Detailed Site Investigation, Finucane Reserve, 1 Finucane Crescent, Matraville NSW

Randwick City Council

Report

JBS&G 68409 | 164,716

5 March 2025

JBS&G

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.

Caring for Country The Journey of JBS&G
Artist: Patrick Caruso, Eastern Arrernte

Table of Contents

List of Tables

Appendices

Abbreviations

Term	Definition
ACM	Asbestos Containing Material
AECs	Areas of Environmental Concern
AF/FA	Asbestos Fines / Fibrous Asbestos
AHD	Australian Height Datum
ASS	Acid Sulfate Soils
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CLM Act	Contaminated Land Management Act 1997
COPCs	Contaminants of Potential Concern
CSM	Conceptual Site Model
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objectives
DSI	Detailed Site Investigation
EILs/ESL	Ecological Investigation/Screening Levels
EPA	NSW Environment Protection Authority
ha	Hectare
HGG	Hazardous Ground Gas
HILs/HSLs	Health Investigation/Screening Limits
JBS&G	JBS&G Australia Pty Ltd
LEP	Local Environmental Plan
LOR	Limit of Reporting
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
OCPs	Organochlorine Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PFAS	Per-and Polyfluoroalkyl substances
QA/QC	Quality Assurance / Quality Control
RCC	Randwick City Council
RPD	Relative Percent Difference
SAQP	Sampling Analysis and Quality Plan
TRH	Total Recoverable Hydrocarbons

Executive Summary

JBS&G Australia Pty Ltd (JBS&G) was engaged by Randwick City Council (RCC, the client) to undertake a Detailed Site Investigation (DSI) for Finucane Reserve located at 1 Finucane Crescent, Matraville, NSW (the site). The site is legally identified as Lot 8 in Deposited Plan (DP) 113489, in addition to a small portion of land to the north comprising an undeveloped section of the Finucane Crescent road reserve. The site location and site layout are shown in **Figures 1** and **2** respectively**.** The combined area of the site is approximately 5,000m^2.

The reserve was historically utilised as a dumping ground between 1942 to 1955, with the park established in the early 1980s. JBS&G understands that during previous works involving the removal of an area of the play facilities, asbestos containing material (ACM) was identified and works were halted and the area capped and covered with clean material (RCC 2024[1]).

An upgrade to the playground and surrounding facilities is proposed. All works are proposed to occur in the northern extent of the site, in proximity to the existing play equipment. Based on the scope of proposed upgrades it is anticipated that works will only require shallow disturbance of soils for minor levelling and some trenching. Given the previous identification of surficial asbestos and the surficial nature of the proposed works, the DSI aimed to characterise potential contamination in surficial soils to 0.5 m at the site to assess the risks to workers during the proposed works and to users from potential contamination in surface soils. Investigation of potential contamination below 0.5 m to assess the overall suitability of the site was beyond the scope of this investigation.

The investigation scope included a desktop assessment to identify potential sources of contamination, development of a sampling and analysis quality plan (SAQP), intrusive investigation across the site to assess potential asbestos and other contamination of surficial soils to 0.5 m depth, asbestos air monitoring during intrusive investigation works, screening of potential hazardous ground gas (HGG) surface emissions across the site, laboratory analysis of collected soil samples for asbestos and other contaminants of potential concern (COPCs), and preparation of a DSI report, with consideration to applicable guidelines made or endorsed by NSW Environment Protection Authority (EPA).

As mentioned above, as asbestos was previously identified onsite, and in accordance with the EPA guidance (EPA 2022[2]), a double sampling density was adopted where 26 test pits were advanced across the site with an additional six test pits (TP27-TP32) advanced for visual observations. Following the intrusive works, JBS&G provided the following conclusions and recommendations:

- The site is generally absent of gross and/or widespread contamination. Notwithstanding, potentially unacceptable risks to future site users were identified at the site, as summarised following:
    - The presence of bonded ACM within subsurface soils above the Health Screening Criteria (HSL-C) and asbestos fines / fibrous asbestos (AF/FA) below the HSL criteria at one location (TP03_0.2-0.5) in the northeast of the site within the proposed works area and assumed to be present in soil beneath the soft-fall rubber of the adjacent playground. The presence of bonded ACM above criteria and AF/FA below the criteria will require management to ensure that ACM is not present on the site surface following redevelopment; and
    - The presence of bonded ACM within surficial soils at three locations (TP23, TP25 and TP31) outside the works area in the south of the site represents a potentially unacceptable risk to future site users and maintenance workers and as such impacted fill/soil requires to be managed.

[1] *Finucane Reserve, Matraville, Site Brief.* Randwick City Council, 5 November 2024 (RCC 2024).

[2] *Contaminated Land Guidelines: Sampling design part 1 – application*, NSW EPA, August 2022 (EPA 2022).

- While current grass and soft-fall surfaces are maintained there are no complete exposure risks to asbestos fibres for current use and maintenance of these areas given the ACM and AF/FA is covered by existing grass or soft-fall rubber mitigating potential for fibres to be released and become airborne.
- The presence of asbestos in soil at the site should be identified via implementation of an Asbestos Register incorporated into an Asbestos Management Plan (AMP) in accordance with *Work Health and Safety Regulation 2017* such that potential occupational exposure scenarios may be appropriately addressed during maintenance of the site in its current state, until such time as the risks are removed;
- No other potentially unacceptable contamination risks to future site users were identified at the site;
- Asbestos air monitoring was conducted during the intrusive works with all reported results considered satisfactory and conforming with the minimum action level of 0.01 fibres/mL for control monitoring as outlined in the *Work Health and Safety Regulation 2017* and Safework NSW (2022) *Code of Practice – How to Safely Remove Asbestos*. A copy of the asbestos air monitoring report is presented in **Appendix J**;
- Following the intrusive works, JBS&G conducted an asbestos clearance inspection for the site's ground surface. No asbestos was identified on the ground surface during the clearance. A clearance letter was prepared and issued to RCC on 8 January 2025 and is provided in **Appendix K;**
- No evidence of background contamination of site soils was identified;
- No unacceptable risk to site users were identified from surface HGG emissions based on the reported concentrations of methane gas and carbon dioxide;
- With consideration of the proposed land use, and observations made during the investigation, aesthetic issues other than the presence of visible ACM within surficial soil were not identified;
- In absence of gross and/or widespread surficial soil contamination at the site, no potential issues relating to off-site migration of contaminants were identified under the current site conditions given the non-friable ACM in surficial soils and noting the friable asbestos at one location was not present in surface soil and covered by grass. Should existing vegetative cover be significantly disturbed, management actions would be necessary to appropriately manage the potential risk of airborne asbestos fibre generation and subsequent contaminant migration; and
- The site within the study boundaries is suitable for the proposed works and recreational use subject to the implementation of the below management recommendations.

Based on the conclusions and limitations of the investigation it is recommended that:

- Management of the identified asbestos contamination is undertaken via preparation and implementation of a Remedial Action Plan (RAP) for the site within the study boundaries to be considered suitable for the proposed works and ongoing use; and
- In the meantime, appropriate asbestos management procedures should be implemented via preparation and implementation of an AMP and asbestos register to ensure occupational exposure risks are appropriately managed during any/all activities that result in ground surface disturbance.

1. Introduction

1.1 Background

JBS&G Australia Pty Ltd (JBS&G) was engaged by Randwick City Council (RCC, the client) to undertake a Detailed Site Investigation (DSI) for Finucane Reserve located at 1 Finucane Crescent, Matraville, NSW (the site). The site is legally identified as Lot 8 in Deposited Plan (DP) 113489, in addition to a small portion of land to the north comprising an undeveloped section of the Finucane Crescent road reserve. The site location and site layout are shown in **Figures 1** and **2** respectively**.** The combined area of the site is approximately 5,000m^2.

The reserve was historically utilised as a dumping ground between 1942 to 1955, with the park established in the early 1980s. JBS&G understands that during previous works involving the removal of an area of the play facilities, asbestos containing material (ACM) was identified and works were halted and the area capped and covered with clean material (RCC 2024[3]).

An upgrade to the playground and surrounding facilities is proposed. All works are proposed to occur in the northern extent of the site, in proximity to the existing play equipment. Based on the scope of proposed upgrades it is anticipated that works will only require shallow disturbance of soils for minor levelling and some trenching.

Given the previous identification of surficial asbestos in soil and the surficial nature of the upgrade works proposed by Council, the DSI aimed to characterise potential contamination in surficial soils to 0.5 m at the site to assess the risks to workers during the proposed works and to users from asbestos in surface soils. Investigation of potential contamination below 0.5 m to assess the overall suitability of the site was beyond the scope of this investigation.

The scope of this DSI included , a desktop assessment of the site's environmental setting and historical land use, implementation of a sampling, analysis and quality plan (SAQP) involving collection and analysis of soil samples from 26 locations to a depth of 0.5 m, visual observations from an additional six locations, soil sample analysis for a range of contaminants of potential concern (COPC), monitoring of surface emissions of any potential hazardous ground gases (HGG) to inform risk to site workers and users, data assessment including comparison of results against EPA endorsed land use criteria for developed open space scenarios, and preparation of this DSI report consistent with guidelines made or endorsed by NSW Environment Protection Authority (EPA).

1.2 Objectives

The objectives of the surficial DSI are to characterise potential contamination in surficial soils to 0.5 m at the site to assess the risks to workers during the proposed works and to users from potential contamination risks in surface soils.

1.3 Scope of work

The scope of work undertaken to prepare this DSI comprised:

- A desktop review of site history and background information, to identify potential areas of environmental concern (AECs) and associated COPCs;
- A detailed inspection of the site and immediate surrounds, and implementation of a SAQP for assessing soils to 0.5 m depth;

[3] *Finucane Reserve, Matraville, Site Brief.* Randwick City Council, 5 November 2024 (RCC 2024).

- Completion of intrusive soil sampling activities and asbestos quantification (AQ) from 26 test pits across accessible areas of the site, and observation of surface soils at a further six test pit locations;
- Completion of asbestos air monitoring during the intrusive soil sampling activities;
- Completion of HGG surface emission monitoring across the site;
- Laboratory analysis of representative soil samples for a range of COPC including heavy metals, asbestos, organochlorine pesticides (OCPs), total recoverable hydrocarbons (TRH), polycyclic aromatic hydrocarbons (PAHs), benzene, toluene, ethylbenzene and xylene (BTEX) and polychlorinated biphenyls (PCBs);
- Preparation of this DSI report in general accordance with relevant EPA guidelines.

2. Site Condition & Surrounding Environment

2.1 Site Identification

The location of the site is shown in **Figure 1**. The site details are summarised in **Table 2.1** and described in detail in the following sections.

Table 2.1 Site Identification

Lot / DP Number	Lot 8 DP 113489
Street Address	1 Finucane Crescent, Matraville NSW
Local Government Authority	Randwick City Council
Site Area	Approximately 5,000m^2 to a depth of 0.5 m below ground surface.
Current Zoning	The site is zoned RE1 (Public Recreation) under the Randwick *Local Environmental Plan (LEP) 2012*
Geographic Coordinates (approximate centre of site) (GDA94 MGA56)	E: 337365 N: 6241000
Previous Land Use	Vegetated and vacant land
Current Land Use	Recreational public open space
Proposed Use	Ongoing recreational open space, following proposed upgrade works in the north of the site.

2.2 Site Description

A site inspection was undertaken on the 4 December 2024 by an appropriately trained and qualified JBS&G environmental consultant (consistent with NEPC (2013) ASC NEPM[4] guidelines). A photographic log is included as **Appendix B.**

Access to the property was through Finucane Crescent where bollards were observed at the reserve entry to block off vehicle access. The site was generally flat and sloped slightly to the southwest.

The site is predominantly landscaped comprising grass and trees with a small portion comprising wet pour rubber in the northeastern section used as a playground area. All vegetation on site appeared to be healthy and in good condition with some observed patches of sand around the trees and in the southern portion of the site along the boundary. No asbestos or staining was observed along the ground surface.

2.3 Surrounding Land Uses

The land uses surrounding the site have been identified as follows:

- North – The site is bound to the north by Matraville Soldiers' Settlement Public School followed by a Childcare Centre and residential properties;
- East – The site is bound to the east by Finucane Crescent and residential properties, followed by Lawson Street;
- South – The site is bound to the south by residential properties followed by Flinders Street; and
- West – The site is bound to the west by residential properties followed by Menin Road.

[4] *National Environment Protection Council National Environment Protection (Assessment of Site Contamination) Measure 1999,* as amended 2013 (NEPC 2013 ASC NEPM)

2.4 Topography

A review of the topography within a 1 km radius of the site was undertaken through LotSearch (Ref: LS069498 EP, p.49 of **Attachment B**) which indicates that the site lies at an elevation between 28 and 32 m Australian Height Datum (AHD), with the overall topography gently sloping southwest.

2.5 Geology & Soil

A review of the geology and soils within a 1 km radius of the site was undertaken through LotSearch (Ref: LS069498 EP, p.63-65 of **Attachment B**) indicating that the site is present within the coastal deposits – bedrock-mantling dune facies comprising marine deposited and aeolian reworked fine to coarse grained quartz-lithic sand with abundant carbonate, sporadic humic debris in stabilised dunes.

Reference to the NSW Department of Planning and Environment's online eSPADE application[5] indicates that the site is within the Tuggerah Landscape group. This group of landscape is characterised by gently undulating to rolling coastal dunefields comprising quaternary (Holocene and Pleistocene) wind-blown, fine to medium grained, well sorted marine quartz sand. Limitations include extreme wind erosion hazard, non-cohesive, highly permeable soil, very low soil fertility, localised flooding and permanently high watertables.

2.6 Hydrology

The nearest permanent surface water receptors are the Tasman Sea and Botany Bay located approximately 2.2 and 2.3 km southwest and east of the site, respectively.

The site inspection identified the site to be generally flat and slightly sloping to the southwest. Rainfall is expected to infiltrate the surface soils or be collected by the stormwater drainage system located in the northeastern portion of the site which are expected to drain to Botany Bay located south of the site or Tasman Sea located to the east.

2.7 Hydrogeology

A search of licensed groundwater bores within 2 km of the site was undertaken through LotSearch (Ref: LS069498 EP, p.51-72 of **Attachment B**) identified a over 50 groundwater bores, generally functional and for the purpose of monitoring, water supply or commercial/industrial use, with the ones closest to the site used for water supply.

Given the topographical slope of the site and broader area, groundwater is anticipated to traverse southwest and east. No groundwater was encountered during the recent intrusive investigation.

2.8 Salinity Potential

A search through LotSearch (Ref: LS069498 EP, p.84 of **Attachment B**) indicates that there is no Dryland Salinity National Assessment data onsite, nor within the dataset buffer, nor where there any salinity assessments provided.

However, there was no indication of saline soils within fill soils assessed during the investigation.

2.9 Acid Sulfate Soils

Review of Acid Sulfate Soil (ASS) Risk Map[6] indicates that the site is located in an area with t no known occurrence of acid sulfate soil materials. Based on the scope of works extending to only 0.5 m below ground

[5] eSPADE DPE web application accessed on 02 August 2022 https://www.environment.nsw.gov.au/eSpade2WebApp
[6] Acid Sulfate Soil Risk Map – Edition 2, 1997 1:25 000, NSW Department of Land and Water Conservation (DLWC), Ref 9130N3 (NSW DLWC)

surface (m bgs) and the location of the site, no further consideration of requirements for the assessment or management of ASS is warranted.

2.10 Meteorology

A review of average climatic data for the nearest Bureau of Meteorology monitoring location (Sydney Airport AMO) indicates the site is located within the following meteorological setting:

- Average minimum temperatures vary from 7.4 ^{o}C in July to 19.2 ^{o}C in February;
- Average maximum temperatures vary from 17.2 ^{o}C in July to 26.7 ^{o}C in January;
- The average annual rainfall is approximately 1095.6 mm with rainfall greater than 1 mm occurring on an average of 96.1 days per year; and
- Mean monthly rainfall varies from 59.8 mm in September to 124.1 mm in June, with the wettest periods occurring on average between January and June.

3. Summary of Site History

Records of EPA searches, Australian and NSW Heritage Register searches and historic aerial imagery are included in the LotSearch report included in **Appendix C.**

3.1 Aerial Photographs

Historical aerial photographs were obtained through LotSearch (Ref: LS069498 EP, p.26-40 of **Attachment B**). The aerial photograph review identified the following features in relation to the history of the site and surrounding area, which are summarised in **Table 3.1** below.

Table 3.1 Historical Aerial Photograph Review

1930	The site comprised vacant vegetated land. The immediate surrounding land comprised vacant vegetated land. Vegetation appeared to be cleared north of the site. A dirt track consistent with Menin Road was present.
1943	The site remained consistent with the 1930 aerial. The immediate surrounding land remained consistent with the 1930 aerial. Vegetation appeared to be cleared south of the site. Menin Road dirt track appeared to be covered with vegetation in some portions. Flinders Street and Knowles Avenue were present. Residential properties were observed to the east and south of the site.
1951	The site had the vegetation cleared and appeared to have some filling activities similar to the land to the north. Additional residential properties were observed south of the site. Industrial warehouses followed by Pozieres Avenue and residential properties were observed to the northeast and north of the site
1955	The site remained consistent with the 1951 aerial with Finucane Crescent observed to transect the northern portion of the site. Additional vegetation was cleared north, northeast and northwest of the site, with residential structures observed north of the site. Menin Road was present.
1961	The site appeared to have undergone some filling activities. Additional residential properties were observed east, north, northwest and northeast of the site.
1965	The site and surrounding properties remained consistent with the 1961 aerial.
1970	The site remained consistent with the 1965 aerial. Some residential properties were observed in the previously vacant land southeast of the site.
1978	The site remained consistent with the 1970 aerial, with some trees observed scattered in the northern and western portions and along the eastern boundary of the site. The industrial warehouses northwest of the site appeared to be demolished and replaced with some residential properties and Flanders Avenue.
1982	The site remained consistent with the 1978 aerial. Additional residential properties were constructed surrounding Flanders Avenue northwest of the site.
1986	The site and surrounding properties remained consistent with the 1982 aerial.
1991	The site and surrounding properties remained consistent with the 1986 aerial.
1994	The site and surrounding properties remained consistent with the 1994 aerial.
2005	The section of Finucane Cresent that traversed the site was removed and the playground area was observed in the northeast portion.

	Buildings associated with Matraville Soldiers' Settlement Public School were constructed north of the site.
2014	The site and surrounding properties remained consistent with the 2005 aerial An additional building associated with Matraville Soldiers' Settlement Public School was constructed north of the site.
2024	The site and surrounding properties remained consistent with the 2014 aerial.

3.2 EPA Searches

A search of the NSW EPA database was undertaken through LotSearch (Ref: LS069498 EP, p.7-17 of **Attachment B**) for the site and surrounding properties within a 1 km radius. The search was undertaken through the following public registers:

- NSW EPA *Protection of the Environment Operations Act 1997* (POEO Act) public register of licences, applications and notices (maintained under Section 308 of the POEO Act).
    - No prevention, clean-up or penalty notices have been issued under the POEO Act for the site. A clean up notice (1033934) was issued for a premises located approximately 860 m southeast of the site. However, due the distance from the site and its downgradient location, it is not considered to pose a risk.
- NSW EPA contaminated land public register of record of notices (under Section 58 of the *Contaminated Land Management Act 1997* (CLM Act)).
    - No notices have been issued under the CLM Act for the site and immediate surrounding land. A notice was issued for 7-Eleven Service Station Matraville located at 515 Bunnerong Road, Matraville approximately 680 m west of the site.
- NSW contaminated sites notified to the EPA (under Section 60 of the CLM Act).
    - The site itself is not listed as notified to the EPA.
    - A premises located on Kain Avenue, Matraville comprising a former Rieco Incinerator located 53 m east of the site was notified to the EPA, with contamination being managed via the planning process (EP&A Act).
    - A premises located on 3 Wilkes Avenue, Matraville comprising a vacant lot located 266 m east of the site was notified to the EPA, with regulation under the CLM Act not required.
    - A premises located on 515 Bunnerong Road, Matraville comprising 7-Eleven Service Station Matraville, located 680 m west of the site was notified to the EPA, with contamination formerly regulated under the CLM Act.
    - A premises located on Franklin Street, Malabar comprising Anzac Rifle Range Former Landfill located 921 m east of the site was notified to the EPA, with regulation being finalised.
- Per-and Poly-fluoroalkyl substances (PFAS) Investigation Program.
    - The site is not listed by EPA on the NSW Government PFAS Investigation program. The closest PFAS investigation area identified by the EPA are Botany Industrial Park located on Dent Street, Botany and Botany Bay Area and Georges River located approximately 1470 m west and 1966 m southwest of the site, respectively. Given the distance from the site, it is unlikely that PFAS related impacts pose a risk to the site.

3.3 Australian and NSW Heritage Register

A search of Australian, State and Commonwealth heritage was undertaken through LotSearch (Ref: LS069498 EP, p.94-96 of **Attachment B**). The search identified the presence of items of Commonwealth and State heritage within 1 km of the site as listed below:

- Malabar Headland located on Franklin Street, Malabar NSW, approximately 749 m east of the site is listed on the Commonwealth Heritage List (place id 105605) and State Heritage Register (map id 5056225);
- Caretakers Cottage and Anzac Rifle Range Malabar located on Franklin Street, Malabar NSW, approximately 921 m east of the site is listed on the Commonwealth Heritage List (place id 106238);
- Long Bay Correctional Centre located on 1250 Anzac Parade, Malabar NSW, approximately 861 m south-east of the site (map id 5045013); and
- Sixteen additional places listed and classified as general on the Environmental Planning Instrument – Heritage located between 376m and 991 m from the site.

3.4 Fair Trading NSW Properties Affected by Loose Fill Asbestos Insulation.

A search of the Fair-Trading NSW Loose-fill Asbestos Insulation Register (LFAI register[7]) for the site address has indicated that the property comprising the site is not currently registered as being affected by the presence of LFAI.

3.5 Dangerous Goods

A dangerous goods licence search of the stored chemical information database of SafeWork NSW was not considered warranted as part the investigation. Review of historical aerials and the site inspection indicated that no significant chemical or fuel storage is apparent at the site.

3.6 Section 10.7 Planning Certificate Search

Council 10.7 (2) and (5) Planning Certificates for the site were obtained from Randwick City Council and are included in **Appendix D**. The planning certificates included the following pertinent information regarding the site:

- The site is zoned as RE1 (Public Recreation) in *Randwick Local Environmental Plan 2012;*
- The land does not include or comprise a critical habitat area under the *Biodiversity Conservation Act 2016*;
- The land is not located in a heritage conservation area under the Randwick LEP 2012;
- Council has not adopted a policy or been notified of any adopted policy of another public authority, that restricts development on the land because of the likelihood of land slip, bush fire, tidal inundation, subsidence; salinity, coastal hazards, or sea level rise;
- Council does have adopted policies or has been notified of adopted policies of another public authority on matters relating to the risk of acid sulphate soils; contamination; low-lying lands; aircraft noise; Malabar Treatment Plant odour; and Former Matraville Incinerator land;
- The land is not affected by a policy adopted by any other public authority and notified to the council for the express purpose of its adoption by that authority being referred to in planning certificates issued by the council that restricts the development of the land because of the likelihood of land slip, bushfire, (other than flooding), tidal inundation, subsidence, acid sulfate soils or any other risk;
- The land is not affected by any road widening or road realignment under the *Roads Act 1993*, Part 3, Division 2 or under the provisions of Randwick LEP 2012;

[7] http://www.fairtrading.nsw.gov.au/ftw/Tenants_and_home_owners/Loose_fill_asbestos_insulation/Public_register_of_affected_properties.page accessed 17 January 2025

- The land or part of the land is not within the flood planning area and is not subject to flood related development controls;
- The land or part of the land is between the flood planning area and the probable maximum flood and subject to flood related development controls;
- The land is not declared to be a mine subsidence district with the meaning of the *Coal Mine Subsidence Compensation Act 2017*;
- The land is not bush fire prone land;
- The land does not include any residential premises (within the meaning of the *Home Building Act 1989*, Part 8, Division 1A) that are listed on the loose-fill asbestos insulation register kept under that division;
- The land is not biodiversity certified land;
- The land is not significantly contaminated, subject to a management order, an approved voluntary management proposal, an ongoing maintenance order, or subject of a site audit statement within the meaning of the CLM Act 1997.

3.7 Historical Title Records

A copy of the historical title documentation obtained for the site are provided in **Appendix E**.

The site comprised of two parts and has been owned by The Crown Land since 1886 to 1977. Part numbered 2 on the Cadastral Records was subject to a Crown Reserve from occupation under Miner's Rights or Business license in 1935 before being transformed for use as a playground in 1948. Both parts were combined in 1954 for continued use a playground under the Crown Reserve before being transferred to Randwick City Council in 1977.

3.8 Integrity Assessment and Summary of Site History

The information obtained from the historical sources reviewed has been found to be in general agreement. It is therefore considered that the information provided in this historical assessment has an acceptable level of accuracy.

Based on the review of aerial photographs, the site appears to have been historically vacant until filling activities took place between 1942 to 1955 as notified by RCC and observed in historical aerial imageries. The site was later transformed into a park in the 1970s and has been used as a public park to this day.

The EPA searches indicated no notices for the site relating to contamination or pollution.

4. Conceptual Site Model (CSM)

Based on review of previous assessments conducted for the Site and broader Precinct, and observations made during the recent JBS&G site inspection, a CSM has been prepared to document the COPCs, sources of COPCs, pathways, and potential receptors.

4.1 Overview

NEPC (2013) identifies a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The development of a CSM is an essential part of all site assessments.

This investigation aims to assess surficial contamination risks for the proposed development and site users and so the CSM focusses on surficial source-pathway-receptor linkages in the upper 0.5 m of the reserve.

NEPC (2013) identified the essential elements of a CSM as including:

- Known and potential sources of contamination and contaminants of concern including the mechanism(s) of contamination;
- Potentially affected media (soil, groundwater, vapours etc.);
- Human and ecological receptors;
- Potential and complete exposure pathways; and
- Any potential preferential pathways for vapour migration (if potential for vapours identified).

4.2 Potential Areas of Environmental Concern

Based on the site history review and observations of site conditions during the detailed site inspection, AECs and associated COPCs at the site have been identified and are presented in **Table 4.1**.

Table 4.1 Areas of Environmental Concern and Associated Contaminants of Potential Concern

Area of Environmental Concern (AEC)	Contaminants of Potential Concern (COPC)
Potential for filling activities across the site	Heavy metals, PAHs, TRH, BTEX, OCPs, PCBs, asbestos and HGG
Known presence of asbestos in surficial fill encountered during maintenance works	Asbestos

4.3 Potentially Contaminated Media

Potentially contaminated media that may be present at the site include:

- Fill materials; and
- Natural soil/bedrock.

Fill and surface soils are considered to be potential impacted media. Fill material is known to have been dumped historically on site. In addition, asbestos was identified during maintenance works conducted previously on site. It is noted the assessment herein focussed on surface soils to 0.5 m depth.

Where fill material is present, or soil has been disturbed (including for the burial of waste, and other infrastructure), there is a likelihood that environmental impact may be present at depth, consistent with the depth of the disturbance. Anthropogenic materials are commonly present in impacted fill materials and can be used as an indication of the depth of disturbance. Where fill material impacted with chemical based contaminants is identified, there the potential for impact to have migrated laterally and vertically below the

fill material to the natural strata. With the exception of asbestos, COPCs identified in **Table 4.1** for the Site have the potential to migrate from shallow soils into groundwater.

Soil vapour is unlikely to be a potentially contaminated medium noting the absence of fuel/chemical/waste use and storage at the site. However, the possible use of uncontrolled fill containing putrescible material at the site may result in surface HGG emissions that could influence the development and site users.

While contaminants in fill could pose a risk to groundwater, groundwater is not considered a potentially contaminated medium within the surficial soil to 0.5 m depth.

4.4 Potential for Migration

Contaminants generally migrate from site via a combination of windblown dusts, rainwater infiltration, groundwater migration and surface water runoff. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid/liquid and mobility characteristics);
- The extent of the contaminants (isolated or widespread);
- The location of the contaminants (surface soils or at depth); and
- The site topography, geology, hydrology and hydrogeology.

The potential contaminants of concern identified as part of the site history review and site inspection are generally in solid form (e.g. asbestos). The site is covered with grass and soft-fall rubber (playground) which decreases the potential for windblown contaminants to migrate from the site, although where grass cover is sparse or disturbed or soft-fall material removed there is a greater potential for asbestos fibres to become airborne.

As the site is landscaped, there is potential for vertical contaminant migration from soils to shallow groundwater, if present, via infiltration, however as groundwater is below the maximum investigation depth it is not assessed herein.

4.5 Receptors and Exposure Pathways

Potential pathways and receptors of environmental impact within the site which will need to be addressed with respect to potential risks to current and/or future site users include:

- Current and future site users who may potentially be exposed to COPCs through direct contact with or ingestion of impacted soils and/or inhalation of dusts associated with impacted soils if disturbed;
- Excavation/construction/maintenance workers conducting activities at the site, who may potentially be exposed to COPCs through direct contact with or ingestion of impacted soils present within excavations and/or inhalation of dusts associated with impacted soils;
- Any flora species to be established on the site; and
- Existing and/or future users/occupants of and/or workers at adjoining properties should surficial contamination migrate from the site. This is anticipated to be limited to potential contaminant migration via windblown dusts where surface is unsealed or becomes disturbed.

4.6 Preferential Pathways

For the purpose of this assessment, preferential pathways have been defined as natural and/or man-made pathways that result in the preferential migration of COPC.

Man-made preferential pathways are likely present throughout the site, generally associated with service trenches in which fill materials and disturbed natural soil are anticipated to have a higher permeability than

the surrounding undisturbed natural soils and/or bedrock. Noting the above discussions, however, based on the activities at the site, the potential for contaminants at the site to migrate via such pathways is low.

5. Sampling, Analysis and Quality Plan (SAQP)

5.1 Data Quality Objectives

Data quality objectives (DQOs) were developed for the investigation, as discussed in the following sections.

5.1.1 State the Problem

It is understood that an upgrade to the playground and surrounding facilities is proposed to be undertaken including installation of a concrete footpath, a picnic setting and shelter, new play equipment, shade sails, seats, replacement of existing rubber softfall surfaces and planting trees.

As a result, a site assessment was required to characterise surficial contamination conditions (<500 mm) at the site that might be potentially unacceptable for the proposed development from a health and ecological health perspective such that conclusions could be drawn on suitability of the proposed works and proposes recommendations on remediation and management of reported COPCs.

5.1.2 Identify the Decision

Based on the decision-making process for assessing urban redevelopment sites detailed in EPA (2017[8]), the following decisions must be made with regards to surficial soils (<500 mm):

- Are there any unacceptable risks to likely future on-site receptors?
- Are there any issues relating to background soil concentrations that exceed appropriate site soil criteria?
- Are there any issues relating to HGG surface emissions?
- Are there any impacts of chemical mixtures?
- Are there any aesthetic issues at the site?
- Is there any evidence of, or potential for, migration of contaminants from the site?
- Is further assessment and/or a site management strategy required?

5.1.3 Identify Inputs to the Decision

Inputs identified to provide sufficient data to make the decisions nominated above include:

- Desktop review of historical and current site uses to identify areas of potential concern;
- Detailed site inspection/walkover;
- Physical observations and interpretation of fill material through the collection of soil samples;
- Laboratory analysis data from potentially impacted media for COPCs;
- Monitoring of potential HGG surface emissions;
- Development of appropriate assessment criteria for evaluation of soil impacts; and
- Confirmation that data generated by sampling and analysis are of an acceptable quality to allow reliable comparison to assessment criteria as undertaken by assessment of quality assurance / quality control (QA/QC) as per the data quality indicators (DQIs) established in **Section 5.1.6**.

8 Contaminated Sites: Guidelines for the NSW Site Auditor Scheme, 3rd Edition, NSW EPA, 2017 (EPA 2017)

5.1.4 Define the Study Boundaries

The lateral study boundaries are limited to the boundaries of the site, as shown on **Figure 2**.

The vertical extent of the investigation was to a maximum depth of 0.5 m bgs, considered sufficient for the proposed upgrade works and typical recreational use of the reserve.

Due to the project objectives, seasonality was not assessed as part of the investigation. Data is therefore representative of the timing and duration of the current investigation.

5.1.5 Develop the Decision Rule

Analytical data for potentially contaminated media will be assessed against NSW EPA endorsed criteria as identified in **Section 6**.

The decision rules adopted to answer the decisions identified in **Section 5.1.2** as relates to the study boundaries are summarised in **Table 5.1**.

Table 5.1 Summary of Decision Rules

Decisions Required to be Made	Decision Rule
1. Are there any unacceptable risks to on-site future receptors?	Analytical data will be compared against EPA endorsed criteria. Statistical analysis of the data will be completed, where necessary, in accordance with relevant guidance documents, as appropriate, to facilitate the decisions. The criteria in **Section 6** were adopted with respect to soil. Either: the reported concentrations were all below the site criteria; Or: no single analyte concentration exceeded 250 % of the adopted site criterion; and the standard deviation of the results was less than 50 % of the site criterion; And: the 95 % UCL of the average concentration for each analyte was below the adopted site criterion. If the statistical criteria stated above were satisfied, the answer to the decision was **No**. If the criteria were not satisfied, the answer to the decision was **Yes**.
2. Are there any issues relating to the local area background soil concentrations that exceed appropriate soil criteria?	If COPC concentrations in soils exceeded published background concentrations (NEPC 2013), the answer to the decision was **Yes**. Otherwise, the answer to the decision was **No**.
3. Are there any issues relating to HGG surface emissions?	If HGG surface emissions were reported to be present above adopted thresholds/criteria, the answer to the decision was **Yes**. Otherwise, the answer to the decision was **No**.
4. Are there any chemical mixtures?	Were there more than one group of contaminants present which increase the risk of harm? If there was, the answer to the decision was **Yes**. Otherwise, the answer to the decision was **No**.
5. Are there any aesthetic issues?	If there were any visible asbestos containing material fragments on the ground surface or in surface soils, any unacceptable odours or soil discolouration, or excessive extraneous/foreign/waste materials, the answer to the decision was **Yes**. Otherwise, the answer to the decision was **No**.
6. Is there any evidence of, or potential for, migration of contaminants from the site?	Based on assessment results, were there any evidence of, or the potential for, migration of unacceptable contaminant concentrations to migrate from the site? If yes, the answer to the decisions was **Yes**. Otherwise, the answer to the decision was **No**.
7. Is further assessment and/or a site management strategy required?	Where the answer to any of the above decisions was Yes and/or there were potential environmental data gaps identified from this investigation, then the response was **Yes**, and further assessment and/or a site management strategy was required.

	Otherwise, further assessment and/or a site management strategy were not required.

5.1.6 Specific Limits on Decision Errors

This step is to establish the decision maker's tolerable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data. Data generated during this project must be appropriate to allow decisions to be made with confidence.

Specific limits for this project have been adopted in accordance with the appropriate guidance from the NSW EPA, NEPC (2013) ASC NEPM, appropriate DQIs used to assess QA/QC, and standard JBS&G procedures for field sampling and handling.

To assess the usability of the data prior to making decisions, the data will be assessed against pre-determined DQIs for to precision, accuracy, representativeness, comparability, completeness and sensitivity (PARCCS parameters). The acceptable limit on decision error is 95% compliance with DQIs.

The pre-determined DQIs established for the project are discussed below in relation to the PARCCS parameters and are shown in **Table 5.2**.

- **Precision** – measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD) of duplicate samples.
- **Accuracy** – measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** – expresses the degree which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** – expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; and ensuring analysing laboratories use consistent analysis techniques; and reporting methods.
- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.
- **Sensitivity** – expresses the appropriateness of the chosen field and laboratory methods, including the limits of reporting, in producing reliable data in relation to the adopted site assessment criteria.

Table 5.2 Data Quality Indicators

Data Quality Indicators	Frequency	Data Quality Criteria
Precision		
Field duplicate (intra laboratory)	1 / 20 samples/media	<50% RPD[1]
Field Triplicate (Inter laboratory)	1 / 20 samples/media	<50% RPD[1]
Laboratory Duplicates	1 / 20 samples/media	<50% RPD[1]
Accuracy		
Surrogate spikes	All organic samples	70-130% recovery
Laboratory control samples	1 per lab batch	70-130% recovery
Matrix spikes	1 per lab batch	70-130% recovery
Representativeness		
Sampling appropriate for media and analytes	All samples	-[2]
Samples extracted and analysed within holding times.	-	Organics (14 days), inorganics (6 months)
Laboratory blanks	1 per lab batch	<LOR
Trip spike	1 per lab batch (soil only)	70-130% recovery
Trip blank	1 per lab batch (soil only)	<LOR
Equipment/rinsate blank	1 per sampling event/media	<LOR
Comparability		
Standard operating procedures for sample collection & handling	All Samples	All Samples
Standard analytical methods used for all analyses	All Samples	NATA accreditation
Consistent field conditions, sampling staff and laboratory analysis	All Samples	All samples[2]
Limits of reporting appropriate and consistent	All Samples	All samples[2]
Completeness		
Sample description and COCs completed and appropriate	All Samples	All samples[2]
Appropriate documentation	All Samples	All samples[2]
Satisfactory frequency and result for QC samples		95% compliance
Data from critical samples is considered valid	-	Critical samples valid
Sensitivity		
Analytical methods and limits of recovery appropriate for media and adopted site assessment criteria	All samples	LOR ≤ site assessment criteria

[1] If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgment will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.

[2] A qualitative assessment of compliance with standard procedures and appropriate sample collection methods will be completed during the DQI compliance assessment.

5.2 Optimise the Design of Obtaining Data

The site boundary includes an area of approximately 5,000 m^2. The EPA (2022) *Contaminated Land Guidelines: Sampling design part 1 – application* recommends 13 systematic sample locations for identifying potential contaminant hotspots. Asbestos was identified previously onsite and consistent with EPA (2022) and WA DOH (2009[9]) guidance on the recommended number of sample locations, a total of 26 sample locations (TP01-TP26) were advanced across the site on a systematic basis with another six sample locations (TP27-TP32) advanced on targeted basis, which JBS&G considered sufficient to meet the DSI objectives for the accessible site areas.

5.3 Investigation Program

5.3.1 Test Pits

Soil sampling was completed via test pits with the use of a backhoe to a depth of 0.5 mbgs under the supervision of a suitably qualified and experienced JBS&G environmental consultant. Soil samples were generally collected from surface soils (0-0.1 m), 0.3 m and 0.5 m.

During the collection of soil samples, material was inspected from each soil horizon and features such as seepage, discolouration, staining, odours, ACM and other indicators of contamination were noted on the test pit logs (**Appendix F**). A photographic log is included in **Appendix B**.

Within test pits, soil samples were collected from the middle of the excavator bucket to minimize disturbance and risk of cross contamination. Collected samples were immediately transferred to laboratory supplied sample jars and bags (for asbestos analysis). The sample jars were transferred to a chilled ice box for sample preservation prior to and during shipment to the testing laboratory. A chain-of-custody form was completed and forwarded with the samples to the testing laboratory. Preservation of the primary soil and QA/QC samples obtained during this investigation was completed in accordance with the protocols outlined in NEPC 2013. Based upon field observations, samples were analysed in accordance with the laboratory schedule in **Table 5.3**.

Not all samples collected were analysed. All samples remain at the primary laboratory for a period of two months for possible future analysis (subject to holding times), if required, following the receipt of sample results.

5.3.2 Field PID Screening

Soil samples were screened onsite during the works using a photo-ionisation detector (PID) to assess the potential presence of volatile organic compounds (VOCs). Samples obtained for PID screening were placed in a sealed plastic bag for a period of approximately 5 minutes to equilibrate, prior to a PID being attached to the bag. Readings were then monitored for a period of approximately 1 minute or until values stabilise and the stabilised/highest reading is recorded on the borehole logs. Calibration records are provided in **Appendix G.**

5.3.3 Asbestos Quantification of Accessible Fill Based Soils

Asbestos quantification sampling was conducted via excavator where visible ACM was identified at the relevant test pit location. Asbestos in soil was quantified by the methods advised in WA DoH (2009) and NEPC (2013) guidelines by appropriately trained JBS&G scientist experienced in the identification of asbestos. The following method was adopted during excavation works:

- Test pits were advanced through the fill soil profile to the depth of different strata and extended to a maximum depth of 0.5 mbgs;

[9] WA DOH (2009) *Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia*. Western Australia - Department of Health as updated 2021.

- ACM was quantified by the methods advised in NEPC (2013), in accordance with DOH (2009) with 10 L samples from test pits collected (per meter/fill stratum). All identifiable ACM or asbestos fines / fibrous asbestos (AF/FA) was collected in separate sample bags (i.e., one sample bag for bonded ACM and one sample bag for FA per each fill stratum) for weighing using an independently calibrated scale (0.01 g accuracy) to enable asbestos in soil concentrations to be calculated;
- Where more than one distinct fill material was observed, separate asbestos calculation was completed for each material type;
- The 10 L sample was sieved using a 7 mm sieve and any ACM fragments retained in the sieve was collected, photographed, double bagged and then weighed using calibrated scales; and
- A field observation log for each sampling location was recorded, noting the presence, type and status or absence of asbestos, ground surface details (e.g., concrete, exposed soils or grass) lithological description, moisture, volume of spoil quantified at each depth and any other observable contamination indicators such as staining, malodorous materials, ash and slag.

Asbestos percentages in soil is calculated as per the formula below:

$$\%w/w\ asbestos\ in\ soil = \%\ asbestos\ content\ x \frac{(bonded\ ACM\ or\ FA)(kg)}{soil\ volume\ (L)\ x\ soil\ density\ (kg/L)}$$

For bonded ACM, an asbestos content of 15% was used, in accordance with enHealth (2013[10]).

For FA, a conservative asbestos content of 100% was used.

5.3.4 Duplicate and Triplicate Sample Preparation

At selected sample locations, sufficient soil was collected to provide a primary, a field (intra-laboratory) duplicate and a field (inter-laboratory) triplicate sample using the sampling methodology outlined above.

The collected samples were divided laterally into three samples with minimal disturbance to reduce the potential for loss of volatiles and placed in three clean glass jars. Soil samples were not homogenised to minimise the loss of volatiles.

Each sample was labelled with primary, duplicate or triplicate sample identification before being placed in the same chilled esky for transport to the laboratory.

5.3.5 Hazardous Ground Gases Surface Emission Monitoring

Two rounds of surface gas emissions monitoring were completed at the site to further assess potential HGG emissions through the site surface, to characterise the nature of any potential surface emissions, e.g. locations, concentrations, identify potential areas of higher/increased gas emissions, and inform a preliminary risk assessment for the site.

Surface emissions monitoring was completed in general accordance with procedures outlined in Section A4.5.2 of the NSW EPA (2016) *Solid Waste Landfill Guidelines* and NSW EPA (2020) *Assessment and Management of Hazardous Ground Gases – Contaminated Land Guidelines*. The procedure is summarised as follows:

1. HGG readings were taken approximately 50 mm above the site surface;
2. Monitoring was conducted on an approximate 20 m grid-pattern across the landfill surface;
3. Depressions, surface fissures and/or cracks in the surface (outside of the grid-pattern) were investigated;

[10] *Asbestos, A guide for householders and the general public, enHealth, February 2013 (enHealth 2013).*

4. Monitoring was completed on calm days with wind speeds less than 10 km/h and during periods of relatively low to stable atmospheric pressure;
5. Gas equipment adopted was Huberg Laser One and either a MX6 iBrid Portable Multi Gas monitor or Eagle 2 Multi-Gas Monitor with the lower instrument detection range able to detect 20 ppmv; and
6. The gas equipment was calibrated and zeroed prior to measurements being taken.

The following parameters were monitoring during each monitoring event:

- Methane (CH_4);
- Lower explosive limit (LEL);
- Carbon monoxide (CO);
- Carbon dioxide (CO_2);
- Volatile organic compounds (VOCs);
- Hydrogen Sulphide (H_2S); and
- Oxygen (O_2).

5.3.6 Laboratory Analysis

JBS&G contracted Eurofins Environment Testing Australia (Eurofins), a National Association of Testing Authorities (NATA) accredited laboratory, as the primary laboratory, and Envirolab Service Pty Ltd (Envirolab), as the secondary laboratory, for the required analyses. In addition, the laboratory was required to meet JBS&G's internal QA/QC requirements. The proposed analysis schedule is summarised in **Table 5.3**.

Table 5.3 Summary of investigation program and laboratory analysis schedule

Sample Type	No. of Sampling Locations	Laboratory Analyses (excludes QA/QC)
Soil	26 locations	Metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn) – 15 samples Zinc – 18 samples TRH/BTEX – 16 samples PAHs – 15 samples OCPs/PCBs – 7 samples Asbestos – 26 samples (500 mL samples + visual assessment at all locations) Silica Gel Clean-Up – 1 sample

In addition to the above, for QA/QC purposes field duplicate and triplicate samples were to be analysed at a rate of 1/20 primary samples for heavy metals, TRH, BTEX, PAHs and asbestos.

6. Assessment Criteria

6.1 Regulatory Guidelines

Development of site assessment criteria and the associated scope of investigation was undertaken with consideration to aspects of the following guidelines, as relevant:

- *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended 2013), National Environment Protection Council (NEPC 2013);
- *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme*, 3rd Edition, NSW EPA, 2017 (EPA 2017);
- *Contaminated land guidelines: Consultants reporting on contaminated land*, NSW EPA, April 2020 (EPA 2020a);
- *Guidelines for the Assessment Remediation and Management of Asbestos-Contaminated Sites in Western Australia*, Western Australia Department of Health, 2009 (WA DoH 2009);
- *Waste Classification Guidelines, Part 1: Classifying Waste*, NSW EPA, November 2014 (EPA 2014);
- *Contaminated Land Guidelines: Sampling design part 1 – application*, NSW EPA, August 2022 (EPA 2022);
- *Solid Waste Landfill Guidelines,* NSW EPA, April 2016 (EPA 2016); and
- *Assessment and Management of Hazardous Ground Gases – Contaminated Land Guidelines,* NSW EPA, May 2020 (EPA 2020b).

6.1.1 Soil Assessment Criteria

Due to the site being investigated for continued use as park, the recreational, public open space land use, setting 'C' from the NEPC (2013) has been adopted. Where there is no NSW EPA endorsed threshold for an individual COPC, the laboratory limit of reporting (LOR) was adopted as an initial screening value for the purposes of this assessment.

The results of asbestos analysis were assessed in general accordance with NEPC (2013) guidance.

Analysed COPC concentrations in soil samples were compared against the following:

- Health Investigation Levels (HILs) 'Recreational/Public Open Space' (HIL C) land use scenario;
- Soil Health Screening Levels (HSLs) for Vapour Intrusion in sand, 'Recreational/Public Open Space' (HSL C) land use scenario with sand soils;
- HSL for asbestos contamination in soil, Recreational/Public Open Space (HSL C);
- Management limits for petroleum hydrocarbons for residential, parkland and public open space land use scenarios. Following the NEPM guidance, Management limits are considered only after HIL/HSLs and EIL/ESLs;
- Ecological Screening Levels (ESLs) 'Urban Residential / Public Open Space' land use scenario, in coarse soil; and
- Ecological Investigation Levels (EILs) 'Urban Residential / Public Open Space' land use scenario.

The results of asbestos analysis were assessed in general accordance with NEPC (2013) including DOH (2009) guidance.

Aesthetics were also considered in the assessment of site suitability consistent with EPA (2017) and NEPC (2013).

Where there was no NSW EPA endorsed thresholds, the laboratory limit of reporting (LOR) was adopted as an initial screening value for the purposes of this assessment.

The adopted soil assessment criteria are presented in the results tables included as **Table A** and **Table B, Appendix A.**

6.1.2 Ground Gas Criteria

The following thresholds outlined in **Table 6.1** were adopted from NSW EPA (2020) guidelines and other sources for surface gas monitoring and for assessment of site conditions as part of the ground gas assessment outlined herein. JBS&G note the adopted thresholds are presented for screening purposes only.

Table 6.1: Monitoring Parameters and Adopted Thresholds

Ground gas parameter	Unit of measurement	Adopted Threshold Values
Methane (CH_4)	%v/v	0.05 %v/v (500 ppm[5])
Carbon Dioxide (CO_2)[1]	%v/v	5,000 ppm
Oxygen (O_2)[4]	%v/v	>19.5% v/v
Carbon Monoxide[2] (CO)	ppm	30
Hydrogen Sulphide[3] (H_2S)	ppm	10
VOCs	ppm	Above background outside air
Barometric Pressure	hPa/mb	For reference

[1] 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)

[2] Reference to workplace exposure limit for carbon monoxide of 8 hour at 30 ppm (SafeWork Australia Workplace Exposure Standards for Airborne Contaminants, 16 December 2019) and lower accuracy range of 0 to 500 ppm cell ±2.0% of full scale

[3] Reference to workplace exposure limit of hydrogen sulphide of 8 hour at 10 ppm SafeWork Australia Workplace Exposure Standards for Airborne Contaminants, 16 December 2019) and lower accuracy range of 0 to 200 ppm cell ±1.5% of full scale

[4] SafeWork Australia 2020, Code of Practice Confined Spaces (SWA 2020c) states that air normally contains 21% v/v air by volume however oxygen levels between 19.5 % v/v and 23.5 % v/v are considered to be safe

[5] Environmental Guidelines – Solid Waste Landfills. NSW EPA 2016. EPA (2016).

7. Quality Assurance / Quality Control

7.1 QA/QC Assessment

The QA/QC results for samples collected at the site are summarised and discussed in **Appendix H.** Detailed QA/QC results are included in the laboratory reports.

The field sampling and handling procedures produced QA/QC results which indicate that the soil data is of an acceptable quality and suitable for use in site characterisation.

The NATA certified laboratory results sheets indicate that the project laboratory was generally achieving levels of performance within its recommended control limits during the period when the samples of this program were analysed.

On the basis of the results of the field and laboratory QA/QC program, the soil data is of an acceptable quality upon which to draw conclusions regarding the environmental condition of the site.

8. Investigation Results

8.1 Field Observations

8.1.1 Soil Observations

The lithology encountered at the site during the field works is summarised below. Detailed test pit logs are included in **Appendix F**. A total of 26 soil sample locations (TP01 to TP26) were advanced across the accessible site with an additional six observational test pits (TP27 to TP32) advanced in the southern portion of the site adjacent to test pits where ACM and anthropogenic inclusions were observed. See **Figure 2** for sample locations.

Fill materials were encountered at all locations extending to the depth of the investigation (0.5 m bgs) and comprised sand and clayey sand with inclusions of brick fragments, metal, slag, glass and ceramic fragments.

The full depth of fill was not established due to the limited depth of the investigation.

Bonded ACM was observed in four test pits (TP03, TP23, TP25 and TP31) with three of these noted to be in the southern portion and within an area that has had patches of sand (TP25 and TP31), and a single location (TP03) in the proposed works area near the playground. Locations where visible asbestos was observed are shown on **Figure 3**.

No odours or staining were observed across the within the test pits advanced on site.

8.1.2 Asbestos Air Monitoring and Surface Inspection

Asbestos air monitoring was conducted during the intrusive works with all reported results considered satisfactory and conforming with the minimum action level of 0.01 fibres /mL for control monitoring as outlined in *Work Health and Safety Regulation 2017* and Safework NSW (2022) *Code of Practice – How to Safely Remove Asbestos*. A copy of the asbestos air monitoring report is presented in **Appendix J.**

In addition, following the intrusive works, JBS&G conducted an asbestos clearance for the site's ground surface. No asbestos was identified on the ground surface during the clearance. A clearance letter was prepared and issued to RCC on 8 January 2025 and is provided in **Appendix K.**

8.1.3 Surface HGG Emission Monitoring

Surface HGG emission monitoring results are presented in **Table 8.1**, for monitoring rounds completed on 19 December 2024 where wind was reported at 41 km/hr and atmospheric pressure at 1017.8 hpa and 22 January 2025 with a wind speed reported at 52 km/h and atmospheric pressure at 1004 hpa.

JBS&G notes that while some wind was noted while doing the monitoring, readings were not taken when gusts were noted and noting that the residences and fences around much of the site would have aided in blocking the worst of the wind at the site.

Table 8.1: Summary of Surface Emissions Monitoring

Monitoring Round	Summary of Observations
19 December 2024	The site detected surface emissions ranged between 0 and 0.1 ppm for methane and 0 ppm for CO_2, well below the NSW EPA (2016) 500 ppm and 5,000 ppm thresholds and adopted criteria in **Table 6.1.**
22 January 2025	The site detected surface emissions ranged between 0 and 0.1 ppm for methane and 0 ppm for CO_2, well below the NSW EPA (2016) 500 ppm and 5,000 ppm thresholds and adopted criteria in **Table 6.1.**

8.2 Field Asbestos Quantification

Results of the quantification are provided in **Table B** (**Appendix A**).

Bonded ACM was observed within fill material at three test pit locations (TP03 0.2-0.5, TP23 0-0.5 and TP25 0-0.5) where samples were collected and analysed. In addition, ACM was observed in one (TP31 0-0.5) of the additional six test pits (TP27-TP32) advanced for visual inspections.

Ten litre samples representative of the respective fill profiles were collected at 26 sample locations (TP01-TP26) for the purposes of asbestos quantification. ACM fragments from each 10 L sample were collected and weighed as per ASC NEPM requirements for field quantification with the results presented in **Table B**. The following exceedances as shown on **Figure 3** were reported:

- TP03_0.2-0.5 with a concentration of 0.59 %w/w ACM exceeded the adopted HSL-C (0.02%) for bonded asbestos (ACM) in soil;
- TP23_0-0.5 with a concentration of 0.074 %w/w ACM exceeded a the adopted HSL-C (0.02%) for bonded asbestos (ACM) in soil. This also exceeds the HSL of 'no visible asbestos in surface soil';
- TP25_0-0.5 with a concentration of 0.185 %w/w ACM exceeded a the adopted HSL-C (0.02%) for bonded asbestos (ACM) in soil. This also exceeds the HSL of 'no visible asbestos in surface soil'; and
- TP31: Asbestos quantification was not conducted at this location due to the size of ACM fragments observed, with concentration considered qualitatively to exceed the adopted criteria. This also exceeds the HSL of 'no visible asbestos in surface soil'.

8.3 Soil Laboratory Results

Representative samples were collected across the accessible site and were analysed for a range of COPCs. The summarised soil laboratory results are presented in **Table A** and **Table B, Appendix A.** Detailed laboratory reports and chain of custody documentation are provided in **Appendix I**.

8.3.1 Heavy Metals

Concentrations of heavy metals were reported below the adopted ecological and health-based criteria in soil samples selected for analysis, except for zinc which was reported exceeding the adopted EIL for urban residential and public open space (70 mg/kg) in the following samples:

- TP10_0-0.1 which reported a concentration of 110 mg/kg;
- TP23_0-0.1 which reported a concentration of 550 mg/kg; and
- TP23_0.2-0.3 which reported a concentration of 120 mg/kg.

8.3.2 TRH/BTEX

Concentrations of TRH/BTEX were reported below the adopted ecological and health-based criteria and or the laboratory LORs in soil samples selected for analysis, except for the following analytes:

- TRH fraction $C_{>16}$-C_{34} was reported in a single sample (TP10_0-0.1) at a concentration of 660 mg/kg, exceeding the adopted ESL for urban residential and public open space (300 mg/kg); and
- F2 (C10-C16 less Naphthalene) was reported in a single sample (TP10_0-0.1) at a concentration of 140 mg/kg, exceeding the adopted ESL for urban residential and public open space (120 mg/kg).

The sample was subsequently subjected to silica gel clean-up which removes non-polar compounds which are typically not associated with petroleum sources. This provides a more accurate representation of the concentration of hydrocarbons attributable to petroleum sources within the sample. Silica gel clean up results reported TRH concentrations below the laboratory LOR and below the adopted ESL, hence confirming the source of TRH is not petrogenic and rather biogenic.

8.3.3 PAH

Concentrations of PAHs were reported below the adopted ecological and health-based criteria and or the laboratory LORs in soil samples selected for analysis.

8.3.4 OCP

Concentrations of OCPs were reported below the adopted ecological and health-based criteria and or the laboratory LORs in soil samples selected for analysis.

8.3.5 PCB

Concentrations of PCBs were reported below the laboratory LOR, and therefore below the adopted ecological and health-based criteria in soil samples selected for analysis.

8.3.6 Asbestos

Concentrations of asbestos were reported below the laboratory LORs in soil samples selected for analysis, and therefore below the adopted health-based criteria. Trace asbestos was detected in a single soil sample (QC02, parent sample TP03_0.2-0.5) reporting an AF/FA concentration of 0.00062 % w/w below the adopted HSL-C (0.02% w/w). AF/FA is considered friable asbestos under NEPC (2013) guidance. It is noted in **Section 8.2** above that ACM (bonded) was observed in this sample and quantified above the ACM criterion.

9. Site Characterisation

Section 5.1.5 provides decision rules appropriate to determine if contamination is present at the site that may be potentially unacceptable from a health and ecological health perspective. Discussion of each of the decision rules is provided in the following sections.

9.1 Are there any unacceptable risks to likely future on-site receptors?

Based on the documented CSM, current site investigation activities were relied upon to characterise site conditions including the potential presence of heavy metal, petroleum hydrocarbon (TRH/BTEX), PAH, OCPs, PCBs, asbestos and HGG impacts at the time. Adopting the recreational / public open space potential land use scenario (public park, HIL-C) proposed for the site, the outcomes of these characterisation activities identified a number of issues with regard to site soil conditions as discussed following.

Asbestos in Soil

The investigation works documented herein have identified bonded ACM which exceeded the adopted HSL-C (0.02%) for bonded asbestos (ACM) in subsurface soil at TP03 (0.2-0.5m) with a concentration of 0.59 %w/w. In addition, AF/FA impacts were also reported in the same sample location at a concentration (0.00062 %w/w) below the adopted HSL-C (0.02 %w/w). The presence of AF/FA (even though below the criteria) and bonded ACM above the criteria will require management during future development works (during which time the site will be a workplace), to ensure that the contaminated soils are remediated/managed and that the site surface and surface soils (0-0.1 m) remains free of visible ACM following redevelopment.

In addition, bonded ACM was visually identified in the field during sampling in three sample locations, as follows:

- TP23_0-0.5 exceeded a the adopted HSL-C (0.02%) for bonded asbestos (ACM) in soil with a concentration of 0.074 %w/w;
- TP25_0-0.5 exceeded a the adopted HSL-C (0.02%) for bonded asbestos (ACM) in soil with a concentration of 0.185 %w/w; and
- TP31: Asbestos quantification was not conducted at this location due to the size of ACM fragments observed, with concentration considered qualitatively to exceed the adopted criteria.

While the grass and soft-fall cover in these areas is maintained and not disturbed/removed the potential for asbestos fibres to become airborne and potentially respirable is mitigated such that there is no complete exposure pathway for the current use or maintenance of the site.

However, management of the asbestos contamination will be required during redevelopment of the site to ensure that the contaminated soils are remediated/managed and that the site surface and surface soils (0-0.1 m) remains free of visible ACM following redevelopment.

Heavy Metals

The current investigation reported zinc in three samples (TP10_0-0.1, TP23_0-0.1 and TP23_0.2-0.3) at concentrations ranging between 110 and 550 mg/kg, exceeding the adopted ecological criterion (EIL-C, 70 mg/kg). It is noted that the impacts do not pose a health risk, and the landscaped area appeared healthy at these two sampling locations and hence, management is not required.

Petroleum Hydrocarbons

The current investigation reported TRH fractions $C_{>16}$-C_{34} and F2 (C10-C16 less Naphthalene) in one sample (TP10 0-0.1) at concentrations of 660 and 140 mg/kg, respectively, exceeding the adopted ecological criteria (ESL-C). Following silica gel clean up on the sample, it was determined that the source of hydrocarbon is biogenic and not petrogenic. On this basis, management of the sample location is not required.

9.2 Are there any issues relating to background soil concentrations that exceed appropriate site soil criteria?

Other than two locations with zinc reported at concentrations which exceeded applicable ecological investigation levels, all metals and other chemical COPCs were at concentrations consistent with typical urban environments, and as such there are not considered to be any background soil concentrations that would pose an issue with regards to adopted site criteria. The elevated zinc may relate to surface water runoff from adjacent roofs or may relate to inclusion in surficial fill soils and are therefore considered to be isolated and attributable to site contamination rather than background sources.

9.3 Are there any issues relating to HGG surface emissions?

The reported HGG surface emissions were between 0 and 0.1 ppm across the site. These values are well below the 500 ppm NSW EPA (2016) fugitive emissions thresholds. On this basis, no unacceptable risk to site users from HGG surface emissions were identified.

9.4 Are there any impacts of chemical mixtures?

There were no potential chemical mixtures identified during the investigation that may increase the risk of harm at the site or require special management.

9.5 Are there any aesthetic issues at the site?

Based on the proposed land uses, and with consideration of the observations made during the site assessment:

- No chemically stained or otherwise discoloured soils were observed;
- No large quantities of inert refuse and/or unsightly refuse were identified; and
- No potentially offensive odours were identified.

As such, there are no unacceptable aesthetic issues at the site, other than the visible ACM in surface soils as discussed elsewhere.

9.6 Is there any evidence of, or potential for, migration of contaminants from the site?

In the absence of gross and/or widespread contamination at the site, migration of contaminants from the site at levels which would cause potential risks to offsite receptors is considered low.

Although the site is vegetated with grasses and some trees, the occurrence of asbestos (as ACM/AF/FA) in surface or near surface soil at the site could pose a risk of airborne asbestos fibres should surface soils be uncovered/disturbed such as during site maintenance or by site users. Management of the identified asbestos impacts will be required in the form of an Asbestos Management Plan (AMP) during any site activities that may include ground disturbance to address the potential risk to site users/workers/occupants until such time as the identified impacts are remediated/removed.

9.7 Is a site management strategy required?

A site management strategy is required to address:

- The presence of ACM above criteria and AF/FA in soils below the adopted site criteria in one location within the proposed works area in the north of the site (TP03); and
- The presence of ACM in soils exceeding the adopted site criteria in three locations in the south of the site, outside the proposed works area.

Site maintenance and/or redevelopment activities require to be managed such that the ACM identified in soils are controlled such that ACM is not present on-site surfaces at the completion of redevelopment.

The presence of asbestos in soil at the site should be identified via implementation of an Asbestos Register incorporated into an AMP in accordance with WHS legislation[11] such that potential occupational exposure scenarios may be appropriately addressed during maintenance of the site in its current state until such time as asbestos risks are removed/remediated.

Management of the identified asbestos impacts with regard to future use/development of the site is readily implemented by the preparation of Remedial Action Plan (RAP).

11 *Work Health and Safety Act 2011* and the *Work Health and Safety Regulation 2017*.

10. Conclusions and Recommendations

Based on the results of the DSI undertaken at the site and the limitations in **Section 11**, the following conclusions are presented:

- As asbestos was previously identified onsite, and in accordance with the EPA guidance (EPA 2022), a double sampling density was adopted where 26 test pits were advanced and sampled for a range of COPCs across the site with an additional six test pits (TP27-TP32) advanced for visual observations;
- The site is generally absent of gross and/or widespread contamination. Notwithstanding, potentially unacceptable risks to future site users were identified at the site, as summarised following:
    - The presence of bonded ACM within subsurface soils above the Health Screening Criteria (HSL-C) and AF/FA below the HSL criteria at one location (TP03_0.2-0.5) in the northeast of the site within the proposed works area and assumed to be present in soil beneath the soft-fall rubber of the adjacent playground. The presence of bonded ACM above criteria and AF/FA below the criteria will require management to ensure that ACM is not present on the site surface following redevelopment; and
    - The presence of bonded ACM within surficial soils at three locations (TP23, TP25 and TP31) outside the works area in the south of the site represents a potentially unacceptable risk to future site users and maintenance workers and as such impacted fill/soil requires to be managed.
- While current grass and soft-fall surfaces are maintained there are no complete exposure risks to asbestos fibres for current use and maintenance of these areas given the ACM and AF/FA is covered by existing grass or soft-fall rubber mitigating potential for fibres to be released and become airborne.
- The presence of asbestos in soil at the site should be identified via implementation of an Asbestos Register incorporated into an Asbestos Management Plan (AMP) in accordance with the *Work Health and Safety Regulation 2017* such that potential occupational exposure scenarios may be appropriately addressed during maintenance of the site in its current state until such time as the risks are removed;
- No other potentially unacceptable contamination risks to future site users were identified at the site;
- Asbestos air monitoring was conducted during the intrusive works with all reported results considered satisfactory and conforming with the minimum action level of 0.01 fibres/mL for control monitoring as outlined in the *Work Health and Safety Regulation 2017* and Safework NSW (2022) *Code of Practice – How to Safely Remove Asbestos*. A copy of the asbestos air monitoring report is presented in **Appendix J**;
- Following the intrusive works, JBS&G conducted an asbestos clearance inspection for the site's ground surface. No asbestos was identified on the ground surface during the clearance. A clearance letter was prepared and issued to RCC on 8 January 2025 and is provided in **Appendix K;**
- No evidence of background contamination of site soils was identified;
- No unacceptable risk to site users were identified from surface HGG emissions based on the reported concentrations of methane gas and carbon dioxide;
- With consideration of the proposed land use, and observations made during the investigation, aesthetic issues other than the presence of visible ACM within surface soil were not identified;
- In absence of gross and/or widespread surficial soil contamination at the site, no potential issues relating to off-site migration of contaminants were identified under the current site conditions given the non-friable ACM in surficial soils and noting the friable asbestos at one location was not present in surface soil and covered by grass. Should existing vegetative cover be significantly disturbed,

management actions would be necessary to appropriately manage the potential risk of airborne asbestos fibre generation and subsequent contaminant migration; and

- The site within the study boundaries is suitable for the proposed works and recreational use subject to the implementation of the below management recommendations.

Based on the conclusions and limitations of the investigation it is recommended that:

- Management of the identified asbestos contamination is undertaken via preparation and implementation of a RAP for the site within the study boundaries to be considered suitable for the proposed works; and
- In the meantime, appropriate asbestos management procedures should be implemented via preparation and implementation of an AMP and asbestos register to ensure occupational exposure risks are appropriately managed during any/all activities that result in ground surface disturbance.

11. 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 report has been prepared specifically for the client for the purposes of the commission, and no warranties, express or implied, are offered to any third parties and no liability will be accepted for use or interpretation of this report by any third party.

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. This report should not be amended in any way without prior approval by JBS&G, or reproduced other than in full including all attachments as originally provided to the client by JBS&G.

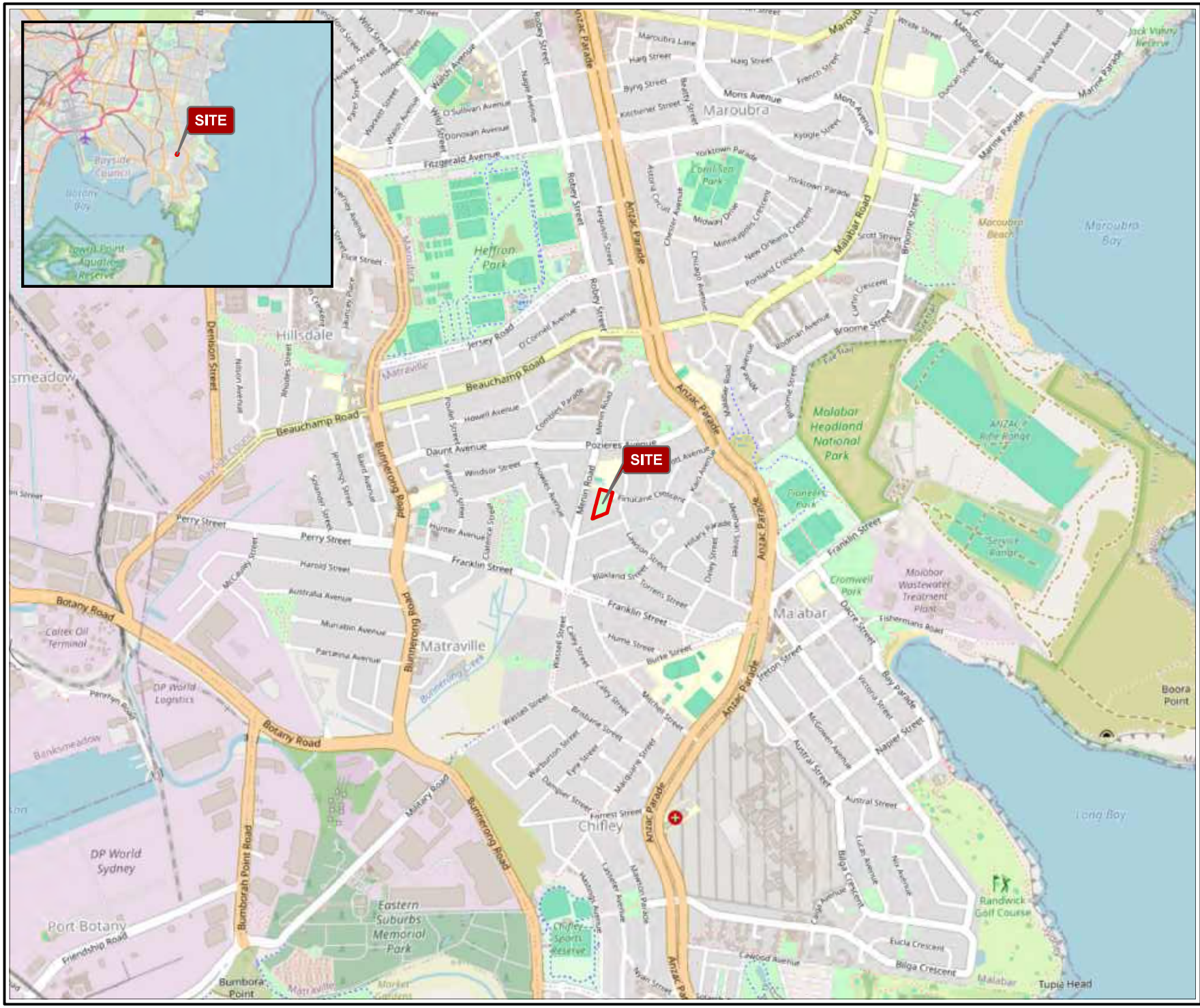
Sampling and chemical analysis of environmental media is based on appropriate guidance documents made and approved by the relevant regulatory authorities. Conclusions arising from the review and assessment of environmental data are based on the sampling and analysis considered appropriate based on the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

Limited sampling and laboratory analyses were undertaken as part of the investigations undertaken, as described herein. 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 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.

Figures



Legend

Approximate Site Boundary

JBS&G

Job No: 68409

Client: Randwick City Council

Version: R01 Rev A | Date 8/01/2025

Drawn By: HW | Checked By: FB

Scale 1:20,000

0 190 380

metres

Coord. Sys. GDA2020 MGA Zone 56

1 Finucane Cres,
Matraville, NSW

SITE LOCATION

FIGURE 1

File Name: 68409_FinucaneReserveDSIandRAP_R01_RevA

Legend

- Approximate Site Boundary
- NSW Cadastre

JBS&G

Job No: 68409

Client: Randwick City Council

Version: R01 Rev A	Date 8/01/2025
Drawn By: HW	Checked By: FB

Scale 1:1,000

0 9.5 19

metres

Coord. Sys. GDA2020 MGA Zone 56

1 Finucane Cres, Matraville, NSW

SITE LAYOUT

FIGURE 2

File Name: 68409_FinucaneReserveDSIandRAP_R01_RevA
Reference: Nearmap - www.nearmap.com (Capture Date: 17/11/2024)

Legend

- Approximate Site Boundary
- NSW Cadastre

Sample Locations

- Test Pit Location
- Visual Test Pit Location

JBS&G

Job No: 68409	
Client: Randwick City Council	
Version: R01 Rev A	Date 31/01/2025
Drawn By: HW	Checked By: FB
Scale 1:750	

0 7 14
metres

Coord. Sys. GDA2020 MGA Zone 56

1 Finucane Cres, Matraville, NSW

SAMPLE LOCATIONS

FIGURE 3

File Name: 68409_FinucaneReserveDSIandRAP_R01_RevA
Reference: Nearmap - www.nearmap.com (Capture Date: 17/11/2024)

Legend

- Approximate Site Boundary
- NSW Cadastre

Sample Locations

- Test Pit Location
- Visual Test Pit Location
- Asbestos Detected at Sample Location

JBS&G

Job No: 68409	
Client: Randwick City Council	
Version: R01 Rev A	Date 31/01/2025
Drawn By: HW	Checked By: FB
Scale 1:700	

0 6.5 13
metres

Coord. Sys. GDA2020 MGA Zone 56

1 Finucane Cres, Matraville, NSW

SAMPLE LOCATIONS

FIGURE 3

File Name: 68409_FinucaneReserveDSIandRAP_R01_RevA
Reference: Nearmap - www.nearmap.com (Capture Date: 17/11/2024)