Appendix B7

Contaminated Land Management Sub-plan

Warringah Freeway Upgrade

August 2023

WHTBLWFU-CPBD-NWW-CT-PLN-000009-3

NSW GOVERNMENT

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Contents

Document control

Approval and authorisation

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3	25 August 2023	Update to include additional construction support site WFU10	

Distribution of controlled copies

This CLMP, as part of the CEMP, is available to all personnel and sub-contractors via the Project document control management system. An electronic copy can be found on the Project website.

The document is uncontrolled when printed. One controlled hard copy of the CLMP as part of the CEMP and supporting documentation will be maintained by the Quality Manager at the Project office.

Copy number	Issued to	Version
1	TfNSW	Rev 2
2	DPE	Rev 2

Glossary/ Abbreviations

Abbreviations	Expanded text
ACM	Asbestos Containing Material
CEMP	Construction Environmental Management Plan
CLM Act	*Contaminated Land Management Act 1997* (NSW)
Construction Site	As defined in the Project Deed: a) *The land and other places described in the Site Access Schedule, including the Works Site, Temporary Areas and those Local Areas shown in the Site Access Schedule as forming part of the Construction Site; and* b) *Any other land and places made available to the Contractor by the principal for the purpose of this deed.*
DPE	Department of Planning and Environment
EIS	Environmental Impact Statement
EPA	NSW Environment Protection Authority
Extra Land	As defined in the Project Deed, land or buildings in addition to the Construction Site which are procured by the Contractor for the purpose of carrying out the Contractor's Activities.
MCoA	NSW Minister's Conditions of Approval
PAH	Polycyclic aromatic hydrocarbons
POEO Act	*Protection of the Environment Operations Act 1997*
PCB	Polychlorinated biphenyls
Project, the	Warringah Freeway Upgrade
RAP	Remediation Action Plan
REMM	Revised Environmental Management Measure
Roads and Maritime	Roads and Maritime Services
RtS	Western Harbour Tunnel and Warringah Freeway Upgrade Response to Submissions Report (dated September 2020)
TfNSW	Transport for NSW
VENM	Virgin Excavated Natural Material

1. Introduction

1.1 Context

This Contaminated Land Management Sub-plan (CLMP or Sub-plan) forms part of the Construction Environmental Management Plan (CEMP) for the Warringah Freeway Upgrade (the Project), a component of the Western Harbour Tunnel and Warringah Freeway Upgrade project.

This CLMP has been prepared to address the requirements of the Minister's Conditions of Approval (CoA) for the Western Harbour Tunnel and Warringah Freeway Upgrade project, the Western Harbour Tunnel and Warringah Freeway Upgrade Environmental Impact Statement dated January 2020 (the EIS), the Western Harbour Tunnel and Warringah Freeway Upgrade Response to Submissions report dated September 2020 (the RtS), the Western Harbour Tunnel and Warringah Freeway Upgrade Modification Report dated September 2022 (Modification 1), the Western Harbour Tunnel and Warringah Freeway Upgrade Modification – Wicks Road Construction Support Site Submissions Report dated May 2023 and applicable guidance and legislation.

This CLMP addresses the management of contaminated land applicable to Stage 2 of the Warringah Freeway Upgrade Project as detailed in the Staging Report – Western Harbour Tunnel and Warringah Freeway Upgrade (SSI 8863) – October 2021 Rev 1.

1.2 Background

The Western Harbour Tunnel and Warringah Freeway Upgrade project comprises a new motorway tunnel connection across Sydney Harbour and an upgrade of the Warringah Freeway to integrate the new motorway infrastructure with the existing road network and enable the future connection of the Beaches Link and Gore Hill Freeway Connection project.

The upgrade of Warringah Freeway extends from the northern end of the Sydney Harbour Bridge to Willoughby Road, and will optimise traffic flow, reduce the number of merge points and introduce a southbound bus lane. The upgrade will also improve Ridge Street and Ernest Street bridges.

The EIS for the Western Harbour Tunnel and Warringah Freeway Upgrade project was prepared and finalised in January 2020 to assess the construction and operational impacts. As part of the EIS development, predicted contamination was included in response to the Secretary's Environmental Assessment Requirements (SEARs) issued by the then Department of Planning and Environment.

The Western Harbour Tunnel and Warringah Freeway Upgrade Project was approved by the Minister for Planning and Public Spaces on 21 January 2021. Modification 1 (Transport for NSW, 2022) was approved by the Minister for Planning and Public Spaces on 8 August 2023.

The proponent, Transport for NSW (TfNSW), has contracted the CPB Contractors and Downer Joint Venture (CPB Downer JV) for the design and construction of the Project.

A detailed description of the Project is provided in Section 1.3 of the CEMP.

1.3 Scope of the Sub-plan

This Sub-plan outlines the mitigation and management measures that will be implemented by the CPB Downer JV to address potential impacts arising from contaminated land management during design and construction of the Project.

This Sub-plan is applicable to all Project activities under the control of the CPB Downer JV, including all areas where physical works will occur or areas that may otherwise be impacted by the

construction works. All CPB Downer JV staff and sub-contractors are required to operate fully under the requirements of this Sub-plan and related environmental management plans, for the duration of the construction program.

This CLMP addresses the management of contaminated land applicable to Stage 2 of the Warringah Freeway Upgrade Project as detailed in the Staging Report – Western Harbour Tunnel and Warringah Freeway Upgrade (SSI 8863) – October 2021 Rev 1.

1.4 Environmental management system

This Sub-plan forms part of the CEMP which provides a structured and systematic approach to environmental management. The CEMP is based on the requirements of the CPB Contractors' Management System (CMS) and the requirements of the CSSI approval.

The CMS is certified to *AS/NZS SIO 14001:2015 Environmental Management Systems – requirements with guidance for use*. Additional details on the CEMP and Project environmental management system documents are provided in Section 1.5 of the CEMP.

Key interactions for this Sub-plan with other elements of the CEMP include:

- **Waste and Resource Management Sub-plan** – details requirements for hazardous materials assessments.
- **Soil and Water Management Sub-plan** – defines the erosion and sediment controls required to be established around stockpiles.

2. Purpose and objectives

1.5 Purpose

The purpose of this CLMP is to describe how the CPB Downer JV will identify and manage contaminated land if encountered during construction of the Project.

1.6 Objectives

The key objective of the CLMP is to ensure all MCoA, Revised Environmental Management Measures (REMMs), licence/permit requirements and contract requirements relevant to contaminated land are described, scheduled and assigned responsibility as outlined in:

- The EIS and Modification 1 prepared for Western Harbour Tunnel and Warringah Freeway Upgrade
- The RtS and Mod 1 Submissions Report prepared for Western Harbour Tunnel and Warringah Freeway Upgrade
- MCoA granted to the project on 21 January 2021
- TfNSW Specification D&C G36 Environmental Protection
- Relevant legislation and other requirements described in Section 3.1 of this CLMP.

1.7 Targets

The following targets have been established for the management of contaminated land during the project:

- Conduct site investigation, remediation and management works in full compliance with relevant legislative requirements, MCoA and REMMs
- Develop and implement adequate controls to minimise or avoid impacts from contaminated land
- Undertake remediation works as necessary to appropriately mitigate potential health, safety and environmental risks and achieve land use standards specified in the Project Deed.

3. Environmental requirements

1.8 Relevant legislation and guidelines

1.8.1 Legislation

Legislation relevant to the management of contaminated land include:

- *Contaminated Land Management Act 1997* (CLM Act)
- *Environmental Planning and Assessment Act 1979* (EP&A Act)
- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Protection of the Environment Operations (Waste) Regulation 2014*
- *Work Health and Safety Act 2011*
- *Work Health and Safety Regulation 2011.*

Relevant provisions of the above legislation are detailed in the Legal Requirements and Compliance Tracking Register (Appendix A1 of the CEMP).

1.8.2 Guidelines and standards

The main guidelines, specifications and policy documents relevant to this Sub-plan include:

- National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC, 2013)
- Waste Classification Guidelines – Part 1: Classifying waste (EPA, 2014)
- Transport for NSW (TfNSW) Specification D&C G36 Environmental Protection (G36)
- Guideline for the Management of Contamination (Roads and Maritime, September 2013)
- TfNSW Technical Guide “Management of road construction and maintenance wastes” (TfNSW Technical Guide)
- Technical Direction: Legal offsite disposal of Roads and Maritime Services Waste (Roads and Maritime 2015)
- Technical Direction: Coal tar asphalt handling and disposal (Roads and Maritime 2015)
- Stockpile Site Management Guideline (Roads and Maritime 2011)
- Environmental Incident Classification and Reporting (TfNSW, 2017)
- Contaminated Land Management – Guidelines for the NSW Site Auditor Scheme (3rd edition) (EPA, 2017)
- State Environmental Planning Policy 55 – Remediation of Land (SEPP 55)
- Managing Land Contamination: Planning Guidelines, SEPP 55 – Remediation of Land (Department of Urban Affairs and Planning and Environment Protection Authority, 1998)
- Contaminated Land Guidelines - Consultants reporting on contaminated land (NSW EPA, 2020)
- Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997 (Office of Environment and Heritage, 2015).
- NSW Government Code of Practice – How to Safely Remove Asbestos, July 2020.

1.9 Minister's Conditions of Approval

The MCoA relevant to this Sub-plan are listed in **Table 3-1**. A cross reference is also included to indicate where the condition is addressed in this Sub-plan or other project management documents.

Table 3-1 Minister's Conditions of Approval relevant to the CLMP

CoA No.	Condition Requirements	Reference	How Addressed
Contaminated Sites			
E115	Prior to the commencement of any work that would result in the disturbance of moderate to high risk contaminated sites as identified in the documented listed in Condition A1, a Detailed Site Investigations must be undertaken by a Contaminated Land Consultant certified under either the Environment Institute of Australia or New Zealand's "Certified Environmental Practitioner" (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia "Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme.	Section 4.2 Section 6.1.1	The process by which moderate and high risk contaminated sites will be investigated is detailed in Section 6.1.1 of this Sub-plan. Detailed Site Investigations of the moderate and high risk contaminated sites identified in the EIS will be undertaken by a certified Contaminated Land Consultant.

CoA No.	Condition Requirements	Reference	How Addressed
E116	A Detailed Site Investigation Report must be prepared and submitted to the Planning Secretary for information following the completion of Detailed Site Investigations required by Condition E115. The report must be prepared in accordance with relevant guidelines made or approved by the EPA under section 105 of the Contaminated Land Management Act 1997 (NSW) and prepared by a Contaminated Land Consultant certified under either the Environment Institute of Australia or New Zealand's "Certified Environmental Practitioner" (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia "Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme. Nothing in this condition prevents the Proponent from preparing individual Site Contamination Reports for separate sites.	Section 6.1.1	The process by which moderate and high risk contaminated sites will be investigated is detailed in Section 6.1.1 of this Sub-plan. Detailed Site Investigation Reports will be prepared by a certified Contaminated Land Consultant in accordance with compliance obligations and submitted to the Planning Secretary for information.

CoA No.	Condition Requirements	Reference	How Addressed
E117	The **Detailed Site Investigation Report** must provide details on: a) primary sources of contamination, for example potentially contaminating activities, infrastructure (such as underground storage tanks, fuel line, sumps or sewer lines) or site practices; b) contaminant dispersal in air, hazardous ground gases, surface water, groundwater, soil vapour, separate phase contaminants, sediments, infrastructure (e.g. concrete), biota, soil and dust; c) contaminant characterisation and behaviour (volatility, leachability, speciation, degradation products and physical and chemical conditions on-site which may affect how contaminants behave); d) potential effects of contaminants on human health, including the health of occupants of built structures (for example arising from risks to service lines from hydrocarbons in groundwater, or risks to concrete from acid sulphate soils) and the environment; e) potential and actual contaminant migration routes including potential preferential pathways; f) the adequacy and completeness of all information available for use in the assessment of risk and for making decisions on management requirements, including an assessment of uncertainty; g) the review and update of the conceptual site model from the preliminary and detailed site investigations; h) nature and extent of any existing remediation (such as impervious surface cappings); and/or; i) whether the land is suitable (for the intended final land use) or can be made suitable through remediation.	Section 6.1.1	The process by which moderate and high risk contaminated sites will be investigated is detailed in Section 6.1.1 of this Sub-plan. The requirements of this condition are detailed in full in Section 6.1.1 and compliance will be demonstrated by the Detailed Site Investigation Reports that are submitted to the Planning Secretary.

CoA No.	Condition Requirements	Reference	How Addressed
E117A	Disturbance to the existing landfill through the site establishment and operation of the proposed Wicks Road Construction Support Site (Mod 1), as described in Condition A1, is prohibited unless a site auditor agrees to any disturbance.	Section 1.22	Any disturbance below surface level to be undertaken in accordance with the Landfill Gas Management Plan (Appendix C)
E118	Should remediation be required to make land suitable for the final intended land use, a **Remediation Action Plan** must be prepared or reviewed and approved, by consultants certified under either the Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme. The **Remedial Action Plan** must be prepared in accordance with relevant guidelines made or approved by the EPA under section 105 of the *Contaminated Land Management Act 1997* and must include measures to remediate the contamination at the site to ensure the site will be suitable for the proposed use when the **Remedial Action Plan** is implemented. The **Remedial Action Plan** must be submitted to the Planning Secretary for information prior to undertaking remediation.	Section 6.1.3	A Remediation Action Plan (RAP) will be prepared where remediation is required to make land suitable for the final intended land use. As detailed in Section 6.1.3 of this Sub-plan, each RAP will be prepared by a certified Contaminated Land Consultant in accordance with the requirements of this condition and submitted to the Planning Secretary for information prior to undertaking remediation.

CoA No.	Condition Requirements	Reference	How Addressed
E119	The **Remediation Action Plan** must include measures to remediate the contamination at the site to ensure the site will be suitable for the proposed use and detail how the environmental and human health risks will be managed during the disturbance, remediation and/or removal of contaminated soil/sediment or groundwater. Nothing in this condition prevents the preparation of individual **Remediation Action Plans** for separate sites.	Section 6.1.3	As detailed in Section 6.1.3 of the Sub-plan, each RAP will include measures to remediate contamination and ensure the site will be suitable for the proposed use. The RAP will also detail how the environmental and human health risks will be managed during the disturbance, remediation and/or removal of contaminated soil/sediment or groundwater.
E120	Prior to commencing remediation, a **Section B Site Audit Statement(s)** must be prepared by a NSW EPA-accredited Site Auditor that certifies that the **Remediation Action Plan** is appropriate and that the site can be made suitable for the proposed use. The **Remedial Action Plan** must be implemented and any changes to the **Remedial Action Plan** must be approved in writing by the NSW EPA accredited Site Auditor. Nothing in this condition prevents the Proponent from engaging the Site Auditor to prepare Site Audit Statements for separate sites.	Section 6.1.4	The process by which Site Audit Statements will be prepared and implemented is detailed in Section 6.1.4 of this Sub-plan. A Section B Site Audit Statement(s) will be prepared by a NSW EPA-accredited Site Auditor to certify in writing that the RAP is appropriate and that the site can be made suitable for the proposed use. The CPB Downer JV will then implement the RAP and ensure any changes are approved in writing by the Site Auditor.

CoA No.	Condition Requirements	Reference	How Addressed
E121	A **Section A1** or **A2 Site Audit Statement** (accompanied by an Environmental Management Plan) and its accompanying **Site Audit Report**, which state that the contaminated land disturbed by the work has been made suitable for the intended land use, must be submitted to the Planning Secretary and Council after remediation and no later than prior to the commencement of operation of the CSSI. Nothing in this condition prevents the Proponent from obtaining Section A Site Audit Statements for individual parcels of remediated land.	Section 6.1.4	The process by which Site Audit Statements will be prepared and implemented is detailed in Section 6.1.4 of this Sub-plan. A Section A1 or A2 Site Audit Statement (accompanied by an Environmental Management Plan) and its accompanying Site Audit Report will be submitted to the Planning Secretary and Council after remediation and no later than prior to the commencement of operation of the CSSI.
E122	Contaminated land must not be used for the purpose approved under the terms of this approval until a **Section A1** or **A2 Site Audit Statement** is obtained which states that the land is suitable for that purpose and any conditions on the **Section A Site Audit Statement** have been complied with.	Section 6.1.4	The process by which Site Audit Statements will be prepared and implemented is detailed in Section 6.1.4 of this Sub-plan. Contaminated land will not be used for the approved purpose until a Site Audit Statement is obtained and compliance can be demonstrated against any conditions.

CoA No.	Condition Requirements	Reference	How Addressed
E123	An **Unexpected Finds Procedure for Contamination** must be prepared before the commencement of work and must be followed should unexpected contamination or asbestos (or suspected contamination) be excavated or otherwise discovered. The procedure must include details of who will be responsible for implementing the unexpected finds procedure and the roles and responsibilities of all parties involved. The procedure must be submitted to the Planning Secretary for information.	Section 6.2 **Table 6-1** **Appendix A**	An Unexpected Finds Procedure for Contamination and Asbestos is included in **Appendix A** of this Sub-plan and referenced in Section 6.2 and **Table 6-1** (CL05). The procedure addresses the requirements of this condition and will be submitted to the Planning Secretary for information.
E124	The **Unexpected Finds Procedure for Contamination** must be implemented throughout construction.	Section 6.2 **Table 6-1** **Appendix A**	A Contamination Register will be maintained by the CPB Downer JV to demonstrate compliance against the requirements of the Unexpected Finds Procedure for Contamination and Asbestos (**Appendix A** of this Sub-plan).

1.11 Revised Environmental Management Measures

Relevant REMMs are listed in **Table 3-2**, including a cross reference to indicate where the commitment is addressed in this Sub-plan or other project management documents.

Table 3-2 Revised Environmental Management Measures relevant to the CLMP

Ref #	Commitment	Reference	How Addressed
SG6	Potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 2008*. This includes, but is not limited to, further investigations in potential areas of environment interest in the project footprint, including: • Easton Park • Birchgrove peninsula (including Yurulbin Park) • Balls Head peninsula • Waverton Park • **Warringah Freeway (from North Sydney to Cammeray)** • **WFU10 (Wicks Road construction support site).** Subject to the outcomes of the investigations, a Remediation Action Plan will be implemented in the event that site remediation is warranted. The Remediation Action Plan will be prepared and implemented in accordance with Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land (Department of Urban Affairs and Planning and EPA, 1998). An independent NSW EPA Accredited site Auditor will be engaged where contamination is complex to review applicable contamination reports and evaluate the suitability of sites for a specified use as part of the project.	Section 6.1.1 Section 6.1.3 Section 6.1.4	The process by which potentially contaminated areas directly affected by the Project will be investigated and managed is detailed in Section 6.1.2 and Section 6.1.2 of this Sub-plan. Subject to the outcomes of the Detailed Site Investigations of the Warringah Freeway (from North Sydney to Cammeray), a RAP will be prepared where remediation is required to make the land suitable for the final intended land use (Section 6.1.4). A Section A1 or A2 Site Audit Statement (accompanied by an Environmental Management Plan) and its accompanying Site Audit Report will be submitted to the Planning Secretary and Council after remediation and no later than prior to the commencement of operation of the CSSI (Section 6.1.5).

Ref #	Commitment	Reference	How Addressed
SG8	Asbestos handling and management will be carried out in accordance with relevant legislation, codes of practice and Australian standards.	Section 6.4	In accordance with relevant legislation, codes of practice and Australian standards, asbestos handling and management controls are detailed in Section 6.4 of this Sub-plan. Implementation of the controls will be evidenced by environmental inspections, audits and disposal receipts.
SG9	A hazardous materials assessment will be carried out prior to and during the demolition of buildings. Demolition works will be carried out in accordance with the relevant Australian Standards and relevant NSW WorkCover Codes of Practice, including the NSW Work Health and Safety Regulation 2011.	Waste and Resource Management Sub-plan (Table 5-2 and Table 7-1)	The requirements of this REMM are addressed in the Waste and Resource Management Sub-plan (Table 5-2 and Table 7-1).
SG10	The Construction Waste Management Plan for the project will include procedures for handling and storing potentially contaminated substances.	Waste and Resource Management Sub-plan (Section 5.3, Table 5-2 and Table 7-1)	The requirements of this REMM are addressed in the Waste and Resource Management Sub-plan (Section 5.3, Table 5-2 and Table 7-1).
SG11	The discovery of previously unidentified contaminated material will be managed in accordance with an unexpected contaminated lands discovery procedure, as outlined in the Guideline for the Management of Contamination (Roads and Maritime, 2013).	Section 6.2 **Table 6-1** **Appendix A**	An Unexpected Finds Procedure for Contamination and Asbestos is included in **Appendix A** and referenced in Section 6.2 and **Table 6-1** (CL05) of this Sub-plan. The procedure was prepared in accordance with the Guideline for the Management of Contamination (Roads and Maritime, 2013) and will be implemented for the duration of the Project.

4. Existing Environment

This section describes the existing environment of the Project, specific to contaminated land. It also summaries contaminated land investigations undertaken to date and outlines further investigation required.

1.12 Land contamination

As part of the EIS, several sources were referenced, and investigations were carried out to determine the potential for land contamination within and adjacent to the project alignment. The sources and investigations included:

- **Historic and current aerial photographs:** the review identified potential contamination associated with the inappropriate handling and disposal of building materials during demolition of buildings for construction of the Warringah Freeway. In addition, particulate matter deposition from vehicles using the Warringah Freeway is a potential source of surficial contamination.
- **NSW EPA Contaminated Sites Register and Record of Notices:** an online search was conducted of the NSW EPA Contaminated Sites Record of Notices and the list of contaminated sites notified to the NSW EPA. The search identified two sites (Caltex service station at 16-38 Military Road, Neutral Bay and Shell service station at 200-204 Ben Boyd Road, Neutral Bay) registered with the NSW EPA within 500 metres of the project that are either regulated (current notices) or have been notified. Contamination exposure risk from the regulated/notified sites was assessed as low due to the relatively large distances from the project and the likely extent of contamination.
- **Yellow Pages business directory search:** the Yellow Pages business directory search identified nine sites within or adjacent to the project alignment whose activities may cause contamination. These sites are located in Warringah Freeway Upgrade (three) and North Sydney (six), and include service stations, paint manufacturers, vehicle mechanics and dry cleaners.
- **Contaminated site investigations:** Soil samples were obtained and analysed for common contaminants including heavy metals, polycyclic aromatic hydrocarbons (PAH), total recoverable hydrocarbons, benzene, toluene, ethylbenzene and xylene, organochlorine pesticides, and organophosphorus pesticides. Selected samples were additionally analysed for phenols, volatile and semi volatile organic compounds, cyanide, polychlorinated biphenyls (PCB) and asbestos. The results of the analysis were compared against guidelines for the protection of ecological and human (investigation and screening levels) receptors under open space and commercial/industrial land usage. The investigations identified exceedances of the human health guidelines for PAH in near surface soils in North Sydney.

In addition to the above and specifically in relation to Modification 1 the sources and investigations included:

- A review of the geological context, soil landscapes, salinity and acid sulfate soils
- A review of the following sources to determine the potential for land contamination within and adjacent to WFU10 included:
    - NSW Environment Protection Authority (EPA) Contaminated Sites Register and Record of Notices
    - iEnvironmental Australia, 2022. Macquarie Park NSW – Prelease Contamination Assessment. 160 Wicks Road, Macquarie Park, NSW 2113. Prepared for City of Ryde

- A review of the existing Site Environmental Management Plan – Porters Creek Depot (City of Ryde, 2021)

1.13 Potential Areas of Environmental Interest

Reflecting the outcomes of the above investigations, the EIS identified 10 potential areas of contamination, or Areas of Environmental Interest (AEI), with moderate to high exposure risk rankings within the Project alignment (**Table 4-1** and **Figure 4-1 and Figure 4-2**). The AEIs are predominately within the unsealed areas adjacent to the Warringah Freeway and are associated with the current and historical deposition of particulates from large volume traffic flows using the Warringah Freeway. Potential contaminants include heavy metals (mainly lead), hydrocarbons (mainly PAH) and asbestos.

Asbestos and PAH compounds have also been detected in soil samples collected from locations adjacent to Alfred Street, North Sydney (AEI reference W9). Concentrations exceeded the open space and commercial/industrial land use criteria contained within the National Environment Protection (Assessment of Site Contamination) Measure 1999 (2013).

The AEIs within the Project alignment pose a moderate to high contamination risk to construction and are located in areas of surface works, the pedestrian bridge and the following construction support sites:

- Cammeray Golf Course (WHT10 and WFU8)
- High Street south (WFU2)
- High Street north (WFU3)
- Arthur Street east (WFU4)
- Berry Street east (WFU5)
- Ridge Street east (WFU6)
- Merlin Street (WFU7)
- Rosalind Street east (WFU9).

In addition to the above, Modification 1 also concluded that the Wicks Road Construction Support Site (WFU10) would pose a high risk of contamination.

The process by which moderate and high risk AEIs will be investigated is detailed in Section 6 of this Sub-plan.

Table 4-1 Potential Areas of Environmental Interest

AEI No.	Site	Construction works	Potential contaminates and distribution	Risk ranking
W9	Unsealed areas next to Warringah Freeway – Alfred Street, North Sydney	Blue Street construction support site (WFU1) and surface work	• Heavy metals (mainly lead), hydrocarbons (mainly PAH), asbestos • Surface impacts (potentially 0 to 0.1 m)	High – known contamination
W10	Unsealed areas next to Warringah Freeway – High Street, North Sydney	High Street north construction support site (WFU3) and surface work	• Heavy metals (mainly lead), hydrocarbons (mainly PAH), asbestos • Surface impacts (potentially 0 to 0.1 m)	Moderate – possible contamination
W11	Unsealed areas next to Warringah Freeway – eastern side (between Arthur Street and Warringah Freeway), North Sydney	Arthur Street east construction support site (WFU4) and surface work	• Heavy metals (mainly lead), hydrocarbons (mainly PAH), asbestos • Surface impacts (potentially 0 to 0.1 m)	Moderate – possible contamination
W12	Unsealed areas next to Warringah Freeway – western side (between Mount Street and Ridge Street), North Sydney	Ridge Street east construction support site (WFU6) and surface work	• Heavy metals (mainly lead), hydrocarbons (mainly PAH), asbestos • Surface impacts (potentially 0 to 0.1 m)	Moderate – possible contamination
W13	Unsealed areas next to Warringah Freeway – eastern side (between Berry Street and Ridge Street), North Sydney	Berry Street east (WFU5) and Cammeray Golf Course (WFU8) construction support sites and surface work	• Heavy metals (mainly lead), hydrocarbons (mainly PAH), asbestos • Surface impacts (potentially 0 to 0.1 m)	(WFU5) Moderate – possible contamination (WFU8) Moderate - known contamination

AEI No.	Site	Construction works	Potential contaminates and distribution	Risk ranking
W14	St Leonards Park bordering Warringah Freeway (between Ridge Street and Falcon Street), North Sydney	Ridge Street north construction support site (WFU9) and surface work	• Heavy metals, hydrocarbons, pesticides, PCB, nutrients, cyanide, VOC, asbestos, PFAS • Surface impacts (potentially 0 to 2 m)	Moderate – possible contamination
W15	Unsealed areas next to Warringah Freeway – western side (between Merlin Street and Warringah Freeway), Neutral Bay	Merlin Street construction support site (WFU7) and surface work	• Heavy metals (mainly lead), hydrocarbons (mainly PAH), asbestos • Surface impacts (potentially 0 to 0.1m)	Moderate – possible contamination
W16	Unsealed areas next to Warringah Freeway – western side (between Ernest Street and Falcon Street), North Sydney	Surface work	• Heavy metals (mainly lead), hydrocarbons (mainly PAH), asbestos • Surface impacts (potentially 0 to 0.1m)	Moderate – possible contamination
W17	Unsealed areas next to Warringah Freeway – eastern side (between Ernest Street and Falcon Street), Cammeray	Surface work	• Heavy metals (mainly lead), hydrocarbons (mainly PAH), asbestos • Surface impacts (potentially 0 to 0.1m)	Moderate – possible contamination
W18	Unsealed areas next to Warringah Freeway – Ernest Street to Miller Street, Crows Nest	Blue Street construction support site (WFU1) and surface work	• Heavy metals (mainly lead), hydrocarbons (mainly PAH), asbestos • Surface impacts (potentially 0 to 0.1m)	High – known contamination
-	Wicks Road Construction Support Site – surface areas	Wicks Road Construction Support Site (WFU10)	• Heavy metals, hydrocarbons (mainly PAH) • Surface impacts (potentially 0.1m)	High – known contamination

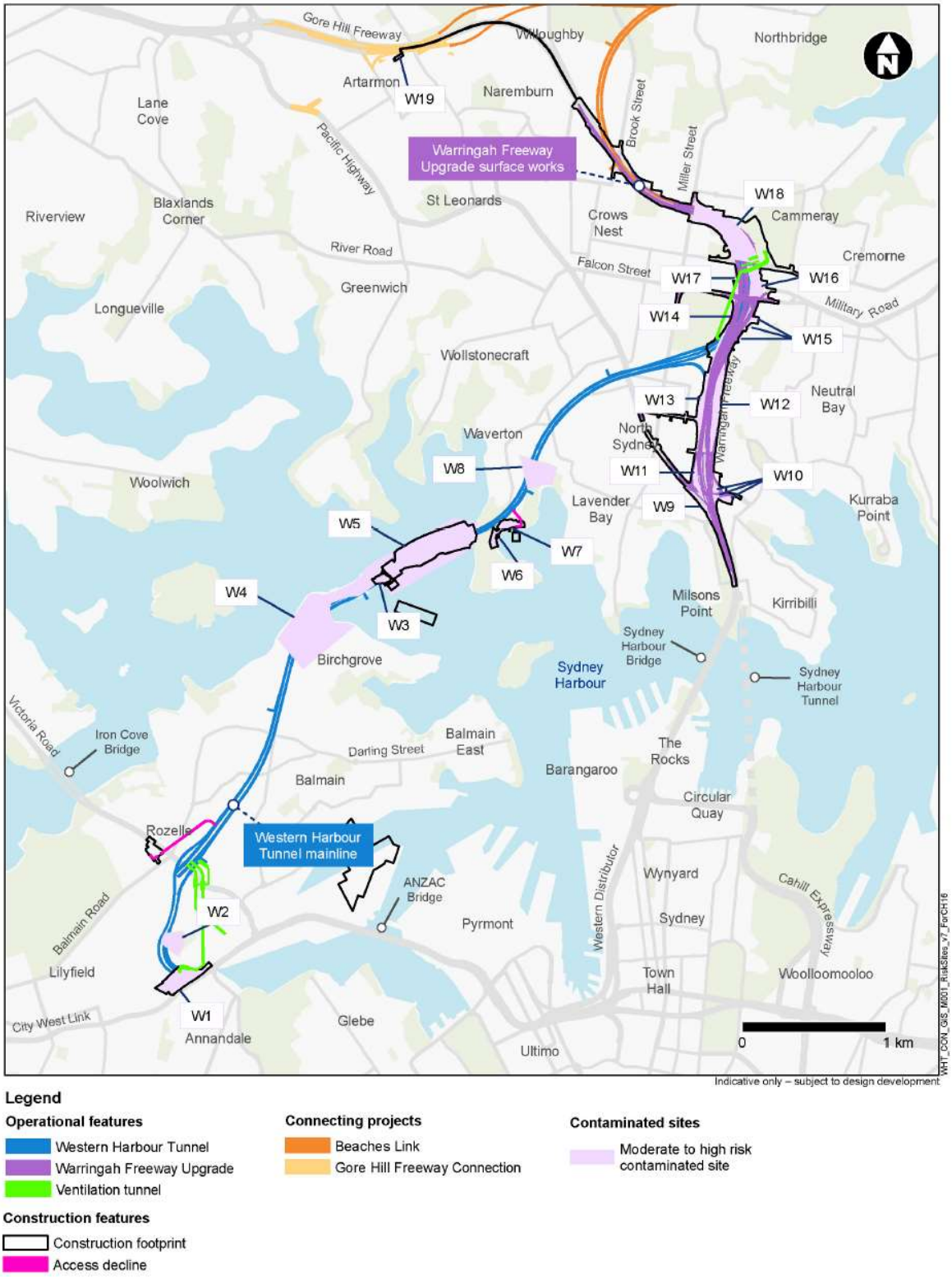


Figure 4-1 Areas of environmental interest (moderate to high exposure risk rankings) map 1

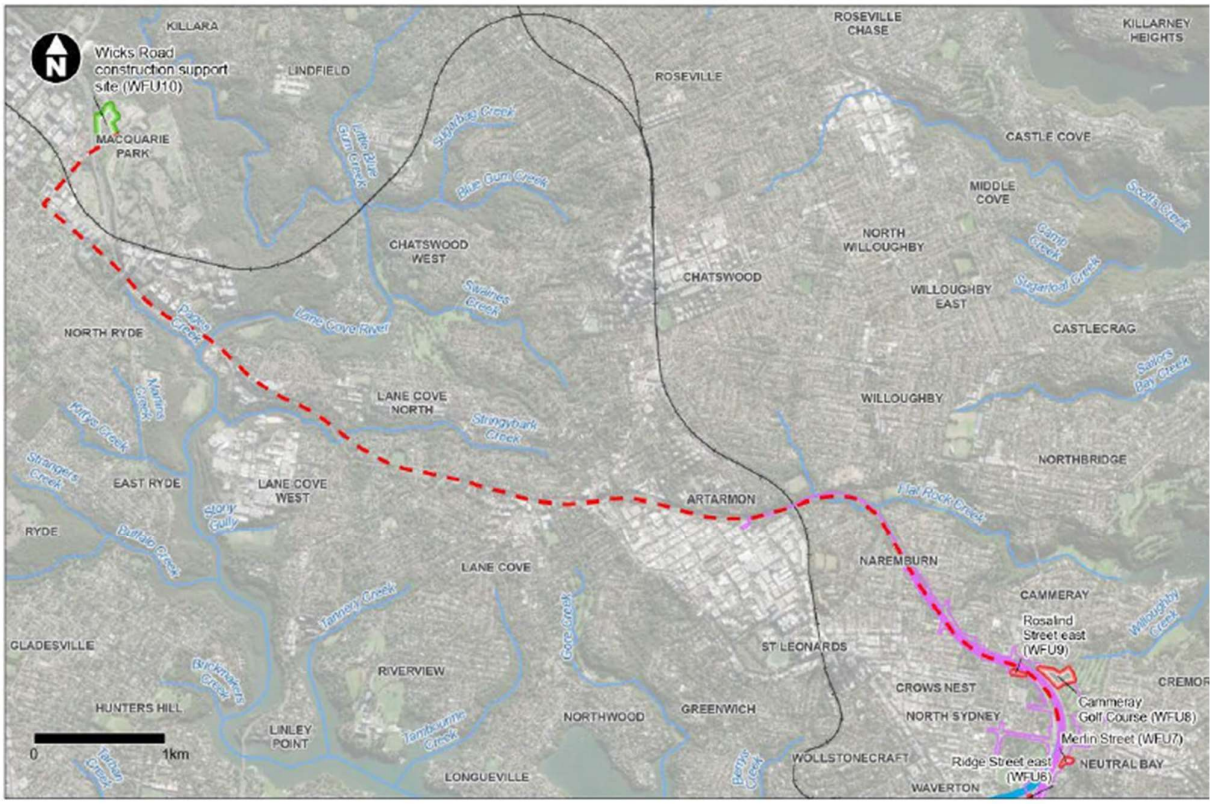


Figure 4-2 **Areas of environmental interest (moderate to high exposure risk rankings) map 2**

5. Environmental aspects and impacts

1.14 Construction aspects

Key aspects of the Project that could result in potential interaction with contaminated lands, and hazardous materials include:

- Early works and site establishment
  - Vegetation clearing, earthworks and demolition of structures
  - Utilities installation, protection, adjustment and relocation
  - Land remediation and heritage salvage and/or conservation works (where required)
  - Construction of minor access roads and the provision of property access including the temporary relocation of pedestrian and cycle paths and adjustments to existing intersections, where required
  - Establishment of construction support sites (including temporary site accesses) and acoustic sheds, where required.
- Surface road works
  - Earthworks

- Bridgeworks
- Construction of retaining walls
- Construction and installation of stormwater and cross drainage
- Pavement works
- Tolling gantries and associated infrastructure
- Installation of road furniture, lighting, signage and noise barriers.

- Subsurface works at WFU10
  - Utilities installation, protection, adjustment and relocation
  - Establishment of internal access roads
  - Establishment of erosion and sediment controls (eg sediment basins and wheel wash)
  - Footings and other excavations for establishment of noise barriers, site sheds or other installations.

Refer to Appendix A2 of the CEMP – Aspects and impacts register.

1.15 Impacts

The potential for contaminated land disturbance and impacts will depend on the nature, extent and magnitude of construction activities and their interaction with known and potential contaminated land sources. Potential impacts attributable to construction include:

- Inhalation and/or ingestion risk to site workers and nearby residents of hazardous building materials via dust
- Release of asbestos fibres during excavation
- Inhalation of vapours or hazardous ground gases noting the potential intersection with unknown historical landfill
- Dermal contact with contaminated materials during the course of general construction / excavation
- Cross contamination associated with the incorrect handling or disposal of spoil/unexpected finds
- mobilisation and spread buried contaminants during excavation
- Accidental leaks and spills
- Erosion and offsite transport of sediment and contamination, affecting the water quality of local waterways (including the Lane Cover River for Modification 1) entering Sydney Harbour

Relevant aspects and the potential for impacts have been considered in Appendix A2 of the CEMP. Section 6 details mitigation measures that will be implemented to avoid or minimise identified impacts.

1.15.1 Cumulative impacts

Potential cumulative impacts associated with the construction of the Project (being both Western Harbour Tunnel and Warringah Freeway Upgrade) were presented and assessed in Chapter 27 of the EIS. The assessment concluded that in all locations associated with the construction of the Project, cumulative impacts were expected to be negligible for contaminated land management issues.

6. Environmental control measures

1.16 Management of contaminated sites

1.16.1 Detailed site investigation

Where a site has been identified as moderate to high risk in the EIS or RtS a Detailed Site Investigation and subsequent Detailed Site Investigation Report will be undertaken by a Contaminated Land Consultant.

The investigation and report will be completed prior to the commencement of any work that would result in the disturbance of moderate to high risk contaminated sites.

Detailed Site Investigation Reports will be:

- Prepared by a Contaminated Land Consultant certified under either the Environment Institute of Australia or New Zealand's "Certified Environmental Practitioner" (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia "Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme
- Prepared in accordance with relevant guidelines made or approved by the EPA under section 105 of the *Contaminated Land Management Act 1997* (NSW)
- Submitted to TfNSW and the Planning Secretary for information on completion.

In accordance with MCoA E117, the Detailed Site Investigation Report will include:

a) Primary sources of contamination, for example potentially contaminating activities, infrastructure (such as underground storage tanks, fuel line, sumps or sewer lines) or site practices
b) Contaminant dispersal in air, hazardous ground gases, surface water, groundwater, soil vapour, separate phase contaminants, sediments, infrastructure (e.g. concrete), biota, soil and dust
c) Contaminant characterisation and behaviour (volatility, leachability, speciation, degradation products and physical and chemical conditions on-site which may affect how contaminants behave)
d) Potential effects of contaminants on human health, including the health of occupants of built structures (for example arising from risks to service lines from hydrocarbons in groundwater, or risks to concrete from acid sulphate soils) and the environment
e) Potential and actual contaminant migration routes including potential preferential pathways
f) The adequacy and completeness of all information available for use in the assessment of risk and for making decisions on management requirements, including an assessment of uncertainty
g) The review and update of the conceptual site model from the preliminary and detailed site investigations
h) Nature and extent of any existing remediation (such as impervious surface cappings)
i) Whether the land is suitable (for the intended final land use) or can be made suitable through remediation.

1.16.2 Duty to Notify

Reflecting the requirements of the CLM Act and the Duty to Report Guidelines, the Construction Environmental Manager will determine in consultation with the Contaminated Land Consultant if contamination requires reporting to the EPA. The reporting triggers, summarised in the *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (NSW EPA, 2015) generally include:

- The level of contamination exceeds or will foreseeably exceed the level described in the Duty to Report Guidelines for the current for approved use of the land
- The level of contamination meets a criterion prescribed by the regulations
- The contaminant has migrated or will foreseeably migrate from the Construction Site to adjoining property, the atmosphere, groundwater or surface water.

1.16.3 Remediation Action Plan

Should remediation be required to make land suitable for the final intended land use, a Remediation Action Plan (RAP) will be prepared or reviewed and approved, by consultants certified under either the Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme.

The RAP will be prepared in accordance with relevant guidelines made or approved by the EPA under section 105 of the CLM Act, including Managing Land Contamination: Planning Guidelines, SEPP 55 – Remediation of Land (Department of Urban Affairs and Planning and Environment Protection Authority, 1998) and include:

- A description of the land and the associated remediation standard applicable to that land (or to any part of that land)
- The remediation work to be carried out
- Measures to remediate the contamination at the site to ensure the site will be suitable for the proposed use
- Details on how the environmental and human health risks will be managed during the disturbance, remediation and/or removal of contaminated soil/sediment or groundwater
- Testing requirements for the classification of any contaminated material prior to its disposal
- A validation plan which includes the area in the immediate vicinity (below and adjacent) to the contamination
- The landform, including filling, drainage arrangements and revegetation proposed to be implemented (unless agree with TfNSW, the filling will be to the same level as the levels at the date of commencement of access to the land)
- Details of compaction of any area that has been filled.

Reflecting the requirements of the Project Deed, remediation will be limited to the Construction Site and Extra Land which is disturbed by or interfered with in the carrying out of the Project. The source of the contamination or wider mass will not be remediated where it extends outside of the footprint that is disturbed or interfered with by the CPB Downer JV.

Subject to the nature and extent of contamination and the construction program, individual RAPs may be prepared for separate sites.

The RAP will be approved by the Site Auditor and submitted to TfNSW and the Planning Secretary for information prior to undertaking remediation.

1.16.4 Site Audit Statement

Prior to commencing remediation, a Section B Site Audit Statement(s) will be prepared by a NSW EPA-accredited Site Auditor that certifies that the RAP is appropriate and that the site can be made suitable for the proposed use. The RAP will then be implemented and any changes to the Remedial Action Plan will be approved in writing by the NSW EPA accredited Site Auditor.

On completion of remediation, a Section A1 or A2 Site Audit Statement (accompanied by an Environmental Management Plan) and its accompanying Site Audit Report, which state that the

contaminated land disturbed by the work has been made suitable for the intended land use, will be submitted to the Planning Secretary and North Sydney Council. The Site Audit Statement will be completed prior to the commencement of operation of the Project.

Contaminated land will not be used for the purpose approved under the MCoA until a Section A1 or A2 Site Audit Statement is obtained which states that the land is suitable for that purpose and any conditions on the Section A Site Audit Statement have been complied with.

1.17 Unexpected Finds Procedure

The discovery of unexpected contamination will be managed in accordance with the Unexpected Finds Procedure for Contamination and Asbestos (**Appendix A**).

Prior to commencement of work, the Unexpected Finds Procedure for Contamination and Asbestos will be submitted to the Planning Secretary for information. The procedure will be implemented by the CPB Downer JV throughout construction.

1.18 Contamination Register

Where contamination is identified prior or during works, the area of land will be captured within the Contamination Register (**Appendix B**). In addition to detailing the proposed future land use of each area of land, the Contamination Register will reference assessments and investigations undertaken.

As detailed in the TfNSW specification G36, a Baseline Assessment will be undertaken for each area of land included on the Contamination Register, for the purposes of:

- Confirming the presence and delineation of known contamination
- Identifying and delineating any contamination that is not known contamination but of which the CPB Downer JV becomes aware
- Informing the review and implementation of this Sub-plan and remedial works (as detailed in a RAP).

The baseline assessment will involve an initial desk top review of potential / known contamination applicable to the location and where deemed necessary investigative sampling.

If additional land is placed under the control of the CPB Downer JV during delivery of the Project, that additional land will also be the subject of a Baseline Assessment.

The Construction Environmental Manager will maintain the Contamination Register and reflect new information as the Project progresses.

1.19 Asbestos management

The discovery of asbestos or Asbestos Containing Material (ACM) during demolition and construction activities will be strictly managed in accordance with the *Protection of the Environment Operations (Waste) Regulation 2014*, *Work Health and Safety Regulation 2011* and the requirements of this Sub-plan.

A licence is not required for the removal of asbestos products in the following circumstances:

- Non-Friable Asbestos – Removal of asbestos or ACM having a total surface area of less than 10 square meters
- Friable Asbestos – Collection of a sample for analysis.

Where licensed removal is required, the Asbestos Removal Contractor will remove ACM or asbestos impacted soils from the relevant site and provide on-site supervision and advice. Air monitoring may be undertaken during asbestos removal work where there is uncertainty as to whether the exposure standard may be exceeded.

The Asbestos Removal Contractor will also ensure that:

- Workers performing the removal works have the relevant asbestos removal licences in accordance with NSW Government Code of Practice – How to Safely Remove Asbestos, August 2019
- Safe Work Method Statements (SWMS) relating to activities of asbestos removal and disposal have been developed and implemented
- An asbestos removal permit has been obtained and the relevant authority notified
- Removal and disposal of ACM or asbestos impacted soils from the site is undertaken in accordance with relevant legislation
- Environmental and safety controls as outlined in this CLMP are maintained for the duration of the works
- A clearance certificate is completed following removal of asbestos, confirming no visible residual asbestos impacts
- Evidence of waste disposal is provided following the removal and disposal of ACM and/or asbestos to a licenced landfill facility.

Asbestos removal and disposal will be tracked in accordance with the requirements of the Waste and Resource Management Sub-plan. If unexpected asbestos is discovered during construction activities, refer to the Unexpected Finds Procedure for Contaminated Land and Asbestos (**Appendix A**).

1.20 Hazardous materials measures

Hazardous materials may be transported to and used on-site to facilitate construction. Hazardous material procedures (including procedures for managing spills and refuelling and maintaining construction vehicles/equipment) will be implemented to minimise potential for harm during works (refer to **Table 6-1**).

Hazardous substances will be stored and used on-site in secured containers in accordance with the manufacturer/supplier instructions. Storage and handling of flammable or combustible liquids will be in accordance with AS 1940-2017: The Storage and Handling of Flammable and Combustible Liquids. The use and storage of Hazardous Materials will also be consistent with the TfNSW Chemical Storage and Spill Response Guidelines - 9TP-SD-066.

A register of hazardous substances will be maintained at all times. The hazardous substances will be clearly labelled and will have Hazardous Chemicals and Safety Data Sheets (SDS) affixed or available nearby. The SDS will be used to determine compatibility of hazardous chemicals to be stored together, i.e. no flammables with corrosives, not all corrosives compatible with each other etc.

The use of hazardous substances that could result in a spill will be undertaken away from drainage or stormwater lines and, wherever possible, within defined bunds. A bund sized to 110% of the largest stored receptacle will be established around any storage area for hazardous substances.

Construction plant, vehicles and equipment will be refuelled off-site, or in designated re-fuelling areas located onsite. Pre-start checks and maintenance (in accordance with manufacturer's requirements) will be undertaken on all plant and equipment to minimise potential for leaks and spills from vehicles.

Emergency spill kits will be maintained on-site and all workers will undergo training on spill response (Section 7.2).

1.20.1 Hazardous building materials assessment

A hazardous building materials assessment will be undertaken prior to the demolition of any building on the Project by a licenced Asbestos Assessor / suitably qualified Environment Scientist. The assessment will include a review of relevant site information and a visual inspection of accessible areas and destructive sampling techniques where deemed necessary.

Any ground contamination found within the footprint of a removed building will be assessed under the Unexpected Finds Procedure for Contamination and Asbestos (Appendix A).

1.21 Environmental Work Method Statement

Prior to commencement of any work that would result in disturbance in the vicinity of contamination, an Environmental Work Method Statement (EWMS) will be prepared by the CPB Downer JV and approved by the TfNSW Environmental Manager. An exception is noted where works are necessary to prepare the EWMS.

As required by TfNSW specification G36 Section, the EWMS will include:

- the delineation and characterisation of the content of, nature of, extent of and risks presented by the contamination
- measures to ensure that the extent of, and risks posed by the contamination, are not exacerbated during the delivery of the Project
- the containment, remediation or removal of contamination (where necessary)
- the disposal of contaminants and contaminated materials (where necessary)
- control measures to ensure that surface runoff is diverted away from the contamination, and that any surface runoff which is contaminated through exposure is captured and properly treated prior to being reused on site or released to the environment
- precautions and actions to ensure the safety of persons working in the vicinity of the contamination
- the regular monitoring of the contamination and of the implementation of the EWMS
- the regular reporting of monitoring result to the TfNSW Environmental Manager
- the retention of records relating to the contamination and implementation of the EWMS
- the validation and certification of compliance with and the completion of work in accordance with the Work Method Statement
- measures to ensure that no work will be undertaken in the vicinity of the contamination pending the implementation of the EWMS.

The EWMS will also specifically reference the relevant CoA, REMM's and management and mitigation measures (Table 6.1).

1.22 Management and mitigation measures

Specific management and mitigation measures to meet the objectives of this CLMP and address relevant MCoA, REMMs and Project Deed requirements are outlined in **Table 6-1**.

Table 6-1 Management and Mitigation Measures

ID	Measure/Requirement	Resources Needed	Evidence	When to implement	Responsibility	Reference
Contamination						
CL01	Sites with a medium to high risk of contamination are not to be disturbed until a Detailed Site Investigation is completed	Contaminated Land Consultant	Detailed Site Investigation Report	Pre-construction	Construction Environmental Manager	MCoA E115
CL01A	Any disturbance at the Wicks Rd construction support site (WFU10) below ground surface level with potential to impact landfill material must not be undertaken unless agreed by a Site Auditor	Contaminated Land Consultant Accredited Site Auditor Detailed Site Investigation Report	Written advice of Site Auditor	Pre-construction Construction	Construction Environmental Manager Construction Manager	MCoA E117A
CL01B	Implement the Wicks Rd Landfill Gas Management Plan (Appendix C)	Landfill Gas Management Plan	Environmental Inspections	Pre-construction Construction	Construction Environmental Manager	Wicks Rd DSI MCoA E117A

ID	Measure/Requirement	Resources Needed	Evidence	When to implement	Responsibility	Reference
CL02	An EWMS will be prepared by the CPB Downer JV and approved by the TfNSW Environmental Manager prior to commencement of any work that would result in the disturbance in the vicinity of contamination (except to the extent that those works are necessary to prepare the EWMS). Refer to Section 6.6 of this Sub-plan for further details.	Contaminated Land Consultant	EWMS	Pre-construction	Construction Environmental Manager	G36 (Section 4.2.6)
CL03	Suspected or identified contamination will be characterised with consideration of the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC, 2013). Where there is a need for remediation, works will be performed in accordance with the hierarchy of preferred strategies in the Guidelines for the NSW Site Auditor Scheme (DECCW 2006).	Contaminated Land Consultant	Preliminary Site Investigation Detailed Site Investigation RAP	Construction	Construction Environmental Manager	G36 (Section 4.2.2)
CL04	Where practicable, remediation works will be integrated with excavation and development works performed during construction.	Contaminated Land Consultant	RAP	Construction	Construction Environmental Manager Construction Manager	Best Practice

ID	Measure/Requirement	Resources Needed	Evidence	When to implement	Responsibility	Reference
CL05	Unexpected contamination and asbestos will be managed in accordance with the Unexpected Finds Procedure for Contaminated Land and Asbestos (**Appendix A)**.	Project team Environmental Control Map	Contamination Register	Construction	Construction Environmental Manager Site Supervisor	MCoA E123 MCoA E124
CL06	Where required, isolate the area in the vicinity of contamination to ensure that any risk to human health or the environment is not exacerbated pending the implementation of an Environmental Work Method Statement.	EWMS Environmental Control Map	Environmental Inspections	Construction	Construction Environmental Manager Site Supervisor	G36 (Section 4.2.6)
CL07	The extent and duration of exposed surfaces (particularly those works that have the greatest potential to disturb soils that are contaminated or have a high erosion and runoff hazard) will be minimised.	EWMS Environmental Control Map	Environmental Inspections	Construction	Construction Manager Site Superintendent	SWMP G36 Sect 4.4
CL08	Implement relevant control measures in accordance with the Soil and Water Management Sub-plan to divert any surface runoff away from contaminated land. Capture and treat any surface runoff contaminated by exposure to the contaminated land.	EWMS Environmental Control Map	Environmental Inspections	Construction	Construction Environmental Manager Site Superintendent	G36 (Section 4.2.7)

ID	Measure/Requirement	Resources Needed	Evidence	When to implement	Responsibility	Reference
CL09	Intermixing of contaminated materials with clean material or any other type of contamination is generally not permissible. However, intermixing may be undertaken subject to further assessment and consultation with EPA and approval of the Construction Environmental Manager.	EWMS Environmental Control Map	Environmental Inspections	Construction	Construction Environmental Manager Site Superintendent	Best Practice Project Deed
Hazardous Substances						
CL10	Fuels, oils, lubricants, chemicals and similar products will be stored in accordance with AS 1940-2017, within designated secondary containment areas (e.g. internally bunded containers or purpose-built structures). Bulk storage areas for fuels, oils and chemicals used during construction will be contained within an impervious bund to retain any spills of more than 110% of the volume of the largest container in the bunded area.	Appropriate receptables and bunded areas Environmental Control Map	Environmental Inspections	Construction	Construction Manager Site Superintendent	REMM HR1 G36 Sect 4.3

ID	Measure/Requirement	Resources Needed	Evidence	When to implement	Responsibility	Reference
CL11	All spills will be immediately reported and managed in accordance with the Environmental Incident Classification and Reporting procedure (refer to Appendix A6 of the CEMP) and the TfNSW procedure, Environmental Incident Classification and Reporting (2017).	Spill kits Training	Environmental Inspections	Construction	Construction Manager Site Superintendent	Environmental Incident Classification and Reporting (TfNSW, 2017)
CL12	Spill kits will be readily available and maintained at site compounds and relevant construction vehicles. Spill kits will be utilised in the event of inadvertent spills of fuels, oils, hydraulic fluids and other hazardous wastes.	Spill kits Training	Environmental Inspections	Construction	Construction Environmental Manager Construction Manager	G36 Sect 4.3
CL13	Refuelling and maintenance of mobile plant will be undertaken offsite (where practicable) or within a designated lined and bunded area.	Refuelling bunds Environmental Control Map	Environmental Inspections	Construction	Construction Manager Site Superintendent	G36 Sect 4.3
CL14	Emergency Spill procedures will be developed to avoid and manage accidental spillages of fuels, chemicals, and fluids to minimise the risk of human health impacts and contamination of groundwater	Not applicable	Procedure included in Soil and Water Management Sub-plan	Construction	Construction Environmental Manager	REMM WQ1 Soil and Water Management Sub-plan

7. Compliance management

1.23 Roles and responsibilities

The CPB Downer JV Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.3 of the CEMP. Specific responsibilities for contamination management are detailed in Section 6 of this CLMP.

1.24 Training

All employees and workers on the Project will attend site induction training including the following elements related to contaminated land management:

- Use of spill kits
- Location and disturbance of identified potential contaminated land sites
- Plant/equipment refuelling locations
- Unexpected Finds Procedure for Contaminated Land and Asbestos
- Specific roles and responsibilities for contaminated land management.

Targeted training in the form of toolbox talks, pre-starts or specific training will also be provided to personnel with a key role in contaminated land management. Examples of training topics include:

- Site access restrictions
- Correct use of PPE
- Decontamination procedures
- Waste handling procedures
- Water quality controls
- Dust control measures and performance measures.

Further details regarding staff induction and training are outlined in Section 3.5 of the CEMP.

1.25 Monitoring and inspection

Requirements and responsibilities in relation to inspections and monitoring are documented in Section 3.9.1 and Section 3.9.2 of the CEMP.

On completion of Detailed Site Investigation Reports, this section will be revised to include site-specific requirements.

1.26 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this Sub-plan, MCoA, REMMs and other relevant approvals, licences and guidelines.

Audit requirements are detailed in Section 3.9.3 of the CEMP.

1.27 Reporting

Reporting requirements and responsibilities are documented in Section 3.9.5 of the CEMP.

Project reporting requirements specifically relevant to contaminated land management are identified in Table 7-1.

Table 7-1 Reporting Requirements

Item	Frequency	Standard	External Reporting	Responsibility
Detailed Site Investigation Report	Prior to the commencement of any work that would result in the disturbance of moderate to high-risk contaminated sites	Prepared in accordance with relevant guidelines made or approved by the EPA under section 105 of the Contaminated Land Management Act 1997 (NSW) and prepared by a Contaminated Land Consultant certified under either the Environment Institute of Australia or New Zealand's "Certified Environmental Practitioner" (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia "Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme.	Submitted to Planning Secretary	Contaminated Land Consultant
Remediation Action Plan	Where remediation is required	Prepared in accordance with relevant guidelines made or approved by the EPA under section 105 of the Contaminated Land Management Act 1997 and must include measures to remediate the contamination at the site to ensure the site will be suitable for the proposed use	Submitted to Planning Secretary	Contaminated Land Consultant
Site Audit Report	When a Section A1 or A2 Site Audit Statement is prepared	Prepared in accordance with relevant guidelines made or approved by the EPA under section 105 of the Contaminated Land Management Act 1997	Submitted to Planning Secretary	EPA Contaminated Site auditor

Item	Frequency	Standard	External Reporting	Responsibility
	Generally where: • The level of contamination exceeds or will foreseeably exceed the level described in the Duty to Report Guidelines for the current for approved use of the land • The level of contamination meets a criterion prescribed by the regulations • The contaminant has migrated or will foreseeably migrate from the Construction Site to adjoining property, the atmosphere, groundwater or surface water.	'Guideline for the Management of Contamination' (Roads and Maritime, September 2013)	NSW EPA	TfNSW

8. Review and improvement

1.28 Continuous improvement

Continuous improvement of this Sub-plan will be achieved through the ongoing evaluation of environmental management performance against environmental policies, objectives and targets. The continuous improvement process will be designed to:

- Identify areas of opportunity for improvement of environmental management and performance
- Determine the cause or causes of non-conformances and deficiencies
- Develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies
- Verify the effectiveness of the corrective and preventative actions
- Make comparisons with objectives and targets.

1.29 CLMP update and amendment

The process by which this Sub-plan will be reviewed and revised is described in Section 3.13 of the CEMP. This will occur as needed, including when additional land is included as part of the Construction Site.

Only the Construction Environmental Manager, or delegate, has the authority to change any of the environmental management documentation.

The ER will review this CLMP (as required by CoA A27(d)) prior to submission to the Planning Secretary to ensure it is consistent with the requirements of the Planning Approval.

The ER will review and approve minor amendments made to this CLMP in line with CoA A27(i).

A copy of the updated CLMP and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure (refer to Section 3.11.2 of the CEMP).

Note: Relevant information on the location and outcomes of detailed site investigations / unexpected finds will be included during future annual reviews of the CLMP.

Appendix A – Stage 2 Unexpected Finds Procedure for Contamination and Asbestos

Purpose

The purpose of this procedure is to define the responsibilities and necessary controls to manage unexpected contamination and asbestos that may be encountered during construction works.

Scope

This procedure is applicable to all activities conducted by CPB Downer JV workers that have the potential to uncover contaminated land and asbestos. This procedure will be implemented for the duration of the Project.

Unexpected Find

An unexpected find is defined as potential contaminated land or asbestos that was not previously identified in the EIS, Detailed Site Investigation or Remediation Action Plan. Unexpected finds that may be encountered during construction works are summarised in **Table A-1**.

Table A-1 Potential Unexpected Finds

Unexpected Find	Description
Fuels or oils	Fuel or oil contamination may be identified by odour, coloured sheen or staining/discolouration of soils. The 'oily' odour can vary in strength from weak (just detectable) to very strong.
Buried waste	Buried waste includes construction and demolition materials (e.g. wood, plastic, metal, bricks, etc) as well as landfill material (domestic putrescible waste).

Unexpected Find	Description
Buried Asbestos Containing Material (ACM), asbestos fines/friable asbestos	Cement-bound ACM may be present in building waste or conduits. Friable asbestos is more commonly associated with lagging and insulation. Laboratory analysis is typically required to identify asbestos fines and fibres. **Licenced Non-Friable Asbestos** • Requires Class B license • Greater than 10 meters squared of Non–Friable (bonded) asbestos or Asbestos containing material (ACM); • Asbestos Contaminated Dust or Debris (ACD) that is associated with removal of 10 square meters or more of non-friable asbestos or Asbestos containing material (ACM) **Unlicenced Asbestos** • No license required • 10 meters squared or less of Non–Friable (bonded) asbestos or Asbestos Contaminated Material (ACM); • Asbestos Contaminated Dust or Debris (ACD) that is not more than a minor contamination and is associated with the removal of 10 square meters or less of non-friable asbestos or Asbestos Contaminated Material (ACM). **Asbestos Removal from Soil** • May require Class A or Class B license depending on type (Friable or Non-Friable) Asbestos-contaminated soil comprising non-attached pieces of asbestos cement products and other material containing asbestos uncovered in soil.
Storage tanks or conduits	Underground storage tanks and former pipelines are typically metal, concrete or plastic. Storage tanks may be full, partially full or decommissioned. Indications of contamination (staining or odour) may be present in the surrounding soils.
Ash or slag	Ash material is typically light weight, grey and white sand. Slag varies in consistency (loose or cemented) and colour (grey, blue, green).

Procedure

Where unexpected contamination or asbestos is identified or suspected, the Unexpected Finds Procedure for Contamination and Asbestos will be implemented (**Figure A-1**).

Figure A-2 Unexpected Finds Procedure for Contamination and Asbestos

Unexpected contamination or asbestos	**All Contamination:** • Site Superintendent in conjunction with the Environmental Coordinator authorises stop work in the immediate area as soon as it is safe to do so • Assess the potential risk to worker health and the surrounding environment; evacuate or contact emergency services if required • Install environmental controls around the site to contain the contaminated material, including diversion of water to minimise potential spread via surface water runoff • If it is determined that there is a risk of environmental harm from the potential contamination, the EPA will be notified immediately in accordance with the TfNSW Environmental Incident and Classification Procedure. • Recommence works in an alternative area where practicable.
Health, safety and environmental controls	**All Contamination:** • Site Superintendent to establish an exclusion zone around the impacted area with para-webbing and appropriate signage • Prior to any contamination investigation, management or remediation activities, appropriate safe work method statements (SWMS) and EWMS will be prepared. • Refer to the Work Health and Safety Plan for Personal Protective Equipment requirements • Divert clean water from the area of excavation in accordance with the Soil and Water Management Sub-plan **Asbestos:** • Cover potential ACM with weighted plastic sheeting or geofabric
Notification	**All Contamination:** • Site Superintendent to notify the Construction Environmental Manager who will notify the TfNSW Environmental Manager, Environmental Representative (ER) and landowner (where relevant) • Notify the EPA where required in accordance with the 'Guidelines on the Duty to Report Contamination under the CLM Act 1997' (Office of Environment and Heritage, 2015) **Asbestos:** Prior to the commencement of licensed asbestos removal works, a minimum of 5 days prior notification to SafeWork NSW is required.

Assessment	**All Contamination:** • Construction Environment Manager (in consultation with TfNSW Environment Manager) to engage a Contaminated Land Consultant (where necessary) to: - Conduct a preliminary assessment of the nature of the contamination and the immediate management controls - Provide advice on additional assessment and/or remediation works **Note:** Contaminated Land Consultant will be certified under either the Environment Institute of Australia or New Zealand's "Certified Environmental Practitioner" (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia "Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme. • Characterise suspected or identified contamination with consideration of the Waste Classification Guidelines (EPA 2014) and the National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC, 2013)
Management and Reporting	**All Contamination:** • Construction Environment Manager in consultation with the Contaminated Land Consultant) to implement necessary management and/or mitigation actions to minimise risk to human health and the environment, and ensure the site will be suitable for the proposed use. • Should remediation be required to make land suitable for the final intended land use, a Remediation Action Plan will be prepared or reviewed and approved, by consultants certified under either the Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme. • Prior to commencing remediation, a Section B Site Audit Statement(s) will be prepared by a NSW EPA-accredited Site Auditor that certifies that the Remediation Action Plan is appropriate and that the site can be made suitable for the proposed use. The Remedial Action Plan must be implemented and any changes to the Remedial Action Plan must be approved in writing by the NSW EPA accredited Site Auditor. • A Section A1 or A2 Site Audit Statement (accompanied by an Environmental Management Plan) and its accompanying Site Audit Report, which state that the contaminated land disturbed by the work has been made suitable for the intended land use, must be submitted to the Planning Secretary and Council after remediation and no later than prior to the commencement of operation of the CSSI. • Record details of the unexpected find in the Contamination Register (Contaminated Land Management Sub-plan, Appendix B)

- Consider whether changes are required to the Contaminated Land Management Sub-plan

Asbestos: Asbestos Removal

Asbestos removal will be undertaken by suitably qualified personnel and/ or subcontractors who are licensed by SafeWork NSW.

An Asbestos Removal Control Plan (ARCP) is required to be completed in accordance with Work Health and Safety Regulation 2017 (Regulation 464). The ARCP will be developed prior to undertaking any asbestos removal works. The aim of the plan is to outline the specific methods and processes that will be used to ensure the removal is safe and effective.

Asbestos: Site Establishment and Signage

The boundaries of the "Asbestos Works Area" and the "Asbestos Removal Site" must be determined and defined by the nominated asbestos removal supervisor.

In determining the asbestos removal boundaries, consideration shall be given to:

- The use and suitability of various types of enclosures and asbestos removal methods; and
- The impacts of the asbestos removal work, including potential exposures in the surrounding region.

In determining the distance between barriers and the asbestos work area a risk assessment should take account of:

- Whether the ACM are friable or non-friable;
- Activity around the asbestos work area (other workers, visitors, neighbours, the public, etc.);
- The methods of ACM removal;
- Any existing barriers (walls, doors, etc.);
- The quantity of ACM to be removed; and
- The type of barrier used (e.g. boarding or tape).

The asbestos removal site boundary must be clearly and securely delineated to ensure persons do not enter inadvertently or without authority. Signage must warn persons that asbestos removal work is being carried out, of the dangers of exposure to asbestos and of PPE and other site entry requirements. All boundary delineation and warning/danger signs must remain in place until a clearance to re-occupy has been granted.

All warning/danger signage must comply with AS 1319 Safety signs for the occupational environment.

Asbestos: Air Monitoring

All air monitoring will be conducted by licensed asbestos assessor (LAA) and in accordance with *Safe Work Australia – Code of Practice on How to Safely Remove Asbestos (2016)*. The location and layout of the air monitors will be detailed within the ARCP.

Asbestos: Clearance

Following removal of asbestos / ACM, the licensed asbestos removalist will arrange for a clearance inspection of the area to facilitate the issue of a clearance certificate and allow construction to recommence in the affected area. The clearance inspection is conducted by:

- an independent licensed asbestos assessor, for work that was carried out by a Class A licensed asbestos removalist.
- an independent competent person, for asbestos work that is not required to be carried out by a Class A licensed asbestos removalist

Asbestos: Decontamination

Decontamination applies to all workers exiting the asbestos work area, all plant, equipment and tools used in the asbestos work area (at the completion of the asbestos work or at their earlier removal from the area) and, at the completion of the asbestos removal work, the asbestos work area itself.

The methods used for decontamination are based on the Code of Practice How to Safely Remove Asbestos 2016

Recommence Works

- Recommence works at the direction of the Construction Environmental Manager when the following criteria have been satisfied:
  - Site is safe to access
  - Management and/or mitigation actions have been implemented
  - Site has been validated as suitable for the proposed use

Roles and Responsibilities

The CPB Downer JV Project Team's organisational structure and overall roles and responsibilities are outlined in Section 3.3 of the CEMP. Additional roles and responsibilities specific to this procedure are detailed in **Table A-2**.

Table A-2 Unexpected Finds Roles and Responsibilities

Role	Responsibilities
All employees and subcontractors	• Notify of potential contamination and asbestos finds
Site Superintendent	• Communicate the discovery of unexpected contamination or asbestos to the Construction Environmental Manager
Construction Environmental Manager	• Ensure adequate resources are allocated to achieve compliance with the requirements of this procedure • Engage a suitably qualified Contaminated Land Consultant to support delivery of this procedure

Role	Responsibilities
Environmental Coordinator	• Implement the requirements of this procedure within the work site
Contaminated Land Consultant	• Conduct an assessment of unexpected contamination or asbestos • Determine necessary management and mitigation measures to minimise risk to human health and the environment, and ensure the site will be suitable for the proposed use

Training

All employees and subcontractors working on the Project will attend site induction training including the following elements related to unexpected contamination and asbestos finds:

- Visual and olfactory indicators of contamination and asbestos
- Requirements of this procedure.

Monitoring and Inspection

Requirements and responsibilities in relation to inspections and monitoring are documented in Section 3.9.1 and Section 3.9.2 of the CEMP.

Reporting

Unexpected contamination and asbestos finds will be reported in the Contamination Register (Appendix B of the Contaminated Land Management Sub-plan). In addition to detailing the proposed future land use of each area of land, the Contamination Register will reference assessments and investigations undertaken.

Appendix B – Contamination Register

Table B-1 Contaminated Lands Register

AEI No.	Location/Legal Description	Proposed Future Land Use*	Assessment and Investigation Report References

* Open space, commercial, residential or no specific land use

Appendix C – Wicks Road Landfill Gas Management Plan

Wicks Road Landfill Gas Management Plan – CPB WFU Occupation

CPB Contractors

Report

JBS&G 62899 | 153,915

24 August 2023

We acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community.

We pay respect to Elders past and present and in the spirit of reconciliation, we commit to working together for our shared future.

Table of Contents

List of Tables

Appendices

Abbreviations

Term	Definition
Bgl	Below Ground Level
BH	Borehole
CEMP	Construction Environmental Management Plan
CLM Act	Contaminated Land Management Act 1997
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CoA	Conditions of Approval
CoR	City of Ryde
CS	Characteristic Situation
DSI	Detailed Site Investigation
EMP	Environmental Management Plan
ENM	Excavated Natural Material
EPA	Environment Protection Authority (NSW unless specified)
EP&A Act	Environmental Planning and Assessment Act 1979
GSV	Gas Screening Value
hPa	Hectopascals
H_2S	Hydrogen Sulphide
JBS&G	JBS&G Australia Pty Ltd
LFG	Landfill Gas
LFGMP	Landfill Gas Management Plan
LFGW	Landfill Gas Monitoring Well
m bgl	Metres below ground level
NSW	New South Wales
POEO	Protection of the Environment Operations Act 1997
ppm	Parts Per Million
ppmv	Parts per million volume
SEPP	State Environmental Planning Policy
SSI	State Significant infrastructure
SWQR	Surface Water Quality Report (CoR, 2022)
TKN	Total Kjeldahl Nitrogen
TRH	Total Recoverable Hydrocarbons
VENM	Virgin Excavated Natural Material
VOCs	Volatile Organic Compounds
% v/v	Percent volume to volume
WARR Act	Waste Avoidance and Resource Recovery Act 2001
WHS	Work Health and Safety
WFU	Warringah Freeway Upgrade project

1. Introduction

1.1 Background

JBS&G Australia Pty Ltd (JBS&G) was engaged by CPB Contractors (CPB, the client), to prepare a Landfill Gas Management Plan (LFGMP) which will be included as part of the Construction Environmental Management Plan (CEMP) for the development of the site located at 162 Wicks Road, Macquarie Park, NSW (the site). The site is approximately 2.3 ha and is identified as Lot 15 and part of Lot 12, 14 and 16 on DP 841065, part of Lot 2 on DP1078026 and part of Lot 540 DP 1005833. The site location and current layout are presented in **Figures 1** and **2** respectively, in **Appendix A**.

JBS&G understands the site was historically used as a putrescible waste landfill which ceased operation in approximately 1985[1]. Following landfill operations, the site was reportedly covered with a landfill cap of unknown composition/thickness. Porters Creek, a tributary to the Lane Cove River is located beneath the landfill. The creek was reportedly encased in concrete culverts prior to the commencement of landfilling operations. Porters Creek is a tributary to Lane Cove River, approximately 350 m to the east of the site.

CPB intends to lease a portion of the site (the Lots and DPs noted above, and parts thereof) from the City of Ryde (CoR) for use as a construction support site for the Warringah Freeway Upgrade (WFU) project. The occupancy of the site by CPB will be transient for the period of the WFU project. Following occupancy, the site will be returned to the CoR for ongoing use as a waste/resource recovery facility. During occupancy by CPB, the site will specifically comprise:

- A material stockpiling, segregation and testing area;
- Material crushing and screening area;
- A construction personnel car parking area providing up to 250 spaces;
- A precast concrete facility to manufacture concrete zipper barriers;
- A truck marshalling area;
- A new access road from Wicks Road onto the site, including a weighbridge and security gate;
- Water quality management controls;
- Office area including demountable structures on raised footings, comprising:
    - Logistics office;
    - Lunch room; and
    - Toilet facilities.
- A dome shelter for plant inspections and minor maintenance;
- Noise barriers comprising 40-foot shipping containers, stacked two high (approximately 5.2 m), along the southern and northeastern boundary of the site; and
- Minor earthworks for the purpose of levelling the site.

Based on information provided by the client, there is not intent to install underground services. Should this change, then consideration will need to be given to preferential pathways for LFG migration and monitored/managed in accordance with **Section 6**.

[1] *Site Environmental Management Plan*, Porters Creek Depot, 160 Wicks Road, Macquarie Park, City of Ryde (CoR EMP, 2021)

1.2 Historical Reports

JBS&G was engaged by CPB to conduct a detailed site investigation (DSI)[2] for the portion of the site intended to be occupied by CPB for the above purposes. The key findings of the JBS&G DSI 2023 are summarised below:

- Three previous investigations/monitoring reports were provided to JBS&G for review:
  - The CoR Environmental Management Plan (EMP) (2021) provided the following historical information:
    - The site operated as a landfill until approximately 1985.
    - The landfill was reportedly capped with primarily Excavated Natural Material (ENM) which was not observed by JBS&G. However, a surface covering of variable thickness was encountered overlying the landfill and comprised soil with anthropogenic inclusions that appeared visually inconsistent with ENM as provided in the ENM Order (2014).
    - Historic reports indicated that methane monitoring was conducted and it was determined that ongoing methane monitoring was not considered necessary in ambient, well-ventilated areas.
    - As a precaution new structures should be monitored prior to occupation.
  - iEnvironmental was engaged by CoR to conduct a *Prelease Contamination Assessment* (iEnvi, 2022)[3] which reported:
    - The investigation focused on near-surface soils (0-0.1 m bgl).
    - Thirteen near-surface soil samples were collected.
    - Total recoverable hydrocarbons (TRH) (C16-C40) were detected at relatively low concentrations (~100-500 mg/kg) with two soil samples reporting TRH (C15-C34) at 1,300 and 1,700 mg/kg, and TRH (C34-C40) at 1,300 and 1,600 mg/kg. This was considered to be localised impacts associated with plant movement over decades of site use.
    - Heavy metals were detected consistent with background concentrations and no asbestos was identified as fragments or as fibres within soils.
  - *Surface Water Quality Report*, *January – December 2022, Porters Creek Depot,* 160 Wicks Road, Macquarie Park, City of Ryde (CoR) (SWQR, 2022) reported:
    - CoR monitors Porters Creek up and downstream of the site.
    - Porters Creek is subject to a CoR monitoring program for typical contaminants associated with landfill leachates such as ammonia, nitrates/nitrites, total kjeldahl nitrogen (TKN), pH, electrical conductivity, suspended solids, sodium, magnesium, calcium, potassium, sulphate, chloride, fluoride and phenols.
    - The monitoring to date indicates that the landfill is having a generally minor impact on Porters Creek and no observable impact on the Lane Cove River.

[2] *Detailed Site Investigation*, 160 Wicks Road, Macquarie Park, NSW, JBS&G Australia Pty Ltd (JBS&G DSI, 2023)
[3] *Prelease Contamination Assessment,* 160 Wicks Road, Macquarie Park, NSW, City of Ryde, iEnvironmental, January 2022 (iEnvi, 2022)

1.3 Data Gaps

The following data gaps were identified by JBS&G as part of the DSI:

- The data provided relating to LFG monitoring was insufficient to determine whether the underlying landfill poses a risk to the proposed CPB site use;
- No information pertaining to the 'cap' placement or thickness was identified. The landfill area was not discernible with any confidence except to presume that it covered the entire subject site area;
- The location of previous monitoring wells/monitoring locations for LFG were not identified nor the results from LFG monitoring. Anecdotal evidence indicated the presence of an old, damaged monitoring well which reportedly extended to 20 m bgl; and
- Information on the composition of the landfill was not detailed except to indicate that it was for municipal purposes. As such the LFG generation potential were considered unknown.

1.4 JBS&G DSI

1.4.1 JBS&G DSI Scope of Work

To close out the above data gaps relevant to the proposed CPB site use the following was conducted:

- Drilling of 20 boreholes across the site with the intent to measure surface covering thickness and composition (including chemical characterisation);
- Installation of LFG wells beneath the inferred surface covering to assess potential LFG generation rates and composition over two rounds of handheld LFG monitoring to enable commentary on gas protection measures required for the proposed CPB site use; and
- Surface emission monitoring to assess the integrity of the surface covering.

1.4.2 JBS&G DSI Findings

- The site was underlain by a surface covering of variable thickness and composition. An ENM 'capping' layer was not encountered, and the site did not appear to include a final capping layer as outlined in the NSW EPA (2016) *Environmental Guidelines: Solid Waste Landfills, 2nd Edition*.
- The surface covering encountered by JBS&G comprised brown/orange silty sand/brown silty gravelly clay/grey, gravelly sand/brown silty sand/and grey gravelly sand. Inclusions observed included brick, plastic and metal fragments, metal wire and decomposing vegetation.
- The surface covering generally extended to approximately 1.4 m bgl at which point the material was inferred to be landfill material comprising soil with decomposing vegetation and inclusions of bricks, plastic, fabric, glass, concrete, wire, and wood mulch. Odours typical of decomposing wastes were noted. It was noted that in one location the surface covering extended to approximately 0.7 m bgl and in two locations, a surface covering or landfill layer was not clearly observed. LFGW07 and LFGW08 are topographically at a lower elevation than the bulk of the site.
- Surface emissions monitoring indicated that generally, surface methane concentrations were consistent with background levels. Methane was detected at the surface in the vicinity of three monitoring wells, LFGW07 and LFGW08 and one historic monitoring well. At LFGW07 and the historic monitoring well, surface methane concentrations exceeded the 500 ppmv trigger value as presented in NSW EPA (2020). Monitoring well LFGW08 reported a concentration of 336 ppmv. The surface methane detections in the vicinity of the monitoring wells are possibly due to a poor seal around the well annuli. Landfill gas monitoring well locations and the historic monitoring well are shown in **Figure 2**.

- Based on historical aerial imagery, the landfill footprint appears to occupy the entire site area (~22,650 m^2), and based on anecdotal information from the site occupants, potentially extends to a approximately 20 m bgl. This gives an estimated landfill volume of 450,000 m^3.
- Surface covering soil samples were collected and all analytical results were below the adopted relevant health criteria.
- Nine of the ten LFG monitoring wells exceeded the 1 %v/v methane and 1.5 %v/v carbon dioxide screening values. Three monitoring wells exceeded the 30 ppm carbon monoxide threshold during the first monitoring round only.
- To understand the risk from a gas protection perspective, *The Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases* (NSW EPA 2020) was given consideration.
- Based on the ground gas data obtained during the monitoring rounds, the highest Gas Screening Value (GSV) value of 0.15 (methane) at LFGW06 was obtained. Initially, this gives a 'characteristic gas situation' (CS) value of 2, however, with consideration of multiple factors, and that the maximum methane concentration exceeds 20% v/v, the guidance indicates that the CS is increased to CS3. Based on this, JSB&G considered that it is reasonable that the site be categorised with a CS score of '3 – moderate risk', whereby gas protection measures are required up to a value of 2 for standard commercial buildings while noting the development by default includes such measures.
- The site structures during CPB's tenure will be demountable offices on raised footings, which by design, contain a void space with very good ventilation. Per the NSW EPA (2020), this gives a gas protection score of 2.5 which exceeds the required protection value of 2. As an additional protection measure, the installation of 200 mm of either ENM or VENM within the proposed footprint of raised structures will constitute a horizontal soil barrier. The protection score provided by a horizontal soil barrier is dependent on site-specific conditions. Given that the required protection level of 2 will be exceeded with the structures having a void space, it is not considered necessary to calculate the score of the horizontal soil barrier as reliance is upon the mitigation effect of the air-filled void. The soil barrier is proposed to extend 1 m laterally from the footprint of the structures and must be geotechnically suitable (level 1).

1.4.3 JBS&G DSI Conclusions and Recommendations

Based on the findings of the investigation, it was concluded that:

- The site can be made suitable for the proposed land use subject to the implementation of a Landfill Gas Management Plan (LFGMP) to provide for control/management measures for the proposed CPB site use with respect to ground gas and associated unexpected finds.
- The landfill gas wells LFGW07, LFGW08 and the damaged historic monitoring well must either be re-sealed or decommissioned to prevent uncontrolled venting of LFG to the atmosphere.
- The footprints of demountable site structures are to have a layer of geotechnically (level 1) suitable Virgin Excavated Material/Excavated Natural Material (VENM/ENM) placed and compacted as an additional layer of surface covering material.
- Structures are to be demountable structures placed on raised footings thereby creating a void space beneath the structures.
- Structures are to be inspected and monitored for LFG prior to occupation. During excavation into the existing surface covering, monitoring of LFG conditions is required to ensure that no hazardous atmospheres are generated from the work.
- Should the proposed land use change, then this would warrant a review of the proposed use against site conditions.

- The data collected and the conclusions made meet the requirements of the Conditions of Approval (CoA) for State Significant Infrastructure (SSI) SSI-8863 condition numbers E116 and E117.
- The JBS&G DSI recommended the preparation of a LFGMP for the CPB site use and as a minimum address the management of the following items:
    - General site safety (i.e., no naked flames/smoking on-site).
    - Decommissioning/re-sealing monitoring wells. LFG monitoring wells LFGW07, LFGW08 and the damaged historic monitoring well (**Figure 2**) must either be re-sealed or decommissioned to prevent further venting of landfill gases to the site surface.
    - Completion of a site survey prior to construction commencement to document existing surface levels and document existing impermeable surface covering.
    - Management measures for excavation works (gas monitoring). Excavation at the site should be kept to a minimum, the surface covering where disturbed should be reinstated with VENM/ENM, and the landfill material from approximately 0.6 m bgl and below should not be disturbed.
    - Placement of an additional layer of material within the footprint of structures to supplement the surface covering providing a horizontal soil barrier.
    - Details of an inspection of new site structures and indoor air monitoring prior to occupation;
    - Surface emission monitoring conducted in accordance with the NSW EPA (2016) Environmental Guidelines: Solid Waste Landfills, 2nd Edition.
    - An Unexpected Finds Protocol detailing how LFG-associated unexpected finds are to be managed.
    - Provisioning of an exit procedure to demonstrate that the site is being returned to CoR in a like or improved condition with respect to surface covering.

2. Summary of Site Conditions

2.1 Site Details

Details the site condition, physical characteristics, history and surrounding land uses provided in the following sections are summarised from the previous JBS&G DSI (2023).

Table 2-1 – Summary of Site Details and Environmental Setting

Site Address	160 Wicks Road, Macquarie Park NSW
Lot and Deposited Plan (DP)	Lot 15 and part of Lot 12, 14 and 16 DP 841065, part of Lot 2 DP 1078026 and Part of Lot 540 DP 1005833.
Site Area	Approximately 2.3 ha
Approximate Geographical Co-Ordinates (GDA04-MGA56), (site centre)	Easting: 327496 Northing: 6260088
Local Government Authority	City of Ryde (CoR) (Council)
Site Zoning	IN2: Light Industrial
Previous Use	Putrescible Landfill
Current Use	Material stockpiling and processing for beneficial reuse of concrete and asphalt
Proposed Use	Construction support site for the Warringah Freeway Upgrade (WFU) (see **Section 2.3**.
Topography	The elevation of the site ranges from approximately 48 m Australian Height Datum (AHD) in the northern lot portion to 36 m AHD within the southwestern corner. In the southwestern portion of the site was mounded soil acting as sound barriers. The site comprises predominately unsealed surfaces with a recycled aggregate cover.
Geology and Soils	Geology: Mittagong Formation (interbedded shale, laminite, and fine to medium-grained quartz sandstone and Artificial Fill (dredged estuarine sand and mud, demolition rubble, industrial and household waste). Soil: Lucas Heights and Disturbed Terrain soil landscapes. As noted, JBS&G encountered a surface covering material from the surface to approximately 1.4 m bgl. Although referenced as such in the CoR EMP (2021), the material was not observed to be consistent with ENM per the ENM Order (2014) and was not considered to be an engineered final cap per the NSW EPA (2016). Landfill material was generally encountered from approximately 1.4 m bgl.
Hydrology	The site is predominately unsealed with some areas of vegetation including thick grasses and minimal flora. Porters Creek, a tributary of the Lane Cove River (350 m northeast of the property boundary) was reported to exist at the site prior to the landfill being developed. The CoR EMP (2021) indicated that Porters Creek runs through the centre of the site and that it was enclosed in reinforced concrete culverts to isolate the creek from landfilled waste. The creek is monitored up and downstream of the site, as well as at the confluence with the Lane Cove River into which Porters Creek discharges.
Hydrogeology	A total of 33 registered groundwater bores were identified. All but one of the registered groundwater bores were reportedly being used for monitoring

	purposes. The groundwater bores were identified clustered around certain sites such as Australian Native Landscapes, Eden Garden Centre, and a 7/11 service station. The locations were generally cross or downgradient and some distance from the site and were considered unlikely to reflect impacts to groundwater at the subject site. The generation of leachate from the landfill is expressed in the water quality of Porters Creek which is subject to an ongoing monitoring program.
Acid Sulfate Soils (ASS)	The site is within an area of no known occurrence, with no available present data on acid sulphate soils. Based on this it appears unlikely that ASS related carbon dioxide represents a significant source.
Meteorology	• Mean maximum temperature ranges from 17.1°C in July to 27.7°C in January, while mean minimum temperature ranges from 4.9°C in July to 16.9°C in both January and February; • The average annual rainfall is approximately 1125.5 mm. On average, September received the least amount of rain with a mean rainfall of 59.1 mm, while March receives the most rain, with a mean of 154.4 mm; and • Rainfall greater than or equal to 1 mm occurs on average of 90 days of the year. During fieldwork (JBS&G DSI 2023), site conditions were derived using both field observations and data recorded at the Observatory Hill weather station (0066214), wind observations from Fort Denison (station 0066022), and pressure data from Sydney Airport AMO (station 0066037): • 21 December 2022 (borehole drilling and LFG well installation): overcast, still conditions, dry, and approximately 18-23°C. • 22 December 2022 (borehole drilling and LFG well installation, monitoring from landfill gas wells): overcast, still conditions, dry, approximately 19-23°C, and barometric pressure of approximately 1016.3 hPa. • 20 January 2023 (monitoring from LFG wells): cloudy, light showers, approximately 18°C, and barometric pressure of approximately 1016.6 hPa. • 8 February 2023 (surface emissions monitoring): overcast, dry (no reported rainfall for the last 8 days (Observatory Hill)), relatively still conditions with (wind speed reported at 9 am at Observatory Hill was 7 km/h), temperature of 24°C and a barometric pressure of 1015.6 hPa.

2.2 Surrounding Land Use

The current land uses of adjacent properties or properties across adjacent roadways is summarised below.

- North: Eden Gardens (garden centre) along with dense bushland part of the Lane Cove National Park (500 m);
- East: A small portion of the Macquarie Park Cemetery followed by the dense bushland. A residential area and the CSIRO Lindfield Site is located further afield (1,300 m);
- South: M2 Motorway with residential and recreational areas further beyond;
- South-East: Macquarie Park Cemetery and Crematorium directly adjacent, followed by dense bushland and some residential properties;

- West: M2 Motorway directly adjacent as well as a commercial/industrial area including Australian Native Landscapes (material supplier – 250 m), and a Shell and 7-Eleven Service Station (petroleum infrastructure – 750 m); and
- No other landfill sites were identified within 250 m of the site.

2.3 Proposed CPB Development

The proposed CPB development comprises:

- A material stockpiling, segregation and testing area.
- Material crushing and screening area.
- A construction personnel car parking area providing up to 250 spaces.
- A precast concrete facility to manufacture concrete zipper barriers.
- A truck marshalling area.
- A new access road from Wicks Road onto the site, including a weighbridge and security gate.
- Water quality management controls.
- Office area including:
    - Logistics office;
    - Lunch room; and
    - Toilet facilities.
- A dome shelter for plant inspections and minor maintenance.
- Noise barriers comprising 40-foot shipping containers, stacked two high (approximately 5.2 m), along the southern and northeastern boundary of the site.
- Potentially cutting/excavation of existing surface covering material to enable the above activities.

The CPB site use will be transient for the purpose of providing support to the WFU project. Once CPB involvement with the WFU project has concluded, the site will be returned to CoR for the resumption of waste recovery operations. The proposed development is superficial in nature with any excavation being for the purpose of site levelling.

3. Identified Landfill Gas Impacts

3.1 Summary of Identified Landfill Gas Issues

The JBS&G DSI identified LFG primarily comprising methane, carbon dioxide and the potential for carbon monoxide, hydrogen sulphide and Volatile Organic Compounds (VOCs) associated with the decay of putrescible material and degrading organic material such as timber, food or green waste within the landfill material.

The LFG present at the site was considered to pose a 'moderate-risk' per the modified Wilson and Card Classification (Table 6, NSW EPA, 2020), whereby gas protection measures are required up to a value of 2 (per Table 9, NSW EPA, 2020) for standard commercial buildings, while noting the development, by default, includes such measures.

It is noted that the site has not been completed with an engineered final capping layer in accordance with NSW EPA (2016). A surface covering was encountered across most of the site surface with a variable thickness. Surface emission monitoring for methane was conducted on a 10x10 m grid across the site, a more conservative spacing than recommended by NSW EPA (2020). Across the general grid, no surface methane emissions were detected, however, in the vicinity of installed landfill gas monitoring wells, LFGW07, LFGW08 and the damaged historic well, surface methane was detected and in two locations (LFGW07 and the damaged historic monitoring well) methane concentrations exceeded the trigger criteria of 500 ppm methane. This is possibly due to a poor seal around the well annuli.

JBS&G notes that the CoR EMP (2021) requires indoor air quality monitoring within newly installed structures prior to occupation.

There are potential exposure risks for activities that result in disturbance of the surface covering. The table below summarises potential risks for site uses/activities. Further details assessing the level of risk associated with the proposed CPB site use and occupation are provided in the JBS&G DSI (2023).

Table 3-1- Summary of Key Risks and Controls

Proposed Use/Activities	Potential Risks	LFGMP Controls
General occupation (outdoors)	Potential risks to site occupants (whether they be workers/visitors, etc.) are unlikely, however, LFGW07, LFGW08 and the historic monitoring well are venting methane to the surface.	• The identified monitoring wells are required to be managed. Two options for management are provided. The selection of which will depend on site requirements. Option A is the extension of the wells to approximately 3 m above the site surface and LFG enabled to vent during surface covering disturbance, or Option B, decommissioning by digging out the monitoring well and grouting to the surface by a licenced driller under supervision monitoring for LFG conditions. Several monitoring wells are located onsite (**Figure 2**) if the location of the monitoring wells interfere with site works, then these too will require management/decommissioning.

		• Surface emission monitoring must occur following site levelling works to confirm that the integrity of the surface covering is maintained. ○ Surface emission monitoring must occur monthly during the CPB occupation in accordance with the recommendation in Section 5.2 of the NSW EPA (2016). • Topographic survey prior to occupation to record site levels.
General occupation (indoors)	A cumulative build-up of landfill gas within new site structures (demountables on raised footings) leads to either an explosion or suffocation risk.	• No slab on grade buildings i.e. all buildings will be supported with an air filled void in between the landfill surface and the underside of the building. • Placement of a soil barrier within the footprint of new raised demountables. • Indoor air monitoring prior to entry, one week following occupation and then monthly to confirm hazardous atmospheres do not exist within structures.
Commencement of surface covering disturbance	Once surface covering disturbance commences, then monitoring of LFG conditions must be conducted using a handheld or emplaced ambient monitor and excavations supervised to ensure that landfill is not disturbed.	• Monitoring during surface covering disturbance.

4. Regulatory Requirements

CPB activities on-site are required to be undertaken in accordance with environmental and occupational health and safety legislation and associated regulations. The primary Acts, Regulations and Guidelines currently in place are listed below. Please note, the list below is not intended to be a comprehensive list of current applicable Acts and Regulations. The Council and contractors would be required to satisfy themselves that all applicable permits and licences have been obtained and their conditions satisfied.

4.1 Statutory Acts and Guidance

Work Health and Safety Act 2011 (WHS Act)

- The overarching Act for NSW setting law relating to employee health and safety and employer responsibilities.

Protection of the Environment Operations Act 1997 (POEO Act)

- The POEO Act enables the Government to set out explicit protection of the environment policies (PEPs) and adopt more innovative approaches to reducing pollution. Includes regulation of waste activities including appropriate assessment, classification and disposal of waste.

***Contaminated Land Management Act 1997* (CLM Act)**

- The CLM Act controls the assessment and management of contamination. The Act also contains guidance for the determination of whether a site is considered to be a Significantly Contaminated Site and allows for accreditation of Site Auditors.

Environmental Planning and Assessment Act 1979 (EP&A Act)

- The EP&A Act allows plans to be made (environmental planning) to guide the process of development including development on potentially contaminated land. Linked to the *Hazards and Reliance* State Environmental Planning Policy relating to making planning decisions in regard to contaminated and potentially contaminated land.

Hazards and Resilience State Environmental Planning Policy (SEPP)

- The Hazards and Resilience SEPP relates to the decision-making process in undertaking remediation of land and making planning decisions in regard to contaminated and potentially contaminated land.

Duty to Report Contamination under the Contaminated Land Act 2009

- The Duty to report guidelines fall under the CLM Act, with the guidelines indicating that a person whose activities have contaminated land or a landowner whose land has been contaminated is required to notify the EPA when they become aware of the contamination, dependent on a range of notification triggers.

Waste Avoidance and Resource Recovery Act 2001 (WARR Act)

- The WARR Act replaced the Waste Minimisation and Management Act 1995 and controls waste generation and reduction.

Assessment and Management of Hazardous Ground Gases, Contaminated Land Guidelines (NSW EPA 2020)

- NSW EPA (2020) sets out the recommended approaches and procedures for the assessment and characterisation of sites that may be impacted by ground gases, their associated risks, options for the management and mitigation of those risks, and provides the planning and regulatory process relating to ground gas in NSW.

Environmental Guidelines, Solid Waste Landfills, Second Edition (NSW EPA, 2016)

- The guidelines provide guidance for the environmental management of solid waste and restricted solid waste landfills in NSW by specifying a series of 'Minimum Standards'. These involve a mix of design and construction techniques, effective site operations, monitoring and reporting protocols, and post-closure management.

4.2 Other Potentially Applicable Code of Practices

Works conducted on-site which may cause disturbance or exposure will need to be conducted by appropriately trained staff, with the reporting and notification of the works conducted in accordance with applicable regulations, guidelines and codes of practice.

Other applicable guidelines and/or codes of practice are listed but not limited to the below:

- SafeWork NSW Excavation Work Code of Practice (August 2019).
- SafeWork NSW How to manage work health and safety risks Code of Practice (August 2019).
- SafeWork NSW Work Health and Safety Consultation, Co-operation and Co-ordination Code of Practice (August 2019).
- SafeWork Australia 2019, Workplace Exposure Standards for Airborne Contaminants' (December 2019).
- SafeWork Australia 2020, How to Safely Remove Asbestos Code of Practice (July 2020).
- SafeWork Australia 2020, How to manage and control asbestos in the workplace Code of Practice (July 2020).
- SafeWork Australia 2020, Code of Practice – Confined Spaces (July 2020).
- AS/NZS 60079.14:2009 Explosive atmospheres - Electrical installations design, selection and erection.
- AS/NZS 60079.17:2009 Explosive atmospheres - Electrical installations inspection and maintenance.
- AS/NZS 4761.1:2008 Competencies for working with electrical equipment for hazardous areas (EEHA).
- AS/NZS 60079.29.2:2016 Explosive atmospheres - Gas detectors - Selection, installation, use and maintenance of detectors for flammable gases and oxygen.

5. LFGMP Application and Responsibilities

5.1 LFGMP Application

This LFGMP must be always applied during the operation of the site by CPB. All site workers and relevant subcontractors and visitors must be made aware of the LFGMP. This includes workers associated with utilities or other infrastructure on site that is not owned/controlled by CPB and those undertaking activities which have the potential to disturb the surface covering.

CPB is to ensure the implementation of the LFGMP for the duration of the CPB occupancy and facilitate ongoing monitoring as prescribed.

Controls within the LFGMP apply to all CPB site development, operation and maintenance activities on site but are particularly important for activities involving disturbance or exposure of the surface covering such as:

- Surface covering disturbance; and
- Excavation e.g., digging, cutting, piling, boring, etc.

5.2 LFGMP Responsibilities

5.2.1 Site Operator

It is the responsibility of the Site Operator to ensure that:

- A person in a senior management position in the organisation is appointed, for the purposes of this LFGMP, as the Site Operator's representative and given the responsibility for ensuring the LFGMP is provided to relevant staff, including the Site Environmental Manager, and other stakeholders and implemented appropriately; and
- The LFGMP is reviewed and updated as prescribed by an appropriately qualified and experienced person to ensure it complies with any updates to regulatory requirements and its relevance to site conditions.

5.2.2 Site Environmental Manager

It is the responsibility of the Site Operator to appoint a Site Environmental Manager (the Site Environmental Manager may oversee several other sites and appoint a Site Manager/Project Engineer to carry out the below functions in their absence) and delegate to the Manager the responsibility for ensuring implementation of the provisions of the LFGMP including:

- Provide site-specific inductions to all site personnel and relevant visitors/subcontractors;
- Implementation of the requirements of the LFGMP;
- Communications as required to ensure understanding of, and agreement with, the requirements of the LFGMP;
- Actions as necessary to ensure any prescribed activities within the LFMGP are conducted;
- The health, safety, and environmental requirements specific to this LFGMP as outlined are complied with;
- Landfill gas-associated incidents and unexpected site conditions are reported in accordance with the timeframes as prescribed in this LFGMP and appropriate statutory authorities as necessary in accordance with legislation; and
- Ensure site foreman/contractors/others know their obligations under the LFGMP.

5.2.3 Site Forman/Contractors/Others

It is the responsibility of the foreman, contractors and others to ensure that:

- Works are conducted in compliance with the LFGMP requirements, in addition to any other specific requirements for the tasks undertaken;
- Notify the Site Environmental Manager or appointed representative (Site Manager/Project Engineer) of any unexpected finds; and
- Report any breaches of the ground surface below 0.6 m bgl where landfill gas monitoring is not currently being conducted and participate in reporting/rectification work.

6. Landfill Gas Management Controls and Monitoring

6.1 Landfill Gas Monitoring Parameters and Adopted Thresholds

The table below provides the NSW monitoring parameters for internal buildings, monitoring wells, service pits and surface gas emissions. The below thresholds will be referenced throughout the following sections.

Table 6-1: NSW Monitoring Parameters and Adopted Thresholds

Ground gas parameter	Unit of measurement	Adopted Threshold Values			
		Internal Buildings	Monitoring Wells	Service pits	Surface Gas Emissions
Methane (CH_4)	%v/v	0.25 % v/v[1] 2,500 (ppm)	1.0	< 1.25	0.05 %v/v (500 ppm[2])
Carbon Dioxide (CO_2)	%v/v	0.5[3] (5, 000ppm) or above established background concentrations*	1.5 or above established background concentrations*	1.5 or above established background concentrations*	5,000 ppm
Oxygen (O_2)[4]	%v/v	>19.5% v/v[4]	For reference	>19.5% v/v	>19.5% v/v
Carbon Monoxide[1] (CO)	ppm	30	30	30	30
Hydrogen Sulphide[2] (H_2S)	ppm	10	10	10	10
VOCs	ppm	10 ppm (above background)	Above background outside air	Above background outside air	Above background outside air
Borehole Differential Pressure	hPa/mb	N/A	±4.0	For reference	For reference
Barometric Pressure	hPa/mb	N/A	±4.0	For reference	For reference
Well Flow	L/h	N/A	±0.3[3]	For reference	For reference

*In Australia, concentrations of over 20 %v/v carbon dioxide are not uncommon due to natural soil processes such as microbial or root respiration. Reference to workplace exposure limit for carbon dioxide for surface gas emissions of 8 hour at 5,000 ppm (SafeWork Australia Workplace Exposure Standards for Airborne Contaminants, 16 December 2019)

6.2 Pre-Occupation Site Survey

Prior to activities commencing on-site, a site topographic survey is to be undertaken to establish current ground levels. This will be used to demonstrate compliance with the LFGMP and ensure that following the use of the site by CPB, the site can be handed back to the CoR in a like or improved condition with respect to the surface covering present at the site. As part of the pre-occupation site survey, sealed areas should be noted.

6.3 Existing LFG Monitoring Well Management

As part of the surface-emission methane monitoring conducted in the JBS&G DSI, a 10x10 m grid traversed the site taking measurements of the surface methane conditions. Where depressions, cracking or penetrations were identified on the surface of the site, these were also monitored. Landfill gas monitoring wells LFGW07, LFGW08 and a historic, damaged monitoring well measured emitting methane at the surface. Two wells,

[1] 5% of LEL in Confined Spaces – NSW WHS Regulation (2017)
[2] *Environmental Guidelines – Solid Waste Landfills*. NSW EPA 2016. EPA (2016).
[3] Time Weighted Average – SafeWork Australia 'Workplace Exposure Standards for Airborne Contaminants' (December 2019)
[4] SafeWork Australia Code of Practice – Confined Spaces (July 2020)

LFGW07 and the historic monitoring well exceeded the trigger value of 500 ppm for surface methane emissions (NSW EPA, 2020).

Prior to occupation, the three monitoring wells indicated above and as shown in **Figure 2**, must be managed in accordance with the following options:

- Option A: the PVC monitoring well be extended to approximately 3 m above the surface of the site. The monitoring well is to be structurally reinforced to support the additional length. The monitoring well will act as a vent for LFG. The vented LFG will be monitored during surface covering disturbance work.
- Option B: The monitoring well is removed by a licenced driller and the resultant void filled with grout to the site surface.
- Option C: the monitoring well seal is repaired by a licenced driller and remains in-situ.

It is noted that there are several LFG monitoring wells across the site (LFGW01 – LFGW10), should the proposed site use require the removal of these then the above process can be implemented.

During the above options, landfill gas monitoring must be conducted to ensure that a hazardous atmosphere does not occur during the work (refer to **Table 6-1**). Following completion of either decommissioning or repair, surface emission monitoring should be conducted to ensure the work was successfully completed and no surface methane concentrations are reported above the relevant threshold value (**Table 6-1**).

6.4 Basic Personal Protective Equipment (PPE) and Hygiene

General PPE requirements will be detailed in the site CEMP.

Regarding hygiene, no smoking can occur on-site and there must not be any naked flames.

6.5 Reinforcement of Surface Covering Beneath Proposed Structures

As part of the CPB site use, demountable offices, lunchrooms and toilet blocks are proposed to be placed on-site on raised footings. Structures will be on raised footings providing a void space beneath structures with good ventilation providing a gas protection score of 2.5 (NSW EPA, 2020). It is noted that this already gives a protection score exceeding the required protection value of 2 (JBS&G DSI, 2023).

To further protect the structures from potential landfill gas, it is required that a 200 mm geotechnically (level 1) suitable layer of Excavated Natural Material (ENM) or Virgin Excavated Natural Material (VENM) be placed within the footprint of the site structures to supplement the surface covering present at the site.

The performance of the surface covering on reducing LFG concentrations at the surface of the site is relatively unknown. Hence, JBS&G understands the structures at the site will be installed on raised footings with a subfloor void space. Gas protection for the structures relies on the void space and monitoring in accordance with this plan during CPB's occupation.

Following the placement of the surface covering improvement, a survey of the placed layer is to be completed and an inspection by an appropriately qualified person is required to confirm the required extent is met. A site survey of the emplaced material is to be conducted to demonstrate the area has been supplemented relative to the initial site survey.

6.6 Structure Inspection and Indoor Air Quality Monitoring

Following the placement of structures and prior to occupation, an appropriately qualified person must inspect the structures to confirm the presence of a void space and that the structures are placed within the newly installed horizontal soil barrier with a 1 m buffer beyond the footprint of the structure.

As part of this inspection, indoor air monitoring will be conducted within the newly placed structures for the presence of hazardous ground gases including methane, carbon dioxide, carbon monoxide, and hydrogen sulphide. The adopted internal building air monitoring thresholds are provided in **Table 6-1**.

Following the pre-occupation monitoring, a monitoring event is to occur one week following occupation and then monthly thereafter.

An inspection letter is to be prepared documenting the findings of the inspection and monitoring events, and indicate whether the structure is suitable for occupation, or provide ameliorating actions as required.

6.7 Excavation/Surface Covering Disturbance

As part of the JBS&G DSI (2023), drilling into the subsurface was conducted through the advancement of 20 boreholes. Based on visual observations, a clear and distinct engineered final cap as defined in NSW EPA (2016) was not observed. A surface covering of variable thickness was encountered, generally extending to approximately 1.4 m bgl. At location, LFGW10, the surface covering thickness was observed to be 0.7 m bgl and the thickness was unclear in locations LFGW07 and LFGW08 which are in topographical low points. LFG monitoring well locations are shown in **Figure 3**.

6.7.1 Disturbance of the Surface Covering

Disturbance of the surface covering requires on-site supervision and monitoring of landfill gas conditions from the commencement of surface covering disturbance work. Given the variability of the surface covering, apart from in the vicinity of LFGW07 and LFGW08 where thickness was unclear, the shallowest depth of the surface covering was 0.7 m bgl. Generally, landfill material was encountered beyond 1 m bgl.

During surface covering disturbance, supervision by an appropriately qualified person is required to ensure excavation does not extend into the landfill material and monitoring of landfill gas atmospheric conditions in the vicinity of the excavation is conducted.

As part of the supervision, the excavation work is to be observed for the presence of landfill material. The landfill encountered during the JBS&G DSI (2023) comprised gravelly peaty sand, brown, and wet with inclusions of metal, glass, plastic, fabric, and decomposing vegetation. In other locations, the landfill was described as brown/grey sandy gravel with vegetation and clay clasts with a strong acetone-like odour, and others as a brown silty clay with inclusions of decomposing vegetation, wood mulch chips and roots. Given the variability in the composition, it is considered that supervision is required to determine whether landfill material has been encountered and to monitor the excavation for landfill gas.

A calibrated landfill gas meter capable of measuring lower explosive limit (LEL) based on methane concentrations, and concentrations of carbon dioxide, oxygen, hydrogen sulphide and carbon monoxide must be used. A meter is required per excavation/soil disturbance location on-site. Monitoring thresholds are provides in **Table 6-1**.

The appropriately trained and qualified personnel responsible for the supervision of excavation work and the atmospheric conditions must guide work and workers in accordance with the measurements of the landfill gas monitors. Alarms on the monitors are typically preconfigured to set points. Work is to cease if 5% of the LEL is encountered, an exclusion zone is established, and the excavation is allowed to vent. Once atmospheric conditions return to a safe level the supervisor will indicate that the excavation can resume under supervised and monitored conditions.

Typical alarm set points for personal explosive gas meters are:

- **Explosive gases (% LEL) – 5 and 10 %LEL**
- **Hydrogen Sulphide (H2S) – 10 and 15 ppm**
- **Carbon Monoxide (CO) – 25 and 200 ppm**
- **VOCs – 50 ppm**
- **Oxygen (O2) – 19.5 and 23.5 %v/v**
- **Carbon dioxide – 5,000 and 30,000 ppm**

PPE to be available on-site must include half-faced respirators fitted with an organic vapour cartridge.

6.8 Surface Emission Monitoring (Methane)

The CoR EMP (2021) stated that further assessment of ambient methane levels on-site in well-ventilated areas was not considered necessary. Given the variable surface cover on the site, JBS&G considers it necessary to conduct surface emission monitoring at the site. Surface emission monitoring must be conducted by a suitably trained and qualified environmental consultant and occur in accordance with NSW EPA (2016) which is summarised below:

- Methane concentrations are to be measured in the atmosphere approximately 5 cm above the surface of the landfill using a calibrated Geotech SEM5000 Laser Methane Analyser or similar that is able to detect methane at sufficiently low concentration (20 ppm);
- Surface emissions are measured in a 10 m by 10 m grid pattern. It is noted that this grid pattern is more conservative than the guideline recommendation of 25 m grid spacing;
- Any surface depressions, surface fissures or penetrations into the ground surface (such as monitoring wells) where observed are measured in addition to the grid pattern;
- Site weather conditions including rainfall (recent and occurring), temperature, atmospheric pressure, and wind speed (not to exceed 10 km/h) must be recorded;
- The trigger for further investigation/corrective action is per **Table 6-1**; and
- Surface emissions monitoring must occur monthly. The frequency of monitoring can be reviewed following data acquisition.

6.9 Exit Procedure

Once CPB no longer requires the use of the site and intends to hand the site back to CoR, the following work should be completed to document the condition of the site being handed over:

- A final site survey is to be completed to provide site levels following CPB use. The final site survey will be compared to the initial site survey. The survey should include a markup of areas that have been sealed with asphalt/hardstand.
- A final surface emission monitoring event for the site in accordance with **Section 6.8**.
- Provision of a report that includes:
    - Summary of inspection(s) regarding the installation of the horizontal soil barrier, thickness, review of relevant ENM/VENM documentation and surface emission monitoring following placement;
    - Details of the indoor air quality monitoring and inspection of the raised-footing, demountable site office and structures;

- Routine surface emissions monitoring;
- Supervision of excavation; and
- Comparison of site levels and surface covering from the pre-occupation site survey and the post-occupation site survey to demonstrate the surface covering of the site has been returned in a like or improved condition – this also relates to the type of surface covering with impermeable seals such as asphalt or hardstand providing a greater protection from the emission of landfill gas to the atmosphere.

7. Unexpected Finds Associated with Landfill Gas

Indicators of potential landfill gas include:

- Flow of gases from the surface; and
- Odours.

Should these be encountered during work outside the above then work is to stop, the area cordoned off and the Unexpected Finds Procedure provided in the CEMP implemented.

8. Work Health and Safety Requirements

Due to the presence of landfill gas at the site, there is potential for methane to build up in future excavations at the site. If excavations are to be entered, then the entry must be undertaken in accordance with the requirements of the SafeWork NSW 2019 *Code of Practice Confined Spaces* (SWA, 2019).

A separate risk assessment should be undertaken by a competent person before carrying out any work. This will assess the following:

- Nature of the confined space;
- Work that is required;
- Range of methods by which the work can be undertaken;
- The hazards involved;
- The method selected; and
- Emergency and rescue procedures.

Monitoring of the atmospheric conditions must be undertaken to assess whether entry into a potential confined space will require PPE, including the supply of ventilation and fresh air.

Monitoring of works will also be required, as per **Section 6.7.1**, to monitor potential explosive limits of methane present at the site.

9. Non-Compliances and Record Keeping

Where non-compliances area identified, the non-complying party will be required to rectify the non-conformity as soon as possible, as per the requirements of the relevant procedure(s) where the non-compliance has occurred. Detail of the corrective actions taken to rectify the non-compliance shall be provided to the Site Environmental Manager or appointed representative (Site Manager/Project Engineer) in writing.

Where a non-compliance cannot be rectified, the LFGMP is required to be reviewed as described in **Section 10.**

The Site Operator shall be responsible for the maintenance of all documents relating to the implementation of the LFGMP. This shall include inspection reports, any additional assessment undertaken and any relevant correspondence between the Site Operator and the Site Environmental Manager.

All records should be maintained to assist ongoing implementation and review/revision of the LFGMP.

10. LFGMP Review and Revision

It may be necessary to revise the LFGMP to reflect changes to legislation and / or regulatory requirements, changes to site conditions and/or improvements in technologies or knowledge.

The LFGMP should be reviewed every one month during construction for the following aspects:

- Revision of the LFMGP will be necessary if the details in the LFGMP have changed (i.e. further assessment provides additional data to inform the LFGMP, impacted material has been remediated / removed from site, additional or unexpected impacts are encountered during site works and/or material changes in relevant legislation, codes and guidelines).
- Revision of the LFGMP will be necessary on completion of development works to incorporate the design details.
- Revision of the LFGMP should be undertaken by an appropriately qualified and experienced Environmental Consultant.
- Copies of the revised LFGMP should be issued to the Site Operator for agreement.
- Copies of the revised LFGMP should be distributed to the current Site Environmental Manager for on-going implementation.
- The Site Environmental Manager should ensure that the most current, up to date LFGMP is provided to all workers on site as part of induction into the LFGMP and requirement to undertake work onsite.

Any future changes in the LFGMP must not result in an increased risk to human health, structures and/or the environment.

11. Site Suitability

Subject to the implementation of the requirements of this LFGMP, and the limitations in **Section 13**, the site is considered suitable for the proposed CPB development and site use as described in **Section 2.3**. Following CPB occupancy/site use, the site is to be handed back to CoR for the resumption of waste recovery/recycling activities. Once CPB has handed the site over, to CoR or others, this LFGMP is no longer applicable and the site owner/occupier will need to satisfy themselves of the safety of their operations and legislative compliance within the context of landfill gas management/controls.

12. References

- Environmental Planning and Assessment 1979 (EPA, 1979).
- Model Work Health and Safety Act, 2016 (WHS, 2016).
- NSW EPA 2012, Guidelines for the Assessment and Management of Sites Impacted by Hazardous Ground Gases (NSW EPA, 2012).
- CIRIA 2007, Assessing Risks posed by Hazardous ground gases to buildings, C665 (CIRIA, 2007)
- SafeWork Australia 2018, Workplace Exposure Standards for Airborne Contaminants (SWA, 2018).
- Environmental Guidelines: Solid Waste Landfills, State of NSW, Environment Protection Authority, Second Edition (EPA, 2016).
- Landcom 2004, Managing Urban Stormwater: Soils and Construction guide (Landcom, 2004).
- SafeWork NSW 2019, Code of Practice 'Confined Spaces'.

13. Limitations

This report has been prepared for use by the client who has commissioned the works in accordance with the project brief only and has been based in part on information obtained from the client and other parties.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

JBS&G accepts no liability for use or interpretation by any person or body other than the client who commissioned the works. This report should not be reproduced without prior approval by the client or amended in any way without prior approval by JBS&G, and should not be relied upon by other parties, who should make their own enquiries.

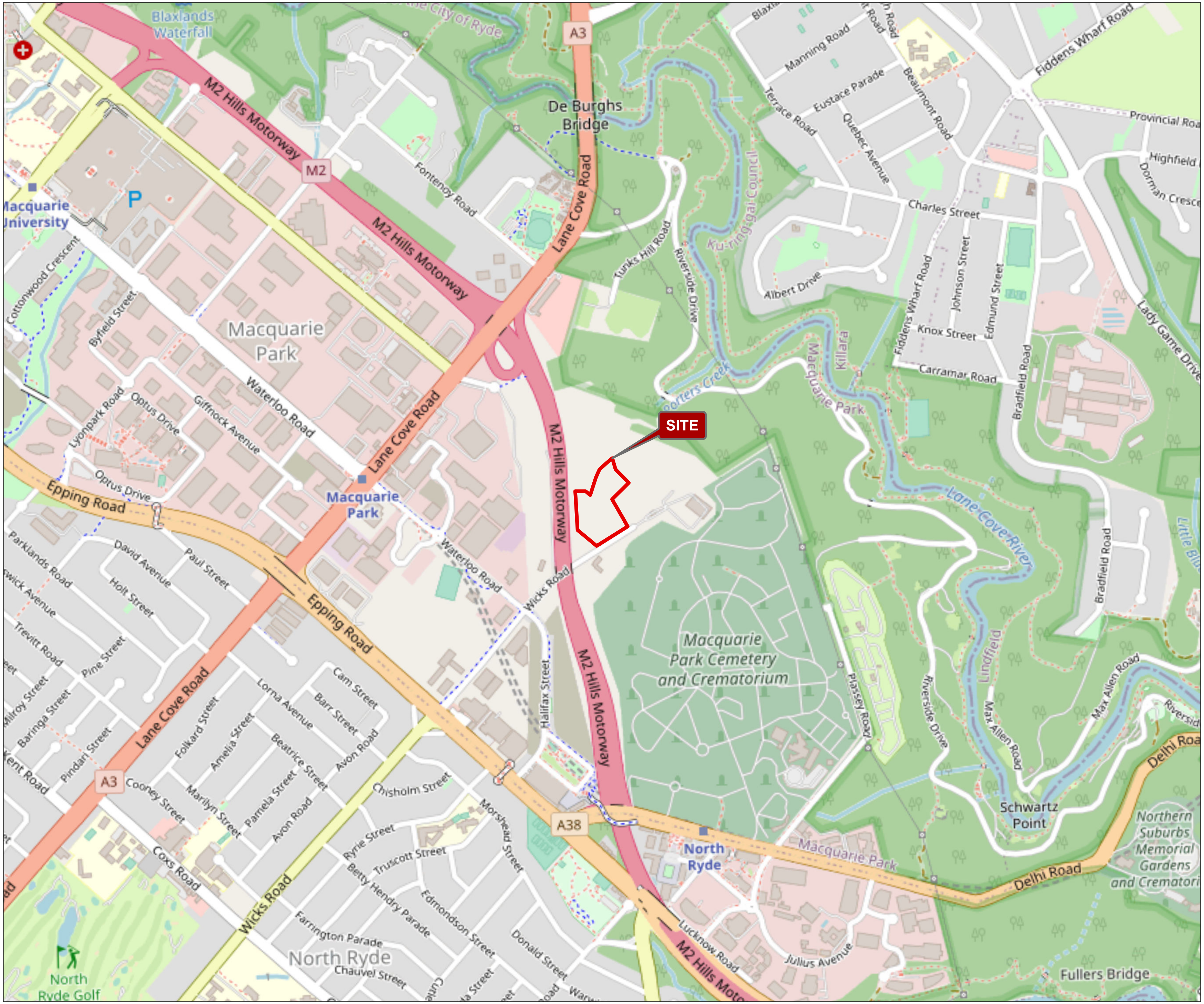
Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the regulatory requirements.

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. Ground conditions between sampling locations and media may vary, and this should be considered when extrapolating between sampling points. Chemical analytes are based on the information detailed in the site history. Further chemicals or categories of chemicals may exist at the site, which were not identified in the site history and which may not be expected at the site.

Changes to the subsurface conditions may occur subsequent to the investigations described herein, through natural processes or through the intentional or accidental addition of contaminants. The conclusions and recommendations reached in this report are based on the information obtained at the time of the investigations.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should information become available regarding conditions at the site including previously unknown sources of contamination, JBS&G reserves the right to review the report in the context of the additional information.

Appendix A Figures



Legend

Approximate Site Boundary

JBS&G

Job No: 62899

Client: CPB Contracting

Version: R03 Rev A	Date 18/08/2023
Drawn By: EP	Checked By: JB

Scale 1:15,000

0 140 280

metres

Coord. Sys. GDA 1994 MGA Zone 56

160 Wicks Road
Macquarie Park, NSW

SITE LOCATION

FIGURE 1

File Name: C:\Users\epiccinin\JBS&G Australia\JBS&G - DCS - Internal - Documents\Projects\CPB Contracting\62899 WFU Priority B and C DSI\GIS\02_MapProjects\62899_WFUPriorityDSI_R03_RevA.aprx

Legend

- Approximate Site Boundary
- NSW Cadastre

Site Features

- Damaged Historical Monitoring Well

Historical Sample Location (IENVI, 2021)

- Surface Sample Location

Sample Locations (JBS&G 2022)

- Borehole Location
- Borehole/Landfill Gas Well Location

JBS&G

Job No: 62899	
Client: CPB Contracting	
Version: R03 Rev A	Date 21/08/2023
Drawn By: EP	Checked By: JB

Scale 1:1,500

0 10 20
metres

Coord. Sys. GDA 1994 MGA Zone 56

160 Wicks Road
Macquarie Park, NSW

SITE LAYOUT AND DSI/HISTORICAL SAMPLE LOCATIONS

FIGURE 2

File Name: C:\Users\epiccinin\JBS&G Australia\JBS&G - DCS - Internal - Documents\Projects\CPB Contracting\62899 WFU Priority B and C DSI\GIS\02_MapProjects\62899_WFUPriorityDSI_R03_RevA.aprx
Reference: Nearmap - www.nearmap.com (Capture Date: 20/06/2023)

File Name: C:\Users\epiccinin\JBS&G Australia\JBS&G - DCS - Internal - Documents\Projects\CPB Contracting\62899 WFU Priority B and C DSI\GIS\02_MapProjects\62899_WFUPriorityDSI_R03_RevA.aprx
Reference: Nearmap - www.nearmap.com (Capture Date: 20/06/2023)

Appendix B CPB Site Plans

Figure 1-2: Indicative layout of the proposed Wicks Road construction support site (WFU10) as presented in the modification report

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