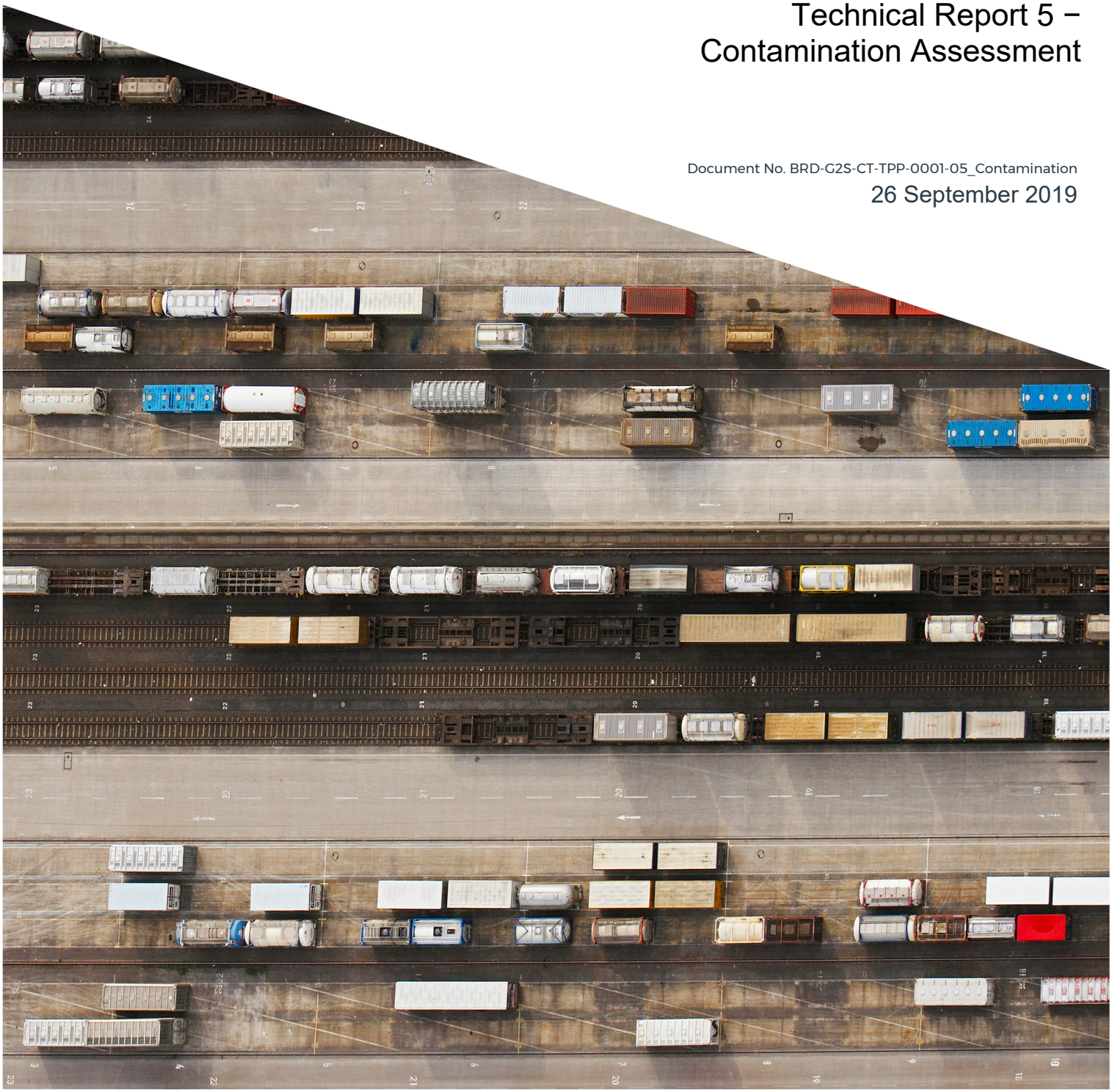
BOTANY RAIL DUPLICATION

TECHNICAL REPORT

Technical Report 5 –
Contamination Assessment

Botany Rail Duplication - Environmental Impact Statement



Technical Report 5 – Contamination Assessment

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Author, Reviewer and Approver details

Prepared by:	Yliane Yvanes-Giuliani; Julie Porter; Zoe McLaughlin	Date: 26/09/2019	Signature:	
Reviewed by:	Amy Valentine	Date: 26/09/2019	Signature:	
Approved by:	David Foldi	Date: 26/09/2019	Signature:	

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Australian Rail Track Corporation, Gateway to Sydney Joint Venture (G2S JV)

Document owner

G2S JV Gateway to Sydney Joint Venture
WSP Australia Pty Limited and GHD Pty Ltd

ABN: 55 836 411 311
Project Office
Level 27 Ernst & Young Centre
680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001
Australia
Tel: +61 2 9272 5100
Fax: +61 2 9272 5101

Contents

Contents (continued)

List of tables

List of figures

List of appendices

Glossary and abbreviations

ACM	Asbestos containing material
AEC	area of environmental concern
AHD	Australian Height Datum
AMP	asbestos management plan
ANZECC	Australian and New Zealand Conservation Council (ANZECC)/Agriculture, and Resource Management Council of Australia and New Zealand (ARMCANZ) 2000, National water quality management strategy. Australian and New Zealand guidelines for fresh and marine water quality.
ARTC	Australian Rail Track Corporation (the proponent)
ASRIS	Australian Soils Resource Information System
ASS	acid sulfate soils
ASSMAC	NSW Acid Sulfate Soil Management Advisory Committee
ASSMP	Acid sulfate soils management plan
Ballast	Material such as crushed rock or stone used to provide a foundation for a railway track. Ballast usually provides the bed on which railway sleepers are laid, transmits the load from train movements and restrains the track from movement.
Botany Bay LEP	Botany Bay Local Environmental Plan 2013
Botany Line	A dedicated freight rail line (operated by ARTC) that forms part of the Metropolitan Freight Network. The line extends from near Marrickville Station to Port Botany.
BSA	Botany sands aquifer
BTEXN	benzene, toluene, ethylbenzene, xylenes and naphthalene
CLM Act	*Contaminated Land Management Act 1997*
CEMP	Construction environmental management plan
construction ancillary facilities	Temporary facilities during construction that include, but are not limited to, construction work areas, sediment basins, temporary water treatment plants, precast yards and material stockpiles, laydown areas, parking, maintenance workshops and offices, and construction compounds.
construction compound	An area used as the base for construction activities, usually for the storage of plant, equipment and materials, and/or construction site offices and worker facilities.
Council, the	Bayside Council

COPC	contaminants of potential concern
CSM	conceptual site model
detailed design	The stage of design where project elements are design in detail, suitable for construction.
DGVs	default guideline values
DoI – Water	NSW Department of Industry – Water
EC	electrical conductivity
EPA, the	NSW Environment Protection Authority
EPL	environmental protection license
EIS, the	Botany Rail Duplication environmental impact statement
embankment	A raised area of earth or other materials used to carry a rail line in certain areas.
existing rail corridor	The corridor within which the existing rail infrastructure is located. In the study area, the existing rail corridor is the Botany Line.
formation	The earthworks/material on which the ballast, sleepers and tracks are laid.
HACA	NSW Heads of Asbestos Coordination Authorities
heavy vehicles	A heavy vehicle is classified as a Class 3 vehicle (a two-axle truck) or larger, in accordance with the Austroads Vehicle Classification System.
HEPA	The heads of the EPAs Australia and New Zealand
HILs	health investigation levels
HSLs	health screening levels
impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
LEP	local environmental plan
LGA	local government area
LORs	laboratory limits of reporting
LPI	NSW Government Land and Property Information
LTEMP	Long-term environmental management plan
mAHD	metres above Australian Height Datum
mBGS	metres below ground surface

Metropolitan Freight Network	A network of dedicated railway lines for freight in Sydney, linking NSW's rural and interstate rail networks with Port Botany. The Metropolitan Freight Network is managed by ARTC.
NEPM 2013	National Environment Protection Council (NEPC) 1999, as amended 2013. *National Environment Protection (Assessment of Site Contamination) Measure 1999*
NWQMS	National Water Quality Management Strategy (Australian Government, 2018)
OCP	organochlorine pesticides
OEH	Office of Environment and Heritage
OLS	Obstacle limitation surface
OPP	organophosphorus pesticides
PAH	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
PFAS	per- and poly-fluoralkylated substances
PFAS NEMP	*PFAS National Environmental Management Plan* (HEPA, 2018)
PFHxS	perfluorohexane sulfonate
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonic acid
possession	A period of time during which a rail line is closed to train operations to permit work to be carried out on or near the line.
project site, the	The area that would be directly affected by construction (also known as the construction footprint). It includes the location of operational project infrastructure, the area that would be directly disturbed by the movement of construction plant and machinery, and the location of the storage areas/compounds etc, that would be used to construct that infrastructure.
project, the	The construction and operation of the Botany Rail Duplication
RAP	Remediation action plan
Secretary's environmental assessment requirements (SEARs)	Requirements and specifications for an environmental assessment prepared by the Secretary of the Department of Planning and Environment under section 115Y of the *Environmental Planning and Assessment Act 1979* (NSW).
SEPP	State Environmental Planning Policy
SEPP 55	State Environmental Planning Policy 55 – Remediation of Land

State significant infrastructure	Major transport and services infrastructure considered to have State significance as a result of size, economic value or potential impacts.
study area, the	The study area is defined as the wider area including and surrounding the project site, with the potential to be directly or indirectly affected by the project (e.g. by noise and vibration, visual or traffic impacts). The actual size and extent of the study area varies according to the nature and requirements of each assessment and the relative potential for impacts but which is sufficient to allow for a complete assessment of the project impacts to be undertaken.
TDS	Total dissolved solids
TRH	Total recoverable hydrocarbons
UXO	Unexploded ordnance
VOCs	Volatile organic compounds
WHS	work health and safety

Executive summary

The primary purpose of this technical report (Contamination) is to undertake an assessment of site contamination to establish whether the site is suitable for the Botany Rail Duplication (the project) and to identify the need for remediation. The assessment follows the policy framework for the assessment of site contamination in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* amended in 2013 (NEPM 2013) and approved by NSW Environment Protection Authority (EPA) under section 105 of the *Contaminated Land Management Act 1997* (CLM Act). The NEPM 2013 identifies that development of a conceptual site model (CSM) is a key component of contaminated site assessments and provides the framework for identifying how potential receptors may be exposed to contamination.

This technical report includes a preliminary (Phase 1) investigation which assesses the potential for contamination to exist based on a desktop study that included a review of nine previous detailed site investigation (Phase 2) reports/assessments and examination of the results from a monthly surface water monitoring programme. The desktop information has been used to develop a preliminary CSM (associated with the current land use) which is used to inform the assessment of construction impacts, operational impacts and site suitability for the purpose of the project.

The Phase 1 assessment has identified land contamination (soil, groundwater and surface water) in the project site. In particular, previous investigations have identified fill material across the eastern portion of the project site that has been found to include asbestos containing material (ACM). During a site inspection on 6 July 2018, several ACM fragments were observed on the ground surface in an area west of the Robey Street Bridge, adjacent to the wall of an existing building. The concentrations of other contaminants of concern in soil analysed within the project site were generally below the adopted guideline criteria for commercial/industrial land use.

The monthly surface water monitoring programme has identified frequent guideline exceedances within Mill Stream and Mill Pond including total nitrogen, aluminium, iron, manganese, zinc, ammonia and turbidity. Elevated concentrations of per- and poly-fluoralkylated substances (PFAS), above the Heads of the EPAs Australia and New Zealand (HEPA) 2018, *PFAS National Environmental Management Plan* (PFAS NEMP) criteria were reported in surface water samples collected from Mill Pond during a previous assessment undertaken adjacent to the project site (EES, 2018).

Groundwater samples were collected from two monitoring locations within the project site. Groundwater concentrations were generally below the adopted assessment criteria with the exception of manganese and arsenic. The assessment also identified the following potential off-site sources of groundwater contamination:

- former Mascot Galvanising site (Site declared as a remediation site by NSW Environment Protection Agency)
- Sydney Airport (including the Qantas Jet Base)
- elevated concentrations of PFAS above the HEPA (2018) criteria have been recorded in nearby off-site monitoring well MW5 (EES, 2018), located between the rail corridor and Botany Road (near Bronti Street)
- contamination from the Orica Botany site, which has impacted contamination of the aquifer on parts of Botany, which is underlain by the Botany Sands aquifer.

However, it is noted that no significant dewatering is envisaged during construction.

The assessment has determined that the soil contamination identified in the eastern portion of the project site is sufficient to warrant remediation to mitigate the risk of contamination exposure to future users of the rail corridor. Based on the results of the available investigation reports, no soil or groundwater conditions have been encountered in the western portion of the project site that would preclude the suitability of the site as a freight rail corridor. Additional investigation is recommended in the western portion of the project site, targeting the area west of Robey Street, where ACM was identified during the site inspection.

Contamination within the project site, if not managed appropriately, could pose a potential risk to human health and the environment during construction or operation of the project. The risk would be managed through the development and implementation of mitigation measures, which would be included in environmental management plans as relevant, including:

- implementation of an erosion and sediment control plan that allows for site-specific erosion and sediment controls at all work sites in accordance with the Blue Book
- implementation of excavation and stockpile management including dust control
- implementation of asbestos management in accordance with NSW EPA guidelines (including waste guidelines), SafeWork NSW 2014, Managing Asbestos in or on Soil and relevant industry codes of practice
- adopting construction techniques to avoid groundwater disturbance where practicable.

1. Introduction

1.1 Overview

1.1.1 Background

Australian Rail Track Corporation (ARTC) proposes to construct and operate a new second track within the existing rail line between Mascot and Botany, in the Bayside local government area (LGA). The Botany Rail Duplication ('the project') would increase freight rail capacity between to and from Port Botany. The location of the project is shown in Figure 1.1.

The project is State significant infrastructure in accordance with Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). As State significant infrastructure, the project needs approval from the NSW Minister for Planning and Public Spaces.

This report has been prepared to accompany the environmental impact statement (EIS) to support the application for approval of the project, and address the Secretary of the Department of Planning and Environment's environmental assessment requirements (the SEARs), issued on 21 December 2018.

1.1.2 Overview of the project

The project would involve:

- Track duplication – constructing a new track predominantly within the rail corridor for a distance of about three kilometres.
- Track realignment (slewing) and upgrading – moving some sections of track sideways (slewing) and upgrading some sections of track to improve the alignment of both tracks and minimise impacts to adjoining land uses.
- New crossovers – constructing new rail crossovers to maintain and improve access at two locations (totalling four new crossovers).
- Bridge work – constructing new bridge structures at Mill Stream, Southern Cross Drive, O'Riordan Street and Robey Street (adjacent to the existing bridges), and re-constructing the existing bridge structures at Robey Street and O'Riordan Street.
- Embankment/retaining structures – construction of a new embankment and retaining structures adjacent to Qantas Drive between Robey and O'Riordan streets and a new embankment between the Mill Stream and Botany Road bridges.

Further information on the key elements of the project is provided in the EIS.

Ancillary work would include bi-directional signalling upgrades, drainage work and protecting/relocating utilities.

Subject to approval of the project, construction is planned to start at the end of 2020, and is expected to take about three years for the main construction works to be undertaken. Construction is expected to be completed in late 2023 with commissioning activities undertaken in early 2024.

It is anticipated that some features of the project would be constructed while the existing rail line continues to operate. Other features of the project would need to be constructed during programmed weekend rail possession periods when rail services along the line cease to operate.

The project would operate as part of the existing Botany Line and would continue to be managed by ARTC. ARTC is not responsible for the operation of rolling stock. Train services are currently, and would continue to be, provided by a variety of operators. Following the completion of work, the existing functionality of surrounding infrastructure would be restored.

Key features of the project are shown on Figure 1.2.

Figure 1.1 Botany Rail Duplication location

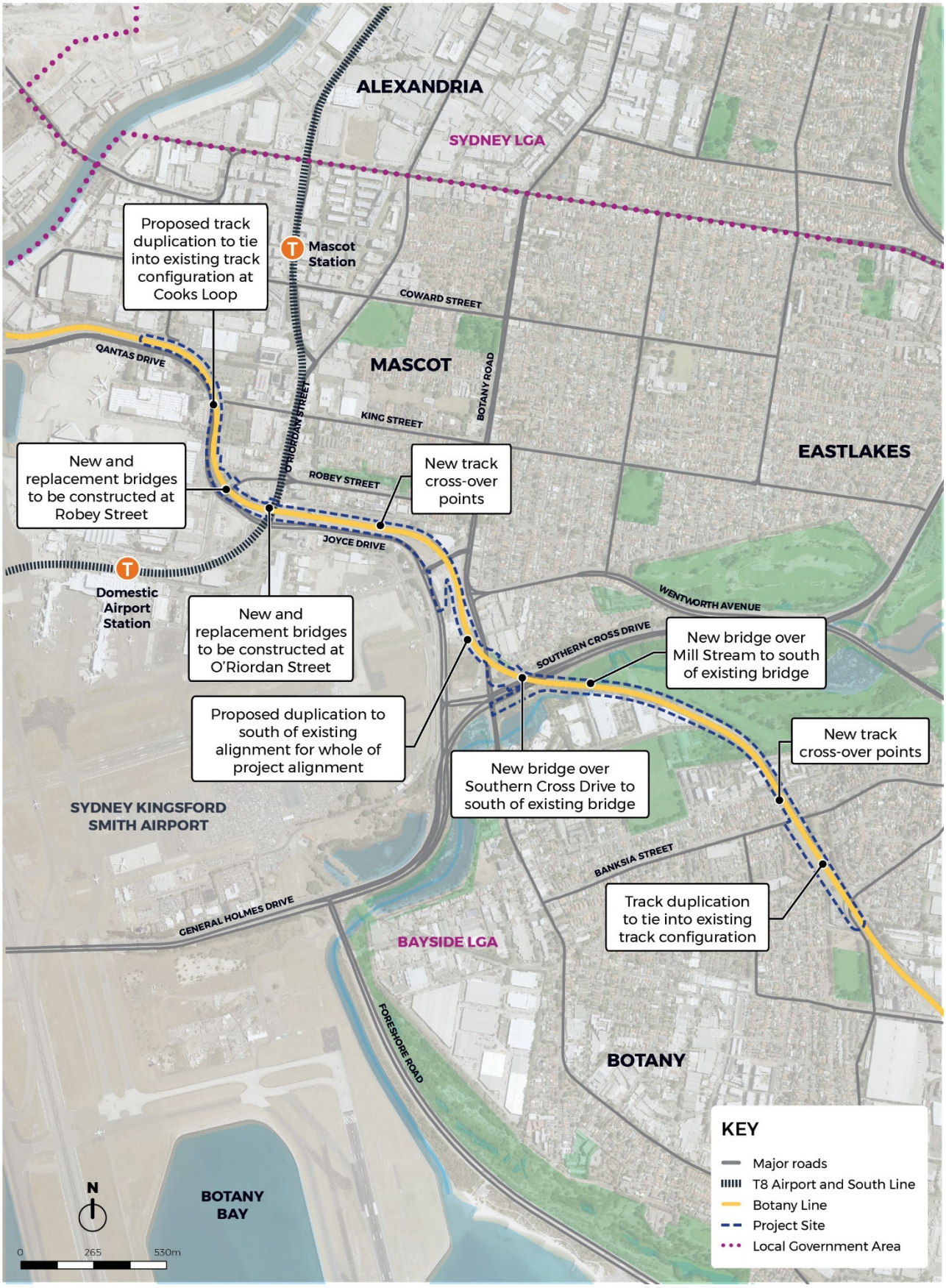


Figure 1.2 Botany Rail Duplication project overview

1.2 Purpose and scope of this report

The primary purpose of this technical report is to undertake an assessment of site contamination to establish whether the site is suitable for the project, and to identify the need for remediation. This technical report aims to identify potential impacts of the project and to outline mitigation measures relating to contamination that can be implemented during detailed design, construction and operation of the project. This contamination assessment addresses the relevant SEARs for the EIS, as outlined in Table 2.3.

The objectives of the technical report are to:

- identify areas of environmental concern (AEC) which have the potential to impact on the project with respect to contamination
- outline mitigation and management measures for potential impacts associated with contamination
- document how further assessment (if required) should be carried out in accordance with current guidelines.

The report:

- describes the existing environment with respect to contamination
- assesses the impacts, in relation to contamination, of constructing and operating the project on human health and environmental receptors
- recommends measures to mitigate the impacts identified.

1.3 Structure of this report

The structure of the report is outlined below:

- Section 1 Introduction – provides an introduction to the report.
- Section 2 Legislative and policy context – describes the legislative and policy context for the assessment, and relevant guidelines.
- Section 3 Methodology – describes the methodology for the assessment.
- Section 4 Existing environment – describes the existing environment as relevant to the assessment.
- Section 5 Background documentation – describes the site history and history of the surrounding area as relevant to the assessment.
- Section 6 Contamination site investigations – describes the previous contamination investigations undertaken at the site or in close proximity to the site.
- Section 7 Project site inspection – provides a summary of observations made during an inspection of the site.
- Section 8 Summary of potential contamination – provides a summary of the AECs and identifies any current data gaps.
- Section 9 Impact assessment – provides an assessment of environmental impacts associated with contamination.
- Section 10 Management of impacts – provides recommendations for additional investigations, mitigation and management of impacts identified.
- Section 11 Conclusion – provides an overview of the key findings of the report.

2. Legislative and policy context

This section provides a summary of the legislation, strategies and/or guidelines relevant to this investigation.

2.1 Relevant legislation, policies and guidelines

2.1.1 *Contaminated Land Management Act 1997*

The *Contaminated Land Management Act 1997* (CLM Act) is part of the management framework for contaminated land in NSW. The act enables the NSW Environment Protection Authority (the EPA) to respond to and manage site contamination when it considers that contamination is significant enough to require regulation. Site contamination requires regulation under the CLM Act when a site is declared "significantly contaminated land" (defined as land described in a notice having effect under section 11 of the CLM Act) or when land is subject to a management order or an approved voluntary management proposal. The project site has not been declared "significantly contaminated" and is not subject to a management order.

Section 105 of the CLM Act allows the EPA to make or approve guidelines for the purposes connected with the objectives of the CLM Act.

Contaminated sites not regulated by the EPA can be managed through the planning process by the relevant planning consent authority.

2.1.2 State Environmental Planning Policy 55 – Remediation of Land

State Environmental Planning Policy 55 – Remediation of Land (SEPP 55) pertains to, and aims to, promote the remediation of contaminated land. Through the development application process, planning authorities (local councils, in particular) are required to assess the contamination status of land prior to granting development consent. SEPP 55 lists remediation work that may be undertaken without the consent of the consent authority.

In accordance with clause 7(1) of SEPP 55, a consent authority must not consent to carrying out development on land unless it has considered whether the land is contaminated. The proposed work will occur within or adjacent to an existing rail corridor. Potential contaminated lands would therefore need to be considered.

2.1.3 National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013

The National Environment Protection (Assessment of Site Contamination) Measure 1999 as amended in 2013 (NEPM 2013) is made under the *National Environment Protection Council Act 1994* and is given effect by individual legislation and guidelines in each state and territory. The NEPM 2013 is approved by the EPA under section 105 of the CLM Act. The purpose of the measure is to establish a nationally consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community, which includes regulators, site assessors, environmental auditors, landowners, developers and industry.

The desired environmental outcome for this measure is to provide adequate protection of human health and the environment, where site contamination has occurred, through the development of an efficient and effective national approach to the assessment of site contamination.

Authorities (at local and state government level) that consent to development or changes in land use consider the land's suitability for its intended use. To determine if a site is suitable, a site's history of use and whether it is indicative of potential contamination should be considered.

Under the NEPM 2013, site contamination assessment is generally carried out in stages involving progressively more detailed levels of data collection and analysis, such as preliminary (Phase 1) site investigations, detailed site investigations and site specific risk assessment. This technical report is a preliminary (Phase 1) investigation, which assesses the potential for contamination to exist based on a desktop study and review of previous reports/assessments undertaken within the project site. This includes a review of a previous detailed site investigation (Phase 2) undertaken for most of the project site (refer to Section 6.1.5).

In general, as per guidance in the NEPM 2013, to achieve the desired environmental outcome, the process of the assessment of site contamination should be placed within the context of the broader site assessment and management process. In particular, in assessing the contamination, the site assessor and others should take into account the preferred hierarchy of options for site clean-up and/or management which is outlined in Table 2.1.

Table 2.1 Hierarchy of clean-up options (NEPM 2013)

Preference	Option
1	On-site treatment of the contamination so that it is destroyed or the associated risk is reduced to an acceptable level.
2	Off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which soil is returned to the site.
If the above are not practicable:	
3	Consolidation and isolation of the soil on site by containment with a properly designed barrier.
4	Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material.
Where the assessment indicates that remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy is required.	

When deciding which option to choose, the sustainability (environmental, economic and social) of each option should be considered, in terms of achieving an appropriate balance between the benefits and effects of undertaking the option.

2.1.4 *National Water Quality Management Strategy*

The *National Water Quality Management Strategy* (NWQMS) (Australian Government, 2018) aims to protect the nation's water resources by improving water quality while supporting the businesses, industry, environment and communities that depend on water for their continued development. The main policy objective of the NWQMS is to achieve sustainable use of water resources, by protecting and enhancing their quality, while maintaining economic and social development.

The NWQMS includes water quality guidelines that define desirable ranges and maximum levels for certain parameters that can be allowed (based on scientific evidence and judgement) for specific uses of waters or for protection of specific values. They are generally set at a low level of contamination to offer long-term protection of environmental values. The NWQMS water quality guidelines include the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) and the *Australian Drinking Water Guidelines* (NHMRC, 2011).

2.1.5 *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*

The *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Water Quality* (ANZG, 2018) have been prepared as part of the NWQMS. The guidelines provide a process for developing water quality objectives required to sustain current or likely future environmental values for natural and semi-natural water resources. The process involves the following:

- identifying the environmental values that are to be protected in a particular water body
- identifying management goals and selecting the relevant water quality guidelines for measuring performance
- developing statistical performance criteria to evaluate the results of the monitoring programs (e.g. statistical decision criteria for determining whether the water quality objectives have been exceeded or not)
- developing tactical monitoring programs focusing on the water quality objectives
- initiating appropriate management responses to attain (or maintain if already achieved) the water quality objectives.

Environmental values (sometimes referred to as beneficial uses) are particular values or uses of the environment that are important for a healthy ecosystem or for public benefit, welfare, safety or health and which require protection from the effects of pollution, waste discharges and deposits. The following environmental values are recognised in the water quality guidelines:

- aquatic ecosystems
- primary industries (irrigation and general water uses, stock drinking water, aquaculture and human consumption of aquatic foods)
- recreation and aesthetics
- drinking water
- industrial water
- cultural and spiritual values.

Default guideline values (DGVs) are presented in the guidelines as a starting point for assessment. DGVs are numerical concentration limits recommended to support and maintain a designated water use.

The *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Water Quality* are a revision from the Australian and New Zealand Environment Conservation Council (ANZECC) guidelines, published in 2000. The current guideline, provides DGVs for varying toxicants, which are the same as the ANZECC guidelines.

The *Australian and New Zealand Water Quality Guidelines for Fresh and Marine Water Quality* establish a guide for setting water quality objectives for surface water resources required to sustain environmental values and the guideline values represent target concentrations within the surface water resource (or surface water body). The guideline has been considered as a conservative trigger value for groundwater. Mill Pond is the receiving surface water body for groundwater within the project therefore criteria for a 90% protection of freshwater ecosystems (for a disturbed system) has been considered. For bioaccumulative toxicants, based on the precautionary principle, a more stringent 95% level will be considered. Bioaccumulative toxicants include per- and poly-fluoralkylated substances (PFAS), polychlorinated biphenyls (PCBs), some pesticides, lead, cadmium, mercury, dioxins, furans, benzo(a)pyrene, hexachlorobenzene and chlorobenzenes.

2.1.6 PFAS National Environmental Management Plan

Per- and poly-fluoroalkyl substances, also known as “PFAS”, are a group of manufactured chemicals that have been used since the 1950s in a range of common household products and specialty applications, including in the manufacture of non-stick cookware; fabric, furniture and carpet stain protection applications; food packaging; some industrial processes; and in some types of fire-fighting foams. There are many types of PFAS, with the best known examples being perfluorooctane sulfonate, known as “PFOS”, and perfluorooctanoic acid, known as “PFOA” and perfluorohexane sulfonate, known as PFHxS. Some PFAS have been globally identified as chemicals of high concern to human health and the environment, particularly due to their persistence and bioaccumulation.

The *PFAS National Environmental Management Plan* (PFAS NEMP) (HEPA, 2018) provides governments with a consistent, practical, risk-based framework for the environmental regulation of PFAS contaminated materials and sites. The PFAS NEMP has been developed as an adaptive plan, able to respond to emerging research and knowledge.

Because these chemicals have been used for decades, PFAS are found widely in the land and water environments around the world. People are exposed to small amounts of PFAS in everyday life through exposure to dust, indoor and outdoor air, food, water and contact with consumer products that contain these chemicals. Food is thought to be the most important source of exposure.

The PFAS NEMP is a reference on the state of knowledge related to the environmental regulation of PFAS. It represents a how-to guide for the investigation and management of PFAS contamination and waste management, including recommended approaches, which will be called upon to inform actions by environmental protection authorities and other regulators.

2.1.7 Acid Sulfate Soil Manual

Acid sulfate soils (ASS) are naturally occurring soils, sediments or organic substrates (e.g. peat) that are formed under waterlogged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, acid sulfate soils are benign. However, if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulfides react with oxygen to form sulfuric acid.

The management of acid sulfate soils (ASS) is coordinated by the NSW Acid Sulfate Soil Management Advisory Committee (NSW ASSMAC). This committee is made up of representatives from various government organisations and other affected parties. The Committee published the *Acid Sulfate Soil Manual* (ASSMAC, 1998) to provide best practice guidance in the assessment and management of projects in areas potentially affected by ASS in NSW.

The guidelines set out a process (refer to Figure 2.1 of *Acid Sulfate Soil Manual*) to decide whether ASS are present on site and how to mitigate potential impacts.

When works involving the disturbance of soil of the change in groundwater levels are proposed in coastal areas, a preliminary assessment should be undertaken to determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils. The purpose of the preliminary assessment is to:

- to establish the characteristics of the proposed works
- to establish whether ASS are present on the site and if they are at such concentrations so as to warrant the preparation of an acid sulfate soil management plan (ASSMP)
- to provide information to assist in designing a soil and water assessment program.

2.1.8 *Managing Asbestos in or on Soil*

The *Managing Asbestos in or on Soil* guide (Safework NSW, 2014) provides general guidance on the assessment of asbestos in soil. Managing asbestos in soil has implications for the current and future occupants of the land/or any worker employed on the site. The principles underlying the guidance in this document are those endorsed by the NSW Heads of Asbestos Coordination Authorities (HACA) and contained in the NSW Asbestos Blueprint (SafeWork NSW 2017). Work health and safety, land use planning and environmental legislation, and the amended NEPM 2013 are referenced where they apply.

The NEPM 2013 emphasises that the assessment and management of asbestos contamination should take into account the condition of the asbestos materials, the potential for damage, and resulting release of asbestos fibres. Bonded asbestos in sound condition represents a low risk to human health. However, both friable and fibrous asbestos materials have a significantly higher potential to generate, or be associated with, free asbestos fibres, and may represent a significant human health risk if disturbed and fibres are made airborne.

The objective of the approach outlined in *Managing Asbestos in or on Soil* guide is to ensure that proportionate and practicable controls are applied in accordance with regulatory requirements and in a manner commensurate with actual risk.

2.1.9 Other guidelines

A number of other guidelines, which are relevant to the management contamination, were considered in the preparation of this technical report and a presented in Table 2.2.

Table 2.2 Other guidelines

Guideline	Consideration in this report
Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (WA Department of Health, 2009)	The guidelines provide a framework and best practice for the assessment, remediation and management of asbestos contaminated sites. The guidelines would need to be considered during the preparation of the asbestos management plan for the project and additional investigations undertaken within the project site.
Guidelines for Consultants Reporting on Contaminated Sites (OEH, 2011)	The guidelines detail reporting objectives and requirements for investigation and remediation reports prepared by contaminated land consultants. These guidelines will need to be considered when preparing additional investigation reports, remediation action plans, validation reports or other report pertaining to contamination for the project.
Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (EPA, 2015)	The guidelines detail circumstances in which contamination at a site triggers the requirement to notify the NSW EPA. The guidelines are made under Section 105 of the CLM Act. The duty to report lies with landowners and those responsible for contamination. The triggers would need to be considered in the preparation future investigation reports and in the event that contamination is encountered within the project site.
Guidelines for the NSW Site Auditor Scheme (3rd edition) (EPA, 2017)	The guidelines describe the obligations of accredited site auditors undertaking site audits in NSW. The guidelines are made under Section 105 of the CLM Act. These guidelines need to be considered when preparing reports that may be reviewed by site auditor (e.g. investigation report or remediation action plan).
Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom, 2004)	The guidelines provide best practice guidance on erosion controls that need to be implemented during construction. The guidelines will need to be considered during the preparation of the soil and water management plan for the project.
Site Investigations for Urban Salinity (DWLC, 2002)	The guidelines provide accepted methodologies for assessing and quantifying the impacts of salinity on urban developments. These guidelines were considered by Golder Associates in assessing the impacts of salinity.

2.2 Secretary's environmental assessment requirements

The SEARs relevant to the contamination assessment, together with a reference to where they are addressed in this report, are outlined in Table 2.3.

Table 2.3 SEARs relevant to this assessment

Requirements	Where addressed in this report
3. Assessment of Key Issues	
1. For each key issue the Proponent must:	
a) describe the biophysical and socio-economic environment, as far as it is relevant to that issue;	Section 4
b) describe the legislative and policy context, as far as it is relevant to the issue;	Section 2
c) identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence (including worst case scenario) of the impact (comprehensive risk assessment), and the cumulative impacts;	Section 9
d) demonstrate how options within the project potentially affect the impacts relevant to the issue;	Section 10.1
e) demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies);	Section 10.1
f) detail how likely impacts that have not been avoided through design will be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant); and	Section 10
g) detail how any residual impacts will be managed or offset, and the approach and effectiveness of these measures.	Section 10
9. Soils	
1. The Proponent must assess the potential for contamination and any impacts associated with the management of contaminated soils and water resources including, but not limited to:	
a) a detailed assessment of the extent and nature of any contamination of the soil, groundwater and soil vapour;	The existing extent and nature of contamination is provided in Section 6
b) an assessment of potential risks to human health and the environmental receptors in the vicinity of the site.	An assessment of potential human health and environmental risks associated with contamination is provided in Section 9
c) a description and appraisal of any mitigation and monitoring measures; and	Section 10
d) consideration of whether the site is suitable for the proposed development.	Section 8.6
2. Any assessment of contamination must be in accordance with relevant guidelines produced or approved under the *Contaminated Land Management Act 1997*;	Section 2.1
3. The Proponent must 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 remediation is required, the Proponent must document how the assessment and/or remediation would be undertaken in accordance with current guidelines.	Section 8.6

3. Methodology

3.1 Specific methodology for the contamination technical report

3.1.1 Overview of approach

This technical report provides a preliminary (referred to as Phase 1) investigation which assesses the potential for contamination to exist based on a desktop study and review of previous detailed site investigation (referred to as Phase 2) assessments. This report documents the results of the targeted (Phase 2) intrusive site investigation for the project which included collection of 80 soil samples from 28 bore locations with groundwater monitoring wells installed at two borehole locations.

The Phase 1 contamination investigation for the project has incorporated the following scope of work:

- a preliminary assessment of potential AECs
- review of publicly available information to identify current of historical potentially contaminating land uses
- a walkover of the project site by an environmental scientist to compare site conditions to the conditions documented in historical reports and to identify potential sources of contamination along the alignment
- a review of previous investigation results undertaken along the project site
- a review of intrusive investigations undertaken for the project
- compilation of a conceptual site model (CSM) for the project site identifying potential contamination sources, receptors and exposure pathways. The CSM depicts potential source-pathway-receptor linkages associated with current land use, project construction and future rail use
- preparation of this technical report summarising the Phase 1 investigations.

In preparing this report, the following sources of information were reviewed:

- a selection of relevant historical aerial photographs from NSW Government Land and Property Information (LPI) covering the project site
- NSW EPA register of contaminated sites and list of notified sites under Section 58 or Section 60 of the CLM Act within 500 metres of the project site
- NSW EPA publicly available records under Section 308 of the POEO Act relating to environmental protection licences (EPLs)
- maps of the area published by the Geological Survey of NSW, former Department of Conservation and Land Management, and Australian Soils Resource Information System (ASRIS), to gain an understanding of surface and subsurface conditions (e.g. geology, hydrogeology, soil landscape, topography)
- WaterNSW database for registered groundwater bores within and in the vicinity of the project site
- existing investigation reports relevant to the project site.

The potential environmental risk associated with contamination has been assessed qualitatively using the ‘source - pathway – target pollutant linkage’ concept, which states that for a risk to arise each stage of the pollutant linkage must be present. The environmental risk has been assessed qualitatively with consideration given to the potential effects of contamination associated with the identified pollution linkages on construction workers and site neighbours (refer to Section 9.1).

Reference to risk classifications in Table 9.1 are made according to the following definitions:

- Low risk: impact can be managed by implementing standard construction management measures.
- Medium risk: contamination specific management plans and controls required.
- High risk: engineered controls and/or environmental/health monitoring required.

3.1.2 Criteria adopted for this assessment

Health and ecological criteria suitable for generic land uses have been provided in NEPM 2013 *Schedule B1, Investigation Levels for Soil and Groundwater* (refer to Section 2.1.3). The criteria for a commercial/industrial land use has been adopted for the project, given that the site would be used in the future for rail operations. The investigation and screening levels presented in the NEPM 2013 are not clean-up or response levels nor are they desirable soil quality criteria. Investigation levels presented in the NEPM 2013 may not be protective of intrusive workers and construction work on the site. Assessment for intrusive or construction workers would be undertaken in accordance with responsibilities under relevant Occupational Health and Safety legislation and relevant industry guidelines.

With respect to assessing site investigation results for PFAS contamination, health and ecological criteria suitable for generic land uses have been provided in Table 1 to Table 5 of the PFAS NEMP (refer to Section 2.1.6). The criteria for a commercial/industrial land use has been considered for the project. The target water quality objectives as outlined in the *Technical Report 8 – Surface Water Impact Assessment* are; 90% protection of freshwater ecosystems for Mill Pond and 80% protection of marine water for Alexandra Canal. A conservative target of 95% protection of marine water ecosystems will be adopted for chemical that bioaccumulate in wildlife. The Stockholm Convention scientific body, the Persistent Organic Pollutants Review Committee has concluded that perfluorohexane sulfonate (PFHxS) meets the screening criteria for persistence and bioaccumulation. As a precautionary approach, the 95% protection of marine water ecosystems will be adopted as assessment criteria for all PFAS compounds.

3.2 Study area

For the purpose of this assessment, the project site has been divided into two study areas for discussion. The study areas are shown in Figure 3.1 and are defined as:

- Area 1 – extending to the east and southeast towards Port Botany from Southern Cross Drive and Mill Pond Road.
- Area 2 – extending west and northwest towards Alexandra Canal from Southern Cross Drive and Mill Pond Road.

Figure 3.1 Location of the study areas within the project site

4. Existing environment

4.1 Surrounding land use

The information in the following section is based on publicly available information and observations made during the project site walkover on 7 July 2018.

The project site lies within a range of land zonings as classified under the Botany Bay Local Environmental Plan 2013 (Botany Bay LEP). The land zoning within:

- Area 1 is SP2 – Infrastructure, Railway.
- Area 2 includes:
  - SP2 – Infrastructure, Railway
  - SP2 – Infrastructure, Airport
  - SP2 – Infrastructure, Classified Road
  - B5 – Business Development
  - IN1 – General Industrial.

The surrounding area comprises mixed land uses such as residential (low and medium density residential), recreational, commercial (business park and local centre) and industrial (general and light industrial) land uses. Adjacent lands uses predominantly comprise of commercial (business park and local centre) and industrial (general and light industrial) land uses. Land uses surrounding the project site are shown in Figure 4.1.

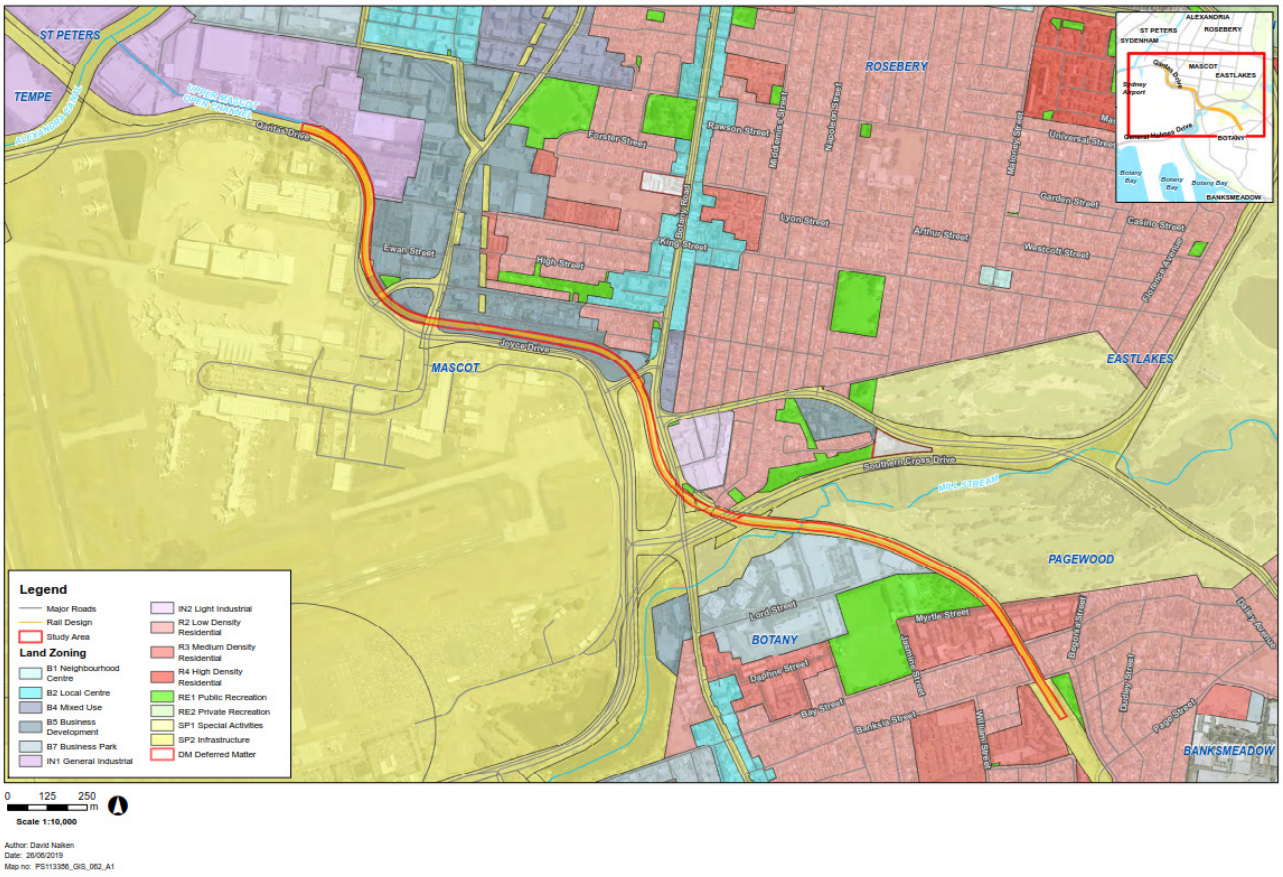


Figure 4.1 Land zoning along the project site (Botany Bay Council, 2013)

4.2 Topography and drainage

The project is located predominantly within the existing rail corridor of the Botany Line between Mascot and Botany. It is located in a highly modified landscape that facilitates industrial development and transport. The project site is generally flat, at elevations less than 12 metres above Australian Height Datum (mAHD). At several sections, the rail corridor is constructed on engineered embankments that are elevated above adjoining ground level.

The general topography of the surrounding area is flat to gently rolling, from 0 mAHD at Botany Bay, grading gently upwards at 30 to 40 mAHD to the north-east, east, and south-east of the project site.

4.3 Surface water features

The project is located within the Botany Bay catchment. The Botany Bay catchment encompasses surface water features near and within the project site including Alexandra Canal, the Botany Wetlands (including Mill Stream) and Botany Bay to the south-east.

Surface water from the northern 1.4 kilometres of the project site flows in a north westerly direction to Alexandra Canal via existing drainage network and the Upper Mascot Open Channel. Alexandra Canal is located within the lower reaches of the Cooks River catchment.

Alexandra Canal is tidally dominated through its connection to the Cooks River. It is around 3.9 kilometres long and 60 metres at its widest. The tidal influence from the Cooks River extends to the head of the canal. The canal is owned and operated by Sydney Water. Runoff into Alexandra Canal was heavily contaminated in the past from surrounding heavy industry. Contaminants entering via stormwater today come from heavy industry, urban areas and road networks.

Surface water from the southern 1.6 kilometres of the project site flows to Mill Stream, directly via overland flow or through existing drainage networks. The Mill Stream catchment is a sub catchment of the Botany Bay catchment which covers about 1,165 square kilometres and contains several sub catchments.

Engine Pond and Mill Stream are located south of the Southern Cross Drive, and intersect the project site. Engine Pond acts as a sink for surface water runoff from the surrounding local area. While a locally and regionally significant surface water feature, it is not considered to be a pristine environment and is expected to be moderately disturbed by run-off from the surrounding urban environment. Engine Pond and Mill Stream are listed as Environmentally Significant Areas under a range of registers, including the directory of important wetlands in Australia (as listed in Sydney Airport Master Plan, 2039) and the national Wetlands Program. Further to this the water sharing plan for the greater metropolitan region groundwater sources 2011 lists Engine Pond, Mill Stream and Mill Pond as high priority groundwater dependent ecosystems. This is based on these features being part of Botany Wetlands (Sydney freshwater wetlands), which are listed as endangered ecological community in the *Biodiversity Conservation Act* 2016.

Botany Bay, which is not considered to be a pristine environment, is used for a range of beneficial purposes such as recreation and fishing (despite the DPI prohibition of commercial fishing in Botany Bay and Cooks River under the *Fisheries Management (General) Regulation, 2010*). Recreational fishing is prohibited in the area between the runways extending into Botany Bay but is not prohibited in and around Mill Stream and the broader Botany Bay area. There is a *Botany Bay Water Quality Improvement Plan* (SMCMA 2011) with the main objective to improve pollutant load reduction and suspended sediment through direction and on-ground implementation.

A map of surface water receptors is shown in Figure 4.2.

Figure 4.2 Surface water bodies in the vicinity of the project site

4.4 Geology and soils

4.4.1 Regional geology

The Permo-Triassic Sydney basin is a convergent margin foreland sedimentary basin located along Australia's central eastern coast. It covers about 64,000 square kilometres, with the onshore basin centred in Sydney, while the offshore basin extends eastward with 5,000 square kilometres between the coast and the outer edge of the continental shelf (Stewart and Alder, 1995). It is characterised by a lower sequence of interbedded marine-deposited strata, followed by local Permian coal-bearing sequences, which are then finally overlain by additional marine and terrestrial deposits. The Permo-Triassic sedimentary succession is intruded by igneous bodies of Jurassic to Tertiary in age, and overlain by unconsolidated Quaternary alluvium. The basement of the Sydney basin includes the Lachlan Fold Belt and Late Carboniferous volcaniclastic sediments.

4.4.2 Site geology

According to the 1:100,000 Sydney Region Geological Map (Geological Survey of New South Wales, 1983), the regional geology consists of Triassic Hawkesbury Sandstone and Ashfield Shale overlain by Quaternary sediments (unconsolidated sands with minor peat, silts and clays and hard iron-cemented layers known as waterloo rock). The Quaternary sediments infilled drowned river valleys that were incised into Hawkesbury Sandstone bedrock. These sediments, otherwise known as the Botany Sands, are composed of predominantly unconsolidated to semi-unconsolidated permeable sands. These are interspersed with lenses and layers of peat, peaty sands, silts and clays (low permeability), which become more common at greater depths. The stratigraphic units encountered in the project site are summarised below.

A map of the geology encountered along the project is presented in Figure 4.3.

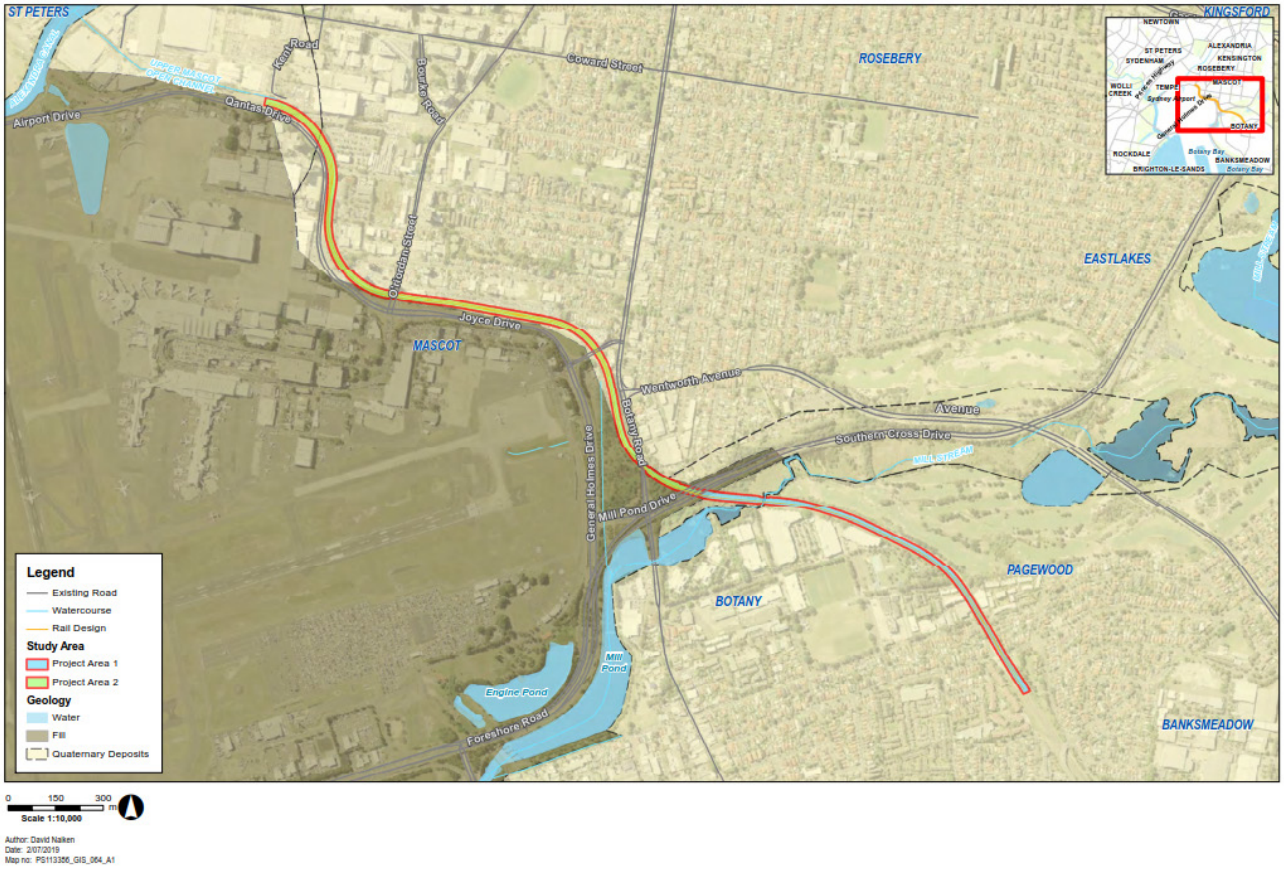


Figure 4.3 Geology within the project site (Geological Survey of NSW, 1983)

Hawkesbury Sandstone

The Hawkesbury Sandstone is composed of medium to coarse-grained quartz sandstone, with very minor shale and laminate lenses. It is divided into three intervals: a lower sequence of medium to coarse sandstones, a middle sequence of clayey sandstones, siltstones and shales, and an upper sequence of medium to coarse sandstones similar to the lower sequence. This unit is exposed about 1 kilometre north of the project site.

Ashfield Shale

The Ashfield Shale of the Wianamatta Group overlies the Hawkesbury Sandstone and was formed as prodelta and delta front deposits. This unit is composed of black to dark grey shale and laminates. The nearest exposure of the unit is located about 1 kilometre north of the project site.

Quaternary sediments

The sediments from the erosion of the underlying bedrock are transported by ancient and current waterways form the Quaternary sediments. The area to the north of the project is underlain by alluvium composed of peat, sandy peat, and mud (Qhs). Medium to fine-grained marine sands with podsols (Qhd) atop the area to the east of the project site.

Botany Sands are Aeolian deposits comprising well-sorted, poorly cemented, fine to medium-grained quartz sands. Lenses and bands of inter-dunal peat and organic clay are also present within the unit. The average thickness of the Botany Sands is 15 to 20 metres (Hatley, 2004).

Fill

A thin layer of fill is commonly encountered in urban areas and is associated with infrastructure and roadworks. Areas of thicker filling are present near the project site comprising dredged estuarine sand and mud, demolition gravels, and industrial and household waste. Sydney Airport located west of the project site is atop mixed Quaternary sediments and manmade fill.

Structural geology

There are a number of north-east to south-west faults cutting across the project site (WSP, 2010). The Woolloomooloo fault zone, consisting of a number of north-east trending unnamed faults, cuts across the Northern Lands (WSP, 2010). Pells (2015) suggests that the Woolloomooloo fault zone is a complex series of sub-vertical and low angle thrust structures (Golder, 2017).

The structural geology is less significant for groundwater issues on this project due to infrastructure primarily intersecting shallow unconsolidated sediments.

Soil landscape

Based on the Soil Landscapes of Sydney Sheet 9130 (Chapman and Murphy, 1989), the project is straddling along two types of soil landscapes – Aeolian Tuggerah (AEtg) to the east of the rail corridor, and Disturbed Terrain (DTX) extending across the airport to the west, along the Botany Wetlands, the lower reaches of the Cooks River and up Alexandra Canal to the north.

Soil salinity

Saline soils are typically present in areas along tidal waterways, such as Alexandra Canal. A soil salinity assessment completed by Golder (2016) for the new M5 classified the northern portion of the project site, located south of St. Peters as a low salinity potential area. The classification presented in Golder Associates (2016) was based on guidance provided in the *Site Investigations for Urban Salinity* (DWLC, 2002). This may be attributed to the high permeability soils in the area that allow for rapid drainage and flushing of salts. This is expected to be similar to the conditions present within the rest of the project site.

4.5 Acid sulfate soils

Acid sulfate soils or sediments are naturally occurring soils and sediments containing iron sulfides. The predominant sulfidic minerals are pyrite and iron disulfide. The exposure of pyrite and other sulfides to oxygen during disturbances can lead to the generation of sulfuric acid. The subsequent acidic leachate can then lead to mobilisation of heavy metals such as aluminium and iron into water bodies. Drainage waters from areas of ASS may affect water quality, can lead to the death or disease of aquatic organisms, can be harmful to human health and may damage infrastructure. ASS are typically found in estuarine, low-lying environments up to 10 mAHD and generally consist of clays and sands containing pyritic material. They can also be found in flood plains and swamps.

The CSIRO ASRIS indicates that there is a low probability of acid sulfate soils occurrence within the project site, except for the area surrounding Mill Pond, which is classified with a high probability of occurrence of ASS. The ASS risk map for Botany Bay published by the Department of Land and Water Conservation (1997) is consistent with the information in ASRIS but also indicates that disturbed terrain occurs in a large portion of Area 2. Disturbed terrains need to be further assessed to establish the presence of ASS.

The project site is located on Class 1, Class 2 and Class 4 land on the Botany Bay LEP ASS maps (2013). Based on the class of land, certain developments need to demonstrate appropriate ASS management procedures. Table 4.1 summarises the types of work requiring ASS management based on the class of land within the project site.

Table 4.1 ASS classification on Botany Bay LEP 2013 for the project site

Land class	Project area(s)	Work requiring management procedures	Potential ASS disturbance work expected to be conducted in project site
1	From Southern Cross Drive bridge to Mill Stream bridge	Any work	■ Track excavation (~0.7 metres below the natural ground surface (mBGS)). ■ Service upgrade trenches (~1 mBGS). ■ Piling for Southern Cross bridge (~40 mBGS). ■ Piling for Mill Stream bridge (~40 mBGS).
2	Western end of the duplication to the O'Riordan Street bridge	■ Work below the natural ground surface. ■ Work by which the water table is likely to be lowered.	■ Track excavation (~0.7 mBGS). ■ Services upgrade trenches (~1 mBGS). ■ Excavation for footings for retaining walls extending south of King Street to about 150 m south of O'Riordan bridge (footing depth of ~1 mBGS or more if piling is required). ■ Piling for Robey Street bridge and O'Riordan Street bridge (~40 mBGS).
3	Not applicable	■ Work more than 1 metres below the natural ground surface (mBGS). ■ Work by which the water table is likely to be lowered more than 1 mBGS.	Not applicable
4	■ From the O'Riordan Street bridge to the western end of Southern Cross bridge. ■ From Mill Stream bridge to Banksia Street.	■ Work more than 2 mBGS. ■ Work by which the water table is likely to be lowered more than 2 mBGS.	■ Piling for Southern Cross Drive bridge (~40 mBGS). ■ Excavation for footings for retaining walls between Botany Road bridge and Southern Cross Drive bridge (footing depth of ~1 mBGS likely to require piling at greater depths).
5	Not applicable	Work within 500 m of adjacent Class 1, 2, 3 or 4 land that is below 5 mAHD and by which the water table is likely to be lowered below 1 mAHD on adjacent Class 1, 2, 3 or 4 land.	Not applicable

Based on the ASS assessment framework presented in the *Acid Sulfate Soil Manual* (ASSMAC, 1998), work conducted in several areas of the project site would trigger the requirement for an ASS management plan (ASSMP) to be prepared. The plan would need to be prepared in accordance with the *Acid Sulfate Soil Manual* (ASSMAC, 1998) and would be included as part of a broader soil and surface water management plan. The ASSMP should include the results of ASS investigations that have been undertaken for the project, procedures to minimise the impacts of the work as well as handling and testing procedures.

The ASS risk maps and ASS maps from the Botany Bay LEP are presented in Appendix B.

4.6 Hydrogeology

There are two main groundwater systems beneath the project site; a deeper confined groundwater system associated with the Triassic aged, fractured/porous Hawkesbury Sandstone and a shallow, unconfined/semi-confined system within Quaternary aged marine sands. The main focus of this section is the aquifer associated with the shallow saturated portion of the Botany Bay Sands, referred to as the Botany Sands Aquifer (BSA) (Hatley, 2004).

The Botany Sands is considered an unconfined, high permeability aquifer. The flow directions within Botany Sands are generally controlled by topography. From the recharge areas located at higher elevations northeast of the Botany basin, groundwater flows south and southwest towards rivers and other tributaries and into Botany Bay. Based on available bore monitoring data, groundwater is about 35 mAHD near Centennial Park, with elevations gently declining south to the Botany Bay. Flow gradients range from 0.003 to 0.01 (Hatley, 2004).

Ongoing monitoring was undertaken by NSW Department of Industry – Water (DoI-Water) from March 1999 through to March 2015 at ten wells primarily located within the Botany Sands aquifer. The data is summarised below and additional information is provided in *Technical Report 7 – Groundwater Impact Assessment*, Section 4:

- Average variation in elevations – Following the topography of the area, groundwater is intercepted at higher elevations (27 mAHD) in the northwest, and at lower elevations (<5 mAHD) to the south near Botany Bay.
- General depth to groundwater – Groundwater at bores located at the north and northwest of the Botany Sands is recorded at shallow depths, ranging from about 1–4 metres below ground. Bores located to the south have encountered deeper water table, from about 8–12 metres below ground. All bores are screened in sandy material.
- Response to rainfall characteristics – Annual rainfall records for Bureau of Meteorology Sydney Station 66037 plotted against groundwater levels are provided in *Technical Report 7 – Groundwater Impact Assessment*, Section 4. The available data shows that groundwater is generally stable, with spikes noted in periods with above average rainfall. However, the groundwater elevations show little response during periods of below average rainfall.

4.6.1 Registered groundwater users and water use restrictions

Review of available data from the Water NSW – Water database identified 50 registered groundwater bores used for domestic, recreational, and commercial purposes located within 500 metre radius of the project site. The majority of the bores are shallow (less than 15 metres in depth) tapping groundwater from the Botany Sands and alluvium.

A restriction on groundwater extraction (related to contamination of the aquifer) has been implemented by the NSW Government in 2006 on parts of Botany, which is underlain by the Botany Sands aquifer. The contamination originated from the Orica Botany site. Under the current Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2018 (issued by the NSW DPI, 2018) prohibitions are stipulated for both Area 1 and Area 2. As shown in Figure 4.4, the project site is within Area 2 and therefore cannot be used for industrial or domestic purposes and can only be extracted for remediation, temporary construction dewatering, testing or monitoring purposes. Any extracted water used for licensed industrial purposes must be sampled, tested and treated (if required) in accordance with a testing plan certified by a consultant as being safe and suitable for its intended use. There is also an embargo on applications for new licences to extract water from the Botany Sands aquifer for domestic and commercial purposes.

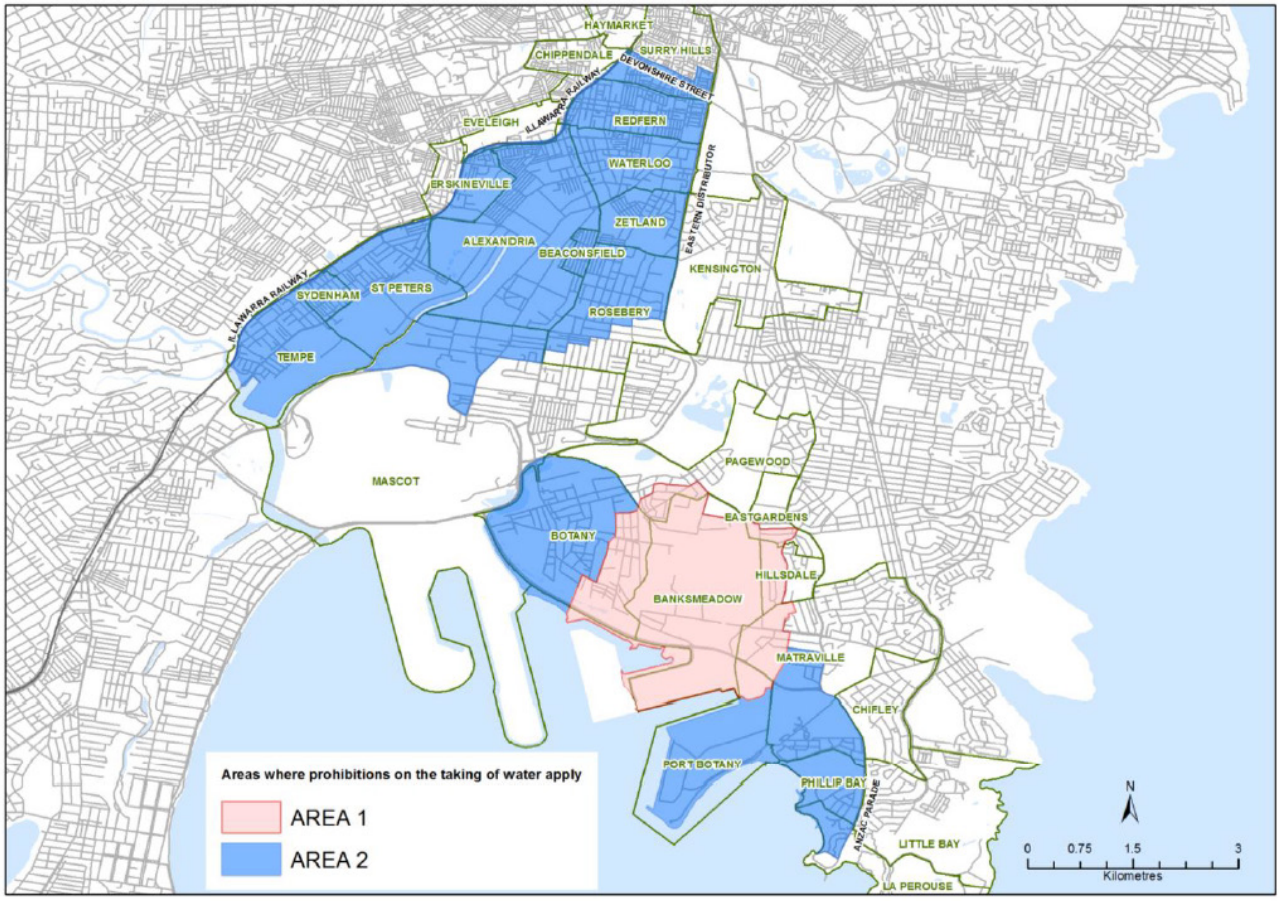


Figure 4.4 Restriction areas under the current Temporary Water Restrictions Order issued by the NSW Department of Industry for the Botany Sands Groundwater Source (2018)

5. Background documentation

5.1 Site history

5.1.1 Historical aerial photography

Historical aerial photographs were obtained from the NSW Department of Finance, Services and Innovation, Spatial Services Division. Photographs for the years 1930, 1943, 1961, 1970, 1986, 1994 and 2005 were reviewed. The findings of the historical aerial photography review are summarised in Table 5.1.

Table 5.1 Historical aerial photography review

Date of aerial photography	Site	Surrounding area
1930	The rail corridor is located in its current alignment. Due to the clarity of the photograph it is difficult to identify any on-site features.	The surrounding area is a mixture of cleared land, and apparent residential properties.
1943	The rail corridor is located in its current alignment. Bridges crossing Botany Road and Mill Stream are visible. No significant features or buildings are visible within the rail corridor.	West of Mill Stream, areas to the north of the rail corridor have undergone extensive residential development. East of Mill Stream an area to the south of the rail corridor has been developed into commercial/industrial premises. The lakes golf club appears to be under construction.
1961	The rail corridor is located in its current alignment. A storage area and car park is located to the east of the bridge crossing at Botany Road (north of the rail track).	West of Mill Steam, significant commercial/ industrial development has occurred north and south of the rail corridor with the airport now visible including runways and terminal infrastructure. The Lakes Golf Club appears in its current configuration.
1970	The rail corridor is located in its current alignment. The storage area and car park east of the bridge crossing at Botany Road is no longer visible.	Further expansion of the airport site has occurred including the construction of new runways.
1986	The rail corridor is located in its current alignment. No significant features or buildings are visible within the rail corridor.	Southern Cross Drive is under construction. Commercial buildings have been developed to the east of the rail corridor along Botany Bay Road.
1994	No significant changes	Southern Cross Drive has been constructed.
2005	No significant changes	No significant changes

5.1.2 Former gasworks sites

A search of NSW EPA list of former gasworks has been carried out on 20 October 2018. There are no former gasworks sites noted within a 500 metre radius of the project site.

5.1.3 Unexploded ordnance contamination

The Australian Department of Defence holds a record of unexploded ordnance (UXO) in Australia. Areas of known or suspected UXO occurrence have been categorised and mapped with the records available online (OPEC Systems, 2018). At the time of preparing this report, there were no records of UXOs within or in the vicinity of the project site.

5.1.4 Site history summary

The historic aerial photograph review indicates that the existing rail corridor was constructed prior to 1930. Earlier site history is presented in the Botany Rail Duplication statement of heritage impact (Artefact 2019). This study indicates that the Botany Rail line was first planned in 1861, however it was not completed until 1925. Market gardens were established around Botany and Mascot in the 1830s with the majority of gardens established between the Alexandra Canal and O'Riordan Street. From 1948 onwards the land use around the eastern and central extent of the study area saw a shift towards industry with the area utilised for wool washing, meat works, candle works, leather, paper etc. These activities have the potential to cause contamination. The area between General Holmes Drive and Banksia Street remained largely unoccupied during this period.

The historic aerial photograph review indicates that the development in the surrounding area post 1930 initially comprised of land clearing and low density residential development. Between 1943 and 1961 there is a significant shift towards commercial industrial land use with major development occurring to both the north and south of the project. The 1961 photograph indicates that the airport has been constructed, with significant expansion occurring between 1961 and 1970. The area surrounding the project site continues to comprise of mixed commercial/industrial and residential land uses.

5.2 NSW contaminated sites register

The NSW EPA records of contaminated sites and records of notices were searched for sites within or in the vicinity of the project site.

5.2.1 Contaminated sites notified to the EPA

The NSW EPA holds records of sites that have been notified under Section 60 of the CLM Act or otherwise reported to the NSW EPA. The record of sites (NSW EPA, 2018) has been reviewed to identify sites which may impact soil and/or groundwater quality within the project site. The record has been last updated by the NSW EPA on 2 August 2018. Contaminated sites at the time of writing, in the vicinity of the project site and current status are presented in Table 5.2 and shown in Figure 5.1.

Table 5.2 Contaminated sites on the NSW EPA register within 500 metres of the project site

Site name	Site address and distance to the Project Site	Site activity notified to the EPA	Contamination status
Ing Industrial Fund	19-33 Kent Road, Mascot, about 465 m northeast	Landfill	Regulation under CLM Act not required
Former Mascot Galvanising	336-348 King Street, Mascot, about 145 m east	Metal Industry	Contamination currently regulated under CLM Act
Sokol Corporation	50-56 Robey Street, Mascot, about 60 m north	Other Industry	Regulation under CLM Act not required
Telstra exchange	904-922 Botany Road, Mascot, about 420 m northeast	Other Industry	Regulation under CLM Act not required
Former Email Site	Corner of Page Street and Holloway Street, Pagewood, 420 m east	Other Industry	Contamination currently regulated under CLM Act
Former Tannery	2 Daniel Street, Botany, 350 m southwest	Other industry	Regulation under CLM Act not required
Roads and Maritime Services	5-9 Lord Street, Botany, 350 m southwest	Other industry	Regulation under CLM Act not required

Most of the sites listed above do not require regulation under the CLM Act. The two sites for which contamination requires regulation are also the subject of notices and are discussed further in Section 5.2.2.

Figure 5.1 Sites on the NSW EPA contaminated land register within and surrounding the project site

5.2.2 Contaminated sites with notices

The NSW EPA holds records of written notices issued by the Office of Environment and Heritage (OEH) under Section 58 of the CLM Act. The record of notices also contains site audit statements (prepared by a site auditor in accordance with part 4 of the CLM Act) provided to the OEH under Section 52 of the CLM Act, management orders (notice served by the EPA to undertake action associated with significantly contaminated land) issued under Part 3 of the CLM Act, as well as approved voluntary management proposals (proposal for the management of significantly contaminated land furnished to the EPA) under Section 17 of the CLM Act. At the time of preparing this report, the record holds 1,500 notices pertaining to 369 sites. There are two sites on the record within 500 metres of the project site. Details about the site are included in Table 5.3.

Table 5.3 NSW EPA record of notices within 500 metres of the project site

Site name	Site address and distance to the project site	Notice type and status	Contamination type
Former Mascot Galvanising	336-348 King Street, Mascot, 150 m east of the project site at the nearest point	Site declared as a remediation site 4 current remediation orders	Zinc, lead and chromium in soil and groundwater Low groundwater pH Groundwater plume migrating off site
Former Email Site	Corner of Page Street and Holloway Street, Pagewood, 420 m east	Site declared as a remediation site 1 current voluntary management proposal	Chlorinated hydrocarbons (TCE and PCE) Groundwater plume migrating off site (to the south)

TCE: trichloroethene; PCE: tetrachloroethene

The former Email site located in Pagewood is unlikely to pose a potential risk during construction or operation activities due to its location across-gradient of the project site.

The former Mascot galvanising site located on King Street in Mascot is hydraulically up-gradient of the project site. Since the latest notice has been issued for the site (in 2004), the site buildings and infrastructure have been removed (as evidenced by historical aerials from 2017 and 2018) and earthworks (most likely to remediate the site) appear to have been conducted between 2005 and 2015. The site has since been redeveloped and is currently a high-rise hotel and car park. There is a potential that groundwater impacts from the former Mascot Galvanising may have migrated beneath the project site.

5.3 Environmental protection license search

Under Section 308 of the POEO Act, the NSW EPA has to record and make available to the public details about EPLs. The information recorded includes new applications, transfers or changes to existing licences, exemptions as well as any penalty notices issued by the EPA.

5.3.1 EPLs within vicinity of the project site

At the time of preparing this report, the record holds over 4,500 active licenced activities for NSW. There are five licenced facilities within 500 metres of the project site. Details about the facilities and activities they are licenced for are included in Table 5.4.

Table 5.4 Record of licenced facilities within 500 metres of the project site

Facility name	Licence number	Site address and distance to the project site	Activity type	Potential contamination
Airport East Precinct	20851	Botany Line rail corridor at General Holmes Drive within the project site	Railway systems activity	Metals Hydrocarbons Asbestos
TG2	20728	Shiers Avenue, Mascot, 250 m south and southeast	Generation of electrical power from gas	Emission of gases to air
Enwave Mascot Pty Ltd	20246	10 Bourke Street, Mascot, 320 m northeast	Generation of electrical power from gas	Emission of gases to air
Kellogg (Aust) Pty Ltd	823	Swinbourne Street, Botany, 400 m south	General agricultural processing	Hydrocarbons, nutrients Clinical and related waste contamination
Allnex Resins Australia Pty Ltd	993	49-61 Stephen Street, Botany, 450 m south	Chemical production waste generation Chemical storage waste generation Contaminated groundwater treatment Dangerous goods production General chemical storage Toxic substances production	Metals Hydrocarbons Toluene, ethylbenzene and xylene Phenols

5.3.2 EPL non-compliance and clean up notices

The public record also contains information pertaining to revoked and or surrendered licences, audits, notices or pollution studies. The record holds information for 12 facilities within a 500 metre radius of the project site. Table 5.5 summarises the information for these facilities.

Table 5.5 Record of notices, audits, revoked or surrendered licences or pollution studies for facilities within 500 metres of the project site

Facility name	Licence number	Address and distance to the project site	Activity incident type	Notice/incident type	Potential contamination
Airport East Precinct	20851	Botany Line rail corridor at General Holmes Drive, within the project site	Railway systems activity	Multiple licence variations (2016–2017)	Unknown (associated with construction activities)
Sydney Airport	7288	241 O'Riordan Street, Mascot, 15 m north	Waste generation or storage	Multiple licence variations (2004–2005) Licence no longer in force	Hydrocarbons PFAS
Botany Aquatic Centre	1791	Cnr Jasmine and Myrtle Street, Botany, 50 m southwest	Miscellaneous licensed discharge to waters	Multiple licence variations (2001–2005) Licence surrendered in October 2006	Chlorine
Qantas Jet Base	12152	Sydney Airport, Mascot, 80 m southwest	Waste generation or storage	Multiple licence variations (2006–2008) Licence no longer in force	Metals Acids Solvents Hydrocarbons
Industrial Galvanizers Corporation Pty Ltd	6728	342 King St, Mascot, 115 m east	Waste generation or storage	Licence surrendered in 2001	Metals Acids Solvents Cyanide Volatile hydrocarbons
Enwave Mascot Pty Ltd	20246	10 Bourke Street, Mascot, 320 m northeast	Generation of electrical power from gas	2 licence variations (2014–2017) 1 mandatory environmental audit (pending)	Emission of gases to air
Gate Gourmet Flight Kitchen	10332	Keith Smith Avenue & Sixth Street, Mascot, 400 m southwest	Waste generation or storage	Licence revoked in 2002	Unknown
SIMS Group Limited	2009	283 Coward Street, Mascot, 400 m west	Waste generation or storage Scrap metal processing	Multiple licence variations (2001–2002) Licence surrendered in May 2004	Metals Hydrocarbons Suspended solids Acids PCBs PAHs

Facility name	Licence number	Address and distance to the project site	Activity incident type	Notice/incident type	Potential contamination
Kellogg (Aust) Pty Ltd	823	Swinbourne Street, Botany, 400 m south	General agricultural processing Storage of clinical and related wastes permitted	Multiple licence variations (2002–2013)	Hydrocarbons, nutrients Clinical and related waste contamination
Allnex Resins Australia Pty Ltd	993	49–61 Stephen Street, Botany, 450 m south	Chemical production and storage waste generation Contaminated groundwater treatment Dangerous goods production General chemical storage Toxic substances production	Multiple licence variations (2002–2018) Penalty notice (#3085765349, September 2012): breach of licence Two pollution studies: air quality assessment and remediation of TEX compounds in groundwater	Known toluene, ethylbenzene and xylene contamination plume in groundwater
Ecolab Pty Ltd	2086	3–5 Anderson St, Banksmeadow, 450 m southeast	Waste storage Non-thermal treatment of liquid waste Toxic substances production Container reconditioning Chemical production and storage waste generation Dangerous goods production General chemicals storage	Multiple licence variations (2002–2016) Surrender of a licence (01 Aug 2016)	Hydrocarbons Solvents Asbestos Clinical and related waste contamination

Of the facilities or former facilities listed in Tables 5.4 and 5.5, three facilities (Sydney Airport, Qantas Jet Base, Industrial Galvanizers Corporation Pty Ltd) include activities which have the potential to impact soil and/or groundwater and are located in close proximity to the project site.

The former Mascot Galvanising site has been redeveloped and is currently a high-rise hotel and car park.

The Botany Aquatic Centre, despite its close proximity to the project site (i.e. 50 metres) is considered to pose a low risk of contamination. The licence for the aquatic centre (which was surrendered in October 2006) allowed discharge of excess water to the sewer.

Current infrastructure work associated with the Airport East Precinct is a licensed activity. The Airport East Precinct may not in themselves present a risk to construction/operation work. However, due to pre-existing contamination in the Airport East project area (EES, 2018), disturbance of contaminated soil and groundwater is likely to be occurring.

6. Contamination site investigations

6.1 Previous investigations

This section provides a summary of previous environmental investigations undertaken within the project site. The following reports have been reviewed for the project site and are discussed further in the sections which follow:

- *Contamination Assessment and Waste Classification of Spoil from Upcoming track formation works between Banksia Street and Mill Pond, Botany NSW* (Coffey 2015).
- *Waste Classification and Reuse Assessment of Spoil from Upcoming Track Upgrading Works within the Metropolitan Freight Network* (Coffey 2016).
- *Mill Pond Geotechnical Investigation and Concept Design* (SMEC 2016).
- *Asbestos Materials Inspection Report, Rail Corridor, Banksia Street, Botany NSW* (ADE 2016).
- *Sydney Gateway Project – Phase 1, 2 & 3 Factual Contamination Assessment* (AECOM 2017).
- *Sydney Gateway Technical & Environmental Advisor, Project Feasibility (Phase 2) December, Civil Design Report* (SMEC 2017).
- *Rail Embankment Material Initial Spoil Assessment – Sydney Airport East, Mascot* (Cardno 2018).

A number of additional investigations undertaken in close proximity to the project site are also summarised including:

- *Roads and Maritime Services Phase 1 and Phase 2 Environmental Site Assessment, WestConnex Enabling Works, Airport East Precinct Mascot, NSW* (JBS&G 2014).
- *Groundwater Investigation Report – WestConnex Enabling Works Botany Road Rail Underpass (WXCAEP)* version 8 (EES 2018).
- AECOM 2018-2019, Sydney Gateway Project – Monthly Baseline Surface Water Monitoring, January 2018 to March 2019.

The sample locations are shown in Figure 1 in Appendix A.

6.1.1 COFFEY (2015) contamination assessment and waste classification of spoil

The Coffey investigation included environmental sampling from 30 test pits located between Banksia Street and Mill Pond (Area 1). Samples were analysed for contaminants of potential concern (COPC) including total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN), polycyclic aromatic hydrocarbons (PAHs), heavy metals and asbestos.

Anthropogenic material was observed within the fill material along the length of the rail corridor. Anthropogenic material typically included fragments of porcelain, glass, ceramic, concrete and brick; rail sleeper metal and timber; scrap metal, paper and plastic; redundant cables and pipes; building rubble; steel rods and plates. In addition, the rusted front end of a vehicle was observed within the fill material in test pit TP10.

Asbestos was detected in three of the soils samples analysed (TP7, TP31 and TP33). Concentrations of the other COPCs analysed were generally below NEPM 2013 criteria for commercial/industrial land use. The only exception to this was a concentration of lead (2,900 mg/kg) in TP14 which was above the health investigation level (HIL; 1,500 mg/kg.).

6.1.2 COFFEY (2016) waste classification and reuse assessment

The Coffey investigation included environmental sampling from seven test pits located between O'Riordan Street and General Holmes Drive (Area 2). Samples were analysed for TRH, BTEXN, PAHs, heavy metals and asbestos.

Asbestos was not detected in any of the samples analysed. Concentrations of the other COPCs analysed were below the NEPM HILs and health screening levels (HSLs) for commercial/industrial land use.

The presence of anthropogenic material (metal fragments) was recorded at one location, within sample location named CH11:980.

Based on the sample results Coffey classified the investigation area between O'Riordan Street and General Holmes Drive as general solid waste (non-putrescible).

6.1.3 SMEC (2016) Mill Pond geotechnical investigation

Hand auger investigations were performed at three locations along the toe of a proposed embankment to recover contamination samples from the upper 500 mm (Area 1). Samples were analysed for TRH, BTEXN, PAHs, heavy metals and asbestos.

Asbestos was not detected in any of the samples analysed. Concentrations of the other COPCs analysed were below the NEPM HILs and HSLs for commercial/industrial land use.

6.1.4 ADE (2016) asbestos material inspection

ADE undertook a visual surface inspection of the rail corridor between Mill Pond and Banksia Street (Area 1) and collected seven fibre cement samples and seven soil samples from the subject area. Asbestos was detected within six of the fibre cement samples. No asbestos was detected within any of the soil samples.

6.1.5 AECOM (2017) factual contamination assessment

AECOM undertook a combined geotechnical, contamination and pavement investigation with environmental samples collected from a total of 28 bores using either vacuum extraction or a drilling auger (Areas 1 and 2). A total of 80 soil samples were collected from the 28 locations for laboratory analysis of the COPCs including heavy metals, TRH, BTEXN, PAHs, phenols, organochlorine pesticides (OCPs), organophosphorus pesticides (OPPs), polychlorinated biphenyls (PCBs) and asbestos. Three select samples were also analysed for PFAS.

The following summarises the soil analytical results against guideline values adopted by AECOM:

- Exceedances of the laboratory limits of reporting (LORs) for PFAS analytes were adopted for screening purposes. One PFAS analyte was reported above the LOR; perfluorooctane sulfonic acid (PFOS) at a concentration of 0.0146 mg/kg.
- Concentrations of the other COPCs analysed were below the NEPM HILs and HSLs for commercial/industrial land use.
- Concentrations of benzo(a)pyrene exceeded the NEPM ecological criteria in seven samples analysed.
- A review of the PFAS results against the PFAS NEMP shows that the PFOS concentration detected is below the human health and ecological screening values for a commercial/industrial lands use.

The following provides a summary of asbestos observation and analysis:

- Asbestos was recorded on the bore log for SG-058 at a depth of 5.5 metres.
- A total of 37 samples were submitted for asbestos analysis. Asbestos was identified in 3 of the samples analysed:
  - SG-LD05_0.5-0.6, four loose fibre bundles of asbestos fibres (2 mm x 1 mm x 0.5 mm)
  - SG-LD05_FRAG1_0.5-1.0, one piece of asbestos cement sheeting (30 mm x 25 mm x 5 mm)
  - SG-LD03_FRAG1_1.0-1.5, two pieces of asbestos cement sheeting (30 mmm x 20 mmm x 5 mm).

During borehole drilling limited soil is available for visual examination compared with test pit and trench methods. Construction and demolition debris which is often an indicator that ACM may be present was identified in the following borehole locations:

- Qantas Drive (west of Robey Street) – SG-BE059, SG-BH018 (Area 2).
- Mill Pond to Banksia Street – SG-BE065, SG-BE066, SG-LD002, SG-LD003, SG-LD004, SG-LD005, SG-LD006, SG-LD007, SH-LD008, SG-LD009, SG-LD010, SG-LD011, SG-LD012, SG-LD014 (Area 1).

Groundwater monitoring wells were installed at two geotechnical borehole locations (SG-BH059 and SGBH065). Samples were analysed for major ions, heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), total iron and manganese, pH, total dissolved solids (TDS) and electrical conductivity (EC).

Groundwater exceedances of adopted criteria were reported for:

- manganese in groundwater exceeded the ANZECC (2000) marine water criteria in samples from SG-BH59 and SG-BH65
- arsenic in groundwater exceeded the adopted United States Environment Protection Agency regional screening levels for tap water in SG-BH59.

6.1.6 CARDNO (2018) initial spoil assessment (Sydney Airport East, Mascot)

The Cardno investigation included soil sampling from 12 test pits and 11 boreholes located within the Botany Line rail corridor adjacent to Wentworth Avenue (Area 2) with a total of 64 representative soil samples analysed. Samples were analysed for a range of COPCs including TRH, BTEXN, PAHs, heavy metals, OCPs, OPPs, PCBs, PFAS and asbestos.

Asbestos was not detected in any of the soil samples analysed. Concentrations of the other COPCs analysed were below NEPM HILs and HSLs for commercial/industrial land use. A minor exceedance of the NEPM ecological criteria for nickel was reported in one sample (TP07_0.4).

Exceedances of the laboratory LORs for PFAS analytes were adopted for screening purposes. PFAS concentrations were reported above the LORs at 14 soil sample locations. A review of the PFAS results against the PFAS NEMP (HEPA, 2018) shows that the PFOS concentration detected is below the human health and ecological screening values for a commercial/industrial land use.

6.1.7 JBS&G (2014) Phase 1 and Phase 2 environmental site assessment (WestConnex, Airport East)

JBS&G undertook a contamination investigation for the WestConnex enabling work at the Airport East precinct located between Botany Road and General Holmes Drive. Work comprised borehole drilling at 49 on-site locations and the installation of one on-site monitoring well (four soil locations BH44 to BH47 and monitoring well MW1 are located within Area 2). An additional 11 soil bore locations (BH49 to BH59) were located off site along the rail corridor (within Area 2).

Laboratory soil analysis included TRH, PAHs, BTEX, heavy metals (arsenic, chromium, cadmium, copper, lead, mercury, nickel and zinc), OCPs, PCBs and asbestos. Groundwater was analysed for TRH, PAHs, BTEX and heavy metals.

The following provides a summary of observations and results for the sampling undertaken within Area 2 (BH44 to BH47 and BH49 to BH59):

- Trace ash and slag gravels were observed in boreholes BH56, BH57 and BH59. No evidence of ACM was observed.
- Asbestos was not detected in any of the samples analysed.
- Concentrations of the COPCs analysed were below the NEPM HILs and HSLs for commercial/industrial land use.
- Concentrations of heavy metals exceeded the NEPM ecological criteria for commercial/industrial use in samples collected from BH45 and BH51.
- The measured depth to groundwater was 5.8 metres below the top of the well casing.
- All groundwater concentrations were below the adopted NEMP 2013 groundwater investigation levels.

6.1.8 EES (2018) groundwater investigation

EES undertook a groundwater investigation as part of the WestConnex Enabling Works - Airport East Project. Work comprised the installation of one nested monitoring well (5 ports), 5 new single monitoring wells (MW2 to MW6), ongoing monitoring of 12 groundwater bores (10 new and 2 existing) and the monitoring of 6 surface water locations. EES completed nine monitoring rounds between February and August 2017.

Laboratory analysis included PFAS, TRH, PAHs, BTEX, heavy metals (aluminium, arsenic, beryllium, boron, cadmium, chromium, copper, lead, magnesium, mercury, nickel, selenium, silver, tin, titanium and zinc), volatile organic compounds (VOCs), free cyanide, phenols, OCPs, OPPs, phthalate esters, halogenated compounds and PCBs.

A review of the PFAS results against the PFAS NEMP (HEPA, 2018) shows that the PFOS concentrations above the human health and/or ecological screening values for a commercial/industrial land use were detected in groundwater samples from MW1, MW2, MW5, MW6, EX1 and EX2 during the monitoring period (based on a 95% species protection – slightly to moderately disturbed systems). Perfluorooctanoic acid (PFOA) concentrations were below the human health and/or ecological screening values for a commercial/industrial lands use.

The concentration of all other analytes in groundwater were generally below the adopted assessment criteria with the exception of ammonia and heavy metals (aluminium, copper and zinc).

Results from analysis of surface water samples from around Mill Pond and Engine Pond showed detectable concentrations of PFAS with PFOS concentrations reported above the HEPA (2018) criteria. Concentrations of copper and zinc were also reported above the NEPM (2013) groundwater investigation levels.

EES concluded that PFAS levels “recorded in groundwater monitoring bores MW2 and MW6 are believed to originate from a western source, while exceedances at monitoring bore MW5 possibly originate from an unknown likely industrial source to the east.” The extent of the PFAS plume for PFOS and perfluorohexane sulfonate (PFHxS) defined by EES is illustrated in Figure 6.1.

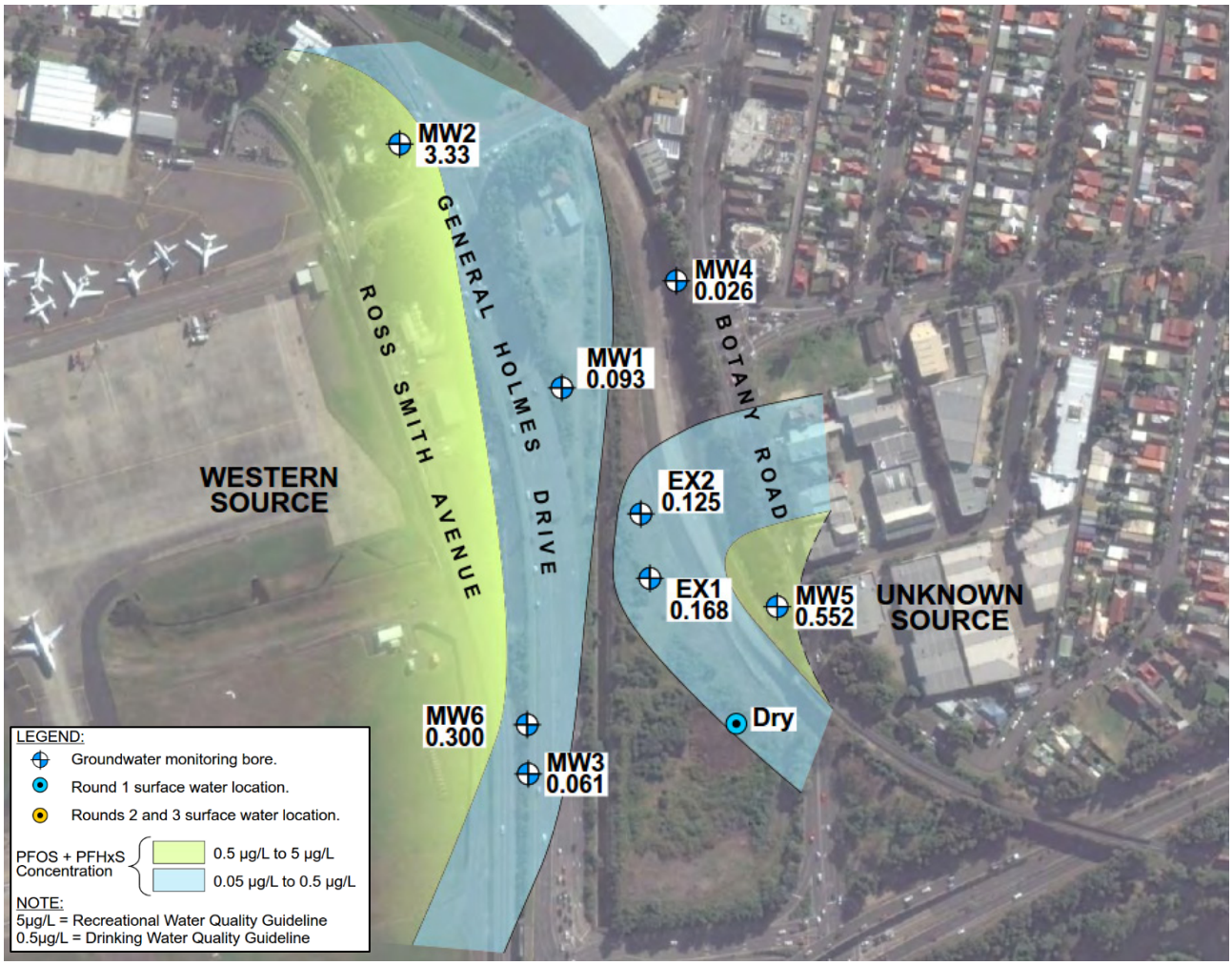


Figure 6.1 PFOS + PFHxS plume map (extract from Figure 4, EES (2018))

6.1.9 AECOM monthly surface water program

Water quality data has been collected at several locations in Alexandra Canal, Cooks River and Mill Stream since December 2017. Fifteen months of data (from December 2017 to March 2019) were provided for this study in the *Sydney Gateway Project – Monthly Baseline Surface Water Monitoring* report (AECOM, 2019).

Data has only been collected at SW9 (Mill Stream) since August 2018 due to issues with access. Location descriptions and an accompanying map of monitoring locations are shown in Figure 6.2 respectively.

Where possible, data was collected during both wet and dry conditions. According to the ANZG (2018) guidelines, two years of monthly water quality data is ideal to gain a reasonable understanding of baseline conditions.

A summary of key observations at SW9, SW10 and SW11 located in Mill Stream is outlined below:

- Total nitrogen, aluminium, iron, manganese, zinc, ammonia and total suspended solids exceeded the adopted guidelines (ANZECC, 2000) for all sites.
- Turbidity exceeded the guidelines at all sites apart from the median at SW10.
- Maximum phosphorus at SW9 and SW10, and average and maximum phosphorus at SW11, exceeded the guidelines.
- Maximum concentrations for arsenic and nickel at SW9 exceeded the guidelines.
- Total lead at SW9, average and maximum lead at SW11, and average, median and maximum lead at SW10 exceeded the guidelines.
- Total copper at all locations and maximum filtered copper at SW11 exceeded the guidelines.
- Maximum, average and total mercury concentrations at all sites exceeded the guidelines.

- Concentrations of contaminants were generally higher upstream at SW9 and diminished further downstream.
- PFAS compounds, including PFOS and PFOA, were detected in all three sampling locations. Concentrations were generally below the PFAS NEMP (95% protection) marine criteria with the except at SW11, where an exceedance of PFOS reported in a sample collected on 28 March 2018.

A summary of the data collected from SW1 to SW8 during these monitoring events is summarised in the *Technical Report 8 – Surface Water Impact Assessment*.

Figure 6.2 Sydney Gateway surface water monitoring locations (AECOM, 2018–2019)

7. Project site inspection

An inspection of the project site was undertaken on 6 July 2018 by G2S JV. The project site is occupied by the current Botany Line. The inspection covered most of the project site with the exception of three areas that could not safely be accessed. The areas that could not be accessed during the site walkover are:

- between Mill Stream bridge and Southern Cross Drive and about the intersection between Botany Road and Wentworth Avenue (northern portion of Area 1 and southern portion of Area 2, about 680 metres length)
- between O'Riordan Street bridge and Robey Street bridge (Area 2, about 240 metres)
- west of Qantas Road Bridge (Area 2, about 200 metres).

These areas are shown in Figure 3, Appendix A. A photographic log of the inspection is provided as Appendix C.

7.1 Area 1

Area 1 was accessed via a gate off Banksia Street. This portion of the project site was inspected from the western side of the tracks. Six ballast stockpiles were observed in the portion between Page Stephen Bridge and the Banksia Street pedestrian overpass. The stockpiles comprised predominantly ballast with vegetation and debris mixed throughout (Photos 3 and 5). These stockpiles were located on the western side of the tracks. A rail sleeper storage area containing both wooden and concrete sleepers was observed in the southern portion of Area 1 near Stephen Road Bridge (Photograph 2).

A number of waste drums were also observed about halfway between Page Stephen Bridge and the Banksia Street pedestrian overpass (Photograph 4). The waste drums appeared to contain limestone based fire-resistant sealant. A covered skip bin was also observed near the Banksia Street pedestrian overpass.

Ground level alterations via earthworks and filling was noted in several portions of Area 1. The access road along the rail corridor was noted to be about 1 metre higher than the train tracks between the area to the north of Banksia Street Pedestrian overpass and the overgrown area near Mill Stream Bridge (Photographs 8 and 9). The ground levels were about the same for the access road and train tracks between the Stephen Road Bridge and Banksia Street pedestrian overpass. However, in the vicinity of the rail sleeper area, ground levels were lower along the western fence line than along the main access road or tracks (Photograph 2).

Signage indicating the presence of asbestos along the rail corridor was present at multiple locations. No ACM fragments were observed in the raised roadway but exposed geofabric was observed in several areas (Photograph 9). Anecdotal evidence provided by ADE (email dated 31 March 2016) identified that an "emu pick" involving the systematic manual collection of asbestos surface fragments had been conducted previously in the eastern portion of the area to remove ACM fragments from the site surface. Slightly overgrown vegetation was observed along most of the raised roadway. The northern portion of Area 1 (near and to the west of Mill Pond Bridge) could not be accessed due to overgrown vegetation. In addition, the access bridge was too narrow to be crossed.

Refer to Figure 3, Appendix A for a location plan of the main features observed during the site walkover in Area 1. Photographs taken in Area 1 are presented in a photographic log, Appendix C.

7.2 Area 2

The southern portion of Area 2 (from Southern Cross Drive to the intersection between Botany Road and Wentworth Avenue) could not be accessed. In addition, the rail corridor area between Botany Road Bridge and the intersection between Botany Road and Wentworth Avenue is currently a construction site. The construction site could not be accessed but it was noted that earthworks were being undertaken in the area (Photograph 3).

Area 2 was accessed via two gates on either side of the General Holmes Drive railway crossing (Photographs 1 and 4). To the south of General Holmes Drive, the walkover was undertaken to the west of the tracks. To the north of General Holmes Drive, the walkover was undertaken to the east/north of the tracks.

Some construction rubbish was observed in the project site to the west of the tracks within a fenced area near the railway crossing (Photograph 2). A groundwater monitoring well was observed within the rail corridor (Photograph 9). This well does not appear on bore searches.

The ground levels were about the same in the rail corridor as Joyce Drive on the eastern side (General Drive crossing) but gradually increased in relative elevation towards O'Riordan Street bridge. At the bridge, the tracks were about 5 metres higher than Joyce Drive. This is consistent with the area being heavily disturbed and indicates potential filling areas.

The area between the O'Riordan bridge and Robey Street bridge could not be accessed as there is no access gate between the bridges, and both bridges are too narrow to be crossed by pedestrian while rail traffic is active (Photograph 10).

The area north or Robey Street bridge was accessed via a gate off Coleman Street (Photograph 11). This portion of the project site was inspected from the eastern side of the tracks. Two sub-stations were observed along the tracks (Photographs 12 and 21). Several ACM fragments were observed on the floor along the wall of a building within the rail corridor (Photographs 14 and 15). The fragments did not appear to be severely weathered.

A stockpile containing ballast, vegetation, a rail sleeper and general rubbish was observed in the rail corridor near the King Street access gate (Photographs 18 and 19). The gate was bent and may have been forced opened in the past. More general rubbish including a drum and rail sleepers were stored along the rail corridor north of King Street (Photograph 20). Several ballast stockpiles were observed before the pinch point towards Qantas Road bridge (Photograph 22).

The western portion of Area 2 immediately east and west of Qantas Road bridge could not be accessed as the rail corridor was too narrow to proceed safely (Photograph 22).

A location plan of the main features observed during the site walkover in Area 2 is presented in Figure 3, Appendix A. Photographs taken in Area 2 are presented in a photographic log, Appendix C.

8. Summary of potential contamination

8.1 Area 1

Based on a review of assessments undertaken in the study area to date, the following summarises the potential contaminants within Area 1.

Historic fill material of unknown origin has previously been imported to the site.

Asbestos has been identified at several locations with anthropogenic material observed within fill material along the entire length of this section of rail corridor. It is noted that sources of asbestos contamination are common on rail corridors due to fill material of unknown composition, illegal dumping of waste material, deterioration of old maintenance infrastructure and historical degradation of train brake pads. However, presence of this asbestos material can still present a risk to human health if disturbed. Given the extent of demolition and construction waste recorded in the investigation borelogs the entire length should be managed as potentially impacted by asbestos (nominated as an area of environmental concern (AEC) AEC1).

The concentrations of the other COPCs analysed in soil were generally below the HILs and HSLs for commercial/industrial land use and therefore appropriate to use as a rail corridor.

PFOS was reported above the LOR in a soil sample collected near Southern Cross Drive. Concentrations were below the HEPA criteria for commercial/industrial land use.

Groundwater samples were collected from one monitoring location within the project site. Groundwater concentrations were generally below the adopted assessment criteria (AECOM, 2017) with the exception of manganese which exceeded the ANZECC (2000) marine water criteria and arsenic which exceeded the US EPA RSL for tap water.

PFOS concentrations above the HEPA criteria have been reported in surface water samples collected from Mill Pond (EES, 2018).

Surface water sampling points in Mill Stream (SW9 to SW11) frequently exceeded ANZECC (2000) guidelines for total nitrogen, aluminium, iron, manganese, zinc, ammonia and turbidity (AECOM December 2017 to March 2019).

8.2 Area 2

Based on a review of assessments undertaken in Area 2 to date, the following summarises the potential contaminants within Area 2.

Historic fill material of unknown origin has previously been imported to the site.

No asbestos fibres or ACM has been identified within soil samples collected along this section of rail corridor. Anthropogenic material which could indicate the presence of construction/demolition waste has only been recorded at three locations (AECOM, 2018 and Coffey, 2015).

During site inspection on 6 July 2018 several ACM fragments were observed on the project site surface in an area west of Robey Street bridge, adjacent to the wall of an existing building (nominated as AEC2).

The concentrations of the other COPCs analysed in soil were generally below the HILs and HSLs for commercial/industrial land use.

Groundwater samples were collected from one monitoring location within the project site. Groundwater concentrations were generally below the adopted assessment criteria (AECOM, 2018) with the exception of manganese which exceeded marine water criteria.

8.3 Off-site areas of concern

Sydney Airport is known to contain sources of PFAS and other contaminants associated with historical and current industrial/commercial uses. Elevated concentrations of PFAS have been recorded in nearby off-site monitoring well MW5 (EES, 2018), located between the rail corridor and Botany Road (near Bronti Street). PFOS concentrations were reported above the HEPA (2018) human health and ecological criteria (nominated as AEC3).

The surrounding area includes several historic and current commercial and industrial activities. Based on a review of the NSW EPA contaminated sites notices and licenses under the POEO Act and considering proximity to the project site the following off-site AECs have been identified:

- AEC 4 – Sydney Airport (including the Qantas Jet Base)
- AEC 5 – Former Mascot Galvanising site.

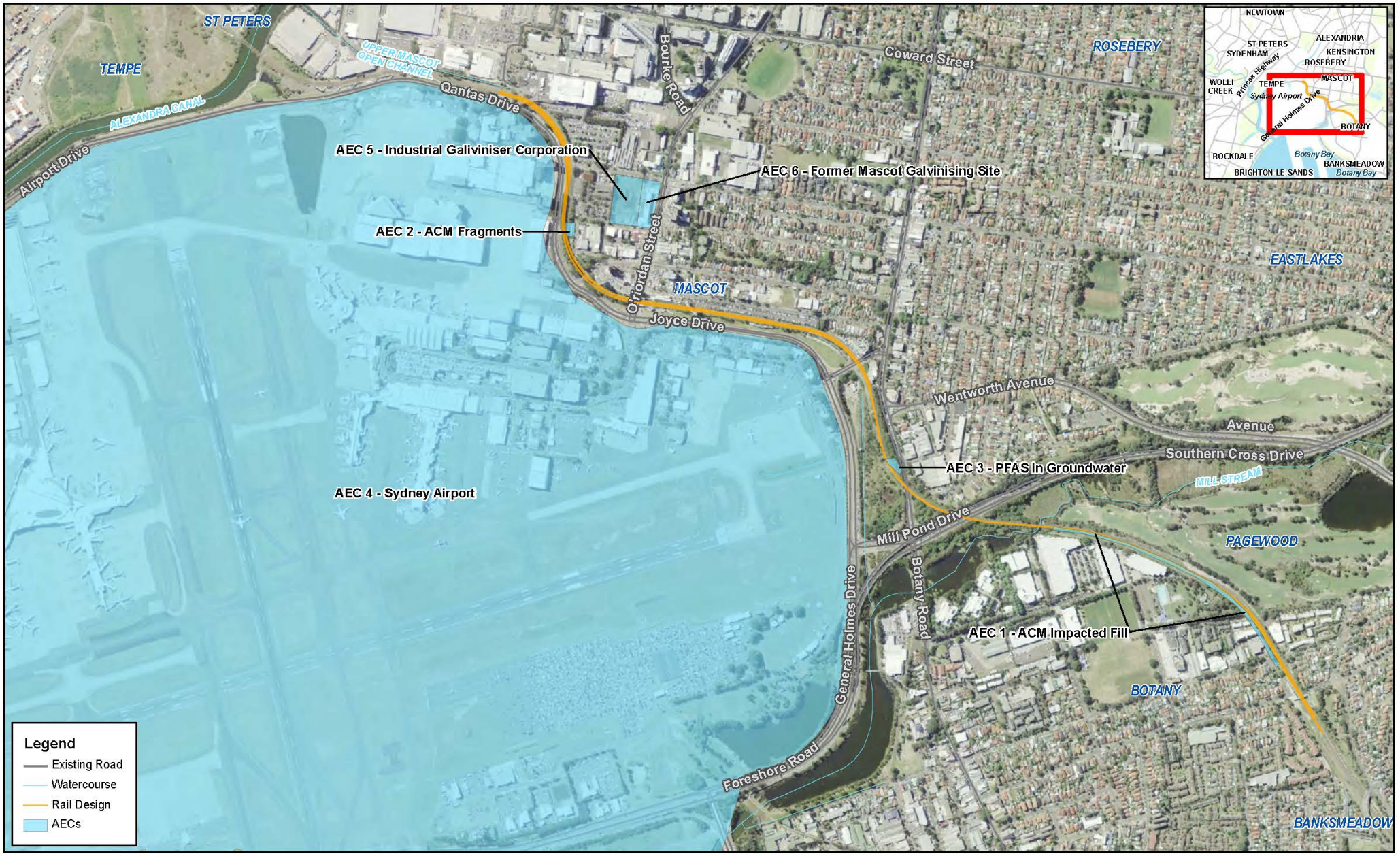


Figure 8.1

AECs Identified along or in the Vicinity of the Botany Rail Duplication

Author: David Naiken
Date: 2/07/2019
Map no: PS113386_GIS_060_A1

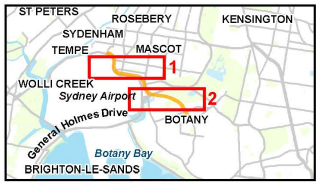
8.4 Data gaps

Limited investigation (involving three boreholes) has been undertaken to the west of Robey Street (AECOM 2017). Although no ACM has been detected, building/construction waste was recorded in two of the borehole locations. Also, ACM was observed on the surface during site inspection (6 July 2018). However, borehole drilling is not the preferred method for asbestos investigation (NEPM 2013) as only limited soil is available for visual examination due to the small diameter of the borehole. The preferred method to identify the presence of asbestos is via a trenching or test pit method, as this allows visual inspection of a greater surface area of soil. Therefore, given the observation of building/construction waste, further asbestos investigation with test pit or trench methods is recommended in the area west of Robey Street (as shown on Figure 8.2) during detailed design to better inspect the nature of the anthropogenic material recorded and confirm whether asbestos is present.

Limited groundwater monitoring has been undertaken to date along the project site. No significant dewatering is proposed during construction. If the need for significant dewatering is identified during detail design or construction, further groundwater monitoring should be undertaken to inform appropriate management and discharge options.

0 100 200 m

1:5,500



- Geotechnical borehole (AECOM 2017)
- Environmental borehole (AECOM 2017)
- Large diameter auger borehole (AECOM 2017)
- Watercourse
- Waterways
- Monitoring well location (AECOM 2017)
- Data gap - additional asbestos investigation required

Author: Jeong Greaves
Date: 7/3/2019
Map no: PS113386_GIS_066_A1

Figure 8.2

Project Site Investigation and Identified Data Gaps

8.5 Conceptual site model

Contamination within the project site, if not managed appropriately could pose a potential risk to human health and the environment during construction or operation of the project. For an ecological or human health risk from contamination to be present, there must be a plausible pollutant linkage between the source of contamination and a receptor by means of a transport mechanism (pathway). A tabular depiction of the conceptual site model (CSM) for the project site is presented in Table 8.1 below.

Table 8.1 Conceptual site model

Site aspect	Details	
Potential sources of contamination	■ ACM in soil along Area 1 (AEC1). ■ Surface ACM in Area 2 (AEC2). ■ Off-site sources of PFAS including airport activities (south and west) (AEC4) and industrial activity (south and north) (AEC5). ■ Off-site former galvanising plant located on King Street in Mascot (north) (AEC6).	
Geology	**Fill material** ■ Various layers of fill encountered. ■ Area 1 – Fill generally present at depths between 1.5 mBGL and 3 mBGL. Matrix generally described as gravel and gravelly sand, building rubble observed at most locations. ■ Area 2 – Fill thickness is variable, generally ranging between 0.5 mBGL and 3.0 mBGL. Building rubble only observed at 3 locations. ■ Adjacent to Mill Pond – Locations either side of Mill Pond, fill recorded up to depths of 7 mBGL. Generally described as sand or gravel and recorded to be reworked natural material.	**Natural soils** ■ 1 mBGL to 20 mBGL sand, generally fine to medium grained, yellow, grey, light brown. ■ Intermittent clay bands encountered from 8 mBGL. ■ 17 mBGL to 32 mBGL clay/sandy clay, high plasticity, grey, brown. ■ Shale encountered at 18 mBGL (SG-BH065).
Depth and flow of groundwater	**Shallow aquifer** ■ Depth to groundwater on site was recorded between 3.3 mBGL and 5.2 mBGL. ■ On site measured groundwater elevations ranged from 3.9 mAHD to 4.3 mAHD (AECOM 2017). ■ Inferred groundwater flow is to the west/southwest. ■ It appears that the groundwater aquifer has a high yield. ■ Groundwater beneath the project site is likely to be subject to tidal influence.	
Influences on groundwater conditions at the site	■ The project site intersects Mill Stream which flows into Mill Pond. ■ Engine Pond is located to the west of Mill Pond beyond General Holmes Drive. ■ Regional groundwater flow in the Botany Sands Aquifer (Hatley 2014) discharges predominantly towards Cooks River and Botany Bay.	
Nature of known soil contamination	**Area 1** ■ Asbestos in soil identified at several locations (AEC1). ■ PFAS concentrations recorded above LORs.	**Area 2** ■ ACM observed on site surface (west of Robey Street Bridge) (AEC2).
Nature of known groundwater contamination	**Area 1** ■ Elevated concentrations of manganese and arsenic.	**Area 2** ■ Elevated concentrations of manganese. ■ PFOS in off-site monitoring well MW5 NEMP criteria (AEC3).
Nature of known surface water contamination	PFOS concentrations above the HEPA 2018 criteria have been reported in surface water samples collected from Mill Pond. Total nitrogen, phosphorus, ammonia, heavy metals, turbidity and total suspended solids exceeded the adopted guidelines (ANZECC, 2000).	

Site aspect	Details				
Potential transport mechanisms and exposure pathways	■ Leaching of soil contaminants into groundwater. ■ Lateral migration of contamination in groundwater. ■ Surface water runoff. ■ Outdoor inhalation of dust or fibres. ■ Direct dermal contact or ingestion of contaminants in soil and/or groundwater.				
Potential receptors	**On-site ecological** ■ None, existing rail corridor	**Off-site ecological** ■ Mill Pond ■ Mill Stream	**On-site workers** ■ Commercial ■ Intrusive	**Construction workers** ■ Construction ■ Maintenance	**Off-site community** ■ Commercial worker ■ Residential
Existing complete source-pathway-receptor links	No	Yes, concentrations of PFAS have been recorded in Mill Pond→aquatic ecosystem.	Yes, ACM observed on the site surface (west of Robey Street) →airborne fibres→worker.	Yes, ACM identified in soil (Area 1) →airborne fibres→worker.	No, groundwater extraction restricted under 2018 order.
Future source-pathway-receptor links (project influence)	None	Yes, the off-site source of PFAS is unknown. Potential for on-gong concentrations of PFAS in Mill Pond.	Yes, ACM identified in soil will be capped and retained on site →airborne fibres→worker.	Yes, ACM identified in soil will be capped and retained on site→airborne fibres→worker.	No, groundwater extraction restricted under 2018 order.

8.6 Site suitability

8.6.1 Area 1

Asbestos has been identified at several locations with anthropogenic material observed within fill material along the entire length of this section of rail corridor. Remediation is required in this area to mitigate the risk of exposure to identified asbestos in soil contamination for future users of the rail corridor. The site would be confirmed to be suitable for the proposed development following remediation. The remediation would be undertaken in accordance with a remediation action plan (RAP) prepared by a suitably qualified environmental consultant.

The concentrations of the other COPCs analysed in soil were generally below the HILs and HSLs for commercial/industrial land use.

8.6.2 Area 2

The concentrations of COPCs analysed in soil were generally below the HILs and HSLs for commercial/industrial land use. Based on the results of the available investigation reports no soil or groundwater conditions have been encountered that would preclude the suitability of the site as a rail corridor.

Several ACM fragments were observed during site inspection on the site surface in an area west of Robey Street Bridge (adjacent to the wall of an existing building). Additional investigation is recommended to further evaluate the risk of potential contamination exposure to workers during construction phase and provide guidance on waste management in the event that excavated materials require off-site disposal or classification for potential reuse.

9. Impact assessment

9.1 Impacts during construction

9.1.1 Contamination

Construction activities, including excavation activities, vegetation clearing, vehicle movement and utilities works, have the potential to disturb soil. This could result in the exposure of sensitive receivers to contaminated soils, which could lead to ecological or human health impacts.

To assess the potential for contamination impacts during construction of the project, a contamination assessment has been performed in accordance with guidelines made or approved under the CLM Act. This impact assessment has been based on the CSM for the project which is presented in Table 9.1. As detailed in NEPM 2013 the development of a CSM is a key component of contamination assessments and provides the framework for identifying how potential receptors may be exposed to contamination.

The outcomes of the qualitative risk ranking completed are presented in Table 9.1, it is noted that the risk rankings are prior to the implementation of the recommended management measures identified in Section 10. Potential risk associated with unexpected contamination finds have not been assessed, this would be managed in accordance with an unexpected finds protocol (refer to section 10.2).

Following the implementation of recommended management measures, it is anticipated that any identified high or medium risk rankings would ultimately present a low risk of exposure.

Table 9.1 Preliminary risk ranking

Area of interest	Construction activity	Construction impact	Likelihood	Consequence	Preliminary risk evaluation
Area 1	■ Construction ancillary facilities. ■ Vegetation clearing. ■ Track excavation (~0.7 mBGS). ■ Services upgrade trenches (~1 mBGS). ■ Excavation for retaining wall footings (footing depth of ~1 mBGL, deeper footings would likely require piling). ■ Excavations for footings of retaining wall between Myrtle Street and Bay Street (footing depth of ~1 mBGS). ■ Piling for Mill Stream bridge (~40 mBGS).	Previous investigations have identified the presence of uncontrolled fill containing ACM throughout Area 1. Other COPCs were generally below the NEPM HILs and HSLs for commercial/industrial land use. No significant dewatering of groundwater is proposed during construction. If not managed appropriately, disturbance of the identified asbestos contaminated soil could result in the following exposure scenarios which have the potential to impact on human health: ■ direct contact, ingestion and inhalation by construction workers ■ risk of airborne asbestos fibres being generated during construction activities associated with the excavation, movement and stockpiling of ACM contaminated soils ■ risk of dust and/or asbestos exposure to construction workers ■ off-site transport of contaminants via dust or vehicle/plant movements ■ surface water runoff and discharge into receiving environment.	Contaminant identified above relevant assessment criteria and widespread.	Exposure pathway complete during construction (without implementation of appropriate controls).	HIGH

Area of interest	Construction activity	Construction impact	Likelihood	Consequence	Preliminary risk evaluation
Area 2	■ Construction ancillary facilities. ■ Vegetation clearing. ■ Removal of above ground infrastructure (including billboards). ■ Track excavation (~0.7 mBGS). ■ Services upgrade trenches (~1 mBGS). ■ Excavation for footings for retaining walls extending south of King Street to about 150 m south of O'Riordan bridge (footing depth of ~1 mBGS of more if piling is required). ■ Piling for Robey Street bridge and O'Riordan Street bridge (up to 20 mBGS). ■ Excavation for footings for retaining walls between Botany Road bridge and Southern Cross Drive bridge (footing depth of ~1 mBGS likely to require piling at greater depths).	No asbestos fibres or ACM has been identified within soil samples collected. Anthropogenic material which could indicate the presence of construction/demolition waste has only been recorded at three locations however, there is limited coverage of sampling in this area so there is the potential for unidentified ACM. Other COPCs were generally below the NEPM HILs and HSLs for commercial/industrial land use. During site inspection on 6 July 2018 several ACM fragments were observed on the site surface in an area west of Robey Street Bridge (AEC2). Excavation is not anticipated to intersect groundwater. If not managed appropriately, disturbance of surface ACM could result in the following exposure scenarios which have the potential to impact on human health: ■ risk of airborne asbestos fibres being generated during construction activities ■ risk of dust and/or asbestos exposure to construction workers.	Potentially present at concentrations above the relevant assessment criteria and limited in extent.	Exposure pathway potentially complete during construction (without implementation of appropriate controls).	MEDIUM

The *Technical Report 7 – Groundwater Impact Assessment*, Section 5.3.2, summarises that there is a reasonable likelihood of intersection with groundwater at isolated locations within the project site, particularly under wet conditions. In these areas, if groundwater is intersected, construction activities would be designed to prevent groundwater dewatering (and hence groundwater drawdown). Bridge footings would intersect groundwater but cast insitu techniques would be adopted that do not require dewatering. With regard to receptors, the outcome of this approach would be that there would be negligible drawdown impacts to:

- contaminated sites
- acid sulfate soils.

Incidental groundwater management and subsequent disposal and/or reuse would need to be managed due to the identification of COPC concentrations above adopted assessment criteria (AECOM 2017).

Contaminated land on and/or adjacent to the project site, if not managed appropriately could potentially impact the environment or site workers during construction. There is also a potential for cross-contamination (or incorrect waste classification) associated with incorrect handling or disposal of contaminated soils if appropriate management procedures are not implemented.

The potential soil and contamination impacts would be minimised by:

- managing contamination in accordance with relevant legislative and policy requirements, as described in Section 2
- development of a contamination management plan to outline the management of contaminated material along with opportunities for retention and/or reuse of contaminated material
- managing contamination through occupational exposure controls in accordance with work health and safety (WHS) legislation
- implementing the soil and contamination mitigation measures described in Section 10.

9.1.2 Acid Sulfate Soils

The risk of ASS occurring within the project site was identified in Section 4.5, which describes project activities requiring ASSMPs. The area between Southern Cross Drive bridge to Mill Stream bridge is a Class 1 ASS area.

The exposure of pyrite and other sulfides to oxygen during disturbances can lead to the generation of sulfuric acid. The subsequent acidic leachate can then lead to mobilisation of heavy metals such as aluminium and iron into water bodies.

Table 9.2 presents an assessment of impact associated with the disturbance of ASS, which was undertaken in accordance with the methodology in Figure 2.1 of the *Acid Sulphate Soil Manual* (ASSMAC, 1998). The treatment categories presented in Table 4.5 of the ASSMAC Acid Sulphate Soil Manual have been used to define the severity of the potential impact associated with ASS. The potential for impacts associated with acid sulfate soil runoff is high due to the proximity of the project to Mill Stream and Mill Pond.

Table 9.2 Acid Sulfate Soil impact summary

ASSMAC Figure 2.1 reference	**Area 1**	**Area 2**
Step 1 – establish works characteristics	No significant excavation into natural material. Potential ASS disturbance during piling for bridge piers.	No significant excavation into natural material. Potential ASS disturbance during piling for bridge piers.
Step 2 – establish if ASS is present	Class 1 adjacent to Mill Pond Class 4 elsewhere.	Class 2 and Class 4.
Step 3 – results from project Investigation (AECOM 2017)	Net acidity (sulfur units) 0.035–0.147%S	Net acidity (sulfur units) 0.032–0.943%S
Step 4 – treatment category (Table 4.5 ASSMP)	Medium	Medium
Step 5 – impact of acid runoff offsite	High	High

Significant excavation below the water table is not proposed. the potential for encountering contaminated groundwater during excavation activities is low. Groundwater would be encountered during pilling works which has the potential to impact marine ecosystems within Mill Pond/Mill Stream.

9.2 Impacts during operation

The operation of the project should not result in exposure to users (e.g. maintenance workers or train drivers) to potentially contaminated soil or groundwater. This is because the project proposes, where feasible and reasonable, to contain existing contaminated soil (that has not been removed during the construction phase of the project) using capping.

The primary operational impact related to the project is the potential contamination of soil, surface water and groundwater arising from intermittent vehicle accidents, leaks and spills on the rail track. However, as the project is located within an existing operational rail corridor, this would not introduce new sources of contamination to the surrounding environment. The increase in frequency of vehicle accidents, leaks and spills from operation of the project is expected to be negligible.

Additionally, the project would adopt a lubrication procedure to minimise noise pollution associated with high frequency wheel squeal. The process will involve the application of a friction modifying agent to the top running surface of the rail requiring the handling and storage of grease and oil products. A rail lubricator will deliver a metered quantity of lubricant from a reservoir to a location on the gauge face of the rail heads where it is picked up by the wheel flanges of passing vehicles. Appropriate lubricant products have a low viscosity, with products needing to provide a pasty texture suitable for application. Spills or leaks of lubricant products have the potential to cause local contamination to the surrounding soil. However, the spill volume is expected to be minor, within an existing rail corridor and unlikely to migrate beyond the project site, however the potential for lubricant to migrate offsite cannot be discounted. Lubricant products may cause skin and eye irritation. There is a potential that spills or leaks could impact on the water quality of Mill Stream/Mill Pond.

Soil contaminated with asbestos has the potential to impact on the health of future rail workers. Maintenance works such as vegetation clearing, removal of above ground-infrastructure (signage), underground utility maintenance, track repair or vehicle movement have the potential to disturb minor amounts of soils. Without the implementation of appropriate controls, disturbance of the identified asbestos contaminated soil could result in the exposure of maintenance or excavation workers to airborne asbestos fibres and/or dust and the tracking of asbestos to non-contaminated areas and/or off-site.

9.3 Cumulative impacts

Major developments currently under construction in the vicinity of the project include:

- M4–M5 Link and New M5
- Sydney Metro Southwest
- Airport North upgrades – O'Riordan Street
- Airport East upgrades – General Holmes Drive, Botany Road, Joyce Drive.

Other developments in the vicinity of the project that are proposed but not yet approved include the Sydney Gateway road project and F6 Stages 1 and 2.

As the Botany Rail Duplication project is a duplication of an existing rail line, sources of contaminants are already likely to be present and entering the receiving environment. The potential for the project to increase the level of contaminants is expected to be negligible.

Disturbance of contaminated soil or groundwater during construction is not expected to have a cumulative impact as long as appropriate mitigation measures are implemented (Table 10.1).

10. Management of impacts

10.1 Approach

A Soil and Water Management Plan (SWMP) would be developed to manage all soil and water risks. The SWMP would comply with the proposal conditions of approval and be in accordance with best on site practice, reflected in the Blue Book (Landcom, 2004). The SWMP would include:

- water quality objectives for the project
- an erosion and sediment control plan that allows for site-specific erosion and sediment controls at all work sites in accordance with the Blue Book
- an asbestos management plan (AMP) that would be prepared in accordance with NEPM 2013 and the *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia* (WA Department of Health, 2009)
- an acid sulfate soil management plan (ASSMP) that would be developed in accordance with the *Acid Sulfate Soils Manual* (ASSMAC, 1998).

The requirement for remediation has been identified in Area 1. The preferred hierarchy of options for site clean-up and/or management presented in NEPM will be adopted for remediation of the site.

The NEPM also notes that where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, an appropriate management strategy should be implemented.

No appropriate on- or off-site treatment methods are available for asbestos in soil. Therefore, the preferred remediation strategy is management through consolidation and isolation on-site using an appropriately constructed barrier to prevent exposure.

The project design seeks to optimise the capping of the existing asbestos containing material to minimise earthworks associated with disturbance of the identified asbestos contaminated fill material. As identified in Section 9, asbestos containing material has been identified within the existing rail corridor, generally between Bay Street, Botany and the existing Mill Stream bridge. In order to allow for the additional track at this location, some of this material is proposed to be removed with the remaining portion of the material to remain in situ and be capped with a layer of capping material (refer to Figure 10.1).

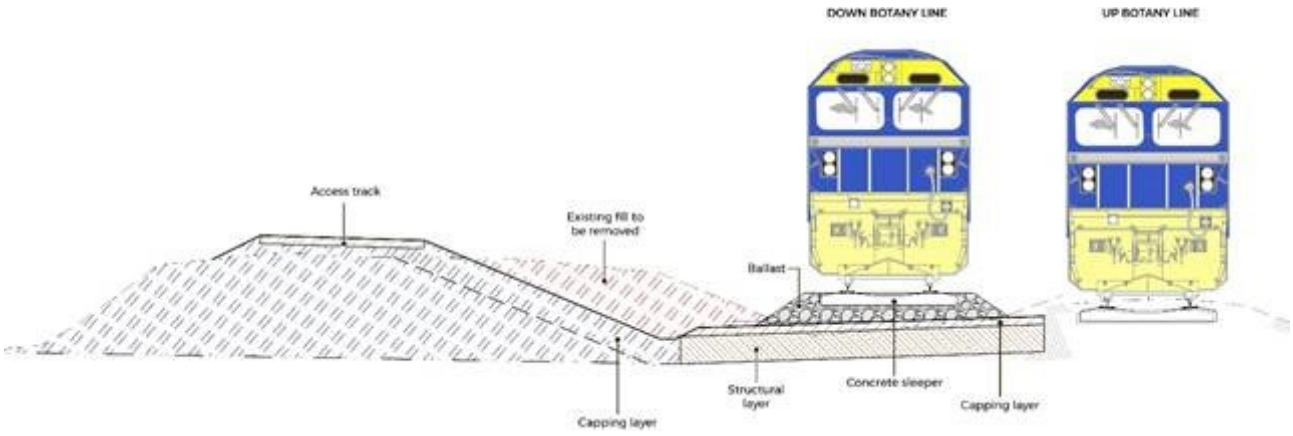


Figure 10.1 Sketch of capping design (not to scale)

The amount of material to be removed would comprise around 4,000 cubic metres of ACM (subject to detailed design); material will be removed to a depth sufficient to construct the cap with the resulting cap surface achieving the final design level. The capping layer to be placed over the remaining ACM would consist of a demarcation layer comprising geofabric and a contrasting-coloured marking layer, a layer of clean fill material (virgin excavated natural material (VENM)) at least 0.3 metres thick with an additional 0.15 metres of topsoil. Based on the current design, this would require around 5,700 cubic metres of VENM for capping material.

The proposed capping approach detailed above would also apply to other areas if previously unidentified ACM contamination if identified during future works or during construction.

10.2 List of mitigation measures

The mitigation measures that would be implemented to address potential contamination and soil impacts are listed in Table 10.1. It is noted that recommendation for additional investigation relates to site characterisation to inform the CSM. Notwithstanding, waste classification as per NSW EPA guidelines is required for all material to be removed from site.

Construction activities would require the preparation of environmental management plans, which would include general best practice measures for management of soil, groundwater and sediment pollution.

Table 10.1 Mitigation measures

Stage	Impact	Measure	Relevant project area
Construction	Remediation of asbestos contaminated fill material	A remediation action plan (RAP) would be prepared for Area 1 in accordance with NEPM 2013 prior to placement of the asbestos capping layer. Remediation in Area 1 would be undertaken in accordance with the endorsed RAP. Following this, a validation report would be prepared by a suitably qualified environmental consultant to validate the suitability of the project site for its proposed use. Installation of the capping layer should be done under the supervision of a suitably qualified and experienced consultant (as defined in Schedule B9 of the NEPM). The final elevation of residual contaminated soils should be surveyed prior to the installation of the marking layer and capping layers. Final levels should also be surveyed and included in the SWMP and ARTC asbestos register.	Area 1
	Potential for unidentified ACM	West of Robey Street, existing investigations would be supplemented with additional sampling, prior to construction, using a test pit or trenching method in accordance with NEPM 2013 and WA Department of Health (DoH) 2009, *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*. If enabling works in this area are undertaken prior to additional sampling, ACM would be assumed to be present and works would be supervised by an appropriately licensed contractor. This would be specified in a site environmental management plan for the enabling works.	Area 2

Stage	Impact	Measure	Relevant project area
	Potential for encountering ASS	An ASSMP would be developed in accordance with the ASSMAC (1998) *Acid Sulfate Soils Manual* and included in the SWMP. ASS encountered during construction would be managed in accordance the ASSMP.	All
	ACM impacted soils	An asbestos management plan (AMP) would be prepared in accordance with NSW EPA guidelines (including waste guidelines), SafeWork NSW 2014, *Managing Asbestos in or on Soil* and relevant industry codes of practice. This AMP would be included in the SWMP.	All
	Surface ACM	An emu pick involving the systematic manual collection of identified asbestos surface fragments would be undertaken to remove ACM fragments from the site surface. A clearance certificate would be obtained from a licensed asbestos assessor (LAA).	Area 1 and portion of Area 2 west of Robey Street
	Contaminated groundwater	Adopt construction techniques to avoid groundwater disturbance where practicable. If groundwater is encountered, temporarily store all extracted groundwater to be disposed of offsite in appropriate containers then ensure it is tested for potential contaminants (including PFAS). Options for final disposal of extracted groundwater include: ■ removal offsite to a water recycling facility if the level of contaminants does not exceed the water acceptance thresholds ■ discharge to a sewer via a trade waste agreement with Sydney Water ■ treatment through a groundwater remediation system before being released to surface water (with approval from NSW EPA). For the above options, the analytical testing results would need to demonstrate compliance with the applicable license or discharge criteria.	All
	Spills and leaks contaminating soil or groundwater	Procedures to store, handle and use materials and equipment appropriately to prevent spills would be prepared and included in a relevant management plan. NSW Pollution Incident Response Management Plan and the ARTC Standard Environmental Management Measures to be adopted. Immediately contain and clean up leakage of fuels, oils, chemicals and other hazardous liquids in accordance with the Safety Data Sheet and relevant emergency response procedure to prevent migration of contaminants to other parts of the site.	All
	Stockpile management and soil handling.	Employ stockpile management procedures for segregating soil and preventing cross-contamination of clean soil with contaminated soil. These would be documented in the SWMP. Any waste material would be disposed of in accordance with the appropriate waste classification, as per the EPA guidelines.	Area 1

Stage	Impact	Measure	Relevant project area
	ACM contaminated areas	ACM impacted soil would be handled and managed in accordance with the AMP. Areas that are designated as ACM contaminated areas would be clearly fenced off and suitable warning signs posted prior to soil disturbance in that area. Hygiene facilities would be provided incorporating a high standard of washing facilities and storage area for contaminated clothing/footwear. These areas should only be accessible to authorised personnel, and work permitted only under controlled/supervised conditions by appropriately qualified/ licensed personnel.	All
	Unexpected contamination	An unexpected finds procedure would be prepared and included as part of a SWMP. It would identify the process to follow in the event that indicators of contamination are encountered during construction (such as odours, ACM or visually contaminated materials).	All
	Potential for cross-contamination	Erosion and sediment control measures would be implemented in accordance with *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom, 2004) to prevent migration of contaminated sediment to sensitive ecosystems, including Mill Pond.	All
Operation	Spills and leaks contaminating soil or groundwater	Potential spills and/or leaks would be managed in accordance with ARTC's pollution incident response procedure (under the Environment Management System) or in accordance with an Operator's Operational Management Environmental Management Plan (OEMP) prepared in accordance with ARTC's access agreement requirements (depending on the extent and natural of the spill).	All
	Potential spillage from lubricant system	Biodegradable low risk non-petrogenic products will be used where appropriate.	
	Containment of contaminated soils	The location and nature of any known contamination will be registered on ARTC's Contaminated Land Register and ARTCMap (internal GIS system). Prior to maintenance works in the corridor, a Task Based Environmental Assessment (TBEA) will be prepared which identifies known environmental sensitivities, including contamination. ARTC's Standard Environment Management Measures (under the Environment Management System) include procedures for no go zones for known areas of in-situ contamination, which will be implemented prior to maintenance works likely to disturb soils. ARTC's Work, Health and Safety work instructions will also be used for works near known contamination. Any required inspections of the capping layer undertaken by ARTC will be undertaken in accordance with ARTC's Asset Management System procedures. These procedures will be summarised in a site management plan in accordance with the CLM framework, which will be prepared by an environmental consultant and guide the management of residual contamination within the project site. This may be a standalone plan or may be combined with site management plans that relate to adjacent areas.	Area 1

11. Conclusion

This report assesses the impacts of potential or known contamination during construction and operation of the project. The assessment has included a desktop review of nine existing contamination assessment reports, review of monthly surface water quality results and consolidation of the data into a CSM.

Existing identified on-site contamination issues are primarily related to historic uncontrolled filling which has adversely impacted the quality of soil/fill material within the project. Additionally, historical and current industrial/commercial uses have been identified off-site with PFAS impacts recorded in Mill Pond.

Remediation would be required in Area 1 to address potential risk of human health exposure to asbestos which has been identified within the site fill material. Remediation options would be identified and selected using the sustainability hierarchy adopted in the NEPM 2013. Additional investigation is recommended in Area 2 during detail design to further evaluate the risk of potential contamination exposure.

Where project impacts have been identified, a range of mitigation measures have been proposed to minimise such impacts. It is expected that impacts would be managed with mitigation measures to ensure risks arising from the disturbance of soil and groundwater contamination, surface water and ASS would be mitigated.

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