- Construction and operation of new passenger rail infrastructure between Westmead and Sydney CBD, including:
  - Tunnels, stations (including surrounding areas) and associated rail facilities
  - Stabling and maintenance facilities (including associated underground and overground connections to tunnels)
- Modification of existing rail infrastructure (including stations and surrounding areas)
- Ancillary development.

Major civil construction work for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval process) is described in Chapter 9 of the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) and includes:

- Tunnel excavation including tunnel support activities between Westmead and The Bays
- Station excavation for new metro stations at Westmead, Parramatta, Sydney Olympic Park, North Strathfield, Burwood North, Five Dock and The Bays
- Shaft excavation for services facilities
- Civil work for the stabling and maintenance facility at Clyde.

Stage 2 of the planning approval process (this proposal) includes all major civil construction work including station excavation and tunnelling between The Bays and Sydney CBD.

Future planning applications for Sydney Metro West will include tunnel fit-out, construction of stations, ancillary facilities and station precincts, and operation and maintenance of the Sydney Metro West line, between Westmead and Sydney CBD. The associated potential impacts are being assessed and will be presented within the Environmental Impact Statement currently being prepared for 'Sydney Metro West - Rail infrastructure, stations, precincts and operations' (Stage 3 of the planning approval process for Sydney Metro West). Sydney Metro West - Rail infrastructure, stations, precincts and operations have been assessed in this assessment only in relation to potential cumulative impacts with this proposal, where relevant.

1.2 Overview of the proposal

This proposal would be located largely underground in twin tunnels. Indicative locations of the proposed alignment and stations are shown in Figure 1-2.

The proposed major civil construction work between The Bays and Sydney CBD would include:

- Enabling work such as demolition, utility supply to construction sites, utility adjustments, and modifications to the existing transport network
- Tunnel excavation including tunnel support activities
- Station excavation for new metro stations at Pyrmont and at Hunter Street, in the Sydney CBD.

Figure 1-2 Overview of Sydney Metro West between The Bays and Sydney CBD

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

The surface construction work at station and shaft excavation sites are intended to occur across a period of about three years.

The proposal is further described in Chapter 5 (Project description) of the Environmental Impact Statement.

The *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a) assessed the impacts of The Bays Station construction site to:

- Carry out the excavation of The Bays Station
- Launch and support two tunnel boring machines for the drive west to the Sydney Olympic Park metro station construction site.

The Bays tunnel launch and support site would cover about 25,000 to 35,000 square metres, within a portion of the approved Sydney Metro West The Bays Station construction site. The area surrounding the site primarily comprises industrial and wharf operations for White Bay and the former White Bay Power Station.

1.3 Purpose and scope of this Technical Paper

This contamination Technical Paper is one of a number of Technical Papers that form part of the Environmental Impact Statement for major civil construction work between The Bays and Sydney CBD. The purpose of this Technical Paper is to identify and assess the potential impacts of the proposal in relation to contamination and other specific geological conditions. It responds directly to the Secretary's Environmental Assessment Requirements outlined in Section 1.3.1.

The objectives of this Technical Paper include:

- Understanding the potential impacts (with respect to contamination) associated with potentially historical and current contaminating activities and/or operations carried out on or surrounding the proposal
- Understanding specific geological conditions (i.e. acid sulfate soils, salinity and erosion potential) within or surrounding the proposal
- Assessing potential cumulative impacts with respect to contamination
- Identifying mitigation measures to manage the identified potential contamination and specific geological condition impacts.

The geographic scope of this Technical Paper (i.e. the study area) is defined in Section 3.2.

1.3.1 Secretary's environmental assessment requirements

The Secretary's Environmental Assessment Requirements were issued on 7 July 2021. The requirements specific to contamination, and where these requirements are assessed in this Technical Paper, are outlined in Table 1-1.

In support of seeking the Secretary's Environmental Assessment Requirements, the *Sydney Metro West Scoping Report – Major civil construction from The Bays to Sydney CBD* (Sydney Metro, 2021) identified a number of investigations and further assessments relevant to this Technical Paper. How the Technical Paper addresses these matters is provided in Table 1-2.

Table 1-1 Secretary's environmental assessment requirements – Soils and Contamination

Secretary's environmental assessment requirements	Where addressed
7. Soils and Contamination	
1. The likelihood of encountering acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Risk Map) (including impacts of acidic runoff offsite) within, and in the area in accordance with the current guidelines and measure to manage where relevant.	Section 4.5.3, Section 5 and Section 6 (likelihood and potential for impacts) Section 7 (management measures)
2. The likelihood of land contamination and identify if remediation of the land is required, having regard to the ecological and human health risks posed by the contamination in the context of past, existing and future land uses. Where assessment and/or remediation is required, the EIS must document how the assessment and/or remediation would be undertaken in accordance with current guidelines.	Section 6 (likelihood of contamination) Section 7 (management measures - how assessment/remediation would be undertaken)

Secretary's environmental assessment requirements	Where addressed
3. Identify whether soil salinity is likely to be an issue and if so, determine the presence, extent and severity of soil salinity within the proposal's area, and assess the impacts of the proposal on soil salinity and how it may affect groundwater resources and hydrology.	Section 4.5.2, Section 5 and Section 6 (likelihood and potential for impacts)

Table 1-2 Investigations and further assessments identified in Scoping Report – Contamination (Sydney Metro, 2021)

Investigations and further assessments	How addressed
Contamination	
Review of previous contamination assessments (where available)	Section 4.10.5
Review of historical aerial photography and plans to identify potential contamination sources along and/or adjacent to the proposed construction sites	Section 4.10.1
Review of publicly available data (web-based information searches)	Section 4.10
A site inspection to identify potential contamination sources and verify those potential areas of concern identified in the review of historical and available information	Section 4.9
An assessment of potential contamination risk based on the potential impacts to the construction of the project and also risks via exposure to environmental and human health receptors	Sections 5 and 6
Recommendations for additional investigations and/or management of potentially contaminated sites which could be encountered during construction	Section 7

1.4 Structure of this Technical Paper

The structure of this Technical Paper is outlined below:

- Chapter 1 (this chapter) introduces this proposal
- Chapter 2 presents relevant legislative and policy context to this proposal
- Chapter 3 documents the assessment methodology for this assessment
- Chapter 4 details the existing contamination environment
- Chapter 5 presents the findings of the contamination investigation
- Chapter 6 provides an assessment of the potential impacts to this proposal from contamination identified as part of this investigation
- Chapter 7 identifies mitigation and management measures.

2 Legislative and policy context

In preparing this Technical Paper, the following legislation, policies and guidelines were considered (where relevant):

- *Environmental Planning and Assessment Act 1979*
- *Acid Sulfate Soils Assessment Guidelines* (Acid Sulfate Soils Management Advisory Committee, 1998)
- *Acid Sulfate Soils Assessment Guidelines* (Department of Planning, 2008)
- National Environment Protection (Assessment of Site Contamination) Measure 1999 (as revised 2013)
- *PFAS National Environmental Management Plan* (Heads of Environment Protection Authorities, January 2020)
- *Contamination Land Management Act 1997* (New South Wales Environment Protection Authority, 1997)
- *Protection of the Environment Operations Act 1997* (New South Wales Environment Protection Authority, 1997)
- Protection of the Environment Operations (Waste) Regulation 2014 (New South Wales Environment Protection Authority, 2014)
- *Guidelines for Consultants Reporting on Contaminated Sites* (New South Wales Environment Protection Authority (Environment Protection Authority), 2020)
- *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and EPA, 1998)
- *Site Investigations for Urban Salinity* (Department of Land and Water Conservation, 2002)
- *Urban salinity – causes and impacts* (Department of Industry and Investment, 2009)
- *Soil and Landscape Issues in Environmental Impact Assessment* (Department of Land, Water and Conservation, 2000).

Should further investigations, remediation work and validation be required, these activities would be carried out in accordance with the following guidelines or other appropriate/endorsed guidelines available at that time:

- Australian Standard (AS 4482.1-2005) Guide to the sampling and investigation of potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds
- Australian Standard (AS 4482.2-1999) Guide to the sampling and investigation of potentially contaminated soils – Volatile substances
- *Acid Sulfate Soils Manual* (Acid Sulfate Soils Management Advisory Committee, 1998)
- *Managing asbestos in or on soil* (WorkCover NSW, 2014). [Online] Available at: http://www.safework.nsw.gov.au/__data/assets/pdf_file/0005/329171/Managing-asbestos-in-soil-guide.pdf

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2018)
- Guidelines made or approved under section 105 of the *Contaminated Land Management Act* 1997, including:
  - *Contaminated Sites: Sampling Design Guidelines* (Environment Protection Authority, 1995)
  - *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (3rd Edition)* (Environment Protection Authority, 2017)
  - *Contaminated Sites: Guidelines for the Assessment and Management of Groundwater Contamination* (Department for Environment and Conservation, 2007)
  - *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (Environment Protection Authority, 2015)
- *Guidelines for the Implementing the Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008* (Department of Environment, Climate Change and Water, 2009)
- *Technical Note: Investigation of Service Station Sites* (Environment Protection Authority, 2014)
- *Technical Note: Light Non-Aqueous Phase Liquid Assessment and Remediation* (EPA, 2015)
- *Information for the assessment of former gasworks sites* (Department for Environment and Conservation, 2005)
- *Vapour Intrusion: Technical Practice Note* (Department of Environment, Climate Change and Water, 2010)
- *Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (Environment Protection Authority, 2012)
- *Best Practice Note: Landfarming* (Environment Protection Authority, 2014)
- *Waste Classification Guidelines* (Environment Protection Authority, 2014)
- *Addendum to Waste Classification Guidelines (2014)* – Part 1: classifying waste (Environment Protection Authority, 2016)
- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004)
- *Managing Urban Stormwater: Soils and Construction Volume 2* (DECC, 2008)
- *National Acid Sulfate Soils Guidance: Guidance for the dewatering of acid sulfate soils in shallow groundwater environments* (Shand et al. for Department of Agriculture and Water Resources, 2018).

3 Assessment methodology

3.1 Overview

The methodology for this contamination investigation is outlined in the following sections and has included:

- Desktop review of available information sources and observations from site inspections to understand the existing environment, specific geological conditions (i.e. acid sulfate soils, salinity and erosion potential) and potential for contamination within the study area
- A high level prioritisation exercise including identification of areas of environmental interest (with respect to contamination or specific geological conditions) and assessment of potential impacts (assuming no mitigation measures) in the context of proposed construction activities
- Identification of appropriate mitigation and management responses for contamination or specific geological conditions, or where further investigation or remediation may be required.

3.2 Study area

To account for potential soil, groundwater and vapour contamination that may be present as a result of historic and/or current activities carried out on and/or next to the construction sites and alignment, and understand specific geological conditions that may impact upon the proposal, the study area for this investigation is defined as follows:

- The tunnel alignment between The Bays and Sydney CBD (as shown on Figure 3-1), and surrounding land within about 500 metres either side of the tunnel alignment
- The Pyrmont Station power supply route and land within about 500 metres of the power supply route
- The construction sites and surrounding land within about 500 metres of the construction sites
- With respect to per-and poly-fluoroalkyl substances (PFAS), the construction sites, power supply routes and tunnel alignment and surrounding land within one kilometre of the respective construction elements. The wider study area adopted for PFAS is due to its highly mobile and persistent nature in the environment.

Tunnel boring machines would be used to excavate twin tunnels with centre lines typically about 14 metres apart. The tunnel alignment is shown in Figure 3-1. The depth of the tunnels would vary from about 15 metres to 50 metres deep due to changes in the topography. The shallower tunnel sections would generally be near the stations. The tunnels would be lined with pre-cast concrete segments to ensure the long term life of the asset and minimise groundwater inflow into the tunnel.

The construction sites considered in this assessment are shown in Figure 3-2 and Figure 3-3. Excavation would occur at each site to facilitate the construction of the tunnel and future stations. Following the completion of excavation, construction of future stations and associated infrastructure would be subject to a separate assessment and approval process. Pyrmont Station power supply route is shown in Figure 3-4.

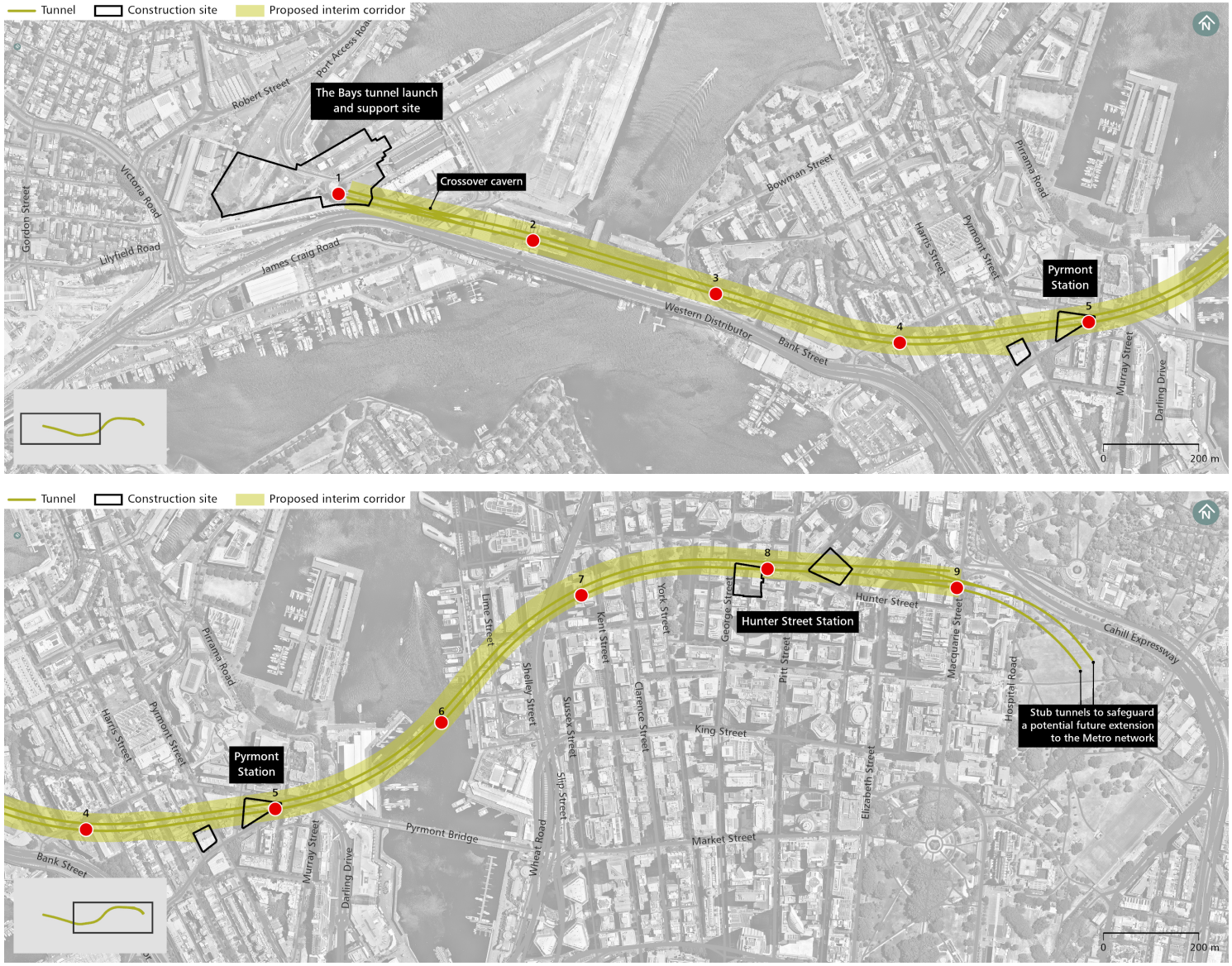

Figure 3-1 Indicative tunnel alignment

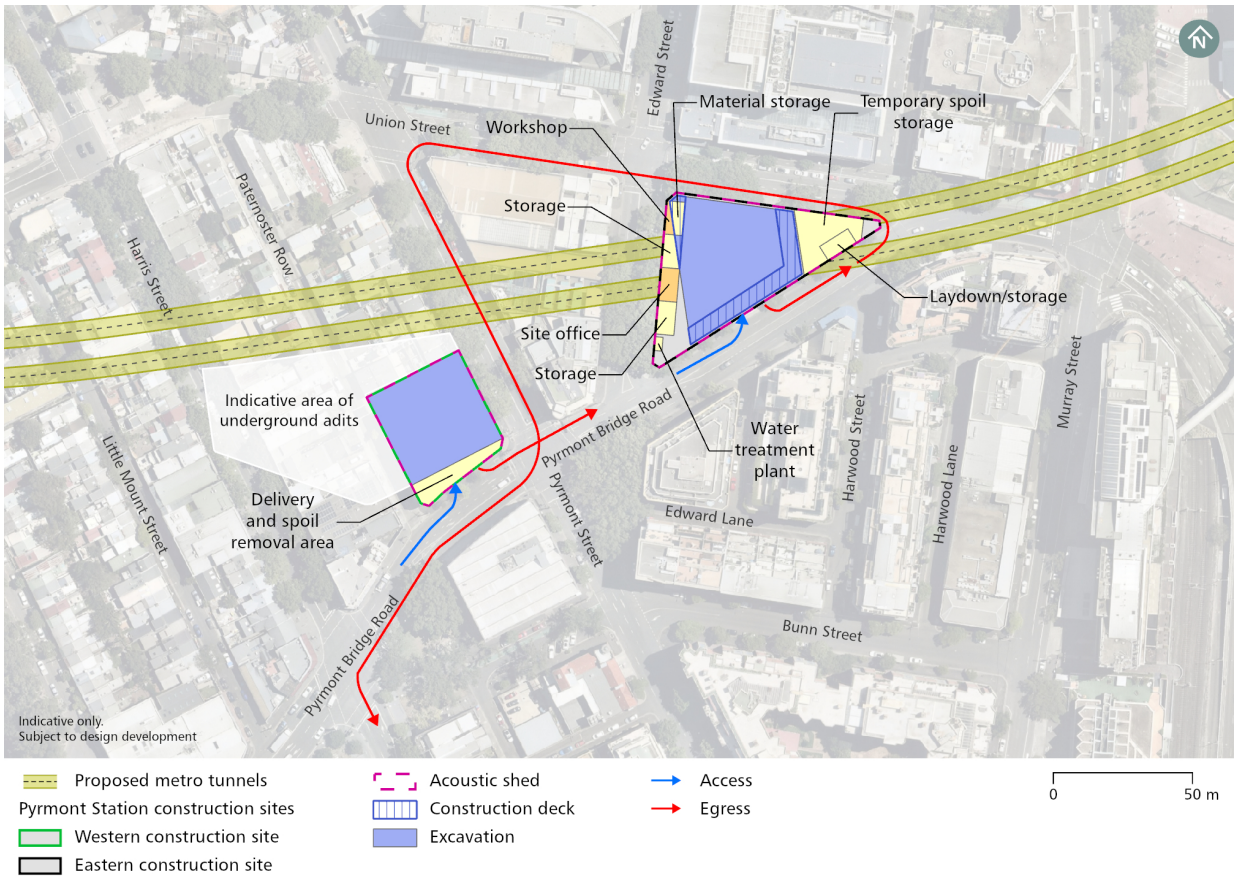

Figure 3-2 Pyrmont Station construction sites

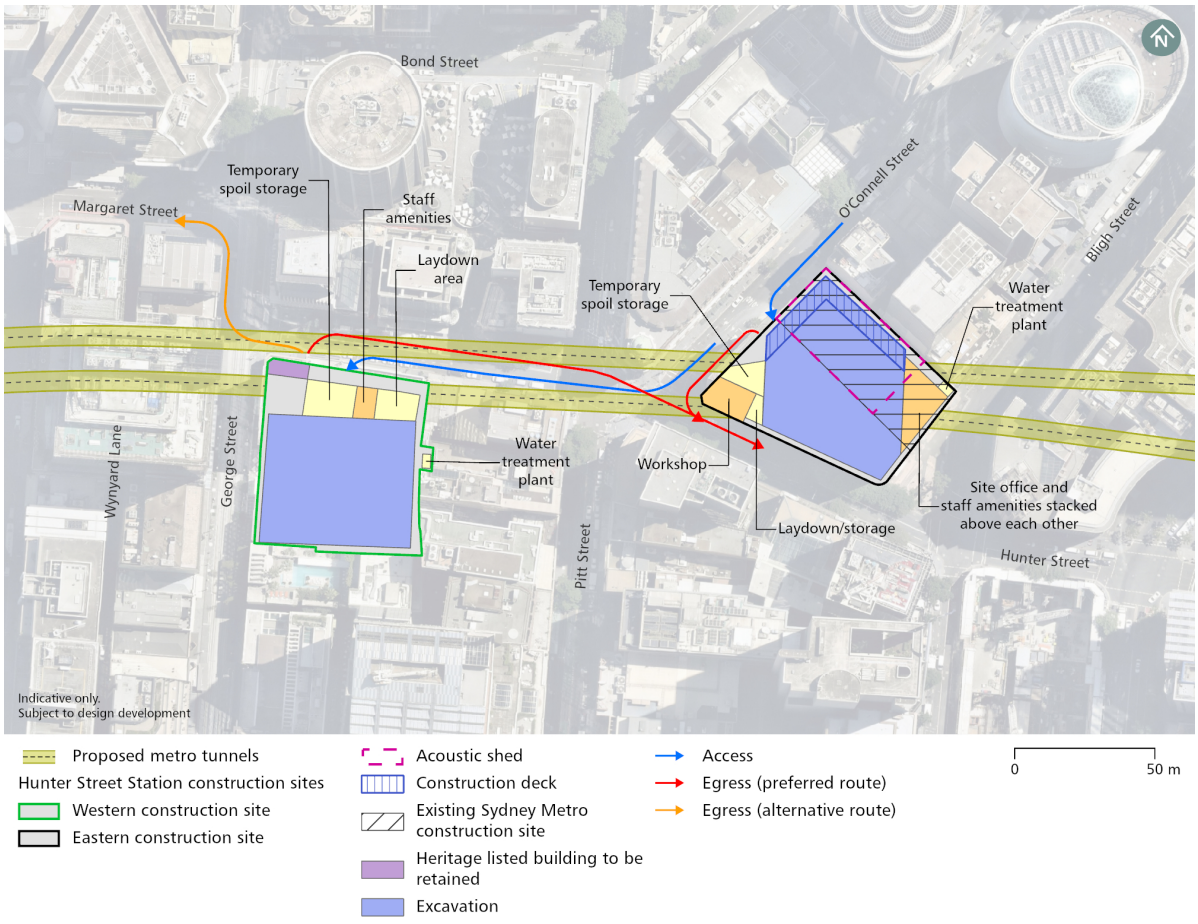

Figure 3-3 Hunter Street Station construction sites

Figure 3-4 Pyrmont Station power supply route

3.3 Desktop review

The desktop assessment involved a review of available information relevant to the study areas to understand the existing environment, the potential risk for contamination and the potential impacts of this proposal. The review of information included:

- Review of existing information on land use, topography, drainage, geology, soils, hydrogeology and receiving environments in the study area. This included the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Australian Soil Resource Information System database and the WaterNSW groundwater database
- Review of historical aerial photographs (1943, 1955, 1970, 1989, 1994 and 2005), and available recent aerial imagery services (GoogleEarth and SIX Maps)
- Review of publicly available information via general internet searches for the key words (contamination, remediation, PFAS and site investigation) for suburbs and major projects within and adjoining the study areas
- Review of publicly available information from the NSW Environment Protection Authority (EPA) including:
  - NSW EPA Contaminated Sites Record of Notices (under section 58 of the *Contaminated Land Management Act 1997*) and the list of contaminated sites notified to the NSW EPA (under section 60 of the *Contaminated Land Management Act 1997*) to identify sites that have been notified, regulated or formerly regulated by the EPA due to the presence of contamination or notified to the EPA as potentially contaminated sites
  - NSW EPA public register for sites that hold a current Environment Protection Licence (EPL) under section 308 of the *Protection of the Environment Operations Act 1997* (POEO Act)
- Review of previous contamination investigation reports provided by Sydney Metro including:
  - Golder & Douglas Partners (2020a). *Sydney Metro West Geotechnical Investigation, Factual Contamination Assessment Report*, 1791865-002-R-CAR-Rev0, 6 May 2020
  - Golder Associates & Douglas Partners (2018). *Sydney Metro West Geotechnical Investigation Groundwater Monitoring Report*, 16 October 2018
  - Golder & Douglas Partners (2021). *Sydney Metro West Geotechnical Investigation, Groundwater Monitoring Report – Stage 2 Locations, 1791865-023-R-GWM-Stage 2 Rev 0, 26 February 2021*
  - Golder Associates & Douglas Partners (2020b). *Sydney Metro West Contamination Assessment Report, The Bays Precinct, Stage 1 Early Works Package, White Bay, Rozelle, NSW, 26 June 2020*
  - Golder Associates & Douglas Partners (2017). *Sydney Metro City and Southwest Geotechnical Investigation, Contamination Assessment Report - Tunnels and Station Excavations (TSE), Chatswood to Sydenham, NSW, 20 January 2017*
  - Senversa (2021). *Factual Contamination Investigation Report – The Bays, Sydney Metro West, White Bay Site Investigation, 21 May 2021*

- Review of publicly available contamination investigation reports including:
  - Roads and Maritime Services (2016). *Rozelle Rail Yards – Site Management Works, Review of Environmental Factors*
  - JBS&G (2015) for UrbanGrowth NSW. *Site Wide Remedial Concept Plan. The Bays Precinct Urban Transformation Area* (4 December 2015)
  - Ramboll (2020) for Infrastructure NSW. *Site Audit Report Revised Remedial Action Plan, The New Sydney Fish Market* (13 August 2020).

3.4 Site inspections

The construction sites, including the Pyrmont Station power supply route, nearby land uses and potential areas of environmental interest (with respect to contamination) were visually inspected on 17 May 2021. These inspections were conducted from publicly accessible areas.

3.5 High-level prioritisation exercise

A high-level prioritisation exercise was carried out to assist in assessing the potential impact from construction to expose specific geological conditions or contamination to human and/or ecological receptors. The exercise considered source-pathway-receptor relationships consistent with a conceptual site model as defined by the National Environment Protection (Assessment of Site Contamination) Measure 1999, as revised 2013 (NEPM, 2013). The prioritisation exercise considered the following:

Contamination severity and extent

- Known or potential sources of contamination and likely potential contaminants of concern, or known or potential locations of acid sulfate soils, salinity or high erosion potential
- The type of potentially contaminated media (soil, sediment, groundwater, surface water, indoor and ambient air)
- Approximate spatial distribution of potential contamination and specific geological conditions, and proximity to construction sites and the alignment (e.g. within the construction site, above the tunnel alignment, etc.)
- The nature of construction activities proposed (e.g. surface disturbance, excavation, tunnelling at depth) and whether such activities would expose known or potential areas of contamination or specific geological conditions.

Pathways and receptors

- Assessment of potential pathways from a contamination source to a receptor, assuming an absence of mitigation measures. Proposed activities that have the potential to disturb contamination were considered to include dust generation, vapour/gas emissions, excavation and disposal or reuse of soils, extraction and disposal or reuse of groundwater from dewatering or drainage, as well as contamination migration pathways such as migration of groundwater via preferential pathways and surface water erosion. Exposure pathways to receptors (see next dot point) were considered to include direct dermal contact (der), ingestion (ing) or inhalation (inh) by human receptors and uptake by aquatic flora and intake by aquatic fauna. It was assumed that where construction activities would expose known or potential areas of contamination, the exposure pathways to construction workers could be complete. Where construction activities are located within and/or adjacent to sensitive environmental receptors, pathways could exist as a result of uncontrolled site discharges during construction. In the context of potential acid sulfate soils, proposed activities that have the potential to either disturb soil or oxidise acid sulfate

soil were considered. The classification of acid sulfate soil risk maps and framework for assessing whether work would potentially result in an impact as outlined in the *Acid Sulfate Soils Management Advisory Committee (ASSMAC) Assessment Guidelines 1998* (ASSMAC, 1998) were used for the pathway and receptor assessment

- Potential human and ecological receptors (including location, and potential for primary or secondary contact with contamination). Potential receptors were considered to comprise project construction workers and visitors, the general public and nearby residents and commercial workers in the surrounding land use, intrusive maintenance workers, receiving water bodies and ecological receptors. Exposure pathways to these receptors were considered to include direct dermal contact (der), ingestion (ing) or inhalation (inh) by human receptors and uptake by aquatic flora and intake by aquatic fauna.

Based on this prioritisation exercise, sites were categorised into five categories of contamination potential (very low, low, moderate, high and very high) representing potential impacts to receptors as a result of construction without mitigation measures. The matrix used for categorising potential impacts as a result of construction is provided in Table 3-1.

The categories of potential contamination impacts to construction represent a qualitative assessment. Although not definitive, examples of the contamination status represented by the categories is provided below:

- Very low to low impact – Could represent smaller volumes of contaminated materials, likely to be limited to surface soils, with pathways readily managed with typical soil and water controls and personnel protective equipment, and readily remediated by standard construction methods
- Moderate impact – Could represent larger volumes of contaminated materials, with pathways readily managed with typical soil and water controls and personal protective equipment and readily remediated by standard construction methods or smaller volumes of more complex contamination which may require specialised remediation methods and specialised management measures
- High to very high impact – Could represent more significant exposure risks, contaminated groundwater and gas/vapours, increased quantum of contaminated materials and wider contamination extent requiring remediation and specialised remediation methods. May require specialised management measures to mitigate exposure pathways to receptors for example, positive pressure tents and odour control.

Table 3-1 Contamination potential matrix

	Exposure pathways to receptors	Contamination severity and extent				
		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	**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	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	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	Moderate	Moderate	High	High	Very high

4 Existing environment

4.1 Overview

The existing environment throughout the study area is detailed in this Section. The existing environment sections have been assessed in the context of the study area for the tunnel alignment and construction sites, where construction activities could potentially affect environmental conditions.

The tunnel alignment would extend from the eastern edge of The Bays Station box through to the end of the turnback and stub tunnel in the Sydney CBD (see Figure 3-3).

The Bays Station construction site is being established under the existing approval (Stage 1 of the planning approval process). A description of the existing environment as it relates to contamination is included within the *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a).

This contamination environment has been altered due to the existing construction work for The Bays Road Relocation Project for Sydney Metro West. Following conclusion of The Bays Road Relocation work, The Bays Station construction site (under the existing Stage 1 approval) will be established. Aspects of the existing surrounding environmental setting of The Bays tunnel launch and support site are considered to remain consistent with the previous assessment (Sydney Metro, 2020a). Establishment of The Bays Station construction site under Stage 1 of the approval process will alter the existing environment at the site through excavation of the station box and establishment of construction site surfaces suitable for commencement of tunnel launch activities. This is further described in Section 4.11.

4.2 Land use zones

Land use zones within and adjoining the proposal tunnel alignment, power supply routes and construction sites are listed in Table 4-1. A number of current land use zones (based on permitted land use with or without consent) may represent a higher contamination risk and are present within the study area, as identified in bold text.

Table 4-1 Land use zones within the study area

Location	Applicable instrument	Land use zones (higher risk with respect to contamination potential are shown in bold)
Tunnel Alignment – The Bays to Pyrmont	*Leichhardt Local Environment Plan 2013*	B1 – Neighbourhood centre
		B2 – Local Centre
		IN2 – Light Industrial
		R1 – General Residential
		RE1 – Public Recreation
		SP2 – Infrastructure (Education, place of public worship, classified road, electricity supply)
	Sydney Local Environment Plan 2012	B2 – Local Centre
		B3 – Commercial Core
		B4 – Mixed Use

Location	Applicable instrument	Land use zones (higher risk with respect to contamination potential are shown in bold)
		R1 – General Residential
		RE1 – Public Recreation
		SP2 – Infrastructure (Railways, classified road)
	Sydney Regional Environmental Plan No. 26 – City West	**Port and Employment**
	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005	**W1 – Maritime Waters**
Tunnel Alignment – Pyrmont to Sydney CBD	*Sydney Local Environment Plan 2012*	B2 – Local Centre
		B3 – Commercial Core
		B4 – Mixed Use
		B8 – Metropolitan Centre
		R1 – General Residential
		RE1 – Public Recreation
		SP2 – Infrastructure (Railways, classified road, boating facilities)
	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005	**W1 – Maritime Waters**
Pyrmont Station power supply route	*Sydney Local Environment Plan 2012*	B2 – Local Centre
		B3 – Commercial Core
		B4 – Mixed Use
		R1 – General Residential
		RE1 – Public Recreation
		SP2 – Infrastructure (Railways, classified road)
	Sydney Regional Environmental Plan No. 26 – City West	**Port and Employment**
	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005	**W1 – Maritime Waters**
Pyrmont Station construction sites	*Sydney Local Environment Plan 2012*	B2 – Local Centre
		B3 – Commercial Core
		B4 – Mixed Use
		R1 – General Residential
		RE1 – Public Recreation
		SP2 – Infrastructure (Railways, classified road)
	Sydney Regional Environmental Plan No. 26 – City West	**Port and Employment**

Location	Applicable instrument	Land use zones (higher risk with respect to contamination potential are shown in bold)
	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005	**W1 – Maritime Waters**
Hunter Street Station (Sydney CBD) construction sites	*Sydney Local Environment Plan 2012*	B8 – Metropolitan Centre
		RE1 – Public Recreation
		SP2 – Infrastructure (Railways, classified road, boating facilities)
	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005	**W1 – Maritime Waters**

4.3 Topography

The elevation varies across the study area. Based on the use of *Google Earth*, the gradient of land is characterised by generally gentle undulating to flat topography, between about five to 20 metres Australian Height Datum (AHD).

At the Pyrmont Station construction sites the topography slopes gently to the east from about 18 to 13 metres AHD.

At the Hunter Street Station (Sydney CBD) construction sites the topography is generally around 15 metres AHD.

The general topography and depth of the proposed tunnel alignment is provided in Figure 4-1 and Figure 4-2.

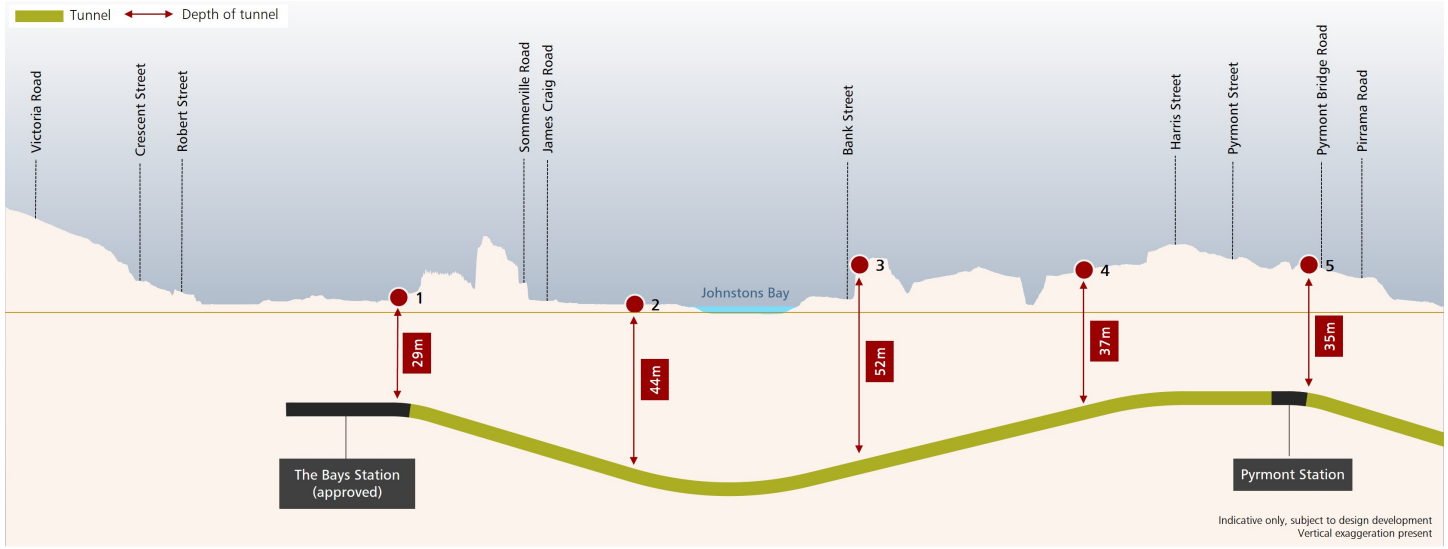

Figure 4-1 Indicative tunnel alignment plan and topography (western section)

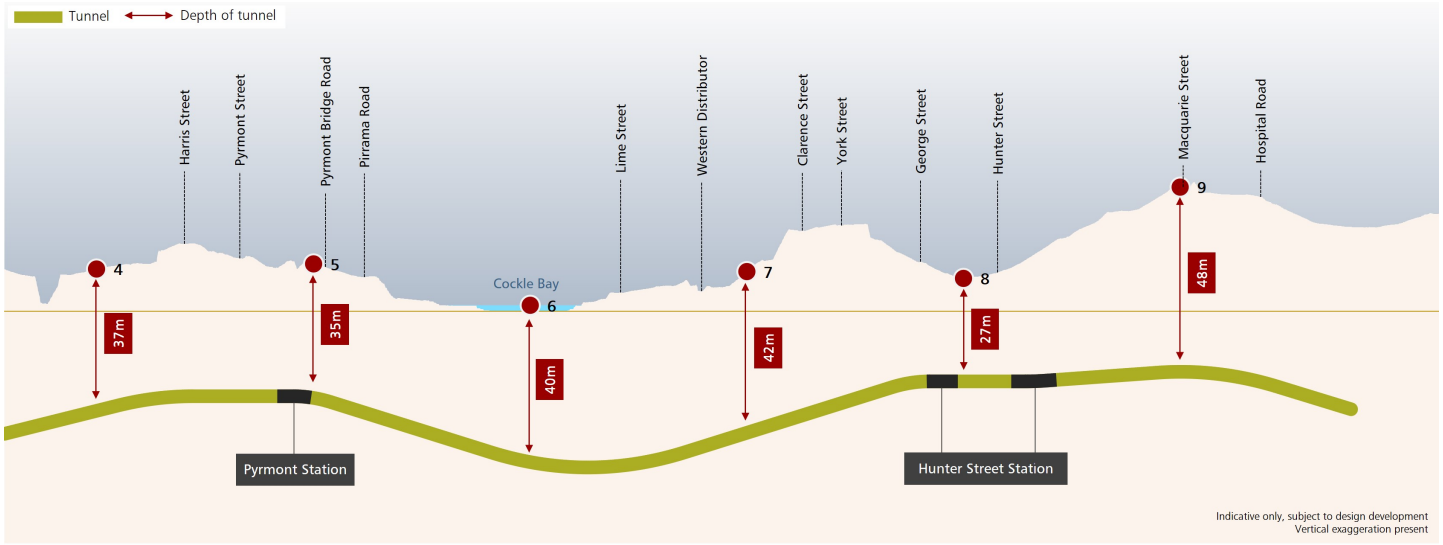

Figure 4-2 Indicative tunnel alignment plan and topography (eastern section)

4.4 Geology

4.4.1 Geology units

Table 4-2 identifies the geological units underlying and adjacent to the proposal. This is based on a review of the Geological Survey of New South Wales Seamless Geology data (available via MinView (NSW Government, 2021). Figure 4-3 illustrates the geological units relative to the proposal.

Table 4-2 Geological units within the study area

Unit	Description
Fill	Typically comprising waste, emplaced material and engineered fill. In general, a thin layer of fill (less than one metre thick) is commonly encountered in urban areas and is associated with minor modifications to the topography, landscaping and pavement construction. Such fill can be highly variable in composition and consistency. Thicker deposits of fill are expected towards the mouths of the infilled channels, associated with land reclamation generally located near waterways/harbours, stream capture and urban development (including parkland, residential, industrial, and open space areas) in these areas. Significant infilled areas are present surrounding White Bay, Blackwattle Bay and Darling Harbour. Fill has been identified during previous site investigations near the surface at The Bays and Pyrmont Station construction sites (Golder-Douglas, 2020a).
Quaternary deposits	Alluvial and marine sediments. Undifferentiated, Holocene- and Pleistocene-age alluvial, estuarine and marine sediments have been deposited in gullies, valleys, and former drainage channels. These sediments comprise interbedded sands and clays with discontinuous “inter-fingered” lenses of the same material. Pleistocene-age, marine sediments comprise typically clayey sediments with intermittent sand lenses.
Hawkesbury Sandstone	Triassic medium to coarse-grained quartz sandstone. It generally has a shallow weathering profile, but possesses increased defects in zones of faulting, shear and valley stress relief. The Middle-Triassic Hawkesbury Sandstone was deposited in a fluvial paleo-environment, likely to have been a braided river setting, and as such it is highly stratified. It is ubiquitous across the Sydney Basin and is up to around 300 metres thick. Hawkesbury Sandstone is often described as a medium to coarse grained and consists of three main depositional environments: massive sandstone facies, cross-bedded or sheet facies, and shale/siltstone interbedded facies. Hawkesbury Sandstone is the surface geology present at the Pyrmont Station and Hunter Street Station (Sydney CBD) construction sites.

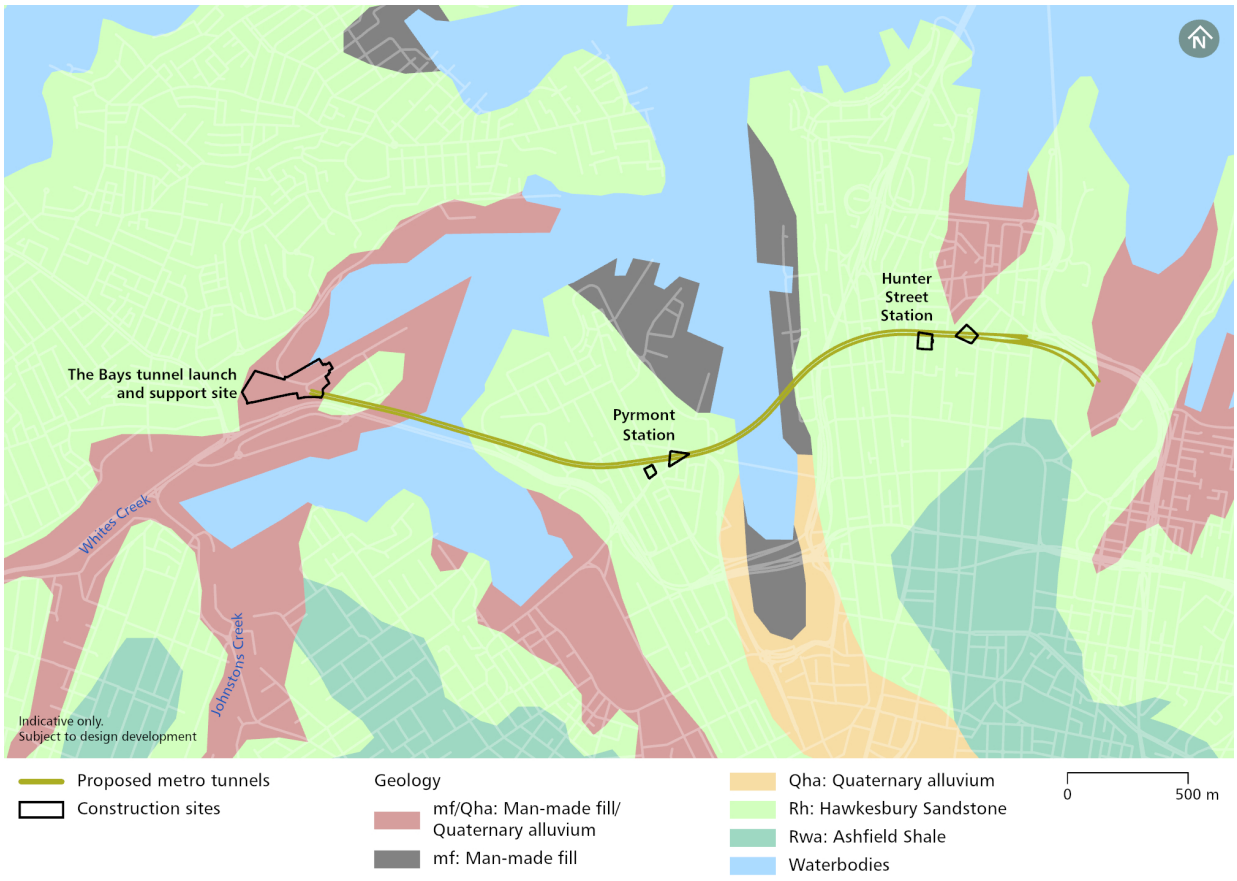

Figure 4-3 Geology within the study area

4.4.2 Structural geology

The rock structures in the Hawkesbury Sandstone typically include:

- Sub-horizontal bedding
- Sub-vertical jointing or joint swarms
- Decomposed zones/seams
- Crushed zones/seams and shear zones
- Sub-vertical igneous intrusions (dykes) and associated jointing
- Buried valleys (palaeovalleys).

Both identified and inferred major sub-vertical faults, and identified dykes, are discussed further in Technical Paper 7 (Hydrogeology). Rock permeability may be higher in the vicinity of faults and therefore result in potentially higher groundwater inflows to excavations in their vicinity. Fault zones generally present as joint swarms or brecciated zones. These structural features have been recorded at numerous locations within the Sydney Basin and are generally continuous, mappable and relatively predictable, although not always uniformly linear across the Sydney region.

Faults and joints can act as conduits to groundwater flow; however, faults may also act as barriers to groundwater flow. Increased groundwater inflows may be experienced during excavation where faults act as conduits to flow, with consequent depressurisation of the unit in

the vicinity of the excavation. Excavation itself can enhance the inherent permeability of joints or brecciated zones through stress relief and dilation.

The occurrence of infilled palaeochannels or palaeovalleys is generally limited to harbour areas and drainage channels in their vicinity. Experience from previous tunnel projects in Sydney indicates that identification of palaeovalleys is critical to tunnel design, because the rock mass beneath palaeovalleys is often more structurally complex, and rock permeability may be locally high due to valley stress relief and/or the presence of faults and dykes. Palaeovalley geometry along the alignment is variable and generally increases in width and depth towards the palaeovalley axes.

Further detail is available in Section 4 of Technical Paper 7 (Hydrogeology).

4.5 Soils

4.5.1 Soil landscapes

Soils within the study area have been identified from the NSW Department of Environment, *Climate Change and Water's Soil Landscapes of Sydney 1:100,000 Sheet* (Chapman et al., 2009). The characteristics of the major soil types identified along the alignment are summarised in Table 4-3 and shown in Figure 4-4.

The soil landscape sheets indicate that the following soil landscape types are present within the study area (within and adjacent to the construction sites and the alignment):

- Residual soils associated with the Gymea and Lucas Heights soil landscapes – These are derived from weathered siltstone and sandstone rock, except where formed by erosion. The residual soils derived from shale typically comprise stiff to hard clay of medium to high plasticity, gravelly clay, sandy clay and silt. The residual soils derived from sandstone typically comprise thin (less than 1.5 metres thick) medium plasticity silty clay to sandy clay
- Alluvial/fluvial soils associated with the Deep Creek soil landscape
- Disturbed terrain.

Table 4-3 Soil landscape characteristics within the study area

Soil unit	Description	Location
Deep Creek	• Landscape: level to gently undulating alluvial floodplain draining the Hawkesbury Sandstone. Slopes are typically less than three per cent and local reliefs of less than five metres • Soils: deep (greater than 200 centimetres) • Limitations: flooding, extreme soil erosion hazard, sedimentation hazard, localised very low fertility and permanently high water tables	• Within 500 metres of Pyrmont Station construction sites

Soil unit	Description	Location
Disturbed Terrain	• Landscape: 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 • Soils: 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 • Limitations: low fertility, low wet strength, low availability water capability, high permeability, localised toxicity/acidity and/or alkalinity, potential mass movement hazard	• Within The Bays tunnel launch and support site and surrounding area • Within 100 metres of the Pyrmont Station eastern construction site and 200 metres of the Pyrmont Station western construction site • Within 100 metres of the Hunter Street Station construction sites
Gymea	• Landscape: found on undulating to rolling rises and low hills on Hawkesbury Sandstone, with slopes between 10 per cent and 25 per cent and local relief up to 80 metres • Soils: shallow to moderately deep (30 centimetres to 100 centimetres) • Limitations: localised steep slopes, high soil erosion hazards, shallow highly permeable soil and very low soil fertility	• Within 500 metres of The Bays tunnel launch and support site • Within Pyrmont Station construction sites and the surrounding study area • Within Hunter Street Station (Sydney CBD) construction sites the surrounding study area
Lucas Heights	• Landscape: gently undulating crests and ridges on plateau surfaces of the Mittagong Formation, with slopes of less than 10 per cent and local relief of 30 metres. • Soils: moderately deep (50 centimetres to 150 centimetres) • Limitations: stony soil, low soil fertility, low available water capacity	• Within 500 metres of the Hunter Street Station (Sydney CBD) construction sites

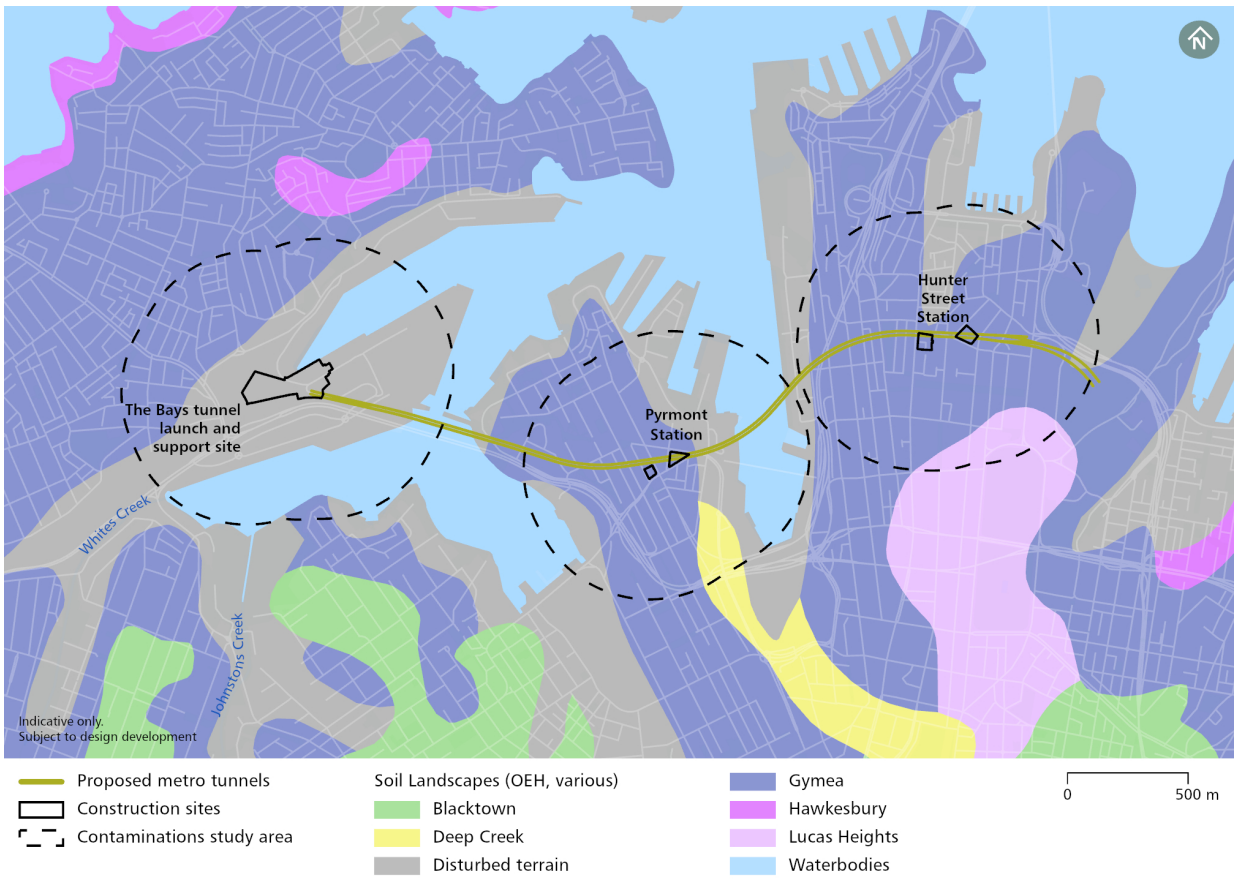

Figure 4-4 Soil landscapes within the study area

4.5.2 Salinity potential

A review of the *Salinity hazard report for Catchment Action Plan upgrade – Sydney Metropolitan CMA* (Winkler et al, 2012) was carried out to identify areas where salinity may be present within the study area. This mapping identifies that there is a very high salinity hazard where potential acid sulfate soils are mapped.

Other lithologies that may represent a salinity hazard have not been identified in the study area for the proposal.

4.5.3 Potential acid sulfate soils

A preliminary site analysis was carried out in accordance with the *Acid Sulfate Soil Assessment Guidelines* (ASSMAC, 1998), including a review of risk maps to identify the probability of acid sulfate soils being present. Acid sulfate soils risk maps compiled by CSIRO and Department of Planning, Industry and Environment were reviewed.

Department of Planning, Industry and Environment mapping (2021) identifies the extent of acid sulfate soils based on the likelihood of acid sulfate soils being present in particular areas and at certain depths. These are shown in Figure 4-5. The classifications indicate the type of work that may present an environmental risk due to the probability of acid sulfate soils being present. A review of this database indicates that:

- Acid sulfate soils are likely to be found on and below the natural ground surface on the eastern side of Johnstons Bay, eastern side of Pyrmont Bay (including part of the Pyrmont Station eastern construction site) and eastern side of Darling Harbour (Class 1). For Class 1, any work may present a risk due to the potential presence of acid sulfate soil

- Acid sulfate soils are likely to be found below the natural ground surface to the south of the study area along Darling Harbour and Johnstons Bay (Class 2). For Class 2, work below the natural ground surface or work involving lowering of the watertable may present a risk
- Acid sulfate soils are not typically found in other areas of the tunnel alignment (Class 5). For Class 5, work that may present a risk are those '*within 500 metres of adjacent Class 1, 2, 3, or 4 land which are likely to lower the watertable below 1 metre AHD on adjacent Class 1, 2, 3 or 4 land*' (ASSMAC, 1998)
- No areas are identified as Class 3 or Class 4 (i.e. where acid sulfate soils are likely to be found beyond one or two metres below the natural ground surface).

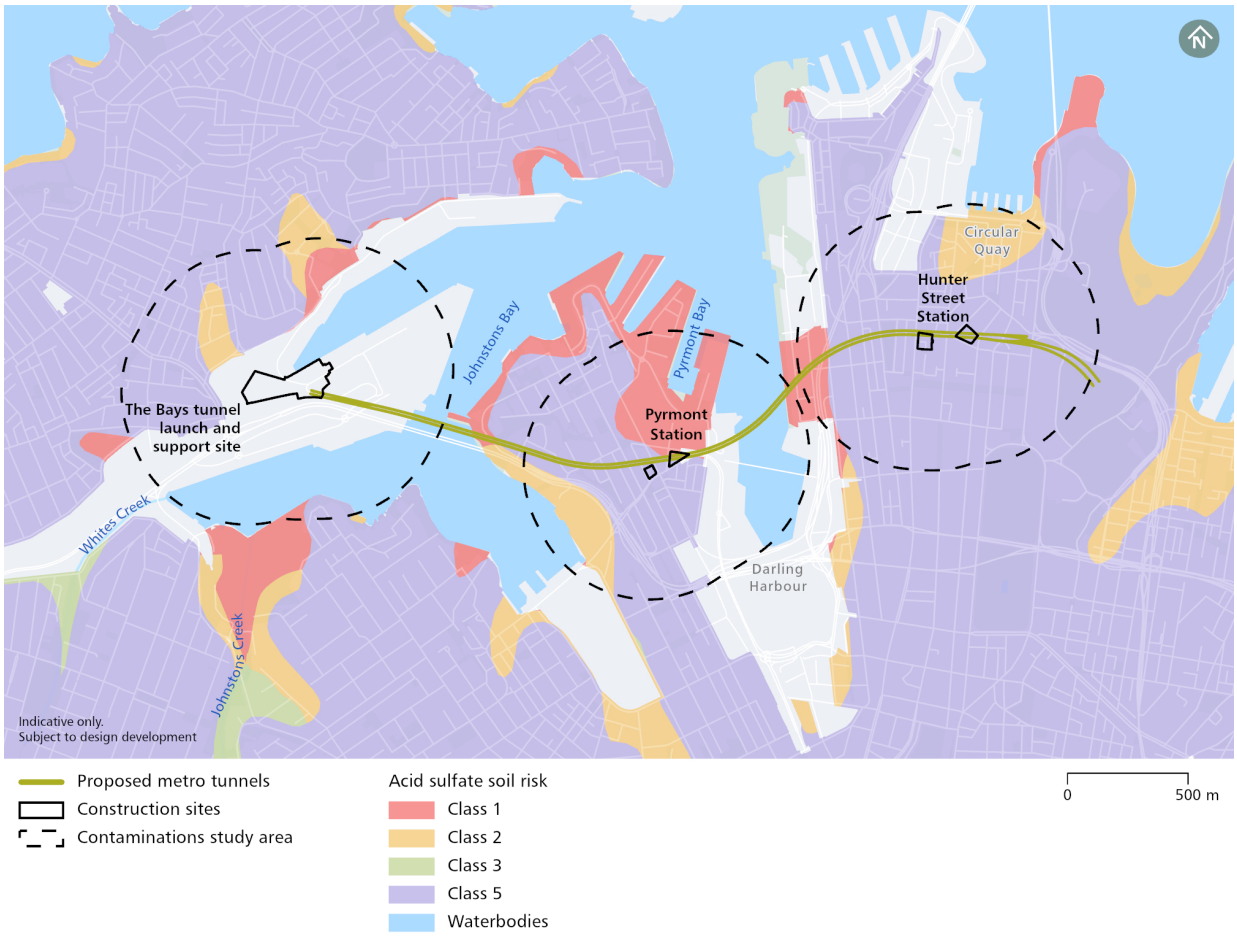

Figure 4-5 Acid sulfate soil risk areas within the study area (DPIE, 2021)

Acid sulfate soils risk maps compiled by CSIRO provide a broad-scale indication of the areas where acid sulfate soils is mostly likely to exist. A review of the Australian Soil Resource Information System (CSIRO, 2021) indicates the following:

- Land surrounding White Bay, Blackwattle Bay, Barangaroo and Pyrmont Bay has a low probability of acid sulfate soils occurrence with unknown confidence
- Within The Bays, there is a high probability of acid sulfate soils with unknown confidence
- In Pyrmont, there is a low probability of acid sulfate soils occurrence with very low confidence
- On the eastern side of Darling Harbour there is an extremely low probability of acid sulfate soils occurrence, with very low confidence.

Testing for the presence of potential or actual acid sulfate soils was completed as part of site investigations carried out by Sydney Metro. Acid sulfate soils were identified as present in underlying natural soils within and surrounding The Bays tunnel launch and support site. Generally, this is most likely deeper than two metres below ground level, and below the level of tidal groundwater fluctuation (Golder-Douglas, 2020a; Golder-Douglas, 2020b; Senversa, 2021). Acid sulfate soils are unlikely to be present in near surface soils (Golder-Douglas, 2020b) in this location.

Disturbance of potential acid sulfate soils at depth during tunnelling work, at the Pyrmont Station western construction site or at the Hunter Street Station (Sydney CBD) construction sites is considered unlikely. Potential acid sulfate soils may be encountered during near surface work at the Pyrmont Station eastern construction site.

4.6 Hydrogeology

4.6.1 Groundwater levels

Technical Paper 7 (Hydrogeology) includes detailed information on existing groundwater conditions as well as predicted drawdown associated with the construction and operation of the project. Groundwater is known to occur in the soil profile and within the fractured/porous rock along the alignment. Available data from site investigations for Sydney Metro West indicate that groundwater levels in the soils along the alignment are generally shallow (typically between one metre and five metres below ground surface) (Golder-Douglas, 2020a; Golder-Douglas, 2021). Other major project assessments (WestConnex M4-M5 Link and Sydney Metro Chatswood to Sydenham) indicate similarly shallow groundwater levels in areas surrounding the alignment.

Where adjacent piezometers were screened separately in soil and rock horizons at The Bays Station construction site (Golder-Douglas, 2018; Golder-Douglas, 2021), the data indicates that generally there is hydraulic connection between the soil and rock aquifers. At some locations, a perched water table may be present within the soils, due to a separation caused by the low conductivity of the soil profile.

West of The Bays tunnel launch and support site, the West Connex Rozelle Interchange is a drained tunnel system which has resulted in the groundwater in the vicinity being drawn down to the invert of the lowest tunnel.

In the vicinity of the Hunter Street Station (Sydney CBD) construction sites the groundwater system is considered highly disturbed due to the large number of existing tunnels, excavations and impermeable barriers (e.g. tanked basements) to groundwater flow.

Table 4-4 presents typical groundwater levels in metres AHD in the vicinity of the alignment based on site investigation data obtained for Sydney Metro West (Golder-Douglas, 2020a; Golder-Douglas, 2021).

Data is limited at many locations, and the typical levels listed may not represent groundwater levels in the immediate vicinity of the alignment.

Table 4-4 Summary of groundwater levels within the study area

Location	Typical groundwater level in the vicinity (metres AHD)
The Bays (Cross over cavern)	0.8
Pyrmont Station	-2.4 (Likely impacted by nearby construction activities)
Hunter Street (Sydney CBD) Station	2.97, -5.5 (Range likely represents highly disturbed groundwater system)

4.6.2 Groundwater extraction

Groundwater supply bores recorded in WaterNSW's groundwater bore database (WaterNSW, 2021) were reviewed. Groundwater bores registered by WaterNSW along the tunnel alignment study area are shown in Figure 4-6.

Licensed groundwater bores in the vicinity of the tunnel alignment or predicted groundwater level drawdown zone of influence are not being used for beneficial purposes (e.g. potable use, irrigation, stock watering etc.).

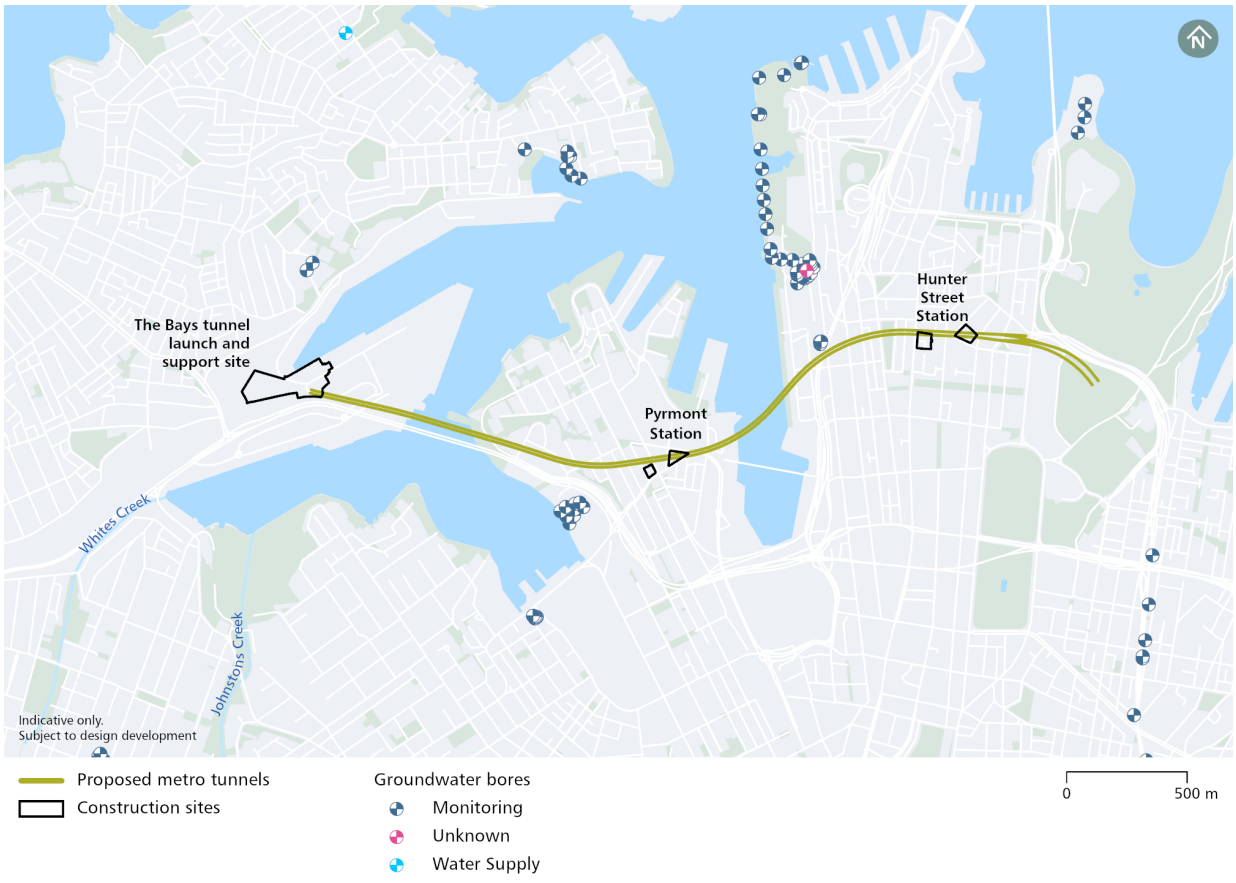

Figure 4-6 Registered groundwater bores within the study area

4.6.3 Surface water – groundwater interaction

The surface waterways within the study area are described in Section 4.8. There are no surface freshwater bodies or creeks within the area of potential drawdown associated with the construction (refer to Technical Paper 7 (Hydrogeology)).

Interactions between surface water and groundwater in the vicinity of the proposal are expected to be negligible or minimal due to:

- The proposal area is highly urbanised with predominantly impervious surfaces across the catchments, which reduces possible surface water infiltration into soils and underlying groundwater
- A lack of surface watercourses near the proposal construction sites. Surface watercourses are generally located south of the proposal, outside the area of potential groundwater drawdown impact
- Watercourses in the vicinity are generally lined (they have a concrete base and sides) and therefore are assumed to have negligible or limited interaction with groundwater
- The dominant groundwater discharge mechanism is to Sydney Harbour.

Therefore, drawdown of the groundwater table due to the proposed construction sites is not anticipated to have a noticeable impact on surface water resources (flow) or access (levels).

4.6.4 Groundwater quality

Typical Quality

The quality of groundwater within the Hawkesbury Sandstone is typically fresh to brackish with near-neutral pH and elevated metals concentrations, particularly for iron and manganese. Salinity is typically low to moderate, with electrical conductivity ranging between 500 microSiemens per centimetre and 2,000 microSiemens per centimetre (about 300 milligrams per litre to 1,400 milligrams per litre as total dissolved solids), and pH values generally range between 4.5 and eight. Generally, groundwater from this unit is a sodium-chloride type water, and high in iron.

Organic compounds are not naturally associated with Hawkesbury Sandstone.

The quality of groundwater within the residual and alluvial soils that overlie the Hawkesbury Sandstone is typically fresh to brackish, and may be saline in close proximity to salt water bodies. It typically has near-neutral to slightly acidic pH and metals concentrations generally lower than those in the underlying bedrock.

Project Specific Quality

Groundwater samples were collected and analysed from monitoring bores installed along the tunnel alignment as part of early planning investigations carried out by Sydney Metro (Golder-Douglas, 2018; Golder-Douglas, 2020a; Golder-Douglas, 2020b) with the majority of wells located at The Bays Station construction site and one well adjacent to the Pyrmont Station eastern construction site. At the time of preparing this Technical Paper, no project specific groundwater quality investigations are known to have been completed near the Hunter Street Station (Sydney CBD) construction sites.

Laboratory analyses were carried out for a range of selected compounds and contaminants (depending on the sample) including major ions, heavy metals, total recoverable hydrocarbons (TRH), benzene, toluene, ethyl benzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAH), nutrients, hexavalent chromium, total and speciated phenols, per- and polyfluoroalkyl substances (PFAS), volatile organic compounds (VOC), organochlorine (OCP) and organophosphate pesticides (OPP), dioxins and tributyltins.

The pH reported from these monitoring bores was consistent with the ranges noted in typical quality in the section above. The electrical conductivity (EC) was also generally consistent with

the typical ranges encountered in similar geological settings in Sydney, with higher EC values recorded in piezometers that are in closer proximity to marine influenced water bodies.

The data indicated that the groundwater in wells near White Bay (i.e. The Bays Station construction site) contained concentrations of nitrate, phosphorous, ammonia and selected heavy metals which exceeded the ANZECC (2018) trigger levels for 95 per cent protection of marine water aquatic and in some wells above screening levels for protection of human health (drinking water or direct contact). Isopropylbenzene (a volatile organic compound) was also detected in one well above ecological protection guidelines. Concentrations of PFAS compounds (PFOS and PFHxS) were also recorded above adopted drinking water guidelines but below recreational water quality guidelines in both shallow and deep groundwater wells.

Light non-aqueous phase liquid was observed in groundwater at two wells, likely associated with a former transformer yard at White Bay about 100 metres west of the proposed tunnel launch and support site (Senversa, 2021).

Concentrations of cobalt exceeded the ANZECC (2018) trigger levels for 95 per cent protection of marine water aquatic ecosystems in the sample near the Pyrmont Station eastern construction site (Golder-Douglas, 2018). Elevated concentrations of other analytes were not reported at this location.

Further details of site investigations and groundwater monitoring results are included Section 4.10.5.

Groundwater in the Sydney region that has not been impacted by anthropogenic activity can contain heavy metals concentrations above the ANZECC trigger levels, and elevated concentrations for some metals (e.g. iron and manganese), which may be associated with the leaching of natural metals from the host rock/soil.

4.7 Groundwater dependent ecosystems

There are no potential groundwater dependent ecosystems (terrestrial vegetation) located in the study area based on a review of the Bureau of Meteorology Groundwater Dependent Ecosystems Atlas.

4.8 Surface waterways

Sydney Harbour has been identified as a receiving environment of high sensitivity, predominantly due to the key fish habitat classifications (including those downstream) identified by the *Fisheries Management Act 1994* and/or proximity to coastal wetlands as defined by the State Environmental Planning Policy (Coastal Management) 2018 (SEPP Coastal Management). These watercourses have a high conservation or community value or supports ecosystems or human uses of water that are particularly sensitive to pollution or degradation of water quality. Further information with relation to surface waterways is available in Chapter 15 (Soils and surface water quality) of the Environmental Impact Statement. Interactions between surface water and groundwater in the vicinity of the proposal are expected to be negligible or minimal.

Table 4-5 lists the waterways, their condition, and their sensitivity, and potential impact mechanism relevant for the proposal.

Table 4-5 Sensitive surface water receiving environments

Water body	Description of the surface water features	Condition	Sensitive receiving environment rating	Location
Sydney Harbour	• Numerous SEPP Coastal Management • Potential habitat for threatened aquatic species and protected aquatic vegetation • Type 1 Key Fish Habitat • Fourth order waterway • Permanently flowing	Moderately disturbed	High	• Receiving waters waterbodies five kilometres north of tunnel alignment and Hunter Street (Sydney CBD) Station at nearest point
White Bay	• Concrete-lined, enclosed embayment • SEPP Coastal Management within 0.5 kilometres	Highly disturbed	Low	• Adjacent north of The Bays tunnel launch and support site • About one kilometre north of the tunnel at the western end
Darling Harbour	• SEPP Coastal Management within 0.5 kilometres • Key Fish Habitat	Moderately disturbed	Moderate	• About 250 metres east of Pyrmont Station construction sites. • Above tunnel alignment between Pyrmont and Sydney CBD
Blackwattle Bay	• Key Fish Habitat • Partially concrete-lined, enclosed embayment	Highly disturbed	Low	• About 500 metres west of Pyrmont Station construction sites. • Above alignment of tunnel between The Bays and Pyrmont
Johnstons Bay	• Key Fish Habitat, • Partially concrete-lined, enclosed embayment	Highly Disturbed	Low	• About 250 metres south of The Bays tunnel launch and support site. • Above alignment of tunnel between The Bays and Pyrmont

4.9 Observations from inspections of construction sites

Areas located within the construction sites, nearby land uses and potential areas of environmental interest (with respect to contamination) were visually inspected on 17 May 2021. These inspections were conducted from publicly accessible areas. The observations made during these inspections with relevance to this assessment are detailed in Table 4-6.

An inspection of The Bays Station construction site was conducted as part of the assessment for Stage 1 of the approval process in 2019. Observations made in 2019 are included in Table 4-6. The condition of the site would be altered as the construction site is established for the approved Sydney Metro major civil construction work Westmead to The Bays.

Table 4-6 Summary of site inspection observations

Locations	Construction site description	Surrounding area description
The Bays Station construction site (2019), (noting The Bays tunnel launch and support site is a construction site for this proposal that would sit within a portion of the larger The Bays Station construction site)	The construction site would be within part of the White Bay Power Station site, which is vacant and mostly paved (asphalt) with some grassed areas. Minimal infrastructure has been built on the site, including a bus stop, a driveway, and two historical railway lines which extended from the south-west of the site to the north-east. Within the site there is also a large fenced-off stockpile which appears to consist predominately of soil and ballast. The stockpile at the time of inspection was approximately 27 metres long by 15 metres wide by seven metres high. Several historical groundwater wells were observed within the site. No information was provided about these wells. A historical pond associated with the power station is located along the north-western boundary of the site. This pond and surrounding vegetated area is a known area of historical contamination. A storage area (on top of the existing asphalt) of old timber and electrical infrastructure is located in the south-western portion of the site. No asbestos containing materials were observed on site surfaces.	Land uses to the north consist of commercial/industrial facilities, including but not limited to automotive mechanics, plumbing/glass suppliers, and timber manufacturers. Further north, land uses consist of low density residential areas. To the east of the construction site are port-related land uses including ship docks, paved carparking, warehouses, silos and sheds. The foreshore of the bay has the potential for historical land reclamation and land filling. Land uses to the south of the construction site consist of a major roadway (James Craig Road) and heavy industry/port facilities. Land to the west of the construction site is occupied by the White Bay Power Station. The land contains a large, unoccupied warehouse, historical power station infrastructure such as a coal hopper and smoke stacks, and surrounding, unkept land. The White Bay Power Station contains known legacy contamination issues and hazardous materials such as asbestos and lead paint. Further west, the land is occupied by a busy roadway (Victoria Road), commercial/industrial warehouses containing automotive mechanics, and low density residential housing.
Pyrmont Station construction sites	The Pyrmont Station construction sites consist of medium density commercial land uses. The eastern construction site is currently occupied by a small business park, while the western construction site is currently occupied by a vacant multi-story building.	The surrounding area consists of medium density residential and commercial land uses, with some high-density commercial buildings. Two additional potential areas of concern were identified during the site inspection: • Enviro Laundrette – 155 Harris Street, Pyrmont (approximately 100 metres north-west of western construction site) • Pyrmont Quality Dry Cleaners and Alteration – 204 Harris Street, Pyrmont (approximately 40 metres west of western construction site).

Locations	Construction site description	Surrounding area description
Pyrmont Station power supply route	The Pyrmont Station power supply route would lie under Harris Street and Pyrmont Bridge Road.	The area surrounding the Pyrmont Station power supply route consists of medium density residential and commercial land uses, with some high-density commercial buildings. Two additional potential areas of concern were identified during the site inspection: • Enviro Laundrette – 155 Harris Street, Pyrmont (adjacent to the power supply route) • Pyrmont Quality Dry Cleaners and Alteration – 204 Harris Street, Pyrmont (adjacent to the power supply route).
Hunter Street Station (Sydney CBD) construction sites	The Hunter Street Station (Sydney CBD) construction sites consist of large commercial buildings (offices/businesses), also occupied by other activities including childcare, food, beauty, healthcare etc. A dry cleaning shop front is present within the building. No evidence of on–site cleaning or chemical use and storage was observed. Potential for fuel storage in commercial buildings where there are back-up generators. The existing Sydney Metro Bligh Street construction site is currently present on the eastern construction site.	The surrounding area consists of medium to high density commercial and residential land uses, including dry cleaners. Potential for fuel storage in commercial buildings where there are back-up generators. Dry cleaners within commercial buildings appear to be shop fronts with off-site cleaning, however there is potential for chemical storage and use on site. Sites from desktop review: • Dry Cleaning – 447 Kent St, Sydney – no longer at this location. No additional potential areas of environmental interest were observed.

4.10 Information review

4.10.1 Aerial imagery

Historical aerial photographs from the NSW Land and Property Management Authority, Land and Property Information Division and SIX Maps (NSW Spatial Services) were reviewed for 1943, 1955, 1970, 1989, 1994, and 2005. Recent aerial photography from GoogleEarth was also reviewed. Historical aerial photography for the Pyrmont Station construction sites were also provided by Sydney Metro for the years 1930, 1949, 1951, 1955, 1961, 1965, 1970, 1978, 1982, 1986, 1991 and 1994 and incorporated into the review (refer to Table 4-7). The aerial photography review focused on the study area to identify land uses that could represent contamination potential.

A summary of the historical aerial review for the tunnel alignment and construction sites are presented in Table 4-7 to Table 4-8.

Table 4-7 Aerial imagery review findings for the Pyrmont Station construction sites and power supply route

Date	Western construction site	Eastern construction site	Surrounding area (including power supply route)
1930	Site appears to be residential on the northern portion and largely vacant on the southern portion	Northern portion of site appears to be used as a laydown area. The southern portion appears to be used for stockpiling	Areas surrounding the construction sites appear to comprise a mixture of residential and commercial / industrial land use including rail yards to the east and the former Pyrmont power station to the north.
1943	No changes evident from previous imagery	No changes evident from previous imagery	Areas surrounding the construction sites do not appear to have undergone significant changes since 1930 imagery with the exception of the addition of the former Pyrmont incinerator to the west.
1949	Site appears to be residential on the northern portion with larger (potentially commercial) building on the southern portion	Site appears to contain small residential/ commercial dwellings	Areas surrounding the construction sites do not appear to have undergone significant changes since 1943 imagery with the exception of the redevelopment of the former Pyrmont Power Station to the north.
1951	No changes evident from previous imagery	No changes evident from previous imagery	Areas surrounding the construction sites do not appear to have undergone significant changes since 1949 imagery with the exception of the completed construction on the former Pyrmont Power Station to the north.
1955	No changes evident from previous imagery	Site appears to be vacant with evidence of earthworks/stockpiling	Areas surrounding the construction sites do not appear to have undergone significant changes since 1951 imagery with the exception of some stockpiling to the west (potentially associated with the incinerator).
1961	No changes evident from previous imagery	Site appears to be used for truck/machinery parking	Areas surrounding the construction sites do not appear to have undergone significant changes in comparison to the 1955 imagery with the exception of minor redevelopment work, including construction of a new building on the current Sydney Fish Market site.
1965	No changes evident from previous imagery	Site appears to be used as a car park	Areas surrounding the construction sites do not appear to have undergone significant changes in comparison to the 1961 imagery.
1970	Northern portion of the site appears to be a car park. Larger building remains on the southern portion	No changes evident from previous imagery	Areas surrounding the construction sites do not appear to have undergone significant changes in comparison to the 1965 imagery.
1978	No changes evident from previous imagery	No changes evident from previous imagery	Areas surrounding the construction sites do not appear to have undergone significant changes in comparison to the 1970 imagery.

Date	Western construction site	Eastern construction site	Surrounding area (including power supply route)
1982	No changes evident from previous imagery	No changes evident from previous imagery	Areas surrounding the construction sites do not appear to have undergone significant changes in comparison to the 1978 imagery.
1986	No changes evident from previous imagery	Site appears to have been flattened and is occupied by a concrete slab	Demolition of the rail yards to the east of the construction sites along Darling Harbour and beginning of new development at the same location. Development of large carparks to the north on area formerly occupied by railyards.
1989	No changes evident from previous imagery	Two potentially commercial buildings present on site with a central car park	Some of the rail yards to the east of the construction sites along Darling Harbour have been redeveloped with large buildings. Demolition of other industrial sites in the vicinity has occurred including the former Pyrmont incinerator to the west.
1991	No changes evident from previous imagery	No changes evident from previous imagery	Areas surrounding the construction sites do not appear to have undergone significant changes in comparison to the 1989 imagery.
1994	No changes evident from previous imagery	No changes evident from previous imagery	Demolition of the former Pyrmont Power Station north of the construction sites appears to have commenced, high density (assumed commercial) buildings to the south-east have been constructed. Buildings to the north of the eastern construction site have been demolished.
2005	Construction over the northern portion of the site has occurred	No changes evident from previous imagery	Areas surrounding the eastern construction site have been redeveloped, mostly associated with the demolition of commercial / industrial buildings and construction of high density residential apartments / retail including The Star Sydney Casino. The area surrounding the western construction site remains a mixture of commercial/residential.
2020	No changes evident from previous imagery	No changes evident from previous imagery	Areas surrounding the eastern construction site have been further redeveloped with high rise buildings.

Table 4-8 Aerial imagery review findings for the Hunter Street Station construction sites

Date	Western construction site	Eastern construction site	Surrounding area
1943	High rise commercial buildings are present on the site	High rise commercial buildings are present on the site	The surrounding areas appear to comprise primarily of commercial land use with open space including the Domain further east and Wynyard Park to the west.
1955	No significant changes evident from previous imagery	No significant changes evident from previous imagery	The surrounding areas do not appear to have undergone significant changes in comparison to the 1943 imagery.
1970	No significant changes evident from previous imagery	No significant changes evident from previous imagery	The surrounding areas do not appear to have undergone significant changes in comparison to the 1955 imagery with the exception of some demolition and redevelopment with higher density buildings being constructed.
1989	No significant changes evident from previous imagery	No significant changes evident from previous imagery	The surrounding areas do not appear to have undergone significant changes in comparison to the 1970 imagery with the exception of some redevelopment of surrounding commercial buildings.
1994	Site appears to have been redeveloped/ extended with additional buildings/ storeys	Site appears to have undergone minor changes to existing buildings	The surrounding areas do not appear to have undergone significant changes in comparison to the 1989 imagery with the exception of some redevelopment of surrounding commercial buildings.
2005	No significant changes evident from previous imagery	No significant changes evident from previous imagery	The surrounding areas do not appear to have undergone significant changes in comparison to the 1994 imagery with the exception of some redevelopment of surrounding commercial buildings.
2020	No significant changes evident from previous imagery	No significant changes evident from previous imagery	The surrounding areas do not appear to have undergone significant changes in comparison to the 2005 imagery with the exception of some redevelopment of surrounding commercial buildings.

4.10.2 NSW EPA Contaminated Sites Register

A search of the NSW EPA Contaminated Sites Record of Notices (under section 58 of the *Contaminated Land Management Act 1997*) and the list of contaminated sites notified to the NSW EPA (under section 60 of the *Contaminated Land Management Act 1997*) indicated that there were 12 sites registered with the NSW EPA within 500 metres of the proposed project corridor and construction sites and power supply routes that were either regulated or had been notified. The sites are summarised in Table 4-9 and shown on Figure 4-7.

Table 4-9 Notified, regulated and formerly regulated sites within the study area

Suburb	Regulated / Notified	Site address	Site activity	Contamination status	Relative location
The Bays tunnel launch and support site and alignment					
Rozelle	Regulated	Robert Street	Other Industry (White Bay Power Station)	EHC Act Revocation Notice (Former) Asbestos and PCB contamination	About 150 meters west of tunnel alignment
Rozelle	Regulated	Reynolds Street	Former Unilever Sulphonation Plant	EHC Act Revocation Notice (Former) Heavy metals, polycyclic aromatic hydrocarbons, linear alkylbenzene and linear alkylbenzene sulphonate compound contamination	About 420 metres north-west of tunnel launch and support site and 500 metres north-west of the tunnel alignment
Rozelle	Regulated	Buchanan Street	Former Ampol Terminal	EHC Act Revocation Notice (Former) Heavy metals and hydrocarbon contamination. Remediation completed prior to 1994	About 350 metres north-west of tunnel launch and support site and 430 metres north-west of the tunnel alignment
Rozelle	Notified	15-39 Wellington Street	Other petroleum	Regulation under CLM Act not required	About one kilometre metres west of tunnel launch and support site and more than one kilometre west of tunnel alignment
Pyrmont Station construction sites, power supply route and alignment					
Pyrmont	Regulated	Pyrmont Road	Pyrmont Power Station	EHC Act Revocation Notice Hydrocarbon, polychlorinated biphenyls, and asbestos contamination	About 100 metres north of alignment and Pyrmont Station eastern construction site
Hunter Street Station (Sydney CBD) construction sites and alignment					
Millers Point	-	38 Hickson Road	Gasworks	Contamination being managed via the planning process (EP&A Act)	About 300 metres north of alignment and about 300 metres west of Hunter Street Station (Sydney CBD) western construction site at the nearest point
Millers Point	Regulated	36 Hickson Road	Gasworks	Contamination currently regulated under CLM Act	

Suburb	Regulated / Notified	Site address	Site activity	Contamination status	Relative location
Millers Point	Regulated	Road reserve fronting 30-38 Hickson Road	Gasworks	Contamination currently regulated under CLM Act	
Millers Point	Notified	30-34 Hickson Road	Gasworks	Regulation under CLM Act not required	
Sydney	Notified	447 Kent Street	Chemical Industry (dry cleaning)	Regulation under CLM Act not required	About 500 metres south of the tunnel alignment and Hunter Street Station (Sydney CBD) western construction site

Figure 4-7 EPA registered sites within the study area

4.10.3 Environmental Protection Licences

A search conducted on 27 April 2021 of the NSW EPA Protection of the Environment Operations (POEO) Act public register (under section 308 of the POEO Act 1997) indicated there were 12 sites within 500 metres to the north and south of the tunnel alignment that have current environmental protection licences. The sites are summarised in Table 4-10. Environmental protection licences no longer in force or surrendered have not been included in

Table 4-10 as it has been assumed that potential contamination risk is only associated with current licensed activities.

There were no sites within 500 metres of the Pyrmont Station construction sites identified that have current environmental protection licences.

Table 4-10 Sites with current environmental protection licences within the study area

Site address	Licence holder	Site activity	Relative location
Tunnel Alignment			
Sommerville Road, Glebe	Newcastle Port Corporation	Shipping in bulk	Adjacent (<100 metres)
The Bays tunnel launch and support site and alignment			
Sommerville Road, Rozelle	Cement Australia Holdings Pty Ltd	Shipping in bulk, Cement or lime handling	• Adjacent to The Bays tunnel launch and support site • 50 metres from the tunnel alignment
Sommerville Road, Rozelle	Gypsum Resources Australia Pty Ltd	Shipping in bulk	• Adjacent to The Bays tunnel launch and support site • 50 metres from the tunnel alignment
WestConnex between the M4-M5 Mainline Tunnels and Rozelle, Rozelle	John Holland Pty Ltd	Road construction (WestConnex)	Adjacent to The Bays tunnel launch and support site
Sommerville Road, Rozelle	Newcastle Port Corporation	Shipping in bulk	Adjacent to The Bays tunnel launch and support site
Robert Street, Balmain	Newcastle Port Corporation	Shipping in bulk	Adjacent to The Bays tunnel launch and support site and tunnel alignment (<100 metres)
Lot 1 Sommerville Road, Rozelle	Sugar Australia Pty Ltd	General agricultural processing, Shipping in bulk	• Adjacent to The Bays tunnel launch and support site • 50 metres from the tunnel alignment
James Craig Road, Rozelle	Sydney Boathouse Holdings Pty Ltd	Boat mooring and storage	• 130 metres from The Bays tunnel launch and support site • 160 metres from the tunnel alignment

Site address	Licence holder	Site activity	Relative location
37 James Craig Road, Rozelle	Sydney City Marine Pty Ltd	Boat construction/maintenance (general)	• 210 metres from The Bays tunnel launch and support site • 200 metres from the tunnel alignment
Berth 4 White Bay, Robert Street, Balmain	White Bay 6 Pty Ltd	Shipping in bulk	• Adjacent to The Bays tunnel launch and support site • 50 metres from the tunnel alignment
Hunter Street Station (Sydney CBD) construction sites and alignment			
Australian Rail Track Corporation (ARTC) Network, Sydney	Australian Rail Track Corporation Limited	Railway infrastructure operations	400 metres south
Between Chatswood dive site and Sydenham dive site, Sydney (associated with Sydney Metro)	CPB Contractors Pty Limited	Railway infrastructure construction (<50,000T)	400 metres south of eastern end of tunnel alignment and Hunter Street Station (Sydney CBD) eastern construction site

4.10.4 Potential PFAS sources

Considering the high mobility of PFAS within the environment, a search of potential PFAS sources was carried out within one kilometre of the tunnel alignment. The search involved a review of:

- NSW EPA Contaminated Sites Record of Notices (under section 58 of the *Contaminated Land Management Act 1997*) and the list of contaminated sites notified to the NSW EPA (under section 60 of the *Contaminated Land Management Act 1997*) for PFAS as a contaminant of concern
- Current and historical (from 1955 onwards) aerial imagery for visually identifiable industry and/or operations which may be associated with PFAS contaminants (as defined by the PFAS NEMP, 2018) including aviation, coal work, power generation (including switchyards), petrochemical production, fuel production, petroleum products storage, aviation, sewage treatment plants and waste disposal
- A review of available aerial imagery services (GoogleEarth).

The results of the review to identify PFAS sources within one kilometre of the proposal are summarised in Table 4-11.

There were no identified potential PFAS sources within one kilometre of the Hunter Street Station (Sydney CBD) construction sites.

Table 4-11 Potential PFAS sources within one kilometre of the proposal

Suburb	Site address	Site activity	Information source	Potential PFAS source	Relative location	Comments
The Bays tunnel launch and support site and tunnel alignment						
Rozelle	Robert Street	White Bay Power Station	NSW EPA	Firefighting activities	About 150 meters west of tunnel launch and support site and alignment	Former EHC Act Revocation Notice for asbestos and PCB contamination (Table 4-9)
Rozelle	Buchanan Street	Former Ampol Terminal	1955 aerial imagery, NSW EPA	Firefighting activities	About 350 metres north-west of The Bays tunnel launch and support site and 430 metres north-west of the tunnel alignment	EHC Act Revocation Notice for heavy metal and hydrocarbon contamination (Table 4-9)
Pyrmont Station construction sites, power supply route and alignment						
Pyrmont	Pyrmont Road	Former Pyrmont Power Station	NSW EPA, 1955 aerial imagery	Firefighting activities	About 100 metres north of the tunnel alignment and Pyrmont Station eastern construction site	Former EHC Act Revocation Notice for hydrocarbon, chemical storage/wastes, asbestos and PCB contamination (Table 4-9)
Pyrmont	Bowman Street	Above ground bulk storage tanks	1955 aerial imagery	Firefighting activities	About 100 metres north of the tunnel alignment	No further information available

4.10.5 Previous site investigations

Geotechnical, contamination and groundwater data collected by Sydney Metro has been reviewed from the following reports:

- Golder & Douglas Partners (2020a), *Sydney Metro West Geotechnical Investigation, Factual Contamination Assessment Report*, 1791865-002-R-CAR-Rev0, 6 May 2020
- Golder Associates & Douglas Partners (2018). *Sydney Metro West Geotechnical Investigation Groundwater Monitoring Report*, 16 October 2018
- Golder & Douglas Partners (2021), *Sydney Metro West Geotechnical Investigation, Groundwater Monitoring Report – Stage 2 Locations*, 1791865-023-R-GWM-Stage 2 Rev 0, 26 February 2021

- Golder Associates & Douglas Partners (2017). *Sydney Metro City and Southwest Geotechnical Investigation, Contamination Assessment Report - Tunnels and Station Excavations (TSE), Chatswood to Sydenham, NSW, 20 January 2017*
- Golder Associates & Douglas Partners (2020b). *Sydney Metro West Contamination Assessment Report, The Bays Precinct, Stage 1 Early Works Package*, White Bay, Rozelle, NSW, 26 June 2020
- Senversa (2021), *Factual Contamination Investigation Report – The Bays, Sydney Metro West, White Bay Site Investigation*, 21 May 2021.

A search of internet resources was carried out for previous contamination investigations and/or general contamination information for sites which were located within and/or adjacent to the tunnel alignment. The internet search used the key words “contamination”, “remediation” “PFAS” and “site investigation” in Rozelle, Pyrmont, Surry Hills, Sydney CBD, Millers Point and Darlinghurst. The following publicly available investigations and contamination information were reviewed in conjunction with reports provided by Sydney Metro:

- *Rozelle Rail Yards – Site Management Works, Review of Environmental Factors* (Roads and Maritime Services, 2016)
- UrbanGrowth NSW. *Site Wide Remedial Concept Plan. The Bays Precinct Urban Transformation Area* (JBS&G, 4 December 2015)
- Infrastructure NSW, *Site Audit Report Revised Remedial Action Plan, The New Sydney Fish Market* (Ramboll, 13 August 2020).

Summaries of previous investigations are included below.

***Sydney Metro West Geotechnical Investigation, Factual Contamination Assessment Report, 1791865-002-R-CAR-Rev0*, (Golder & Douglas Partners, 2020)**

Sydney Metro West undertook a geotechnical, groundwater and contamination investigation during the early stages of project development. In interpreting the results, the following NSW EPA endorsed screening levels (derived from NEPM, 2013) for assessing soil contamination were adopted:

- Health investigation levels for commercial/industrial use (NEPM, 2013)
- Health screening levels for commercial/industrial use – Vapour intrusion (NEPM, 2013)
- Ecological investigation levels for commercial/industrial use (NEPM, 2013)
- Ecological screening levels for commercial/industrial use – coarse soil (NEPM, 2013)
- Per and poly-fluoroalkyl substance results were compared to criteria from the PFAS National Environment Management Plan (Heads of EPA, 2018)
- Acid sulfate soil results were compared to the action criteria presented in the *Acid Sulfate Soils Assessment Guidelines* (NSW Acid Sulfate Soils Management Advisory Committee, 1998)
- Soil results were also compared against the *Waste Classification Guidelines* (EPA, 2014).

A total of 23 soil bores were installed within The Bays Station construction site, one bore near the Pyrmont Station eastern construction site, two bores within the proposed tunnel alignment in Darling Harbour between Pyrmont Station and Hunter Street Station (Sydney CBD) and one bore between the two Hunter Street Station (Sydney CBD) construction sites.

The following investigation results were reported relevant to The Bays tunnel launch and support site:

- Soil samples collected from the majority of boreholes reported concentrations of heavy metals in fill and natural soil up to exceeding the ecological guidelines. Exceedances were reported in samples from 0.5 metres below ground level to a maximum depth of 18 metres below ground level. Exceedances of ecological guidelines in deeper samples (>8 metres below ground level) were limited to zinc. Additionally, exceedances of the adopted ecological criteria was reported for benzo(a)pyrene, zinc, chromium (CrIII), nickel and copper
- Asbestos was identified at a depth of one metre and at surface. Concentrations of heavy metals (copper, zinc, nickel, chromium, lead), total recoverable hydrocarbons and/or benzo(a)pyrene were detected above human health guidelines for commercial / industrial land use in soil samples. Exceedances of adopted human health criteria for total recoverable hydrocarbons (fraction C6-C10) were reported at a depth of 4.3 metres where hydrocarbon odours were observed and at a depth of three metres. These detections suggested the potential for lateral migration of contamination from another location
- Soil was tested for per- and polyfluoroalkyl substances across the wider White Bay area (i.e. within and adjacent to The Bays tunnel launch and support site) with concentrations reported below adopted ecological and human health criteria
- Potential acid sulfate soils were identified to be present in the general White Bay area and underlying The Bays tunnel launch and support site (likely below two metres below ground level as tidal fluctuations of groundwater would have intermittently exposed any potential acid sulfate soils above this depth).

Selected soil results classified soils initially as Restricted Solid Waste or Hazardous Waste. Following toxicity characteristic leaching procedure (TCLP) analysis, soil was classified as General Solid Waste, with some localised areas of Restricted Solid Waste or Hazardous Waste to PFAS, benzo(a)pyrene or lead concentrations, limited to the western section of The Bays tunnel launch and support site. Where asbestos is present in the central and western sections of The Bays tunnel launch and support site, soil was classified as Special Waste.

At Pyrmont Station eastern construction site, fill was encountered to a depth of one metre below ground level. Exceedances of the adopted ecological and human health guidelines for commercial/industrial land use were not reported in the soil samples analysed. Soil results classified soils as General Solid Waste. No asbestos fines were detected in the soil samples analysed. It is noted that no analysis for PFAS or ASS was completed on soil samples collected from one borehole as part of the investigation.

Concentrations in soil at Hunter Street Station (Sydney CBD) construction sites and the tunnel alignment in Darling Harbour between Pyrmont Station and Hunter Street Station (Sydney CBD) were reported below adopted ecological and human health guidelines.

Shallow and deeper groundwater wells were installed at The Bays Station construction site in six locations. A vibrating wire piezometer was installed in one well to measure groundwater depth. The results of monitoring these wells is discussed in the Groundwater Monitoring Report below (Golder-Douglas, 2021).

Sydney Metro West Geotechnical Investigation Groundwater Monitoring Report, (Golder & Douglas Partners, 2018)

Sydney Metro undertook a groundwater investigation during early stages of project development. Three groundwater wells were sampled within The Bays Station construction

site and near the Pyrmont Station construction sites to provide preliminary information regarding potential groundwater contamination at various sites. Groundwater wells within the tunnel alignment were not sampled as part of the investigation. Results from wells installed at locations relevant to the tunnel alignment are detailed below.

Based on information from the groundwater investigation report, monitoring wells at White Bay – adjacent to The Bays Station construction site were not checked for the presence of LNAPLs or DNAPLs. Jacobs undertook a review of the TRH analytical data from the groundwater investigation for these monitoring wells. TRH concentrations were low or below laboratory limits of reporting in water sampled from these locations. The low to non-detectable concentrations of TRH reported within these monitoring wells would not be conducive to the formation of NAPLs (i.e. NAPL would be unlikely to be present in these monitoring wells).

Based on information from the groundwater investigation report, groundwater well near White Bay contained concentrations of nitrate, phosphorous, ammonia and selected heavy metals which exceeded the ANZECC (2018) trigger levels for 95 per cent protection of marine water aquatic. Concentrations of PFAS compounds (PFOS and PFHxS) were also recorded above adopted drinking water guidelines and below recreational water guidelines. This groundwater well is installed to a depth of 42 metres below ground level.

In the groundwater sample collected from Pyrmont Station eastern construction site, concentrations of cobalt exceeded the ANZECC (2018) trigger levels for 95 per cent protection of marine water aquatic ecosystems. Elevated concentrations of other analytes were not reported. The sample collected from this well was not analysed for PFAS as part of the investigation. This groundwater well is installed to a depth of 35.1 metres below ground level.

Sydney Metro West Geotechnical Investigation, Groundwater Monitoring Report – Stage 2 Locations, 1791865-023-R-GWM-Stage 2 Rev 0 **(Golder & Douglas Partners, 2021)**

Sydney Metro undertook further groundwater investigations between April 2019 and February 2021 within the proposed project alignment between The Bays and Pyrmont and within the alignment for major civil construction between Westmead and The Bays. The groundwater investigation relevant to the proposal included installation and sampling of new wells as outlined in the Factual Contamination Assessment Report above (2020) and further sampling of existing wells at The Bays, as well as water level monitoring at five wells near Hunter Street Station (Sydney CBD). Wells are screened in shallow and deeper groundwater. Samples were analysed from wells at The Bays for a broad range of potential contaminants including metals, hydrocarbons, volatile and semi-volatile organic compounds, PFAS, major ions and nutrients.

Reported results included:

- Concentrations of major ions, nitrogen, heavy metals (particularly iron and manganese) were reported in wells at The Bays above adopted guidelines for protection of human health (recreational/direct contact or drinking water) and/or ecological protection in shallow and deeper groundwater wells
- Hydrocarbons above human health drinking water guidelines but below guidelines for direct contact, as well as isopropylbenzene (a volatile chlorinated compound), above ecological protection guidelines in one groundwater well installed to 13 metres below ground level
- PFAS above PFAS NEMP human health drinking water guidelines but below guidelines for recreational contact and protection of ecosystems (HEPA, 2018) in one shallow well at 4.6 metres below ground level. Detections of PFAS were reported below guidelines in the corresponding deeper groundwater well at 13.5 metres below ground level

- Groundwater levels measured in wells near Hunter Street Station (Sydney CBD) were between 2.97 and about -6.8 metres AHD.

Wells installed near Hunter Street Station (Sydney CBD) were monitored for water level only and no analytical data was available for review.

***Sydney Metro City and Southwest Geotechnical Investigation, Contamination Assessment Report - Tunnels and Station Excavations (TSE), Chatswood to Sydenham* (Golder Associates & Douglas Partners, 2017)**

Sydney Metro engaged Golder-Douglas to conduct a detailed contamination assessment during the design and development stage of the Metro City and Southwest work between Chatswood and Sydenham, specifically relating to the tunnel and station excavation work.

Within the scope relevant to this proposal, a total of three soil bores were installed in the vicinity of the proposed tunnel alignment and the Hunter Street Station (Sydney CBD) construction sites, generally approximate to Hunter Street and Castlereagh Street. Soil samples were analysed for potential contamination and returned results below the specified human health screening levels for commercial and industrial land use and waste classification criteria for General Solid Waste.

Groundwater wells were installed within the vicinity of the proposed tunnel alignment and Hunter Street Station at two of the locations outlined above within the sandstone aquifer. A sample from one location was analysed for potential contamination and returned values for dissolved copper and chromium that were above the respective environmental based trigger levels for protection of surface water ecosystems. The groundwater level at this location was measured as 6.74 metres AHD.

Analysis of potential acid sulfate soil, volatile organic compounds and PFAS was not completed at the locations relevant to this proposal.

***Sydney Metro West Contamination Assessment Report, The Bays Precinct, Stage 1 Early Works Package, White Bay, Rozelle* (Golder Associates & Douglas Partners, 2020).**

Sydney Metro engaged Golder-Douglas to conduct a detailed contamination assessment at land within The Bays Precinct. The Bays Precinct includes the proposed tunnel and launch support site as well as broader area that forms part of the major civil construction for Sydney Metro West between Westmead and The Bays. The assessment involved a review of historic and publicly available information and preparation of a summary of existing soil and groundwater data collected from The Bays Precinct, in particular related to a portion of the site where early work for the major civil construction for Sydney Metro West between Westmead and The Bays was proposed.

Data from the following investigations is summarised within the GDP 2020 report:

- Detailed Site Investigation White Bay Power Station Proposed Lot 2, Roberts Street, Rozelle, NSW, 52630/108235, (JBS&G, 2017)
- Factual Contamination Assessment Report, 00013/11180 Sydney Metro West Geotechnical Investigation, 1791865-002-R-CAR-Rev0, (Golder-Douglas, 2020)
- Addendum Final Geotechnical Data Report – White Bay Pavement Investigation, 1791865-018-R-Rev0 (Golder-Douglas, 2020).

A review of the Golder-Douglas 2020 report was completed as part of the preparation of this Technical Paper. Results from the White Bay Pavement Investigation (Golder-Douglas, 2020) identified the following.

- Asbestos was detected at a depth of 0.5 metres below ground level
- Heavy metals and benzo(a)pyrene were reported in soil above adopted ecological criteria
- Fill was observed to a depth of 10 metres below ground level
- Acid sulfate soil was identified as potentially present.

Results summarised from the JBS&G 2017 Detailed Site Investigation included:

- Extensive fill material was observed comprising gravelly, silts, sands, clayey gravelly sands, coal wash, ash, sandstone gravels and cobbles, shells, bricks and glass. The deepest observed fill was to 3.3 metres below ground level
- Strong hydrocarbon odours were observed at some locations
- Fill and near surface soils at several locations including within the proposed tunnel launch and support site at depths up to 4 metres were impacted with heavy metals, semi- and non-volatile hydrocarbons, polycyclic aromatic hydrocarbons, volatile organic compounds (dichloromethane) and asbestos. Metals in soil were identified as leachable
- Natural soil at depth underlying the site was identified as actual or potential acid sulfate soil
- Groundwater was impacted with heavy metals and localised reported exceedances of ammonia (as N). Detections of chlorinated hydrocarbons (tetrachloroethane) and polycyclic aromatic hydrocarbons were reported west of the site below the adopted assessment criteria
- Exceedances of adopted human health criteria (for residential or public open space land use) were reported in soil for lead, total recoverable hydrocarbons and polycyclic aromatic hydrocarbons and friable asbestos was detected
- Concentrations of heavy metals (copper and/or zinc) were reported above criteria for ecological protection in groundwater. Polycyclic aromatic hydrocarbons were also reported above ecological protection criteria
- Soil vapour results did not exceed criteria adopted for any land use scenario from the four soil vapour bores
- Groundwater levels were observed between 0.5 to three metres below ground level , with flow direction north-easterly towards White Bay.

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

Sydney Metro engaged Senversa to carry out a contamination investigation and groundwater monitoring in The Bays tunnel launch and support site at White Bay. The purpose of the investigation was to supplement previous data to form a detailed understanding of the baseline condition of the site prior to commencing work for the purpose of meeting licence conditions between Sydney Metro and the licensors of the site, and to provide data to inform the tunnelling.

The investigation included excavation of 14 test pits and drilling of 56 boreholes for collection of soil and rock samples, collection of three surface or stockpile samples, installation of 10 groundwater monitoring wells, water level gauging of 31 new and existing wells and sampling of 27 wells. The locations were both within the area of the proposed tunnel launch

and support site and across the broader The Bays Station construction site. Results reported include:

- Light non-aqueous phase liquid (phase separated hydrocarbon) were measured in two groundwater wells. These wells are about 100 metres west of The Bays tunnel launch and support site
- Groundwater levels were measured between 0.18 and 2.3 metres AHD
- Concentrations of heavy metals and ammonia were reported above adopted ecological protection criteria (95 per cent species protection) in several wells
- Concentrations of PFAS were reported in exceedance of adopted ecological protection criteria, with exceedances of human health (drinking water) criteria reported. These locations are within and up- hydraulic gradient of The Bays tunnel launch and support site
- Potential acid sulfate soils are present at depth beneath the site
- Asbestos was identified in six locations. The concentration reported at S19 was in exceedance of adopted human health guidelines (commercial/industrial). The majority of these are within The Bays tunnel launch and support site
- Dioxins were reported in the six soil samples selected for this analysis at concentrations greater than the mean background toxic equivalent concentration for southeast Australia
- Concentrations indicate soil would be classified as general solid waste, restricted solid waste or hazardous solid waste in some locations due to total and leachable concentrations of heavy metals. Where asbestos is present this would be classified as special waste
- Exceedances of adopted human health guidelines were reported for lead and benzene.

PFAS was detected in several soil samples however concentrations were below the adopted human health and ecological screening levels for commercial/industrial use, and below the upper limits for classification as general solid waste (based on total concentrations alone).

Rozelle Rail Yards – Site Management Works, Review of Environmental Factors **(Roads and Maritime Services, 2016)**

The location of the site subject of this report is located about 150 metres south-west of the tunnel alignment and The Bays tunnel launch and support site.

The former Roads and Maritime Services undertook a Review of Environmental Factors along the former Rozelle Rail Yards which proposed to remove rail and rail related infrastructure in order to manage existing issues at the site such as waste and noxious weeds.

The assessment notes the existence of contamination in the form of redundant rail infrastructure. This includes waste, stockpiles, vegetation, rail infrastructure, ballast, sleepers, remnant service lines, buildings and noxious weeds. These structures were causing ongoing environment management, maintenance and safety issues at the time of preparing the Review of Environmental Factors.

UrbanGrowth NSW. ***Site Wide Remedial Concept Plan. The Bays Precinct Urban Transformation Area*** **(JBS&G, 2015)**

The site wide remedial concept plan (SWRCP) was prepared to identify strategies and remedial options to address the identified environmental impacts present at The Bays that would render the site suitable for the proposed land uses at that time.

The Bays Precinct Urban Transformation Area comprised seven precincts within the study area including:

- Precinct 1 – Blackwattle Bay
- Precinct 2 – White Bay Power Station
- Precinct 3 – Rozelle Rail Yards
- Precinct 4 – Rozelle Bay
- Precinct 5 – Glebe Island
- Precinct 6 – White Bay
- Precinct 7 – Wentworth Park.

One of the objectives of the SWRCP was to provide a summary of historical characterisation investigation work completed across The Bays and present a Conceptual Site Model documenting the overall understanding of site contamination characteristics and potential exposure pathways applicable to all or portions of The Bays Station construction site.

Based on information from the SWRCP, the contamination status for each of the precincts is summarised below.

Precinct 1 – Blackwattle Bay

- Fill material and natural soil at selected locations are impacted by heavy metals (primarily comprising lead but also arsenic), benzo(a)pyrene, total PAHs and petroleum hydrocarbons
- Groundwater is impacted by petroleum hydrocarbons and PAHs in the vicinity of Banks Street and the Fish Markets carpark. Elevated heavy metals (above background concentrations) have been detected in groundwater at selected locations across the precinct.

Precinct 2 – White Bay Power Station

- Near surface and sub-surface fill material within the yard area and foreshore of the White Bay Power Station are impacted by lead, benzo(a)pyrene, total PAHs, petroleum hydrocarbons and asbestos. Limited available subsurface information available for commercial properties within the broader White Bay Power Station Precinct, indicate the presence of impacted soil underlying the subject properties also contaminated with heavy metals, PAHs including benzo(a)pyrene and petroleum hydrocarbons
- Free product transformer oil impacts have been identified in groundwater within the north-west portion of the power station site underlying the former transformer yard area. Elevated heavy metals (above background concentrations) and petroleum hydrocarbons have been detected in groundwater at selected locations across the precinct.

Precinct 3 – Rozelle Rail Yards

- Surface and subsurface fill material in various portions of the precinct are impacted to varying degrees with heavy metals including lead, arsenic and zinc (noting the absence of data for cadmium, chromium and nickel), benzo(a)pyrene and total PAHs and petroleum hydrocarbons
- Elevated petroleum hydrocarbons have been detected in groundwater at selected locations across the precinct.

Precinct 4 – Rozelle Bay

- Fill material selected locations are impacted by benzo(a)pyrene, total PAHs and petroleum hydrocarbons. Asbestos and organotins impacts have been identified in surface and sub-surface fill materials in the vicinity of The Crescent
- Elevated heavy metals and PAHs have been detected in groundwater at selected locations across the precinct.

Precinct 5 – Glebe Island

- Historical assessment of the Glebe Island Precinct has been limited in scope and whilst to date the presence of significant soil and/or groundwater contamination has not been identified, detailed characterisation may identify the presence of specific areas of the Precinct that will require management during future redevelopment.

Precinct 6 – White Bay

- Sampling locations completed in the vicinity of port workshops located in the central portion of the precinct have previously identified the occurrence of both light fraction and heavy fraction petroleum hydrocarbon impacts in subsurface soil/fill material
- No groundwater characterisation data was available for this precinct at the tie of preparing the SWRCP.

Precinct 7 – Wentworth Park

- Fill material and natural soil at selected locations are impacted by heavy metals (comprising lead, copper and zinc), benzo(a)pyrene, total PAHs and petroleum hydrocarbons in the vicinity of identified fuel storage facilities
- Elevated heavy metals, petroleum hydrocarbons, naphthalene and PAHs have been detected in groundwater at selected locations across the precinct.

***Site Audit Report Revised Remedial Action Plan, The New Sydney Fish Market* (Ramboll, 2020)**

A site contamination audit was carried out with relation to redevelopment of the New Sydney Fish Market Site, as a condition of the State Significant Development application approval (SSD 8924). The audit was required to confirm that the prepared remedial action plan was appropriate and that the site could be made suitable for the proposed use.

The new fish market site is about 300 metres south of the tunnel alignment on the southern end of Blackwattle Bay.

The audit report identifies the following of relevance to the proposed tunnel alignment:

- The site was formerly reclaimed around Blackwattle Bay between 1859 and 1909. This may have included material dredged from deep-water berths. The site used for a variety of industrial uses including timber merchants, abattoirs, waste collection and coal loading. More recently a portion of the site was used for concrete batching and an Ausgrid substation was east of the site
- Underground storage tanks, associated contaminated soil, and 700 square metres of asbestos were removed from the site in 1995. The USTs contained fuels, mineral spirit and mineral oil. It was considered unlikely that widespread contamination would be present from the USTs

- The potential for ASS to be present was considered highly probable and would require management during the remediation
- Concentrations of contaminants were reported in soil above adopted guideline criteria, including TRH, PAHs and heavy metals (typically in shallow soil between surface and four metres below ground level)
- Concentrations of contaminants were reported in groundwater above adopted guideline criteria for 95 per cent species protection in marine waters including PAHs and selected heavy metals
- Soil vapour monitoring did not identify volatile organic compound (VOC) contamination.

General information provided by Sydney Metro relevant to The Bays tunnel launch and support site supports the findings of the above reports, including that:

- Fill soil is present across the site surface and is impacted with heavy metals, semi and non-volatile hydrocarbons, asbestos, pesticides and phenols as well as asbestos
- Acid sulfate soils are present within underlying natural soils. Near surface soils in the area are unlikely to be potentially acid forming
- Groundwater is impacted with heavy metals with localised impacts of hydrocarbons and volatile compounds.

4.11 The Bays tunnel launch and support site

It is important to note that, should this proposal be approved, the construction work is scheduled to commence in 2023. By this time, the approved major construction work between Westmead and The Bays would have progressed. The approved tunnelling work westwards from The Bays to Sydney Olympic Park, (supported at The Bays Station construction site), would overlap with the tunnelling work in this proposal for a period of about six months until about mid-2024. The assessment of the proposed overlap in potential contamination impacts are included in the cumulative impacts assessment (refer to Section 6.6.1).

This would result in the following changes to the existing contamination environment as described above, by the time the work associated with this proposal starts:

- Excavation of soil and rock (including contaminated soil) associated with construction of the station box and the handling/management of materials within spoil storage areas
- Potential drawdown of groundwater (including potential contaminants) below current levels (if required during construction of excavation voids).

These works would be undertaken under the Concept and Stage 1 Approval for major construction work between Westmead and The Bays.

5 Contamination investigation findings

5.1 Areas of environmental interest

Based on the findings of the desktop review and site inspections, a number of known and potential contamination sources (areas of environmental interest – AEIs) or areas of specific geological conditions have been identified within and/or adjacent to the proposal. To understand the potential interaction of construction activities with potential contamination or specific geological conditions and to assess the potential impact of contamination or specific geological conditions on construction, sites have been categorised into five categories of potential impact (very low, low, moderate, high and very high) based on the impact prioritisation methodology in Section 3.5.

Some sites contain multiple potential contamination sources (AEIs) which were defined by activities/operations and not by cadastral boundaries. Where this occurs, a range of categories of potential contamination impact has been provided for the site.

The results of this exercise are provided in Table 5-1 to Table 5-5. The tables also include references to potential mitigation measures which are discussed further in Section 7. Figure 5-1 shows sites of moderate potential contamination impact and above and locations where geological conditions (acid sulfate soils or salinity) may represent a potential impact.

A number of previously recorded contaminated sites within and or next to the tunnel alignment are considered to represent a low potential for contamination or specific geological conditions to impact upon receptors during construction. No further consideration of contamination or specific geological conditions has been provided for these low potential sites.

Potential groundwater contamination in the vicinity of the Pyrmont Station construction sites as a result of ‘general industrial use’ (AEI11) is considered to have a moderate risk of resulting in potential impacts to receptors during construction prior to application of mitigation measures. This AEI does not correspond to a specific geographic location, rather relates to evidence of a long history of industrial land use in Pyrmont including historic railyards, factories, bulk fuel storage and warehousing. This captures various sites in the area identified in historic aerial imagery and during the site inspection that are not recorded in public databases as specific source sites of potential or actual contamination (e.g. on EPA databases).

In addition, potential acid sulfate soils have been identified as representing a moderate potential impact for the eastern construction site prior to application of mitigation measures. Saline soils may also be present within the same extent as potential acid sulfate soils.

Mitigation measures would be implemented to manage potential contamination and acid sulfate risks for the proposal. An additional data review would be undertaken to inform this plan. Where there is insufficient data available, detailed site investigations may be required. Where contamination is identified to present a moderate or higher potential risk of impacting receptors, a Remediation Action Plan or other management plan would be implemented as required.

5.2 Tunnel alignment from The Bays to Sydney CBD

Twin tunnels would be constructed using tunnel boring machines. The tunnels would be lined with precast concrete segments to ensure the long-term life of the asset and minimise groundwater inflow into the tunnel.

Cross passages, turnbacks and stub tunnels would also be excavated at depth.

The proposed construction methodology is for progressive lining of the tunnel during construction as the tunnel boring machine advances. As a result of this, groundwater inflow to the tunnel is expected to be limited however there is potential of higher inflows at the cutting face, depending on the operating mode.

Areas of environmental interest identified in the vicinity of the tunnel alignment are presented in Table 5-1. Potential impacts from contamination were assessed as low or very low for the tunnel alignment.

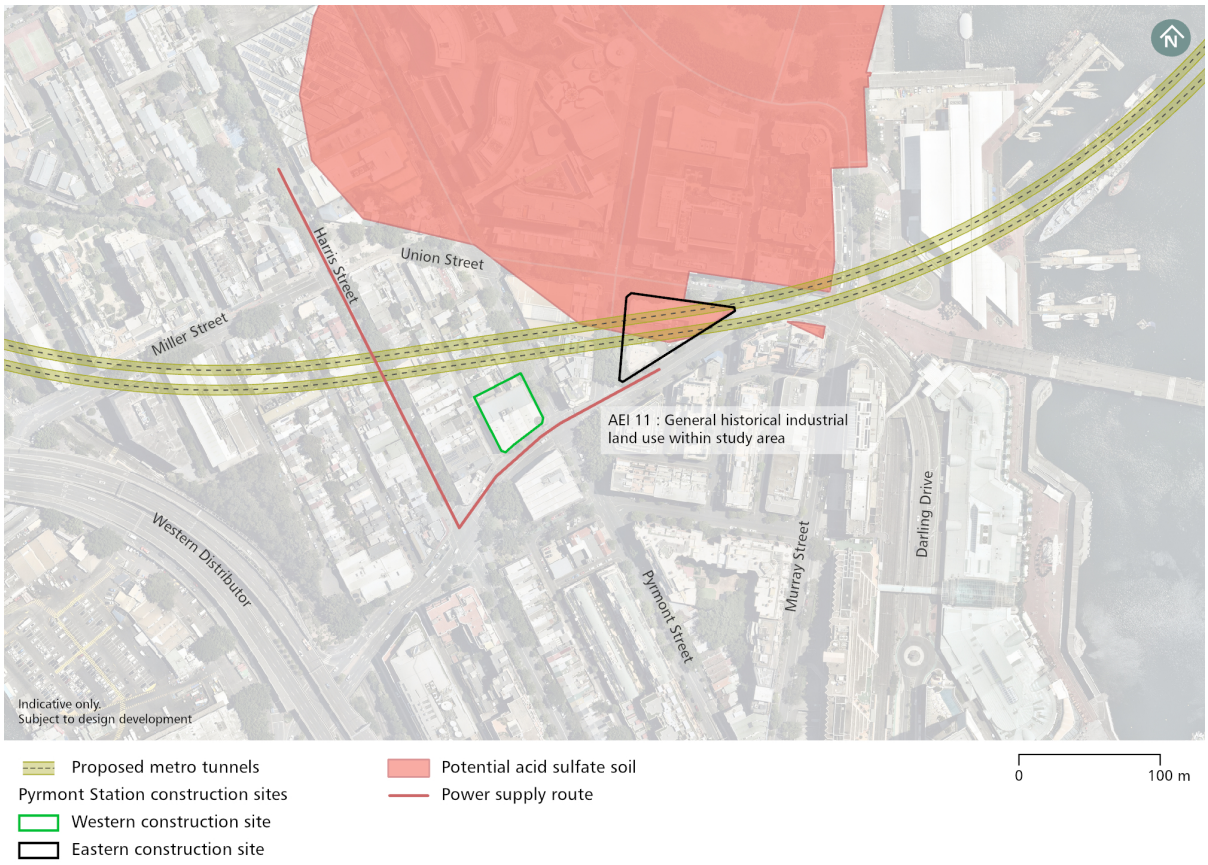

Figure 5-1 AEIs assessed as moderate or higher contamination impact potential for Pyrmont Station construction sites

Table 5-1 Areas of Environmental Interest for tunnel alignment

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
1	Former Pyrmont Power Station, including substation and structures (including potential firefighting activities and demolition) EHC Act Revocation Notice (recognised hydrocarbons, PCBs, chemical storage/waste and asbestos)	Tunnelling (The Bays to Pyrmont)	Soil PFAS, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, polychlorinated biphenyls, chemical storage/waste and asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	100 metres north	Surface soil contamination (if present) from source site unlikely to migrate and be exposed during tunnelling at depth	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater PFAS, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, polychlorinated biphenyls, volatile organic compounds	Contamination unlikely to be present in groundwater at concentrations above the relevant assessment criteria and limited in extent Limited sampling of groundwater has been completed within Pyrmont however data (Golder-Douglas, 2018) does not suggest that widespread contamination is present as a result of former power station operations in this vicinity	SE1		Potential for contaminated groundwater migration from off-site source to be present at depth within tunnel alignment	Construction workers could be exposed to contamination via contact (der, ing) with contaminated groundwater Ecosystems could be exposed to contamination via uncontrolled releases (water) during construction	PR2	Low
			Vapour Volatile hydrocarbons	Vapour contamination unlikely to be present as a result of former power station operations at concentrations above the relevant assessment criteria	SE1		Vapour (if present) unlikely to be exposed during excavation of materials to the depth of construction due to nature of consolidated rock	Vapour emissions unlikely to be encountered during construction	PR1	Very low
2	Former Ampol terminal. EHC Act Revocation Notice (Former). Known heavy metals and hydrocarbon contamination Soil remediation completed prior to 1994, potential for remaining contamination above current guideline levels unknown	Tunnelling (The Bays to Pyrmont)	Soil Heavy metals, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	430 metres north-west	Surface soil contamination (if present) from source site unlikely to migrate and be exposed during tunnelling at depth	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Heavy metals, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2		Contaminated groundwater (if present) unlikely to migrate from off-site source and be present at depth within tunnel alignment due to groundwater flow direction and nature of consolidated rock at tunnel depth	Construction workers unlikely to be exposed to groundwater contamination (if present) from source site	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
			Vapour Volatile hydrocarbons	Vapour contamination potentially present as a result of former Ampol terminal operations at concentrations above the relevant assessment criteria and limited in extent	SE2		Vapour (if present) unlikely to be exposed during excavation of materials to the depth of construction due to distance from site and nature of consolidated rock	Vapour emissions unlikely to be encountered during construction	PR1	Low
3	Above ground bulk fuel storage (Pyrmont)	Tunnelling (The Bays to Pyrmont)	Soil Hydrocarbons, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	100 metres north	Surface soil contamination (if present) from source site unlikely to migrate and be exposed during tunnelling at depth	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Hydrocarbons, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread	SE3		Contaminated groundwater (if present) unlikely to migrate from off-site source and be present at depth within tunnel alignment due to groundwater flow direction and nature of consolidated rock	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Vapour Hydrocarbons, PFAS	Vapour contamination potentially present as a result of bulk fuel storage at concentrations above the relevant assessment criteria and limited in extent	SE2		Vapour (if present) unlikely to be exposed during excavation of materials to the depth of construction	Vapour emissions unlikely to be encountered during construction	PR1	Low
4	Former Unilever Sulphonation Plant Chemical and potential fuel storage and use, potential spills, manufacturing processes, inappropriate demolition/waste disposal practices EHC Act Revocation Notice issued. Remediation completed prior to 1997 Contaminated soil deeper than 0.5 metres remains	Tunnelling (The Bays to Pyrmont)	Soil Heavy metals, polycyclic aromatic hydrocarbons, linear alkylbenzene and linear alkylbenzene sulphonate compounds, asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	500 metres north-west	Surface soil contamination (if present) from source site unlikely to migrate and be exposed during tunnelling at depth	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Heavy metals, polycyclic aromatic hydrocarbons, linear alkylbenzene and linear alkylbenzene sulphonate compounds	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread	SE3		Contaminated groundwater (if present) unlikely to migrate from off-site source and be present at depth within tunnel alignment due to groundwater flow direction and nature of consolidated rock	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
5	Dry cleaning (447 Kent Street, CBD and potentially other locations within Sydney CBD) Residuals from current dry cleaning activities. inappropriate disposal of solvents, depth distribution associated with potential underground tanks EPA notified site at 447 Kent Street, but site not regulated. No longer operational based on site inspection	Tunnelling (Pyrmont to Sydney CBD)	Surface soil Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1	500 metres south	Surface contamination from source site unlikely to migrate and be exposed during construction	Contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Very low
			Groundwater Chlorinated hydrocarbons, volatile organic compounds	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2		Contaminated groundwater (if present) unlikely to migrate from off-site source and be present at depth within tunnel alignment due to distance from source site and nature of consolidated rock	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Vapour Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1		Vapour (if present) unlikely to be intersected by excavation as likely to be localised to vicinity of source site.	Vapour unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
6	Former gasworks at Millers Point including waste products (slag, coal tar), fuel storage leaks and spills Contamination currently regulated under CLM Act Remediation partially complete	Tunnelling (Pyrmont to Sydney CBD)	Soil Hydrocarbons, coal tar	Known contamination present in the media of concern at concentrations above the relevant assessment criteria at source site. Contamination at depth of tunnel in rock possibly present at source site however limited in extent	SE2	300 metres north at closest point	Surface soil contamination (if present) from source site unlikely to migrate and be exposed during tunnelling at depth	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Hydrocarbons, ammonia, phenol, cyanide, pH	Known contamination present at site however contamination at depth of tunnel in rock possibly present at source site however likely to be limited in extent given extensive remediation	SE2		Groundwater drawdown towards tunnel considered to be negligible therefore unlikely for contaminated groundwater from source site to migrate and be present at depth within tunnel at depth as drawdown of groundwater from tunnel construction likely to be negligible	Unlikely for construction workers or ecological receptors to exposed to contaminated groundwater from source site	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
			Vapour Volatile hydrocarbons	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2		Unlikely for vapour contamination from source site to be present in tunnel or migrate as drawdown of groundwater contaminated with vapours into tunnel anticipated to be negligible	Unlikely for construction workers to be exposed to vapour	PR1	Low
7	Former Pyrmont incinerator including potential fuel spills and storage, inappropriate waste burial and demolition	Tunnelling (The Bays to Pyrmont)	Soil Heavy metals, hydrocarbons, asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	100 metres north at closest point	Surface soil contamination (if present) from source site unlikely to migrate and be exposed during tunnelling at depth	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Heavy metals, hydrocarbons	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2		Contaminated groundwater (if present) unlikely to migrate from off-site source and be present at depth within tunnel alignment	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
8	Former White Bay Power Station including substation and structures (including potential firefighting activities and demolition) EHC Act Revocation Notice (recognised asbestos and PCB contamination)	Tunnelling (The Bays to Pyrmont)	Soil. Heavy metals, hydrocarbons (TRH, PAH), PCB, asbestos, PFAS	Contamination present in soil at surface at concentrations above the relevant assessment criteria however considered limited in extent and unlikely at depth of the tunnel in rock	SE2	150 metres west of tunnel at westernmost point	Surface soil contamination (if present) from source site unlikely be exposed during tunnelling at depth	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater. Heavy metals, hydrocarbons (TRH, PAH), PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria Groundwater monitoring completed for Sydney Metro indicates concentrations of metals in groundwater at depth however these are likely to be naturally occurring Contamination has been reported in shallower groundwater (PFAS, hydrocarbons, metals and nutrients) and monitoring has indicated connectivity between shallow and deeper groundwater Groundwater contamination, if present above guidelines for protection of human health and ecosystems, is likely to be limited in extent within rock at depth of tunnel	SE2		Groundwater contamination (if present) unlikely to be exposed during excavation of tunnel considering proposed construction method and limited expected groundwater inflow during construction	Groundwater contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
			Vapour Chlorinated ethenes, volatile hydrocarbons	Vapour possibly present at concentrations above the relevant assessment criteria and limited in extent. Monitoring has not been completed at the depth of tunnel however vapour has been identified near the surface at The Bays tunnel launch and support site and volatile compounds within shallow groundwater.	SE2	Exceedance of vapour criteria for protection of human health about 250 metres west of tunnel alignment westernmost point	Vapour unlikely to migrate and be exposed during excavation of materials during the tunnel construction as drawdown of groundwater contaminated with vapours into tunnel anticipated to be negligible	Construction workers unlikely to be exposed to contamination via vapour emissions during tunnelling)	PR1	Low
9	Land reclamation – Historical use of potentially contaminated fill adjacent to waterways	Tunnelling (The Bays to Pyrmont)	Surface soil Heavy metals, hydrocarbons (TRH, PAH), pesticides, PCB, asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	Within alignment	Surface soil contamination (if present) from source site unlikely to migrate and be exposed during tunnelling at depth	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Heavy metals, hydrocarbons (TRH, PAH)	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread due to widespread nature of filling and land reclamation throughout tunnel alignment	SE3		Contaminated groundwater (if present) unlikely to be present at depth within sandstone in tunnel alignment	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
10	Dry cleaning and laundry facilities (149 and 204 Harris Street, Pyrmont and 7 Hunter Street, Sydney CBD) Residuals from current dry cleaning activities. inappropriate disposal of solvents, depth distribution associated with potential underground tanks	Tunnelling (Pyrmont to Sydney CBD)	Surface soil Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1	Adjacent to alignment in Pyrmont and Sydney CBD	Surface contamination from source site unlikely to migrate and be exposed during construction of tunnel	Contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Very low
			Groundwater Chlorinated hydrocarbons, volatile organic compounds	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2		Contaminated groundwater (if present) unlikely to migrate to depth of tunnel.	Construction workers unlikely to be exposed to contamination via contact (der, ing) with contaminated groundwater	PR1	Low
			Vapour Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1		Vapour (if present) unlikely to be intersected by excavation as likely to be localised to vicinity of source site	Vapour unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
11	General historical commercial / industrial use including rail yards – Inappropriate chemical storage and use, industrial operations, waste disposal and management etc.	Tunnelling	Surface soil Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	Within alignment	Surface soil contamination (if present) from source site unlikely to migrate and be exposed during tunnelling at depth	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread	SE3		Contaminated groundwater (if present) unlikely to be present at depth within sandstone in tunnel alignment	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Vapour Volatile hydrocarbons VOC	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2		Vapour (if present) unlikely to migrate and be exposed during excavation of materials to the depth of tunnel construction	Construction workers unlikely to be exposed to contamination via vapour emissions during tunneling.)	PR1	Low
12	Current and historical storage of diesel for backup power supply generators within commercial buildings - Leaks and spills from underground petroleum storage infrastructure	Tunnelling (Pyrmont to Sydney CBD)	Soil Petroleum hydrocarbons	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	Within and adjacent to the alignment beneath Sydney CBD	Soil contamination (if present) from source site unlikely to migrate and be exposed during tunnelling at depth	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Petroleum hydrocarbons	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1		Groundwater contamination (if present) from source site unlikely to migrate and be exposed during tunnelling at depth	Groundwater contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Very low

5.3 Pyrmont Station power supply route

Areas of environmental interest identified within and surrounding the Pyrmont Station supply route are presented in Table 5-2.

Shallow excavation is assumed as the method for the development of the power supply routes, thus interaction with groundwater is unlikely.

AEIs assessed as moderate or higher contamination impact potential for the Pyrmont Station power supply route are shown on Figure 5-1.

Table 5-2 Areas of Environmental Interest for the Pyrmont Station power supply route

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
1	Former Pyrmont Power Station including substation and structures (including potential firefighting activities and demolition) EHC Act Revocation Notice (recognised hydrocarbons, PCBs, chemical storage/waste and asbestos)	Pyrmont Station power supply route surface work	Soil PFAS, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, polychlorinated biphenyls, chemical storage/waste and asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	100 metres north	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
3	Above ground bulk fuel storage (Pyrmont)	Pyrmont Station power supply route surface work	Soil Hydrocarbons, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	400 metres north-west	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
8	Former Pyrmont incinerator including potential fuel spills and storage, inappropriate waste burial and demolition	Pyrmont Station power supply route surface work	Soil Heavy metals, hydrocarbons, asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	400 metres north-west	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
10	Land reclamation – Historical use of potentially contaminated fill adjacent to waterways	Pyrmont Station power supply route surface work	Surface soil Heavy metals, hydrocarbons (TRH, PAH), pesticides, PCB, asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	Adjacent surrounding Blackwattle Bay and Darling Harbour (50 - 100 metres)	Surface soil contamination (if present) unlikely to be exposed during excavation of surface materials	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
11	General historical commercial / industrial use including rail yards – Inappropriate chemical storage and use, industrial operations, waste disposal and management etc	Pyrmont Station power supply route surface work	Surface soil Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	Adjacent to construction sites	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
13	Dry Cleaning and Laundry facilities (149 and 204 Harris Street, Pyrmont) Residuals from current dry cleaning activities. inappropriate disposal of solvents, depth distribution associated with potential underground tanks	Pyrmont Station power supply route surface work	Surface soil Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1	Adjacent to construction sites	Surface contamination from source site unlikely to migrate and be exposed during construction	Contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Very low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
-	Acid sulfate soils	Pyrmont Station power supply route – adjacent to eastern construction site	Soil Potential formation of sulfuric acid	Acid sulfate soils (Class 1) possibly present.	SE2	Adjacent	Potential ASS likely to be disturbed during surface soil work	Ecosystems of Darling Harbour or Blackwattle Bay could be exposed to sulfuric acid via uncontrolled releases during construction	PR3	Moderate
		Pyrmont Station power supply route – adjacent to western construction site		Low potential for acid sulfate soils to be present (Class 5)	SE1	50 metres east of construction site	Potential ASS unlikely to be disturbed during surface soil work Dewatering and lowering of water table not required for power supply route construction	Potential acid sulfate soil unlikely to be exposed therefore impacts to receptors unlikely	PR1	Very low
-	Saline soils	Pyrmont Station power supply route – adjacent to eastern construction site	Soil Salinity	Saline soils possibly present (associated with acid sulfate soils) and limited in extent	SE2	Within eastern construction site (where PASS present)	Saline soils likely to be disturbed where PASS present during surface soil work	Ecosystems of Darling Harbour or Blackwattle Bay could be exposed to saline runoff water via uncontrolled releases during construction	PR3	Moderate
		Pyrmont Station power supply route – adjacent to western construction site		Low potential for saline soils to be present and limited in extent	SE1	50 metres east of construction site	Saline soils unlikely to be disturbed	Saline soil unlikely to be exposed therefore impacts to receptors unlikely	PR1	Very low

5.4 The Bays tunnel and launch support site

The Bays Station construction site would be established under the Stage 1 approval, and a portion of the site would be handed over to provide tunnel launch and support for tunnelling between The Bays and Hunter Street Station (Sydney CBD) construction site. Activities that would be carried out as part of the tunnel launch and support site are:

- Site set up and enabling work
- Excavation of the crossover cavern using roadheaders from within the approved The Bays Station cut-and-cover box, requiring removal of about 43,707 cubic metres of spoil at depth.

There would be minimal surface ground disturbance associated with this work.

Inflow of groundwater to the crossover cavern is conservatively estimated to be around 45 cubic metres per day (refer to Technical Paper 7 (Hydrogeology)), assuming the cavern is open for a 12 month construction period. Intersection of geological features may impact inflows. This is considered to be conservative however and inflows would be lower as the cavern would be progressively sealed, restricting groundwater inflow to open areas, and treatment of geological features would be completed to minimise inflows. Drawdown of groundwater as a result of the tunnel and launch support site activities, including excavation of the crossover cavern, is considered negligible based on the proposed construction methodology.

Areas of environmental interest identified within and surrounding The Bays tunnel and launch support site are presented in Table 5-3.

As part of the assessment carried out for the major civil construction work for Westmead to The Bays (Stage 1 of the planning approval process), a number of moderate potential contamination impacts were identified for The Bays Station construction site, namely the potential for soil and groundwater contamination to be present within the site and be intersected by the construction. The resulting Conditions of Approval require completion of a detailed site investigation where disturbance of moderate or high risk contaminated sites are identified, and subsequent remediation is to be completed if required to make the land suitable for the final intended use. Therefore, further investigation and potentially remediation of potential impacts from contamination will be completed prior to the start of work for this proposal. Additionally, removal of contaminated soil and groundwater (if present) from within the station box will occur as part of the Stage 1 approval.

It is considered that compliance with the Conditions of Approval will therefore reduce the potential for contamination to be present and reduce the risk of contamination impact as part of this proposal. As a result, there were no identified areas of environmental interest that are considered to have moderate, high or very high potential contamination impact for the proposed construction activities at The Bays tunnel and launch support site under this proposal.

Table 5-3 Areas of Environmental Interest for The Bays tunnel and launch support site

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
2	Former Ampol terminal. EHC Act Revocation Notice (Former) Known heavy metals and hydrocarbon contamination Soil remediation completed prior to 1994, potential for remaining contamination above current guideline levels unknown	The Bays excavation of crossover cavern	Soil Heavy metals, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	400 metres north-west	Surface soil contamination (if present) from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Heavy metals, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2		Groundwater contamination (if present) likely migrating east towards White Bay and unlikely to be present within excavation	Construction workers unlikely to be exposed to groundwater contamination	PR1	Low
			Vapour Volatile hydrocarbons	Vapour contamination potentially present as a result of former Ampol terminal operations at concentrations above the relevant assessment criteria and limited in extent	SE2		Vapour (if present) unlikely to be exposed during excavation of materials due to distance from site and nature of consolidated rock	Vapour emissions unlikely to be encountered during construction	PR1	Low
4	Former Unilever Sulphonation Plant Chemical and potential fuel storage and use, potential spills, manufacturing processes, inappropriate demolition/waste disposal practices EHC Act Revocation Notice issued Remediation completed prior to 1997 Contaminated soil deeper than 0.5 metres remains	The Bays excavation of crossover cavern	Soil Heavy metals, polycyclic aromatic hydrocarbons, linear alkylbenzene and linear alkylbenzene sulphonate compounds, asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	400 metres north-west	Soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Heavy metals, polycyclic aromatic hydrocarbons, linear alkylbenzene and linear alkylbenzene sulphonate compounds	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread	SE3		Groundwater contamination (if present) likely migrating east towards White Bay and unlikely to be exposed during excavation of materials to the depth of construction	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
8	Former White Bay Power Station including substation and structures (including potential firefighting activities and demolition)	The Bays excavation of crossover cavern	Soil. Heavy metals, hydrocarbons (TRH, PAH), PCB, asbestos, PFAS	Contamination present in surface fill and natural soil at concentrations above the relevant assessment criteria and limited in extent, however contamination at the depth of excavation in rock (if present) is likely to be limited in extent	SE2	Within footprint	Surface soil contamination (if present) unlikely to be disturbed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
	EHC Act Revocation Notice (asbestos and PCB contamination)		Groundwater. Heavy metals, hydrocarbons (TRH, PAH), PFAS	Low potential for groundwater contamination to be present at depth of construction activities within rock for excavation of the crossover cavern Groundwater monitoring completed for Sydney Metro indicates concentrations of metals in groundwater at depth however these are likely to be naturally occurring Contamination (hydrocarbons, PFAS and nutrients) has been reported in shallower groundwater Monitoring has shown connectivity between shallow and deeper groundwater, however construction as part of the Stage 1 approval for The Bays station box is considered to reduce the potential for contamination to be present.	SE1		Groundwater contamination (if present) could be exposed during excavation of materials for the crossover cabin.	Construction workers could be exposed to groundwater contamination via contact (der, ing) with contaminated groundwater Ecosystems of White Bay could be exposed to contamination via uncontrolled releases (water) during construction	PR2	Low
			Vapour Chlorinated ethenes, volatile hydrocarbons	Vapour possibly present at concentrations above the relevant assessment criteria and limited in extent Monitoring has not been completed at the depth of construction for this proposal however vapour has been identified near the surface at The Bays tunnel launch and support site and volatile compounds within shallow groundwater	SE2	Exceedance of vapour criteria for protection of human health about 100 metres west of The Bays tunnel launch	Vapour unlikely to migrate and be exposed during excavation of materials during the tunnel construction	Construction workers unlikely to be exposed to contamination via vapour emissions during tunnelling)	PR1	Low
9	Land reclamation – Historical use of potentially contaminated fill adjacent to waterways	The Bays excavation of crossover cavern	Surface soil Heavy metals, hydrocarbons (TRH, PAH), pesticides, PCB, asbestos	Contamination present in surface fill and natural soil at concentrations above the relevant assessment criteria and limited in extent, however contamination at the depth of excavation in rock (if present) is likely to be limited in extent	SE2	Within footprint	Surface soil contamination (if present) unlikely to be disturbed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
			Groundwater Heavy metals, hydrocarbons (TRH, PAH)	Low potential for groundwater contamination to be present at depth of construction activities within rock for excavation of the crossover cavern Contamination possibly present in the groundwater at concentrations above the relevant assessment criteria however based on groundwater monitoring completed for Sydney Metro this is likely to be limited in extent Construction as part of the Stage 1 approval for The Bays station box is considered to reduce the potential for contamination to be present at the depth of construction for the crossover cavern	SE1		Groundwater contamination (if present) could be exposed during excavation of materials for the crossover cabin	Construction workers could be exposed to groundwater contamination via contact (der, ing) with contaminated groundwater Ecosystems of White Bay could be exposed to contamination via uncontrolled releases (of inflow water) during construction	PR2	Low
11	General historical commercial / industrial use, including rail yards – Inappropriate chemical storage and use, industrial operations, waste disposal and management etc	The Bays excavation of crossover cavern	Surface soil Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	Adjacent to footprint	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread	SE3		Contaminated groundwater (if present) unlikely to migrate from off-site source to The Bays tunnel launch and support site due to groundwater flow direction	Construction workers unlikely to be exposed to groundwater contamination from off-site general sources	PR1	Low
-	Acid sulfate soils	The Bays excavation of crossover cavern	Soil Potential formation of sulfuric acid	Acid sulfate soils known to be present and widespread in natural soils in the vicinity of White Bay at depths below two metres in natural soil, however unlikely to be present at depth of excavation within sandstone	SE1	At surface within footprint	Potential ASS unlikely to be disturbed during excavation of the crossover cavern Groundwater drawdown as a result of construction is considered negligible therefore exposure of acid sulfate soils and generation of acidic runoff due to water level changes unlikely	Ecosystems unlikely to be exposed to sulfuric acid via uncontrolled releases during construction	PR1	Low
-	Saline soils	The Bays excavation of crossover cavern	Soil Salinity	Saline soils potentially present and widespread in natural soils in the vicinity of White Bay in natural soil near surface, however unlikely to be present at depth of excavation within sandstone	SE1	At surface within footprint	Saline soils unlikely to be disturbed during excavation of the crossover cavern	Ecosystems of White Bay or Blackwattle Bay unlikely to be impacted by saline runoff	PR1	Low

5.5 Pyrmont Station construction sites

Construction at the two Pyrmont Station construction sites would involve:

- Excavation of shafts then caverns using a mined technique to remove about 220,000 cubic metres of spoil
- Ancillary support work including spoil storage and removal, water supply, water treatment and disposal, temporary ventilation plant, material storage and office facilities, worker amenities and parking
- During construction, inflows to station caverns would be drained up until the station caverns are sealed and waterproofed. Pyrmont Station would be constructed with a tanked design.

During the two year construction period, drawdown of groundwater from the surrounding area is anticipated to occur (to about the width of the Pyrmont peninsula), reversing current groundwater flow directions towards the construction sites. Inflow over the construction period is estimated to be relatively small (<0.7 litres per second). Technical Paper 7 (Hydrogeology) provides further detail with regards to the influence of construction on groundwater conditions, based on the proposed construction methodology.

Areas of environmental interest within and surrounding the Pyrmont Station construction sites are presented in Table 5-4. Potential contamination impacts assessed as moderate or higher are presented in Figure 5-1. Note, AEI 11 is a 'general industrial use' in the vicinity of the construction site and does not correspond to a specific geographic location. This AEI relates to evidence of a long history of industrial land use in Pyrmont including historic railyards, factories, bulk fuel storage and warehousing. This captures various sites in the area identified in historic aerial imagery that are not recorded in public databases as specific sources of potential or actual contamination (e.g. on EPA databases).

All potential areas of environmental interest and associated potential contamination impacts relate to both of the Pyrmont Station construction sites. The exception to this is the potential for acid sulfate soils and saline soils to be disturbed which is higher at the Pyrmont Station eastern construction site. Saline soils may also be present within the same extent as potential acid sulfate soils.

Table 5-4 Areas of Environmental Interest for Pyrmont Station construction sites

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
1	Former Pyrmont Power Station including substation and structures (including potential firefighting activities and demolition) EHC Act Revocation Notice (recognised hydrocarbons, PCBs, chemical storage/waste and asbestos)	Pyrmont Station surface work associated with major civil construction	Soil PFAS, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, polychlorinated biphenyls, chemical storage/waste and asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	100 metres north	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
		Pyrmont Station shaft and deep excavation	Groundwater PFAS, polycyclic aromatic hydrocarbons, petroleum hydrocarbons, polychlorinated biphenyls, volatile organic compounds	Contamination unlikely to be present in groundwater at concentrations above the relevant assessment criteria and limited in extent Limited sampling of groundwater has been completed within Pyrmont however data (Golder-Douglas, 2018) does not suggest that widespread contamination is present as a result of former power station operations in this vicinity	SE1		Groundwater contamination (if present) likely migrating away from station to the north-east. Depending on dewatering activities, potential for migration towards station excavation and groundwater contamination could be exposed during excavation of materials to the depth of construction	Construction workers could be exposed to contamination via contact (der, ing) with contaminated groundwater Ecosystems of Darling Harbour or Blackwattle Bay could be exposed to contamination via uncontrolled releases (water) during construction	PR2	Low
		Pyrmont Station shaft and deep excavation	Vapour Volatile hydrocarbons	Vapour contamination unlikely to be present as a result of former power station operations at concentrations above the relevant assessment criteria	SE1		Vapour (if present) unlikely to be exposed during excavation of materials	Vapour emissions unlikely to be encountered during construction	PR1	Very low
3	Above ground bulk fuel storage (Pyrmont)	Pyrmont Station surface work associated with major civil construction	Soil Hydrocarbons, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	500 metres north-west	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
		Pyrmont Station shaft and deep excavation	Groundwater Hydrocarbons, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread	SE3		Groundwater contamination (if present) likely migrating away from station to the north-west to Sydney Harbour Based on modelled groundwater drawdown, migration towards station excavation unlikely and groundwater contamination from bulk fuel storage unlikely to be exposed during excavation of materials to the depth of construction	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
		Pyrmont Station shaft and deep excavation	Vapour Hydrocarbons, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread	SE3		Vapour (if present) unlikely to be exposed during excavation of materials to the depth of construction due to distance from source site and likely groundwater flow direction	Vapour emissions unlikely to be encountered during construction	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
7	Former Pyrmont incinerator including potential fuel spills and storage, inappropriate waste burial and demolition	Pyrmont Station surface work associated with major civil construction	Soil Heavy metals, hydrocarbons, asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	500 metres north-west	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
		Pyrmont Station shaft and deep excavation	Groundwater Heavy metals, hydrocarbons	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2		Groundwater contamination (if present) likely migrating away from station to the north-west to Sydney Harbour Based on modelled groundwater drawdown, low potential for migration towards station excavation and groundwater contamination to be exposed during excavation of materials to the depth of construction	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
9	Land reclamation – Historical use of potentially contaminated fill adjacent to waterways	Pyrmont Station surface work associated with major civil construction	Surface soil Heavy metals, hydrocarbons (TRH, PAH), pesticides, PCB, asbestos	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	Adjacent surrounding Blackwattle Bay and Darling Harbour (50 - 100 metres)	Surface soil contamination (if present) unlikely to be exposed during excavation of surface materials	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
		Pyrmont Station shaft and deep excavation	Groundwater Heavy metals, hydrocarbons (TRH, PAH)	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread	SE3		Groundwater contamination (if present) from land reclamation unlikely to be exposed during excavation of materials to the depth of construction for station due to groundwater flow direction	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
10	Dry Cleaning and Laundry facilities (149 and 204 Harris Street, Pyrmont) Residuals from current dry cleaning activities. inappropriate disposal of solvents, depth distribution associated with potential underground tanks	Pyrmont Station surface work associated with major civil construction	Surface soil Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1	Adjacent to construction sites	Surface contamination from source site unlikely to migrate and be exposed during construction	Contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Very low
		Pyrmont Station shaft and deep excavation	Groundwater Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent based on no observations of relevant contaminants of concern within groundwater wells monitored near Pyrmont Station for Sydney Metro	SE1		Potential for contaminated groundwater (if present) migration from off-site source to be present at depth within station shaft excavation due to proximity to site	Construction workers could be exposed to contamination via contact (der, ing) with contaminated groundwater	PR2	Low
		Pyrmont Station shaft and deep excavation	Vapour Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1		Vapour (if present) unlikely to be intersected by excavation as likely to be localised to vicinity of source site	Vapour unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
11	General historical commercial / industrial use including rail yards – Inappropriate chemical storage and use, industrial operations, waste disposal and management etc	Pyrmont Station surface work associated with major civil construction	Surface soil Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	Adjacent to construction sites	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
			Groundwater Heavy metals, hydrocarbons (TRH, BTEX, PAH), VOC, PFAS	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and potentially widespread Land surrounding the Pyrmont Station construction sites has a long history of industrial use broadly across the Pyrmont peninsula The potential nature and extent of contamination from a range of sites where industrial land use has occurred is not known Groundwater monitoring completed by Sydney Metro near the Pyrmont Station eastern construction site reported concentrations of metals above guideline criteria for protection of marine ecosystems It is noted however that analysis for all contaminants of potential concern has not undertaken to date (e.g. PFAS)	SE3		Potential for contaminated groundwater migration from off-site source to be present at depth within construction sites, particularly from up-gradient sources to the south of the station site based on modelled groundwater drawdown and zone of influence	Construction workers could be exposed to contamination via contact (der, ing) with contaminated groundwater	PR2	Moderate
-	Acid sulfate soils	Pyrmont Station surface work - eastern construction site associated with major civil construction	Soil Potential formation of sulfuric acid	Acid sulfate soil possibly present (Class 1)	SE2	Within eastern construction site	Potential ASS likely to be disturbed during surface soil work. Groundwater drawdown as a result of construction likely to lower the water table and expose potential acid sulfate soil to oxidation	Ecosystems of Darling Harbour or Blackwattle Bay could be exposed to sulfuric acid via uncontrolled releases during construction	PR3	Moderate
		Pyrmont Station surface work - western construction site associated with major civil construction		Low potential for acid sulfate soils to be present (Class 5)	SE1	50 metres east of construction site	Potential ASS unlikely to be disturbed during surface soil work Groundwater drawdown as a result of construction likely to lower the water table on adjacent Class 1 land and expose acid sulfate soil to oxidation (see above)	Acid sulfate soil unlikely to be exposed in near surface soils at western construction site. Potential acid sulfate soil likely to be exposed due to dewatering (see above)	PR1	Very low
-	Saline soils	Pyrmont Station surface work - eastern construction site associated	Soil Salinity	Saline soils possibly present where acid sulfate soils are present and limited in extent	SE2	Within eastern construction site (where	Saline soils likely to be disturbed where PASS present during surface soil work	Saline runoff water via uncontrolled releases may enter Darling Harbour or Blackwattle Bay and reach ecological receptors,	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
		with major civil construction				PASS present)		however based on salinity of these waterways it is unlikely that any runoff as a result of the project would alter current conditions		
		Pyrmont Station surface work - western construction site associated with major civil construction		Low potential for saline soils to be present and limited in extent	SE1	50 metres east of construction site	Saline soils unlikely to be disturbed	Saline soil unlikely to be exposed therefore impacts to receptors unlikely	PR1	Very low

5.6 Hunter Street Station (Sydney CBD) construction sites

Construction at the two Hunter Street Station (Sydney CBD) construction sites would involve:

- Excavation of shafts then station caverns using a mined technique to remove about 505,000 cubic metres of spoil
- Ancillary support work including spoil storage and removal, water supply, water treatment and disposal, temporary ventilation plant, material storage as well as office facilities, worker amenities and parking, and storage
- During construction, inflows to station caverns would be drained up until the station caverns are sealed and waterproofed. Hunter Street Station would be constructed with a tanked design.

During the two year construction period, drawdown of groundwater from the surrounding area is anticipated to occur (the extent of drawdown is outlined in Technical Paper 7 (Hydrogeology)), reversing current groundwater flow directions towards the construction sites. The interpreted drawdown contours are considered to be conservative and likely overestimated due to a lack of site specific water level data and the significant number of subsurface structures (such as basements and tunnels) likely to impact on hydrogeological conditions that were not incorporated into the modelling. Inflow over the construction period is estimated to be relatively small (<0.95 litres per second). Technical Paper 7 (Hydrogeology) provides further detail with regards to the influence of construction on groundwater conditions based on the proposed construction methodology.

Areas of environmental interest identified within and surrounding the Hunter Street Station (Sydney CBD) construction sites are presented in Table 5-5.

Table 5-5 Areas of Environmental Interest for Hunter Street Station (Sydney CBD) construction sites

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
5	Dry cleaning (447 Kent Street, CBD and potentially other locations within Sydney CBD) Residuals from current dry cleaning activities, inappropriate disposal of solvents, depth distribution associated with potential underground tanks EPA notified site at 447 Kent Street, but site not regulated	Hunter Street Station (Sydney CBD) surface work associated with major civil construction	Surface soil Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1	500 metres south	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Very low
		Hunter Street Station (Sydney CBD) shaft and deep excavation	Groundwater Chlorinated hydrocarbons, volatile organic compounds	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2		Contaminated groundwater (if present) unlikely to migrate to station shaft excavation due to distance from site and nature of sandstone aquifer	Groundwater contamination (if present) unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	P1	Low
			Vapour Chlorinated hydrocarbons, volatile organic compounds	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2		Vapour (if present) unlikely to be intersected by excavation as likely to be localised to vicinity of source site	Vapour unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Very low
6	Former gasworks at Millers Point including waste products (slag, coal tar), fuel storage leaks and spills Contamination currently regulated under CLM Act Remediation partially complete	Hunter Street Station (Sydney CBD) surface work associated with major civil construction	Soil Hydrocarbons, coal tar	Potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent (following remedial work) Contamination at depth of tunnel in rock possibly present at source site however limited in extent	SE2	300 metres west at closest point	Surface soil contamination from source site unlikely to migrate and be exposed during construction	Soil contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
		Hunter Street Station (Sydney CBD) shaft and deep excavation	Groundwater Hydrocarbons, ammonia, phenol and cyanide	Known contamination present at site. Contamination at depth of tunnel in rock possibly present at source site however likely to be limited in extent given extensive remediation	SE2		Groundwater contamination understood to be migrating towards Darling Harbour however during construction, area of drawdown from construction sites is modelled to extend to former gasworks site, therefore potential for migration towards station excavation Unlikely that during the two year construction period contaminated groundwater from former gasworks will reach receptors at station construction sites due to distance and sandstone geology	Construction workers or environmental receptors unlikely to be exposed to groundwater contamination via contact (der, ing) with contaminated groundwater	PR1	Low
			Vapour Volatile hydrocarbons	Potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent (following remedial work)	SE2		Unlikely vapour associated with former gasworks to migrate to station excavation due to distance and nature of sandstone geology	Construction workers unlikely to be exposed to vapour	PR1	Low

AEI #	Site of concern and potential source of contamination	Relevant proposal activities	Contamination severity and extent assessment			Pathways and receptors (Assessment of relationship to construction sites and scope)				Potential contamination impact
			Media and COPCs	Contamination status	Refer to Table 3-1	Approx. location relative to proposal	Potential for contamination to be intersected by proposal	Exposure pathways (der – direct contact, ing – ingestion or inh – inhalation)	Refer to Table 3-1	
10	Dry Cleaning facilities (7 Hunter Street) Residuals from current dry cleaning activities. inappropriate disposal of solvents, depth distribution associated with potential underground tanks. Presence of tanks and chemical use not confirmed and potentially shop front only.	Hunter Street (Sydney CBD) Station surface work associated with major civil construction	Surface soil Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1	Within Hunter Street Station western construction site	Surface contamination from source site unlikely to migrate and be exposed during construction	Contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Very low
		Hunter Street (Sydney CBD) Station shaft and deep excavation	Groundwater Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent based on no observations of relevant contaminants of concern within groundwater wells monitored near Pyrmont Station for Sydney Metro	SE1		Potential for contaminated groundwater (if present) migration from off-site source to be present at depth within station shaft excavation due to proximity to site	Construction workers could be exposed to contamination via contact (der, ing) with contaminated groundwater	PR2	Low
		Hunter Street (Sydney CBD) Station shaft and deep excavation	Vapour Chlorinated hydrocarbons, volatile organic compounds	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1		Vapour (if present) unlikely to be intersected by excavation as likely to be localised to vicinity of source site	Vapour unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
12	Current and historical storage of diesel for backup power supply generators within commercial buildings	Hunter Street Station (Sydney CBD) surface work associated with major civil construction	Soil Petroleum hydrocarbons	Contamination possibly present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE2	Within and adjacent to Hunter Street Station	Soil contamination (if present) likely to localised around storages	If present, soil contamination is likely to be minor and unlikely to represent a significant risk during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Low
	Leaks and spills from underground petroleum storage infrastructure	Hunter Street Station (Sydney CBD) shaft and deep excavation	Groundwater Petroleum hydrocarbons	Low potential for contamination to be present in the media of concern at concentrations above the relevant assessment criteria and limited in extent	SE1		Groundwater contamination (if present) likely to localised around storages	Groundwater contamination unlikely to be exposed during construction and therefore unlikely to impact upon human and environmental receptors	PR1	Very low

6 Impact assessment

Based on the information reviewed, construction of Pyrmont Station has been assessed to have a moderate potential for contamination or acid sulfate soils to impact on receptors. A number of sites have been identified as having a low potential for contamination to impact on receptors related to other construction activities that will be managed through the mitigation measures described in Section 7.

If contamination and acid sulfate soil risks are not quantified and appropriately managed at sites where there is a moderate potential for impacts to occur, construction activities may expose workers, the public and environmental receptors to contaminated soil, groundwater or vapour.

Without appropriate management and/or remediation, potential impacts may include:

- Contaminant exposure risk to construction personnel and the general public
- Contaminant exposure to environmental receptors
- Oxidation of acid suflate soils and generation of acidic conditions
- High saline discharges to receptors
- Degradation of aquatic ecosystems
- Cross contamination associated with the incorrect handling or disposal of spoil/water/unexpected finds
- Contamination of previously clean areas.

Vapours are generally partitioned from volatile compounds present within soil and groundwater. The generation of vapours can be influenced by sub-surface conditions and the presence of below ground and on surface structures. If present within and/or adjacent to the construction sites and alignment, vapours could accumulate within below ground excavations and enclosed structures associated with the proposal concentrations which could represent an explosion or acute/chronic health risk.

All potential contamination identified can be managed subject to the implementation of appropriate management measures and/or remediation.

Higher risks and increased management and/or remediation effort during construction associated with soil contamination could be associated where materials contain dispersible fibres (i.e. asbestos), could generate vapours (hydrocarbons and VOC) or contain concentrations of contaminants which categorise material at a higher waste classification (i.e. restricted or hazardous waste). Higher risks and increased management and/or remediation effort are likely to be associated with groundwater contamination where the source is not located on the construction site (i.e. construction would not remove all and/or part of the contamination source).

The appropriate management measures and/or remediation can only be determined based on the results of additional information reviews and investigations, which would be completed prior to the commencement of construction.

6.1 Tunnelling from The Bays to Sydney CBD

No specific potential contamination impacts associated with the proposed tunnelling between The Bays and Sydney CBD have been identified with a moderate or higher potential impact rating.

6.2 Pyrmont Station power supply route

No specific potential contamination impacts associated with the proposed use and activities along the Pyrmont Station power supply route have been identified with the exception of a general potential for encountering fill soils that may contain asbestos or other contaminants. Acid sulfate and saline soils may be encountered in the vicinity of the eastern construction site.

6.3 The Bays tunnel and launch support site

The Bays Station construction site is being established under the existing approval (Stage 1 of the planning approval process) as described in *Sydney Metro West Environmental Impact Statement – Westmead to The Bays and Sydney CBD* (Sydney Metro, 2020a). Potential contamination impacts associated with this site will be investigated and remediated if required as part of establishment of The Bays Station construction site and excavation of the station box, prior to this proposal. No specific potential contamination impacts associated with the proposed use and activities for The Bays tunnel and launch support site have been identified with a moderate or higher potential impact rating.

6.4 Pyrmont Station construction sites

The potential contamination impacts associated with the proposed use and activities at the Pyrmont Station construction sites would include:

- Groundwater may be impacted by heavy metals, nutrients, petroleum hydrocarbons or polycyclic aromatic hydrocarbons, volatile organic compounds or PFAS within the construction sites, as a result of general industrial land use in the vicinity and given the likely shallow depth of groundwater. Increased potential for impact is likely to be associated with the ingress of contaminated groundwater into excavation voids, drawdown of groundwater and potential for migration from source sites towards the construction site and management of dewatering during construction
- Potential acid sulfate and saline soils are also likely to be present near the surface of the Pyrmont Station eastern construction site. Increased potential for impact is likely to be associated with the removal of surface soils for excavation of the station shafts or other supporting surface construction work, as well as lowering of the water table from dewatering activities during construction resulting in potential oxidation of acid sulfate soils.

6.5 Hunter Street Station (Sydney CBD) construction sites

No specific potential contamination impacts associated with the proposed use and activities at Hunter Street Station (Sydney CBD) construction sites have been identified with a moderate or higher potential impact rating.

6.6 Cumulative impacts

Cumulative impacts are impacts that result from the successive, incremental, or combined effects of an activity or project when added to other past, current, planned, or reasonably anticipated future impacts (Department of Planning and Environment, 2017). Work covered by this proposal has the possibility of interacting with a number of other projects along the tunnel alignment or at proposed construction sites. Key projects to be considered are described below.

Potential cumulative impacts from contamination have been assessed in consideration of the interaction of multiple projects (including major civil construction work between Westmead and The Bays) that would increase, decrease and/or alter potential contamination impacts to common human and/or environmental receptors.

Cumulative impacts would be dependent on a variety of factors including the presence of contamination and the type of potentially affected media (e.g. soil, groundwater), the nature and timing of construction disturbance (associated with major civil construction work between The Bays and Sydney CBD and other projects), as well as complete exposure pathways for contamination to human and/or environmental receptors.

Contamination impacts from individual projects, prior to appropriate typical mitigation measures being implemented could include (but are not limited) to the following:

- Excavation activities and liberation of contamination (as dust or fibres) which could deposit on adjacent land and be transported by surface water flows to surrounding areas
- Dewatering activities and discharge of contaminated water to adjacent land and waterways
- Odours/vapours detectable at site boundaries
- Accumulation of gas within below ground structures and low lying land form features on adjacent land.

It should be noted that contamination is reported as a concentration (e.g. milligrams per kilogram, micrograms per litre or grams per metre cubed) and not as mass. As such, the measurement of contamination from multiple sources at a receptor is not compounded, rather it would be reported as an average concentration. If contamination is not migrating from source sites at concentrations above criteria protective of receptors, then the cumulative contamination from the source sites is unlikely to impact upon that receptor.

Management of contamination associated with the construction of the proposal and construction and operation of other projects would need to be carried out in accordance with the following legislation (where triggered):

- *Contaminated Land Management Act 1997* – Sites containing existing contamination and sites that have been contaminated by future operations where the contamination is deemed significant enough to warrant regulation by the regulator (NSW EPA)
- *Protection of the Environment Operations Act 1997* – Establishes the NSW environmental regulatory framework and includes a licensing requirement for certain activities to control the localised, cumulative and acute impacts of pollution in NSW.

In consideration of the construction of the proposal, 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 the 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 and implemented by the contractor.

With respect to existing contamination (known and potential), the construction of the proposal is likely to reduce the overall contamination loading currently existing within the construction sites and the alignment as a result of the removal of contaminated materials to facilitate construction (for example due to excavation of contaminated soils to facilitate station construction and removal of contaminated groundwater during dewatering activities).

It is envisaged that contamination sources associated with the construction and operation of other projects would also be managed in accordance with appropriate construction environmental management plans (including appropriate licensing requirements to meet legislative obligations under the *Protection of the Environment Operations Act 1997*, where applicable). Any new projects to be carried out within the vicinity of the proposal would need to carry out contamination investigations to assess the suitability of the site/s for the proposed land use. Where contamination is identified, it would need to be remediated to remove or suitably reduce the exposure to human and/or environmental receptors in accordance with the legislative requirements of the *Contaminated Land Management Act 1997*. Both the management of contamination sources during construction and operation of these projects and remediation work to render the project sites suitable for use is unlikely to increase potential cumulative impacts from contamination exposure to common receptors (i.e. unlikely that cumulative impacts would arise).

An assessment against specific projects is provided below.

6.6.1 Sydney Metro West existing approval

The Sydney Metro West Concept and major civil construction work for Sydney Metro West between Westmead and The Bays (Stage 1 of the planning approval) were approved on 11 March 2021. As part of this work, The Bays tunnel launch and support site would initially be used to carry out construction work (tunnelling westbound) under the existing approval.

The site would be in use for an extended period for this proposal, from the second quarter, 2023 to about end of the fourth quarter, 2025. In addition, proposed work at The Bays tunnel launch and support site would occur concurrently with the approved tunnelling work westwards from The Bays to Sydney Olympic Park, for a period of about six months.

Other than use of the construction site, there would also be concurrent tunnelling. The tunnelling west from this site as part of the existing approval would be carried out between mid-2022 and mid-2024. The tunnelling east as part of this proposal would be carried out between early 2024 and early 2025.

Construction management and mitigation measures would be implemented to prevent adverse impacts to receptors. Additionally, construction at The Bays is likely to reduce potential contamination through excavation of the station, reducing the potential for contamination to cause an impact as a result of this proposal. Cumulative impacts due to concurrent tunnelling or work at The Bays Station construction site are unlikely to occur.

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

Stage 3 of the planning approval process for Sydney Metro West includes tunnel fit-out, construction of stations, ancillary facilities and station precincts, and operation and maintenance of the Sydney Metro West line. The Scoping Report for *Sydney Metro West – Rail infrastructure, stations, precincts and operations* (Sydney Metro, 2021) was lodged on 21 June 2021.

Station construction at The Bays Station would be carried out between the third quarter 2025 and the first quarter 2028, while station construction at Pyrmont Station and Hunter Street Station (Sydney CBD) would be carried out between the final quarter 2025 and the second quarter 2028. Construction activities associated with tunnel fit-out and rail systems would be carried out between the final quarter 2024 and the first quarter 2028.

Construction and operation management and mitigation measures would be implemented during the work to prevent adverse impacts to receptors. With due consideration of the proposed management measures to be implemented as part of this proposal, there are unlikely to be adverse cumulative contamination impacts.

6.6.3 Sydney Metro City & Southwest

Sydney Metro City & Southwest will deliver 30 kilometres of new metro rail between Chatswood and Bankstown, including new twin tunnels under Sydney Harbour, and the upgrade and conversion of all 11 stations between Sydenham and Bankstown to metro railway standard. The Chatswood to Sydenham component of Sydney Metro City & Southwest was granted planning approval in January 2017, and the Sydenham to Bankstown upgrade was approved in December 2018.

The Sydenham to Bankstown component of this project was not considered in this cumulative impact assessment as this stage of the project did not meet the spatial relevance criterion. Components of the Chatswood to Sydenham alignment relevant to this assessment include the tunnel rail systems fit out and station construction and fit out work which would overlap with shaft excavation work at the Hunter Street Station (Sydney CBD) eastern construction site during the first quarter of 2023.

The existing Sydney Metro City and Southwest tunnelling support site at 33 Bligh Street would be handed over from the City and Southwest contractor to the Sydney Metro West contractor around January 2023 and would become part of the Hunter Street Station (Sydney CBD) eastern construction site. The site would, therefore, be in use for an extended period, from January 2023 to about the end of the fourth quarter of 2025.

Potential contamination impacts as a result of the City & Southwest project will be mitigated to prevent adverse impacts to receptors. With due consideration of the proposed management measures to be implemented as part of this proposal and scheduling of the projects, there are unlikely to be adverse cumulative contamination impacts.

6.6.4 WestConnex M4-M5 Link

The WestConnex M4-M5 Link will comprise a new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project will also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (the Iron Cove Link).

All construction work on the mainline tunnels for the M4-M5 Link will be completed by the end of 2022. Therefore, it is anticipated that the proposal would only produce cumulative impacts with the Rozelle interchange and Iron Cove Link stage of the WestConnex M4-M5 Link which will continue until the third quarter of 2023. Work to be carried out during this time include site rehabilitation and landscaping, demobilisation, and testing and commissioning.

Potential contamination impacts during the WestConnex M4-M5 Link project will be mitigated to prevent adverse impacts to receptors. Considering this and the proposed project work, the overlapping work between the second quarter of 2023 and the third quarter of 2023 is unlikely to have cumulative contamination impacts on the proposal.

6.6.5 Western Harbour Tunnel and Warringah Freeway Upgrade

The Western Harbour Tunnel and Warringah Freeway Upgrade project forms part of the Western Harbour Tunnel and Beaches Link Program and comprises 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 and to connect to the Beaches Link and Gore Hill Freeway connection program. A construction site at White Bay is proposed to support the construction of the Western Harbour Tunnel. Activities associated with the treatment and movement of materials are proposed to occur between the first quarter of 2022 and the last quarter of 2024, and site clean-up and removal is proposed to occur between the first quarter of 2025 and the last quarter of 2025 at this location. Contamination risks will be mitigated as part of the project to prevent adverse impacts to receptors. The overlapping work with this proposal between the second quarter of 2023 and the first quarter of 2025, therefore, does not have the potential to have cumulative impacts on contamination.

6.6.6 Other projects

A review of the Department of Planning, Industry and Environment Major Project Register, Government agency websites, relevant local government websites and state media releases identified a list of 12 other projects that have the potential to generate further cumulative impacts with this proposal (see Appendix G of the Environmental Impact Statement).

Potential cumulative contamination impacts could occur if the proposal activities were to interact with existing contamination or remediation activities of adjoining or nearby sites which could potentially cause a greater impact. It is assumed that projects will be managed in accordance with relevant Conditions of Approval and usual construction environmental management practices and therefore are unlikely to exacerbate contamination.

Potential cumulative impacts as a result of the projects outlined in Appendix G of the Environmental Impact Statement with respect to contamination are therefore considered unlikely, provided that contamination assessed as part of this report is managed in accordance with the measures in Section 7.

6.7 Summary of contamination impacts

A summary of the potential types of contamination impacts on the project at the respective construction sites that have been assessed as moderate or above are detailed in Table 6-1.

Table 6-1 Summary of potential impacts (all rated moderate)

Proposal component	Potential contamination impacts to construction		
	Soil	Groundwater	Vapour / gas
Tunnelling			
The Bays tunnel and launch support site			
Pyrmont Station eastern construction site	X (Acid sulfate soil & salinity)	X	
Pyrmont Station western construction site		X	

Proposal component	Potential contamination impacts to construction		
	Soil	Groundwater	Vapour / gas
Hunter Street Station (Sydney CBD) eastern construction site			
Hunter Street Station (Sydney CBD) western construction site			
Pyrmont Station power supply route	X (Acid sulfate soil and salinity)		

7 Mitigation and management measures

This section provides a summary of the mitigation and management measures that would be required to minimise, avoid or mitigate the impacts of the project on contamination. Mitigation measures identified for this proposal are provided in Table 7-1.

These would be supplemented by mitigation measures detailed in Chapter 24 (Synthesis of the Environmental Impact Statement) of the Environmental Impact Statement with respect to cumulative impacts.

Table 7-1 Summary of potential contamination impacts and management measures

Reference	Impact	Mitigation measure	Applicable location(s)
C1	Low risk contamination	For sites where potential contamination risk is moderate, high or very high, a further review of data (if available), including a detailed site inspection, would be carried out. Where this Environmental Impact Statement or the additional data review provides sufficient information to confirm that contamination conditions are likely to have a very low or low impact to receivers at a construction site, the site would then be managed as part of construction and in accordance with the relevant subplan in the Construction Environmental Management Framework (the Soil and Water Management Plan). This would typically occur where there is minor, isolated contamination that can be readily remediated through standard construction practices such as excavation and off-site disposal.	All
C2	Unknown risk of contamination	Where data from the additional data review (mitigation measure C1) is insufficient to understand the risk of contamination, a Detailed Site Investigation would be carried out in accordance with the National Environment Protection Measure (2013) and other guidelines made or endorsed by the NSW EPA. The sites requiring a Detailed Site Investigation would be confirmed following the additional data review (mitigation measure C1) however based on the impact assessment, it is anticipated that a Detailed	Pyrmont Station eastern construction site

Reference	Impact	Mitigation measure	Applicable location(s)
		Site Investigation would be required at the applicable location.	
C3	Moderate, High or Very High risk of contamination	Where data from the additional data review (mitigation measure C1) or the Detailed Site Investigation (mitigation measure C2) 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 relevant area of the construction site/s. Each Remediation Action Plan would detail the remediation or management work required to mitigate risks from contamination in order to make the site suitable for its proposed use. The Remediation Action Plan would be prepared in accordance with relevant NSW EPA guidelines and where applicable, detail remediation methodologies in accordance with Australian Standards and other relevant government guidelines and codes of practice. Remediation would be performed as an integrated component of construction and to a standard commensurate with the proposed end use of the land. The sites requiring Remediation Action Plans would be confirmed following the additional data review (mitigation measure C1) and Detailed Site Investigation (mitigation measure C2).	As applicable
C4	Impacts to receivers occurring from highly complex contamination	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 sites requiring Site Audit Statements would be confirmed following the preparation of Remediation Action Plans (mitigation measure C3).	As applicable

Reference	Impact	Mitigation measure	Applicable location(s)
C5	Residual contamination following construction	Ongoing management and monitoring measures would be documented in an appropriate form and implemented for any areas where minor, residual contamination remains following construction.	As applicable
C6	Migration of contaminated groundwater	Where off-site sources of groundwater contamination have been identified, development and implementation of controls to manage the potential impacts of contamination due to drawdown and resulting migration of contaminated groundwater into the construction footprint would be implemented. A review of available groundwater data would be completed to inform the relevant subplan in the CEMF (the Groundwater Management Plan). Where insufficient data is available to understand groundwater conditions and the potential for contamination to migrate as a result of the proposal, further investigation would be carried out if considered necessary and if not already undertaken under mitigation measure C2.	All

8 References

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