Transport for NSW

NSW GOVERNMENT

# Interpretive Contamination Report

Parramatta Light Rail Stage 2

October 2023


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# Parramatta Light Rail Stage 2 – Interpretive Contamination Report

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# Executive Summary

Parramatta Light Rail is one of the NSW Government's major infrastructure projects being delivered to serve a growing Western Sydney. Transport for New South Wales (TfNSW) submitted an Environmental Impact Statement (EIS; TfNSW, 2022) for Parramatta Light Rail Stage 2 (the 'project') and is now in the process of preparing a submissions report for the Department of Planning and Environment (DPE). To support the submissions report, TfNSW engaged Nation Partners Pty Limited (Nation Partners) to prepare this Interpretive Contamination Report (ICR).

## ES1 Purpose and Objectives

The purpose of the ICR was to consolidate and interpret available contamination data to describe contamination conditions within and alongside the project boundary and identify potential impacts to project delivery.

To fulfil this purpose, the objectives of the ICR were to:

- Characterise contamination and potential and actual acid sulphate soil (P/ASS) conditions along the project alignment;
- Define areas or sections of the alignment where existing contamination conditions potentially present a risk to construction workers, future site users, the environment and/or to project delivery, including areas that may require remediation to mitigate potential health, safety or environmental risks from contamination;
- Identify data gaps or areas where further contamination and/or P/ASS investigations, sampling and assessment should be undertaken to inform remediation and management requirements; and
- Provide recommendations for further assessment, management and remediation measures to facilitate the construction and operation of the project.

## ES2 Scope of Work

To fulfil the objectives of the ICR, Nation Partners undertook the following scope of work:

- Completed a detailed review of available contamination, groundwater and geotechnical data for the project;
- Consolidated and analysed the available data to characterise contamination and P/ASS conditions;
- Assessed design dimensions and anticipated construction methods required to construct the project's infrastructure to evaluate potential exposure scenarios for human and environmental receptors to known or likely existing contamination;
- Developed conceptual site models (CSMs) based on source – pathway – receptor (SPR) relationships between contamination and human and environmental receptors during construction and/or operation of the project;
- Defined areas within the project boundary where existing contamination conditions would require mitigation measures or controls above standard construction and environmental management practices to mitigate potential health, safety or environmental risks from contamination during construction and operation of the project; and
- Prepared this report.

The contamination data used to inform this ICR was predominantly sourced from contamination investigations and reports completed on behalf of TfNSW for the project. Nation Partners did not perform independent site investigations, nor undertake an independent review or verification of data quality, in preparing this ICR.

## ES3 Assessment Methodology

Nation Partners drew upon the risk assessment approach presented in International Standard *ISO 31000:2018 Risk management – Guidelines* (2018), adapted to the conditions and delivery stages of the project, in undertaking this ICR. This broader risk assessment approach, which was adapted to incorporate the tiered approach for the assessment of contamination recommended in the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPM; NEPC, 2013) was adopted because:

- Provides a transparent, consistent risk-based approach to evaluating potential risks to receptors, as well as to delivery of the project, from existing contamination and P/ASS conditions;
- Allows an appropriately balanced evaluation of risks from contamination to be presented, and responses and mitigation measures commensurate to these risks to be identified;
- Aligns with NSW EPA's risk-based approach to regulation its risk-based licensing system under the *Protection of the Environment Operations Act 1997* (POEO Act); and
- Aligns with the risk-based approach espoused in the NEPM (NEPC, 2013) for the assessment and management of contaminated land.

Application of the risk assessment methodology resulted in the determination of qualitative risk rankings for contamination for typical construction and operational scenarios, as well as area- and activity-specific scenarios for defined sections of the project alignment based on contamination conditions and/or construction activities required. The risk rankings allowed potential implications on project delivery to be evaluated, and commensurate risk treatments to be identified where required.

## ES4 Summary of Contamination Conditions

Contamination is known to be present in environmental media along the project alignment, including in soils and fill material, groundwater and sediments. Based on information and data available, the following sources of contamination and P/ASS were identified along the project alignment:

- Contamination of fill materials, soil and groundwater in the Camellia peninsula resulting from historical and current industrial activities, waste disposal practices, and land reclamation using contaminated fill materials;
- The presence of heavy metals, petroleum hydrocarbons and dioxins in sediments in Parramatta River;
- Potential asbestos containing materials (ACMs) in fill materials used for land reclamation and/or ground levelling;
- Contamination of fill materials, soil and groundwater in Wentworth Point and Sydney Olympic Park resulting from historical industrial activities and the presence of multiple landfills and associated leachate management infrastructure, including the potential presence of landfill gas; and
- P/ASS in soils and sediments in areas within and adjacent to Parramatta River, and in Ken Newman Park, Ermington.

## ES5 Risk Assessment

Based on the project's environmental setting, contamination and P/ASS conditions along the alignment, and the construction works and operational activities required to build and operate the project, potential impacts and risks from contamination were identified through the development of CSMs for particular scenarios (e.g. construction stage or operation stage) or geographic areas. Scenarios were identified based on the typical construction and operational activities required to build and operate the project, with further evaluation undertaken for individual sections of the project alignment with specific contamination and P/ASS conditions, design and/or construction requirements. These CSMs were then used to evaluate and assign a risk ranking in accordance with the assessment methodology adopted for this ICR. Data gaps in characterising the nature and extent of contamination were also identified for individual sections of the project alignment, as well as data gaps that should be addressed to mitigate potential impacts to project delivery.

The qualitative risk rankings determined for the project alignment allowed commensurate responses and mitigation measures to be identified and inform potential implications on project delivery. These mitigation measures were identified using a base set of mitigation measures and revised according to the contamination conditions or activities specific to individual areas. **Table ES.1** presents the outcomes of the risk assessment process for the typical construction and operation scenarios and the individual sections of the alignment, and the corresponding mitigation measures and project delivery implications.

**Table ES.1: Mitigation Measures and Delivery Phase Implications**

| Qualitative Risk Ranking | Applicable Scenarios / Sections | Mitigation Measures and Delivery Phase Implications |
|---|---|---|
| Low | • Entire project alignment<br>• Typical construction and operation stage scenario applicable to sections north of Parramatta River, and between Dawn Fraser Avenue and Lidcombe | Management of potential impacts and risks from contamination during construction through:<br>• During detailed design development, establishment and implementation of an iterative process of reviewing available data and undertaking targeted contamination investigations (where further data is required) to inform further design development, including documenting the outcomes in the project's design report, to minimise and mitigate potential impacts from contamination on project delivery;<br>• Implementation of standard construction safety and environmental management measures and controls defined in a Construction Environmental Management Plan (CEMP) for the project, including design and application of a monitoring and reporting regime by an independent Environmental Representative (ER) (or similar) to monitor compliance;<br>• Design and application of an Unexpected Finds Protocol (UFP) as part of the CEMP that considers the potential to encounter unexpected contamination during construction; and<br>• Development and application of a project-specific spoil management framework and waste classification protocol for the management of potentially contaminated spoil. |
| Medium | • Construction works for bridges crossing Parramatta River | Potential impacts and risks from the construction of bridges crossing Parramatta River will need to be mitigated through adoption of the mitigation measures for Low Risk sites, plus:<br>• Development and application of management measures and controls to minimise impacts from construction activities and sediment disturbance on water quality and aquatic ecosystems in Paramatta River, to be documented in a soil and water management plan (or similar activity or media-specific plan) as part of the project's CEMP, including a review, monitoring and compliance reporting regime to be undertaken by an independent ER (or similar); and<br>• Implementation of physical controls such as sediment curtains for all works in, and adjacent to, Parramatta River, to mitigate potential impacts from construction activities on vegetation and aquatic ecosystems in Parramatta River. |
| High | Construction and operation of the project in:<br>• Camellia; and<br>• Wentworth Point to Dawn Fraser Avenue in Sydney Olympic Park. | Potential impacts and risks from contamination and/or existing remediation infrastructure in Camellia and in Wentworth Point and Sydney Olympic Park will need to be mitigated through:<br>• Completion of targeted investigations and data collection activities to inform the design of an appropriate remediation system (i.e. remediation design investigations) that integrates with the construction, infrastructure and operational requirements for the project;<br>• Development and implementation of a Remediation Action Plan (RAP) that facilitates the safe implementation of the remediation system, including:<br>– For Camellia, consultation and engagement with appropriate personnel within TfNSW regarding the design, purpose and existing remediation infrastructure along the Sandown Line; and<br>– At Wentworth Point and Sydney Olympic Park, consultation and engagement with Sydney Olympic Park Authority (SOPA) and the NSW Environment Protection Authority (EPA) during development of the RAP to ensure the project's design and construction activities allow SOPA to meet its environmental commitments and policies and continue to adhere to Maintenance of Remediation Notice 28040;<br>• Engagement of a NSW EPA-accredited Site Auditor at the planning stage of the remediation design investigations to undertake a site audit in accordance with the requirements of the *Contaminated Land Management Act 1997* (CLM Act), concluding with the issue of an SAS and accompanying SAR declaring the area suitable for the proposed land use; and<br>• Given that residual contamination and/or remediation infrastructure is likely to remain at Camellia and the Wentworth Point to Sydney Olympic Park sections of the alignment following completion of construction, implementation of a long-term environmental |

| Qualitative Risk Ranking | Applicable Scenarios / Sections | Mitigation Measures and Delivery Phase Implications |
|---|---|---|
| | | management plan, endorsed by the Site Auditor as part of the site audit process, to monitor and maintain the remediation system will be required during the operational stage of the project. |

# ES6 Recommendations

Based on the evaluation, interpretation and analysis of contamination data along the project alignment, Nation Partners presents the following recommendations for further assessment, management and remediation measures to facilitate the construction and operation of the project:

- Undertake additional targeted contamination investigations to characterise the extent of contamination identified in boreholes in the north of Wentworth Point;
- Adopt the qualitative risk rankings for contamination shown in **Figure 6.11**, and corresponding mitigation measures identified in **Table 6.12**, to mitigate potential risks from contamination during project delivery;
- For pre-construction works and activities, the presence of, and potential for exposure to, contamination should be identified and controlled through the development and implementation of a health, safety and environmental management plan (HSEMP) or safe work method statement (SWMS) (or similar) specific to the location, activities and type of contamination present, including potential ACM and asbestos;
- As the project's detailed design progresses, implement an iterative process of reviewing available data and undertaking targeted contamination investigations (where further data is required) to inform further design development, and document the outcomes in the project's design report, to minimise and mitigate potential impacts from contamination on project delivery;
- Develop and implement a project-specific spoil management and waste classification protocol in accordance with NSW EPA guidelines and specific to the nature and type of spoil material to be generated during the project;
- For sections of the project alignment classified as high risk due to existing contamination conditions and remediation infrastructure, including Camellia and Wentworth Point to Dawn Fraser Avenue in Sydney Olympic Park (refer **Figure 6.11**):
  - As part of detailed design development, undertake targeted investigations and data collection activities as required to inform the design of an appropriate remediation system (i.e. remediation design investigations) that integrates with the construction, infrastructure and operational requirements for the project;
  - For Camellia, consult with relevant personnel within TfNSW to understand the design, purpose, layout and extent of the existing capping system along the Sandown Line to evaluate the magnitude and extent of interaction between the project's design and construction works on existing remediation infrastructure;
  - For Wentworth Point and Sydney Olympic Park, consult with SOPA to understand the precise location, layout, design purpose, and functioning of the remediated landfills and their associated leachate management infrastructure in order to assess where and how the project will interact with existing infrastructure; and
  - For both high risk sections, develop and implement a RAP in consultation with relevant stakeholders, including NSW EPA and a NSW EPA-accredited Site Auditor, and in accordance with the site audit process defined in the CLM Act.

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# 1 Introduction

Parramatta Light Rail is one of the NSW Government's major infrastructure projects being delivered to serve a growing Western Sydney. Stage 1 of Parramatta Light Rail is currently under construction and will connect Westmead to Carlingford via Parramatta's central business district (CBD) and Camellia. Parramatta Light Rail Stage 2 (PLR2) will connect Stage 1 and Parramatta's CBD to Sydney Olympic Park via the suburbs of Camellia, Rydalmere, Ermington, Melrose Park and Wentworth Point. Parramatta Light Rail will connect local communities in the Greater Parramatta to Olympic Peninsula (GPOP) area, identified as a priority growth area by the Greater Sydney Commission.

In June 2022 the NSW Government confirmed it would proceed with PLR2, committing funding to continue the project's planning and approvals process, and to facilitate delivery of enabling works including a new bridge across Parramatta River between Melrose Park and Wentworth Point. PLR2 will include 14 stops over 10 kilometres (km) of light rail track, with travel times of approximately 30 minutes from Camellia to the Carter Street Precinct via Sydney Olympic Park, and an additional 7 minutes to the Parramatta CBD.

## 1.1 Background

Transport for New South Wales (TfNSW) has prepared an Environmental Impact Statement (EIS; TfNSW, 2022) for PLR2 (the 'project'), which was placed on public exhibition between 9 November 2022 and 16 December 2022. TfNSW is now in the process of reviewing submissions on the EIS from the public and NSW government agencies and preparing a written response to the Department of Planning and Environment (DPE) in accordance with Section 5.17(6) of the *Environment Planning and Assessment Act 1979* (EP&A Act). The written response is required to be in the form of a submissions report in accordance with DPE's *State Significant Infrastructure Guidelines* (2021).

## 1.2 Purpose and Objectives

To support the submissions report, TfNSW engaged Nation Partners Pty Limited (Nation Partners) to prepare this Interpretive Contamination Report (ICR). The purpose of the ICR was to consolidate and interpret available contamination data collected from contamination, groundwater and other investigations along the project alignment to describe contamination conditions within and alongside the project boundary and identify potential impacts to project delivery.

To fulfil this purpose, the objectives of the ICR were to:

- Characterise contamination and potential and actual acid sulphate soil (P/ASS) conditions along the project alignment;
- Define areas or sections of the project alignment where existing contamination conditions potentially present a risk to construction workers, future site users, the environment and/or to project delivery, including areas that may require remediation above typical construction safety and environmental management practices, to mitigate potential health, safety or environmental risks from contamination;
- Identify data gaps or areas where further contamination and/or P/ASS investigations, sampling and assessment should be undertaken to inform remediation and management requirements; and
- Provide recommendations for further assessment, management and remediation measures to facilitate the construction and operation of PLR2.

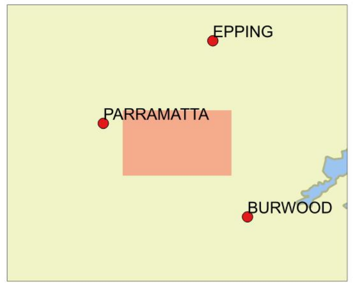
The project boundary subject to assessment in this ICR is shown in **Figure 1.1**. This project boundary differs slightly from the 'project site' defined in the EIS (TfNSW, 2022), as it is targeted to the portion of the alignment where new light rail infrastructure will be constructed. As such, the project boundary assessed in this ICR does not include the Stabling and Maintenance Facility (SaMF) site located at 6 Grand Avenue, Camellia, or existing light rail track to the west of the SaMF, as both were constructed as part of Parramatta Light Rail Stage 1.


**Figure 1.1: Project Boundary**

*TfNSW - PLR2 Interpretive Contamination Report*

**Legend**

- PLR2 Track Alignment
- ICR Project Boundary
- EIS Project Site




DATA SOURCES
TfNSW, 2023; Imagery: Nearmaps, 2023

SCALE 1:18,000
100 0 100 200 300 400 500 m

## 1.3 Scope of Work

To fulfil the objectives of the ICR, Nation Partners undertook the following scope of work:

- Completed a detailed review of available contamination, groundwater and geotechnical data for the project;
- Consolidated and analysed the available data to characterise contamination and P/ASS conditions;
- Assessed design dimensions (e.g. excavation dimensions and ground disturbance footprints) and anticipated construction methods required to construct the PLR2 infrastructure to evaluate potential exposure scenarios for human and environmental receptors to known or likely existing contamination;
- Developed conceptual site models (CSMs) based on source – pathway – receptor (SPR) relationships between contamination and human and environmental receptors during construction and/or operation of the project;
- Defined areas within the project boundary where existing contamination conditions would require mitigation measures or controls above standard construction and environmental management practices to mitigate potential health, safety or environmental risks from contamination during construction and operation of PLR2; and
- Prepared this report.

The contamination data used to inform this ICR was predominantly sourced from the *Factual Contamination Report – Parramatta Light Rail Stage 2 (Draft)* (Factual Contamination Report; WSP Golder, 2022a), which provides the most recent and comprehensive data set for the PLR2 alignment. The Factual Contamination Report was prepared by WSP Golder (2022a) to document the contamination investigations completed on behalf of TfNSW for the project. Contamination data has been reproduced where relevant to the interpretation and analysis presented, however readers should refer to the Factual Contamination Report (WSP Golder, 2022a) for the complete data set, including figures, sampling and analysis schedule, chemical data tables, laboratory results and borehole logs.

Additional contamination, groundwater and geotechnical information and data used to inform this ICR was sourced from the following reports completed on behalf of TfNSW:

- *Geotechnical Data Report – Parramatta Light Rail Stage 2 (Draft)* (Geotechnical Data Report; WSP Golder, 2022b);
- *Factual Groundwater Report – Q1 – Parramatta Light Rail Stage 2* (Factual Groundwater Report; WSP Golder, 2022c);
- *Transport for NSW – Parramatta Light Rail (Stage 2) Corridor Wide Site Contamination Report (Draft)* (Coffey, 2019); and
- *Parramatta Light Rail Stage 2 – Desktop Contamination Assessment* (Nation Partners, 2018).

Where contamination data was sourced from investigations and assessments other than the Factual Contamination Report (WSP Golder, 2022a), the data source is cited in this report.

## 1.4 Regulatory Framework

### 1.4.1 Approval Requirement

The project has been declared State Significant Infrastructure (SSI) under the EP&A Act, which requires approval from the NSW Minister for Planning. An EIS (TfNSW, 2022) was prepared to support the SSI application (SSI-10035) for approval, and TfNSW is currently preparing a submissions report in accordance with Section 5.17(6) of the EP&A Act. This ICR has been prepared to support the project's submissions report.

### 1.4.2 Contaminated Land Management

In NSW requirements for the investigation and management of contaminated land are driven by two primary regulatory mechanisms:

- The NSW Environment Protection Authority (EPA), which uses its powers under the *Contaminated Land Management Act 1997* (CLM Act) to declare sites to be significantly contaminated land, and to issue orders or approvals to investigate and/or manage significantly contaminated land; and
- Planning approval authorities, who can impart requirements for the investigation and/or management of contamination through the planning approvals process.

Section 105 of the CLM Act gives the EPA power to make or approve guidelines for the purposes connected with the objects of the CLM Act. In practice these guidelines establish the process and technical standards for the assessment and management of contaminated land.

Whilst this ICR has not been prepared to address a specific regulatory requirement, approval, or condition, it has been developed to support the submissions report required under the planning approvals process for the project's SSI application (SSI-10035). As such Nation Partners has referred to the following guideline documents made or approved by NSW EPA under Section 105 of the CLM Act that were considered relevant to the preparation of this ICR:

- *Assessment and management of hazardous ground gases: Contaminated Land Guidelines* (NSW EPA, 2020);
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018);
- *Guidelines for the assessment and management of groundwater contamination* (NSW EPA, 2007);
- *Guidelines for the NSW Site Auditor Scheme, 3rd Edition* (NSW EPA, 2017); and
- *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPM; NEPC, 2013).

### 1.4.3 Other Legislation, Guidelines and Standards

Other legislation, guidelines, orders and practice notes from NSW EPA, Australian regulatory authorities, advisory committees and industry bodies considered relevant and referred to in the preparation of this ICR include:

- *Protection of the Environment (Operations) Act 1997* (POEO Act);
- *State Environmental Planning Policy (Resilience and Hazards) 2021*;
- *Waste Classification Guidelines – Part 1: Classifying Waste* (NSW EPA, 2014a);
- *Waste Classification Guidelines – Part 4: Acid Sulfate Soils* (NSW EPA, 2014b);
- *Addendum to the Waste Classification Guidelines (2014) – Part 1: Classifying Waste* (NSW EPA, 2016);
- *Acid Sulfate Soils Assessment Guidelines* (NSW ASSMAC, 1998);
- *PFAS National Environmental Management Plan, Version 2.0* (PFAS NEMP; HEPA, 2020);
- *Chemical Control Order in Relation to Dioxin-Contaminated Waste Materials* (NSW EPA, 1986); and
- *Managing urban stormwater: soils and construction* (the Blue Book; Landcom, 2004).

In NSW the legislation and regulatory framework applicable for the management of contamination in construction projects includes both the CLM Act and the POEO Act, whose object is the protection, restoration and enhancement of the environment. When assessing and managing contamination, the regulatory frameworks and requirements under these Acts often interact, and in some cases overlap, requiring both to be considered when assessing potential impacts to project delivery and the formulation of appropriate mitigation measures. To fulfil the purpose and objectives of this ICR, the regulatory framework and mechanisms under both the CLM Act and the POEO Act applicable to the assessment and management of contamination and for the delivery of PLR2 have been adopted in the assessment methodology described in **Section 2**.

## 1.5 Assumptions

In preparing this ICR, Nation Partners has assumed that the contamination data set (generated by others) is reliable, representative, and of suitable quality to describe contamination conditions within and adjacent to the project boundary. This assumption is supported by the following factors:

- WSP Golder considered the data reported in their Factual Contamination Report (WSP, 2022a) was suitable for comparison against nominated assessment criteria; and
- Coffey (2019) provided an assessment of quality assurance and quality control (QA/QC) procedures adopted in their data collection activities and provided a clear statement on the quality of the data reported and its suitability for use.

Nation Partners did not perform independent site investigations, nor undertake an independent review or verification of data quality, in preparing this ICR.

## 1.6 Abbreviations and Acronyms

For ease of reference, acronyms and abbreviations used throughout this report are summarised in **Table 1.1**.

**Table 1.1: Abbreviations and Acronyms**

| Abbreviation / Acronym | Meaning |
|---|---|
| 2,3,7,8-TCDD | 2,3,7,8-tetrachlorodibenzo-p-dioxin |
| ACM | Asbestos containing material |
| AHD | Australian Height Datum |
| ATL | Active Transport Link |
| bgs | below ground surface |
| Blue Book | *Managing urban stormwater: soils and construction* (Landcom, 2004) |
| BTEX | Benzene, toluene, ethylbenzene and xylene |
| CBD | Central business district |
| CEMP | Construction Environmental Management Plan |
| CLM Act | *Contaminated Land Management Act 1997* |
| CrVI | Hexavalent chromium |
| CSM | Conceptual Site Model |
| DPE | NSW Department of Planning and Environment |
| EIS | Environmental Impact Statement |
| EP&A Act | *Environmental Planning and Assessment Act 1979* |
| EPA | Environment Protection Authority |
| ER | Environmental Representative |
| Factual Contamination Report | *Factual Contamination Report – Parramatta Light Rail Stage 2 (Draft)* (WSP Golder, 2022a) |
| Factual Groundwater Report | *Factual Groundwater Report – Q1 – Parramatta Light Rail Stage 2* (WSP Golder, 2022c) |
| Geotechnical Data Report | *Geotechnical Data Report – Parramatta Light Rail Stage 2 (Draft)* (WSP Golder, 2022b) |
| GPOP | Greater Parramatta to Olympic Peninsula |
| HIL-D | Health-based Investigation Levels for commercial / industrial land use |
| HSEMP | Health, Safety and Environment Management Plan |
| HSL-D | Health-based Screening Levels for commercial / industrial land use |
| ICR | Interpretive Contamination Report (this report) |
| km | kilometres |
| LEL | Lower Explosive Limit |

| Abbreviation / Acronym | Meaning |
|---|---|
| LEP | Local Environmental Plan |
| LOR | Limit of reporting |
| m | metres |
| NEPM | *National Environment Protection (Assessment of Site Contamination) Measure 1999* (NEPC, 2013) |
| NSW | New South Wales |
| OEMP | Operational Environmental Management Plan |
| P/ASS | Potential and actual acid sulfate soils |
| PAH | Polycyclic aromatic hydrocarbons |
| PFAS | Per- and poly-fluorinated substances |
| PFAS NEMP | *PFAS National Environmental Management Plan, Version 2.0* (HEPA, 2020) |
| PFHxS | Perfluorohexane sulfonate |
| PFOA | Perfluorooctanoic acid |
| PFOS | Perfluorooctane sulfonate |
| POEO Act | *Protection of the Environment (Operations) Act 1997* |
| pg | picograms |
| PLR2 | Parramatta Light Rail Stage 2 |
| QA/QC | Quality Assurance and Quality Control |
| RAP | Remediation Action Plan |
| SaMF | Stabling and Maintenance Facility |
| SAR | Site Audit Report |
| SAS | Site Audit Statement |
| SOPA | Sydney Olympic Park Authority |
| SPR | Source – Pathway – Receptor |
| SSI | State Significant Infrastructure |
| SWMS | Safe Work Method Statement |
| TEF | Toxicity Equivalence Factor |
| TEQ | Toxic Equivalent Concentration |
| TfNSW | Transport for New South Wales |
| TRH | Total recoverable hydrocarbons |
| UFP | Unexpected Finds Protocol |
| VCH | Volatile chlorinated hydrocarbons |
| WHO | World Health Organisation |

# 2 Assessment Methodology

The following sections describe the methodology adopted in this ICR to assess the risks to potential receptors, including human and environmental receptors during both construction and operation of PLR2, as well as the risks to delivery of the project itself, from existing contamination and P/ASS along the project alignment.

This assessment does not include the evaluation of new activities or hazards that may cause contamination, such as spills or leaks of chemicals or fuels during construction and operation, as these aspects are expected to be addressed through the project's approval conditions and the Environment Protection Licence required for the project (TfNSW, 2022).

## 2.1 Risk Assessment Methodology

### 2.1.1 Approach

For the purposes of this ICR Nation Partners has drawn upon the risk assessment approach presented in International Standard *ISO 31000:2018 Risk management – Guidelines* (2018), adapted to the conditions and delivery stages of the project. This approach was adopted because it:

- Provides a transparent, consistent risk-based approach to evaluating potential risks to receptors (e.g. construction workers, future users of PLR2), as well as to delivery of PLR2, from existing contamination and P/ASS conditions;
- Allows an appropriately balanced evaluation of risks from contamination to be presented (i.e. not understated or overstated), and responses and mitigation measures commensurate to these risks to be identified;
- Aligns with NSW EPA's risk-based approach to regulation identified in its *Regulatory Strategy 2021 – 24* (NSW EPA, 2021a) and *Regulatory Policy* (NSW EPA, 2021b), and implemented through its risk-based licensing system under the POEO Act; and
- Aligns with the risk-based approach espoused in the NEPM (NEPC, 2013) for the assessment and management of contaminated land.

The risk assessment process presented in *ISO 31000:2018 Risk management – Guidelines* (2018) accommodates a broader scope and application than the recommended process for the assessment of site contamination provided in Schedule A of the NEPM (NEPC, 2013). Nation Partners adopted this broader risk assessment approach for this ICR, whilst incorporating the tiered approach for the assessment of contamination recommended in the NEPM (NEPC, 2013), for the following reasons:

- Potential impacts and risks from contamination must be assessed during the planning, design, construction and operation stages of the project, with different receptors and exposure scenarios needing to be considered based on the progression of the planning and design stages, and during delivery of the construction and operation stages;
- The risk assessment process provided in the NEPM (NEPC, 2013) is used for assessing risks to human health from chronic exposure to contaminants under a range of land use scenarios. Adopting the NEPM (NEPC, 2013) approach alone may provide an overly conservative assessment of potential risks to receptors during the construction phase (i.e. short-term or acute exposure);
- Options to mitigate risks from contamination should take into account the regulatory mechanisms (e.g. approval conditions) and mitigation measures (e.g. safety and environmental management practices during construction), beyond the recommended assessment process in the NEPM (NEPC, 2013), that will be applied during project delivery; and
- The project's design and infrastructure requirements, along with the interface and overlap of legislation for pollution prevention and contamination management (the POEO Act and the CLM Act, respectively), provide opportunities to manage and mitigate risks from contamination through mechanisms that

operate in parallel with the NSW contaminated land management framework. For example, potential risks from contaminated soils and groundwater required to be excavated and removed (i.e. construction dewatering) during construction will be mitigated through the implementation of safety and environmental management standards and practices required under the project's approval conditions and the NSW waste management framework under the POEO Act, without the need for further investigation and/or requirement for a site audit under the CLM Act.

### 2.1.2 Application

**Figure 2.1** illustrates how the risk assessment approach outlined in *ISO 31000:2018 Risk management – Guidelines* (2018) was applied in this ICR, with the addition of a hazard identification component to accommodate the regulatory framework for contaminated land management. Application of the risk assessment approach is described in the following sections.

#### *Scope, context and criteria*

The scope, context and criteria inputs were used to inform the risk identification component through the following sections:

- *Context* – The background, purpose and objective, and assumptions that define the context for the assessment are presented in **Sections 1** and **2**;
- *Scope* – The scope of the assessment is defined by the project description and anticipated activities (**Section 4**), its environmental setting (**Section 3**), and areas of environmental concern with respect to contamination and/or P/ASS identified in the EIS (TfNSW, 2022); and
- *Criteria* – Criteria used to determine those areas and/or conditions along the alignment that may present a hazard to receptors or to delivery of the project are based on land use investigation and screening levels for a variety of contaminants, as presented in **Section 2.2**.

#### *Risk identification*

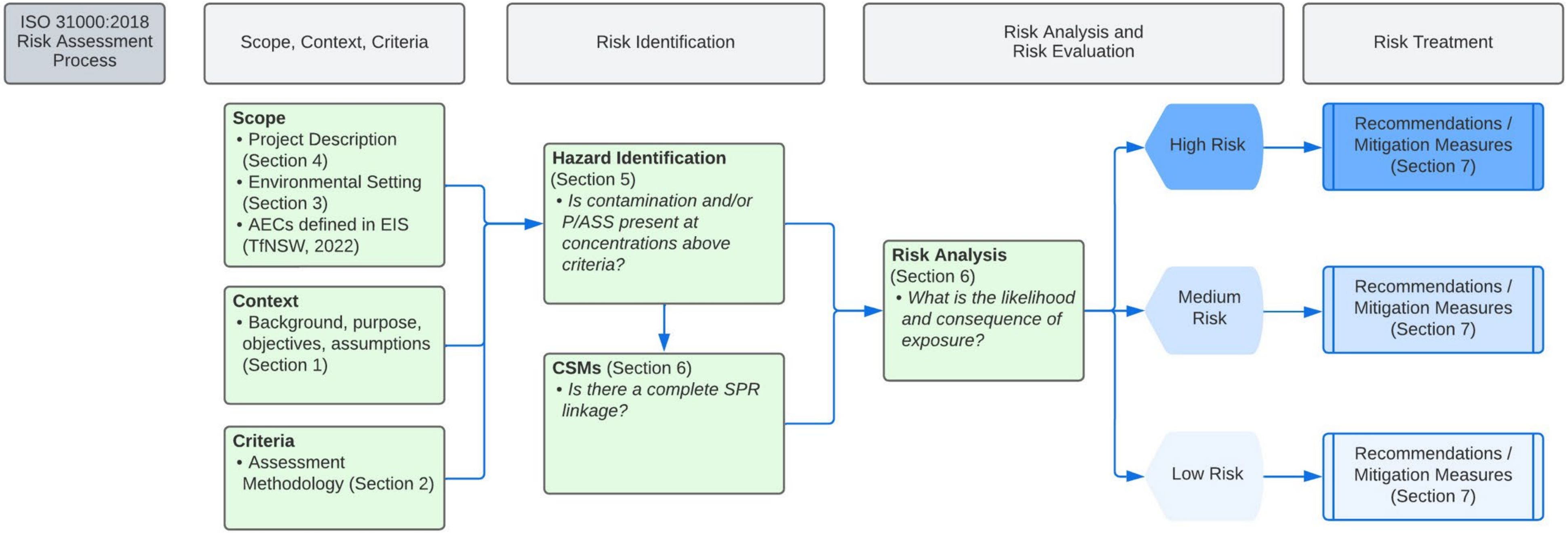
Risk identification was performed through the following steps:

- *Hazard Identification* – Hazards were identified by assessing contamination data from the Factual Contamination Report (WSP Golder, 2022a) and other investigations along the project alignment against the adopted land use criteria to identify areas and environmental media where contamination and/or P/ASS are present at levels above the nominated criteria, and as such may present a hazard to human or ecological receptors (**Section 5**); and
- *Risk Identification* – Risks were identified through the development of CSMs (conceptual site models), which are descriptive representations of physical systems used to portray key features, properties and conditions that influence how the system works. In the context of contaminated sites, a CSM typically describes the known and potential (suspected) contamination sources and affected media (which cumulatively represent hazards), along with relevant receptors and exposure pathways between the sources and receptors (NEPC, 2013).

A CSM is an essential element for contaminated site assessments as it details the potential and opportunity for contamination to impact human and environmental receptors, and the corresponding need for remediation and/or management activities. The NEPM (NEPC, 2013) provides guidance on the development of CSMs for contaminated sites, noting that the purpose of the CSM is to identify existing or potential complete pathways between known or potential contamination sources and receptors. Essential elements required in a contamination CSM include (NEPC, 2013):

- Known and potential sources of contamination and contaminants of concern;
- Environmental media known or potentially impacted by contamination;
- Contaminant migration and exposure pathways; and
- Existing or potential future human and environmental receptors.

**Figure 2.1: Risk Assessment Approach Adopted for this ICR**



A critical concept in the development and application of CSMs, and specifically when identifying the need for remediation and/or management, is the SPR relationship. In situations where the SPR relationship is incomplete, there can be no risk to receptors from contamination, and as a result remediation and/or management is not required.

In accordance with the NEPM (NEPC, 2013), contamination CSMs based on SPR relationships were developed to identify potential risks to receptors from contamination. CSMs were developed for typical scenarios to be encountered during the construction and operation stages of the project, as well as for area-specific scenarios where existing contamination or P/ASS conditions had been identified as a potential hazard. These CSMs are presented throughout **Section 6** and were used as inputs to the risk analysis and evaluation step, and to guide the development of a risk treatment response.

In developing the CSMs presented throughout **Section 6**, the following principles were applied in relation to responsibilities for pre-existing contamination:

- The project is required to understand the relevant contamination and P/ASS conditions, and to mitigate resultant risks to project delivery and to related human and environmental receptors;
- The project must also be constructed and operated in a manner that minimises the spread or exacerbation of existing contamination or P/ASS, where present;
- The project is not responsible for remediating or managing contamination or P/ASS beyond the extent of ground disturbance (both laterally and vertically), unless such remediation is required to render the project footprint suitable for construction activities or for ongoing operational activities.

In applying the risk assessment approach adopted for this ICR and shown in **Figure 2.1**, differences between application of the hazard and risk identification steps to the contaminated land assessment process outlined in the NEPM (NEPC, 2013) must be highlighted. In the NEPM assessment process (NEPC, 2013), where contaminant concentrations are below the adopted site assessment criteria, no hazard is considered present, and where an SPR linkage is incomplete there can be no risk to receptors, and therefore remediation or management is not required. However for the purposes of this ICR a conservative position was adopted for these situations (i.e. contaminant concentrations do not exceed the adopted land use criteria, or an SPR linkage is considered incomplete), and they were still subjected to the risk analysis and risk evaluation step. This position was adopted for the following reasons:

- To account for inherent uncertainties in the interpolation of point-based contamination data across large areas (the project boundary), where small scale contamination or other unexpected finds may occur; and
- An expectation amongst stakeholders, regulators and the general public, and a commitment from TfNSW, that works and activities associated with major construction and infrastructure projects will be undertaken to minimise the potential for adverse impacts to the public and the environment.

In undertaking the hazard and risk identification step for this ICR, potential impacts and risks to project delivery from spoil generation and management, including waste classification for spoil requiring off-site disposal, were also recognised. However, as potential spoil management options and waste classification requirements, including as re-use opportunities and options, will be based on the project's design development and its corresponding cut / fill balance, the information and data needed to quantify potential time and cost risks to project delivery were not available at this stage. Instead, potential risks from spoil management and waste classification requirements were identified and proposed to be addressed through the establishment of formal protocols for determining spoil management requirements (e.g. re-use options) during design development, and subsequent waste classification steps specific to the project's activities, location and anticipated spoil characteristics, as discussed in **Section 6.6**.

### *Risk analysis and risk evaluation*

Based on the CSMs, potential risks to receptors from contamination were analysed through a risk matrix based on:

- The likelihood of exposure to contamination and/or P/ASS, considering the nature and extent of activities required to construct and/or operate the project (e.g. disturbance footprint, excavation depths); and
- The consequence of exposure to contamination and/or P/ASS, based on the type and behaviour of the contaminant in the environment (e.g. volatility, solubility, migration potential), the potential exposure scenario, and/or the potential impacts to the project or to the surrounding environment.

Application of the risk analysis step requires the definition of transparent criteria for evaluating and determining qualitative risk rankings (e.g. High, Medium and Low) for complete SPR linkages. These criteria include both the likelihood for exposure to occur, and the impact or consequence of exposure based on the credible worst-case scenario. **Table 2.1** and **Table 2.2** present the likelihood and consequence levels and descriptors, respectively, adopted for the risk analysis step applied in this ICR.

**Table 2.1: Likelihood Ratings and Descriptors for Assessing Risks**

| Rating | Descriptor |
|---|---|
| L1 | • Environmental media of concern (e.g. soil, groundwater) are unlikely to be disturbed, accessed or exposed when constructing or operating the project; AND/OR<br>• Mechanisms or pathways for exposure to environmental media of concern are unlikely to occur during the construction or operation of the project; AND/OR<br>• Mechanisms for spreading or exacerbating existing contamination are unlikely to occur as a result of constructing or operating the project. |
| L2 | • Environmental media of concern (e.g. soil, groundwater, vapour / gas) may be disturbed, accessed or exposed when constructing or operating the project, dependent upon the detailed design (e.g. track levels, utilities conduits, excavation dimensions) and construction methods to be used; AND<br>• Mechanisms or pathways for exposure to environmental media of concern could occur during the construction or operation of the project; AND/OR<br>• Mechanisms for spreading or exacerbating existing contamination could occur as a result of constructing or operating the project. |
| L3 | • Environmental media of concern (e.g. soil, groundwater, vapour / gas) will be disturbed, accessed or exposed when constructing or operating the project; AND<br>• Mechanisms or pathways for exposure to environmental media of concern are likely to occur during the construction or operation of the project; AND/OR<br>• Mechanisms for spreading or exacerbating existing contamination to less contaminated areas could occur as a result of constructing or operating the project. |

**Table 2.2: Consequence Ratings and Descriptors for Assessing Risks**

| Rating | Descriptor |
|---|---|
| C1 | • Data indicates the presence of contamination at concentrations below the adopted land use assessment criteria; AND/OR<br>• The type of contamination and environmental media of concern (e.g. soil, groundwater) is well understood, as evidenced by the availability of construction industry standards, guidelines and codes of practice; AND<br>• The extent of contamination is limited. |
| C2 | • Additional data is needed to determine whether contamination is present at concentrations above the adopted land use assessment criteria; OR<br>• Data indicates the presence of contamination at concentrations above the adopted land use assessment criteria; AND<br>• The type of contamination, or the nature of activities, has the potential to adversely impact receptors beyond the project boundary in the absence of specific management controls. |
| C3 | • The area or site is under regulation by NSW EPA in accordance with the CLM Act; OR<br>• Construction or operation activities will impact existing remediation infrastructure; OR<br>• Data indicates the presence of contamination at concentrations above the adopted land use assessment criteria; AND<br>• The type of contamination, or the nature of activities, has the potential to adversely impact receptors beyond the project boundary in the absence of specific management controls; AND<br>• The type of contamination requires assessment by technical specialists to understand contaminant mobility and migration behaviour, and corresponding exposure pathways. |

In defining the likelihood and consequence ratings and descriptors, the level of information and detail available describing contamination conditions, and the design and construction methods that will be implemented to construct the project, have been considered. Areas of the project alignment where further information or data is needed to determine whether contaminant concentrations are above the adopted land use criteria, or where the extent of ground disturbance may be subject to change as detailed design for the project progresses, were conservatively assigned consequence and likelihood ratings of C2 and L2 respectively. These specific situations / locations were then considered when developing recommended actions and mitigation measures, such as those presented in **Table 2.4**.

The consequence ratings and descriptors presented in **Table 2.2** were developed, in part, to account for the availability of standard workplace guidelines and codes of practice for the management and removal of asbestos, given its prevalence in urban environments and especially in the western Sydney region. In particular:

- Where data identified the presence non-friable asbestos or asbestos-containing materials (ACMs) in limited extent (i.e. an ACM fragment in a test pit), a consequence rating of C1 was adopted as no licence is required to remove such material provided it is removed with the requirements of the *Code of Practice – How to safely remove asbestos* (Safework NSW, 2022); or
- Where data identified the presence of friable asbestos, including fibrous asbestos, asbestos fines and loose fibre bundles, or asbestos and/or ACMs in significant extent (e.g. layers of asbestos cement sheeting used as fill material), a consequence rating of C2 was adopted as specific management controls (i.e. asbestos control conditions) and licences (e.g. Class A or Class B) are required to manage and remove such asbestos types (Safework NSW, 2022).

For the risk analysis step each complete SPR linkage is evaluated using the likelihood and consequence ratings defined above to determine a qualitative risk ranking using the three-by-three risk matrix presented in **Table 2.3**. This risk matrix allocates comparative risk rankings for the SPR linkages being evaluated to allow the identification and application of appropriate responses and mitigation measures. As such, the risk rankings presented should not be considered absolute determinations that an adverse impact to human or environmental receptors will occur.

**Table 2.3: Risk Matrix**

| | | Consequence | | |
|---|---|---|---|---|
| | | C1 | C2 | C3 |
| Likelihood | L1 | Low | Low | Medium |
| | L2 | Low | Medium | High |
| | L3 | Medium | High | High |

The output of the risk analysis was a qualitative risk ranking for each SPR linkage in accordance with the risk matrix defined in **Table 2.3**, which allowed potential implications on project delivery to be evaluated, and commensurate risk treatments to be identified where required. In determining whether risk treatments were required, a conservative approach was again adopted based on the stakeholder expectations identified above, meaning that some level of risk treatment would be applied even for a low risk ranking.

### *Risk treatment*

For each SPR linkage, mitigation measures were developed taking into account the qualitative risk ranking, the available data, the specific site conditions, the project's design and operational requirements, its delivery stage and anticipated approval conditions. The resulting risk treatments and corresponding delivery phase implications are presented in **Section 6.6**, which were derived from the base set of mitigation measures presented in **Table 2.4**.

**Table 2.4: Example Mitigation Measures**

| Qualitative Risk Ranking | Mitigation Measure |
|---|---|
| Low | Management of potential impacts and risks from contamination through:<br>• Standard construction safety and environmental management measures and controls defined in a Construction Environmental Management Plan (CEMP) for the project;<br>• Design and application of an Unexpected Finds Protocol (UFP) that considers the potential to encounter unexpected contamination during construction; and<br>• Application of the waste management framework and hierarchy for the management of potentially contaminated spoil. |
| Medium | For sites where gaps in the understanding of the presence, level and extent of contamination, or where knowledge of the extent of disturbance and exposure to contaminated media requires further progression of the design and construction methods for the project, further investigations and data collection activities should be undertaken. These additional investigations should be designed and implemented with the following objectives:<br>• To characterise contamination conditions for the area, extent (e.g. lateral and vertical depth) and relevant environmental media required to be disturbed, accessed or exposed when constructing or operating the project; and<br>• To determine qualitative risk rankings for these areas in accordance with the risk assessment approach defined in this ICR.<br>For areas assigned a Medium Risk ranking based on sufficient data, potential impacts and risks should be mitigated through adoption of the mitigation measures for Low Risk sites, plus:<br>• Development and application of targeted management measures or controls through contaminant or media-specific sub-plans to be developed as part of the project's CEMP (e.g. Water Quality and Sediment Management Plan). |
| High | For areas assigned a High Risk ranking, potential impacts and risks should be mitigated through the following measures, in addition to the measures identified for Low and Medium Risk sites:<br>• Development and implementation of a Remediation Action Plan (RAP), including completing any additional investigations or data collection activities required to inform the remediation or management strategy prescribed in the RAP;<br>• Completion of a site audit in accordance with the requirements of the CLM Act, concluding with the issue of a Site Audit Statement (SAS) and accompanying Site Audit Report (SAR) declaring the area suitable for the proposed land use; and<br>• Application of the waste management hierarchy and framework for the management of potentially contaminated spoil. |

## 2.2 Land Use Criteria

The land use criteria adopted to assess potential risks to human receptors from contamination during the construction and operation of the project were for the protection of human health under a commercial / industrial land use scenario. These criteria were adopted based on the following factors:

- Potential human receptors to contamination during the construction phase comprise workers who may be exposed to contamination as part of construction activities, and who would be required to adhere to standard safety and environmental management practices defined under the project's CEMP;
- Potential human receptors to contamination during the operation phase of the project would be the general public using the light rail and active transport links (ATLs), and workers operating and maintaining the light rail; and
- Whilst the ATLs planned along the light rail corridor will be used by the general public for recreational purposes, such as walking, running and biking, these activities will be undertaken on hardstand surfaces (i.e. concrete or asphalt footpaths). Where landscaping may be present along the ATLs (such as on nature strips or verges next to the footpaths), these landscaped areas will be finished with clean fill and topsoil at the ground surface. Given these surface conditions, potential exposure pathways for recreational users of the ATLs will be comparable to a commercial / industrial land use scenario, rather than an open space / recreation land use scenario.

The commercial / industrial land use criteria used to evaluate the available contamination data set was derived from the health-based investigation levels (HIL-D) and screening levels (HSL-D) provided in the NEPM (NEPC, 2013), as well as other relevant guidelines for other contaminants (e.g. PFAS NEMP).

Land use criteria for the protection of ecological health were not considered necessary for the purposes of this ICR for the following reasons:

- The limited potential for the operational project boundary to support ecosystems as a result of the project being a linear corridor and the predominance of hardstand across the operational area; and
- Where construction or operational activities have the potential to adversely impact off-site ecological receptors, criteria will be defined through the site- or activity-management approach applied during delivery, including management plans, in accordance with the requirement to protect the environment under the POEO Act. In these scenarios criteria for the protection of ecological receptors will be defined on a location or activity-specific basis to demonstrate that construction and operational activities have been undertaken in a manner that minimises the spread or exacerbation of existing contamination or P/ASS.

Criteria for waste classification of spoil has not been applied in this ICR as potential options for spoil management (e.g. cut / fill balance, re-use options, disposal as waste) are still under development and will depend upon further development of the project’s detailed design and construction methods, and the corresponding need (or otherwise) for waste classification, as identified in **Section 2.1.2**. Instead, a formalised approach for spoil management and waste classification specific to the nature and type of spoil material to be generated during the project is presented in **Section 6.6** to mitigate potential time and cost risks to project delivery.

# 3 Environmental Setting

The section summarises the existing environmental setting for the project boundary. Most information presented was drawn from the EIS (TfNSW, 2022) and supported by other environmental assessments completed for the project (Nation Partners, 2018; Coffey, 2019; WSP Golder, 2022a; WSP Golder, 2022b).

## 3.1 Topography

Topographic information sourced from Geoscience Australia indicates that elevation contours along the alignment range from sea level to 30 metres Australian Height Datum (AHD).

Topography in the Camellia peninsula is relatively flat, being between approximately six (6) to seven (7) m AHD (TfNSW, 2022), noting that much of this land has been subject to historical reclamation. North of Parramatta River, the alignment rises in elevation from the river crossing through Rydalmere and up to its highest elevation at approximately 30 m AHD in Ermington (TfNSW, 2022; WSP Golder, 2022b), before descending into Melrose Park and back across the Parramatta River. Topography is generally flat at an elevation of approximately two (2) m AHD from the northern end of Wentworth Point to Haslams Creek in Sydney Olympic Park before increasing in elevation to 20 m AHD along Dawn Fraser Avenue (WSP Golder, 2022b). The alignment then gently slopes down until reaching the Carter Street stop, where elevation is approximately 15 m AHD (WSP Golder, 2022b).

## 3.2 Hydrology

The project lies entirely within the Parramatta River catchment, which covers approximately 252 square kilometres (TfNSW, 2022). Other watercourses in the vicinity of the project include significant tributaries to the Parramatta River, such as Duck Creek and Haslams Creek, and the Narrawang Wetlands in Sydney Olympic Park.

Surface water flows along the project alignment generally follow local topography and drain towards the Parramatta River or its tributaries. In Camellia peninsula surface water flows north into Parramatta River or east towards Duck Creek, whilst north of the river between Rydalmere and Melrose Park surface water flows to the south. Towards the centre of Sydney Olympic Park, surface water flows towards Haslams Creek, which runs in a north-easterly direction and drains into Homebush Bay.

The EIS (TfNSW, 2022) reported that all watercourses within the vicinity of the project are highly modified and subject to current and historical stressors that negatively impact water quality, including historical contamination and fill materials, wastewater overflows, and runoff from highly urbanised and industrial areas. Monitoring data for Parramatta River and urban sub-catchments indicated that common water quality indicators and pollutants (e.g. pH, dissolved oxygen, turbidity, chlorophyll-a, total nitrogen and total phosphorous) consistently exceeded guideline values and water quality objective criteria (TfNSW, 2022). The data reflects the highly urbanised and highly modified environment in which the project is located, with water quality generally considered to be poor and reflective of urban catchments in Sydney.

## 3.3 Geology and Soils

### 3.3.1 Geology

The *Sydney 1:100,000 Geological Series Sheet 9130* (NSW Department of Mineral Resources, 1983) identified the following geological units along the project alignment:

- Along the Camellia peninsula, geology transitions from quaternary-aged alluvial and estuarine sediments characterised by silty to peaty quartz sand, silt, and clay, to man-made fill at the eastern end of the peninsula, a product of historical filling and land reclamation activities;

- North of Parramatta River (Rydalmere, Ermington, Melrose Park) geology is characterised by the Triassic-aged Ashfield Shale and Hawkesbury Sandstone belonging to the Wianamatta Group, with quaternary-aged alluvial and estuarine sediments along the northern edge of the river;
- Geology underlying Wentworth Point is a combination of quaternary-aged alluvial sediments and man-made fill, transitioning to Ashfield Shale south of Haslam's Creek; and
- Along Sydney Olympic Park and Carter Street, geology consists of estuarine swamp, anthropogenic deposits, and Ashfield Shale.

### 3.3.2 Soils

The *1:100,000 Soil Landscape Series Sheet for Sydney* (SCS, 1989) identified the following surficial soil landscapes along the project alignment:

- Disturbed terrain across the Camellia peninsula;
- Residual soil landscapes including the Blacktown and Lucas Heights landscapes north of Parramatta River and in the Lidcombe area, which are characterised by gently undulating topography and soils up to 1.5 m deep overlying the Wianamatta Shale (Blacktown landscape) and Mittagong Formation (Lucas Heights landscape);
- Erosional soils belonging to the Glenorie landscape in the Ermington area, where higher relief topography (slopes up to 20 degrees) exists;
- Alluvial soils belonging to the Birrong landscape are present across Wentworth Point and either side of Haslams Creek; and
- The Ettalong soil landscape, resulting from coastal swamps and characterised by very shallow groundwater tables and a high probability for organic acids, is present at the north-western end of Wentworth Point and immediately north of Haslams Creek.

Sections of the project alignment at Camellia peninsula, Wentworth Point, Sydney Olympic Park and at the proposed bridge crossings north of Parramatta River, are situated on reclaimed land typically comprised of fill overlying natural alluvium, shale or sandstone bedrock (TfNSW, 2022). The characteristics of the fill material, especially on the southern side of Parramatta River, are highly variable. The fill includes dredged marine and fluvial sands, muds, silts, peat and anthropogenic fill with construction and demolition waste, asbestos, landfill waste and residues from historical chemical manufacturing activities along the Camellia peninsula.

Previous environmental investigations along the project alignment reported the following typical stratigraphic sequence encountered in boreholes:

- Coffey (2019) reported a general sequence of topsoil and fill material to depths ranging from 0.5 to 4.0 metres below ground surface (m bgs), followed by natural soils comprised of estuarine sediments, alluvium or residual soil, underlain by weathered bedrock consisting of shale and/or sandstone. Bedrock was encountered at less than 2 m bgs in boreholes drilled along the higher elevation part of the alignment in Ermington; and
- WSP Golder (2022a) reported that two general soil types were encountered in boreholes drilled along the alignment, including:
  - Fill variously comprised of sandy gravel, sandy clay, gravel and clayey gravel; and
  - Alluvium described as silty clay and sandy clay.

## 3.4 Groundwater

For the majority of the project alignment groundwater is expected to be relatively shallow and contained within the alluvial and estuarine deposits and fill areas along the Parramatta River and around Haslams Creek, including the Camellia peninsula, Wentworth Point, and into Sydney Olympic Park. Groundwater in these areas is typically within three (3) metres to five (5) metres of the ground surface and hydraulically connected to nearby surface water bodies. Recent environmental investigations along the project alignment have reported groundwater levels ranging from the ground surface to 3.5 m bgs (Coffey, 2019; WSP Golder, 2022c; refer **Section 5.1**).

In more elevated terrains further from Parramatta River (i.e. through Rydalmere, Ermington and Melrose Park), regional groundwater is expected to be encountered in the underlying bedrock formations, though perched groundwater can be found in unconsolidated natural soils and man-made fill overlying bedrock (TfNSW, 2022).

The EIS (TfNSW, 2022) identified two (2) licensed groundwater bores within or near the project boundary. Bore GW063660 is located within the project boundary and registered for mining exploration purposes. Bore GW107659 is located in Camellia approximately 100 m from the project boundary, registered for commercial and industrial use and was reported to be drilled 145 m deep.

In addition to the Coffey (2019) and WSP Golder (2022c) investigations, previous environmental investigations at multiple sites across the Camellia peninsula have identified the presence of groundwater contamination associated with current and historical industrial activities. Contaminants of concern in groundwater at Camellia peninsula include:

- Dissolved metals, including hexavalent chromium (CrVI);
- Benzene, toluene, ethylbenzene and xylene (BTEX);
- Total recoverable hydrocarbons (TRH); and
- Volatile chlorinated hydrocarbons (VCHs).

## 3.5 Acid Sulfate Soils

P/ASS classes present along the project alignment, as identified in the Parramatta, Ryde and Auburn Local Environmental Plans (LEPs), include the full range of classifications possible. The less granular CSIRO Australian Soil Resource Information System identifies various sections along the PLR2 alignment as either a high probability (i.e. > 70% chance of occurrence) or a low probability of occurrence (between 6 and 70% chance). Both data sources consistently identify areas with a likelihood of P/ASS and the corresponding environmental risk. **Table 3.1** summarises the classification of P/ASS within the project boundary.

**Table 3.1: P/ASS Classifications**

| Location | Class | Description of works potentially exposing P/ASS |
|---|---|---|
| Camellia (Western Portion) | 4 | Any works likely to disturb soils two metres or more below the ground surface<br>Any works likely to lower the water table by two metres or more below the ground surface. |
| Camellia (Eastern Portion) | 3 | Any works likely to disturb soils one metre or more below the ground surface<br>Any works likely to lower the water table by one metre or more below the ground surface. |
| Parramatta Riverbanks (between Camellia and Rydalmere) | 1 | Any works likely to disturb soils below the natural ground surface |
| Parramatta Riverbanks (between Melrose Park and Wentworth Point)<br>Northern portion of Wentworth Point<br>Sydney Olympic Park (near Haslams Creek) | 2 | Any works likely to disturb soils below the natural ground surface<br>Any works likely to lower the water table below the ground surface. |
| Rydalmere, Ermington, Melrose Park (other areas) | 5 | Acid sulfate soils are not present within the area. This area is located within 500 metres of class 1, 2, 3 and 4 soils. |

Based on the data sets and mapping available, P/ASS is likely to be found along sections of the PLR2 alignment and will require assessment and management as part of the construction phase.

# 4 Project Description

This section provides an overview of the project, its location and the construction and operational activities required to deliver PLR2. Activities that have the potential to interact with contaminated media (e.g. soil, groundwater, surface water, sediment, vapour and landfill gas) are presented to allow further assessment of potential impacts and risks to project delivery.

## 4.1 Project Overview

The project will connect communities north and south of the Parramatta River using infrastructure constructed as part of Parramatta Light Rail Stage 1 between Parramatta CBD and Camellia, and constructing new light rail infrastructure through the suburbs of Camellia, Rydalmere, Ermington, Melrose Park, Wentworth Point, Sydney Olympic Park and Lidcombe. The project boundary subject to assessment in this ICR is shown in **Figure 1.1**.

The project includes the following key components (TfNSW, 2022):

- Construction of approximately 10 km of new dual light rail track between Camellia and the Carter Street Precinct in Lidcombe, including 14 new light rail stops, turnback facilities, traction power substations, overhead wiring, driver facilities, and communication equipment;
- Construction of new bridges between the following locations:
  - Two bridges crossing Parramatta River between Camellia and Rydalmere, and between Melrose Park and Wentworth Point;
  - A bridge over Silverwater Road between Rydalmere and Ermington;
  - A bridge in Ken Newman Park and Boronia Street; and
  - A new bridge adjacent to the existing Hill Road bridge, along with bridge reinforcement works at Sydney Olympic Park.
- Construction of approximately 8.5 km of new ATLs (footpaths, cycleways, or shared paths) and connection to the existing cycling and pedestrian network;
- Alterations of the existing road network to accommodate new rail infrastructure;
- Construction of new publicly accessible open space and public realm improvements, including urban design and landscape works at Ken Newman Park, the Atkins Road stop and Archer Park;
- Temporary laydown and ancillary works for construction; and
- Operation of approximately 13 km of light rail alignment between Parramatta CBD and the Carter Street precinct in Lidcombe.

For the assessment of potential impacts and risks from contamination to delivery of the project, the nature and extent of activities to be undertaken and infrastructure to be built during both the construction and operation stages must be understood.

## 4.2 Construction

As described in the EIS (TfNSW, 2022) the majority of the PLR2 alignment will be constructed on or adjacent to existing roads, with activities primarily involving the installation of light rail track infrastructure and stops. Other construction works will include utility protection and relocation works, installation of drainage infrastructure, construction of retaining walls, installation of overhead wiring, road and intersection modifications, public amenity improvements, and construction of ATLs.

The proposed approach to construction would generally involve the site establishment stage, followed by the main construction and finishing works stages (TfNSW, 2022). The types of activities and works associated with each stage are described below:

- Site establishment
  - Installation of environmental management controls and salvaging heritage artefacts;
  - Demolition of redundant buildings and structures;
  - Establishment of construction compounds and work areas, including utility installation;
  - Trimming, removal, and relocation of vegetation;
  - Relocation, adjustment, and protection of the existing utility network;
  - Temporary diversion of roads, cyclists, and pedestrians; and
  - Remediation of contaminated land, where required prior to the commencement of civil works.
- Main construction works
  - Civil works for construction of light rail tracks and stops, including the removal of existing road surface and subgrade, excavation box out to accommodate the track slab, platforms, foundation and subgrade, installing services conduits and drainage infrastructure, installation of the track slab and platform structure, construction of retaining walls (where required), backfilling and reinstatement;
  - Track and overhead wiring installation such as that as shown in **Figure 4.1**, including track laying, rail systems and services installation, track form finishing, excavation of footings for overhead wiring poles, installation of overhead wiring, and stringing and connection of overhead wires and associated utilities;
  - Construction of bridges, including excavation at bridge take-off and landing points to allow the construction of abutments, construction of bridge piles, piers and superstructure, installation of light rail track and overhead wiring, and bridge fit-out works;
  - Reinforcement of the existing Holker Busway and Hill Road bridges;
  - Realignment of the road network to accommodate the light rail infrastructure, including removal of road components (e.g. kerbs, gutters, median strips), excavation, placement and compacting road base and pavement, construction of new road components, installation of signage, roadside furniture, makings, and establishment of public domain works; and
  - Construction of ATLs, which in some areas would involve removal of existing hardstand (if present), excavation of existing ground to accommodate drainage and services (as required) and installation of hardstand surface as shown in **Figure 4.2**.
- Finishing works
  - Removal of construction equipment, plant, infrastructure, materials, compounds, and environmental controls;
  - Demobilisation and rehabilitation of disturbed areas, including landscaping and make good; and
  - Testing and commissioning of light rail infrastructure, electrical systems, light rail vehicles, signalling and operation, and defects rectification.

To facilitate delivery of the construction works described above, land beyond the permanent light rail corridor (comprising the land required for the project’s operational infrastructure) will be required for construction purposes. Activities on these temporary lands would typically include clearing and levelling (where required) to accommodate site offices and amenities, material, plant and equipment storage and laydown areas, workshop and maintenance facilities, and vehicle parking. Proposed construction compounds identified in the EIS (TfNSW, 2022) are shown in **Figure 4.3**. Following completion of construction these temporary lands would be rehabilitated and made good.

**Figure 4.1: Track installation works during construction of Parramatta Light Rail Stage 1 (TfNSW, 2022)**

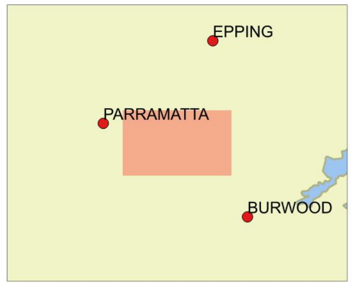
**Figure 4.2: Construction of ATL as part of Parramatta Light Rail Stage 1 (TfNSW, 2022)**


**Figure 4.3: Location of Construction Compounds**

*TfNSW - PLR2 Interpretive Contamination Report*

**Legend**

- Construction Compounds
- PLR2 Track Alignment
- ICR Project Boundary
- EIS Project Site




DATA SOURCES
TfNSW, 2023; Imagery: Nearmaps, 2023

SCALE 1:18,000
100 0 100 200 300 400 500 m

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### 4.2.1 Ground Disturbance

To evaluate the potential impacts and risks from contamination on the construction of the project, the nature and extent of ground disturbance that would potentially interact with contaminated media must be understood. Based on the construction activities and works described above, preliminary design information, and the construction of Parramatta Light Rail Stage 1 and similar recent light rail projects (e.g. Sydney Light Rail, Canberra Light Rail), ground disturbance activities required to construct the project include:

- The box out excavation for the light rail track slab, services conduits and drainage infrastructure. The extent and depth of the excavation box out will vary dependent upon the final design level and form for the light rail track and, where present, stops and ATLs. Where the final design level for the track alignment matches the existing ground surface, as commonly occurs where the light rail is installed along existing roadways, the maximum depth of excavation is typically 1.5 to 2.0 m bgs to accommodate the track slab, underlying services conduits and drainage infrastructure, and foundation and subgrade layers (where required). The lateral extent of the excavation box is typically 8 to 12 m in width, dependent upon the track form design;
- The depth and extent of ground disturbance required to construct bridge abutments will depend upon the final design and construction methods adopted for the bridges. The EIS (TfNSW, 2022) reported that the proposed construction methods for the bridges over Parramatta River had been selected to minimise potential impacts on environmentally sensitive areas, adopting methods intended to minimise the extent of ground disturbance required. The proposed construction method involves the construction of a temporary jetties from both abutments up to the central bridge piers with perpendicular bents at selected intervals to allow for construction of the bridge piers. The temporary jetties would be supported by driven piles to minimise spoil generation, with the jetty deck constructed sequentially into the river and eliminating the need for a barge. This construction method will minimise the areal extent of ground and sediment being disturbed, minimising the spoil volume generated and the potential exposure pathways for workers to contaminated soil and sediment, should it be present;
- The depth of excavations required to accommodate road network upgrades, construct ATLs and construction compounds are typically limited to less than 1.5 m bgs to accommodate any utilities and services, drainage infrastructure, and hardstand footpath for the ATL;
- As part of the project, works to integrate with the public domain and upgrade public open space areas will be undertaken, including improvements to Ken Newman Park and Archer Park, and the creation of a new open space area around the Atkins Road stop in Ermington. Ground disturbance and excavation works will be required in these areas to facilitate these open space improvements, including the planned terracing of the northern section of Ken Newman Park, though the depth of excavations would typically be limited to within one metre of the existing ground surface to accommodate any drainage design and landscaping improvements; and
- The depth of excavation required to accommodate installation of overhead wiring poles is governed by TfNSW design standards and is typically less than 3.0 m bgs, dependent upon geotechnical conditions. Deeper excavations to install the overhead wiring poles are typically completed using piles.

### 4.2.2 Interaction with Groundwater

The EIS (TfNSW, 2022) reported that groundwater is unlikely to be encountered during most excavation works, though during periods of high rainfall temporary increases in local groundwater levels may result in seepage into excavations.

Due to local topography in the vicinity of Boronia Street, Ermington, the design level for the track will require the excavation of a cutting approximately 140 m long and almost three (3) m deep. WSP Golder (2022c) recorded groundwater levels in the vicinity of this cutting between September and October 2022 between 1.75 m bgs and 1.97 m bgs, indicating that local groundwater is likely to be intercepted in this cutting and would require dewatering.

Elsewhere along the alignment groundwater may be encountered in the vicinity of the bridge crossings over Parramatta River and Haslams Creek, though the extent of interaction and exposure to groundwater will depend upon the final design levels, track form and infrastructure, and construction methods adopted. In these locations the track alignment would be elevated to achieve the height of the proposed bridges, meaning the track level at the bridge take-off and landing points will need to be elevated above existing ground surface and supported by piles. The installation of temporary (for working platforms) and permanent (for the bridge structures) piles will intercept groundwater, however potential exposure pathways for workers to contaminated groundwater (if present) would be limited because of the piling methods adopted. However potential impacts to vegetation and aquatic ecosystems along the banks and within Parramatta River (outside of the project boundary) would need to be considered when conducting these works.

### 4.2.3 Interaction with Surface Water and Sediment

The EIS (TfNSW, 2022) identified the following areas where the project interacts with surface water bodies:

- Parramatta River – The project crosses the Parramatta River via two new bridges to be constructed, one between Camellia and Rydalmere, and the second between Melrose Park and Wentworth Point; and
- Sydney Olympic Park – The project will include bridge reinforcement works of existing bridges at Sydney Olympic Park, one being the Holker Busway bridge that crosses Haslams Creek, and the second being the Hill Road bridge that traverses the Narawang Wetland.

As described in **Section 3.2**, all watercourses along the alignment are considered highly modified and subject to current and historical stressors that negatively impact water quality. The nature and extent of impacts from construction activities on these water bodies and their sediments will depend upon the final design and construction methods adopted, in the same manner as potential interactions with groundwater. The construction methods detailed in the EIS (TfNSW, 2022), specifically the use of piles for installation of temporary working platforms and the permanent bridge structures, would minimise potential exposure pathways for construction workers to contaminated surface water and sediments, though potential impacts to vegetation and aquatic ecosystems along the banks and within Parramatta River would need to be mitigated.

## 4.3 Operation

The operational stage of the project will comprise the running of light rail vehicles along the newly constructed light rail infrastructure, as well as portions of the existing Parramatta Light Rail Stage 1 infrastructure, between Parramatta CBD and the Carter Street stop in Lidcombe. Operation of the project will comprise the following key infrastructure components:

- Approximately 10 km of new dual light rail track and 14 light rail stops, including overhead wiring and other above ground ancillary infrastructure (e.g. electrical and communications, signage, furniture);
- Approximately 8.5 km of new ATLs, which include shared and separated footpaths and cycleways for pedestrians and cyclists;
- Two new bridges over Parramatta River, new bridges over Silverwater Road and in Ken Newman Park, and duplication of the existing bridge over Hill Road in Sydney Olympic Park; and
- Other facilities and infrastructure to support operation, such as track turnback facilities, the SaMF, substations for traction power and driver facilities.

The track form design for the new light rail track will comprise embedded tracks, where tracks are embedded in concrete and laid within or adjoining to existing or proposed roads, and permeable tracks, which use permeable materials between the tracks to allow water infiltration and reduce stormwater runoff. The permeable materials are laid within a depressed concrete slab or on concrete sleepers.

Based on the design information available, services pits and access points for sub-surface utility conduits along the alignment will be constructed in pre-cast pits to facilitate access from the ground surface, with no intrusive maintenance pits (i.e. pits that require maintenance workers to physically enter the pit, potentially under confined space conditions) or requirement to directly contact underlying soils for maintenance reasons. As such, intrusive maintenance workers were not considered potential receptors to contamination during the operational stage of the project.

# 5 Contamination and Acid Sulfate Soil Conditions

This section provides a summary of available contamination and P/ASS data along the project alignment.

## 5.1 Previous Investigations

In addition to the reports identified in **Section 1.3**, TfNSW provided information and data relating to the identification of asbestos and asbestos containing materials (ACMs) during archaeological heritage assessments currently underway as part of ongoing assessments to inform the project's design development.

The following sections provide a high-level summary of these previous investigations.

### 5.1.1 *Parramatta Light Rail Stage 2 – Desktop Contamination Assessment* (Nation Partners, 2018)

In 2018 TfNSW engaged Nation Partners to conduct a desktop contamination assessment along the PLR2 alignment for incorporation in the Final Business Case for the project. The desktop assessment was undertaken to identify potential impacts and risks from contamination along the alignment that could impact the cost and constructability of PLR2.

Nation Partners (2018) identified that land use along the PLR2 alignment is characterised by heavy industrial properties in Camellia, primarily low-density residential land between Rydalmere and Melrose Park with some commercial and light industrial facilities, and parkland, open space, and commercial land use in Sydney Olympic Park.

The desktop review identified sites and areas with known or potential contamination along the proposed alignment. Potential impacts from contamination and existing remediation infrastructure were evaluated within the context of the construction and operational requirements for light rail infrastructure. The project alignment assessed in the Nation Partners (2018) report differed slightly to the project boundary being assessed in this ICR (refer **Figure 1.1**), with the primary change being the eastern end of Camellia peninsula, where the alignment previously ran parallel to Grand Avenue before turning north and crossing Parramatta River at 37a Grand Avenue, Camellia. The current alignment follows the former Sandown Line before crossing Parramatta River and does not traverse 37a Grand Avenue.

The Nation Partners desktop assessment (2018) identified the following areas likely to have an impact on the cost and constructability of PLR2:

- Camellia Peninsula – contamination resulting from current and historical industrial land use activities including chemical and asbestos manufacturing and disposal;
- 37a Grand Avenue, Camellia – the location for the foundation and abutment for the bridge crossing between Camellia and Rydalmere was known to be contaminated by CrVI and was being regulated by NSW EPA under the CLM Act; and
- Sydney Olympic Park – existing landfill and leachate management infrastructure associated with several engineered landfills at Sydney Olympic Park were being regulated by NSW EPA under the CLM Act and would need to be considered in the design and construction of PLR2.

Nation Partners (2018) also identified that other areas of the alignment were likely to be affected by low levels of contamination and hazardous materials such as asbestos, a result of historical uncontrolled landfilling. Nation Partners (2018) concluded that these contamination issues were not expected to have a material impact on the construction and operation of PLR2, and recommended that contamination assessment, remediation, and management works be factored in the appropriate project delivery phases to mitigate potential time and cost impacts.

### 5.1.2 *Transport for NSW – Parramatta Light Rail (Stage 2) Corridor Wide Site Contamination Report (Draft)* (Coffey, 2019)

Following the desktop contamination assessment (Nation Partners, 2018), TfNSW engaged Coffey to undertake an intrusive contamination assessment along the proposed PLR2 alignment (Coffey, 2019). The stated objectives of the contamination assessment were to assess whether contamination, where present, would warrant management and/or remediation during construction and/or operation of the light rail, and to provide recommendations for further assessment, management or remediation of contamination, if identified (Coffey, 2019).

To undertake the assessment, Coffey collected soil samples from 32 borehole locations, sediment samples from four (4) overwater geotechnical boreholes, and groundwater samples from seven (7) groundwater monitoring wells.

In planning their investigation, Coffey (2019) identified the following potential sources of contamination in their designated study area:

- CrVI contamination in Camellia;
- Legacy asbestos contamination associated with James Hardie's past operations in Camellia peninsula;
- Contamination in fill and associated with past industrial activities across the study area;
- Sydney Olympic Park – landfills and associated leachate management infrastructure; and
- P/ASS and potential contamination as not yet identified.

Results from their investigation identified contamination at several locations (Coffey, 2019), including:

- One location which reported TRH in soil, which Coffey (2019) concluded presented a potentially unacceptable risk to buried services without further assessment, management, or remediation;
- Asbestos in soil at one location within Eric Primrose Reserve, Rydalmere. Coffey (2019) also reported that the Camellia Peninsula, in particular the Sandown Line which is a known former James Hardie asbestos disposal site, had a high potential for asbestos in soil;
- Heavy metals (arsenic, chromium, copper, lead, mercury, and zinc), TRH, and dioxins in sediment samples from Parramatta River; and
- The lower explosive limit for methane was exceeded during background atmospheric gas monitoring at one location in Wentworth Point.

Coffey (2019) also reported the following groundwater data:

- Groundwater levels ranging from 0.6 to 3.5 m bgs;
- Concentrations of dissolved copper, nickel, and zinc above the adopted investigation levels, however Coffey (2019) considered the concentrations to be representative of background groundwater quality rather than indicators of contamination;
- Detectable concentrations of TRH in two monitoring wells (BH20 and BH37), one of which Coffey (2019) considered to be naturally occurring; and
- Concentrations of other chemical contaminants scheduled for analysis recorded concentrations below the adopted human health and ecological screening criteria.

### 5.1.3 Factual Contamination Report (WSP Golder, 2022a)

WSP Golder was engaged by TfNSW to undertake a geotechnical and contamination investigations for PLR2. The Factual Contamination Report (WSP Golder, 2022a) does not provide the objectives of the investigations, instead stating that the report *"documents the contamination investigations completed as part of the broader WSP Golder site investigation package and includes laboratory analytical results."* The investigations were completed between May and September 2022, though the report noted that not all investigations were completed due to access constraints, and that additional mobilisations may be undertaken once access is obtained (WSP Golder, 2022a).

In total WSP Golder (2022a) reported completing 198 borehole locations, including large diameter boreholes and standard geotechnical and contamination boreholes, over the approximate 10.4 km length of the alignment. The investigation included 184 boreholes on land and 14 boreholes over water, and additional geotechnical investigation methods including cone penetration tests and seismic dilatometer tests were completed at other locations. Groundwater wells were also installed as part of the investigations, however the report did not state where or how many wells were installed (WSP, 2022a).

WSP Golder (2022a) reported that soil samples were collected from 149 borehole locations, with a minimum of two samples from each location submitted for laboratory analysis for a general suite of contaminants of potential concern. At least one of the two samples from each location submitted for analysis was collected within one metre of the ground surface (WSP Golder, 2022).

For this ICR Nation Partners completed a review of the laboratory analytical results provided in the Factual Contamination Report (WSP Golder, 2022a) and identified the following exceedances of the adopted land use criteria for the protection of human health in a commercial / industrial land use setting:

- Concentrations of TRH (>$C_{10}$-$C_{16}$ Fraction F2) were recorded in soil samples collected from depths ranging from 0.3 m bgs to 1.5 m bgs at three borehole locations (one within Camellia, and two locations within Wentworth Point in the vicinity of the Woo-La-Ra Landfill) that exceeded the NEPM management limit criterion for petroleum hydrocarbons (NEPC, 2013). The borehole location in Camellia was outside the project boundary being assessed in this ICR;
- Total cyanide concentrations were recorded in soil samples collected from depths of 1.0 m bgs and 1.5 m bgs at two locations in the vicinity of the Woo-La-Ra Landfill that exceeded the HIL-D criterion for free cyanide, which was applied against total cyanide results as a conservative measure in the absence of free cyanide data;
- Asbestos was detected in 11 samples collected from eight borehole locations, with all samples collected from soils designated as fill material, or natural soils within 0.2 m of overlying fill material, and typically at depths of less than 1.5 m bgs;
- Samples with P/ASS that exceeded the action criteria for coarse textured soils (ASSMAC, 1998) were collected at 15 locations, including 5 locations (two locations in Parramatta River, one location in Ken Newman Park, Ermington, and two locations in Wentworth Point) where samples were collected within 3.0 m bgs exceeded the action criteria; and
- Coal tar was detected to be present in asphalt samples collected at two (2) locations within public roads in Ermington.

In addition to these results, WSP Golder (2022a) collected and analysed soil and sediment samples along the project alignment for dioxins, driven by the known presence of dioxins in sediments in Sydney Harbour and Parramatta River and corresponding dietary advice issued by the NSW Food Authority recommending that seafood from these water bodies is not consumed[1]. Despite the establishment of a National Dioxins Program in 2001, and the program's recommendation for the development of investigation levels for dioxins in Australia (EPHC, 2005), no state or nationally endorsed criteria for the assessment of sites contaminated with dioxins has been established.

Results for samples analysed for dioxins were assessed for the toxic equivalent (TEQ) concentrations calculated using the World Health Organisation's toxicity equivalent factors (TEFs), in accordance with the approach adopted by the National Dioxins Program (EPHC, 2005), and using the laboratory's limit of reporting (LOR) value for compounds whose concentrations were below the laboratory's LOR, as a conservative measure. Sample results reported by WSP Golder (2022a) included:

- Dioxin TEQ concentrations for soil samples ranged from 5 picograms per gram (pg/g) to 124 pg/g, with the highest concentrations generally recorded at depths greater than 3.0 m bgs along Australia Avenue in Sydney Olympic Park. Samples with dioxin TEQ concentrations greater than 40 pg/g were also

[1] NSW Health: https://www.health.nsw.gov.au/environment/factsheets/Pages/dioxins.aspx, accessed 26 January 2022.

reported at shallower depths (less than 3.0 m bgs) in two locations on Broadoaks Street, Ermington, and in one location along the Sandown Line in Camellia; and

- Concentrations in sediment samples collected from Parramatta River ranged from 5 pg/g to 171 pg/g TEQ, generally comparable to the sediment results reported by Coffey (2019), who reported concentrations for five (5) sediment samples ranging from 8 pg/g to 130 pg/g TEQ, with one other sediment sample collected between Melrose Park and Wentworth Point recording a concentration of 6,640 pg/g TEQ.

To provide context for these results, reference was made to data available through the Australian Government's *National Dioxins Program – Dioxins in Australia: A summary of the findings of studies conducted from 2001 and 2004* (DEH, 2004), and NSW's *Chemical Control Order in Relation to Dioxin-Contaminated Waste Materials* (NSW EPA, 1986):

- The National Dioxins Program (DEH, 2004) reported that dioxins were detected in most soils sampled across Australia, with concentrations ranging from 0.05 to 23 pg/g TEQ, and noted that concentrations in soils in urban and industrial environments were substantially higher than in agricultural and remote locations, with the highest concentrations recorded in soils in southeast population centres;
- Sediment data obtained as part of the National Dioxins Program (DEH, 2004) revealed the highest concentrations of dioxins were found in the lower Parramatta River, where the project is located, with concentrations ranging from 100 to 520 pg/g TEQ; and
- The NSW *Chemical Control Order in Relation to Dioxin-Contaminated Waste Materials* (NSW EPA, 1986) applies to only one congener in the dioxin family of compounds and defines dioxin contaminated waste as any material that contains greater than 10,000 pg/g of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD).

The maximum concentration of 2,3,7,8-TCDD reported by WSP Golder (2022a) was 64 pg/g TEQ, which falls orders of magnitude below the threshold for dioxin contaminated waste.

### 5.1.4 Geotechnical Data Report (WSP Golder, 2022b)

WSP Golder prepared a Geotechnical Data Report (WSP Golder, 2022b) to present the factual results of the geotechnical investigation completed on behalf of TfNSW. The geotechnical investigation was undertaken in parallel with the contamination investigation reported in the Factual Contamination Report (WSP Golder, 2022a), so no additional contamination-related information and data was provided in the report.

### 5.1.5 Factual Groundwater Report (WSP Golder, 2022c)

As part of their broader engagement with TfNSW to undertake a geotechnical and contamination investigations along the PLR2 alignment, WSP Golder prepared a Factual Groundwater Report (WSP Golder, 2022c) to document the results of quarterly groundwater monitoring completed between September and October 2022.

Eight groundwater monitoring wells were installed as part of the contamination investigation (WSP Golder, 2022a), with well installation details provided in the Factual Groundwater Report (WSP Golder, 2022c). The locations of the eight monitoring wells are shown in **Figure 5.1** and include:

- One groundwater well (BH266) along the Sandown Line in Camellia, at the location of the proposed take-off for the bridge from Camellia to Rydalmere;
- Three groundwater wells (BHMW353, BH355 and BHMW336) in Rydalmere north of the Parramatta River, in the vicinity of the landing of the bridge from Camellia to Rydalmere;
- One groundwater well (BH145) along Boronia Street, Ermington, in the vicinity of the proposed cutting;
- A nested pair of groundwater wells (BHMW166 and BHMW345) in Melrose Park near the take-off for the bridge between Melrose Park and Wentworth Point; and
- One groundwater well (BHMW167) in Wentworth Point at the landing for the bridge between Melrose Park and Wentworth Point.

WSP Golder (2022c) collected groundwater samples from these eight locations and reported:

- Groundwater levels ranging from above the top of the well casing to approximately 3.37 m bgs. Groundwater levels recorded in the nested well pair in Melrose Park (BWMW166 and BHMW345) recorded water levels above the top of the well casing, which WSP Golder (2022c) attributed to inundation of these wells resulting from their proximity to Parramatta River;
- Dissolved methane was detected at a concentration exceeding the criterion adopted by WSP Golder (2022c) in one groundwater well (BHMW336), which was based on a British Geological Survey (2015) reference that reported the lowest dissolved methane concentration that could theoretically result in methane concentrations exceeding the lower explosive limit (LEL) in a confined space. This well location is located outside the project boundary being assessed in this ICR, and other well locations in its vicinity (wells BHMW353 and BH355, refer **Figure 5.1**) did not record dissolved methane concentrations above the assessment criterion adopted by WSP Golder (2022c);
- Concentrations of perfluorooctanoic acid (PFOA) and the sum of perfluorohexane sulfonate (PFHxS) and perfluorooctane sulfonate (PFOS), members of the per- and poly-fluorinated substances (PFAS) group of compounds, were recorded above the human health criteria for recreational exposure to water in one groundwater well (BHMW353) located on the north side of Parramatta River where the Camellia to Rydalmere bridge lands; and
- Concentrations of nutrients (ammonia, nitrogen, phosphorous), dissolved metals (cobalt, copper, lead, manganese, nickel, zinc) and TRH were detected above the adopted ecological assessment criteria, but below the human health criteria for recreational exposure to water, in all groundwater samples collected along the alignment.

### 5.1.6 Archaeological Heritage Assessments

As part of the investigation works to inform the reference design, archaeological heritage investigations are currently underway across the proposed alignment. Preliminary results of these investigations from December 2022 identified the presence of asbestos in excavations at the following locations:

- Broadoaks Park, Rydalmere – ACM within 3 of 14 investigation pits;
- Ken Newman Park, Ermington – ACM within 2 of 6 investigation pits; and
- Ermington Boat Ramp, Melrose Park – ACM and asbestos loose fibre bundles were identified within sieved soil from one investigation pit, and ACM was observed on the ground surface.

## 5.2 NSW EPA Records and Other Information Sources

A search of the NSW EPA's list of notified contaminated sites identified several sites with regulatory notices and/or management orders along the project alignment as of January 2023. These sites are shown in **Figure** 5.2 and include:

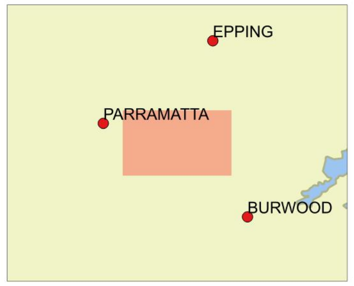
- Camellia:
  - 13 Grand Avenue (Wrigg), which has a preliminary investigation order from NSW EPA;
  - 15 Grand Avenue (Mauri Foods), with regulation being finalised;
  - 27 Grand Avenue (Railway Land), with regulation not required; and
  - 33a Grand Avenue (Maritime Services Board), with regulation not required.


**Figure 5.1: Groundwater Monitoring Wells Along Project Alignment**

*TfNSW - PLR2 Interpretive Contamination Report*

**Legend**

- Groundwater Monitoring Wells (WSP Golder, 2022a)
- ICR Project Boundary
- EIS Project Site




DATA SOURCES
WSP Golder, 2022a; TfNSW, 2023; Imagery: Nearmaps, 2023

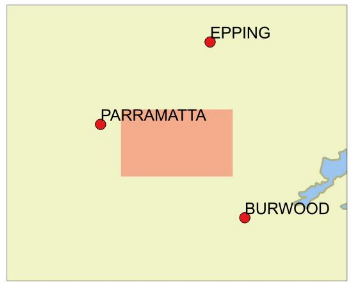
SCALE 1:18,000
100 0 100 200 300 400 500 m


**Figure 5.2: NSW EPA Notified Sites Along Project Alignment**

*TfNSW - PLR2 Interpretive Contamination Report*

**Legend**

- NSW EPA List of Notified Contaminated Sites
- PLR2 Track Alignment
- ICR Project Boundary
- EIS Project Site




DATA SOURCES
NSW EPA, 2023; TfNSW, 2023; Imagery: Nearmaps, 2023

SCALE 1:18,500
100 0 100 200 300 400 500 m

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- Sydney Olympic Park:
  - 14A-14E and 16 Hill Road, Sydney Olympic Park (RMS Western Precinct), with regulation not required;
  - Hill Road, Sydney Olympic Park (Woo-La-Ra Landfill), ongoing maintenance required to manage residual contamination;
  - Kevin Coombes Avenue (Kronos Hill Landfill), ongoing maintenance required to manage residual contamination; and
  - 23 Bennelong Parkway, Wentworth Point (Former TNT Express), with regulation not required.
- Melrose Park (identified as West Ryde on the NSW EPA's listed of notified sites):
  - 44 Wharf Road, West Ryde (Reckitt Benckiser), with regulation not required.

The following sections provide a high-level summary of contamination information for sites within the project boundary.

### 5.2.1 Camellia Peninsula

As part of a partnership between DPE and City of Parramatta Council, Golder Associates prepared a *Camellia Precinct Contamination Study - Part 1 - High Level Contamination Review* (Golder, 2015a) and *Camellia Precinct Stage 2 Contamination and Remediation Study* (Golder, 2015b) to inform the Camellia Master Plan. The Camellia Precinct was considered to be land bound by Parramatta River to the north and east, Duck River and the Western Motorway to the south and east, and James Ruse Drive to the west. The reports identified that a number of properties are under some form of statutory contamination remediation management (Golder, 2015a and 2015b). Additionally, Golder (2015b) identified that large-scale remediation would be required across the Precinct to facilitate redevelopment as a result of significant and widespread contamination with asbestos, CrVI, and other hazardous substances from current and historical land use.

Rail Corporation NSW (RailCorp) (now part of TfNSW) previously undertook as staged program of investigation, detailed design, preparation and implementation of a Remediation Action Plan (RAP), and validation works for asbestos and asbestos impacted soil along the portion of the Sandown Line that falls within the project boundary. This portion of the Sandown Line was raised above natural ground level by filling with material sourced from the former James Hardie asbestos manufacturing facility in Camellia. The remediation strategy was developed in 2007 in response to a Notice of Clean-Up Action from NSW EPA. A RAP was finalised in 2013 (WorleyParsons, 2013), with subsequent detailed design report issued in 2014 (SKM, 2014). The first stage of remediation comprised relocation of the rail siding away from the riverbank due to slope stability concerns, and capping of the area. The second stage of remediation comprised the stabilisation and scour protection of the riverbank, followed by capping of the remaining area within the lot boundary. Asbestos fill of variable thickness remains beneath the capping layer and the remaining Sandown Line and along the Parramatta River foreshore.

### 5.2.2 Sydney Olympic Park

Sydney Olympic Park Authority (SOPA) maintains responsibility for the day-to-day and long-term management of ten (10) former landfills located throughout Sydney Olympic Park. NSW EPA has issued a Maintenance of Remediation Notice 28040 under Section 28 of the CLM Act to SOPA for seven (7) of the landfills. To meet the requirements of this notice, SOPA prepared a *Remediated Lands Management Plan* (SOPA, 2009) that details the approach to the management of the remediated landfills and their associated remediation infrastructure. The *Remediated Lands Management Plan* (SOPA, 2009) is a key part of SOPA's commitment to managing all remediated landfills and leachate systems in accordance with their environmental guidelines.

**Figure 5.3** shows the location and extent of the remediated landfills and their associated infrastructure, which forms part of Maintenance of Remediation Notice 28040. The remediated landfills subject to the notice include:

- Aquatic Centre Carpark Landfill;

- Bicentennial Park Landfill;
- Blaxland Common Landfill;
- Golf Driving Range Landfill;
- Kronos Hill Landfill;
- Woo-La-Ra Landfill; and
- Wilson Park Bioremediation.

**Figure 5.3** also shows the presence of other remediated landfills not subject to Maintenance of Remediation Notice 28040.

A key requirement of the *Remediated Lands Management Plan* (SOPA, 2009) is that excavations deeper than 0.5 m are prohibited on the remediated landfills without prior approval from NSW EPA. In line with this requirement and their commitment to managing its remediated landfills, SOPA has also submitted feedback on the PLR2 EIS (TfNSW, 2022) requesting the preparation of a RAP in consultation with SOPA and NSW EPA, and endorsement of the RAP by a NSW EPA-accredited Site Auditor, for any activities or works required in areas subject to Maintenance of Remediation Notice 28040.

### 5.2.3 Melrose Park

The former Reckitt Benckiser site at 44 Wharf Road, Melrose Park, forms part of a larger precinct scale redevelopment known as Melrose Park North. In December 2016 the City of Parramatta Council adopted the Northern Structure Plan for Melrose Park to guide future development in the precinct. Subsequently, a planning proposal to amend the Parramatta LEP 2011 was submitted to enable the redevelopment of the precinct for residential and mixed-use development. The planning proposal was approved in June 2022, with the planning controls due to come into effect on 30 June 2023.

To support the planning proposal Senversa (2015) prepared a technical advice letter that outlined what further investigations and remediation works would be required to render the precinct suitable for mixed-use commercial and residential land use. The Senversa (2015) advice included a high-level summary of the site, previous investigations, a CSM, and presented a remediation strategy that broadly comprised:

- Completion of a hazardous materials survey prior to demolition works;
- Additional investigations to delineate the extent of a chlorinated solvent plume, and to evaluate the potential for point source impacts at former and existing underground storage tanks and associated infrastructure;
- Shallow soil sampling to meet recommended sampling density requirements to characterise the site;
- Preparation of a RAP that considers the nature and extent of contamination identified from the additional investigations and sampling;
- Remediation of soil and groundwater, in particular dense non-aqueous phase liquid from the former aerosols building (located approximately 300 m north of the proposed PLR2 alignment), dissolved phase groundwater impacts, and contaminated fill;
- Preparation of a CEMP to manage key environmental risks and document the requirements for remaining remediation, investigation, and validation during the works; and
- Validation of the combined investigation, demolition, and remediation activities.

Based upon the proposed change in land use and required amendment to the Parramatta LEP, Nation Partners has assumed that a site audit would be required in accordance with the CLM Act. The status of the investigation, remediation and validation works recommended by Senversa (2015) is not currently known.

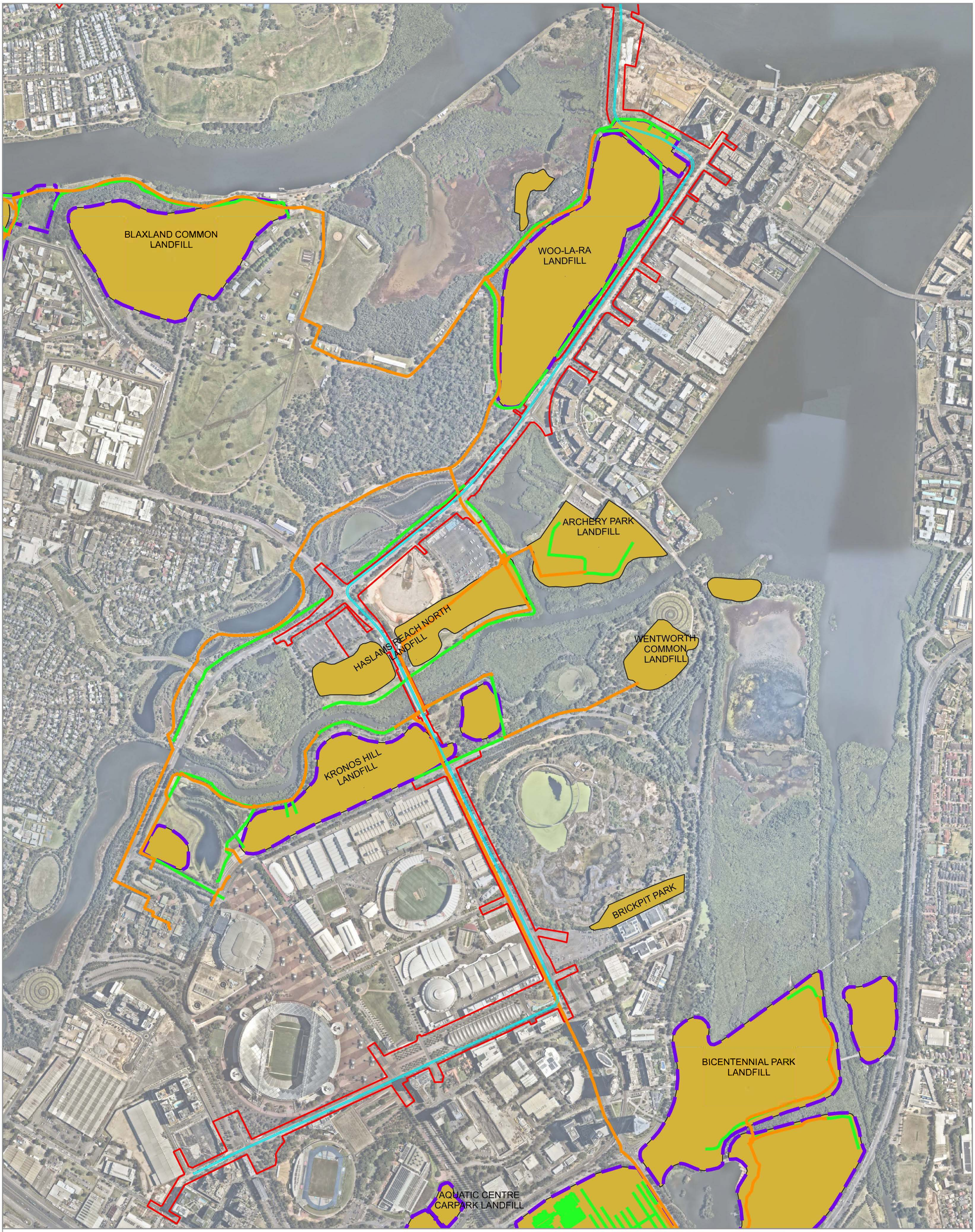
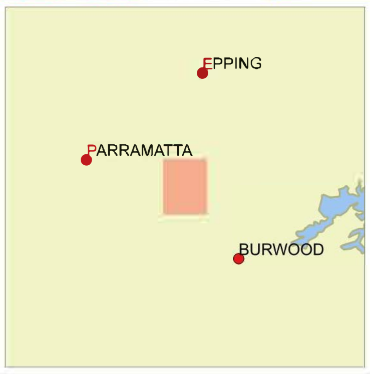



**Figure 5.3: Remediated Landfills and Associated Infrastructure at Wentworth Point and Sydney Olympic Park**

*TfNSW - PLR2 Interpretive Contamination Report*

**Legend**

SOPA Remediated Lands (SOPA, 2009)
- Leachate Rising Main
- Leachate Line / Drain
- Leachate Pump Pits
- Maintenance of Remediation Order 28040
- Landfill Extents
- PLR2 Track Alignment
- ICR Project Boundary
- EIS Project Boundary




DATA SOURCES
SOPA, 2023; TfNSW, 2023; Imagery: Nearmaps, 2023

SCALE 1:10,000
50 0 50 100 150 200 250 m

nation partners

## 5.3 Summary of Contamination

Whilst contamination is known to be present in environmental media along the selected sections of the project alignment, including in soils and fill material, groundwater and sediments, the majority of data available did not indicate the presence of contamination at concentrations above the adopted land use criteria. Based on information and data available from the EIS (TfNSW, 2022), previous contamination investigations and assessments (Nation Partners, 2018; Golder, 2019; WSP Golder, 2022a and 2022c), and publicly available information from NSW EPA and other sources, the following sources of contamination and P/ASS are present along the project alignment:

- Contamination of fill materials, soil and groundwater in the Camellia peninsula resulting from historical and current industrial activities, waste disposal practices, and land reclamation using contaminated fill materials, with contaminant types comprising heavy metals including CrVI, BTEX, TRH, VCHs, polycyclic aromatic hydrocarbons (PAHs), volatile and semi-volatile organic compounds, and ACMs;
- The presence of heavy metals, TRH and dioxins in sediments in Parramatta River;
- Potential ACMs in fill materials used for land reclamation and/or ground levelling;
- Contamination of fill materials, soil and groundwater in Wentworth Point and Sydney Olympic Park resulting from historical industrial activities and the presence of multiple landfills and associated leachate management infrastructure, including the potential presence of landfill gas; and
- P/ASS in soils and sediments in areas within and adjacent to Parramatta River, and in Ken Newman Park, Ermington.

# 6 Risk Assessment

Based on the project's environmental setting (**Section 3**), contamination and P/ASS conditions along the alignment (**Section 5**), and the construction works and operational activities required to build and operate the project (**Section 4**), potential impacts and risks from contamination were identified through the development of CSMs for particular scenarios (e.g. construction stage or operation stage) or geographic areas. These CSMs were then used to evaluate and assign a risk ranking in accordance with the methodology presented in **Section 2**.

Scenarios were developed by starting with the typical construction and operational scenario (**Section 6.1**), with further evaluation of individual sections of the project alignment to accommodate specific contamination and P/ASS conditions, design and/or construction requirements. These individual sections of the alignment are shown in **Figure 6.1** and comprised:

- **Camellia Peninsula** (**Section 6.2**) – the section of the alignment in Camellia peninsula, where specific contamination conditions are characterised by the presence of asbestos and ACMs, CrVI, and other co-contaminants associated with historical industrial land use, including the presence of existing remediation infrastructure along the Sandown Line;
- **Parramatta River Crossings** (**Section 6.3**) – the two bridge crossings over Parramatta River, including the abutments for the bridges on the north side of the river;
- **North of Parramatta River** (**Section 6.4**) – the section of the alignment north of Parramatta River that extends from the bridge abutment in Rydalmere, through Ermington and into Melrose Park, generally characterised by low-density residential land use; and
- **Wentworth Point and Sydney Olympic Park** (**Section 6.5**) – the section of the alignment from the Wentworth Point bridge landing, along Hill Road through Wentworth Point and along Australia Avenue in Sydney Olympic Park.

The following sections present the hazard identification, CSMs and risk ranking for the typical construction and operation scenario, followed by scenarios for each section of the alignment.

## 6.1 Typical Scenario

As most of the project alignment will be constructed on existing roadways (TfNSW, 2022), the activities and infrastructure required to construct and operate the project in this setting were used as base case scenarios to identify potential SPR linkages. The resulting CSMs were considered representative of the typical exposure scenarios that receptors would encounter during the construction and operation stages of the project.

### 6.1.1 Construction Stage CSM

In developing the CSM for the typical construction stage scenario, activities that could result in the interaction with and/or exposure to contamination or P/ASS (if present in fill and soils within the project boundary), included the following ground disturbance activities:

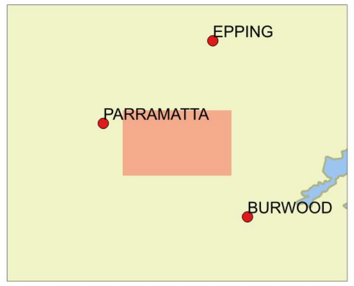
- Demolition and excavation of existing roads, including the road surface, road base, sub-grade and underlying strata, to a typical maximum depth of 1.5 to 2.0 m bgs to accommodate the light rail track slab and underlying services conduits; and
- Excavations required to accommodate road network upgrades, construct ATLs and construction compounds, and public open space upgrades, typically being less than 1.5 m bgs.

**Figure 6.1: Project Sections Identified for Risk Assessment**

*TfNSW - PLR2 Interpretive Contamination Report*

**Legend**

- Camellia Peninsula
- Parramatta River Crossings
- North of Parramatta River
- Wentworth Point and Sydney Olympic Park
- ICR Project Boundary
- EIS Project Site




DATA SOURCES
TfNSW, 2023; Imagery: Nearmaps, 2023

SCALE 1:18,000
100 0 100 200 300 400 500 m

nation partners

For the typical construction stage scenario potential human receptors to contamination were limited to construction workers, and no environmental receptors were considered viable as the works area would be a dedicated construction site. As identified in **Section 2.1.1**, potential risks to environmental receptors from management and disposal of contaminated soil and/or groundwater generated as part of construction works will be mitigated through the implementation of safety and environmental management standards and practices required under the project's approval conditions and the NSW waste management framework under the POEO Act.

**Table 6.1** summarises the SPR relationships identified for the typical construction stage scenario, and **Figure 6.2** presents the graphical CSM.

**Table 6.1: SPR Assessment for Typical Construction Scenario**

| Environmental Media / Contaminant Type | Exposure Pathway | | Receptor | SPR Assessment |
|---|---|---|---|---|
| Fill / soil materials used for road construction and subgrade, with intermittent presence of heavy metals, petroleum hydrocarbons and ACMs of limited extent | • Dermal contact and incidental ingestion<br>• Inhalation of soil derived dust / fibres<br>• Inhalation of contaminant vapours outdoors and/or in an excavated trench | ☑ | Construction workers | • Available contamination data did not identify the presence of contaminants at concentrations above the adopted land use criteria in fill and shallow soils less than 2 m bgs beneath public roads, or in open space areas, along the project alignment. As such, a known hazard has not been identified.<br>• Despite the absence of contaminant exceedances, as described in **Section 2.1.2** a conservative approach was adopted to account for inherent uncertainties in characterising contamination and stakeholder expectations. As such, the SPR linkage has been assessed and found to be potentially complete, noting that based on the contamination data, the level and extent of any such contamination (including ACMs) is expected to be limited.<br>• Groundwater was not considered an environmental media of concern for the typical construction scenario as the depth of excavation required (typically no more than 1.5 to 2.0 m bgs) is not anticipated to intercept groundwater across the majority of the project alignment (refer **Section 4.2.2**). |

Key:
☑ – Complete SPR linkage
☒ – Incomplete SPR linkage

### 6.1.2 Operation Stage CSM

**Table 6.2** summarises the SPR relationships and **Figure 6.3** shows the graphical CSM for the typical operation stage scenario. Potential human receptors to contamination during operation of the project include the general public using PLR2, light rail vehicle drivers and maintenance workers, and ATL users (e.g. pedestrians, runners, cyclists).

For the operation stage, should contamination remain in sub-surface fill materials or soils underlying the light rail infrastructure, potential exposure pathways to such contamination would be mitigated by the hardstand surfaces required for the light rail track, stop platforms, and ATL paths, and/or any remediation infrastructure or controls (should they be required) installed during the construction stage. Where grass or unsealed surfaces are present during operation, these would be comprised of clean fill (e.g. topsoil or landscaping materials) installed as part of the finishing works.

As no complete SPR linkages will be present during the operation stage, potential impacts and risks from residual contamination (should it be present) would be considered low and maintained through standard operating and maintenance procedures. Given the outcomes of the SPR linkage assessment and CSM for the typical operation stage scenario, further assessment of potential impacts and risks from contamination and P/ASS on the operation stage of the project was not undertaken for individual portions of the alignment in the following sections. It is recognised however, that any remediation infrastructure (including capping materials) installed during the construction stage may require ongoing monitoring and maintenance during the operation stage via appropriate management plans.

**Figure 6.2: Graphical CSM for Typical Construction Scenario**

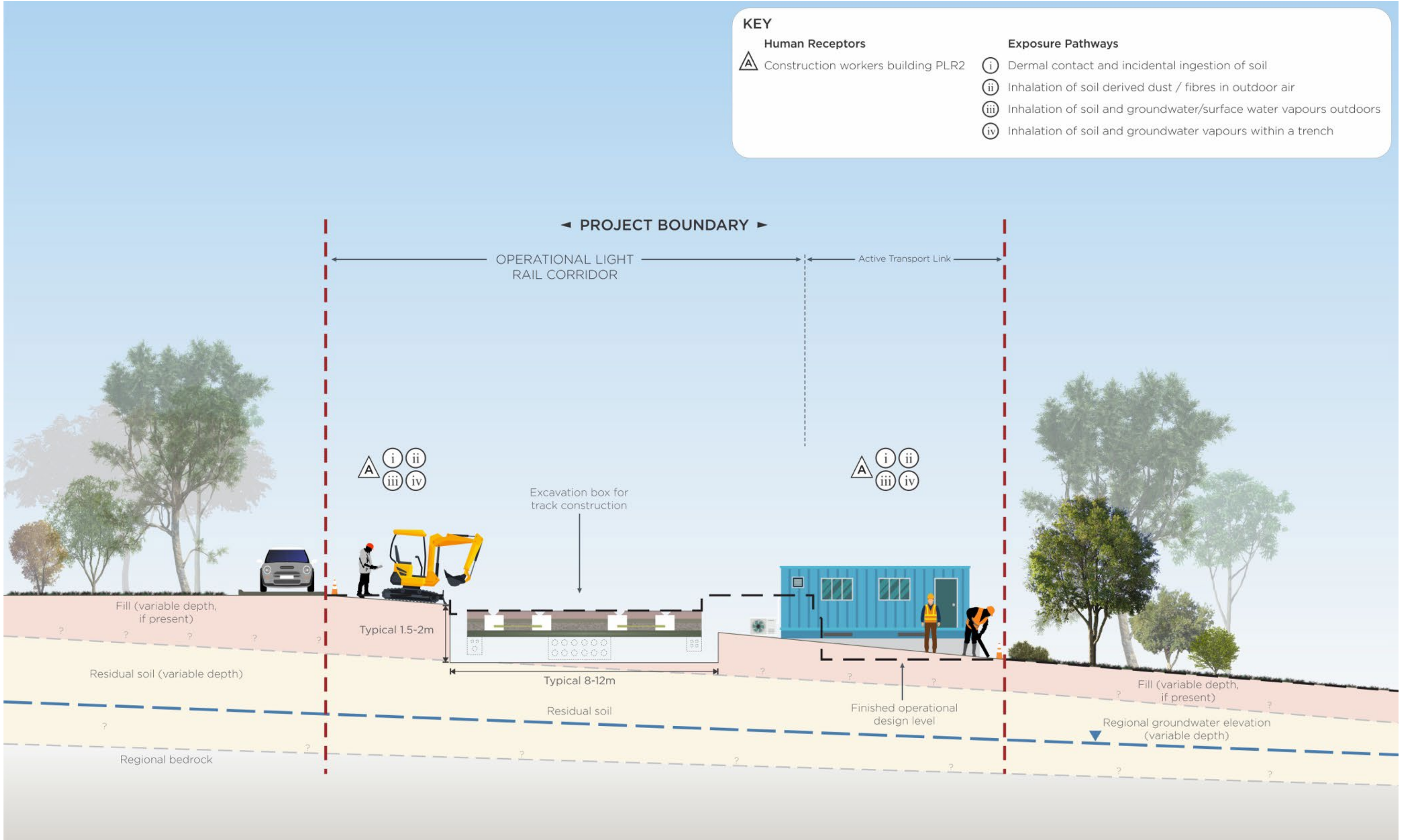


**Figure 6.3: Graphical CSM for Typical Operational Scenario**

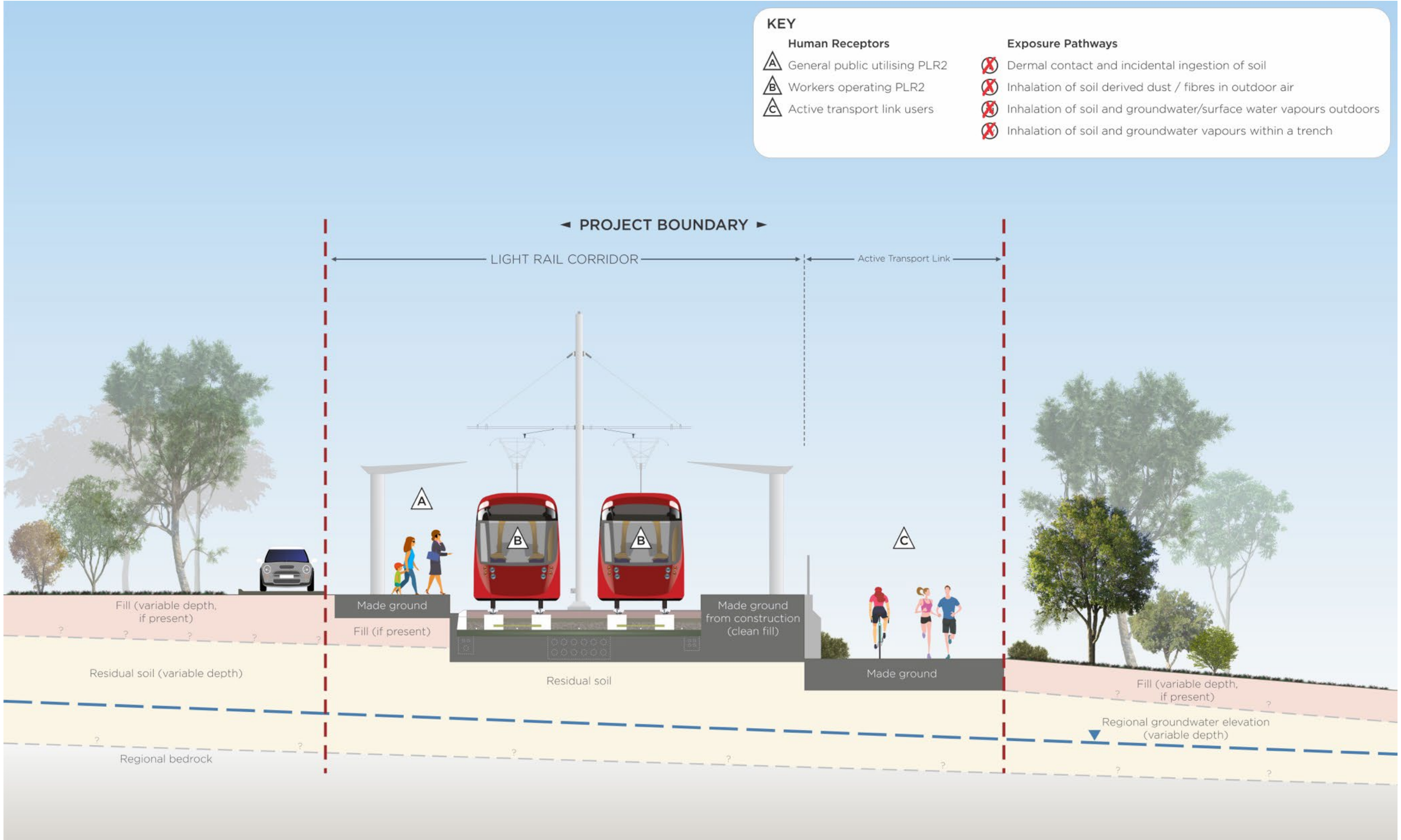


**Table 6.2: SPR Assessment for Typical Operational Scenario**

| Environmental Media / Contaminant Type | Exposure Pathway | | Receptor | SPR Assessment |
|---|---|---|---|---|
| Residual contamination in fill material / soil that remains following construction | • Dermal contact and incidental ingestion<br>• Inhalation of soil derived dust / fibres<br>• Inhalation of contaminant vapours outdoors and/or in an excavated trench | ☒ | • General public<br>• Operational workers<br>• ATL users | • Potential exposure pathways to receptors would be mitigated by the light rail infrastructure required for operation of the project, and/or via remediation infrastructure or controls installed during the construction stage. |

Key:
☑ – Complete SPR linkage
☒ – Incomplete SPR linkage

### 6.1.3 Qualitative Risk Ranking

Qualitative risk rankings for the typical construction stage and operation stage scenarios were assigned using the risk analysis and risk evaluation methodology described in **Section 2.1.2** and are presented in **Table 6.3**.

For the construction stage, the likelihood and consequence ratings were assigned based on the following:

- Likelihood Rating: L2 – Based on the potential for construction workers to be exposed to contamination in fill materials and/or soils during excavation and ground disturbance activities; and
- Consequence Rating: C1 – Based on:
  - Available contamination data identified only the intermittent presence of ACMs in fill and shallow soils less than 2 m bgs beneath public roads, or in open space areas, indicating that any contamination (if present) is limited in extent; and
  - The availability of construction industry standards, guidelines and codes of practice for managing asbestos contamination.

The resulting qualitative risk ranking for the typical construction stage scenario was **Low Risk**.

The qualitative risk ranking for the typical operation stage scenario was also **Low Risk**, based on the absence of SPR linkages between residual contamination (should it be present) and receptors using the permanent light rail corridor.

**Table 6.3: Qualitative Risk Ranking for Typical Construction and Operation Stage Scenarios**

| Hazard Identification | Risk Identification | Risk Analysis | | |
|---|---|---|---|---|
| | | Likelihood | Consequence | Risk Ranking |
| ***Construction Stage*** | | | | |
| Fill / soil materials used for road construction and subgrade, with intermittent presence of heavy metals, petroleum hydrocarbons and ACMs of limited extent | • Dermal contact and incidental ingestion<br>• Inhalation of soil derived dust / fibres<br>• Inhalation of contaminant vapours outdoors and/or in an excavated trench | L2 | C1 | **Low** |
| ***Operation Stage*** | | | | |
| Residual contamination in fill material / soil that remains following construction | • Dermal contact and incidental ingestion<br>• Inhalation of soil derived dust / fibres<br>• Inhalation of contaminant vapours outdoors and/or in an excavated trench | L1 | C1 | **Low** |

### 6.1.4 Data Gaps

Given the generalised scenario being evaluated, specific data gaps in characterising the nature and extent of contamination for individual sections of the alignment are presented in the following sections. However, data gaps that should be addressed to mitigate potential impacts to delivery of the project can be identified, as these gaps arise from the current design development stage of the project and apply across the entire alignment. These data gaps include:

- Evaluation of potential opportunities for re-use of spoil along the project alignment, should fill be needed to achieve the final track design levels and supporting infrastructure. Should fill be required, opportunities for re-use of spoil impacted with ACMs or low levels of contamination would require the collection of additional data for spoil scheduled for excavation to characterise contamination or P/ASS conditions and assess its suitability for re-use. However the precise scope and extent of these additional investigations will be dependent upon the progression of the detailed design for the track alignment, and as such cannot be defined at this stage of project delivery; and
- Similar to the evaluation of re-use opportunities, the waste classification of excess spoil that cannot be re-used as part of the project will require further sampling and data collection. Whilst the Factual Contamination Report (WSP, 2022a) provided a waste classification assessment, the density and variability in sample results would not meet the requirements of the *Waste Classification Guidelines – Part 1: Classifying Waste* (NSW EPA, 2014a). However, as with the data gap for assessing re-use opportunities, the scope and extent of additional investigations required to determine waste classification of spoil will be dependent upon further design development.

## 6.2 Camellia Peninsula

### 6.2.1 Nature and Extent of Contamination

Contamination along the Camellia section of the project alignment that runs from the SaMF east along the Sandown Line is characterised by the widespread presence of asbestos in fill materials and soils, including the likely presence of both loose asbestos fibres and ACMs. This asbestos contaminated fill is currently managed via the capping system installed during previous remediation of the Sandown Line (WorleyParsons, 2013).

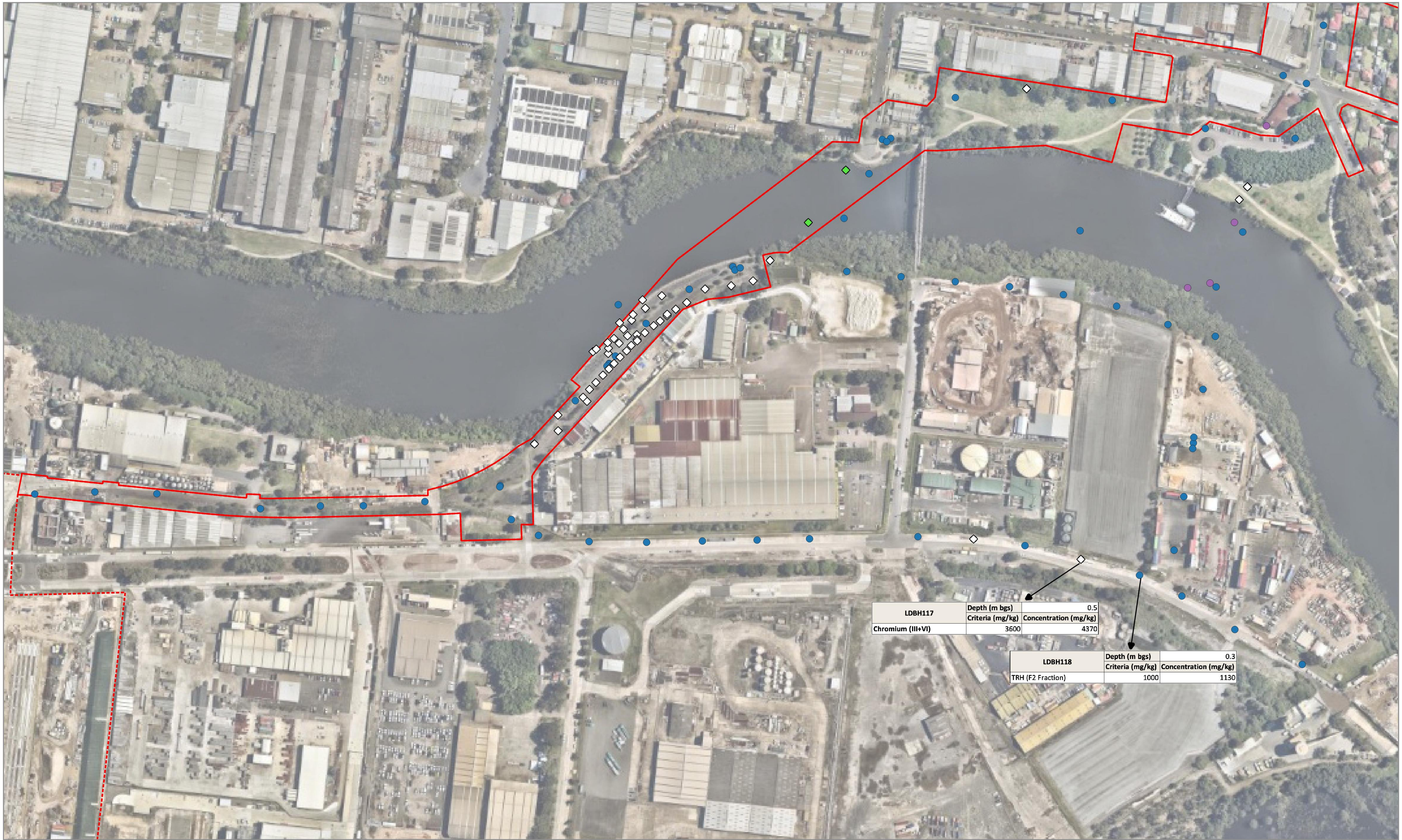
CrVI contamination in soils and groundwater is also known to occur throughout Camellia peninsula, though investigations referenced in the previous RAP for the remediation of the Sandown Line (WorleyParsons, 2013) reported that soil and groundwater along the portion of the Sandown Line that coincides with the project alignment was not contaminated by CrVI. Other potential contaminants present along this portion of the alignment include petroleum hydrocarbons, PAHs and VCHs from historical industrial activities in the area and land reclamation.

**Table 6.4** presents the contaminant types that returned results above the applicable land use criteria from the contamination data available from the WSP Golder (2022a) investigation. Coffey (2019) did not complete investigation locations along this section of the alignment during their previous investigation. **Figure 6.4** shows the locations where soil samples exceeded the adopted land use criteria.

**Table 6.4: Contaminant Exceedances in Camellia (WSP Golder, 2022a)**

| Analyte | Results | Detects | Minimum Concentration | Maximum Concentration | Criterion | Exceedances |
|---|---|---|---|---|---|---|
| TRH (F2 Fraction) | 62 | 1 | < LOR | 1,130 | 1,000 | 1[2] |
| Asbestos | 30 | 2 | -- | -- | Detect | 2 |

Notes:
1) All results in mg/kg
2) The borehole location at which the exceedance of the TRH criterion was detected was outside the project boundary being assessed in this ICR, and as such was not considered to indicate the presence of TRH contamination along the project alignment.



| LDBH117 | Depth (m bgs) | 0.5 |
| --- | --- | --- |
| | Criteria (mg/kg) | Concentration (mg/kg) |
| Chromium (III+VI) | 3600 | 4370 |

| LDBH118 | Depth (m bgs) | 0.3 |
| --- | --- | --- |
| | Criteria (mg/kg) | Concentration (mg/kg) |
| TRH (F2 Fraction) | 1000 | 1130 |

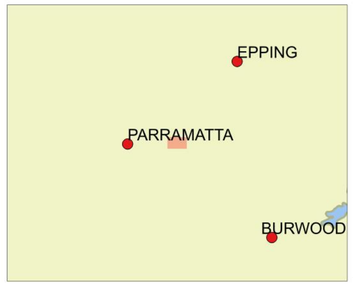
## Figure 6.4: Investigation Locations and Exceedances in Camellia

*TfNSW - PLR2 Interpretive Contamination Report*



**Legend**

Sample Locations
- Coffey (2019)
- WSP Golder (2022a)
- Asbestos Detection
- P/ASS Detection (< 3.0 m bgs)
- ICR Project Boundary
- EIS Project Site




DATA SOURCES
Coffey, 2019; WSP Golder, 2022a; TfNSW, 2023; Imagery: Nearmaps, 2023

SCALE 1:3,200
20 0 20 40 60 80 100 m

nation partners

### 6.2.2 Conceptual Site Model

Based on the nature and extent of contamination and construction works required, potential exposure pathways for construction workers along the Camellia section of the alignment were evaluated through the SPR linkage assessment presented in **Table 6.5**, and the corresponding CSM is presented in **Figure 6.5**.

The contaminant types and exceedances identified in **Table 6.4** suggest the nature and extent of contamination along this section of the alignment is limited to asbestos. However, in developing the CSM for this scenario a conservative approach was adopted, including:

- Allowance for the potential presence of other contaminant types, especially CrVI, given the well-established history of contamination in the area; and
- A final track design level that requires construction works to excavate below existing ground surface and into the existing capping system and/or fill material contaminated with asbestos and potentially CrVI.

**Table 6.5: SPR Assessment for Construction in Camellia**

| Environmental Media / Contaminant Type | Exposure Pathway | | Receptor | SPR Assessment |
|---|---|---|---|---|
| Fill / soil materials contaminated with loose asbestos fibres, ACMs, CrVI, petroleum hydrocarbons, PAHs, VCHs | • Dermal contact and incidental ingestion<br>• Inhalation of soil derived dust / fibres<br>• Inhalation of contaminant vapours outdoors and/or in an excavated trench | ☑ | Construction workers | • Available contamination data indicates the presence of asbestos in shallow soils likely to be excavated during construction.<br>• Whilst other contaminant types (CrVI, petroleum hydrocarbons, PAHs, VCHs) were not detected above the adopted land use criteria, given the well-established presence of contamination in Camellia, their presence cannot be discounted.<br>• Existing remediation infrastructure is present in the form of an engineered capping system installed to prevent exposure to asbestos that remains buried beneath the Sandown Line. |

Key:
☑ – Complete SPR linkage
☒ – Incomplete SPR linkage

### 6.2.3 Qualitative Risk Ranking

The qualitative risk ranking for construction along the Camellia section of the project alignment is presented in **Table 6.6**. The risk ranking determined was **High Risk**, based on the following likelihood and consequence ratings:

- Likelihood Rating: L2 – Based on the potential for construction workers to be exposed to asbestos, and potentially other contaminant types, in fill materials and/or soils during excavation and ground disturbance activities; and
- Consequence Rating: C3 – Based on:
  - Construction activities will impact existing remediation infrastructure (the engineered capping system along the Sandown Line);
  - Data indicates the widespread presence of contaminants (i.e. asbestos) at concentrations above the land use assessment criteria; and
  - The type of contaminants present (e.g. CrVI) requires specialist technical advice to characterise contaminant mobility and migration behaviour, and corresponding exposure pathways.

**Figure 6.5: Graphical CSM for Construction in Camellia**

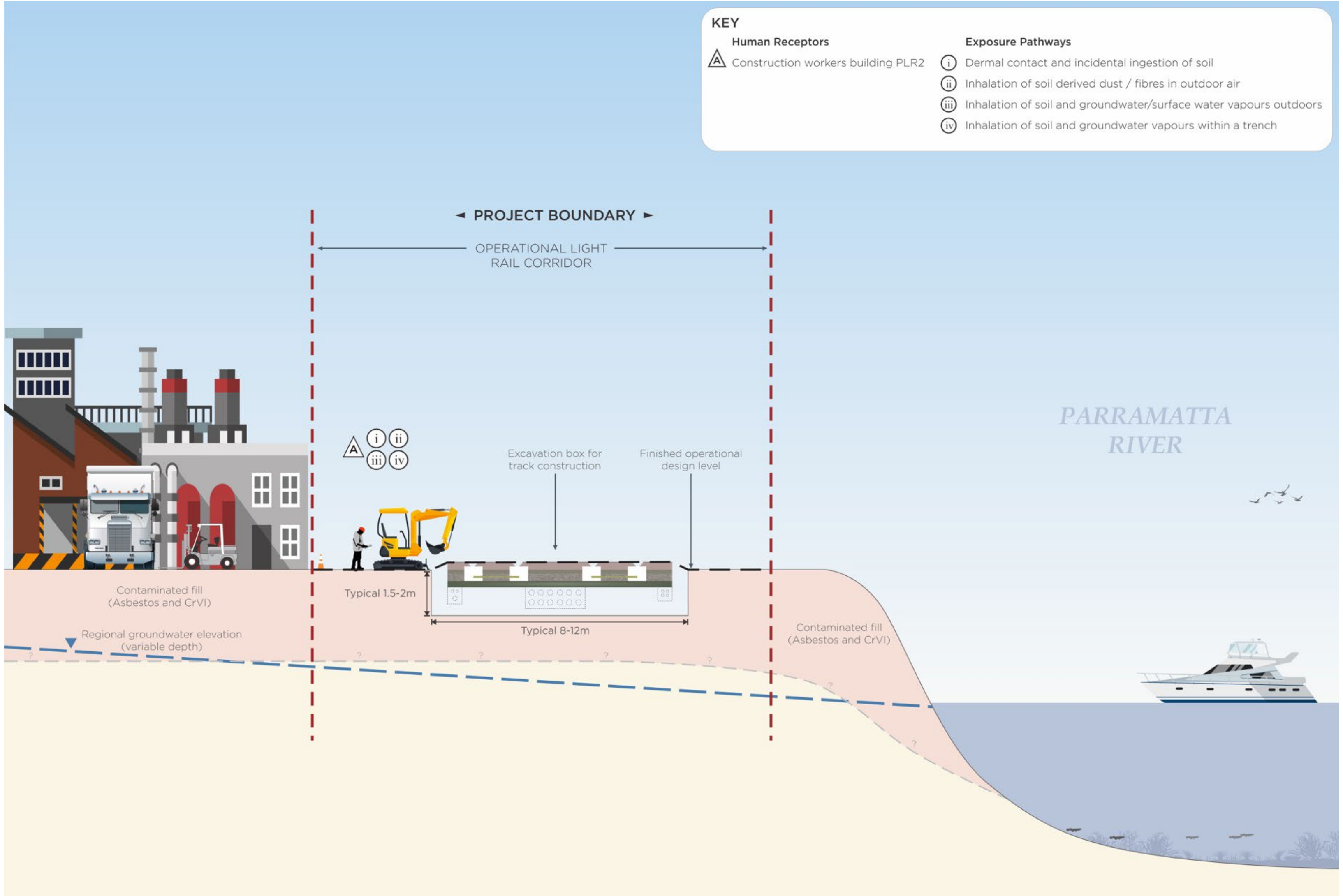


Table 6.6: Qualitative Risk Ranking for Construction in Camellia

| Hazard Identification | Risk Identification | Risk Analysis | | |
|---|---|---|---|---|
| | | Likelihood | Consequence | Risk Ranking |
| Fill / soil materials contaminated with loose asbestos fibres, ACMs, CrVI, petroleum hydrocarbons, PAHs, VCHs | • Dermal contact and incidental ingestion<br>• Inhalation of soil derived dust / fibres<br>• Inhalation of contaminant vapours outdoors and/or in an excavated trench | L2 | C3 | **High** |

### 6.2.4 Data Gaps

Based on the number of previous investigation locations (refer **Figure 6.4**) and generally well-established understanding of contaminant types and conditions present in Camellia, additional investigations to address data gaps in the nature and extent of contamination along the Camellia section of the alignment were not considered necessary. However, data gaps were identified based on their potential impacts to project delivery, including:

- Understanding the design, purpose, layout and extent of the existing capping system along the Sandown Line, and the corresponding magnitude and extent of interaction between the project's design and construction works on this existing remediation infrastructure; and
- Further development of the project's detailed design and construction methods will dictate the extent of excavation and ground disturbance activities required, which will in turn inform the scope and extent of further investigations needed to design appropriate health, safety and environmental management controls during construction, and remediation systems to be implemented to render the site suitable for its proposed use as a permanent light rail corridor. In other words, further investigations and data collection activities will be required to inform detailed design of both remediation and light rail infrastructure, however the nature, scope and extent of these investigations cannot be determined until the design and constructability of the light rail infrastructure is further progressed.

## 6.3 Parramatta River Crossings

### 6.3.1 Nature and Extent of Contamination

The nature and extent of contamination in soils and sediments that will be disturbed during construction of the two bridges over Parramatta River is characterised by:

- Heavy metals, TRH, and dioxins in sediments in Parramatta River;
- The presence of ACMs, including loose fibre bundles, in shallow soils at the bridge abutments on the north side of Parramatta River;
- P/ASS in sediments in Parramatta River and in shallow soils at the take-off and landing of both bridges; and
- PFAS in groundwater at the bridge abutment in Rydalmere.

Coffey (2019) reported the presence of heavy metals, TRH and dioxins in sediment samples collected from Parramatta River, however their assessment was based on comparison of contaminant concentrations against sediment guideline values for the protection of aquatic ecosystems (ANZG, 2018). Comparison of the Coffey (2019) results against the criteria adopted in this ICR to assess potential risks to construction workers, who may be exposed to sediments excavated from Parramatta River as part of the project, did not identify any exceedances. Where criteria were not available, such as for dioxins, concentrations reported by Coffey (2019) and WSP Golder (2022a) were found to be generally in agreement with sediment data reported as part of the National Dioxins Program (DEH, 2004), and significantly lower than the threshold for dioxin contaminated waste defined in the *Chemical Control Order in Relation to Dioxin-Contaminated Waste Materials* (NSW EPA, 1986).

**Figure 6.6** shows the locations where soil and sediment samples exceeded the adopted land use criteria.

### 6.3.2 Conceptual Site Model

Based on the anticipated construction methods to be adopted for the bridges, which were adopted to minimise the extent of ground and sediment disturbance required and are not anticipated to require dewatering or extraction of contaminated groundwater, as described in **Section 4.2.1**, potential exposure pathways for construction workers are limited. However, due to the sensitivity of the environment in which construction will take place, potential impacts to the aquatic ecosystems within and along Parramatta River were considered in the CSM and in the SPR linkage assessment presented in **Table 6.7**.

**Table 6.7: SPR Assessment for Construction of Parramatta River Bridges**

| Environmental Media / Contaminant Type | Migration / Exposure Pathway | | Receptor | SPR Assessment |
|---|---|---|---|---|
| Fill material, shallow soils and sediments contaminated with heavy metals, TRH, dioxins and ACMs | • Dermal contact and incidental ingestion<br>• Inhalation of soil derived dust / fibres<br>• Inhalation of contaminant vapours outdoors and/or in an excavated trench | ☑ | Construction workers | • Available contamination data did not indicate the presence of chemical contaminants at concentrations that exceed the criteria adopted to assess potential risks to construction workers.<br>• ACMs were identified in shallow soils that may be disturbed as part of construction activities for the bridge abutments and/or construction compounds.<br>• The construction methods adopted, primarily comprising piling for temporary working platforms and for bridge foundations, limit the potential for construction workers to be exposed to, and the need to manage or dispose of, contaminated sediments. |
| Shallow soils and sediments contaminated with heavy metals, TRH, dioxins and P/ASS | • Migration / exacerbation of existing contamination | ☑ | Aquatic ecosystems of Parramatta River | • Whilst the proposed construction methods (piling) were adopted to minimise potential impacts on environmentally sensitive areas, potential exists for the works to adversely impact riparian vegetation and aquatic ecosystems of Parramatta River. |
| Groundwater contaminated with PFAS | • Dermal contact and incidental ingestion | ☒ | Construction workers | • The construction methods adopted, primarily comprising piling for temporary working platforms and for bridge foundations, limit the potential for construction workers to be exposed to, and the need to manage or dispose of, contaminated groundwater. |

Key:
☑ – Complete SPR linkage
☒ – Incomplete SPR linkage

### 6.3.3 Qualitative Risk Assessment

The qualitative risk ranking determined for the Parramatta River crossings was **Medium Risk**, as presented in **Table 6.8**, based on the following likelihood and consequence ratings:

- Likelihood Rating: L2 – Based on:
  - The potential for construction workers to be exposed to asbestos, and potentially other contaminant types, in fill materials and/or soils during excavation and ground disturbance activities; and
  - The potential for construction activities in Parramatta River to disturb and potentially exacerbate existing contamination; and
- Consequence Rating: C2 – Based on:
  - Data indicates the presence of contaminants (i.e. asbestos as loose fibre bundles) at concentrations above the land use assessment criteria; and
  - The required construction activities have the potential to adversely impact the aquatic ecosystems of Parramatta River outside the project boundary.

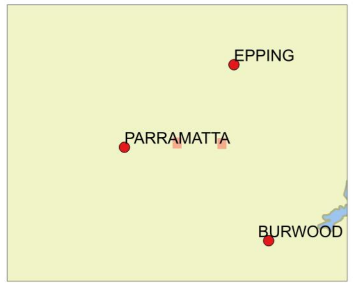
**Figure 6.6: Investigation Locations and Exceedances at Parramatta River Crossings**

*TfNSW - PLR2 Interpretive Contamination Report*

**Legend**

Sample Locations

- Coffey (2019)
- WSP Golder (2022a)
- Asbestos Detection
- P/ASS Detection (< 3.0 m bgs)
- ICR Project Boundary
- EIS Project Site




DATA SOURCES
Coffey, 2019; WSP Golder, 2022a; TfNSW, 2023; Imagery: Nearmaps, 2023

SCALE 1:3,000
20 0 20 40 60 80 m

nation partners

Table 6.8: Qualitative Risk Ranking for Construction of Parramatta River Bridges

| Hazard Identification | Risk Identification | Risk Analysis | | |
|---|---|---|---|---|
| | | Likelihood | Consequence | Risk Ranking |
| Fill material, shallow soils and sediments contaminated with heavy metals, TRH, dioxins, asbestos and P/ASS | • Dermal contact and incidental ingestion<br>• Inhalation of soil derived dust / fibres<br>• Inhalation of contaminant vapours outdoors and/or in an excavated trench<br>• Migration / exacerbation of existing contamination | L2 | C2 | **Medium** |

### 6.3.4 Data Gaps

Given the nature of planned construction activities, which were selected to minimise impacts to Parramatta River, further investigations to characterise the nature and extent of contamination in Parramatta River sediments are not considered necessary.

Potential impacts to the riparian vegetation and aquatic ecosystems of Parramatta River will be mitigated through media-specific management controls, such as the use of silt curtains during piling works and the implementation of a P/ASS management plan, irrespective of the type and level of contamination present. Additional data may be needed to inform the measures and controls defined in the P/ASS management plan, however the type and need for such data will be dependent upon the final track alignment and construction methods adopted.

## 6.4 North of Parramatta River

### 6.4.1 Nature and Extent of Contamination

The project alignment north of Parramatta River is generally characterised by low-density residential properties and public open space areas through Rydalmere and Ermington, before reaching former light industrial area of Melrose Park. Available contamination data along this section of the alignment did not identify the presence of any chemical contaminants above the adopted land use criteria. ACMs were occasionally detected in shallow soils along this section of the alignment, and P/ASS above the action criteria for coarse textured soils (ASSMAC, 1998) was identified at 2.0 m bgs in one location in Ken Newman Park, Ermington. **Figure 6.7** shows the location of asbestos and P/ASS detections along the section of the alignment north of Parramatta River.

Contamination conditions specific to this section of the alignment that were considered as potential contamination sources to be evaluated in the assessment of SPR linkages and development of the CSM included:

- The potential for groundwater interaction in the proposed cutting at Ken Newman Park, Ermington; and
- Contamination and associated remediation works that, based on current aerial photographs, appear to be underway at the Melrose Park North precinct proposed for residential and mixed-use redevelopment (refer **Section 5.2.3**).

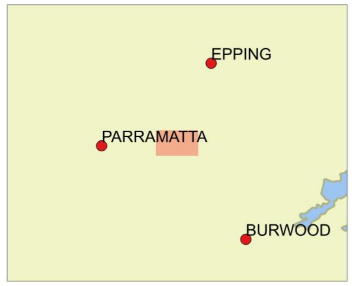
**Figure 6.7: Investigation Locations and Exceedances North of Parramatta River**

*TfNSW - PLR2 Interpretive Contamination Report*



**Legend**

Sample Locations
- Coffey (2019)
- WSP Golder (2022a)
- Asbestos Detection
- P/ASS Detection (< 3.0 m bgs)
- ICR Project Boundary
- EIS Project Site




DATA SOURCES
Coffey, 2019; WSP Golder, 2022a; TfNSW, 2023; Imagery: Nearmaps, 2023

SCALE 1:7,000
50 0 50 100 150 200 m

Groundwater levels reported by WSP Golder (2022c) in the vicinity of the proposed cutting at Ken Newman Park, Ermington indicate that local groundwater is likely to be intercepted. While groundwater interaction may occur in this cutting, groundwater was not considered an environmental media of concern with respect to contamination for the following reasons:

- The absence of potential sources of groundwater contamination in the vicinity of the cutting, which is characterised by low-density residential properties; and
- Groundwater data for monitoring well BH145, which did not contain contaminant concentrations above the human health criteria for recreational exposure to water, which would be considered a conservative application of criteria for construction workers exposed to groundwater.

Whilst the project alignment will run adjacent to the Melrose Park North redevelopment, the potential for contamination at this site to act as a source of contamination that would impact the construction and operation of the project was considered low based on:

- The location, type and depth of contamination present at the Melrose Park North site, where the closest area requiring groundwater remediation was located approximately 300 m from the project alignment (Senversa, 2015);
- The extent and depth of ground disturbance activities required to construct PLR2, which would be limited to the width and depth of the track slab excavation box; and
- The anticipated requirement for completion of a site audit in accordance with the CLM Act for the redevelopment, which would require potential pathways for off-site migration of contaminants to be mitigated.

### 6.4.2 Conceptual Site Model

As the majority of the track alignment north of Parramatta River will be constructed on existing roads or public open space areas, the contamination conditions and construction works required for this section of the alignment are identical to the typical scenario presented in **Section 6.1.1**. As a result the SPR linkage assessment and CSM presented in **Table 6.1** and **Figure 6.2**, respectively, was considered applicable to the section of the alignment north of Parramatta River.

### 6.4.3 Qualitative Risk Ranking

The qualitative risk ranking determined for the typical construction stage scenario in **Section 6.1.3**, and applicable to the section of the alignment north of Parramatta River, was **Low Risk**. Whilst contamination in the form of ACMs were identified in archaeological investigations at Broadoaks Park, Rydalmere and Ken Newman Park, Ermington within this section of the alignment, the consequence rating of C1 and corresponding risk ranking (Low Risk) determined for the typical construction stage scenario was considered applicable for the type and extent of asbestos identified (ACMs at intermittent locations, refer **Section 5.1.6**), in accordance with the risk assessment methodology detailed in **Section 2.1.2**.

The sample location that recorded the presence of P/ASS in Ken Newman Park was located below the proposed bridge that traverses the drainage gully that runs north-south through the park. Given this location and the proposed bridge, P/ASS may be encountered when constructing foundations to support the bridge. The presence of P/ASS in this location was not considered to present a significant impact or risk to delivery of the project given the ready availability of construction industry standards and guidelines for managing P/ASS during construction works.

### 6.4.4 Data Gaps

Given the nature of planned construction activities, further investigations to characterise the nature and extent of contamination in the alignment north of the Parramatta River are not considered necessary.

# 6.5 Wentworth Point and Sydney Olympic Park

## 6.5.1 Nature and Extent of Contamination

Contamination conditions along the section of the project alignment that runs from Wentworth Point through Sydney Olympic Park are characterised by:

- Organic (TRH) and inorganic (cyanide) contamination identified in boreholes at the northern end of Wentworth Point where the bridge crossing Parramatta River lands;
- The presence of P/ASS generally at depths starting at 3.0 m bgs and greater in Wentworth Point;
- The presence of ACMs in shallow soils along Hill Road in Sydney Olympic Park;
- The presence of several remediated landfills and associated infrastructure that are managed by SOPA and subject to Maintenance of Remediation Notice 28040, located within and adjacent to the project boundary (refer **Figure 5.3**); and
- The potential presence of landfill gas from these landfills.

Contamination and P/ASS was not identified in any investigation locations between Haslams Creek and the end of the project alignment in Lidcombe.

**Table 6.9** presents the contaminant types that returned results above the applicable land use criteria from the contamination data available from the Coffey (2019) and WSP Golder (2022a) investigations, and **Figure** 6.8 shows the locations where soil samples exceeded the adopted land use criteria.

**Table 6.9: Contaminant Exceedances in Wentworth Point and Sydney Olympic Park (Golder, 2019; WSP Golder, 2022a)**

| Analyte | Results | Detects | Minimum Concentration | Maximum Concentration | Criterion | Exceedances |
|---|---|---|---|---|---|---|
| Cyanide | 174 | 7 | < LOR | 14,400 | 1,500 | 2 |
| TRH (F2 Fraction) | 207 | 7 | < LOR | 2,400 | 1,000 | 3 |
| TRH (F3 Fraction) | 210 | 35 | < LOR | 8,290 | 3,500 | 2 |
| Asbestos | 23 | 1 | -- | -- | Detect | 1 |

Notes:
1) All results in mg/kg

## 6.5.1 Conceptual Site Model

As shown in **Figure 6.8**, the project alignment crosses the footprint of the Woo-La-Ra Landfill before running adjacent to it along Hill Road in Wentworth Point. The required interaction with existing landfills and associated leachate management infrastructure, and the presence of contamination identified in other locations, informed the SPR linkage assessment presented in **Table 6.10**. Graphical CSMs were developed for two locations where the project alignment is scheduled to traverse the existing Woo-La-Ra Landfill, as shown in **Figure 6.9**, and where it runs alongside the landfill, shown in **Figure 6.10**. The graphical CSMs show the interaction between the construction activities required and the landfills and associated remediation infrastructure.

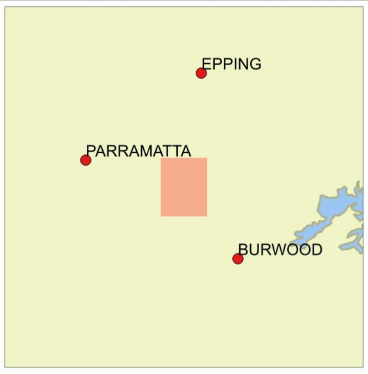

**Figure 6.8: Investigation Locations and Exceedances at Wentworth Point and Sydney Olympic Park**

*TfNSW - PLR2 Interpretive Contamination Report*

**Legend**

Sample Locations

- Coffey (2019)
- WSP Golder (2022a)
- Asbestos Detection
- P/ASS Detection (< 3.0 m bgs)
- ICR Project Boundary
- EIS Project Boundary




DATA SOURCES
Coffey, 2019; WSP Golder, 2022a; TfNSW, 2023; Imagery: Nearmaps, 2023

SCALE 1:10,500
100 0 100 200 300 m

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**Table 6.10: SPR Assessment for Construction in Wentworth Point and Sydney Olympic Park**

| Environmental Media / Contaminant Type | Exposure Pathway | | Receptor | SPR Assessment |
|---|---|---|---|---|
| Fill / soil materials contaminated with TRH, cyanide, ACMs and P/ASS<br>Landfill gas associated with adjacent and intersecting landfills | • Dermal contact and incidental ingestion<br>• Inhalation of soil derived dust / fibres<br>• Inhalation of contaminant vapours outdoors and/or in an excavated trench | ☑ | Construction workers | • Available contamination data indicates the presence of TRH, cyanide and ACMs in shallow soils likely to be excavated during construction.<br>• Existing remediation infrastructure is present in the form of landfill capping systems and associated landfill leachate management systems for remediated landfills in Wentworth Point and Sydney Olympic Park. The project alignment crosses these remediated landfills and infrastructure in some locations, meaning construction works will impact such infrastructure. |

Key:
☑ – Complete SPR linkage
☒ – Incomplete SPR linkage

Based on the absence of contamination or P/ASS detected at investigation locations for the section of the alignment along Dawn Fraser Avenue in Sydney Olympic Park to Lidcombe, the SPR linkage assessment undertaken for the typical construction scenario and presented in **Table 6.1** was considered applicable.

### 6.5.2 Qualitative Risk Ranking

The qualitative risk ranking for construction in the Wentworth Point and Sydney Olympic Park section of the project alignment is presented in **Table 6.11**. The risk ranking determined was **High Risk**, based on the following likelihood and consequence ratings:

- Likelihood Rating: L3 – Based on the fact that construction workers are likely to be exposed to contamination and asbestos in fill materials and/or soils during excavation and ground disturbance activities; and
- Consequence Rating: C3 – Based on:
  - Construction activities will take place on and adjacent to lands currently subject to regulation by NSW EPA under Maintenance of Remediation Notice 28040;
  - Construction activities will impact existing remediation infrastructure (capping and leachate management infrastructure at Woo-La-Ra Landfill and other remediated landfills);
  - Data indicates the presence of contaminants (i.e. cyanide, TRH, asbestos) at concentrations above the land use assessment criteria; and
  - Specialist technical inputs are required to understand contaminant mobility and migration behaviour, and corresponding exposure pathways.

A qualitative risk ranking of **Low Risk** was assigned to the section of the alignment from the intersection of Australia Avenue and Dawn Fraser Avenue in Sydney Olympic Park, to the project terminus in Lidcombe, in accordance with the risk analysis for the typical construction scenario presented in **Table 6.3**.

**Table 6.11: Qualitative Risk Ranking for Construction in Wentworth Point and Sydney Olympic Park**

| Hazard Identification | Risk Identification | Risk Analysis | | |
|---|---|---|---|---|
| | | Likelihood | Consequence | Risk Ranking |
| Fill / soil materials contaminated with TRH, cyanide, ACMs and P/ASS<br>Landfill gas associated with adjacent and intersecting landfills | • Dermal contact and incidental ingestion<br>• Inhalation of soil derived dust / fibres<br>• Inhalation of contaminant vapours outdoors and/or in an excavated trench | L3 | C3 | **High** |

**Figure 6.9:** **Graphical CSM for Construction of Light Rail above Woo-La-Ra Landfill**

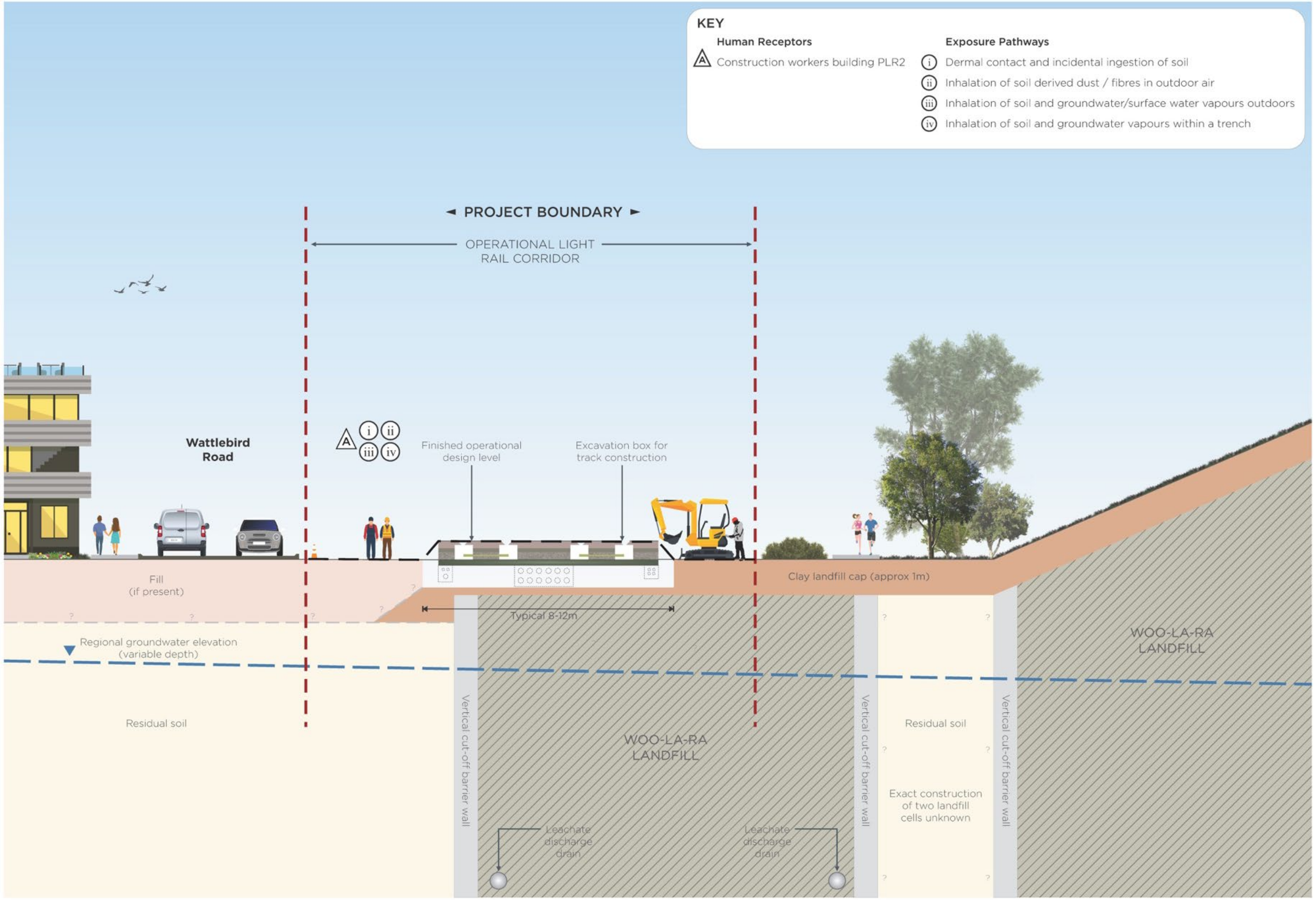
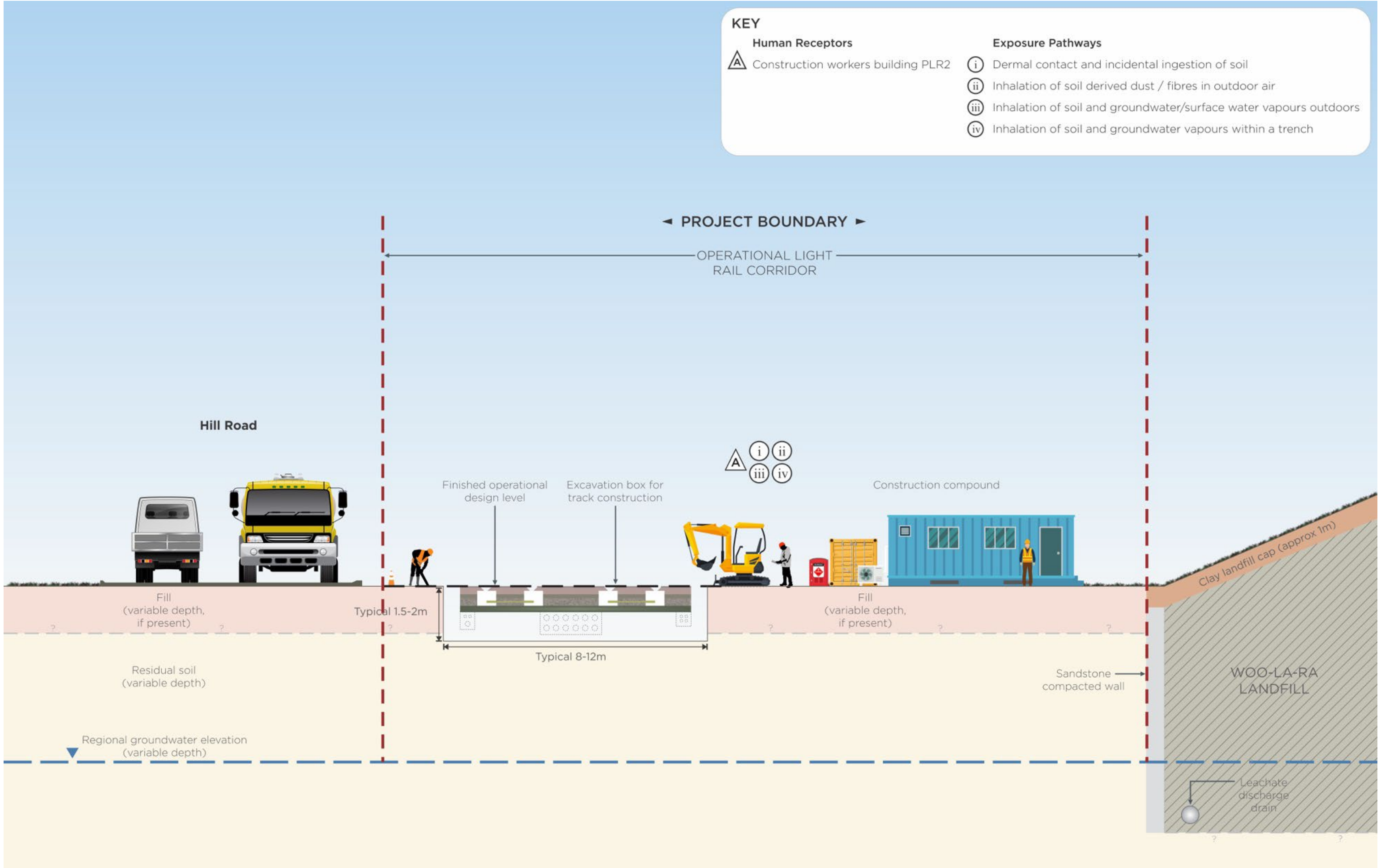


**Figure 6.10: Graphical CSM for Construction along Hill Road adjacent to Woo-La-Ra Landfill**



### 6.5.3 Data Gaps

**Figure 6.8** indicates boreholes in the north of Wentworth Point, where the bridge between Melrose Park and Wentworth Point lands, recorded concentrations of TRH and cyanide above the adopted land use criteria. Given these exceedances and the history of the adjacent Woo-La-Ra Landfill, where tarry waste from the former Wilson Park gasworks was buried (SOPA, 2009), additional investigations are needed to further characterise the extent of contamination in this area. The scope and extent of the additional data required (e.g. location and depth of additional data collection) should be developed in parallel with the detailed design for the track alignment to ensure representative data is collected for areas and media that will be disturbed during construction. This data would be used to inform remediation and/or management measures required to mitigate potential risks to receptors during construction and/or operation of the project.

Data gaps were also identified for potential impacts to project delivery in a similar manner to those identified for the Camellia section of the alignment. These data gaps include:

- The requirement to understand the precise location, layout, design purpose, and functioning of the remediated landfills and their associated leachate management infrastructure managed by SOPA in order to assess where and how the project will interact with existing infrastructure; and
- The need for additional data to inform remediation design and construction methods will be dependent upon the project's detailed design development. As the project's design and construction methods are refined, the scope and extent of additional data required will be determined.

## 6.6 Delivery Phase Implications

The qualitative risk rankings determined for the project alignment, shown spatially in **Figure 6.11**, allow commensurate responses and mitigation measures to be identified and inform potential implications on project delivery. In addition, as described in **Section 2.1.2**, potential impacts and risks to project delivery from spoil generation and management, including waste classification for spoil requiring off-site disposal, were also recognised and are discussed here.

As identified in the description of data gaps for the typical construction scenario (refer **Section 6.1.4**) and individual sections of the project alignment, the progression of detailed design for the track alignment (e.g. design elevation, location and footprint) and construction methods (e.g. piers, foundations) will dictate the vertical and lateral extent of ground disturbance, and corresponding quantity of potentially contaminated spoil, required. Minor adjustments in the design elevation for the track can have a major effect on the volume of spoil generated, which can in turn have significant implications on project delivery in terms of time, cost, and space requirements, material re-use opportunities, and waste classification requirements.

An integrated and iterative process of targeted investigations (where additional data is needed) and design development would accommodate and mitigate these potential impacts as the project's design progresses. Targeted investigations in areas where extensive ground excavation and disturbance is required can inform further design development, potentially allowing for minor design changes that may significantly reduce the likelihood for exposure to contamination and/or reduce spoil management requirements. Adoption and implementation of an iterative process of targeted contamination investigations and design development, including documenting the outcomes in the project's design report, will demonstrate how potential impacts from contamination on project delivery have been minimised.

In a similar manner, adoption and implementation of a spoil management and waste classification protocol in accordance with relevant guidelines and specific to the project's activities, alignment and contamination conditions, will further mitigate potential cost and time risks to project delivery arising from uncertainties or data gaps for waste classification. In particular, a project-specific waste classification protocol would provide a clear, transparent process for classifying waste in accordance with NSW EPA guidelines and specific to the nature and type of spoil material to be generated during the project, whilst ensuring relevant classifications have been considered and adopted. **Figure 6.12** presents an example waste classification protocol that could be defined and implemented to mitigate potential impacts to project delivery.

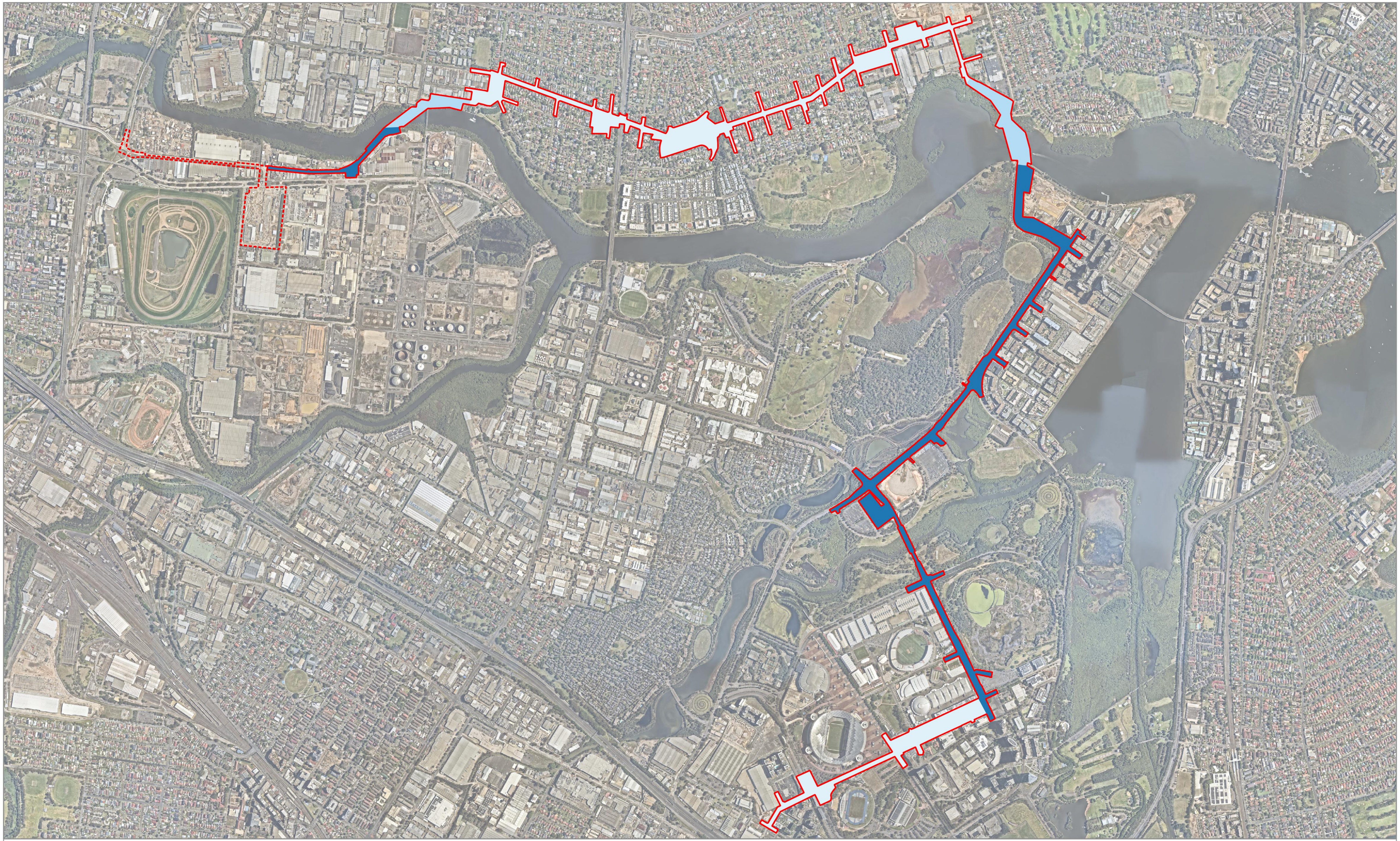
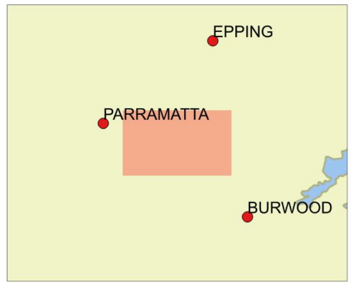


**Figure 6.11: Qualitative Risk Rankings for Contamination Impacts Along Project Alignment**

*TfNSW - PLR2 Interpretive Contamination Report*

**Legend**

- High Risk
- Medium Risk
- Low Risk
- ICR Project Boundary
- EIS Project Site




DATA SOURCES
TfNSW, 2023; Imagery: Nearmaps, 2023

SCALE 1:18,000
100 0 100 200 300 400 500 m

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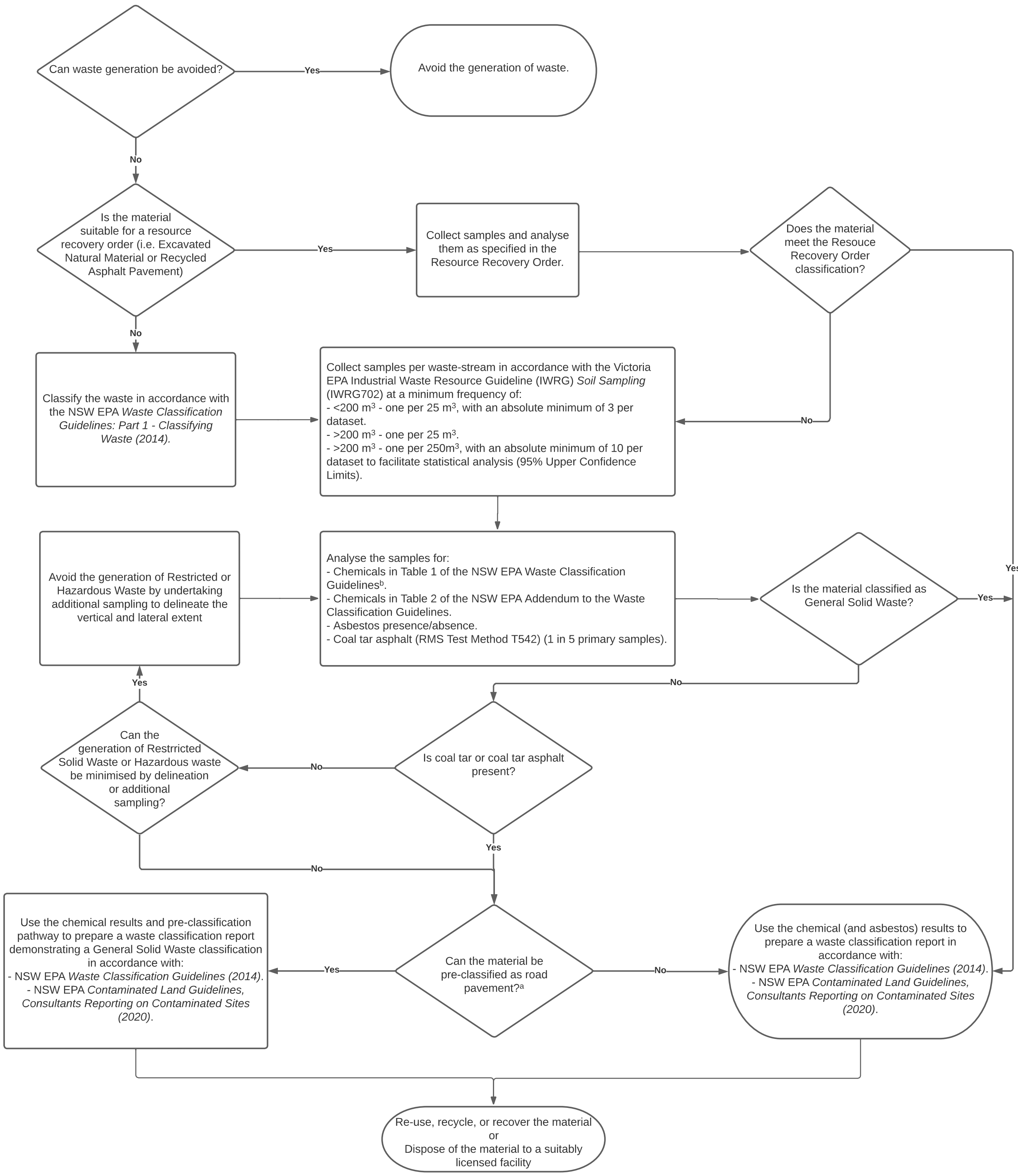
**Figure 6.12: Example Spoil Assessment and Waste Classification Protocol**




CT - Contaminant Threshold
ENM - Excavated Natural Material
SCC - Specific Contaminant Concentration
TCLP - Toxicity Characteristics Leaching Procedure
VENM - Virgin Excavated Natural Material

a - refer to RMS Technical Direction Environment No. 21, NSW EPA reclaimed asphalt exemption and order 2014, and RMS Technical Guide, Management of Road Construction and Maintenance Wastes.
b - If concentrations exceed the CT1 criteria for General Solid Waste, undertake TCLP analysis of representative samples and consider the Table 2 TCLP1 and SCC1 criteria.

**Table 6.12** presents proposed mitigation measures according to the qualitative risk rankings and corresponding sections of the alignment, noting that these measures are intended to be additive in nature (i.e. mitigation measures for Low Risk areas are intended to apply to the entire project alignment). These mitigation measures were identified using the base set of mitigation measures described in **Table 2.4** as a starting point and revised according to the contamination conditions or activities specific to individual areas.

**Table 6.12: Mitigation Measures and Delivery Phase Implications**

| Qualitative Risk Ranking | Applicable Scenarios / Sections | Mitigation Measures and Delivery Phase Implications |
|---|---|---|
| Low | • Entire project alignment<br>• Typical construction stage scenario applicable to section north of Parramatta River, and between Dawn Fraser Avenue and Lidcombe | Management of potential impacts and risks from contamination during construction through:<br>• During detailed design development, establishment and implementation of an iterative process of reviewing available data and undertaking targeted contaminated investigations (where further data is required) to inform further design development, including documenting the outcomes in the project's design report, to minimise and mitigate potential impacts from contamination on project delivery;<br>• Implementation of standard construction safety and environmental management measures and controls defined in a CEMP for the project, including design and application of a monitoring and reporting regime by an independent Environmental Representative (ER) (or similar) to monitor compliance;<br>• Design and application of an UFP as part of the CEMP that considers the potential to encounter unexpected contamination during construction; and<br>• Development and application of a project-specific spoil management framework and waste classification protocol for the management of potentially contaminated spoil. |
| Medium | • Construction works for bridges crossing Parramatta River | Potential impacts and risks from the construction of bridges crossing Parramatta River will need to be mitigated through adoption of the mitigation measures for Low Risk sites, plus:<br>• Development and application of management measures and controls to minimise impacts from construction activities and sediment disturbance on water quality and aquatic ecosystems in Parramatta River, to be documented in a soil and water management plan (or similar activity or media-specific plan) as part of the project's CEMP, including a review, monitoring and compliance reporting regime to be undertaken by an independent ER (or similar); and<br>• Implementation of physical controls such as sediment curtains for all works in, and adjacent to, Parramatta River, to mitigate potential impacts from construction activities on vegetation and aquatic ecosystems in Parramatta River. |
| High | Construction and operation of the project in:<br>• Camellia; and<br>• Wentworth Point to Dawn Fraser Avenue in Sydney Olympic Park. | Potential impacts and risks from contamination and/or existing remediation infrastructure in Camellia and in Wentworth Point and Sydney Olympic Park will need to be mitigated through:<br>• Completion of targeted investigations and data collection activities to inform the design of an appropriate remediation system (i.e. remediation design investigations) that integrates with the construction, infrastructure and operational requirements for the project;<br>• Development and implementation of a RAP that facilitates the safe implementation of the remediation system, including:<br>– For Camellia, consultation and engagement with appropriate personnel within TfNSW regarding the design, purpose and existing remediation infrastructure along the Sandown Line; and<br>– At Wentworth Point and Sydney Olympic Park, consultation and engagement with SOPA and NSW EPA during development of the RAP to ensure the project's design and construction activities allow SOPA to meet its environmental commitments and policies and continue to adhere to Maintenance of Remediation Notice 28040;<br>• Engagement of a NSW EPA-accredited Site Auditor at the planning stage of the remediation design investigations to undertake a site audit in accordance with the requirements of the CLM Act, concluding with the issue of an SAS and accompanying SAR declaring the area suitable for the proposed land use; and<br>• Given that residual contamination and/or remediation infrastructure is likely to remain at Camellia and the Wentworth Point to Sydney Olympic Park sections of the alignment following completion of construction, implementation of a long-term environmental management plan, endorsed by the Site Auditor as part of the site audit process, to monitor and maintain the remediation system will be required during the operational stage of the project. |

# 7 Recommendations

Based on the evaluation, interpretation and analysis of contamination data along the project alignment, Nation Partners presents the following recommendations for further assessment, management and remediation measures to facilitate the construction and operation of the project:

- Undertake additional targeted contamination investigations to characterise the extent of contamination identified in boreholes in the north of Wentworth Point;
- Adopt the qualitative risk rankings for contamination shown in **Figure 6.11**, and corresponding mitigation measures identified in **Table 6.12**, to mitigate potential risks from contamination during project delivery;
- For pre-construction works and activities, the presence of, and potential for exposure to, contamination should be identified and controlled through the development and implementation of a health, safety and environmental management plan (HSEMP) or safe work method statement (SWMS) (or similar) specific to the location, activities and type of contamination present, including potential ACM and asbestos;
- As the project's detailed design progresses, implement an iterative process of reviewing available data and undertaking targeted contamination investigations (where further data is required) to inform further design development, and document the outcomes in the project's design report, to minimise and mitigate potential impacts from contamination on project delivery;
- Develop and implement a project-specific spoil management and waste classification protocol in accordance with NSW EPA guidelines and specific to the nature and type of spoil material to be generated during the project;
- For sections of the project alignment classified as high risk due to existing contamination conditions and remediation infrastructure, including Camellia and Wentworth Point to Dawn Fraser Avenue in Sydney Olympic Park (refer **Figure 6.11**):
  - As part of detailed design development, undertake targeted investigations and data collection activities as required to inform the design of an appropriate remediation system (i.e. remediation design investigations) that integrates with the construction, infrastructure and operational requirements for the project;
  - For Camellia, consult with relevant personnel within TfNSW to understand the design, purpose, layout and extent of the existing capping system along the Sandown Line to evaluate the magnitude and extent of interaction between the project's design and construction works on existing remediation infrastructure;
  - For Wentworth Point and Sydney Olympic Park, consult with SOPA to understand the precise location, layout, design purpose, and functioning of the remediated landfills and their associated leachate management infrastructure in order to assess where and how the project will interact with existing infrastructure; and
  - For both high risk sections, develop and implement a RAP in consultation with relevant stakeholders, including NSW EPA and a NSW EPA-accredited Site Auditor, and in accordance with the site audit process defined in the CLM Act.

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